April 19, 1955 A. FERRARI, JR 2,706,485

APPARATUS FOR WASHING TEST TUBES OR OTHER ARTICLES

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Fig. 1.

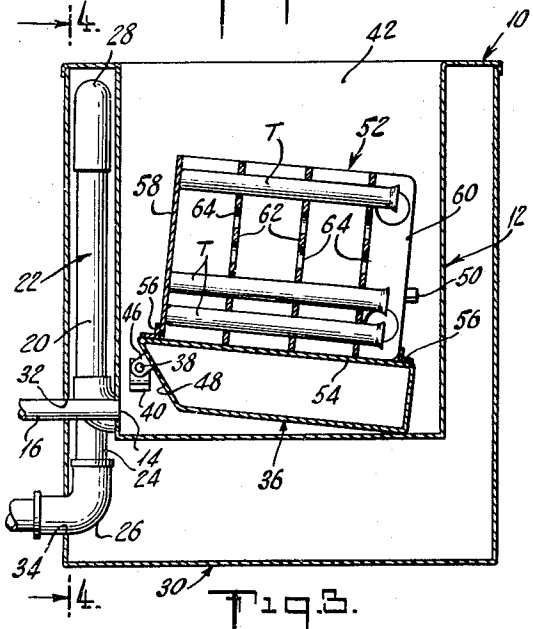


Fig. 2.

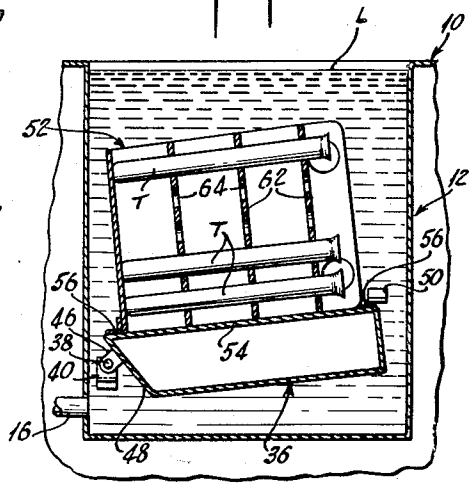
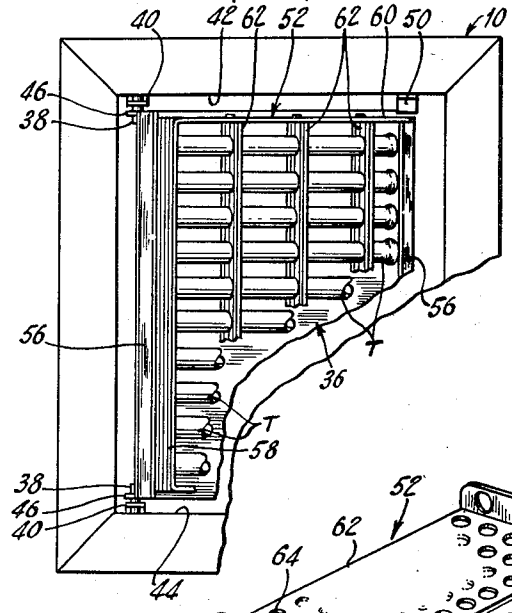


Fig. 3.



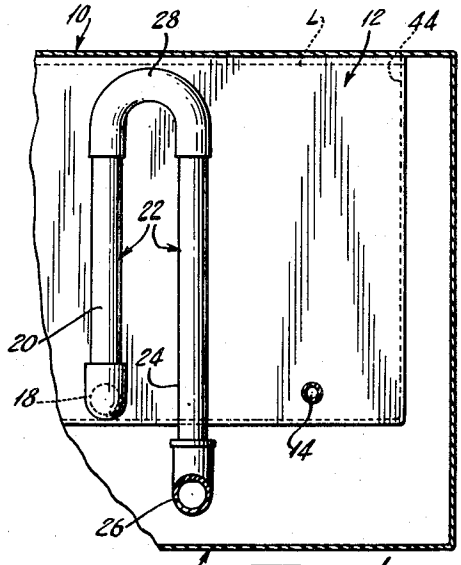
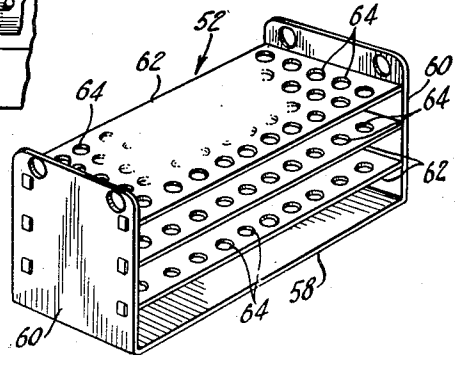


Fig. 4.

Fig. 5.



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APPARATUS FOR WASHING TEST TUBES OR OTHER ARTICLES

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Application March 30, 1951, Serial No. 218,307

2 Claims. (Cl. 134—56)

This invention relates to apparatus for washing test tubes or other tubular articles which are closed at one end thereof.

One object of the present invention is the provision of apparatus which is particularly well adapted for washing or rinsing or both washing and rinsing a large number of test tubes or other tubular articles which, like test tubes, are closed at one end thereof, the apparatus being of such character that the articles to be washed are, during the operation of the apparatus, subjected automatically to a plurality of successive washing and/or rinsing treatments.

Another object of the invention is the provision of washing apparatus which enables the test tubes or other articles to be washed and/or rinsed externally and internally at the same time in automatic fashion during the operation of the apparatus, the apparatus being of such character that the test tubes or other articles may be repeatedly filled with washing or rinsing liquid with alternate discharge of such liquid from the articles automatically during the operation of the apparatus.

A further object of the invention is the provision of washing apparatus in which the test tubes or other articles, which like test tubes, are closed at one end, are disposed in such position in the washing tank that the washing or rinsing liquid can completely fill such articles. More specifically, pursuant to this object of the invention, provision is made for preventing the formation of air pockets in the articles which, if allowed to form therein, would interfere with or prevent the filling of the articles completely with the washing or rinsing liquid.

A yet further object of the invention is generally to provide washing apparatus which is of simple construction and which is highly effective in operation to enable a large number of test tubes or other articles to be washed and/or rinsed in a comparatively short time.

The above and other objects, features and advantages of this invention will be more fully understood from the following description considered in connection with the accompanying illustrative drawings.

In the drawings:

Fig. 1 is a vertical sectional view of washing apparatus embodying the present invention, showing the condition of the apparatus prior to or after the discharge of the washing or rinsing liquid therefrom;

Fig. 2 is a view similar to Fig. 1, with parts omitted, showing the condition of the apparatus after the admission of liquid thereto and prior to the discharge of said liquid therefrom;

Fig. 3 is a top plan view of the apparatus, a portion thereof being cut away;

Fig. 4 is a sectional view on the line 4—4 of Fig. 1, and;

Fig. 5 is a perspective view of a rack which may be conveniently used with the apparatus of the present invention and when used therein forming a part of the invention.

Referring now to the drawings in detail, the washing apparatus **10** embodying the present invention comprises a tank or vessel **12** provided with a liquid inlet **14** to which liquid is conducted in any suitable way as by a pipe **16**. Any other provision may be made for the admission of liquid into the tank, for example liquid may be admitted through the open top of the tank and inlet **14**, **16** may be omitted, although said inlet is preferred. Said tank **12** is also provided with a discharge outlet **18** to which the up-leg **20** (Figs. 1 and 4) of a

siphon **22** is connected, said siphon having a down-leg **24** which is provided with the outlet member **26**. The upper reverse bend **28** of the siphon is preferably disposed near the top of tank **12** so that the latter may be substantially completely filled with liquid before the discharge operation of the siphon is initiated for emptying said tank. Tank **12** may be made of any suitable metal or other material. Preferably, an enclosure **30** is provided for tank **12** and it will be observed that the siphon **22** is arranged in the space between tank **12** and said enclosure **30**, and that the liquid inlet pipe **16** and the discharge end **26** of the siphon extend through openings **32** and **34**, respectively, in said enclosure **30**.

A float **36** is disposed within tank **12**, preferably and advantageously, but not necessarily, near the bottom of said tank, and said float is mounted for pivotal movement by means of a cross rod **38** which is fastened to the brackets **40** secured to the opposite side walls **42** and **44** of tank **12**. As here shown the pivotal mounting of float **36** on rod **38** includes the apertured ears **46** which are secured to the end wall **48** of the float, rod **38** engaging said ears in the aperture thereof. Stop members **50** are secured to the opposite side walls **42** and **44** of the tank in position near the opposite end of the float **36** to be engaged by the adjacent part of the float to limit the upward movement of the latter, as clearly illustrated in Fig. 2. Float **36** is preferably made of sheet metal and is hollow as illustrated by the drawings.

Pursuant to the present invention float **36** is constructed and arranged to move a test tube rack or holder **52** from a position in which the test tubes are disposed in downwardly inclined relation as shown in Fig. 1, for example, to a position in which said holder or rack is disposed so that the test tubes carried thereby are positioned in an upwardly inclined relation as illustrated in Fig. 2. Although as here shown, the support for the test tube rack is an integral part of the float, being constituted by the upper surface of the float, it is within the scope of this invention to make the float and the support as separate members with the float operatively connected to the support therebelow so as to tiltably raise and lower the support when the liquid level rises and falls in tank **12**. The movement of the rack **52** from the position illustrated in Fig. 1 to the position illustrated in Fig. 2 and vice versa occurs automatically during the admission of liquid into the tank **12** and the discharge of liquid therefrom, respectively, under the control of siphon **22**, and it will be understood that said movements of the rack **52** are repeated automatically at regular intervals in accordance with the filling and emptying of tank **12**, which take place automatically at regular intervals so long as water is admitted into tank **12**. Further in this connection it will be understood that during the operation of the apparatus the washing or rinsing liquid is admitted continuously into tank **12** so that said liquid continuously flows into the tank to fill the latter intermittently between discharge operations of the siphon **22**. Also it will be understood that the discharge operations occur intermittently at regular intervals each time the liquid reaches a level which is at or just above the bend **28** of the siphon as indicated by the broken line L. It will be noted that the outlet **18** is larger than the inlet **14** and that the discharge capacity of siphon **22** is correspondingly such that, with the usual city water pressure at inlet **14**, as soon as the discharge operation of the siphon is initiated, the discharge of liquid from tank **12** occurs at a considerably greater rate than the flow of liquid into the tank **12**, so that the discharge operation of the siphon is sufficiently rapid to enable the siphon to automatically complete the discharge operation and substantially completely empty the tank notwithstanding the continuous flow of liquid into the tank. In other words each time the liquid rises in the tank **12** to a level sufficient to initiate the operation of the siphon, the tank is then substantially completely emptied by the siphon action and then the siphon action is terminated and the liquid admitted through the inlet **14** again rises to the level required for the next discharge operation of the siphon. Although a single siphon is illustrated in the drawings, the apparatus is preferably provided with a double siphon such as that shown in

United States Patent No. 2,524,581 issued October 3, 1950 to Edwin C. Weiskopf for Automatic Washing Apparatus. It is to be understood however that as to certain aspects of the present invention the latter is not to be limited specifically to the use of siphon discharge means for accomplishing the repeated periodic filling and emptying of the tank, and that it is within the scope of this invention to accomplish the intermittent liquid-discharge operation by means other than siphon discharge means. However, the siphon means provided pursuant to the above description is presently considered highly advantageous and is therefore preferred.

Referring now more particularly to the manner in which the test tube rack or holder **52** is moved to its downwardly and upwardly inclined positions, respectively, as described above, it will be noted that as illustrated herein the top surface **54** of float **36** is provided with laterally spaced members **56**, here shown as angle irons, between which the holder **52** is positioned, said angle irons providing guide means for preventing movement of the holder on said float due to tilting of the latter and for holding said rack **52** in the operative position illustrated in Figs. 1 and 2. Rack **52** may be of any suitable construction and as here shown comprises a bottom **58**, sides **60** fixed to and upstanding from said bottom, and a plurality of test tube positioning members or plates **62** vertically spaced from each other and secured to the sides **60** of the rack. It will be observed that said plates **62** are provided with a plurality of rows of openings **64** with openings in the several plates in registry to receive and hold in position the test tubes or other tubular articles T, as will be obvious from an inspection of the drawings. It will be noted that while Fig. 5 shows the normal upright position of rack **52** when the latter is removed from the apparatus, said rack when positioned in the tank **12** is mounted on its side and is positioned so that the open ends of the test tubes or other tubular articles are lowermost, in comparison with the closed ends of said tubes, respectively, when the float **36** is in its downwardly inclined position, as illustrated in Fig. 1, pursuant to the emptying of the tank resulting from the discharge operation of the siphon **22**. In this connection it will be observed that when the test tubes are in the downwardly inclined position, shown in Fig. 1, liquid which previously entered said test tubes during the flow of liquid into tank **12** is discharged from said tubes.

It is important to note that the provision of the float **36** whereby the test tubes T are in upwardly inclined relation, substantially as illustrated in Fig. 2, before a substantial quantity of liquid enters the test tubes, during the rise of the liquid in tank **12**, prevents air pockets from being formed in the respective test tubes which, if formed, would prevent the liquid from completely filling the test tubes. Thus, in the part of the cycle of the apparatus during which liquid rises in tank **12**, float **36** is moved from the position in which the test tubes are downwardly inclined (Fig. 1) say at an angle of 5° to the horizontal to the position in which the test tubes are upwardly inclined (Fig. 2) say to an angle of 5° to the horizontal before the liquid has risen in said tank sufficiently to enter even the lowermost test tubes in rack **52**, at which time further upward movement of the float is prevented by stops **50**, and as the liquid continues to rise in said tank, it enters the test tubes in the successive vertically spaced rows thereof and completely fills all of said test tubes. As soon as the liquid rises to the level referred to above for the discharge operation of siphon **22**, the liquid level falls and when the level is sufficiently low the float starts to move from its upwardly inclined position illustrated in Fig. 2 to its downwardly inclined position illustrated in Fig. 1 and concomitantly with the downward movement of said float the liquid flows out of the test tubes.

It will be observed that as the liquid rises and falls in vessel **12**, the test tubes are washed or rinsed both internally and externally. Provision may be made by means of suitable valved pipes (not shown) for admitting a detergent solution or other cleansing liquid to the vessel during a predetermined period of time for washing

the test tubes followed by the admission of plain water for a predetermined period of time for rinsing the test tubes. However, as used in the claims the term washing designates either washing by detergent or other cleansing solutions or by plain water or by an appropriate liquid chemical depending upon requirements.

It will be understood that while I have shown and described the presently preferred embodiment of my invention, the latter may be embodied otherwise than as herein specifically illustrated or described and that in the illustrated embodiment certain changes in the details of construction and in the form and arrangement of parts may be made without departing from the underlying idea or principles of this invention within the scope of the appended claims.

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

1. Apparatus for washing test tubes, comprising a vessel having a liquid inlet and a liquid outlet, a test tube holder, float operated means responsive to the level of the liquid in said vessel for supporting said test tube holder for movement to a position in which the test tube openings are uppermost, so that the liquid in the vessel may enter said tubes when the liquid in the vessel rises to a predetermined level therein, and to a position for emptying the liquid from said tubes when the liquid in the vessel falls to a predetermined level, said float operated means comprising a hollow float member having an upper surface provided with guide means to removably mount said test tube holder, the latter having means to support said test tubes on their sides when said holder is mounted on said surface of said float member, and siphon means connected to said outlet and operable intermittently and continually while liquid continues to flow into said vessel to automatically discharge liquid from the vessel repeatedly at regular intervals with intervening periods of non-discharge of liquid whereby the level of the liquid automatically rises and falls for actuating said float operated means and for admitting the liquid into the test tubes and emptying the liquid therefrom.

2. Apparatus for washing test tubes, comprising a vessel having a liquid inlet and a liquid outlet, a test tube holder, float means responsive to the level of the liquid in said vessel for supporting said test tube holder for movement to a position in which the test tube openings are uppermost, so that the liquid in the vessel may enter said tubes when the liquid in the vessel rises to a predetermined level therein, and to a position for emptying the liquid from said tubes when the liquid in the vessel falls to a predetermined level, said float means having a surface provided with guide means to removably mount said test tube holder, the latter having means to support said test tubes on their sides when said holder is mounted on said surface of said float means, and siphon means connected to said outlet and operable intermittently and continually while liquid continues to flow into said vessel to automatically discharge liquid from the vessel repeatedly at regular intervals with intervening periods of non-discharge of liquid whereby the level of the liquid automatically rises and falls for actuating said float means and for admitting the liquid into the test tubes and emptying the liquid therefrom.

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