April 16, 1968 E. S. SMITH 3,378,162

INSULATED TANKS

Filed Oct. 1, 1965 5 Sheets-Sheet 1

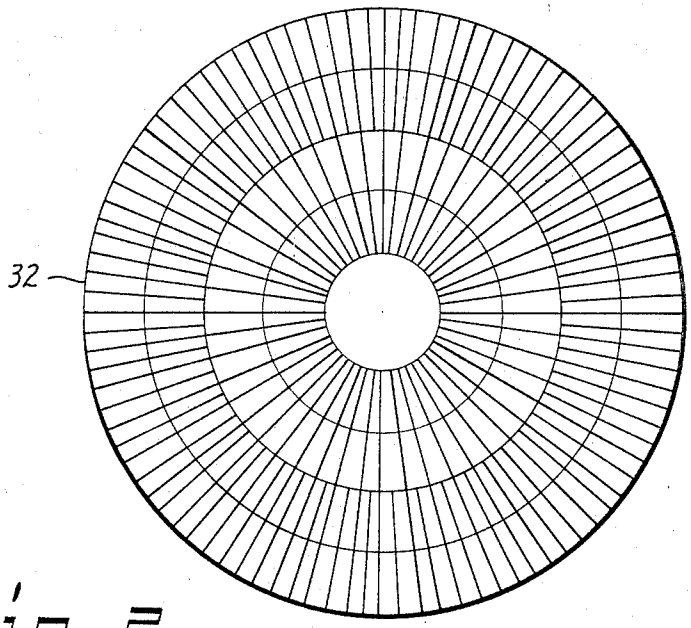



Fig. 2

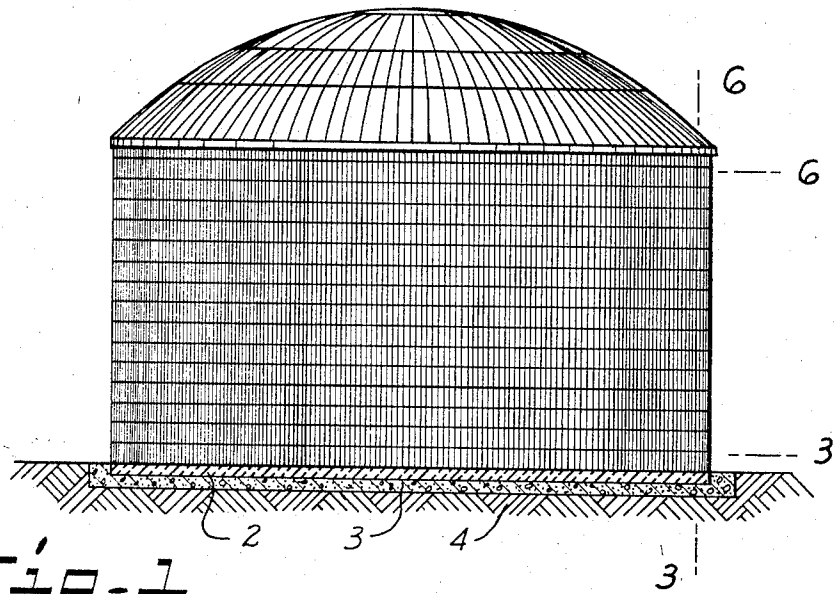



Fig. 1

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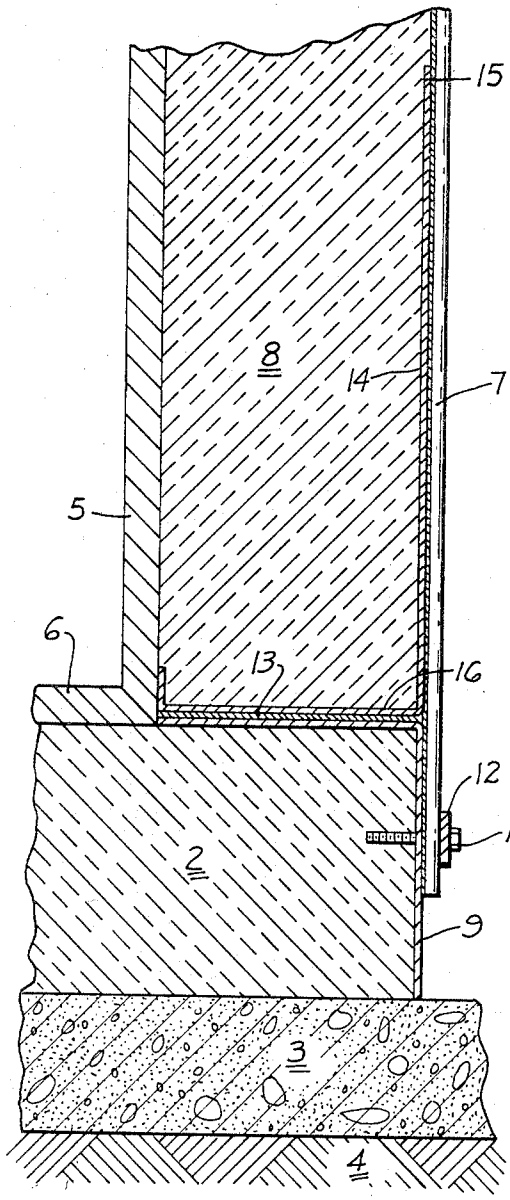



Fig. 3A

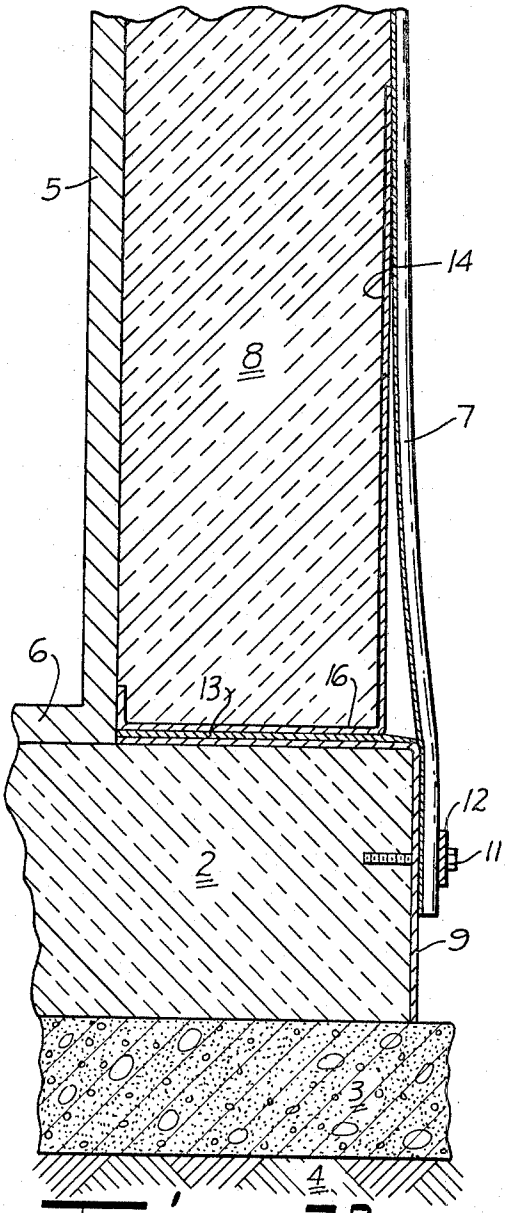



Fig. 3B

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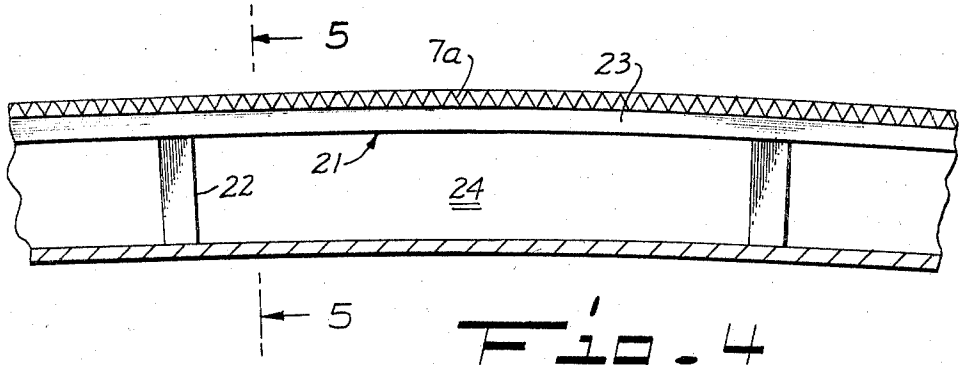



Fig. 4

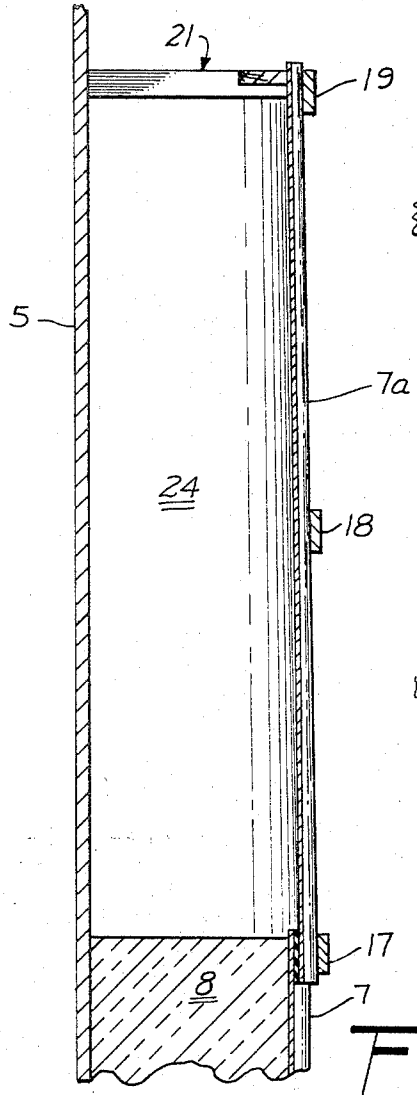



Fig. 5

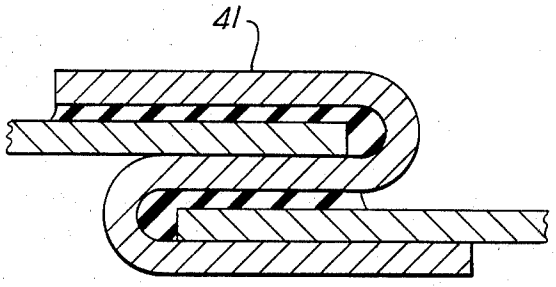



Fig. 10

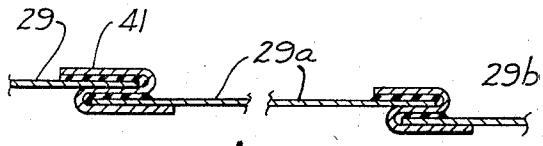



Fig. 10A

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INSULATED TANKS

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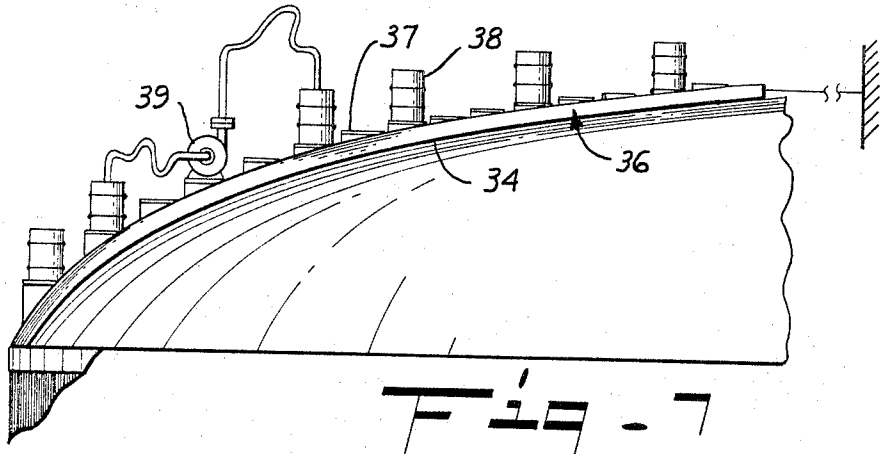



Fig. 7

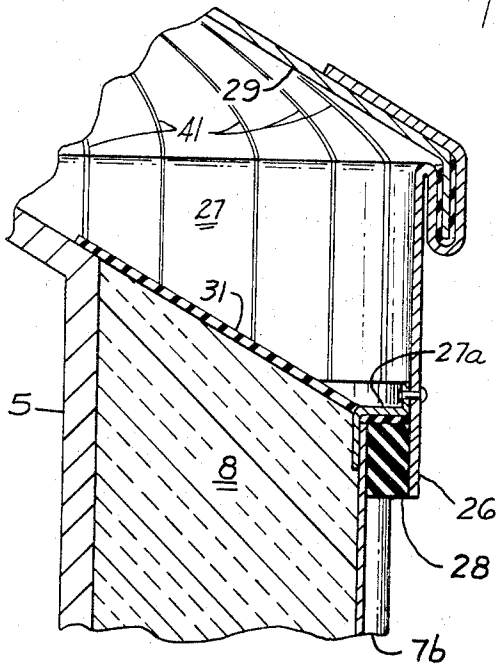



Fig. 8

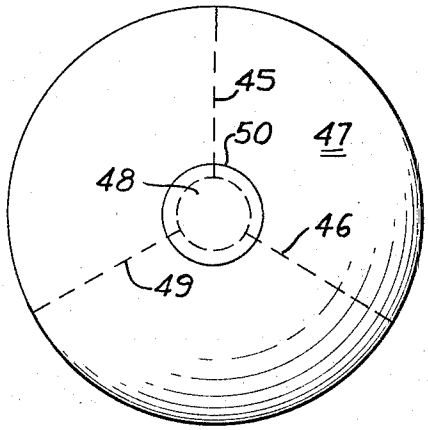



Fig. 11

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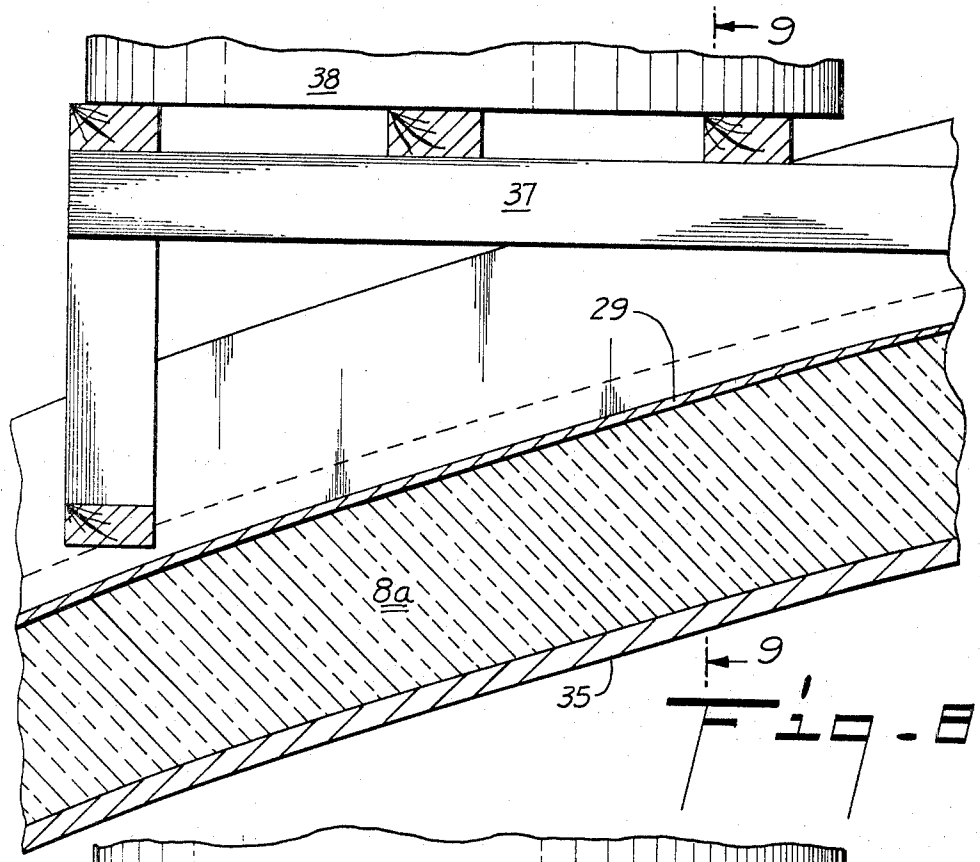



FIG. 8

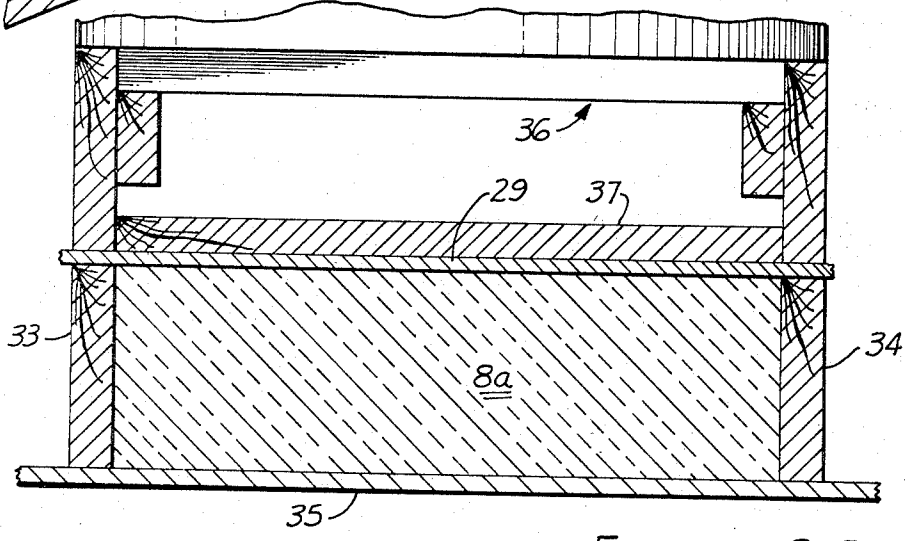



FIG. 9

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United States Patent Office 3,378,162
Patented Apr. 16, 1968



3,378,162

# INSULATED TANKS

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Filed Oct. 1, 1965, Ser. No. 491,927
5 Claims. (Cl. 220—9)

## ABSTRACT OF THE DISCLOSURE

An insulated tank comprising a tank body, an impervious jacket of vertically corrugated metal surrounding the tank body, and plastic foam insulation between the body and jacket. The jacket is in tension, and the insulation adheres to the tank body and the jacket and is maintained under compression by the tension of the jacket. The jacket includes a plurality of strips of the corrugated metal disposed substantially horizontally around the tank, and each of the strips above a bottom strip overlaps the next lower strip. Mastic is disposed between this overlapping portion to provide a vapor proof expansion joint.

This invention relates to improvements in insulated tanks and to improvements in processes for insulating tanks. It is especially useful in large tanks for storing very cold liquids, such as methane, propane, butane and ammonia, but is not limited to such use.

Large tanks for the storage of cold liquids present special problems in the maintenance of insulation since these tanks are usually insulated with cellular or fibrous materials which require a vapor barrier to prevent the intrusion of moisture. Attachment of insulation, vapor barrier, and weatherproofing is complicated by the large and variable differentials in temperature, and resulting expansion and contracting of the tank, insulation, vapor barrier and weatherproofing. These is a constant moving of these items with relation to each other as the ambient temperature changes or the tank is filled or emptied. Also it is necessary to apply the insulation, vapor barrier, and weatherproofing to a tank at ambient temperature and upon filling, the full contraction of the tank takes place, resulting in a displacement of the tank with relation to the insulation and/or the insulation with respect to vapor barrier and weatherproofing. This constant movement usually results in failure of the insulation securement, or rupture of the insulation, or fracture of the vapor barrier or all of them and failure of the system.

In order to nullify this movement, I have devised a system of insulating tanks whereby the tank is free to expand and contract on its vapor sealed base insulation of cellular glass or insulating concrete, a normal construction of sufficient strength to carry the weight of the tank, contents, and insulating system. The sidewall insulation is monolithic and bonded to the tank and has a coefficient of thermal expansion such that the insulation is always held in contact with the tank by thermal contraction. The vapor barrier and weatherproofing is circumferentially elastic and bonded to the insulation under tension within its elastic limit such that it always holds the insulation under radial compression. The vapor barrier and weatherproofing are also free to follow vertical expansion and contraction. The sidewall vapor barrier is bonded to the base insulation vapor barrier without any relative movement between the two at the point of junction so that it does not become a point of failure. The roof or dome insulation is monolithic of the same or similar material as the sidewall insulation and is bonded to the tank and vapor barier. The vapor barrier and weatherproofing are either elastic and applied under tension or incrementally free to follow expansion and contraction of the tank and insulation. The dome vapor barrier is free to follow the sidewall vapor barrier at the point of junction. There is no connection between the tank and jacket by a thermally conductive material at any point.



It is an object of the present invention to provide an improved process for insulating a tank wherein a plastic foam is generated and cured in a space between the exterior of the tank and an impervious or vapor-tight jacket held under tension.

Another object is to provide process for insulating large tanks for low temperature service which results in a tank insulated with plastic foam held under light compression between the tank and a jacket free to expand and contract both vertically and radially in response to change in temperature.

Another object is to provide a process of the above type wherein foamed plastic insulation on the exterior of a tank does not adhere firmly to the impervious jacket at a level adjacent the bottom of the tank.

Another object is to provide a process for insulating a tank with foamed plastic insulation which provides free vertical and radial expansion of the tank, jacket, and insulation at different rates.

Another object is to provide an improved insulated tank having insulation on the exterior thereof which does not work loose from the tank under the influence of both radial and vertical expansion.

Still another object is to provide an improved insulated tank having a flat bottom supported by flat base insulation, cylindrical side walls and domed top in which radial and vertical expansion of the tank, foamed plastic insulation and vapor-tight jacket do not cause separation of the tank and jacket from the insulation.

Other objects and advantages will become apparent to those skilled in the art from consideration of the detailed description given below and the attached drawings.

In the present invention, a strip of impervious or vapor-tight elastic jacket material, which preferably is of cross-corrugated metal, is stretched around the exterior of a tank under sufficient force to increase its length within the elastic limit of the strip and by an amount sufficient to maintain foam insulation in a space between the jacket and the exterior of the tank under pressure when the tank is at maximum contraction and the jacket is at maximum expansion due to ambient temperature and sunlight.

The stretched strip is held at a selected distance from the exterior of the tank, preferably by a wooden form placed between the upper part of the strip of jacket material and the exterior of the tank and by detachable bands surrounding the strip of jacket material and the tank. The wooden form preferably is of skeleton type providing room for introduction of a plastic foam producing material into the space between the tank and strip. This space, of course, is selected according to the thickness of foam insulation desired.

A plastic foam as for example, a polyurethane foam is then generated in the space between the tank and the impervious jacket material by introducing a plastic foam producing mixture into this space. As the mixture foams, outward pressure is exerted upon the strip of jacket material and expansion of the space is resisted by the bands around the jacket. As the foam is generated and set, it expands and adheres to both the tank and strip. Preferably a primer is applied to the exterior of the tank and interior of the strip before the foam producing material is introduced, to increase adhesion of the foam to strip and tank. After the foam has set, the strip is released and in tending to contract it applies pressure upon the foam between the strip and tank.

The plastic foam producing mixture may be any of the mixtures commonly sold for producing plastic foams such as polyurethane foam, epoxy foam, etc. which are

readily available from manufacturers of these materials and are widely sold upon the market. The primer also may be any of the commercially available primers commonly sold for this use. It is not believed that it is necessary to describe these mixtures and primers in detail since they are well known in the art and the present invention is not limited to any particular plastic foam producing mixture or primer.

To take care of the large variation in radial expansion between the bottom of the tank and the base insulation a lower course of impervious jacket material is stretched around the base insulation and the lower part of the tank adjacent thereto to an increase in length as described above and the stretched strip is permanently attached to the base insulation, as for example by a metal band around a lower part of the strip, holding the bottom of the strip in sealed contact with the base insulation.

In one particular embodiment of the invention, a sheet of plastic film, such as a film of polyethylene or polypropylene plastic, is attached at one of its edges to the inside of the stretched lower strip of jacket material near the top of the stretched strip and the opposite edge of the sheet is attached to the exterior of the tank at the bottom. The sheet of film extends around the tank and it has sufficient width to provide a bight to lie flat upon the base insulation which normally extends a few inches beyond the base of the tank. The upper edge of the stretched strip of jacket material is held at a selected distance from the tank and a plastic foam producing material is poured upon the strip of plastic film and as the material foams and expands, a plastic foam adhering to the tank, to the film and to the lower course of jacket material is formed and set. The stretched strip of jacket material is then released so that it may apply compression upon the foam between itself and the tank.

The next course of jacket material above the lower course is then formed by stretching a second strip of jacket material around the tank above and overlapping the outer upper edge of the lower course just poured and set. This strip of jacket material is stretched to the same degree, so that corrugations in the metal of the adjacent strips fit into each other. This strip also is held at the same selected distance from the tank and the plastic foam producing material is poured in the space between the strip and the tank. The overlapping edges of the lower course and the course just above are then sealed with a mastic material which does not harden but remains soft so that vertical expansion and contraction between the adjoining strips of jacket material may occur freely without breaking the vapor-tight seal formed by the mastic. Mastic materials of this type are very common, and are available from a large number of suppliers on the market so it is believed that it is unnecessary to describe their composition since the present invention is not concerned with any particular mastic material. Any of those widely sold on the market which do not harden and remain plastic are usable.

After the foam has set in the second course, a third course of jacket material is stretched around the tank in the same way and an additional course of foam producing material is poured. Addition of courses in this manner is continued until the top of the tank is reached. When the top of the tank is reached, a band of sheet metal made up of separate laterally overlapping sections connected by vapor proof expansion joints is installed around the tank. This band of sheet metal is then sealed to the exterior of the top course of corrugated jacket material by mastic, in the same manner as in the overlapping joints of the courses of jacket material used in building up the insulation on the side of the tank, and insulation of the top of the tank is then carried out.

Forms are set for producing an "orange peel" section or gore of the tank top. Depending upon the diameter of the tank, several courses of these orange peel sections may be required but usually two or three courses of orange peel sections of decreasing size, and a circular center section are sufficient. A strip of flat jacket material is cut to provide an external jacket for the first orange peel section and is held at a selected distance from the tank while the foamed plastic material is poured in this section. To prevent leakage of water and vapor into the insulation it is necessary to seal this strip to the corresponding section of the sheet metal band around the top of the side wall of the tank. This preferably is accomplished by the use of an ordinary "Pittsburg" joint filled with mastic.

The forms for the first orange peel course are curved to conform with the curve of the top of the tank, and a second form carrying sufficient weight to hold the orange peel strip of jacket material in place on the top of these forms is placed over the section of jacket material. The plastic foam producing material is then introduced between the strip of jacket material and the top of the tank, foam is generated, and is set. Because of the length of these orange peel strips, it may be necessary to pour each strip in several increments such as three or more.

After one of the orange peel sections is completely poured and the resulting foam has set, a form is moved outward for a distance to provide a second orange peel section and a second section is poured in the same manner. The process is continued until sections extending all the way around the tank have been poured. Inner orange peel sections are then set and poured in the same manner which may cover the entire top of the tank except for a small circular opening in the center of the top which is left during the pouring of the inner course of orange peel sections to permit introduction of the plastic foam producing material. After all the orange peel sections have been set, a circular disc of jacket material sufficient to cover this central opening and overlap the inner edges of the orange peel sections is provided, the central opening in the tank top is filled with insulation by introducing plastic foam producing material into it, and the circular disc of jacket material is held down for example by a foot of a workman until the foam has expanded against it and set.

In insulating the top all edges of the orange peel sections of jacket material are arranged to form expansion joints with all adjoining sections. This preferably is done by the use of mastic filled S-couplings receiving edges of adjoining sections while the overlapping edges of the central disc of jacket material and the inner edges of the corresponding orange peel sections are sealed by introducing mastic beneath the edges of the circular disc to fill the spaces.

It is believed that the process may be more easily understood from consideration of the detailed description given below and of the attached drawings wherein:

FIGURE 1 is an elevation of a tank having insulation installed by the method of this invention,

FIGURE 2 is a top view of the tank shown in FIGURE 1.

FIGURES 3A and 3B are enlarged detail sections of the tank on the line 3—3, FIGURE 3A showing the bottom of the tank in expanded position and 3B showing the bottom of the tank in contracted position,

FIGURE 4 is top plan view of a stretched strip of jacket material illustrating one preferred means of holding the stretched jacket material at a selected distance from the tank until plastic foam has been poured and set,

FIGURE 5 is an elevation, in section, of a strip of jacket material stretched around the tank overlapping a poured lower course and held at a selected distance from the tank,

FIGURE 6 is a detail showing a preferred method of attaching the side wall jacket to the jacket material of the top in the location shown by the line 6—6 of FIGURE 1,

FIGURE 7 illustrates one preferred type of apparatus effective to hold an orange peel section of jacket material at a selected distance from a domed tank top,

FIGURE 8 is an enlarged fragmentary elevation of the apparatus of FIGURE 7.

FIGURE 9 is a cross-section through the apparatus of FIGURE 8 on the line 9—9,

FIGURES 10 and 10A are enlarged details showing preferred expansion joints for the edges of orange peel sections of jacket material for the top of the tank, and

FIGURE 11 is an enlarged view of an innermost course of orange peel sections of jacket material on a domed tank top.

The large tank shown in FIGURE 1 is a steel tank constructed in the usual manner standing upon a stratum of base insulation **2** made of foamed glass or other similar insulating material best shown in FIGURES 3A and 3B, which rests upon a concrete base **3** and in turn is supported by packed earth **4**. In applying insulation by the process of the present invention, a strip of impervious jacket material illustrated as a strip of cross-corrugated metal **7** is stretched around the lower part of the tank wall **5**, tank bottom **6** and base insulation **2** and a form **21**, (FIGURES 4 and 5) disposed between the tank wall and the upper edge of strip **7** to an increase in length within its limit of elasticity and sufficient to maintain foam insulation **8** later formed in a space between strip **7** and the exterior of the tank under compression when the tank is at maximum contraction and the jacket is at maximum expansion due to ambient temperature plus any small additional expansion effect due to sunlight. Since the jacket will be stretched at ambient temperature the minimum degree of stretch thus can be taken as somewhat greater than the change in circumference of the tank due to expansion of contraction of the tank between a low temperature due to the cold liquid, when the tank contains such liquid, and ambient temperature when the tank is empty. The change in circumference of the tank of course can be easily calculated from the coefficient of expansion of the material from which the tank is made, expected change in temperature, and length of circumference at ambient temperature by equations well known in the art. It is preferred that the strip be stretched to an extent about twice the change in circumference of the tank on such change in temperature. Considerable variations from this preferred degree of stretch of jacket material can be used if desired, but should always be in excess of the maximum change in tank circumference and should not be so great as to cause difficulties in installation.

Stretched in this manner, the sheet of jacket material always will be under tension tending to compress plastic foam insulation **8** in the space between the jacket material and tank and thereby counteract the tendency of the tank insulation and jacket material to separate under the influence of variations in temperature. The steel walls **5** and bottom **6** of the tank expand and contract at one rate, the insulation **8** at another rate and the jacket material **7** at still another rate. It has been found however, that this relatively light degree of compression due to tension of the jacket is highly effective in preventing separation of the tank, insulation and jacket. Plastic foam insulations are sufficiently compressible that a tendency for separation does not occur in response to changes in degree of tension on the jacket due to expansion and contraction with temperature changes.

Before stretching the strip of jacket material **7** around the base insulation and lower part of the sidewall of the tank, it is preferred that a vapor barrier **9** be installed upon the top and outer edge of base insulation **2**. The strip of jacket material for the lower course of insulation is then stretched and is rigidly attached to the base insulation by means of pins **11** and band **12** or other type of permanent attachment. It is preferred that a smooth strip of plastic material **13** be placed upon the vapor seal **9** to provide a smooth sliding joint between a sheet of plastic film **14** and sheet **13**. The upper edge **15** of plastic sheet **14** is sealed to the lower course of jacket material **7** adjacent to the top of this course. The strip **14** extends around the tank and has width sufficient to provide a bight **16** tc lie flat upon the sheet **13**, and at the lower edge is sealed to tank wall **5** adjacent the bottom thereof.

Preferably the tank is given a coat of primer and a plastic foam producing material is then introduced between the jacket strip **7** and tank wall **5** so that the resulting foamed plastic fills the space between the plastic sheet **14** and the tank and also adheres to the tank and to the strip of jacket material above the upper edge of sheet **14**.

This construction permits a very large variation in expansion between the bottom **6** of the tank and the base insulation **2**. Thus, when the bottom **6** is at its maximum expansion as occurs when the tank is empty, the sheet of plastic film **14** is moved to lie against the strip **7** of jacket material but does not adhere to the bottom of the jacket. This situation is illustrated in FIGURE 3A. FIGURE 3B illustrates contraction of the bottom of the tank such as occurs when the tank contains cold liquid. Since the bight **16** is free to move on the sheet of jacket material **7** and strip **7** is under tension, the strip **7** tends to follow the sheet **14** and support it and insulation **8** so that the insulation does not become loosened from the tank wall **5**, even though radial contraction of the tank wall is quite different from that of the bottom insulation.

After the lower course has been constructed as described above the form **21** is moved upward, thus releasing the strip **7** to contract circumferentially and exert pressure on insulation **8** forcing the insulation against tank wall **5**. A second strip **7*a*** of impervious jacket material, illustrated in FIGURES 4 and 5 as a cross-corrugated metal strip, is stretched around the tank with its lower edge overlapping the upper edge of the jacket material of strip **7**. This strip **7*a*** is stretched to the same extent as strip **7**, so that its corrugations fit snugly upon the exterior of corresponding corrugations in strip **7**. The stretched strip **7*a*** is held in place by bands **17**, **18** and **19** on the exterior thereof and the open work form designated generally as **21**, preferably of wood, is used to hold the upper edge of the strip at a selected distance from tank wall **5**. The overlapping lower edge of strip **7*a*** may be riveted to the lower course at the overlap of the two courses, or may be held in place by band **17** as desired. The form **21** preferably includes crossbars **22** at suitable intervals and an outer strip **23** cut to a curvature parallel to the circumference of the tank. The bands **17**, **18** and **19**, or rivets replacing band **17**, are required since the force of the plastic foam during its evolution and setting are substantially equivalent to the weight of a similar volume of concrete in forcing the strip **7*a*** outward. This strip is normally of very lightweight material as for example, cross-corrugated aluminum sheet of .016" to .020" in thickness or greater.

After this strip **7*a*** has been stretched around the tank, the plastic foam producing material is introduced into the space between the tank wall **5** and the stretched strip **7*a***. The plastic foam produced from this material forms a continuation of the insulation **8** extending upward therefrom. Often it may be desirable because of the characteristics of the foam producing material used to pour the material to produce foam in this space in several increments, as for example, to fill the lower third or so first and continuing around the tank, come back and fill the second third, and continue introduction until all the space between strip **7*a*** and tank wall **5** is filled.

A space **25** between the interior of strip **7*a*** and the exterior strip **7** is sealed with mastic to provide for lateral expansion of the strips while maintaining a vapor tight seal between them. The bands **17**, **18** and **19** are removed, or if rivets have been used instead of band **17**, the rivets are drilled out, and form **21** is removed and another upper strip is stretched, as described above for **7*a***, around the tank and is held at a selected distance from wall **5** by forms **21** and bands **17**, **18** and **19** which are merely moved upward. The insulation **8** now filling space **24** acts to hold the stretched strip at the required distance from the tank

wall 5 so an inside form at the bottom of the space is not required.

Additional strips of jacket material are stretched and foam plastic forming material is introduced between them and the tank wall as described above until the top of the side wall is reached. At this point it is preferred that a strip of sheet metal 26 made up of numerous short sections 27 having their lateral edges connected by S-clips 41 be installed around an upper part of the upper course of stretched jacket material 7b. The upper part of each section 27 of strip 26 preferably is formed into a double U shape to provide a conventional "Pittsburg" joint illustrated only in FIGURE 6, with the lower edge of a corresponding orange peel section of roofing jacket material 29.

On setting of the upper increment of insulation 8, a rough irregular upper surface of insulation results. It is preferred that the irregular upper part of the insulation be sawed or cut off to provide a substantially plane surface on insulation 8 extending from the top of the tank to the upper edge of jacket strip 7b, which need not be at the same level. A vapor barrier 31 is immediately installed and is sealed to the top of the tank and to the upper edge of the jacket strip 7b. The reason for applying the vapor barrier 31 is that tanks of this type are normally very large and the insulation is usually installed by a crew of a few men, so that it may be days or even weeks before pouring of the side walls and insulation of the top of the tank can be completed and the vapor barrier, which preferably is a strip of mastic, prevents atmospheric moisture, rain, dew, etc., from entering the foam insulation 8 and destroying its insulating properties before the top insulation and jacket can be installed. The vapor barrier 31 is left in place and the top insulation is poured above it as described below.

A plain sheet of jacket material 29 corresponding in shape to one of the orange peel sections 32 (FIGURE 2) having lateral edges defined by circumferences of a sphere equal in radius to the domed top has its outer edge inserted in a U-turn of section 27 (FIGURE 6) and is held at a selected distance from the top of the tank so that the plastic foam producing material may be poured into the space between sheet 29 and the top of the tank.

Since the top of the tank is curved, it is preferred that the lateral edges of this strip be supported upon a wooden form and that a second weight carrying form be placed over the top of the strip to prevent the strip from being forced upward by a force of the expanding foam. This arrangement is shown in FIGURE 9 wherein the strip 29 is shown supported on the tops of wooden forms 33 and 34 having their top and bottom edges curved to conform to the curvature of the top 35 of the tank. A second form designated generally as 36 having a lower member 37 with bottom surface conforming to the upper edge of forms 33 and 34 is placed over the sheet 29 of the orange peel section of jacket material and a material producing foamed plastic insulation is poured into the space between the top of the tank 35, forms 33, 34 and strip 29. This material expands with considerable force and causes good adhesion between the tank top 35 and the jacket section 29 which are preferably coated with a primer before introduction of the foam producing material.

The form 36 is of special construction as shown in FIGURES 7 and 8. The form 36 preferably is constructed with a series of horizontal platforms 37 thereon of sufficient size to support 55 gallon steel drums 38 of water to furnish the necessary weight to this form. This construction is much preferred as it gives sufficient rigidity to the strip 29 so that it is not bulged outward by force of the expanding foam, and further, provides an extremely easy method for applying weight. Because of the length of these forms it is usually preferred that they be poured in two or three increments, beginning at the lower edge of the top of the tank. Two or three 55 gallon drums of water will be sufficient to hold the strip 29 at the proper distance from the top of the tank and after the first increment of insulation has set the water can be pumped from the lower drums to upper drums when the next increment is poured, and the drums themselves can then be transported to still further positions along form 36.

With this arrangement, only the empty drums need be handled manually and the weight applying material, water, can be pumped from place to place by pump 39 very easily. Of course, other methods for holding the upper form 36 in position to prevent bulging of plate 29 may be used if desired but form 36 constructed as shown is an extremely convenient device for holding the strip in its proper location.

After the first of the orange peel sections of the roof has been poured and the foam is set, one or both of forms 33 and 34 are moved laterally to support additional orange-peel shaped sheets of jacket material similar to sheet 29. While the next orange peel section is poured, the set insulation 8a serves as a form to support one side of the next orange peel section of jacket material. The second piece of jacket material 29a (FIGURE 10A) corresponding to 29 is attached to the corresponding lateral edge of piece 29 by S-connections 41 as shown in FIGURE 10A and shown in enlarged detail in FIGURE 10.

The form 37 is moved over so that it exerts pressure on the second orange peel section 29a while insulation is poured. The S-connections 41 are filled with mastic so that there is free expansion and contraction of sheets 29 and 29a with respect to each other.

This process is repeated by moving the forms over, adding another sheet 29b and so on until an entire course around the top of the tank has been poured and the foam is set. S-connectors as shown in FIGURE 10 are then installed on the upper edges of each of the pieces 29, 29a and 29b, etc., and the process is repeated using a different set of forms 34 conforming to the change in curvature in the inner part of the tank top. After the second course or as many courses as are necessary of orange peel sections have been poured and the foam has set, a small central opening left for introducing the plastic foam producing material will be filled with insulation. This may then be poured in the manner illustrated in FIGURE 11 in which two short forms, corresponding to the dotted lines may be used to support the side wall of a segment covered by jacket section 47 while this segment is poured through a central opening 48.

One of the forms 45 and 46 is then removed and the other moved to the position 49 and a second segment is poured and the foam is allowed to set. The last form is then removed and the third section is poured between set segments of foam insulation. The small central opening 48 is then poured and a disc of jacket material 50 is held in place over the foaming material until the plastic has risen against it and set.

By this process a large tank provided with foamed plastic thermoinsulation is produced in which the insulation on sidewalls of the tank is maintained under compression at all times tending to force the jacket insulation and tank wall together and effectively preventing separation due to inequalities in expansion and contraction of the tank, insulation and jacket either radially or vertically.

A tank top insulated in this manner has been found to be very stable in that the insulation does not work loose either from the top of the tank proper or from the jacket. The weight of the insulation itself tends to hold it in adhering contact with the top of the tank and the free expansion of each of the orange peel sections of the roof top in all directions prevents the development of forces separating the jacket from the insulation.

The differential in expansion and contraction of the sidewalls and bottom may be quite large without causing separation of the insulation material from the tank, because of the fact that the insulation may move laterally upon the base insulation when required by changes in

temperature without sufficient stress to result in separating the insulation from the tank wall. At all times the jacket is maintained in water and vapor proof relationship with the insulation so that it does not leak and no moisture or vapors may enter the insulation.

From the foregoing, it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent to the process and method.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

**1.** An insulated tank comprising a tank body, a jacket formed of at least one horizontally extending elongated strip of impervious elastic sheet material under tension surrounding and substantially covering the vertical wall of the tank body, and plastic foam insulation between the body and jacket, said insulation adhering to both tank body and jacket and being maintained under compression by the tension of each said jacket strip, so that the jacket will expand and contract in a radial direction upon expansion and contraction, respectively, of said tank body.

**2.** The tank of claim **1** wherein each elongated strip of the jacket is made of cross-corrugated metal.



**3.** The tank of claim **1** wherein the jacket strips of impervious material are disposed one above the other around the tank, each of said strips above a bottom strip overlapping the exterior of a next lower strip with a vapor proof expension joint disposed between overlapping portions of each strip.

**4.** The tank of claim **3**, wherein the tank has a flat bottom resting upon a base, the bottom strip overlaps a side of the tank and base beneath the tank and is permanently attached to the base beneath the tank, a strip of plastic film extends around the tank and is attached to an upper part of the interior of the bottom strip and to the exterior of the tank adjacent the bottom thereof, and plastic foam insulation is disposed between the plastic film and adjacent side of the tank.

**5.** The tank of claim **3**, wherein each elongated strip of the jacket is made of a cross-corrugated metal.


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