March 20, 1934. J. A. REAVELL 1,951,560

EXPANSION MECHANISM FOR OIL HEATING SYSTEMS

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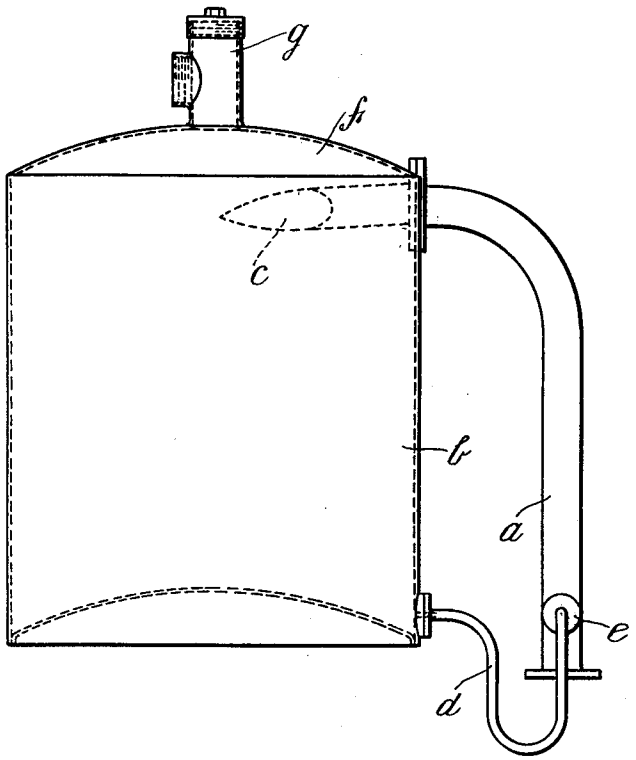

Fig. 1.

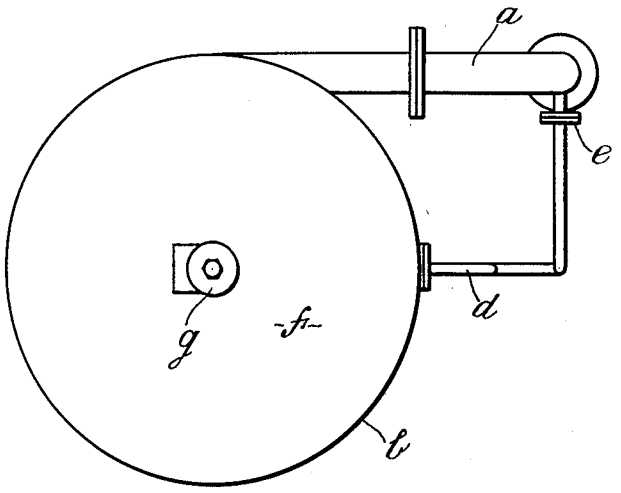

Fig. 2.

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EXPANSION MECHANISM FOR OIL HEATING SYSTEMS

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3 Claims. (Cl. 237—66)

This invention relates to expansion mechanism for oil heating systems and has particular reference to the type in which a body of oil is heated by independent means and circulated as a heating medium or fluid for industrial purposes. The invention is adapted to be applied to an oil heating system such as that disclosed in the patent to J. W. F. Macdonald, No. 1,437,187, granted November 28, 1922.

Heretofore, in order to discharge imprisoned air or steam formed as the result of residual water within the apparatus it has been customary to employ a single large diameter pipe acting as an expansion main which enters the base of an expansion chamber provided with means for the escape of steam or air. This form of apparatus has been found in practice to possess the disadvantage that considerable heat losses are incurred in the rising expansion main and expansion chamber, whilst the temperature of the oil in the chamber frequently approaches that of the temperature of the oil in the circulatory system due to convection currents in the large bore pipes usually employed. Further, when moisture is present in the system, this is liable to be evidenced suddenly by the formation of steam which causes considerable disturbance in the expansion chamber due to frothing of the oil therein which results in considerable loss of oil through the over-flow pipe.

It is the object of the present invention to overcome the disadvantages referred to above and provide an arrangement for dealing with the expansion of the oil heating medium in an improved manner whereby air or steam can be discharged from the circuit without loss of the circulating medium.

According to the invention an expansion chamber is employed situated at the terminal end of a rising expansion main and having means whereby any vapour can escape from the chamber and allow the circulating medium to return through a separate outlet to the expansion main with a minimum loss of heat.

In the preferred form of the invention illustrated herein a cylindrical expansion chamber is located in proximity to and in axial parallelism with the rising expansion main and the expansion main enters the expansion chamber substantially tangential to its circumference at or near its upper portion, while an additional connection, such as a pipe, establishes a connection between the lower portion of the expansion chamber and the expansion main at substantially the same level. The connection or pipe desirably is of relatively small cross sectional area and preferably is provided with a U-shaped depression forming a liquid seal.

The objects of these provisions are:—

(1) To provide for the immediate separation and escape from the body of oil within the system of steam resulting from the vaporization of water when present as an impurity, and of air or other gases when such are present, as may frequently occur when a system is newly filled with oil and heated for the first time.

Under such circumstances, the flashing of the water into steam when the boiling point of water is reached results in a sudden increase in volume which requires immediate relief, and this is afforded by the delivery of the steam and vapor from the upper end of the rising expansion main into the upper end of the chamber in contradistinction to the former practice of connecting the expansion main with the bottom of the expansion chamber. By reason of the construction characteristic of the present invention the frothy fluid entering the expansion chamber from the upper end of the expansion main is given a swirling motion which facilitates the escape of steam or gases from the frothing oil, while at the same time providing for the return of the oil to the system through the lower connection or conduit after the separation of the impurities is completed.

(2) To avoid wasteful loss of heat by radiation from the surfaces of the expansion chamber.

In systems of the class described it is the established practice to fill the system with oil to an extent such that when unheated and at its natural temperature the oil will stand in the expansion main and the expansion chamber at a level slightly above the bottom of the chamber, the volume of the expansion chamber being such that when the oil is heated to its maximum temperature the expansion chamber will be filled to not more than two-thirds of its depth; thus the expansion chamber constitutes a reservoir more than sufficient to contain the increased volume due to the expansion of the contents of the system.

During the normal operation of the heating system, after the oil has been brought up to approximately the working temperature, the conditions in the expansion tank are substantially static, that is to say, the movement of the oil into and out of the expansion tank is relatively slow.

Under the former practice of connecting the rising expansion main to the base of the expansion chamber, there is a constant and appreciable tendency for hot oil rising through the expansion main to continue to flow upwardly through the oil within the expansion chamber and a corresponding tendency of the oil, that has been cooled by convection due to such circulation and by radiation from the walls of the chamber, to flow from the lower portion of the expansion chamber into the expansion main and to the extent that the oil in the expansion chamber surrenders heat by such convection and radiation there is a con-

stant and appreciable loss of heat from the system while it is maintained in operation.

One of the important advantages of the invention is the reduction and substantial elimination of the convection currents above described by means of the U-shaped depression in the lower connection between the expansion chamber and the expansion main from which it results that the body of oil present in the expansion chamber, having once given up sufficient heat to reduce its temperature to that of the air surrounding the chamber, suffers no further substantial losses of heat by radiation.

It will be observed that these provisions in no way interfere with the normal functions of the expansion chamber and expansion riser since oil may pass freely from the system into the chamber during a period of rising temperature, or be returned from the expansion chamber to the system during a period of falling temperature by providing in the lower connection a bore of size sufficient to permit the free passage of the fluid without excessive resistance.

The combination of the upper connection to the expansion chamber on the one hand and the lower connection on the other from the expansion main are both essential to the purposes of my invention above described and are distinguishing characteristics thereof.

Reference will now be made to the accompanying drawing which illustrates by way of example a construction according to the invention and in which:—

Figure 1 is a sectional elevation of an expansion tank and connection thereto and

Figure 2 is a plan.

In the form illustrated a rising expansion main *a* is curved at its upper end to enter an expansion tank *b* near its upper end. The expansion tank is of cylindrical form as shown in the plan, Figure 2, and extends in axial parallelism with said expansion main, and the expansion main *a* enters by a tangential opening *c* so that any inflow of oil to the tank *b* is caused to impinge against its sides. The base of the tank *b* is provided with an outlet communicating with a U-shaped pipe *d* of relatively narrow bore as compared with the bore of the expansion main *a* with which the pipe *d* communicates as shown at *e*. The expansion tank *b* is provided with a dome *f* which may be fitted with a vapour separator and is provided at its apex with the usual over-flow pipe *g* for the escape of steam or air.

The operation of the device above described is as follows:—

When the apparatus is working normally expansion of the hot oil in the circulatory system takes place, follows up the vertical rising main *a* and enters the expansion tank *b* through the U-shaped pipe *d*. If the flow of the oil up the rising main *a* is of considerable volume or speed it enters the tank *b* partly through the pipe *d* and partly through the inlet *c*, the oil introduced to the tank *b* subsequently returning to the rising main through the pipe *d*. If water steam or air is present this also passes up the rising main *a*, and escapes into the upper part of the expansion tank *b* from which it escapes from the system through the outlet *g*. In this way the fluid level in the tank *b* is maintained at a reasonably uniform level depending upon the heat of the fluid and escape of steam or other vapour takes place without causing water hammer or similar disturbances in the circulatory system.

In the arrangement above described the U-shaped pipe *d* serves normally as the conduit through which the oil may pass from the main system to the expansion chamber in response to expansion, or from the expansion chamber to the main system in response to contraction, while the larger connection from the main to the upper portion of the chamber is utilized only in response to the emergency that arises when frothing occurs.

By this arrangement no appreciable heat is lost by radiation from the surfaces of the expansion chamber when the system is in normal operation and subject to neither expansion nor contraction, and a corresponding substantial fuel economy is thereby effected.

I claim:

1. Expansion mechanism for an oil circulating heating system having an expansion main rising therefrom comprising a closed cylindrical expansion chamber into the upper portion of which the upper end of the expansion main enters substantially tangentially to its circumference to permit discharge of steam and vapor from the oil circulating in the system, a conduit of relatively smaller diameter than that of said rising main connecting the lower peripheral portion of said expansion chamber with said rising main to permit the maintenance of substantially the same liquid level in the rising main and expansion chamber during the normal operation of the system, and means for permitting the escape of vapor from the upper end of the expansion chamber.

2. Expansion mechanism for an oil circulating heating system having an expansion main rising therefrom comprising a cylindrical expansion chamber into the upper portion of which the upper end of the rising main enters substantially tangential to its circumference to permit the discharge of steam and vapor from the oil circulating system in such a manner as to produce a swirling motion which facilitates the escape of vapor from the frothing oil, a conduit of relatively small diameter connecting the lower portion of the expansion tank with said rising main to permit the maintenance of substantially the same liquid level in the rising main and expansion tank during the normal operation of the system, and means for permitting the escape of vapor from the upper end of the tank.

3. Expansion mechanism for an oil circulating heating system having an expansion main rising therefrom comprising a closed cylindrical expansion chamber of relatively greater cross sectional area than the rising main located in proximity to and in axial parallelism with said rising main, with the upper end of said rising main entering the expansion chamber substantially tangential to the circumference of said chamber, means for permitting escape of vapor from the upper part of said expansion chamber a pipe of relatively small diameter connecting the lower peripheral portion of said expansion chamber and said rising main at substantially the same level having intermediate of its length a downwardly extending U-shaped bend providing a fluid seal and acting to restrict the rate of flow of oil between the rising main and the expansion chamber but to permit the maintenance of substantially the same liquid level in the rising main and expansion chamber during normal operation of the system.

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