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C. O. MEYERS
PULSATION CHAMBER
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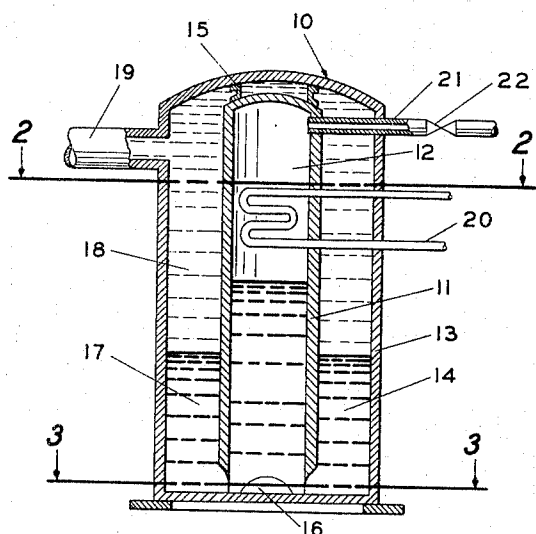


FIG. 1

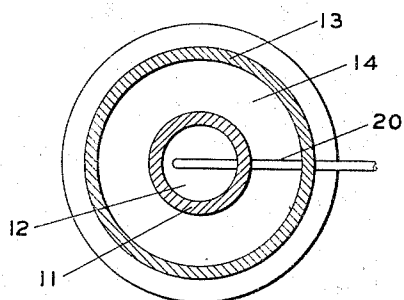


FIG. 2

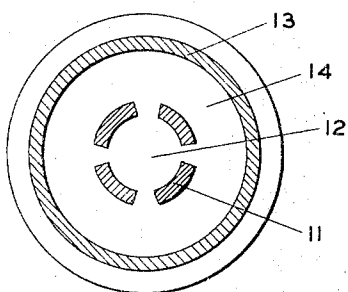


FIG. 3

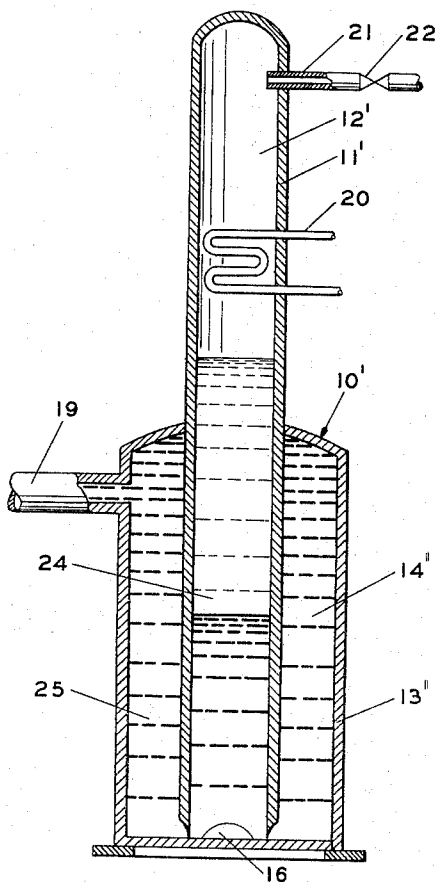


FIG. 4

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PULSATION CHAMBER

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5 Claims. (Cl. 138—30)

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My invention relates to new and useful improvements in pulsation dampening devices for flow lines. In a more specific aspect it relates to a vapor cushion pulsation dampening device.

Pulsation dampening devices have long been used in all types of pipe line operations. Many arrangements have been disclosed by prior art and the most commonly used arrangement of such a device comprises a surge tank communicating with the flow line and air within the tank acting as a cushion for shocks caused by surges of liquid in the line.

Operating efficiency of such a device is dependent upon the amount of air present in the surge tank which can be compressed as a cushion for the fluid from the flow line. Among the disadvantages of such a device is the fact that the air is absorbed by the fluid and necessitates periodically pumping additional air into the chamber against high pressure or in the alternative necessitates cutting off the surge tank from the pipe line by means of a valve while additional air is injected into the surge tank. Use of high pressure in the flow lines has made this disadvantage more noticeable because of the necessity for greater amounts of air to form a sufficiently large cushion to absorb the shock caused by surges of the fluid being pumped. An additional disadvantage to such a device in high pressure operation is the expense and difficulty of pumping air into the air chamber against the great pressure carried in the line.

An object of my invention is to provide a vapor cushion pulsation dampening method and a device for carrying out such method on flow lines, which device is simple in construction and efficient and economical in operation.

Another object of my invention is to provide a vapor cushion pulsation dampening device which uses a fluid vapor as the cushioning means and to further provide a method for forming such a cushion.

Other objects and advantages of my invention will be apparent from the accompanying description and discussion.

In the drawing—

Figure 1 is a longitudinal sectional view of a vapor cushion pulsation dampening device showing a preferred embodiment of my invention.

Figure 2 is a transverse sectional view taken along the 2—2 line of Figure 1.

Figure 3 is a transverse sectional view taken along the 3—3 line of Figure 1.

Figure 4 is a longitudinal sectional view of a vapor cushion pulsation dampening device embodying a modification of my invention.

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Figure 1 shows a preferred embodiment of my invention wherein trap 10 comprises vapor dome 11 forming interior chamber 12 and outer shell 13 forming outer chamber 14 with supporting members 15 attached to the outer top of vapor dome 11 and the interior top of outer shell 13. Vapor dome 11 has ports 16 in its lower extremities for the purpose of communicating between interior chamber 12 and outer chamber 14. Sealing fluid 17 is relatively more volatile than and is relatively heavier than fluid 18, which is the fluid being pumped in a flow line not shown. Conduit 19 communicates with chamber 14 and such a flow line and conveys fluid 18 to the upper portion of outer chamber 14. Coil 20 carries a heating medium into interior chamber 12 from a source which, for the sake of simplicity, is not shown and supplies heat to vaporize sealing fluid 17. Inlet 21 having valve 22 installed therein, is provided for the purpose of charging sealing fluid 17 into vapor dome 11.

Figure 4 shows a modification embodying my invention wherein trap 10' comprises vapor dome 11' forming interior chamber 12', extending through the top of outer shell 13' and fastened therein in such a manner that outer chamber 14' will be pressure tight in the connection. Vapor dome 11' has ports 16 in its lower extremities for the purpose of allowing a fluid to pass to and fro between outer chamber 14' and interior chamber 12'. Inlet 21 having valve 22 installed therein, is provided to charge a sealing fluid into interior chamber 12' and heating coil 20 provides the heat necessary to vaporize the sealing fluid. A further modification shown in this figure is that sealing fluid 24 is relatively more volatile than and is relatively lighter than fluid 25 which is pumped in the flow line.

Operation

My invention provides an apparatus and a method for overcoming disadvantages of the old air cushion pulsation dampening device and a method for carrying out the improvements. In the preferred embodiment of my invention I install a heating coil, or some equally good heating means, in the upper portion of the vapor dome. The inlet and outlet for such coil may or may not go through the outer shell and the outer chamber. The main requirement is that the heating apparatus be positioned in the upper portion of the vapor dome.

Heat has been used to vaporize the liquid being pumped in the flow line, in order to form a vapor cushion. In many cases, however, the pres-

sure maintained on a flow line is so great that it would take exceedingly high temperatures to vaporize the fluid being pumped. For that reason a sealing fluid which is relatively more volatile than the pumped fluid is charged to the interior chamber. After the sealing fluid has been charged, fluid under the full flow line pressure is turned into the outer chamber. This fluid forces the sealing fluid upward in the interior chamber so that it contacts the heating coil or heating means. Steam or some equivalent heating medium is then passed through the coil. In this manner the sealing fluid is vaporized until a vapor pocket is formed which surrounds the heating unit. From this point in the operation the apparatus of my invention becomes self compensating. As the vapors are condensed to such a degree that fluid surges up over the heating unit, additional vapors will be formed and the fluid will once more be forced downward until the fluid in its surges fails to reach the heating unit. This heating coil is an important feature of my invention, since it insures having a vapor space available to absorb pulsations but does not supply excessive quantities of heat to the system during normal operation when the top level of unvaporized sealing fluid is below the heating coil.

Some of the sealing fluids which may be used in my invention when hydrocarbons are being pumped include water and aqueous solutions of ammonia, carbon dioxide or methylamine. Carbon tetrachloride is a satisfactory sealing fluid when water is the fluid being pumped. The amount of sealing fluid charged to the apparatus should be in excess of that expected to be vaporized. The excess fluid seals the vapors from the fluid being pumped in the flow line.

In a further modification of my invention, the temperature of the heating element may be controlled by hand or may automatically be controlled by means of an attachment on a liquid level indicator or control. Any commonly used liquid level indicator or control may be used for the purpose of checking the level of the sealing liquid within the interior chamber.

The modified construction of my invention shown in Figure 4 of the drawing will be advantageous where it is necessary to maintain a larger vapor cushion than would be practicable in a device such as the one shown in Figure 1 of the drawing.

Many modifications may be made in the heating means for the sealing fluid in the construction of either figure. The primary requirement is that the heating unit be positioned so that it will be above the sealing fluid level when the device is in full operation.

The apparatus shown in Figure 1 and the apparatus of Figure 4 may be used either with a sealing fluid which is lighter than the pumped fluid or with a sealing fluid which is heavier than the fluid being pumped. Once the selection of a sealing fluid which will be substantially insoluble in the pumped fluid has been made and comparisons of specific gravities made, it is relatively easy to start operation of the device. Operation of the device using a heavy sealing liquid has been described above. Where a lighter sealing fluid is used, sufficient flow line fluid is charged to the device to partially fill the vapor dome and the outer chamber of the trap. Sealing medium is then charged to the vapor dome. Sufficient pressure is maintained on the flow line fluid to prevent the sealing fluid from passing out of the vapor dome. After the sealing fluid has been charged

the full pressure of the flow line is released thereon and sealing fluid is vaporized by means of the heating unit. The desired volume of vapor is formed and maintained as has been previously described.

For those skilled in the art it will be obvious that many alterations and modifications in the construction and operation of this device may be made without change in the principles and scope of my invention.

Having described my invention, I claim:

1. A vapor cushion pulsation dampening device for connection to a high pressure flow line in which pulsing flow of a comparatively low vapor pressure liquid occurs comprising in combination with said flow line a trap including a vapor dome; a fluid within said trap, which fluid is relatively more volatile than said flow line liquid and is immiscible with the former liquid, whereby said vapor dome is sealed from the balance of said trap and means to heat a portion of said high vapor pressure fluid in said dome to form a vapor pocket therefrom in said dome.

2. A vapor cushion pulsation dampening device for connection to a high pressure flow line in which pulsing flow of a comparatively low vapor pressure liquid occurs, comprising in combination with said flow-line a trap comprising an upright outer shell and an inner shell of smaller diameter which includes a vapor dome and communicates with a chamber formed within said outer shell only through the lower end of said inner shell; a fluid sealing medium within said trap and which fluid is relatively heavier but more volatile than the former liquid, whereby said vapor dome is sealed from the balance of said trap; and means to heat a portion of said heavier fluid in said dome to form a vapor pocket therefrom in said dome.

3. A vapor cushion pulsation dampening device for connection to a high pressure flow line in which pulsing flow of a comparatively low vapor pressure liquid occurs, comprising in combination with said flow line a trap comprising an upright outer shell and an inner shell of smaller diameter which includes a vapor dome and communicates with a chamber within said outer shell only through the lower end of said inner shell; a fluid sealing medium within said dome and which fluid is relatively lighter and more volatile than the former liquid; and means to heat a portion of said lighter fluid in said dome to form a vapor pocket therefrom in said dome.

4. A vapor cushion pulsation dampening device for connection to a high pressure flow line in which pulsing flow of a comparatively low vapor pressure liquid occurs comprising in combination with said flow line, chambers intercommunicating in their lower extremities; a fluid sealing medium positioned to shut off one chamber from another; a conduit connecting said flow line with one intercommunicating chamber at a point above the normal level of the sealing medium, such sealing medium being immiscible in and being more volatile than the liquid contained in the flow line, the relation between the flow line liquid and the sealing medium being such that pressure of the former tends to force the level of the sealing medium down in the chamber communicating with the flow line and up in the chamber which has no direct communication with said line; and means for heating said sealing medium in the latter chamber, whereby vapors of said sealing medium form a vapor cushion in the upper portion of the latter chamber.

5. A vapor cushion pulsation dampening device for connection to a high pressure flow line containing a comparatively low vapor pressure liquid, comprising in combination an upright outer shell connected at its upper end portion to said flow line; an inner shell including a vapor dome, smaller in diameter than said outer shell, extending upwardly from the bottom of said outer shell and communicating with the chamber within said outer shell only through the lower portion of said inner shell; a fluid which is immiscible with and more volatile than said low vapor pressure liquid, disposed at least within said inner shell; and means to heat a portion of said high vapor pressure fluid in said inner shell.

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15 Number
158,616

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
412,547	Sherman -----	Oct. 8, 1889
561,992	Hooker et al. -----	June 19, 1896
1,216,761	York -----	Feb. 20, 1917
1,938,167	Baker -----	Dec. 5, 1933
2,315,179	Allender -----	Mar. 30, 1943
2,341,501	Greenwell et al. -----	Feb. 8, 1944

FOREIGN PATENTS

Country	Date
Switzerland -----	of 1933