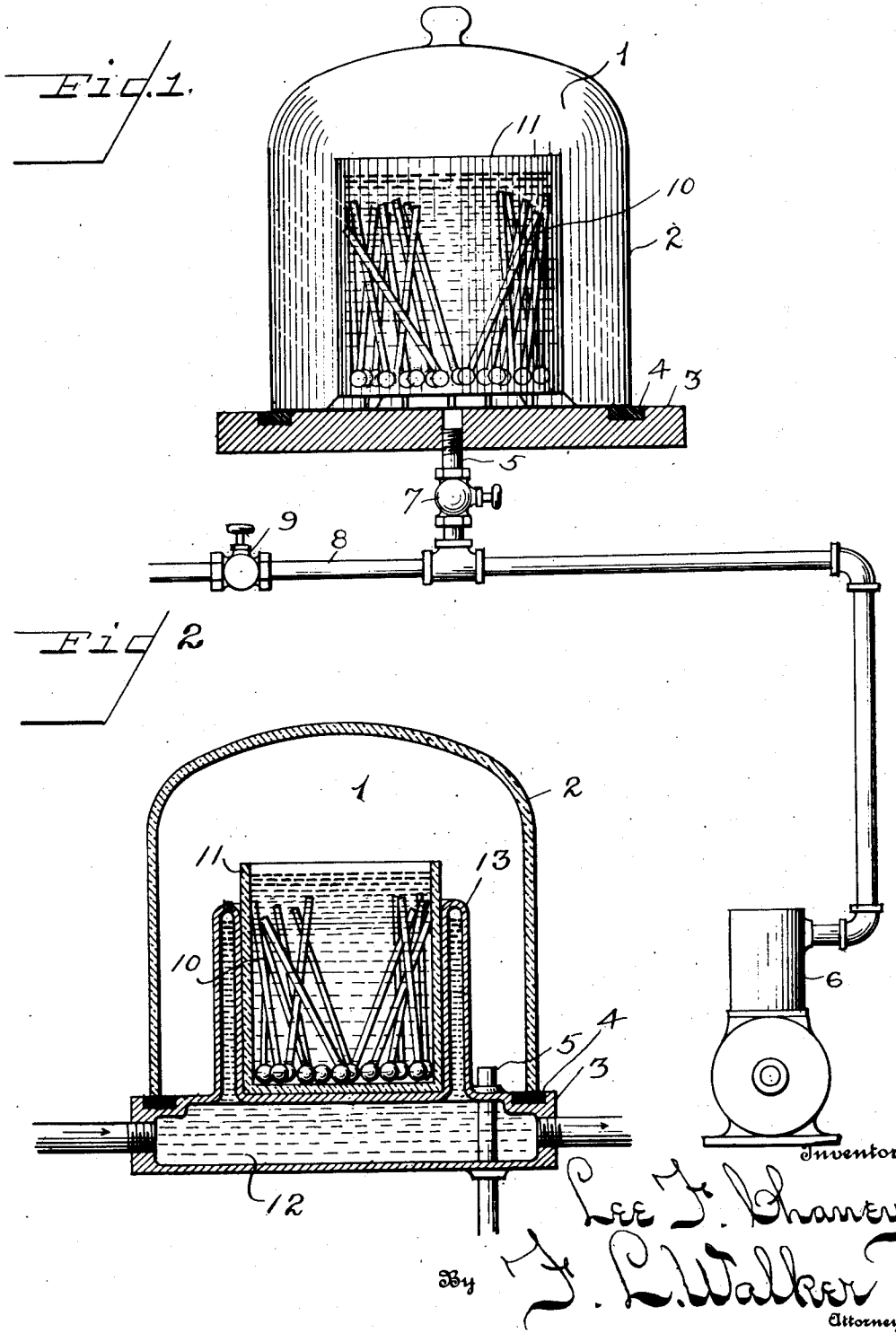


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METHOD OF FILLING THERMOMETER TUBES AND THE LIKE.
APPLICATION FILED DEC. 20, 1918.

1,345,347.

Patented July 6, 1920.



UNITED STATES PATENT OFFICE.

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METHOD OF FILLING THERMOMETER-TUBES AND THE LIKE.

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Specification of Letters Patent.

Patented July 6, 1920.

Application filed December 20, 1918. Serial No. 267,704.

To all whom it may concern:

Be it known that I, LEE F. CHANEY, a citizen of United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Methods of Filling Thermometer-Tubes and the like, of which the following is a specification.

My invention relates to a method or process of filling containers or receptacles having restricted inlet orifices, with a liquid, and particularly a means for filling thermometer tubes with an alcoholic liquid. While the invention will be herein described particularly in its application to the filling of thermometer tubes, it is to be understood that it is not limited to this use.

The object of the invention is to simplify the means and mode of operation of filling such devices, particularly alcoholic thermometer tubes, whereby such tubes may be easily and quickly filled in large quantities without the necessity of handling each tube individually.

A further object of this invention is to provide tube filling means which will be safe, substantially automatic in operation, and will obviate the dangers attendant upon the usual filling methods in which boiling alcohol is employed.

With the above primary and other incidental objects in view as will more fully appear in the specification, the invention consists of the means and mode of operation, the steps, succession and combinations thereof, and the means of carrying out such succession of steps, as herein described and set forth in the claim.

Referring to the drawings, Figure 1 is a side elevation of one form of apparatus for carrying out the method or process forming the subject hereof. Fig. 2 is a detail view of a modification of the apparatus shown in Fig. 1, enabling the performance of the "heating out" operation automatically at the completion of the filling operation.

Like parts are indicated by similar characters of reference throughout the several views.

In filling thermometer tubes with the colored alcoholic solution by the fluctuations of which variations of temperature are gaged, it has been the practice to submerge such tubes in a vessel or container filled with the colored alcoholic solution,

after which the solution was subjected to heat to a comparatively high temperature. The tubes at the time of their submersion in the fluid are open at the small, or neck end. The heating and consequent boiling of the alcoholic solution expands the air within the bulb and tube, causing a portion of it to be expelled. The vessel containing the solution and submerged tubes is then cooled, usually in a water bath, to a much lower temperature. This causes the remaining body of air within the bulb and tube to be contracted, and as the air within the tube contracts, a small quantity of the fluid is drawn into the tube to compensate for the air expelled by the previous expansion. The vessel with the submerged tubes is then again subjected to heat and brought to a boiling point which expands the remaining body of air within the tube, driving out another portion thereof, after which the vessel is again cooled to a much lower temperature, contracting the remaining air bubble and drawing into the tube an additional supply of liquid. This succession of heating and cooling effecting alternate expansion and contraction of air within the tube, and the induction of the colored alcoholic liquid in small quantities to compensate for the reduced quantity of air, is continued until the tubes are completely filled. This process is extremely tedious and laborious, requiring a long time and repeated boiling and cooling operations to effect the complete filling of the tube. Moreover, the boiling of the alcohol causes extensive losses of the solution through evaporation, which renders this process quite expensive, and moreover, the alcoholic vapors are exceedingly dangerous, being discharged in close proximity to the fire by which the boiling operation is effected, and are quite likely to explode. Moreover, the alcoholic fumes and vapors resulting from the boiling operation are extremely unhealthful and have an intoxicating effect upon the workmen.

To obviate the danger and objectionable features of the commonly practised method above described and to enable the complete filling of the tubes in a short time and with minimum effort, are primary objects of the present invention.

In carrying out the invention there is employed a vacuum apparatus, comprising a vacuum chamber 1, which as shown in

Fig. 1 may consist of an ordinary bell glass 2, resting upon a table or platen 3, with which it makes a hermetically tight joint. To this end the table 3 may be provided with a suitable body of packing 4, upon which the dome or bell glass rests. Leading to the interior of the vacuum chamber 1, preferably through the table or platen 3, is a branch conduit 5 communicating with a suitable air pump or suction means 6. This branch conduit 5 contains a cut-off valve 7. There is also provided a conduit branch 8, open to atmosphere, and having therein a cut-off valve 9, to be closed when the chamber 1 is to be exhausted. The thermometer tubes 10, to be filled with their small or neck ends open, are submerged in a vessel 11, of colored alcoholic liquid the depth of which is sufficient to entirely cover the quantity of tubes to be filled. By this process any quantity may be simultaneously filled at a single operation of the apparatus, which quantity is limited only by the capacity of the vessel or container 11. The vessel 11, containing the submerged tubes is then placed within the chamber 1, resting upon the table or platen 3, in such a manner as not to interfere with the passage of air into and out of the chamber 1, through the conduit 5. To this end the vessel 11 is preferably supported upon lugs located on the table or platen 3, which table may, in lieu of the lugs, contain a series of radiating grooves or recesses, or the vessel 11 may be provided with supporting feet by which it is elevated slightly above the table, permitting free passage of air to and from the orifice of the conduit 5. The valve 9 being closed and the suction pump 6 set in operation, the air is exhausted from the interior of the chamber 1, producing therein a partial vacuum. The air contained within the thermometer tubes and bulbs, being at normal or atmospheric pressure, will pass out of the tubes and bubble up through the colored liquid as the air within the chamber 1 is rarefied by the action of the pump 6. Partial vacuum is thus produced within the tubes as well as within the chamber 1. Having thus exhausted or rarefied the air within the tubes 10, the valve 9 is opened allowing air to rush into the chamber 1, through the conduit 5 and conduit 8, at atmospheric pressure. The tubes 10, being exhausted to a state of partial vacuum, the air pressure upon the surface of the colored alcoholic liquid within the vessel 11, which as before stated entirely covers the tubes 10 and prevents the entrance of air, forces the colored liquid into the tubes 10 under air pressure. To insure all the tubes receiving a full charge of the colored liquid, it is desirable to close the valve 9, and again subject the chamber 1 to exhaustion, which will cause any remaining air bubbles in the

tubes 10 to be exhausted therefrom, and upon again subjecting the fluid to air pressure by the opening of the valve 9, sufficient fluid is forced into the tubes to completely fill the same. The alcoholic fluid within the vessel 11 will boil violently while a vacuum is maintained within the chamber 1. As before stated the initial rarefaction of the air within the tubes and subsequent increase of the air pressure upon the filling fluid causes the tubes to receive a partial charge. The tubes being of considerable length and the bores thereof being of quite small diameter, or of capillary character, the liquid does not readily flow into the tubes. Capillary tubes of this character present difficulties in filling not met with in filling cans or vessels having minute orifices of no appreciable length. The initial charge of alcoholic liquid may be quite small only serving to moisten the inner walls of the tube in some cases due to the presence of air in the tube and the difficulty of exhausting the air through the small bore and introducing the liquid to replace the air. However upon the subsequent exhaustion of the chamber the small quantities of liquid introduced at the initial operation are caused to vaporize within the tubes, and the alcoholic vapors thus formed displace the remaining air. Upon the subsequent admission of air at atmospheric pressure to the chamber, the vapors are again condensed, and additional liquid is drawn into the tube to replace the vapors.

This volatilization of the alcoholic liquid occurs without the addition of heat, as the liquid boils at ordinary temperature in the partial vacuum. Other liquids may be heated by the means disclosed to induce the volatilization as before mentioned. In the present process the air content of the tube is removed by suction or exhaustion without the application of heat and through displacement by alcoholic vapors induced by variation of atmospheric pressure, whereas in the old process this air was merely expanded by a heat application, causing small charges of it to be expelled by successive heating operation. During the operation of the process no alcoholic vapors or fumes escape from the chamber 1, and there is little or no evaporation of the contents of the vessel 11. The alcoholic vapors and fumes being confined within the chamber 1, and no fire or heating of the fluid being resorted to, there is absolutely no danger from explosion and the workmen are not compelled to breathe these alcoholic emanations. Moreover, the process is quickly performed, requiring but a minute or more to exhaust the chamber 1, depending upon its capacity, and that of the pump 6, while the admission of air by opening the valve 9, to force the fluid into the tubes can be effected within

a few seconds, the whole process thus consuming but a few minutes. It has been found in practice that a given quantity of alcoholic fluid sufficient to fill one thousand thermometer tubes by the old process is sufficient to fill ten thousand tubes by this improved process forming the subject matter hereof.

In the manufacture of thermometer tubes after being filled by the boiling process or the vacuum process, the tubes are subjected to a "heating out" operation. This step in the manufacture of thermometers ordinarily consists in subjecting the filled tubes to a water bath having a temperature greater than the maximum temperature to be indicated by the thermometer in process of manufacture. For the ordinary household thermometer this temperature is usually arbitrarily fixed at 132 degrees. It is to be understood however that any other temperature may be adopted. By this "heating out" operation the alcoholic fluid contents of the tubes is expanded and the extra fluid is discharged from the ends of the tubes, so that it is then known that the column of colored liquid at the predetermined temperature corresponding to that of the water bath, is equal to the length of the tube: or in other words the end of the tube is thus scaled to a given degree of temperature. The other points upon the thermometer scale are made to agree with this predetermined temperature indicated by the end of the tube, which is also the height of the column of fluid at the same temperature.

In Fig. 2, the platen or table 3, is shown provided with a chamber 12, through which is circulated water or other fluid at the desired "heating out" temperature. This chamber 12 may be extended upward as at 13, around the vessel or container 11, thus providing substantially a water bath for the vessel 11, within the chamber 1. By maintaining the water circulated through the chamber 12, and its extension 13, at the predetermined "heating out" temperature, the tubes 10 may be filled and the quantity of liquid therein may be gaged at the same time. Upon removing the tubes from the vessel 11, the excess fluid may be blown off by an air blast or mopped off, thus leaving the column of colored liquid at the given temperature equal to the length of the tubes and so obviating the succeeding "heating out" operation, as ordinarily practised.

Likewise, while the admission of air at atmospheric pressure has been herein mentioned, it will be understood that air under pressure greater than normal or atmospheric, may be employed. The invention involves the creation of an area of low pressure within the tube or receptacle and an area of greater pressure outside the tube or receptacle and interposing a body of filling fluid between the low and high pressure areas which is driven into the tube or receptacle by the preponderance of pressure upon one side thereof.

From the above description it will be apparent that there is thus provided a method of filling a small mouthed receptacle, and an apparatus for carrying the process into operation, possessing the particular features of advantage before enumerated as desirable but which obviously is susceptible of modification in form, proportion, detail construction or arrangement of parts, without departing from a principle involved or sacrificing any of its advantages. While in order to comply with the statutes, the invention has been described in a language more or less specific as to structural features and the mode of operation, it is to be understood that the invention is not limited to the specific details shown and described, but that the means and construction, as well as the several steps herein described, comprise but one of several modes of putting the invention into effect, and the invention is therefore claimed in any of its possible forms or modifications within the legitimate and valid scope of the appended claim.

Having thus described my invention I claim:

The method of filling thermometer tubes and like receptacles, consisting of creating an area of low pressure within the receptacle, heating the filling liquid, and then creating an area of greater pressure than that within the tube outside thereof, and interposing a body of filling fluid between said high and low pressure areas, substantially as specified.

In testimony whereof, I have hereunto set my hand this 5th day of December A. D. 1918.

LEE F. CHANEY.

Witnesses:

W. F. HEROLD,
J. E. WARD.