

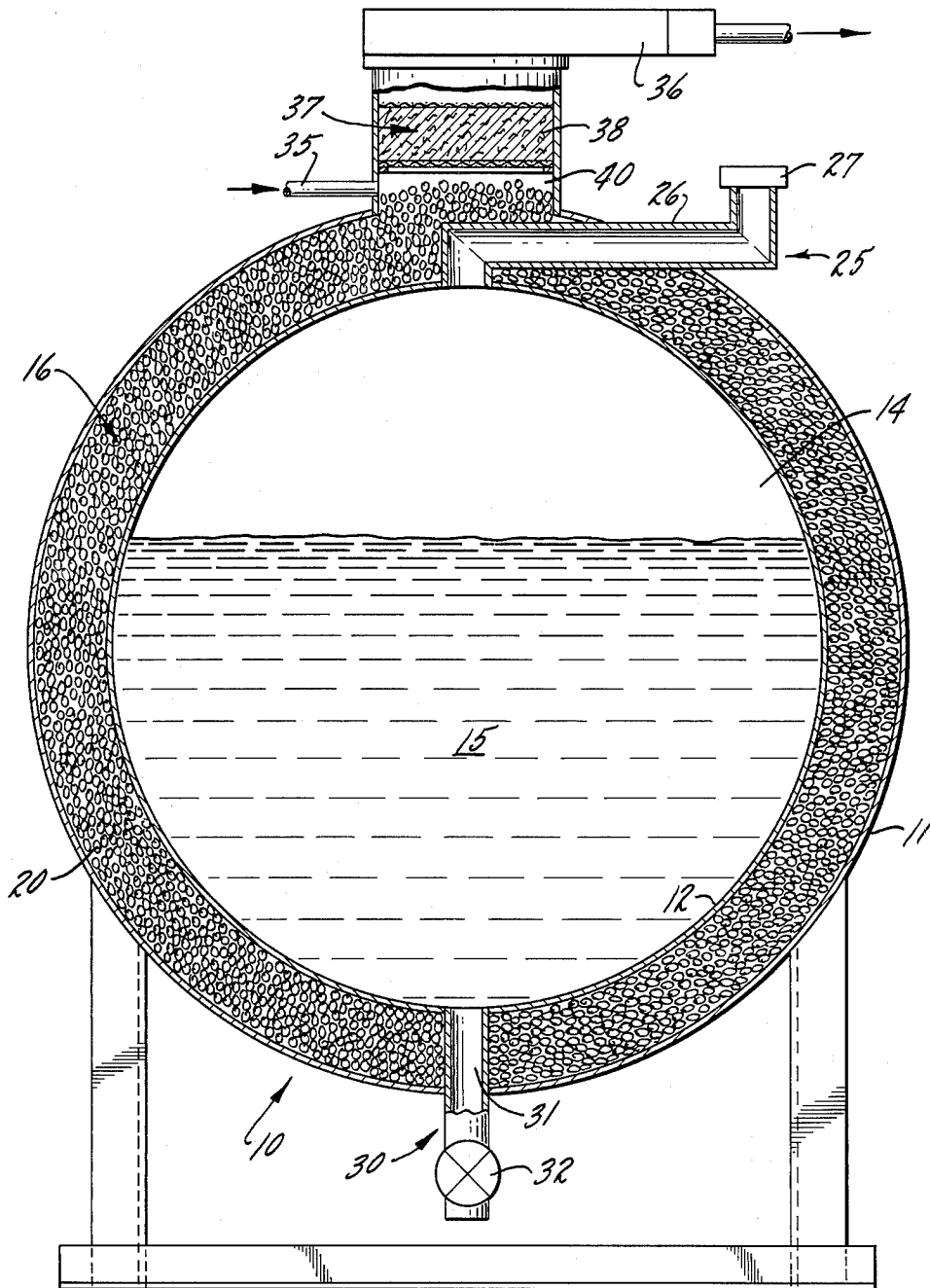
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METHOD OF TREATING POWDER

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METHOD OF TREATING POWDER

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This invention is related in general to the treatment of powdered materials. It deals more particularly with a method of decompacting powdered materials.

It is an object of the present invention to provide an improved method of decompacting powdered materials.

It is another object to provide an improved method of decompacting which decreases the density of the powdered material uniformly.

It is still another object to provide a method of decompacting powdered material which is simpler and less expensive than methods presently utilized.

The foregoing and other objects are realized in accord with the present invention by providing a method of decompacting powdered material in an enclosed space by introducing a gas under pressure to the space until the powdered material is completely permeated and then explosively decompressing the space. The potential kinetic energy of the gas molecules is released and force is exerted on the particles to uniformly disperse them and lower the overall density of the powdered material. A cushion of air is left between the particles of powder, giving the mass of powder a pseudo-compressibility.

The invention will best be understood by reference to the following description taken in connection with the accompanying drawing. The drawing is a diagrammatic sectional view taken through a conventional insulated vessel 10. The vessel 10 is cylindrical and comprises an outer shell 11 preferably fabricated from steel plate. Inside the outer shell 11 and concentric therewith is an inner shell 12 forming a storage area 14 within which a liquid 15 or the like is stored. The inner shell is preferably fabricated of lighter gauge steel plate than the shell 11.

The inner shell 12 is supported within the outer shell 11 in a conventional manner by suitable structural mounting members (not shown). An annular space 16 between the shells 11 and 12 is substantially filled with a powdered insulation material 20 for insulating the stored liquid 15 from the environment of the vessel 10. The powdered insulation material 20 is Perlite in the present instance, although any of numerous conventional powdered insulating materials might be used.

To facilitate filling the vessel 10 with liquid 15, a filler assembly 25 surmounts the outer shell 11. It includes a filler pipe 26 extending through the outer shell 11 and the inner shell 12 to the area 14. The stored liquid 15 is introduced to the storage area 14 through the pipe 26. A removable cap 27 is provided on the pipe 26.

At the bottom of the tank 10 a drain assembly 30 provides means for emptying the storage area 14 of stored liquid 15. The drain assembly 30 includes a drain pipe 31 extending through the outer shell 11 and the inner shell 12 to the storage area 14. A suitable drain valve arrangement 32 is provided on the free end of the pipe 31 for controlling withdrawal of the stored liquid 15.

In operation of the vessel 10, when a relatively cool liquid is introduced to the storage area 14, the inner shell 12 contracts slightly, as would be expected. The annular space 16 is thus enlarged and the powdered insulation material tends to settle into its larger quarters.

Subsequent removal of the relatively cool liquid 15, as when the vessel 10 is taken out of service, permits the shell 12 to warm and expand. This expansion is opposed by the insulation material 20 to the extent that the material is not compressible. Since powdered insulation

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material 20 such as Perlite or the like has substantial compressive strength, it is not readily compressed by the expanding shell 12. Accordingly, the inner shell 12 is often caused to buckle or otherwise fail by the counterforce exerted by the material 20.

To avoid damage of the aforescribed character to the inner shell 12 of the vessel 10, the powdered insulation material 20 is decompacted before or during the inner shell 12 "cooling cycle" by the method embodying features of the present invention. To accomplish this decompaction a clean, dry gas is introduced to the annular space 16 between the inner shell 12 and the outer shell 11 under pressure. In the present instance the gas is air, but it might be helium, nitrogen, or any of a number of gases, depending primarily upon availability. The gas is introduced through a pipe 35 from a suitable source of gas under pressure (not shown). The pipe 35 extends through the outer shell 11 of the vessel 10 adjacent the liquid filler assembly 25, as illustrated.

Gas is introduced to the annular space 16 containing the powdered insulation material 20 until a predetermined pressure is reached. This gas under pressure in the space 16 soon permeates the powdered insulation material 20 completely; gas molecules gathering in interstices between each powder particle throughout the material. After a predetermined period of time depending upon the bulk of the insulation material 20, this permeation is complete. The pressure selected, which might vary from a few ounces to several pounds per square inch, is primarily dependent upon the anticipated rate of decompression, as will hereinafter be discussed more thoroughly.

After the predetermined length of time calculated to assure complete permeation of the powdered insulation material 20 in the annular space 16 of the vessel 10 the space 16 is explosively decompressed by suddenly opening it to the atmosphere through the medium of a conventional exhaust valve 36. The force exerted by the gas molecules on the powder particles as the gas molecules accelerate under decompression tends to disperse the powder particles uniformly. The density of the powdered insulation material 20 is thus reduced and a cushion of uncompressed air is left between the particles of powder. The reduction in density and air cushion makes the insulation material 20 substantially more compressible and this resultant compressibility accommodates slight expansion of the inner shell 12, if necessary.

The exhaust valve 36 flow rate capacity is a determining factor in selecting the optimum predetermined pressure for charging the annular space 16, since it controls rate of a decompression, of course. If flow rate capacity is high, a lower pressure is utilized, while a lower capacity necessitates a higher pressure.

To prevent the escape of powdered insulation material 20 from the annular space 16 when explosive decompression is accomplished, a filter unit 37 is provided. The filter unit 37 comprises any well known filtering medium 38 of suitable porosity mounted in the outlet passage 40 between the valve 36 and the annular space 16 to permit passage of the expanding gas while preventing the escape of particles of powdered material 20.

It should now be seen that a simple and economical method of decompacting powdered material in an enclosed space has been described. The method embodying features of the present invention assures uniform dispersment of particles throughout the powdered material. Consistently lower densities are thus achieved throughout the material. Furthermore, decompaction is accomplished in a "one shot" operation. The amount of costly, dry, clean gas required is kept at a minimum.

Though the method has been described in the context of decompacting powdered insulation material in a double wall storage vessel 10, it should be understood that it

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finds advantageous application in numerous other situations where powdered material is involved. For example, in the storage of powdered materials, such as flour or the like, the contraction of a storage vessel during cooling weather is opposed by the compression strength of the flour. Damage to the vessel can easily result. Decompression of the flour or other stored powdered material by the method embodying features of the present invention obviates the possibility of such damage.

What is claimed is:

1. A method of decompacting powdered insulation material compacted in an enclosed space, comprising the steps of: charging the space with gas under pressure, holding the gas in said space under pressure a sufficient time for the gas to completely permeate the powdered insulation material, suddenly relieving the pressure in the space without letting material escape from the space whereby the gas molecules uniformly force particles of powdered insulation material farther apart to decrease the density of the material.

2. The method of claim 1 further characterized by and including the step of charging the space with gas under pressure until a predetermined pressure in excess of at least one ounce per square inch above environmental pressure is established within said space.

3. A method of decompacting powdered insulation material tightly compacted in the enclosed space between walls of a double wall insulation vessel, comprising the steps of: charging the space with gas until a predetermined

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positive pressure is developed in the space without letting gas escape, holding the gas in said space under pressure a sufficient time for the gas to completely permeate the powdered insulation material, and explosively decompressing the space whereby the gas molecules accelerate rapidly and uniformly force particles of powdered insulation material farther apart to decrease the density of the material and increase its compressibility.

4. The method of claim 3 further characterized by and including the step of decompressing the space through a filter designed to permit the passage of gas under pressure while preventing the escape of particles of powdered material.

5. The method of claim 3 further characterized by and including the step of charging the space with gas under pressure until a predetermined pressure in excess of at least one ounce per square inch above environmental pressure is established within said space.

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