March 15, 1960 K. M. GLASOE, JR 2,928,565

INSULATED STRUCTURE

Filed Sept. 6, 1955 2 Sheets-Sheet 1

FIG. 1

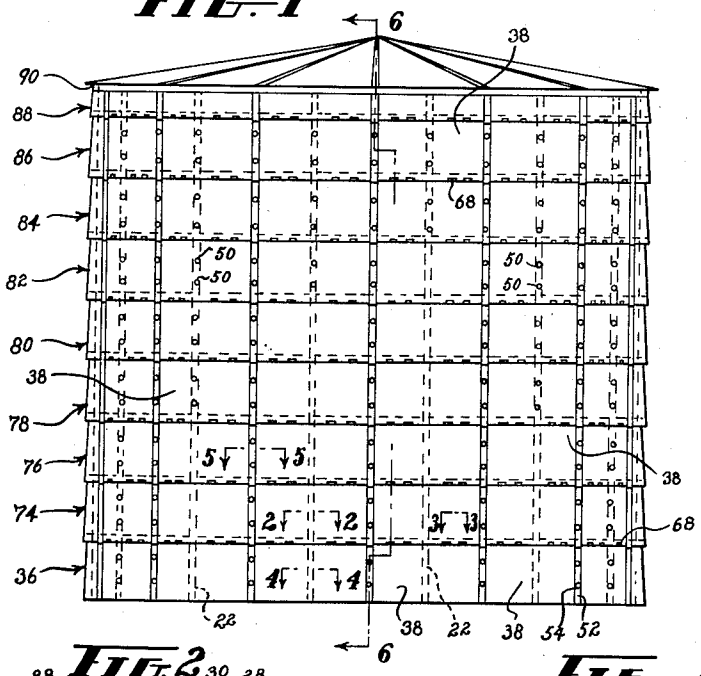

FIG. 2

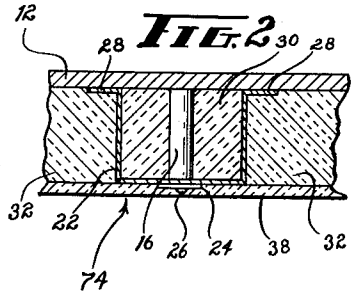

FIG. 3

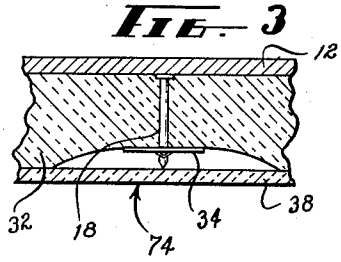

FIG. 4

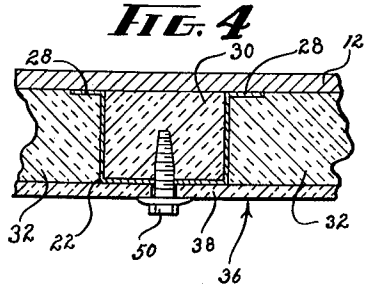

FIG. 5

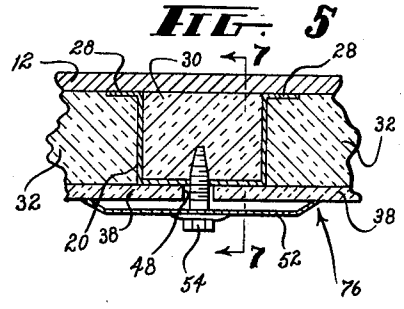

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FIG. 6

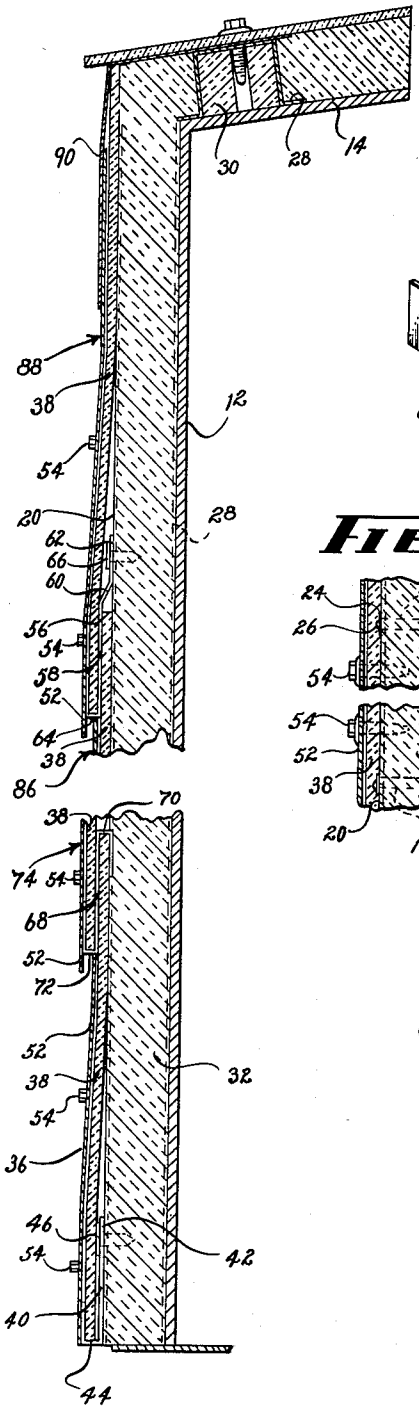


FIG. 8

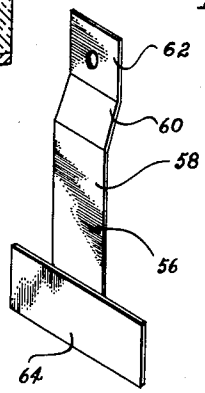


FIG. 7

FIG. 9

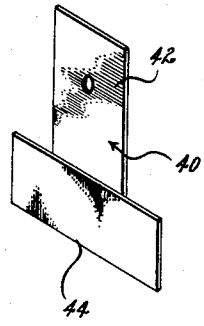
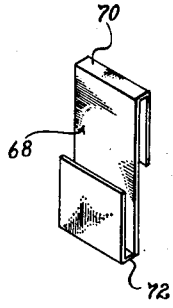


FIG. 10



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2,928,565

INSULATED STRUCTURE

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Application September 6, 1955, Serial No. 532,677

2 Claims. (Cl. 220—9)

The present invention relates in general to an insulated structure and a method of insulating structures and, since the invention is particularly applicable to insulating tanks, such as oil storage tanks, it will be considered in such connection herein with the understanding that it is equally applicable to insulating other structures. Also, the invention will be considered herein as applied to insulating a vertical structure, such as the side of a tank, it being understood, however, that the same principles may be applied to insulating generally horizontal, or other nonvertical surfaces.

In general, the present invention contemplates insulating a tank by covering it with a layer of insulating material, which is then covered with a sheathing material for protective purposes, the insulating material minimizing heat transfer between the interior and the exterior of the tank.

In insulating the side of a tank in accordance with the invention, vertical supports or studs are secured to the side of the tank in spaced, parallel relation, the spaces between the vertical supports being filled with insulating material, preferably in the form of blankets secured to the side of the tank. The vertical supports are preferably hollow and are also filled with insulating material. The insulating material and the studs are then sheathed for protective purposes by placing over the insulating material and the studs overlapping courses of sheathing panels, which may be metallic panels, composition panels, or the like.

A primary object of the invention is to provide an insulating means of the foregoing general nature wherein the sheathing panels are so mounted on the side of the tank that they float relative to each other and relative to certain of the vertical supports or studs. Such a floating mounting for the sheathing panels enables them to perform their function without damage thereto when the tank expands or contracts, due for example, to temperature changes, filling or draining of the tank, and the like. In a large oil storage tank, for example, such expansion and contraction may be extremely large, and the present invention accommodates such expansion and contraction without damage to the sheathing panels.

Considering the invention more specifically now, an object is to provide an insulating means which includes main and intermediate vertical supports spaced apart along the side of the tank in alternating relation, insulating material between the supports and overlying the side of the tank, overlapping courses of sheathing panels overlying the supports and the insulating material with each sheathing panel spanning the space between two of the main supports and overlying the intermediate support therebetween and with spaces between the sheathing panels at the main supports, and means for rigidly securing the sheathing panels only to the intermediate supports which they overlie. With this construction, the sheathing panels are rigidly secured to the tank only at their centers so that they may float relative to each other to compensate for expansion and contraction of the tank, which is an important feature of the invention.

Another object is to provide means interconnecting the sheathing panels in a manner permitting relative sliding movement therebetween in response to expansion and contraction of the tank, such interconnecting means slidably engaging the edges of the sheathing panels. With this construction, the sheathing panels are rigidly secured to the intermediate supports at their centers, and are lightly secured at their edges in a manner permitting relative sliding movement between the panels to maintain the desired floating mounting for the panels.

Another object is to provide means for interconnecting the overlapping edges of the panel courses in a manner permitting relative sliding movement, which includes clips connected to the main supports and slidably engaging the panel edges, and which includes S-shaped clips intermediate the supports and engaging the overlapping edges of the panels to permit relative sliding movement therebetween. More particularly, the S-shaped clips are hooked over the upper edges of the panels of one course and receive the lower edges of the panels of the next higher course.

Another object is to provide means interconnecting the vertical panel edges in a manner permitting relative sliding movement therebetween comprising battens overlying the spaces between the sheathing panels of each course and attached to the main supports by fastening means extending through the spaces between the sheathing panels at the main supports.

With the foregoing construction, the horizontal panel edges are overlapped and the vertical panel edges are covered with battens, all in a manner permitting relative sliding movement of the panel edges to provide the desired floating action while still weatherproofing the insulating material underneath or behind the sheathing panels.

An important feature of the S-shaped clips mentioned is that, in addition to interconnecting the overlapping edges of the sheathing panels in a manner permitting relative movement therebetween, they serve as a means of mounting the second and subsequent sheathing panel courses on the sheathing panel courses therebeneath, respectively, while the sheathing panels are being secured at their centers to the intermediate supports, this dual function of the S-shaped clips being quite important.

The foregoing objects, advantages, features, and results of the present invention, together with various other objects, advantages, features and results thereof which will be quite evident to those skilled in the art in the light of this specification, may be attained with the exemplary embodiment of the invention illustrated in the accompanying drawings and described in detail hereinafter. Referring to the drawings:

Fig. 1 is a side elevation of an oil storage tank insulated in accordance with the present invention;

Figs. 2, 3, 4, and 5 are enlarged, fragmentary sectional views respectively taken along the arrowed lines 2—2, 3—3, 4—4 and 5—5 of Fig. 1;

Fig. 6 is an enlarged, fragmentary sectional view taken approximately along the irregular broken line 6—6 of Fig. 1;

Fig. 7 is a fragmentary sectional view taken along the arrowed line 7—7 of Fig. 5; and

Figs. 8, 9 and 10 are isometric views of sheathing panel supporting clips of the invention.

It is thought that the simplest and most direct way of disclosing the insulating means of the invention in detail is to describe the procedure followed in insulating the tank shown in the drawings, this tank having a cylindrical side wall 12, Figs. 2 to 7, and a conical top wall 14, Fig. 6. Only the procedure for insulating the side wall 12

of the tank will be considered herein, the same principles being applicable to the top wall **14**.

One of the initial steps is to weld, or otherwise secure, studs **16**, Figs. 2 and 7, to the side wall **12** in horizontally spaced, vertical rows. Also insulation-retaining pins **18** are welded, or otherwise secured, to the exterior of the side wall **12** between the vertical rows of studs **16**, the pins **18** being arranged in a more or less regular pattern.

After the vertical rows of studs **16** have been secured to the side wall **12**, vertical main and intermediate supports **20** and **22** are secured to the side wall **12** in alternating relation by means of the vertical rows of studs **16**. In other words, one vertical row of studs **16** is utilized to secure a main support **20** to the side wall **12**, the next vertical row of studs **16** is utilized to secure an intermediate support **22** to the side wall **12**, and so forth, a main support being shown in cross section in Fig. 5, and an intermediate support being shown in cross section in Figs. 2 and 4. As clearly shown in Fig. 2, each stud **16** projects through the intermediate support **22** shown, and its outer end is then peened over a washer **24**, as indicated at **26**, thereby securing the intermediate support **22** shown to the side wall **12**. Each main support **20** and each intermediate support **22** is secured to the side wall **12** by the studs **16** in the same manner.

It will be noted that the main and intermediate supports **20** and **22** are channels which face inwardly relative to the side wall **12** and which are provided at their inner edges with flanges **28** seated against the side wall, whereby the studs **16** rigidly secure the main and intermediate supports to the side wall. To minimize heat transfer through the supports **20** and **22** and the studs **16** which secure them to the side wall **12**, the channels forming the supports **20** and **22** are filled with insulating material, as indicated at **30**.

After the foregoing has been accomplished, the spaces between the supports **20** and **22** are filled with insulating material **32**, preferably in the form of blankets or strips which are merely pressed inwardly into the spaces between the supports **20** and **22** and against the side wall **12** so that they are pierced by the pins **18**. The insulating material **32** is then retained by washers **34**, Fig. 3, pressed onto the pins **18**.

The foregoing completed, the insulated side wall **12** is now in condition for sheathing to protect the insulating material **32** against the weather. The sheathing procedure will now be described.

The first step is to install a bottom or lower course **36** of sheathing panels **38**, which is accomplished in the following manner. As an initial step, supporting clips **40**, Figs. 6 and 9, for the sheathing panels **38** are secured to the main and intermediate supports **20** and **22** adjacent the lower ends thereof. As shown in Figs. 6 and 9, each supporting clip **40** includes a tab **42** having at the lower end thereof an upwardly facing channel **44**. As shown in Fig. 6, the supporting clips **40** are secured to the supports **20** and **22** by means of screws **46**, such as sheet metal screws, extending through the tabs **42** into the supports **20** and **22**, the channels **44** of the supporting clips **40** being positioned at the level desired for the lower edges of the sheathing panels **38** of the lower course **36**.

The foregoing accomplished, the sheathing panels **38** of the lower course **36** are then positioned over the supports **20** and **22** and the insulating material **32**, with their lower edges in the channels **44** so that the channels **44** support the sheathing panels of the lower course temporarily. In order to permit the hereinbefore discussed floating action of the sheathing panels **38**, the lower edges of the panels of the lower course **36** make sliding fits in the channels **44**.

It will be noted that, as best shown in Fig. 1 of the drawings, each panel **38** spans the space between two of the main supports **20** and thus overlies the intermediate support **22** therebetween. Also, the width of the panels **38** is so related to the main support spacing as to provide spaces or gaps **48** between adjacent panels, as typically shown in Fig. 5 of the drawing. It will be understood that the foregoing discussion in this paragraph is applicable not only to the sheathing panels **38** of the lower course **36**, but to the sheathing panels **38** of all of the courses.

Adverting to the lower course **36**, after the sheathing panels **38** thereof have been seated in the channels **44**, or as each panel is seated in the channels **44** of the supporting clips **40** connected to the main supports **20** which it spans, the centers of the sheathing panels of the lower course are secured to the intermediate supports **22** which they overlie. As best shown in Fig. 4 of the drawings, each panel **38** is secured to the intermediate support **22** which it overlies by one or more screws **50**, such as sheet metal screws. The screws **50** connecting the central portions of the panels **38** to the intermediate supports **22** represent the only rigid connections between the sheathing panels and the side wall **12** of the tank, all other portions of the sheathing panels being able to move relative to each other and to the supports **20**, as will more fully appear hereinafter, to compensate for expansion or contraction of the tank. It should be pointed out that this floating action is the reason for the gaps **48** between adjacent panels **38** of each course, these gaps closing as the tank contracts and opening as the tank expands.

To cover the gaps **48**, battens **52** of any suitable material are placed over the gaps and are secured to the corresponding supports **20**, as by means of sheet metal screws **54**, Fig. 5, extending through the gaps **48** and threaded into the main supports **20**. The vertical edges of the sheathing panels **38** are slidable relative to the main supports **20** and the battens **52**, as well as relative to the supporting clips **40** connected to the main supports **20**, to attain the desired floating mountings for the panels.

The foregoing completes the installation of the sheathing panels **38** of the lower course **36**, these panels being free to float relative to the main supports **20** despite the fact that the battens **52** cover the vertical joints therebetween. Thus, the battens in effect provide vertical expansion joints between the panels of the lower course.

After the first sheathing-panel course **36** is completed, supporting clips **56** are connected to the main supports **20** just above the upper edge of the lower sheathing panel course. As best shown in Fig. 8, each clip **56** includes a tab **58** having an offset portion **60** to enable an upper portion **62** of the tab to contact one of the main supports **20**, while the lower portion of the tab overlies the lower sheathing-panel course **36**. The tab **58** of each supporting clip **56** is provided at its lower end with an upwardly-facing channel **64** which, as best shown in Fig. 6, is located below the upper edge of the preceding sheathing-panel course a sufficient distance to provide an overlap. The supporting clips **56** may be secured to the main supports **20** in any suitable manner, as by means of sheet metal screws **66** extending through the upper portions **62** thereof into the respective main supports **20**.

Concurrently with the installation of the supporting clips **56**, S-shaped supporting clips **68**, best shown in Fig. 10, are installed. Referring to Fig. 10, each S-shaped clip **68** is provided with an inner, downwardly facing channel **70** and an outer, upwardly facing channel **72**, the channels **70** and **72** being spaced apart sufficiently to align the channels **72** of the clips **68** with the channels **64** of the clips **56** when the upper channels **70** are placed over the upper edges of the sheathing panels of the preceding course. As the foregoing suggests, the upper channels **70** of the S-shaped clips **68** are merely hooked over the upper edges of the sheathing panels **38** of the lower course **36**, best shown in Fig. 6, there preferably being two S-shaped clips between each pair of vertical supports **20** and **22**.

After the clips **56** and **68** have been installed in the foregoing manner, the sheathing panels **38** of the next course, designated by the numeral **74**, are seated in the channels **64** and **72** of the clips **56** and **68** and are se-

cured to the intermediate supports 22 which they overlie, the lower edges of the sheathing panels of the course 74 making sliding fits in the channels 64 and 72 and the upper edges of the panels of the lower course 36 making sliding fits in the channels 70. From this point on, the panels 38 of the second course 74 are secured and battened in the same manner as the panels 38 of the first course 36 so that a repeated description is thought to be unnecessary.

Successive courses of sheathing panels 38, such as the courses 76, 78, 80, 82, 84, 86 and 88, are then installed in the same manner as the second course 74, the various operations hereinbefore described being repeated until the top of the side wall 12 of the tank is reached. The uppermost course 88 is then overlapped by a flashing 90, and the top wall 14 of the tank is then insulated, utilizing the same general principles as hereinbefore discussed. Consequently, it will not be necessary to consider in detail the manner in which the top wall 14 is insulated.

As hereinbefore suggested, a major feature of the present invention is that each sheathing panel 38 is rigidly secured at its central portion only, being rigidly secured to the intermediate support 22 which it overlies. The edge portions of each sheathing panel 38 are free to slide relative to everything else in the structure, such as the edge portions of adjoining sheathing panels, the various clips 40, 56 and 68, the main supports 20, and the battens 52. Thus, any expansion or contraction of the tank, due for example, to temperature changes, or filling or draining of the tank, merely results in movement of the sheathing-panel edges relative to the balance of the structure. Consequently, the sheathing structure of the invention can accommodate a great deal of tank expansion and contraction with no possibility of damage.

Another important feature is that the S-shaped clips 68 provide a means of interconnecting the horizontal edges of the sheathing panels 38 to retain them in their proper relationship, while still permitting the aforementioned relative movement, similar considerations being applicable to the battens 52, and to the support clips 40 and 56. However, the S-shaped clips 68 are particularly important since they serve the dual function of positioning the sheathing panels of a succeeding course and of interconnecting the panels of adjacent courses.

Although I have disclosed an exemplary embodiment of my invention herein for purposes of illustration, it will be understood that various changes, modifications and substitutions may be incorporated in such embodiment, without departing from the spirit of the invention as defined by the claims hereinafter appearing.

I claim as my invention:

1. In an insulated structure, the combination of: main and intermediate supports spaced apart along said structure in alternating relation; insulating material between said supports and overlying said structure; means including pins which have inner ends connected to said structure and which project outwardly through said insulating material for securing said insulating material to said structure; sheathing panels overlying said supports and said insulating material, each of said sheathing panels spanning the space between two of said main supports and overlying the intermediate supports therebetween, the ends of said sheathing panels being spaced apart at said main supports; means securing each sheathing panel only to the intermediate support which it overlies; and battens secured to said main supports and overlying the spaces between and the ends of said sheathing panels, whereby said sheathing panels float relative to each other and relative to said main supports to compensate for expansion and contraction of said structure.

2. In an insulated structure, the combination of: main and intermediate supports spaced apart along said structure in alternating relation; insulating material between said supports and overlying said structure; a plurality of sheathing panels overlying said supports and said insulating material and arranged in overlapping courses, each of said sheathing panels spanning the space between two of said main supports and overlying the intermediate support therebetween, the ends of said sheathing panels being spaced apart at said main supports; means comprising a row of fastening elements rigidly securing each of said sheathing panels only to the intermediate support which it overlies; and means permitting relative movement therebetween for connecting said sheathing panels to each other and to said main supports, whereby said sheathing panels float relative to each other and relative to said main supports to compensate for expansion and contraction of said structure, the means last defined including supporting clips secured to said main supports and loosely and slidably engaging edges of said sheathing panels.

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