Jan. 16, 1951 C. ARNE 2,537,954

LIQUID STORAGE TANK

Filed Sept. 18, 1946 2 Sheets-Sheet 1

Fig. 1.

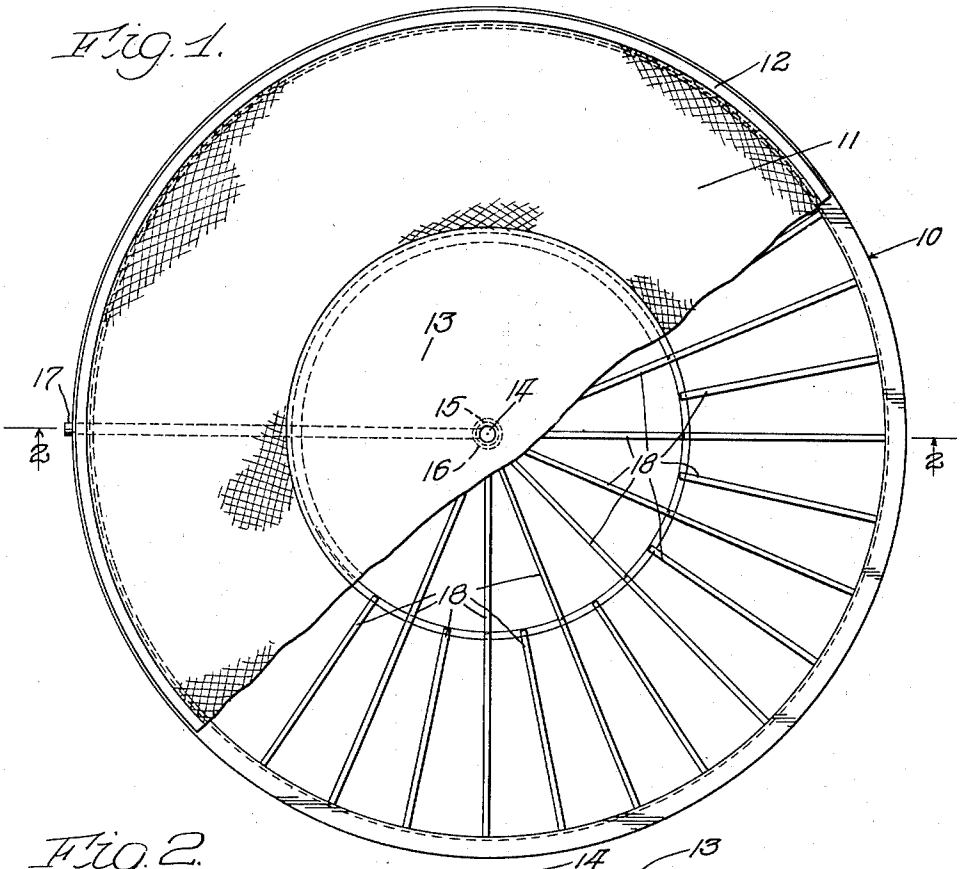
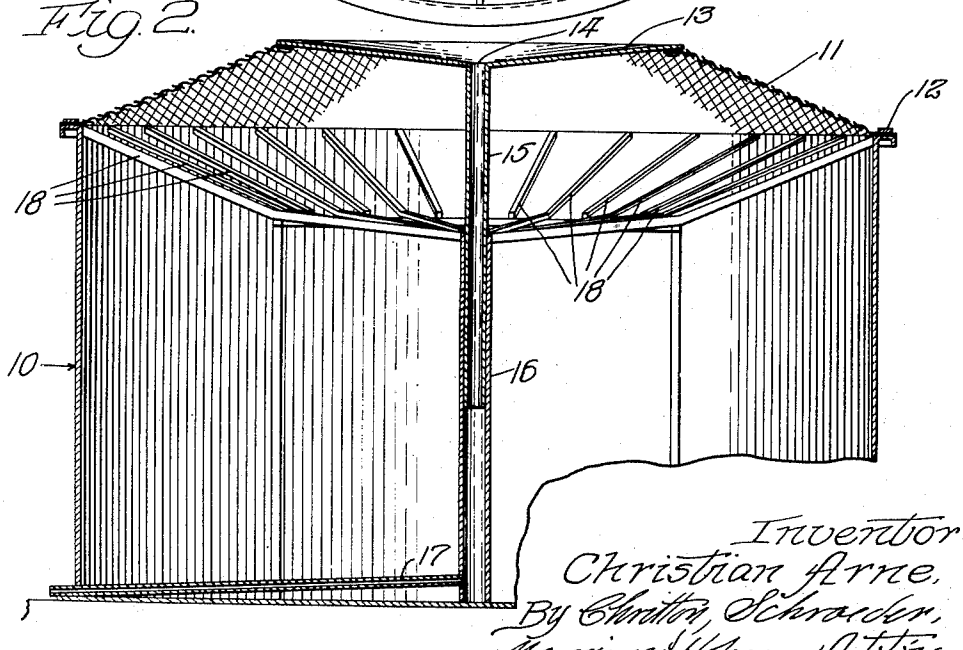


Fig. 2.



Inventor:
Christian Arne,
By Charlton, Schroeder,
Merriam & Hofgren, Attys.

Jan. 16, 1951 C. ARNE 2,537,954

LIQUID STORAGE TANK

Filed Sept. 18, 1946 2 Sheets-Sheet 2

Fig. 3.

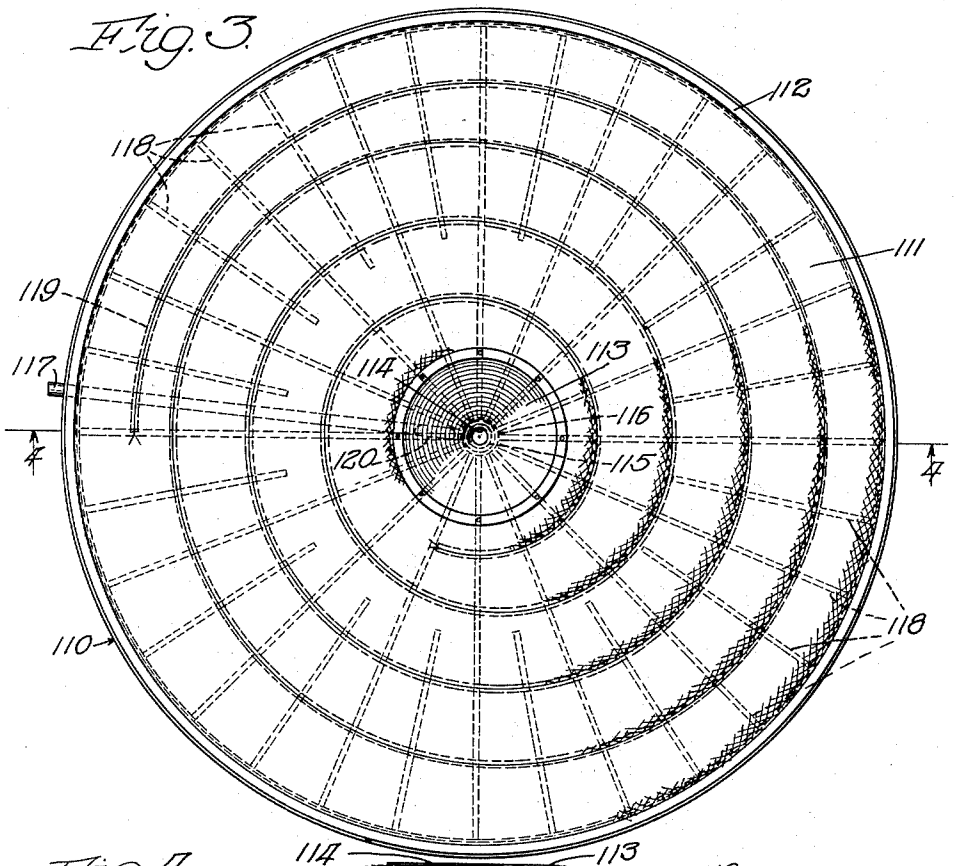
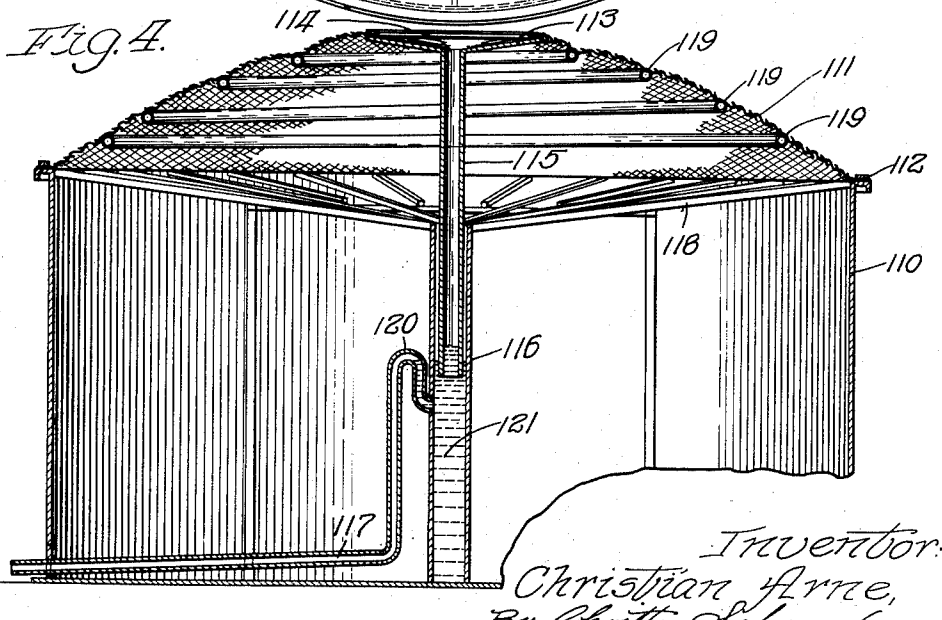


Fig. 4.



Inventor:
Christian Arne,
By Britton, Schroeder,
Merriam & Hogan, Attys.

Patented Jan. 16, 1951

2,537,954

UNITED STATES PATENT OFFICE

2,537,954

LIQUID STORAGE TANK

Christian Arne, Chicago, Ill., assignor to Chicago Bridge & Iron Company, a corporation of Illinois

Application September 18, 1946, Serial No. 697,739

3 Claims. (Cl. 220—85)

1

This invention relates to liquid storage tanks, and more particularly to liquid storage tanks having a variable volumetric vapor capacity.

In storage tanks for volatile liquids, such as gasoline, provision must be made for the varying volume of volatilized vapor caused by changes in temperature, etc. It has been customary in many installations to provide a separate vessel to receive expanding vapors from the storage tank, and to return the vapors to the storage tank upon their contraction due to a decrease in temperature or otherwise. Other installations provide for a rising and falling lifter roof.

I have invented, and am herein disclosing and claiming, a storage tank having a flexible non-metallic roof thereover, which is adapted to rise and fall with increases and decreases of vapor pressure within the tank so as to allow "breathing" of the vessel. The flexible "breather" roof being also the weather roof over the tank eliminates the necessity of providing a metallic weather roof over the tank and also eliminates the necessity of a separate breather or vapor vessel.

The invention will be described as embodied in the accompanying drawings in which

Fig. 1 is a top elevation, partly broken away, of a storage tank having a breather roof thereover;

Fig. 2 is a vertical section along lines 2—2 of Fig. 1;

Fig. 3 is a top elevation of a slightly modified form of roof, and

Fig. 4 is a vertical section along lines 4—4 of Fig. 3.

Referring more particularly to Figs. 1 and 2, I show a storage tank 10 being generally cylindrical in shape having a flexible non-metallic weather roof 11 secured to the sides of the shell at 12. The flexible roof is in the form of an annulus, and is secured at its inner periphery to a dished metallic member 13 having a central drain opening 14 therein. Communicating with the opening 14 is a vertical pipe 15 extending downwardly into the interior of the tank where it is received by an upstanding vertical pipe 16 of somewhat larger diameter. Near the lower portion of the pipe 16 is a drain pipe 17 to the exterior of the tank. Moisture falling or condensing upon the roof and the dished metallic portion 13 is conveyed by means of the drain pipes just described to the exterior of the tank. The drain pipes also aid in keeping the roof centered. The entire roof, comprising the portions 11 and 13, is free to flex upwardly and downwardly with variations in vapor pressure within the tank,

2

and the roof is supported at its lowest position by girders 18 attached at one end to the side of the tank and at the inner ends to the drain pipe 16.

A somewhat similar embodiment is shown in Figs. 3 and 4 to which similar reference numerals have been added differing by an even one hundred. The roof in the embodiment shown in Figs. 3 and 4 is reinforced by a spiral metallic member 119 which spirals inwardly from the outer portion of the roof to the inner portion. In its lowest position, the metallic reinforcing member rests upon the girders 118 and the spiral form permits drainage to the central drain pipe 114 when the roof is in its lowest position. The drain pipe 117 is provided with a trap 120 in order to retain liquid 121 within the lower portion of the drain pipe 116 at all times. The liquid so retained serves not only to seal the connection between the drain pipes 115 and 116, but also serves as a pressure and vacuum venting means. Should the vapor pressure within the tank exceed a predetermined limit, the vapor will force the liquid 121 some of the distance upwardly in the pipe 115 and thence escape, while excessive vacuum within the tank when the roof is in its lowest position would draw air in through the vents and through the liquid. The upper limits of pressure and vacuum desired within the tank may be predetermined by the location of the entrance of the drain pipe 120 into the drain pipe 116.

While I have shown and described certain embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims.

I claim:

1. A liquid storage tank comprising a shell and a flexible weather roof thereover, said roof being adapted to flex upwardly and downwardly with changes of vapor pressure within the tank to provide a variable volumetric vapor capacity for said tank, said roof comprising an annular non-metallic flexible member attached to the shell at its outer periphery and at its inner periphery to a substantially circular metallic member, said roof being reenforced by a metallic member attached to said roof, said metallic member being in the form of a spiral commencing at the outer portion of the roof and terminating adjacent the inner portion thereof, said circular member having an opening in its center communicating with a vertical drain pipe upstanding from the bottom

of said tank, and support means within the tank for supporting said roof in its lowest position.

2. A liquid storage tank comprising a shell and a flexible weather roof thereover, said roof having a circular dished metal central portion and an outer annular fabric portion and being adapted to flex upwardly and downwardly with changes of vapor pressure within said tank to provide a variable volumetric vapor capacity for said tank, said roof being provided with a vertical drain pipe in the center of the metal portion and extending a part of the distance toward the bottom of said tank, and said tank having an upstanding vertical drain pipe extending a part of the distance toward said roof, said downwardly extending drain pipe being slidably received in said upwardly extending drain pipe, an exhaust pipe communicating with the exterior of the tank and connected to the upwardly extending drain pipe above its bottom whereby water accumulating on said roof may pass into said drain pipes to maintain a supply of water in the upstanding drain pipe beneath the connection of the exhaust pipe thereto and excess water will be drained to the exterior of the tank whereby excessive pressures and vacuums within said tank will be prevented by venting to and from the atmosphere, respectively.

3. A liquid storage tank comprising a shell and a flexible fabric weather roof thereover, said roof being adapted to flex upwardly and downwardly with changes of vapor pressure within said tank to provide a variable volumetric vapor capacity for said tank, an inwardly dished metallic member at the center of the roof attached to the flexible roof at its outer edge and having an opening at its center communicating with a vertical drain pipe extending downwardly into the interior of the tank and into an upstanding vertical pipe of larger diameter than said first mentioned pipe positioned within the tank, means for maintaining water in the upstanding pipe at all times, and supporting means within said tank for supporting said roof in its lowest position.

CHRISTIAN ARNE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,597,399	Wilson	Aug. 24, 1926
1,911,988	Chevalier	May 30, 1933
2,061,175	Staber	Nov. 17, 1936
2,127,519	Jagschitz	Aug. 23, 1938
2,318,766	Ellis	May 11, 1943