Oct. 8, 1963 F. X. CROWLEY 3,106,227

FOAM INSULATED PRESTRESSED CONCRETE WALL

Filed June 20, 1962

FIG. 1

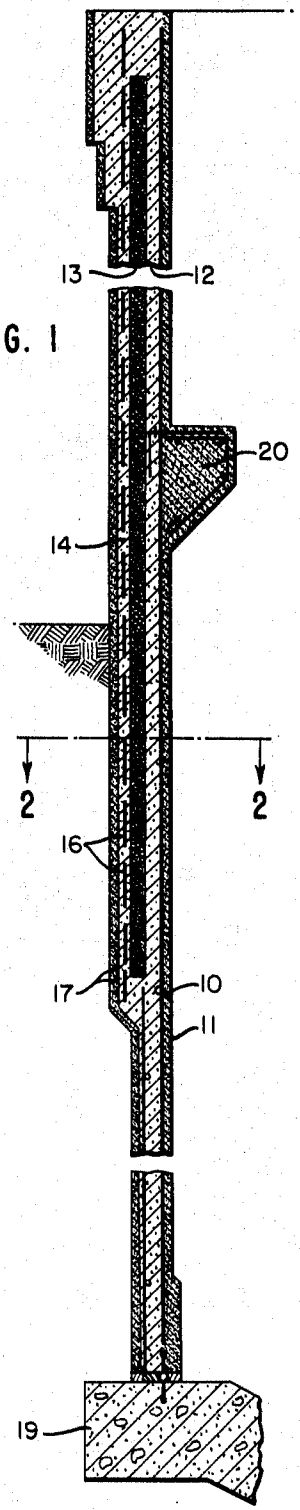
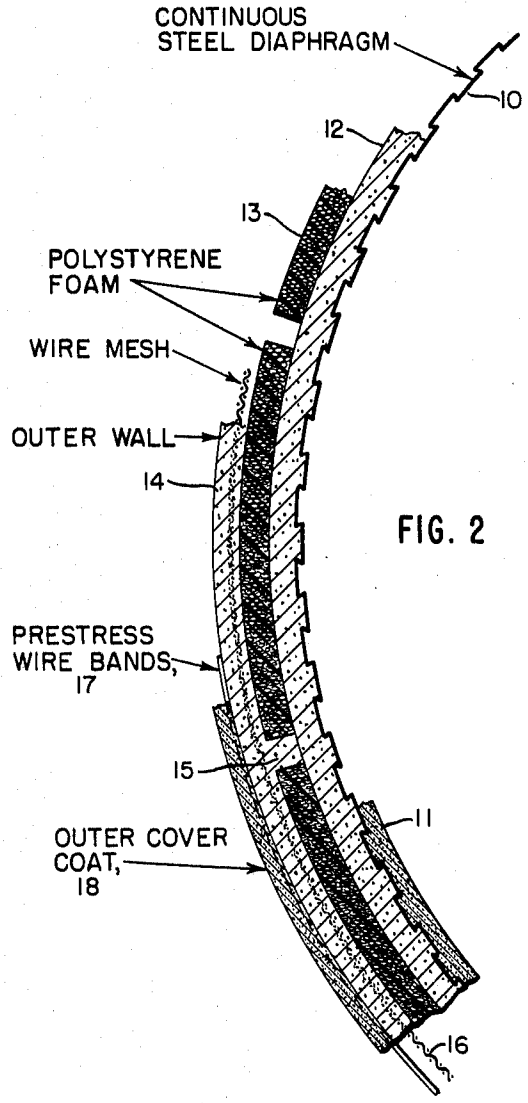


FIG. 2



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United States Patent Office 3,106,227 Patented Oct. 8, 1963

3,106,227

FOAM INSULATED PRESTRESSED CONCRETE WALL

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Filed June 20, 1962, Ser. No. 206,120
2 Claims. (Cl. 138—176)

This invention comprises a new and improved wall structure for tanks and the like that in use must efficiently protect their contents against loss of heat. The structure of my invention is characterized by the encasement in prestressed concrete of sheets or slabs of heat-insulating material that is elastomeric to the extent that it is capable of absorbing or adjusting itself to changes in operating pressures and temperature without in any way impairing the integrity of the wall structure of which it is a component.

One important field of use for my invention is in the construction of digester tanks for sewage in which the contents must be maintained continuously at an elevated temperature to insure the required bacteriological reaction, i.e. at 90° to 100° F. for optimum conditions. Heretofore such tanks have been built at very considerable expense to include an inner concrete wall and an outer brick wall spaced therefrom by an annular dead air space or a space packed with heat insulating material.

The structure of my invention is not only much less expensive to build both from the standpoint of labor and materials but has 50–100% greater heat insulating efficiency.

These important advantages may be achieved in a structure selected as a preferred embodiment of my invention and shown in the accompanying drawing, in which:

FIG. 1 is a view in longitudinal or vertical section, and

FIG. 2 is a fragmentary view in horizontal cross section.

The first step in constructing a tank such as that shown in FIGS. 1 and 2 is to erect a diaphragm of sheet metal **10** in the form of an upright cylindrical enclosure of the desired diameter, for example 20–40 feet. The diaphragm as herein shown is formed with vertically disposed corrugations. Layers of concrete are next applied to the inner concave face of the diaphragm **10** and to its outer convex face. These layers of concrete are applied by the well known "Gunite" process in accordance with which a mixture of sand and cement in water is blasted under air pressure against the supporting surface. In this manner an inner layer **11** and an outer layer **12** are formed which are coextensive in area with the metal diaphragm and present substantially smooth and continuously cylindrical surfaces.

To the outer convex surface of the concrete layer **12** are now affixed rectangular slabs **13** of a sponge heat-insulating sheet material, such as polystyrene or polyurethane foam. These slabs as shown in FIG. 2 are spaced slightly from each other in a circumferential direction and may be 2′ x 8′ in area and 2″ or 3″ in thickness. They may be initially secured in place by adhesive cement or any other convenient means. Having distributed and assembled heat-insulating slabs as suggested in FIG. 2, the assembled components are encased in an outer wall of concrete **14** which bonds itself to the convex wall **12** in the spaced areas **15** between the longitudinal sides of the slabs **13** as well as above and below the slabs so that the latter are completely concealed and encased. Preferably, the outer layer **14** is applied by the same "Gunite" process as before and this layer may be provided with wire mesh reinforcing **16**.

Having concluded the outer wall **14** which it will be understood extends continuously and smoothly about the whole circumference of the tank, the whole structure is wrapped with wire or wire bands **17** and these are subjected to severe tension in order to hold the structure under prestressed compression. A suitable wire for this purpose is cold-drawn high-carbon steel wire 0.162 in diameter having an ultimate strength of 210,000 p.s.i. and a work stress of 105,000 p.s.i.

Having placed the wire **17** under the required tension, a final outer cover-coat **18** of concrete is applied to the circumferential surface of the tank concealing and encasing the wire bands **17** and imparting a smooth surface finish to the tank. This coating is also preferably applied by the "Gunite" process. The whole structure as herein shown is erected upon a solid concrete base **19** which may be shaped to provide a concave bottom for the tank and a flat annular flange to which the wall structure is connected by any conventional form of leakproof joint as suggested in FIG. 1. Also as herein shown the upper rim of the wall structure may be thickened for ornamental or structural reasons and a circumferential flange **20** may be molded at any desired level as a part of the inner concrete layer **11**. This may be secured in place by anchor bolts affixed in spaced relation to the metal diaphragm **10**, and may be employed to support a cover or staging inside the tank.

Comperative figures emphasize insulating efficiency of the novel wall structure above described, in each case the outer surface being subjected to wind 15 m.p.h. and the tank containing warm sludge in contact with its inner surface now as follows:

	U
8″ concrete wall	1.2
4″ brick+2″ Air+12″ concrete	0.36
4″ brick+2″ airspace+8″ concrete	0.41
2½″ Gunite+2″ polystyrene+3″ Gunite	0.20

Where U values indicate the amount of heat loss through the walls of the different types listed. From this it will be seen that a tank of my improved structure is more than twice as effective against heat loss as the more conventional tank having walls of 4″ brick+2″ airspace+8″ concrete.

While I prefer to employ polystyrene sponge as the material of the slabs **13** any equivalent elastomeric foam or sponge may be substituted within the scope of the invention.

The composite wall, comprising the inner concave layer **11**, the metal diaphragm **10** and the convex layer **12**, may be termed the "core wall" and may be varied in the shape and character of its components. In a broad aspect the invention may be defined as a process characterized by the steps of constructing a core wall, encasing elastomeric sponge thereon within a covering layer and subjecting the whole structure to permanent prestress applied outside the encased elastomeric sponge.

This application is a continuation in part of allowed application Serial No. 838,733, filed September 8, 1959, now abandoned.

Having thus disclosed my invention and described in detail a preferred embodiment thereof, I claim as new and desire to secure by Letters Patent:

1. A heat insulating wall for digester tanks and the like, comprising a continuous metal diaphragm in the form of an upright cylindrical enclosure having vertical stiffening corrugations on its surface, concave and convex walls of concrete enclosing the corrugated metal diaphragm between them and presenting substantially smooth and continuous cylindrical surfaces, separate rec-

tangular slabs of heat-insulating elastomeric foam conformed to the outer cylindrical surface of the convex concrete wall and affixed thereto in circumferential spaced relation, an outer concrete wall encasing said elastomeric slabs and being bonded to the convex concrete wall in the spaced areas between the slabs, pre-tensioned wire wrapped in continuous circular bands about the outer concrete wall so as to hold under compression the entire wall structure including the elastomeric slabs, and a cover layer of concrete encasing said wires.

2. A heat-insulating wall for digester tanks as above described, further characterized in that the said elastomeric slabs are of polystyrene foam.

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