May 3, 1960 V. W. GROTLISCH 2,935,429

METHOD FOR CLEANING NON-DRAINABLE TUBES

Filed July 25, 1956

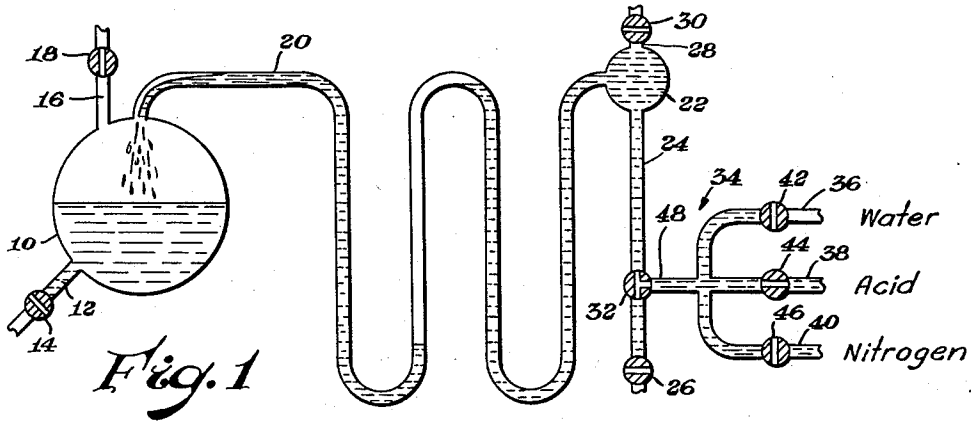


Fig. 1

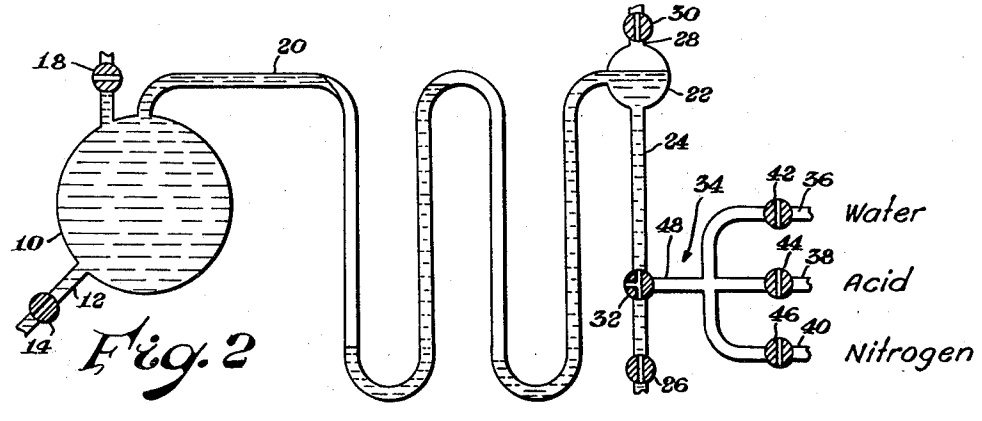


Fig. 2

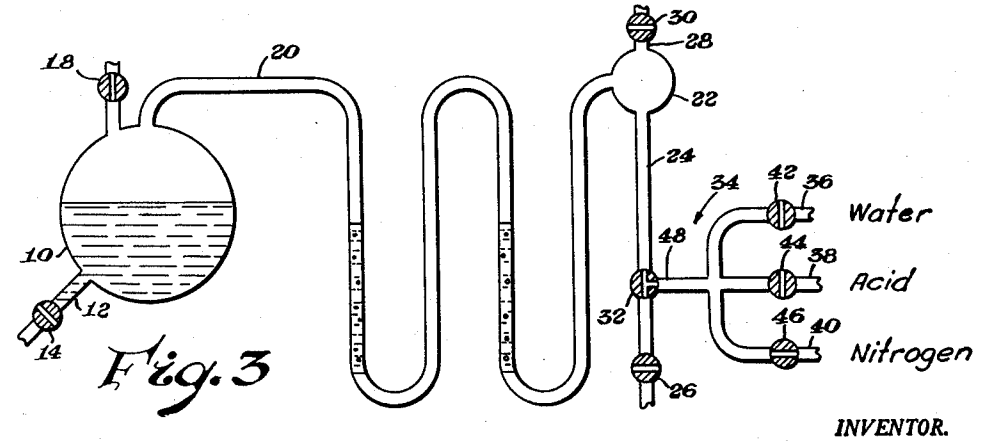


Fig. 3

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United States Patent Office 2,935,429 Patented May 3, 1960

2,935,429

METHOD FOR CLEANING NON-DRAINABLE TUBES

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Application July 25, 1956, Serial No. 599,952

5 Claims. (Cl. 134—22)

This invention relates to a method of cleaning the tubes of non-drainable superheaters and particularly to a method of chemically cleaning tubes of superheaters.

Non-drainable superheaters cannot be filled by ordinary methods (like filling a tank or a bucket) because air becomes trapped in loops in the tubes. Also, the tubes of such superheaters cannot be drained completely because the loops trap more or less liquid.

Non-drainable superheater tubes are usually cleaned by means of a tool or machine which can be used to introduce the cleaning solvents into each tube individually. Such a tool is used by removing a cover which is usually present at the end of the inlet or outlet header of the superheater and then pushing the tool (which includes a solvent carrying hose) down the header. As each tube is reached, the tool is used to introduce a tight fitting nozzle of the solvent hose into the tube. In this fashion each tube is individually filled with solvent, then later individually flushed and neutralized. This operation is time consuming since the cleaning of each tube of the superheater constitutes a separate cleaning operation. Also, in some superheaters it has been impossible to fashion a tool with which each tube can be filled.

Accordingly, a principal object of this invention is to provide an improved method of chemically cleaning non-drainable tubes of superheaters.

Another object of this invention is to provide an improved method of cleaning simultaneously a plurality of non-drainable tubes in a superheater.

In accordance with this invention a solvent is first pumped into one end of a superheater, then solvent is pumped into the other end of the superheater to back fill the tubes, then (usually) purging the superheater tubes with a gas, and flushing and neutralizing the superheater.

The invention, as well as additional objects and advantages thereof, will best be understood when the following detailed description is read in connection with the accompanying drawings, in which:

Fig. 1 is a simplified diagrammatical view of a superheater and steam chest showing the initial application of solvent to the superheater;

Fig. 2 is similar to Fig. 1, but shows the back filling of the superheater with solvent, and

Fig. 3 is similar to Fig. 1, but shows the purging of the superheater with gas.

Referring to Fig. 1, there is shown a steam chest **10** having an inlet tube **12** including a valve **14**, a vent **16** including a valve **18**, a superheater having at least one non-drainable tube **20**, an outlet header **22**, a drain tube **24**, drain valve **26**, a vent tube **28** and a valve **30**. A three way valve **32** is connected into the drain tube **24** between the drain valve **26** and the outlet header **22**. A treating header, indicated generally by the numeral **34**, is connected to the three way valve **32**.

The treating header includes a water tube **36**, acid tube **38**, and gas (nitrogen) tube **40**, each connected through a separate valve, **42**, **44**, or **46**, respectively, to a tube **48** which is connected to the three way valve **32**.

In practicing the invention, and as shown in Fig. 1, the steam chest vent valve **18** is opened, the steam chest inlet valve **14** is closed, the outlet header vent valve **30** is closed, the three way valve **32** is positioned to provide a passageway between the treating header **34** and the drain tube **24**, the drain valve **26** is closed, and the valve **44** is open to permit acid cleaning solvent to be pumped through the drain line 24 and outlet header **22** and into the superheater tubes **20**. The overflow of acid goes into the steam chest **10**. However, as may be seen in Fig. 1, acid does not completely fill the superheater tubes **20**.

Fig. 2 shows the arrangement by which the tubes **20** are back filled. The steam chest vent valve is closed, the outlet header vent valve is opened, the three way valve **32** is positioned to by-pass the treating header **34** and open the drain tube **24**, the drain valve **26** is open, and the steam chest inlet valve **14** is open. Under such conditions, acid is pumped into the steam chest **10** (or inlet header if convenient to do so) through the inlet tube **12**. The pumping of acid through the tube **12** and steam chest **10** "back fills" the superheater tubes **20**, the acid cleaning fluid filling the parts of the superheater tubes **20** which are not filled when acid is pumped into the outlet header **22**.

Following the back filling of the superheater tubes **20**, and with the valves in the positions shown in Fig. 3, gas (nitrogen, for example, although air or other suitable gases would do) is applied through the tube **40** and valve **46** of the treating header **34**, the gas passing up the drain tube **24**, through the superheater tubes **20** into the steam chest **10** and out the steam chest vent tube **16**. The purging of the superheater tubes **20** with the gas serves to empty the superheater tubes **20** and to agitate the acid in the tubes **20** to assure that all of the inner surfaces of the tubes **20** will be contacted by the acid.

The superheater is then filled as completely as possible with flush water (probably including a neutralizing material) through the outlet header, through the steam chest, or both.

The superheater tubes **20** are then purged with gas, a neutralizing solution is pumped in, and the neutralizing solution purged from the tubes **20** by blowing gas through the tubes **20**. Additional flushing by filling and back filling the tubes **20** with water or other suitable solution, followed by purging the tubes **20** with gas, may, if desired, take place in order to complete the cleaning operation.

In the above description it is stated that the cleaning fluid is applied first through the outlet header **22** and then through the steam chest **10** or inlet header (not shown). In practice, the initial application of cleaning fluid (10 percent hydrochloric acid is often used, for example) may be made to either end of the tubes **20**.

Further, steam or gas (such as nitrogen, for example) may be applied through the tubes **20** during the acid cleaning operation in order to agitate the acid, heat the acid, or both.

Among the advantages of the invention are that non-drainable superheater tubes, i.e., those with loop formations wherein the loops extend below each of the ends of the tubes and trap liquid in the bottom of the loops can be cleaned easily and thoroughly with liquid solvents without leaving obnoxious residues in the loops.

I claim:

1. The method of cleaning non-drainable tubes of a superheater whose tubes are connected to fluid inlet means at one end and to fluid outlet means at the other end thereof, comprising pumping an acid solvent through said tubes from one end thereof, then pumping an acid solvent through said tubes from the other end thereof, purging said tubes with gas, flushing said tubes with water, circulating a neutralizing fluid through said tubes, again purg-

ing said tubes with gas, and flushing said tubes with water.

2. The method of cleaning non-drainable tubes of a superheater whose tubes are connected to fluid inlet means at one end and to fluid outlet means at the other end thereof, comprising pumping hydrochloric acid through said tubes from one end thereof, bubbling nitrogen through said tubes, then pumping hydrochloric acid solution through said tubes from the other end thereof, again bubbling nitrogen through said tubes, purging said tubes with nitrogen then flushing said tubes with water, purging said tubes with nitrogen, pumping an acid neutralizing solution through said tubes, again purging said tubes with nitrogen, and flushing said tubes with water.

3. A method in accordance with claim 2, wherein heated acid is pumped through said tubes.

4. A method in accordance with claim 2, wherein said hydrochloric acid is a ten percent acid solution.

5. A method in accordance with claim 1, wherein steam is circulated through said tubes simultaneously with said acid.

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