May 8, 1956 C. C. GOLDEN 2,744,842

TEST TUBE CLEANING DEVICE AND METHOD

Filed Sept. 10, 1953

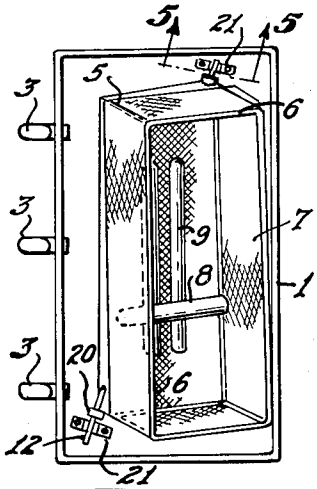


FIG. 1.

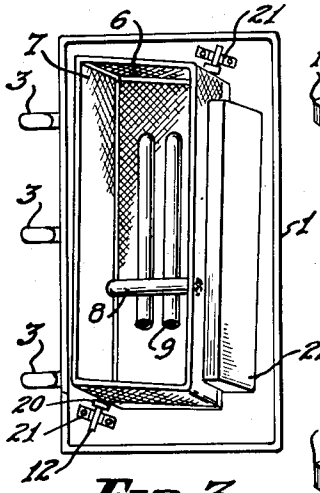


FIG. 3.

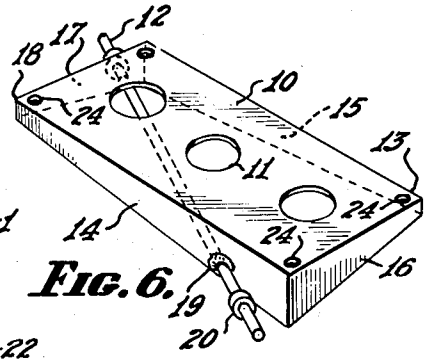


FIG. 6.

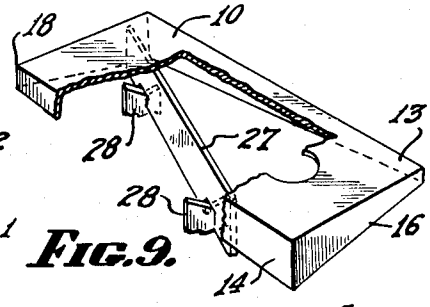


FIG. 9.

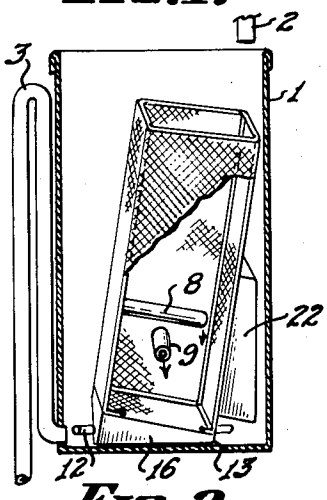


FIG. 2.

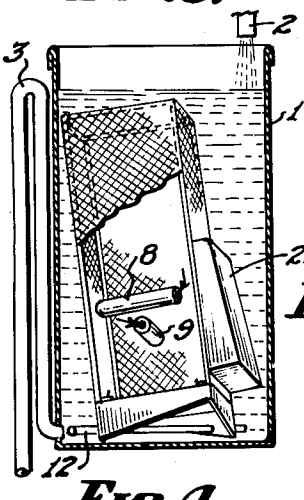


FIG. 4.

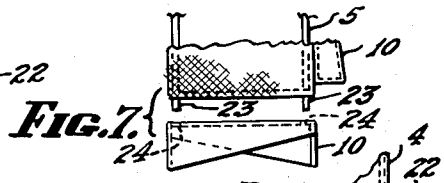


FIG. 7.

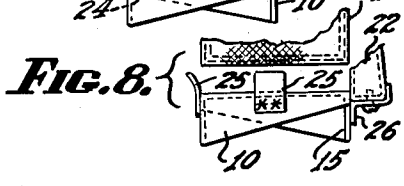


FIG. 8.

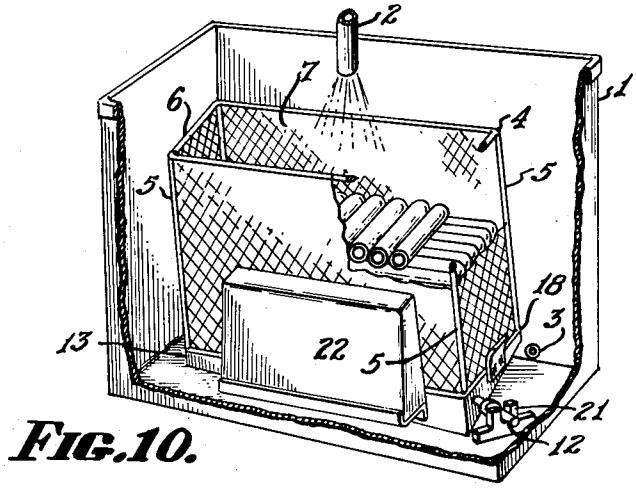


FIG. 10.

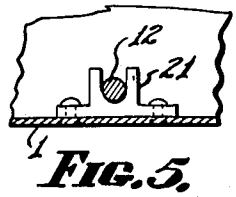


FIG. 5.

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TEST TUBE CLEANING DEVICE AND METHOD

Catherine C. Golden, Cincinnati, Ohio

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10 Claims. (Cl. 134—23)

My invention relates to a device and method for cleaning test tubes, and more particularly to a cleaning device for use in laboratories and the like wherein large numbers of test tubes or similar laboratory equipment may be cleaned at one time.

It has heretofore been the practice in laboratories to provide a test tube cleaning device in which the test tubes to be cleaned are placed in a holder, usually in the form of a wire basket, which is then placed into a larger tank adapted to be repeatedly filled and drained. The tank will be filled and drained as many as fifteen to twenty times, depending upon the requirements of the laboratory and the degree of contamination of the articles being cleaned. Generally speaking, the test tubes are cleaned with water, the repeated filling and draining of the tank resulting in the removal of all foreign matter from the test tubes.

It has also been heretofore suggested that more thorough cleaning of the test tubes will result if they are positioned with their open ends lying slightly above their closed ends, so that as the tank is filled the water will flow downwardly into each tube thereby forcing out any air bubbles which might otherwise be trapped in the closed end of the tube which would prevent contact of the cleaning fluid with all surfaces of the tube. However, where the tubes are tilted in this manner, it is evident that, upon draining of the tank, all of the liquid will not be drained from the individual tubes unless they are tilted so as to place their open ends lowermost. To this end, devices have been provided in which the holder or basket for the test tubes is itself tilted during each filling and draining operation. Heretofore, such tilting of the holder has been done either by hand or by means of complicated mehanism which adds greatly to the cost of the equipment.

It is a principal object of my invention to provide a device and method of the character described in which the test tube holder is automatically tilted from one position to another and returned during the filling and draining of the tank, which means are of simple and economical construction and devoid of motors or other complicated operating mechanism.

It is a further object of my invention to provide a cleaning device and method of the character described in which test tubes may be placed in the device both longitudinally and transversely thereof and the device automatically tilted in such fashion that both the longitudinally disposed and the transversely disposed tubes will be tilted to a fill position as the tank is being filled and to a drain position as the tank is being drained.

It is yet another object of my invention to provide a test tube cleaning device and method wherein the holder or basket for the test tubes is supported on a tiltable platform capable of being tilted from one position to another by means of a buoyancy chamber operatively connected to the platform and responsive to the filling and draining of the tank in which the platform is supported.

These and other objects of my invention which will appear hereinafter or which will be apparent to the skilled worker in the art upon reading these specifications, I accomplish by those constructions and arrangements of parts and that procedure of which I shall now describe certain exemplary embodiments. Reference is now made to the accompanying drawings wherein:

Figure 1 is a plan view of a cleaning device in accordance with my invention showing the platform and test tube holder in their initially tilted condition.

Figure 2 is a vertical sectional view of the device when in the position illustrated in Figure 1.

Figure 3 is a plan view similar to Figure 1 but showing the position of the platform and test tube holder when the tank is filled.

Figure 4 is a vertical sectional view illustrating the tank and platform in the position shown in Figure 3.

Figure 5 is a sectional view taken along the line 5—5 of Figure 1.

Figure 6 is a sectional view illustrating the platform in accordance with my invention.

Figure 7 is a partial elevational view illustrating the manner in which the platform receives the test tube holder.

Figure 8 is a partial elevational view similar to Figure 7 illustrating a modified platform construction including means for receiving and positioning the test tube holder.

Figure 9 is a perspective view with parts broken away illustrating a modified form of platform.

Figure 10 is a perspective view with parts broken away illustrating my complete cleaning unit.

As best seen in Figures 1 and 10, my device comprises a tank 1 capable of being repeatedly filled and drained, as by means of filling tube 2 and drain tubes 3 which, as shown, are in the form of a plurality of siphons adapted to rapidly drain the tank as soon as it has been filled to a point adjacent the tops of the tubes 3. It will be understood that this mode of filling and draining the tank 1 is exemplary only and various other means for this purpose which are well known to the art may be used. It is, however, desirable to provide a tank which may be repeatedly filled and drained as rapidly as possible so that the cleaning operation may be conducted as quickly as possible.

The test tubes to be cleaned are placed in a holder or basket 4 which is preferably of open mesh construction so that the water or other cleaning fluid may readily flow through it. Preferably it will be formed with vertical corner posts 5 connected together at their tops and bottoms by means of horizontal rods 6, the frame so formed being then covered with wire mesh or similar material 7. If desired, a cover (not shown) may also be provided.

The holder or basket 5 is preferably rectangular in cross section and of a size such that test tubes may be placed therein either longitudinally or cross-wise of the basket, the test tubes being stacked in rows in horizontally disposed position. Thus relatively short test tubes 8 will be positioned transverse the length of the basket 4, whereas the relatively long test tubes 9 will be placed lengthwise therein. In order to assure proper filling and draining of the tubes, they all must be placed with their open ends extending in the same direction. Where the tubes are placed both longitudinally and laterally of the container, all longitudinally disposed tubes will have their open ends facing one end of the basket, whereas all laterally disposed tubes will have their open ends facing one side of the basket.

The basket will be rocked or tilted in the tank by means of the platform 10 (Figure 6) on which the basket is adapted to be supported. The platform will preferably have an upper surface of a size to correspond to the bot-

tom of the basket and may be provided with a plurality of openings 11 through which the cleaning fluid may pass. The platform 10 is tiltably supported on a rocker 12 positioned to normally tilt the platform from the horizontal in the direction of a corner edge thereof. As seen in Figure 6, the rocker 12 is diagonally disposed with respect to the edges of the platform 10 and off-set from the center of balance of the platform so as to normally tilt the platform in the direction of the corner edge 13 thereof.

The sides 14 and 15 and the ends 16 and 17 of the platform will be tapered in the manner illustrated so that the bottom edges of the side 15 and end 16 will rest on the bottom of the tank when the platform is tilted toward the corner edge 13; and similarly, when the platform is tilted about the rocker 12 in the direction of the corner edge 18, the platform will be supported on the bottom edges of the side 14 and end 17.

As seen in Figure 6, the rocker 12 may be in the form of a rod which is welded or otherwise fixedly secured to the platform side and end walls, as at 19; and the rod carries adjustable collars 20 which serve to position the rod and platform relative to supporting brackets 21 secured to the bottom of the tank. As best seen in Figure 5, the ends of the rod 12 are pivotally received by the brackets 21, the arrangement being such that the platform may be rocked or tilted in the direction of the opposite corner edges 13 and 18. Due to the fact that the rocker or rod 12 is positioned off-center with respect to the platform, the platform will normally tilt in the direction of the corner edge 13 and hence a basket 4 placed thereon will normally assume the tilted position illustrated in Figures 1 and 2 of the drawings. Then, upon tilting of the platform toward the opposite corner edge 18, the basket will be made to assume the position illustrated in Figures 3 and 4 of the drawings.

The tilting of the platform and basket supported thereon from one position to the other during the filling and draining of the tank is accomplished by means of a buoyancy chamber or float 22 secured to the side edge of the basket adjacent the corner edge 13 of the platform. The buoyancy chamber or float will be of a size to provide sufficient buoyancy to lift the side of the basket and platform adjacent the corner edge 13 as the tank is filled, thereby causing the platform to tilt on the rocker toward the opposite corner edge 18. In other words, the buoyancy chamber 22 is selected to provide sufficient buoyancy to overcome the unbalanced condition of the rocker which tilts the platform toward the corner edge 13 and hence create an unbalanced condition in the opposite direction so as to cause the platform to tilt on the rocker 12 toward the corner edge 18. The basket and platform will remain tilted in the direction of the corner edge 18 until the tank has drained sufficiently to relieve the lifting effect created by the buoyancy chamber 22, whereupon the platform will again be caused to tilt in the direction of its corner edge 13. The size of the buoyancy chamber will vary with the size of the holder and the tilt of the platform, but will be sufficiently large to cause the filled holder to be tilted from one position to the other as the tank is filled.

In the operation of the device, the test tubes will be placed so that their open ends will face the side or end of the basket adjacent the corner edge 13, and hence in either position will be tilted so that water will readily drain from them. As the tank is filled and the buoyancy chamber 22 acts to tilt the platform in the direction of the corner edge 18, the basket is thereby tilted and the open ends of the test tubes raised above their closed ends, thereby permitting the water or other cleaning fluid to readily flow into the tubes without entrapping air in the tubes. Then, as the tank is drained, the buoyancy member 22 will no longer be effective to overcome the unbalanced condition tending to tilt the platform in the direction of the corner edge 13 and it will return to its initially tilted position, in which position the test tubes will again be tilted downwardly and hence the liquid therein will be readily drained. I have found that an inclination of the tubes at an angle of approximately 9° from the horizontal in either direction will provide for proper filling and draining, although it will be evident that the degree of inclination may be varied. It will be understood that the filling and draining operation may be repeated as many times as desired, depending upon laboratory standards of cleanliness for the tubes being cleaned.

While I have found that the weight of the basket or holder 4 is generally sufficient to maintain it on the platform 10 without additional supporting means, a positive connection of the basket to the platform may be easily effected, as illustrated in Figure 7, by extending the corner post members 5 downwardly to form legs 23 adapted to be received in openings 24 at the corners of the platform. Alternatively, as illustrated in Figure 8, the platform 10 may be provided with flanges 25 extending upwardly therefrom which will receive and position the bottom of the basket 4, the arrangement being such that the flanges 25 will make gripping contact with edge portions of the basket.

It is also within the spirit of my invention to arrange the buoyancy chamber or float 22 so that it may be attached either directly to the basket 4 as in the embodiment already described, or, as shown in Figure 8, attached to the platform 10 as by means of a bracket 26 secured to the side wall 15 of the platform. Additionally, the buoyancy chamber may be arranged to extend about the corner edge 13 of the platform with a portion thereof adjacent the end wall 1.

Other modifications may be made in my invention without departing from the spirit of it. For example, as seen in Figure 9, the platform 10 may be supported on a bar-like rocker 27 supported on blocks 28 in the manner illustrated. Alternatively, the bar-like rocker 27 may rest directly on the bottom of the tank. It is also within the spirit of my invention to form the holder or basket and platform as an integral unit so that the basket itself is pivoted directly on the rocker.

While I have taught a preferred construction wherein the platform is tiltable in the direction of opposite corner edges thereof so that both longitudinally and transversely disposed test tubes may be handled, it will be evident that the rocker may be disposed either longitudinally or transversely of the platform so as to tilt it in but a single direction where it is desired to use test tubes of substantially uniform size which may be packed in the basket in the same direction. It will be also apparent that my device will find utility in cleaning diverse objects other than test tubes wherein the filling and draining problem is encountered. While my platform device is preferably employed using a buoyancy chamber as a lifting or tilting means, it will also be evident that other means may be employed to tilt the platform. While adding to the cost of the equipment, it would nevertheless be within the spirit of my invention to provide a simple motor driven mechanism to tilt the platform in synchronism with the filling and draining of the tank.

Having, however, described my invention in certain exemplary embodiments, what I desire to secure and protect by Letters Patent is:

1. In a device for the purposes described, a tank capable of being filled and drained, a generally rectangular holder in said tank, said holder being tiltably supported on a pivoting means positioned to normally incline said holder from the horizontal in the direction of one corner edge thereof, said holder being tiltable on said pivoting means in the direction of the opposite corner edge thereof, and means connected to said holder for moving it from one position to the other as said tank is filled and drained.

2. In a device for the purposes described, a tank ca-

pable of being filled and drained, a generally rectangular foraminous basket in said tank, said basket being tiltably supported on a diagonally disposed pivoting means positioned to normally incline said basket from the horizontal in the direction of one corner edge of said basket, said basket being tiltable on said pivoting means in the direction of the opposite corner edge thereof, and buoyancy means connected to said basket for moving it from one position to the other as said tank is filled and drained, whereby articles placed either longitudinally or cross-wise in said basket between opposite side edges thereof will be tilted first in one direction and then in the other.

3. In a device for the purposes described, a tank capable of being filled and drained, a generally rectangular foraminous basket in said tank, said basket being tiltably supported on a rocker diagonally disposed with respect to the sides of said basket, said rocker being positioned to normally incline said basket from the horizontal in the direction of a corner edge thereof, said basket being tiltable on said rocker in the direction of the opposite corner edge thereof, and buoyancy means connected to said basket for moving said basket from one position to the other as said tank is filled and drained, whereby articles positioned horizontally in said basket and extending either longitudinally or transversely thereof, will be tilted first in one direction and then in the other.

4. In a test tube cleaning device, a tank capable of being filled and drained, a generally rectangular platform in said tank supported on a rocker positioned to normally tilt said platform from the horizontal in the direction of a corner edge thereof, said platform being tiltable on said rocker in the direction of the opposite corner edge thereof, a generally rectangular holder for test tubes supported on said platform and having its side edges in alignment with the side edges of said platform, and buoyancy means operatively connected to said platform for causing it to be tilted from one position to the other as said tank is filled and drained, whereby test tubes positioned horizontally in said holder and extending either longitudinally or transversely thereof, will be tilted first in one direction and then in the other.

5. In a test tube cleaning device, a tank capable of being filled and drained, a generally rectangular platform in said tank supported on a diagonally disposed rocker positioned to normally tilt said platform from the horizontal in the direction of a corner edge thereof, said platform being tiltable on said rocker in the direction of the opposite corner edge thereof, a generally rectangular receptacle for test tubes supported on said platform and having its side edges in alignment with the side edges of said platform, and a buoyancy chamber secured to said receptacle for causing said platform to be tilted from one position to the other as said tank is filled and drained, whereby test tubes positioned horizontally in said receptacle and extending either longitudinally or transversely thereof, will be tilted first in one direction and then in the other.

6. The device claimed in claim 5 wherein said rocker comprises a bar-like member the lower edge of which defines the axis of tilt of said platform.

7. The structure claimed in claim 5 wherein said rocker comprises a rod secured to said platform, said rod having its ends journaled in brackets mounted on the bottom of said tank.

8. The structure claimed in claim 5 including interconnecting means for securing said basket to said platform.

9. The structure claimed in claim 5 wherein said platform includes side and end wall members the bottom edges of which are tapered in the direction of the said opposite corner edges thereof, whereby said side and end walls are of lesser depth adjacent the said opposite corner edges than at the remaining corner edges.

10. The method of cleaning test tubes in a tank which is adapted to be repeatedly filled and drained, which consists in placing said test tubes in horizontally disposed condition in a generally rectangular foraminous basket with their open ends extending either longitudinally or transversely of said basket, supporting said basket in said tank on a tiltable platform balanced to normally tilt toward one corner edge thereof and capable of being tilted in the opposite direction, said basket being placed on said platform with the open ends of the test tubes facing toward a side edge of said basket adjacent the first named corner edge of said platform, and providing buoyancy means connected to the first named side edge of said basket, whereby upon filling of said tank, said first named corner edge of said platform will be lifted so as to tilt said platform in the opposite direction, and upon draining of said tank, said basket will be returned to its initial position.

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