Sept. 18, 1934. E. R. SCHAEFFER 1,974,314

STRUCTURE SUCH AS TANK ROOFS

Filed Feb. 25, 1930

Fig. 2.

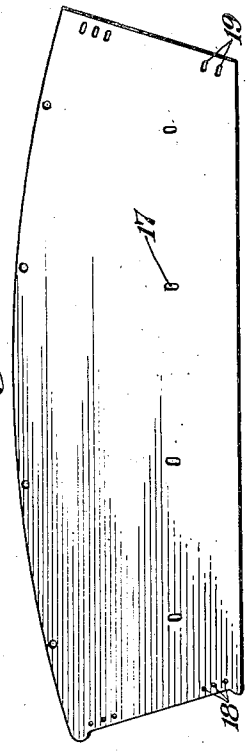
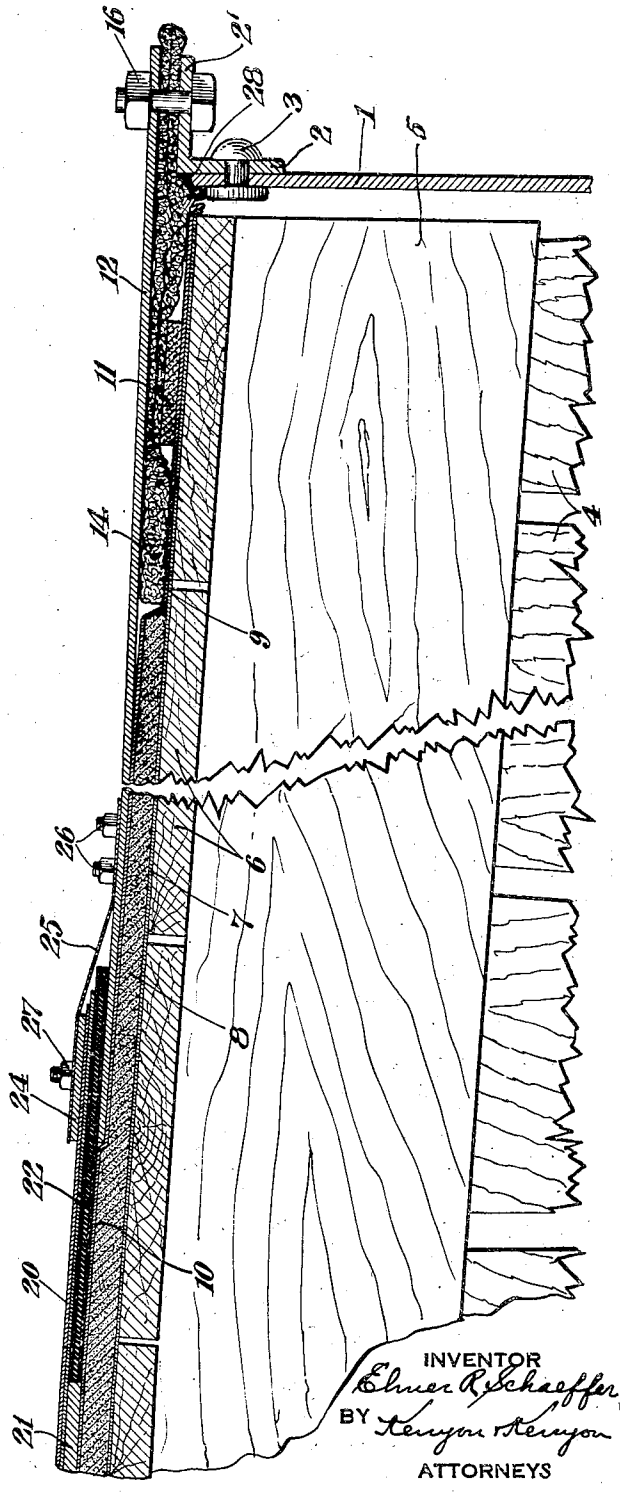


Fig. 1.



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STRUCTURE SUCH AS TANK ROOFS

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18 Claims. (Cl. 220—81)

This invention relates to structures, such as tank roofs and more particularly to roofs for oil storage tanks.

In cases where the contents of the tank (such as various sulphur containing oils) would cause corrosion to a steel cover or deck, and sometimes for economy, it is customary to make the tank roof of wood and cover it with roofing material. It has heretofore been found difficult to make and keep such a roof vapor tight at the eaves, since the steel shell or side wall of the tank is subject to a considerable amount of movement incidental to filling and emptying and to temperature changes. Losses due to evaporation where the tank cover is not tight amount to very large sums. On the other hand, confining the oil vapors within the tank increases the tendency to loss by fire due to lightning or sparks caused by release of static charges or by induced voltages from distant lightning unless provision is made to prevent loss from these causes.

One object of the invention is to provide an improved roof having a flexible gas tight connection between the metal shell or side walls and the wooden roof, whereby the normal movement of the metal shell is permitted without interrupting the gas tightness of the tank.

Another object of the invention is to provide a roof construction having desirable electrical properties and readily adapted for the application of lightning protection.

Other objects, features and advantages will appear more fully from the following detailed description and appended claims.

The accompanying drawing forming a part of this specification illustrate one embodiment of the invention.

In the drawing,

Figure 1 is a fragmentary vertical sectional view of the tank; and

Figure 2 is a plan view of one of the metallic plates constituting part of the roof construction.

Referring to Fig. 1, the tank has the usual cylindrical steel shell or side wall 1 around the upper rim of which an angle iron 2 is secured, as by rivets 3. The angle iron is arranged with one of its flanges 2′ horizontal and preferably slightly above the upper edge of the shell 1. Within the shell there are the usual wooden vertical stanchions or supports 4 supporting wooden rafters 5 upon which rest the wooden sheathing 6 enclosing the top of the tank.

The sheathing 6 is covered with a layer 7 of roofing such as any flexible roofing material which is designed to a considerable degree to be impervious to the vapor in the tank. To this end it may comprise the usual flexible roofing formed of asbestos felt or paper impregnated with bituminous composition such as asphalt or coal tar. This flexible roofing sheet covers the entire sheathing 6.

Overlying the roofing sheet 7 is a layer or cover 8 of suitable heat insulating material, preferably of a rigid board-like form such as the well known products Celotex, Masonite, etc. This material extends over the entire central portion of roofing sheet 7 but terminates, as shown at 9, a slight distance inwardly of the shell 1. A second layer 10 of like flexible roofing is superposed upon the material 8 but is turned downwardly at the outer edge of the said material into contact with the layer 7, thereby forming near the eaves of the roof two superposed layers 7 and 10 of flexible roofing. Between the outer edge of the heat insulating material 8 and the angle member 2 is arranged a ring 11 of heat insulating material similar to that shown at 8, this ring resting on the superposed layers 7 and 10 of flexible roofing material.

To add to the rigidity of the shell and to provide a strong construction, I secure to the flange 2′ of the angle member a rigid metallic ring 12; and in order to provide a vapor tight seal or gasket at the eaves portion of the tank, I arrange between this plate and the roofing 10 and ring 11 a sheet of resilient material which is substantially impervious to the hydrocarbon vapors within the tank. This sheet 14, as shown, has its inner portion arranged adjacent the edge 9 of the central cover of heat insulating material and extends outwardly therefrom over ring 11 of heat insulating material between the upper surface of the said ring and the plate 12 and then outwardly between the flange 2′ and the metallic plate 12. The resilient sheet is doubled over at its outer portion so as to have two layers of the sheet over the flange 2′, over the outer portion of the roofing 10 and over the ring 11. A seal is thus formed at the angle member 2; and another seal is formed at the ring 11. Between the angle member 2 and the ring 11, the resilient sheet 14 is compressed in a radial direction and thus permits considerable motion between the shell 1 and the wooden roof without tearing the resilient sheet. When the plate 12 is securely fastened in place, this resilient sheet 14 thus forms a gasket which prevents escape of vapor and at the same time permits such relative movement as occurs between the sheathing 6 and the

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metallic shell 1 and between the sheathing 6 and the plate 12 without breaking the vapor seal.

While the resilient sheet 14 forming the gasket may be made of various materials, I prefer to make the same of a felt, such as hair felt, which is made impervious to vapor by saturating the same with a suitable composition. I have found that a suitable composition for this purpose is formed by adding to a vegetable oil, such as corn oil, some form of sulphur such as from 20% to 25% sulphur chloride. When these materials are used a chemical action takes place which causes the oil to change to a thick rubber-like material which is practically insoluble in gasoline and impervious to hydrocarbons. The rubber-like material is applied to the hair felt while the compound is hot and thereby caused to thoroughly impregnate the felt.

The ring 12 is preferably made of sector shaped plates, such as shown in Fig. 2. These plates are rigidly secured to the angle member as by bolts 16 (Fig. 1). The plates are secured to the sheathing in such a way as to leave the plates and sheathing free for such relative movement as takes place in service. To this end the various plates are, as shown in Fig. 2, provided with slots 17 extending transversely to the outer or peripheral edges of the plates. Through these slots lag screws are passed into the sheathing to secure the plates to the sheathing. With this arrangement the plates are held firmly in place while at the same time allowing freedom for the desired relative movement between the plates and the sheathing. Adjacent plates may be secured together in any suitable way, as by bolts passed through the openings 18 and 19 adjacent the radial or side edges of the plates. It will be seen that the openings 19 are slightly elongated in a direction transverse to the radial edges of the plates so as to permit a certain degree of relative movement of the plates peripherally of the tank.

I also place between the upper edge of the metal shell and angle member 2 and rivet heads a mass 28 of a sealing cement which is impervious to and unaffected by the hydrocarbon vapors in the tank. A suitable cement for this purpose is pitch containing a filler of asbestos.

The tank roof is covered with a suitable roofing material 20. This material may be any suitable roofing, such as a built-up roofing formed of a plurality of layers of flexible roofing, such as asbestos roofing. This is preferably capped with an asbestos felt impregnated with a bituminous composition, such as asphalt, and coated with a suitable coating material such as asphalt and surfaced with a finely divided aluminum. To secure this roofing in place and also to provide over the center of the tank a sealing layer of material which is impervious to hydrocarbon vapors, the roofing sheet 10 is covered with a layer 21 of asphalt upon which the roofing 20 is placed before the asphalt has hardened.

Between the roofing 20 and the metallic ring 12 I form a slip connection which provides a tight joint and at the same time permits freedom of relative movement between the ring 12 and the roofing 20. To this end I superpose between the outer edge portion of the roofing 20 and the roofing sheet 10 a layer 22 of suitable strong material which is also substantially impervious to hydrocarbon vapors. This material may comprise an inner body portion of bituminous material with reinforcing surface layers of felt impregnated with bituminous material. The outer portions of the roofing 20 and material 22 overlie the inner portion of the metallic ring 12. Superposed on the roofing material 20 and arranged above the outer portion of the ring 12 is a second metallic ring 24 which is connected to the ring 12 by radial spring members 25. These members are, as shown, secured to the ring 12 by bolts 26 and to the ring 24 by bolts 27. The springs 25 press the ring 24 downwardly upon the roofing 20 and towards the ring 12 thereby providing a slip coupling which forms a tight joint between the roofing material and the metallic ring 12 and at the same time permits movement of the said roofing material 20 with respect to the said ring.

By making the ring 12 of metal, such as steel, not only is a strong mechanical construction provided, but also by reason of the electric properties of the ring, a simple form of lightning protection for the tank can readily be applied, as shown for example, in my copending application Ser. No. 433,597, filed March 6, 1930.

While I have described the preferred form of my invention, it is understood that modifications within the scope of the appended claims may be made without departing from the spirit of the invention.

I claim:

1. A tank comprising a side wall and a roof including a metallic ring secured to side wall, roofing material overlying the inner edge portion of said ring and a second metallic ring overlying the outer surface of said roofing material and first named ring and resiliently secured to the latter.

2. A tank comprising a side wall and roof sheathing, a metallic ring secured to the side wall and overlying the sheathing but free to move with respect to the underlying sheathing, and means arranged under said ring and including a resilient composition impervious to hydrocarbon vapors forming a seal between the ring and the side wall and between the ring and the sheathing.

3. A tank comprising a side wall, an angle member at the upper edge portion thereof, roof sheathing, a cover of heat insulating material on said sheathing, a ring secured to said angle member and overlying said sheathing and said heat insulating material, and means arranged under said ring and forming a vapor tight seal between said ring and angle member and between said ring and sheathing.

4. A tank comprising a side wall, an angle member at the upper edge portion thereof, roof sheathing, a cover of heat insulating material on said sheathing, a ring secured to said angle member and overlying said sheathing and said heat insulating material, and means forming a vapor tight seal between said ring and angle member and between said ring and sheathing, said means including roofing paper and a resilient material impervious to hydrocarbon vapors.

5. A tank comprising a side wall, roof sheathing, a central cover of heat insulating material on said sheathing, a ring of heat insulating material on said sheathing between said central cover and said side wall, a member secured to the side wall and overlying said central cover and said ring, and means forming a vapor tight seal between said member and said side wall, sheathing cover and ring.

6. A tank comprising a side wall, an angle member at the upper edge portion of said side wall, roof sheathing, a central cover of heat insulating material on said sheathing, a ring of heat insulating material on said sheathing between

said central cover and said side wall, a metallic ring secured to the side wall and overlying said central cover and said ring of heat insulating material, and means coacting with said cover and ring of heat insulating material and forming a vapor tight seal between said metallic ring and said angle member, and sheathing.

7. A tank comprising a side wall, an angle member at the upper edge portion of said side wall, roof sheathing, a central cover of heat insulating material on said sheathing, a ring of heat insulating material on said sheathing between said central cover and said side wall, a metallic ring secured to the side wall and overlying said central cover and said ring of heat insulating material, and means forming a vapor tight seal between said metallic ring and said angle member, said means including a felt saturated with vapor resisting material extending from a point inwardly of said ring of heat insulating material outwardly over said angle member.

8. A tank comprising a side wall, an angle member at the upper edge portion of said side wall, roof sheathing, a central cover of heat insulating material on said sheathing, a ring of heat insulating material on said sheathing between said central cover and said side wall, a metallic ring overlying said central cover and said ring of heat insulating material, and means forming a vapor tight seal between said metallic ring and said angle member and sheathing, said means including a felt saturated with vapor resisting material extending from a point inwardly of said ring of heat insulating material outwardly over said angle member, and having a doubled portion between said angle member and said metallic ring.

9. A tank comprising a side wall, an angle member at the upper edge portion of said side wall, roof sheathing, a central cover of heat insulating material on said sheathing, a ring of heat insulating material on said sheathing between said central cover and said side wall, a metallic ring overlying said central cover and said ring of heat insulating material, and means forming a vapor tight seal between said metallic ring and said angle member and sheathing, said means including sheets of roofing paper arranged above and below said cover and extending under said ring of heat insulating material and a felt saturated with material impervious to hydrocarbon vapors and extending from a point inwardly of said ring of heat insulating material outwardly over said angle member, and having a doubled portion between said angle member and said metallic ring.

10. A structure having a wall and a roof, a roofing composed of a plurality of layers of flexible roofing material separated by a layer of heat insulating material, said wall being free to move with respect to said roofing material and means coacting with said roofing material and wall to form a vapor tight seal between the said roofing material and the wall.

11. A structure having a wall and a roof, a layer of roofing material applied to said roof, heat insulating material covering a portion of said roof, a roofing material applied over said heat insulating material and extending at the edge of said insulating material down into contact with the first mentioned roofing material, said wall being free to move with respect to said roofing material, and means creating a vapor tight seal between said roofing material and said wall.

12. A structure having a wall and a roof, a layer of roofing material applied to said roof, heat insulating material covering a portion of said roof, a roofing material applied over said heat insulating material and extending at the edge of said insulating material down into contact with the first mentioned roofing material, a rigid member connected to said wall and extending over said roof, and means between said rigid member and the roofing creating a vapor tight seal.

13. A structure having a wall and a roof, a layer of roofing material applied to said roof, heat insulating material covering a portion of said roof, a roofing material applied over said heat insulating material and extending at the edge of said insulating material down into contact with the first mentioned roofing material, a rigid member connected to said wall and extending over said roof, and means between said rigid member and the roofing consisting of a gasket material for creating a vapor tight seal.

14. A structure having a wall and a roof, including roofing material, a rigid member secured to the wall and lapping said roofing material but free to move with respect thereto and with respect to the roof, and means creating a vapor tight seal between the roofing material and said rigid member, said means providing a slip connection between the rigid member and the roofing material.

15. A structure having a wall and roof, a rigid member secured to the wall and overlying the roof but free to move independent of the roof, and means arranged under said rigid member and including a fibrous material and a resilient composition impervious to vapors within the structure forming a seal between the rigid member and the wall, and between the rigid member and the roof.

16. A structure having a wall and a roof, a rigid member fixed to the upper edge of said wall, a heat insulating material over a central portion of said roof, heat insulating material spaced from said first heat insulating material on said roof, said rigid member overlying said last mentioned heat insulating material and a portion of said central heat insulating material but being free to move with respect thereto, and means forming a vapor tight seal between said rigid member and said roof.

17. A structure having a metal wall, a roof including sheathing, a rigid metal member fixed to said wall, means creating a vapor tight seal between said member and said wall, plies of roofing material and heat insulating material applied to said sheathing, and built-up roofing applied over the central portion of said roof and extending down slidably over a portion of said rigid member.

18. A structure having a wall, a roof, a rigid member projecting from said wall in over a portion of said roof, a roofing composed of a plurality of alternating layers of saturated felt and suitable bonding materials extending down over a portion of said rigid member, and a rigid member overlying said built-up roofing and attached to said first mentioned member.

ELMER R. SCHAEFFER.