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[54] **FLOATING ROOF TANK LEVEL ALARM**

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[52] **U.S. Cl.** ..... **182/18,** 182/1, 220/26 R

[51] **Int. Cl.** **E06c 5/34**

[58] **Field of Search** ..... 141/95, 94, 98; 182/1, 182/19, 18; 220/26 R, 26 S, 26 D, 26 SA

[56] **References Cited**

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[57] **ABSTRACT**

Combined with a storage tank that has a floating roof and a ladder which changes its angle of incidence to the roof as the ladder rises and falls, there is an angular position-responsive switch that is actuated by the ladder angle. The switch may control a high-level alarm circuit.

5 Claims, 2 Drawing Figures

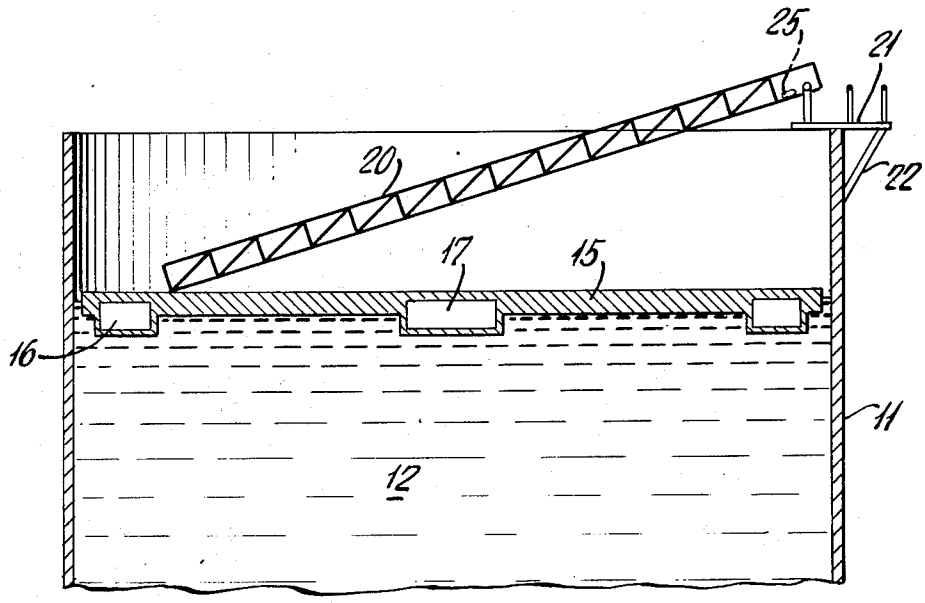


Fig. 1.

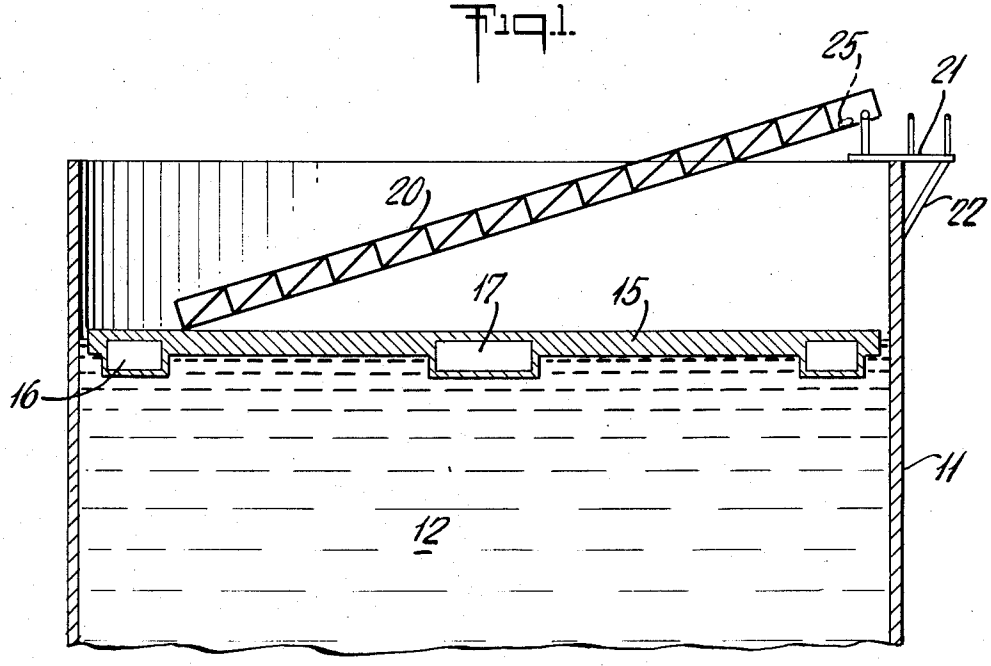
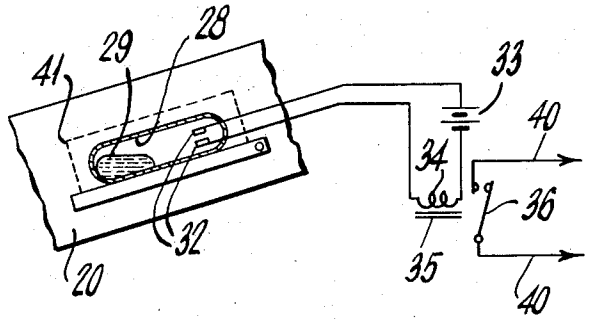


Fig. 2.



FLOATING ROOF TANK LEVEL ALARM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention concerns liquid-level measurement in general and, more specifically, deals with the provision of an alarm for high-level conditions in floating-roof tanks.

2. Description of the Prior Art

There are many and diverse arrangements for measuring liquid-level conditions in tanks or containers of various sorts. However, in connection with petroleum products, where they are stored in floating-roof type tanks, it is usual to provide an automatic gauging system. Such gauging systems have been somewhat complex and, furthermore, the sensitivity has been such that they are not very reliable for warning of high levels. Also, such automatic gauging systems have been prone to error, and they also required considerable maintenance with only moderate reliability resulting.

It is common practice to provide a ladder with floating-roof tanks. Such ladder changes its level of incidence to the roof as the liquid level rises and falls. It is an object of this invention to provide a combination that includes such ladder structure with a floating-roof tank.

SUMMARY OF THE INVENTION

Briefly, this invention concerns a combination which includes a storage tank for liquid petroleum products and the like. It also includes a floating roof for covering said liquid in said tank, and a ladder pivotally supported by said tank for access to the upper surface of said roof. The foregoing ladder has the free end thereof supported by said roof whereby the angle of incidence of the ladder to said roof varies in accordance with the level of said liquid in said tank. The combination also includes an angular position-responsive switch actuated by said ladder for actuating an electric alarm circuit when said liquid level reaches a predetermined high level in said tank.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects and benefits of the invention will be more fully set forth below in connection with the best mode contemplated by the inventors in carrying out the invention, and in connection with which there are illustrations provided in the drawings, wherein:

FIG. 1 is a schematic cross-sectional view illustrating a floating-roof tank in combination with alarm-circuit elements; and

FIG. 2 is an enlarged schematic circuit diagram illustrating an alarm circuit according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In connection with storage of petroleum products, there is commonly employed a type of tank that includes a floating roof over the liquid contents. Such tank structure almost invariably includes a pivoted ladder that is supported at an edge of the tank and has its free end resting upon the floating-roof structure. Such ladder is useful in providing access to the interior of the tank including the upper surface of the floating-roof structure. Heretofore, such storage tanks have been

provided with an automatic gauging system in order to indicate the level of the liquid in the tank. However, such gauging systems are relatively poor in the accuracy of such measurements while, at the same time, they include a number of mechanical parts plus electrical contacts so that they are prone to error. In addition, they necessitate quite a high degree of maintenance. On the other hand, this invention provides an extremely simple, yet highly reliable arrangement that will give a high-level alarm signal at a predetermined position of the floating roof.

Referring to FIG. 1, there is illustrated a tank 11 that has a body of liquid 12 therein. The liquid 12 is a petroleum product, or the like, so that some care must be taken to avoid explosions or similar damage. In order to contain any vapors from the liquid 12, there is a floating roof 15 that may have any feasible arrangement for creating the necessary buoyancy. For example, there are shown air-space compartments 16 and 17 that create the required buoyancy.

Attached to the upper edge of tank 11 in a pivotal manner, there is a ladder 20. The ladder is attached in any feasible manner adjacent to a platform 21 that is mounted on the upper edge of the tank 11. In conjunction with the platform 21, there may be spiral stairs 22 which are attached to the outside of the tank 11 for permitting access to the platform 21.

In order to provide for a high-level alarm, there is an angular position-responsive switch 25 attached in any feasible location on the ladder 20. In this manner, when the ladder 20 reaches a predetermined angle of incidence relative to the roof 15, the switch 25 will be set so as to close. Closing the switch will actuate an alarm circuit.

Referring to FIG. 2, it will be noted that a preferable type of angle-sensitive switch is a mercury-capsule type. This switch 25 has an elongated housing 28 that is sealed in order to provide protection against oxidation of a small body of mercury 29 that is contained therein. At one end of the housing 28, there is a pair of electrical contact elements 32. These contacts 32 have an electrical circuit connected thereto which is completed by the body of mercury when the attitude of the housing 28 reaches a particular angle such that the mercury will slide over to the end where the contacts 32 are located. Such circuit-closing caused by the mercury switch will act to complete the circuit for energizing an alarm. Thus, the circuit illustrated includes a battery 33 and a solonoid 34 that may be part of a relay 35 which has normally open contacts 36. The contacts 36 are connected into any feasible alarm circuit which is indicated by a pair of arrows 40.

The housing 28 of the mercury switch 25 is mounted relative to the ladder 20 so that the longitudinal axis of housing 28 is set to cause actuation of the switch 25 when the ladder 20 reaches a predetermined low angle of incidence. Preferably, the switch 25, i.e. housing 28, is mounted in an explosion-proof junction box 41 (indicated by dashed lines) for providing adequate protection against damage by explosions, and to insure that no open spark will be created at the switch 25 under any circumstances.

It will be noted that the combination of elements, as described above, provides for a very simple, yet highly reliable system which will give an alarm signal by actuating a relay (such as the relay 35) when the floating roof 15 of the tank reaches a predetermined level.

While a particular embodiment of the invention has been described above in considerable detail according to the applicable statutes, this is not to be taken as in any way limiting the invention but merely as being descriptive thereof.

What we claim is:

1. In combination with a storage tank for liquid petroleum products and the like,

said tank having a floating roof for covering said liquid in said tank, and

a ladder pivotally supported by said tank for access to the upper surface of said roof,

said ladder having the free end thereof supported by said roof whereby the angle of incidence of the ladder to said roof varies in accordance with the level of said liquid in said tank;

the improvement comprising an angular position-responsive switch actuated by said angle of incidence of the ladder for actuating an electric alarm circuit when said liquid level reaches a predetermined high level in said tank.

2. Combination according to claim 1, wherein said switch is spark-free.

3. Combination according to claim 2, wherein said switch is a mercury type.

4. Combination according to claim 3, further including

explosion-proof mounting means for said switch.

5. Combination according to claim 4, wherein said switch and said mounting means are mounted on one side of said ladder.

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