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GRAIN STORGE CONTAINER

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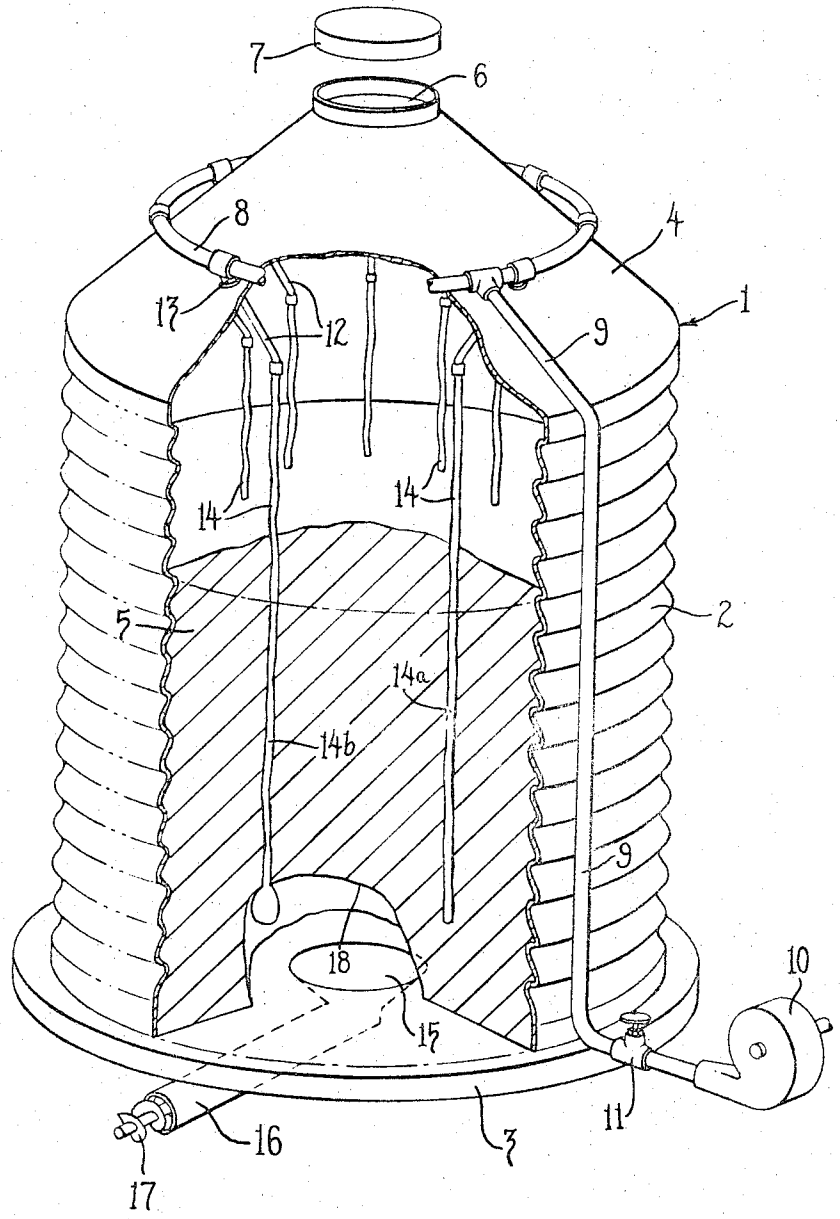

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GRAIN STORAGE CONTAINER

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This invention relates to storage containers for particulate material, for example grain or Portland cement.

A problem encountered in storing such particulate materials in containers in the form of tanks or bins with withdrawal apertures adjacent their lower ends is that the materials have a tendency to form a bridge above the withdrawal aperture when the tank is being emptied. The existence of such a bridge prevents material from flowing to the withdrawal aperture and consequently the bridge has to be broken before further material can be withdrawn.

According to the present invention a storage container for particulate material comprises, a wall substantially totally enclosing a material storage space, a fluid-tight bag attached to the inside of the wall and connected through the wall to a source of fluid pressure external thereto, so that in the event of the formation of a bridge by material within the storage space, the bag can be pressurized to break down the bridge.

Preferably, a plurality of bags in the form of tubes hang downwardly from the upper parts of the wall, all such tubes being connected to a ring main pipe capable of being connected to a source of air pressure and of being pressurized thereby. The ring main pipe is preferably situated outside the wall.

Some bulk containers are shaped so that there is a definite junction between the side portions of the wall and the roof or base, others e.g. spherical containers do not have separate portions which may be termed a roof or a base. The use of the term "wall" in this specification is intended to include a roof and a base.

An embodiment of the invention will now be described simply by way of example with reference to the accompanying drawing which shows a grain container with part of the outside cut away to show the interior.

The drawing shows a container whose sides **2** define a cylinder, standing on a base **3** and capped by a conical roof **4**; the roof is provided with a filler opening **6** and a closure **7** therefor. The container contains a quantity of grant **5** which is itself shown cut away.

Encircling the roof **4** is a ring main pipe **8** which can be fed through a pipe **9** with compressed air from a pump **10** controlled by a valve **11**. A series of branch pipes **12** are connected to the ring main pipe by flanged connections **13** which seal against holes in the roof **4**.

Long air tight tubes **14** closed at one end are air tightly joined at the other end to the inner ones of the flanged connections **13** and hang down into the body of the container.

In operation, as grain fills the container, the bottom ends of the tubes **14** become trapped and as the level rises, the air is squeezed out of them, the valve **11** being turned to a venting position. When the container is full and the grain has been stored for some time, the consistency of the grain mass may, for biochemical reasons, change from a free flowing particulate substance to a moist mass having a tendency to coagulate and form a bridge.

The drawing shows an opening **15** in the base of the container **1** and a pipe **16** capable of receiving an auger conveyor **17** for withdrawal of grain from the container.

There is also shown at **18** an example of a bridge formed in the grain mass **5** above the opening **15**. The drawing illustrates one tube **14***a* which does not extend into the cavity below the bridge and a tube **14***b* which does. Both tubes are shown with pressure applied to them.

The tubes are made of sheet synthetic material such as polyethylene and can either be formed from two long strips of material joined along their edges or from a single sheet by joining the two longitudinal edges together and making a folded joint at one end. Clearly more elaborate tubes or bags can be made to the extent of providing finger tubes extending laterally or in any other direction, away from the main tube. The common essential of all the tubes is that they should be fluid tight and that when filled with fluid they should occupy a larger volume than when not so filled.

Air pressure applied within the tubes will tend to make them expand and exert forces in a generally horizontal direction throughout the grain mass. In the case of the part of tube **14***b* not surrounded by grain, there will be no resistance to expansion of the tube and hence a bulb will be formed. The tendency will be for the tube to break the under surface of the bridge locally adjacent to the point where the bulb tapers into the grain-constrained part of the tube.

It is found that the application for force to the grain in the horizontal direction, together with local weakening of the bridge where tubes project through it, is normally sufficient to break down the bridge.

Clearly the invention as described in its preferred embodiment can be modified to suit different circumstances. The material stored may form such strong bridges that it might be necessary to use water pressure or any other hydraulic liquid pressure. In large installations it would be possible to install concentric rings of tubes or other patterns which may be found to be more efficient. Also it would be within the present invention to apply pressure sequentially to different tubes or groups of tubes, e.g. pressure could be applied alternatively to two groups of tubes placed on opposite sides of the container.

I claim:

1. Apparatus for storing and dispensing particulate material comprising: a hollow container, an opening in the container through which material is withdrawn from the container, at least one fluid pressure responsive, expansible and contractable member suspended from one end within said container so as to extend into and be surrounded by the particulate material, and means for selectively pressurizing and venting said member to loosen coagulated particulate material surrounding said member to permit the material to be withdrawn from the container through said opening.

2. The construction defined in claim **1** wherein said expansible and contractable member comprises an inflatable tube.

3. A container for storing particulate material having a base with a centrally located opening therein through which the particulate material is withdrawn, a main pipe connected with a source of fluid pressure, a plurality of branch pipes each connecting said main pipe with the interior of the container, said branch pipes terminating at a point spaced vertically above the base, and a plurality of elongated inflatable tubes open at one end and closed at the other, each having its open end fitted onto the end of one of said branch pipes such that the tube is suspended from its associated branch pipe and hangs into and be surrounded by the material within the container, said tubes being inflatable from the fluid pressure source to loosen the particulate material within the container to assist the removal thereof through said opening.

4. Apparatus for storing particulate material comprising a container having a base and a roof with side walls

extending therebetween, an opening in the base, dispensing means connected with said opening for withdrawing particulate material from the container, and a plurality of elongated inflatable tubes suspended by their upper ends from the roof within the container and connected at their upper ends with a source of fluid pressure, said tubes being operable when inflated from said source of fluid pressure to loosen coagulated particulate material within the container adjacent said opening.

5. Apparatus as defined in claim 4 further including a ring pipe on the roof, a plurality of branch pipes mounted in the roof connecting the ring pipe with the interior of the container, each of said inflatable tubes being connected with one of said branch pipes, and means for conducting fluid under pressure to and from said tubes through said ring pipe and branch pipes to selectively inflate and deflate the tubes.

6. Apparatus as defined in claim 5 wherein said conducting means comprises a pump connected with a source of fluid pressure, and a valve controlling said pump for selectively pressurizing and venting the ring pipe.

References Cited

UNITED STATES PATENTS

2,005,681	6/1935	Norquist	222—226
2,501,047	3/1950	Gustafsson et al.	222—193
2,513,455	7/1950	Cornelius	222—386.5
2,646,905	7/1953	Vincent	222—203 X
3,170,600	2/1965	Pierson	222—195 X
3,209,680	10/1965	McGinnis	222—386.5 X

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