Aug. 10, 1937. G. E. WILDER, JR 2,089,317

METHOD FOR CLEANING WATER HEATERS

Filed March 25, 1936 2 Sheets-Sheet 1

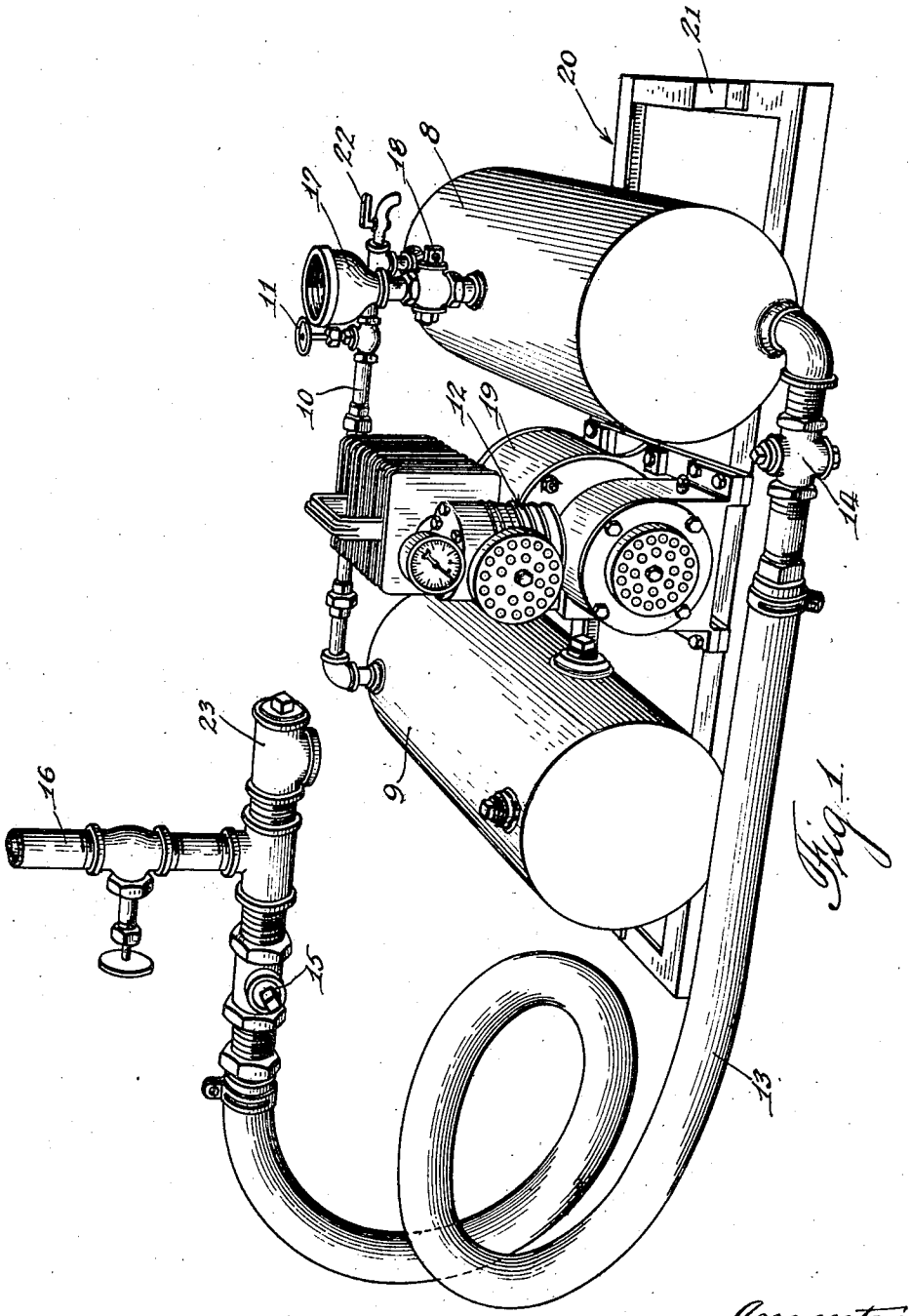


Fig. 1.

Inventor:
George Edward Wilder, Jr.
By: Jones, Addington, Ames & Seibold
Attys.

Aug. 10, 1937. G. E. WILDER, JR 2,089,317

METHOD FOR CLEANING WATER HEATERS

Filed March 25, 1936 2 Sheets-Sheet 2

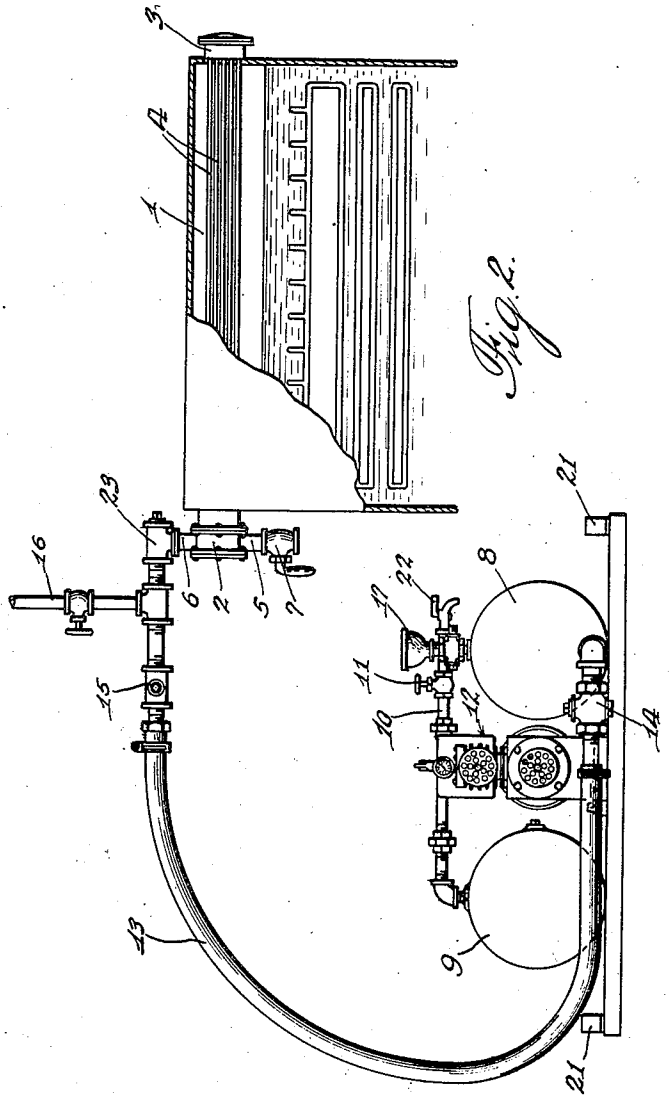


Fig. 2.

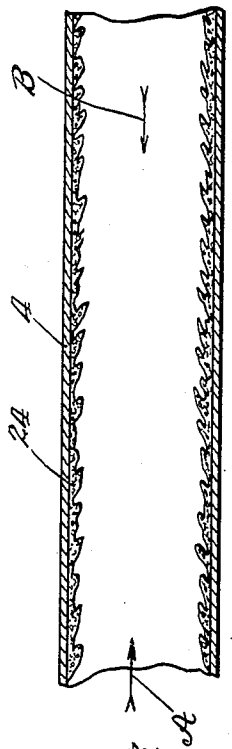


Fig. 3.

Inventor:
George Edward Wilder, Jr.
By: Jones, Addoms, Amos & Siebold:
Attys.

Patented Aug. 10, 1937

2,089,317

UNITED STATES PATENT OFFICE

2,089,317

METHOD FOR CLEANING WATER HEATERS

George Edward Wilder, Jr., Chicago, Ill.

Application March 25, 1936, Serial No. 70,803

2 Claims. (Cl. 141—1)

This application is a continuation as to common subject matter of my co-pending application Serial No. 747,537, filed October 9, 1934.

My invention relates to a method for removing the incrustation from the interior of water heaters. More specifically, it relates to such a method when applied to the type of heater known as submerged heaters.

One of the objects of my invention is to shorten the time and lessen the cost of removing this incrustation.

A further object of my invention is to provide an improved method which will be more efficacious than those heretofore used.

A further object of my invention is to provide an improved method which will avoid the use of acids which not only attack the metal parts of the heater into which it is introduced but also constitute a menace to health in case the water from the heater should be used for drinking purposes.

A further object of my invention is to provide a method involving the use of the sudden application and release of hydrostatic pressure in the tubular heater which will tend to cause the incrustation-loosening liquid to impregnate the scale and which will further cause a physical distortion of the thin tubes of the heater, causing a sort of peristaltic action tending to loosen the scale from the tubes.

Further objects and advantages of the invention will appear from the description and claims.

Up to the present time, two methods have been in use for removing the incrustation from submerged water heaters. The first method involved the removal of the entire heater from the boiler and the burning out of the incrustation on the interior of the tubes by means of a torch. This was a slow, tedious and expensive process and not efficacious in removing all of the incrustation.

Another method involved the filling of the heater with a solvent (often containing acid) intended to dissolve the incrustation, allowing the solvent to remain in the heater until it slowly dissolved the incrustation, the solvent being allowed to seep through the heater by gravity. As the tubes of the heater are sometimes almost completely clogged, this process also was slow and expensive, frequently taking as long as forty-eight hours to complete the work. During all this time, the tenants or other users of the water heaters would have to be without the use of hot water. Furthermore, this method was not efficacious in removing all of the incrustation. Furthermore, if acid were used in the solvent, it would constitute a menace to health in case water from the heater should be used for drinking purposes.

By means of my improved method and apparatus, I am enabled to cut the time required for cleaning the heaters to a small fraction of that ordinarily required. I am also enabled in general to avoid the use of acid in the incrustation-loosening liquid. This is accomplished by the method and apparatus hereinafter set forth in detail.

In the drawings in which my invention is illustrated,

Figure 1 is a perspective view showing my improved apparatus;

Fig. 2 is a somewhat diagrammatic view showing my improved apparatus connected up for cleaning a water heater; and

Fig. 3 is an axial section of one of the tubes of the water heater on a larger scale than is shown in Fig. 2, showing in a general way the nature of the incrustation.

My improved method is disclosed in connection with a hot water heater 1 of the submerged type, including a front header 2 having a partition dividing it into upper and lower compartments, a rear header 3, and heating tubes 4 connecting the headers, the front header having a lower inlet 5 opening into its lower compartment for the entry of the water to be heated and an upper opening 6 from the upper compartment for the outlet of the heated water, and having tubes 4 of relatively thin copper leading from the lower compartment of the front header 2 through the lower heater tubes to the lower half of the rear header 3, thence from the upper half of the rear header 3 forwardly to the upper compartment of the front header 2, and thence to the upper outlet opening 6. The copper tubes 4 used in this heater vary in size from a diameter of around ⅜" in certain types of heater to a diameter of 3" in larger heaters. The thickness of the walls of the copper tubes also varies in the different types and sizes—perhaps from a thickness of .02" on the smaller tubes to .064" on the 3" tubes.

In a general way, the method I employ for removing the incrustation in these heaters comprises the disconnection of the heater 1 from the water supply and discharge line, the screwing on of a quick-opening and closing valve 7 on the lower opening 5, which is the inlet opening when the heater is in use, and coupling on to the upper opening, which is the discharge opening when the heater is in operation, of apparatus by means

of which an incrustation-loosening liquid may be supplied to the tubes of the heater and by means of which aforesaid connections pressure may be suddenly applied and released with respect to the incrustation-loosening liquid filling the tubes of the heater.

In carrying out this method, after the heater 1 has been disconnected from the line and allowed to drain and the quick opening and closing valve and the liquid supply connections have been made, the valve 7 on the lower opening is set to a slightly open position and the incrustation-loosening liquid, which is preferably alkaline or at least non-acid, is supplied to the heater through the upper opening 6 and fills the tubes in the heater, the air which was in the heater tubes escaping through the slightly open lower valve 7. When the liquid begins to flow from this lower valve, indicating that the heater tubes are full of liquid, the valve 7 is completely closed and a substantial hydrostatic pressure is suddenly applied by apparatus, which will be described more in detail hereinafter, to the incrustation-loosening liquid in the tubes, causing a sudden distortion and peristaltic action of the thin copper tubes 4, tending to loosen the incrustation from the tubes by physical action and also causing the incrustation-loosening liquid to penetrate and impregnate the scaly incrustation, enabling it to act in and throughout the mass of the incrustation and causing it to force its way in between the inner surface of the copper tubes and the adjacent incrusted scale. The pressure used may vary within rather wide limits. In practice, I have found that a pressure up to 100 or even 150 pounds per square inch is advantageous, although reasonably good results are obtained with much lower pressure, such as 30 pounds per square inch, or even 15 pounds per square inch. The pressures herein referred to are gauge pressures, i. e. superatmospheric.

After the pressure is suddenly applied, it is maintained for a substantial period, during which the incrustation liquid penetrates still further into the mass of the incrustation and in between the incrusted scale and the inner surface of the tubes. The duration of this holding period may also vary over a considerable range. In practice, I have found that desirable results are obtained by using a holding period of around 30 seconds although it may sometimes be desirable to increase this holding period considerably. The length of time which the incrustation-loosening material is allowed to remain in the heater depends to a large extent upon the amount of incrustation on the inside of the heater tubes, which may be determined by running temperature tests on the incoming and outgoing water supply prior to the cleaning of the heater.

After the incrustation-loosening liquid has been held in the heater under pressure for the desired length of time, it is suddenly released and discharged by quickly opening the valve 7, the high pressure to which the liquid in the tubes is subjected causing the liquid to be quickly ejected, carrying with it the loosened material which was incrusted on the walls of the tubes. After the incrustation-loosening liquid has all been ejected from the heater, the apparatus for supplying the incrustation-loosening liquid may be uncoupled from the upper opening and the heater may be flushed out from the usual water supply main, this flushing out preferably being in a direction the reverse of that in which the incrustation-loosening liquid is made to flow through the heater. This back-wash or flushing may be kept up as long as it is producing a useful result in removing incrustation. I have found that in general this back-wash or flushing period may be about fifteen minutes, although this may vary within wide limits.

After the back-wash or flushing operation has been completed, it may sometimes be desirable to repeat the first operation of again filling the hot water heater with the incrustation-loosening liquid, subjecting it to quickly-applied high pressure and quickly releasing it to force out any remaining incrustation.

As indicated above, in general I prefer to use an incrustation-loosening liquid which is of an alkaline or non-acid character. This liquid may contain various substances, the nature of these substances depending upon the nature of the incrustation on a particular job. Under various conditions I have found that liquids containing one or more of the following substances may be useful:

(1)—Sodium aluminate;
(2)—Trisodium phosphate;
(3)—Magnesium sulphate;
(4)—Sodium hydroxide;
(5)—Ferrous hydroxide

I will now describe one form of apparatus which I find satisfactory in carrying out my improved method. This apparatus comprises a liquid tank 8, a compressed air tank 9, a pipe connection 10 between the tanks having a valve 11 for controlling the communication, an air compressor 12 for supplying compressed air to the tank 9, and a conduit 13 leading from the liquid tank to the pipe fitting which makes connection with the upper end of the front header. Suitable valves 14 and 15 may be provided in the conduit 13 between the liquid tank 8 and the header 2 for cutting off and opening communication when desired, in making the connections and disconnections with the header, and in carrying out the cleaning operation. If desired, a valve-controlled vent 16 may be provided in the conduit to enable the release of gases generated in the cleaning operation. The liquid tank 8 is provided with a filling funnel 17 having a communication with the liquid tank controlled by a valve 18. A motor 19 may be provided for driving the air compressor 12. The motor 19, compressor 12 and two tanks 8 and 9 may be mounted on a suitable rectangular frame 20 having handles 21 at each end thereof so that the apparatus may be easily carried.

In preparing this apparatus for use, the valve 14 from the liquid tank 8 is closed, the valve 11 between the compressed air 9 and liquid tank 8 is closed, and the valve 18 below the funnel 17 is opened. The liquid tank is then filled with suitable incrustation-loosening liquid. Air may escape from the tank as it is forced out by the liquid through the pet cock 22, which should be opened for this purpose. After the tank 8 is filled, the valve 18 and pet cock 22 are closed. The compressor 12 is put in operation to provide a supply of compressed air in the air tank 9. As indicated above, I have found that an initial tank pressure of around 150 pounds per square inch gives desirable results.

The pipe coupling 23 is then connected to the upper end of the front header 2, the gas vent valve 16 is closed, the valves 14 and 15 are opened and the air supply valve 11 to the liquid tank 8 is opened to enable the compressed air to force the liquid from the liquid tank and fill the tubes

of the heater, the lower outlet valve 7 being slightly open to enable the escape of air as previously described. When water begins to escape from the lower valve, it indicates that the heater is full of liquid, whereupon the lower valve 7 is closed. In order to fill the heater without waste of the liquid, one of the valves 14 or 15 may be placed in a partially closed position. The closing of the valve 7 is followed instantly by the building up of pressure in the heater tubes to the maximum, causing a water hammer and a distortion and peristaltic action of the tubes, loosening the incrustation and causing the liquid to penetrate the incrustation. After the heater tubes are filled with liquid and the outlet valve 7 is closed, the partially closed valve 14 or 15 is opened wide and the liquid in the heater is maintained under the pressure of the air. This pressure is held on for a suitable period of time—usually around 30 seconds—whereupon the pressure is suddenly released by quickly moving the discharge valve 7 to its wide open position, causing a rush of the liquid through the heater tubes, carrying with it the loosened incrustation. When the charge of liquid has been forced out of the heater, the liquid supply is cut off by closing the valve (14 or 15) and the fitting is disconnected to enable the above-described back-flushing operation.

It will be noted that when the valve 7 is quickly opened to release the incrustation-loosening liquid under pressure, the discharge flow is in a direction the reverse of that of the normal flow of water through the heater when the heater is in use. This reverse direction of flow has an advantage, as will be apparent from an inspection of Fig. 3, as in Fig. 3 the arrow A indicates the normal flow of the liquid when the heater is in use, and the arrow B indicates the direction of flow of the incrustation-loosening liquid when it is suddenly discharged in the cleaning operation. As shown in Fig. 3, the incrustation 24 on the inside of the tube has a tendency to form in projections inclined in the direction of the flow of the water through the meter, indicated by the arrow A. When the cleaning liquid is suddenly discharged, it flows with a great velocity in a direction reverse to that in which the projections on the scale extend, thus catching on these projections and tending to tear the scale loose from the tube.

Further modifications will be apparent to those skilled in the art and it is desired, therefore, that the invention be limited only by the prior art and the scope of the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A method of removing scaly incrustation from the interior of the tubes of a hot water heater, which heater has an inlet opening for the water to be heated and an outlet opening for the heated water and which tubes have relatively thin walls, which method comprises filling the tubes through one of said openings with an incrustation-loosening liquid capable of reacting chemically with the incrustation, by means of pressure applied to the liquid to force it into the heater through said opening, said pressure being greater than that to which the tubes are normally subjected when serving to heat water, the other opening being open to enable the entry of the liquid into the heater, closing said other opening when the heater is filled with the liquid and while pressure is still applied to the liquid, thereby subjecting the liquid in the tube to said suddenly-applied high pressure to cause a peristaltic action of the tube walls, tending to loosen the scale, maintaining the other opening closed for a substantial period of time while said pressure is still applied to cause the liquid to impregnate the previously loosened scaly material and penetrate between the scaly incrustation and the walls of the tube and to react chemically with the loosened scaly material, and thereafter quickly opening said other opening while said pressure is still applied, causing another peristaltic action of the tubes and causing the liquid to flow through the tubes at a high velocity and out through said other opening.

2. A method of removing scaly incrustation from the interior of the tubes of a hot water heater, which heater has an inlet opening for the water to be heated and an outlet opening for the heated water and which tubes have relatively thin walls, which method comprises filling the tubes through said outlet opening with an incrustation-loosening liquid capable of reacting chemically with the incrustation by means of pressure applied to the liquid to force it into the heater through said opening, said pressure being greater than that to which the tubes are normally subjected when serving to heat water, the other opening being open to enable the entry of the liquid into the heater, closing said other opening when the heater is filled with the liquid and while the pressure is still applied to the liquid, thereby subjecting the liquid in the tube to a suddenly applied high pressure to cause a peristaltic action of the tube walls, tending to loosen the scale, maintaining the other opening closed for a substantial period of time while the pressure is still applied to cause the liquid to impregnate the previously loosened scaly material and penetrate between the scaly incrustation and the walls of the tube and to react chemically with the loosened scaly material, and thereafter quickly opening said other opening while the pressure is still applied, causing another peristaltic action of the tubes and causing the liquid to flow through the tubes at a high velocity and out through said other opening, the flow of the liquid through the tubes being in a direction opposite to that of the normal flow of water through the heater.

GEORGE EDWARD WILDER, JR.