

[54] SURGE ABSORBER FOR CRYOGENIC FLUIDS

2,876,859 3/1959 Moore ..... 138/26 X  
3,648,472 3/1972 Kozłowski..... 62/45

[75] Inventor: George E. Lewis, Arcadia, Calif.

Primary Examiner—Meyer Perlin  
Assistant Examiner—Ronald C. Capossela  
Attorney, Agent, or Firm—William W. Haefliger

[73] Assignee: Hydril Company, Los Angeles, Calif.

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[57] ABSTRACT

A surge absorber for cryogenic fluids comprises  
a. a first container for containing pressurized gas, and  
b. a second container to receive surging cryogenic liquid via an inlet to the second container, the upper interior of the second container being in open communication with the interior of the first container so that gas in the first container is increasingly pressurized as cryogenic liquid is received into the second container.

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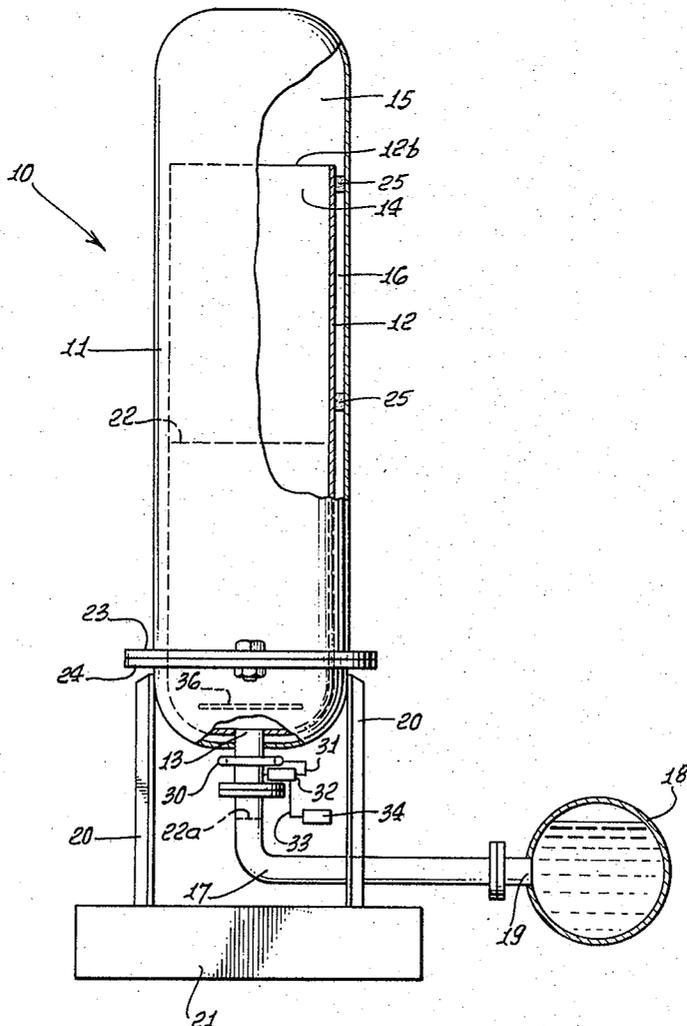
[51] Int. Cl. .... F16I 55/04

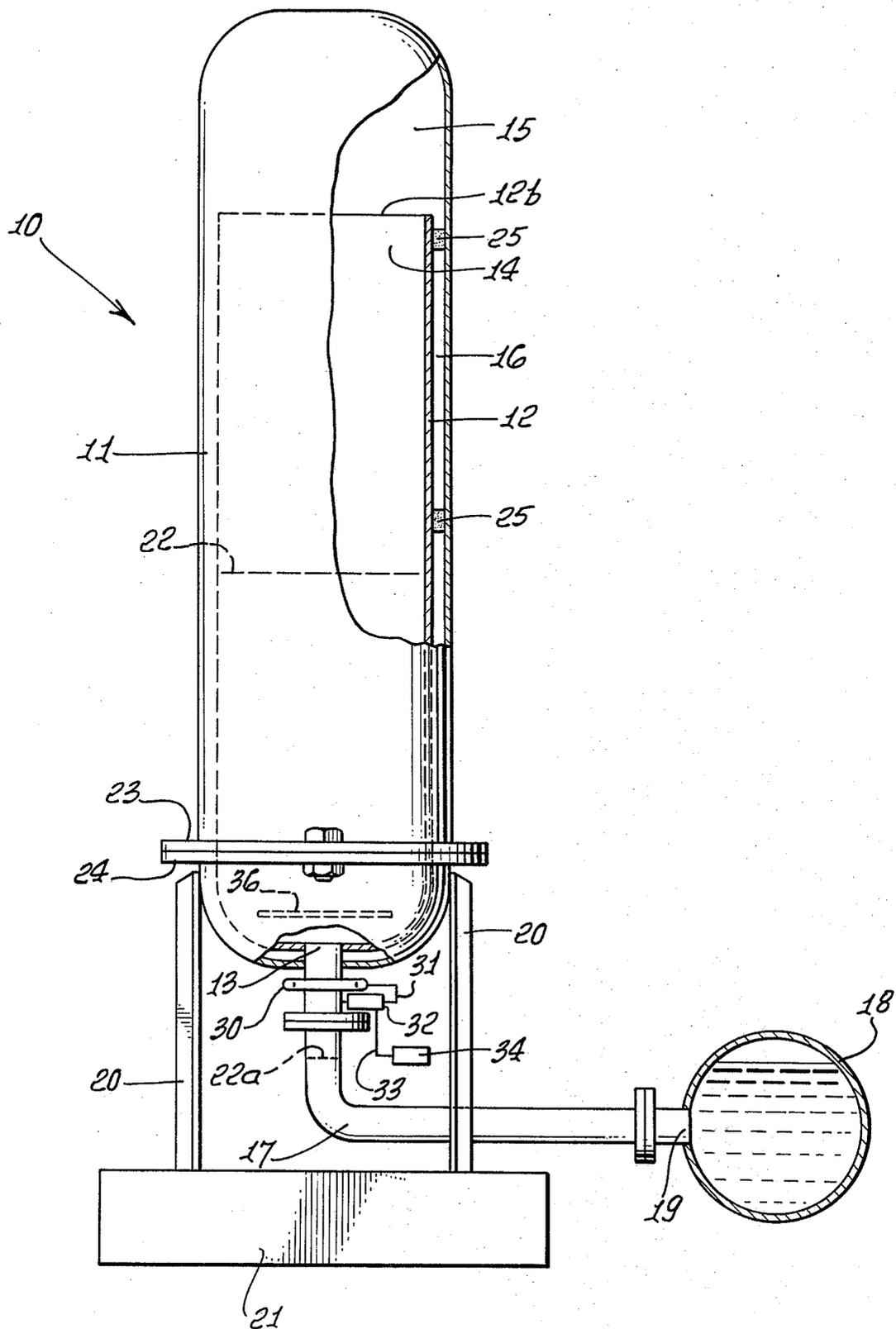
[58] Field of Search ..... 62/45, 52, 53, 55, 514;  
159/2 R, 3, 4 E; 138/26

[56] References Cited  
UNITED STATES PATENTS

361,649 4/1887 Rider ..... 138/26  
2,522,026 9/1950 Evans..... 62/52 X  
2,551,569 5/1951 Strelzoff..... 159/2 R X

8 Claims, 1 Drawing Figure





## SURGE ABSORBER FOR CRYOGENIC FLUIDS

### BACKGROUND OF THE INVENTION

This invention relates generally to surge absorbers, and more particularly concerns surge absorbers for cryogenic liquids.

Hydro-pneumatic accumulators have been used on liquid transporting lines to reduce the water hammer produced by sudden closure of valves. These units, usually of the separator type having a diaphragm or floating piston to separate the fluid and gas volumes, are quite satisfactory as long as the operating temperature is moderate and relatively constant. When operating a cryogenic line, the temperature in the surge absorber may vary from plus 60°F to minus 260°F in as little as 7 seconds. This represents a very severe thermal shock on the pressure vessel.

To my knowledge, no way was known prior to the present invention, to eliminate the thermal shock problem, and particularly in the unusually advantageous manner as now afforded by the present invention.

### SUMMARY OF THE INVENTION

It is a major object of the invention to provide a cryogenic fluid surge absorber overcoming the above described problem. Basically, it comprises:

- a. a first container for containing pressurized gas, and
- b. a second container to receive surging cryogenic liquid via an inlet to the second container, the upper interior of the second container being in open communication with the interior of the first container so that gas in the first container is increasingly pressurized as cryogenic liquid is received into the second container.

As will appear, the second container preferably extends into or within the first container; the two containers have spaced walls to allow reception of gas into the interwall space, and the liquid thus being confined within the inner or second container. Further, a heater may be provided to heat and vaporize a portion of the liquid rising into the second container to assure the presence of a gas cushion in the first or outer container, and a thermostat may be located to sense the incoming cryogenic liquid so as to activate the heater. Further, a surge of cryogenic liquid rising into the second container may be baffled to prevent displacement of liquid into the gas space between the two containers.

These and other objects and advantages of the invention, as well as the details of an illustrative embodiment, will be more fully understood from the following description with reference to the drawing.

### DETAILED DESCRIPTION

The illustrated surge absorber 10 for cryogenic fluid comprises a first container, as for example upright elongated shell 11, for containing pressurized gas, and a second container, as for example upright elongated shell 12. As referred to, the second container is located to receive surging cryogenic liquid via an inlet 13, the upper interior 14 of the second container being in open communication with the interior 15 of the first container so that gas in the first container is increasingly pressurized as cryogenic liquid is received into the second container. An extremely compact unit may be provided wherein the second container extends into the first container as shown, with the two containers having annular walls which are closely spaced apart, the gas in the first container then filling the space 16 between the

walls and insulating the liquid receiving portion of the second container from the wall of the first container.

Typically, the cryogenic liquid may consist of a hydrocarbon gas such as liquified natural gas; the inner shell 12 need not comprise a pressure vessel and may consist of material such as aluminum or stainless steel capable of withstanding thermal shock; and the outer pressure containing vessel or shell 11 may consist of steel plate capable of safe operation in the temperature range -20° to 650° F.

The inlet 13 is preferably located proximate the lowermost extent of the second container 12, and is shown as connected, via insulated branch pipe 17, with a pipe 18 such as insulated main conduit having a side port 19. The surge absorber 10, mounted via legs 20 on a base 21, functions to absorb surges in the cryogenic fluid or liquid in pipe 18 by converting the kinetic energy of the moving fluid into stored potential energy by compression of the gas in the first container interior as at 15. Note that the second container extends vertically upwardly to a level 12b above the uppermost level of cryogenic liquid entering container 12. A typical uppermost liquid surge level is indicated at 22, the normal level lying near the inlet 13, as for example at 22a which is the top-most level in pipe 18. Flanges 23 and 24 respectively integral with upper and lower portions of the outer container serve to interconnect those portions; also, insulating spacers or blocks 25 in space 16 serve to maintain the two containers in annularly spaced relation. Blocks 25 may consist of styrofoam. Other type spacers may be employed, if desired.

To insure the presence of compressible gas in the interior of outer container 11, and above level 22, a heater may be provided proximate the lower extent of the second container, or near the inlet, to transfer heat to incoming cryogenic liquid, vaporizing a portion thereof. One such heater is illustrated in the form of electric heating coil 30, electrically connected at 31 with thermostat 32. The latter is in turn connected at 33 with a source 34 of electrical power. The thermostat is located close to the inlet piping and preferably above level 22a to sense the presence of the incoming cryogenic liquid rising into container 12 via inlet 13, during a surge. The thermostat activates the heater, as by connecting power source 34 with the coil 30, in response to such "cold" sensing.

A baffle 36 may advantageously be located directly above inlet 13 to impede the upward inrush of cryogenic liquid into container 12, thereby to prevent rapid filling or jetting of the inrushing liquid above the open top level 12b of the inner container 12.

The inlet pipe size can be controlled to provide a pressure loss at the time of maximum fluid inrush to provide the maximum allowable pressure in the main line. The piping 17 is shown attached to the bottom of the surge absorber and to the side of the main line to provide the maximum flexibility between the pipe and pressure vessel to accommodate pipe movement due to temperature induced expansion and contraction. The pressure vessel could be mounted above and on the main line pipe 18 to move therewith, provided the main line is properly supported to withstand the weight of the absorber filled with cryogenic liquid.

I claim:

1. In a surge absorber for cryogenic fluids,
  - a. a first container for containing pressurized gas, and

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b. a second container to receive surging cryogenic liquid via an inlet to the second container, said inlet located near the bottom of the second container and there being a cryogenic liquid inlet pipe passing through the wall of the first container near the bottom thereof to terminate proximate said inlet, the upper interior of the second container being in open communication with the interior of the first container so that gas in the first container is increasingly pressurized as cryogenic liquid is received into the second container, the second container extending into the first container, the two containers having annular upstanding walls which are substantially everywhere closely spaced apart.

2. The absorber of claim 1 wherein the containers are vertically elongated and there are insulative spacers located between the walls of the two containers.

3. The absorber of claim 2 including a baffle within the second container to impede the flow of cryogenic liquid entering the second container.

4. The absorber of claim 2 including an electric heater proximate the lower extent of the second con-

tainer for transferring heat to incoming cryogenic liquid to vaporize a portion thereof, thereby to assure the presence of said gas in the first container and within the upper interior of the second container above the surface level of cryogenic liquid received into the second container.

5. The absorber of claim 4 including a thermostat located to sense the presence of said incoming cryogenic liquid and operatively connected with said electric heater to activate the electric heater in response to said sensing.

6. The absorber of claim 1 including a main conduit for said liquid and having a side port in communication with said inlet.

7. The absorber of claim 6 including said liquid in said main conduit and in said second container, and said gas in the first container.

8. The absorber of claim 7 wherein said gas consists of a hydrocarbon gas, and said liquid consists of said gas in liquified state.

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