May 21, 1963 E. E. EMERSON 3,090,089

THERMOMETER DISPENSER AND STERILIZER

Filed Jan. 15, 1960 4 Sheets-Sheet 1

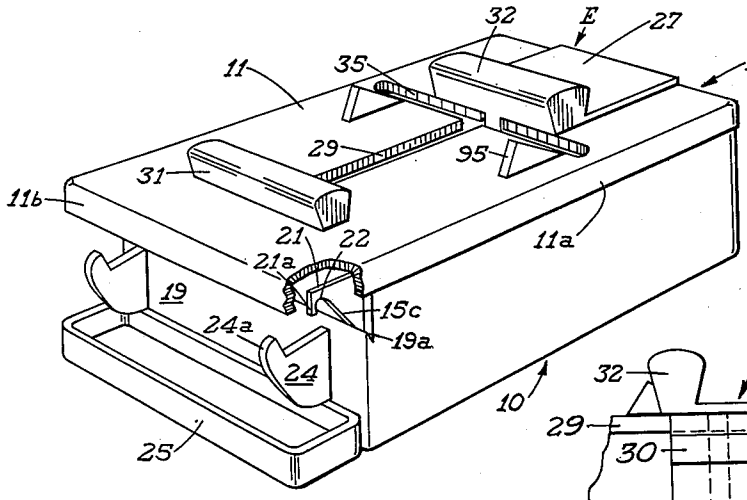


Fig 1

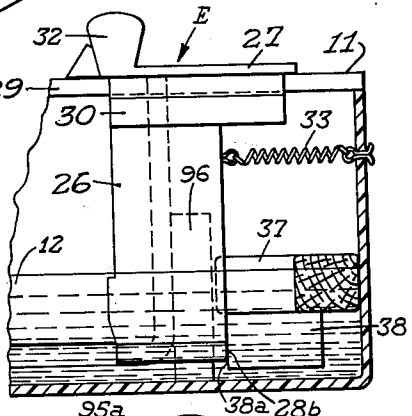


Fig 5

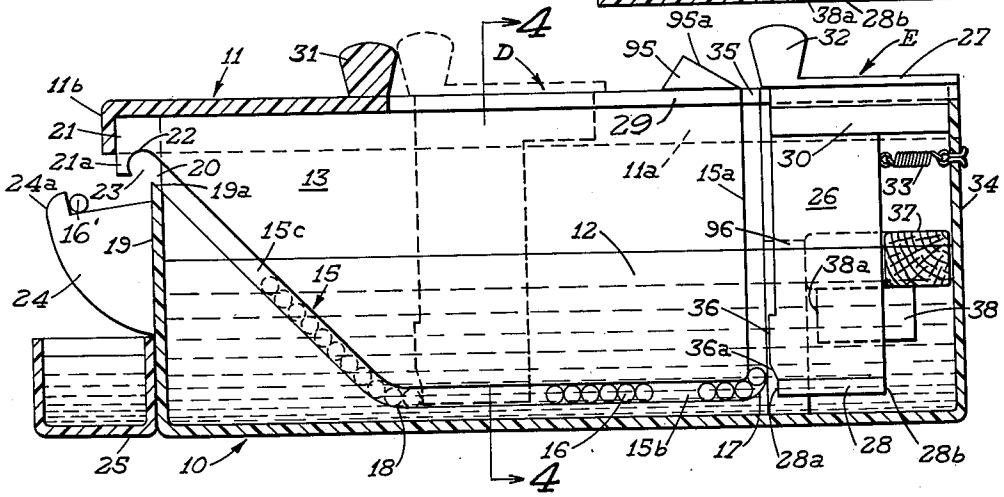


Fig 2

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THERMOMETER DISPENSER AND STERILIZER

Filed Jan. 15, 1960 4 Sheets-Sheet 2

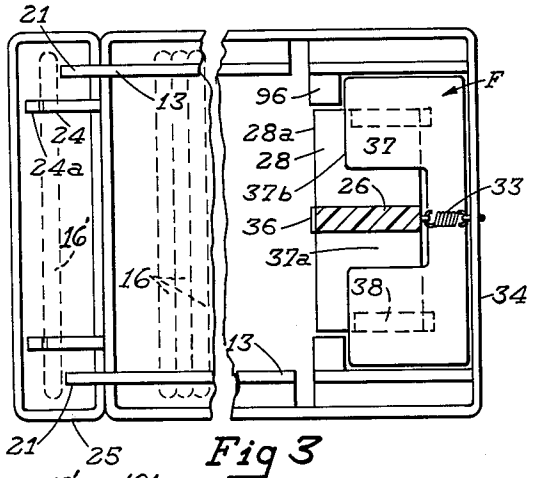


Fig 3

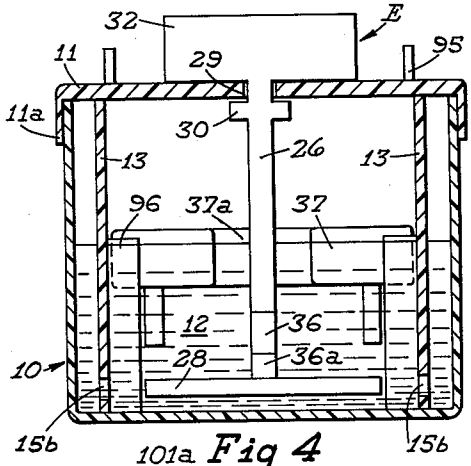


Fig 4

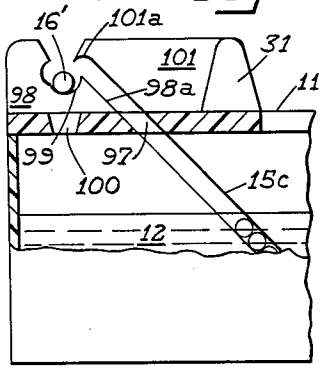


Fig 6

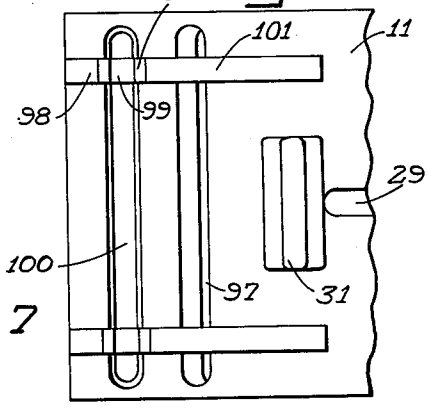


Fig 7

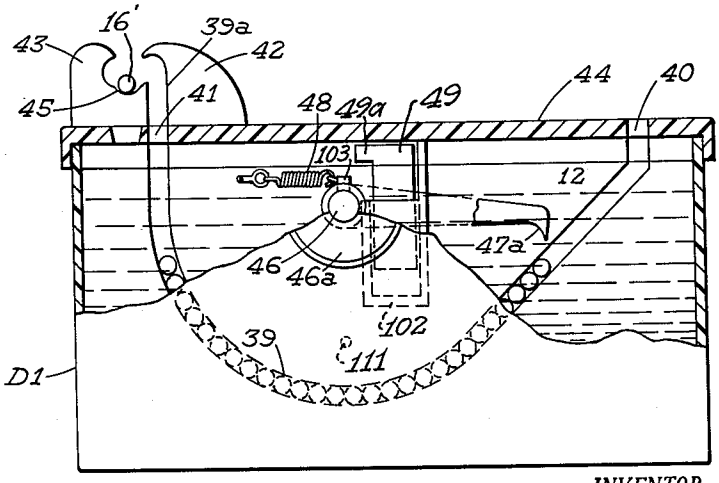


Fig 8

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THERMOMETER DISPENSER AND STERILIZER

Filed Jan. 15, 1960 4 Sheets-Sheet 3

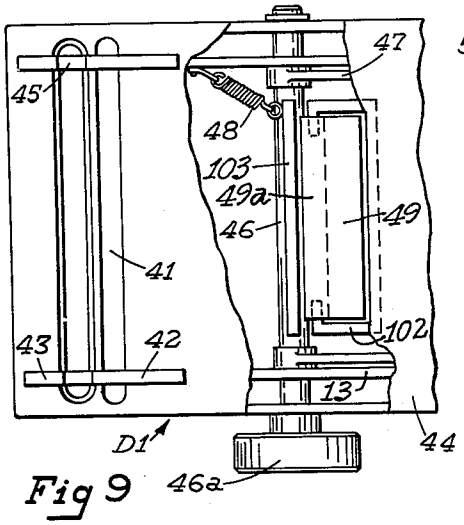


Fig 9

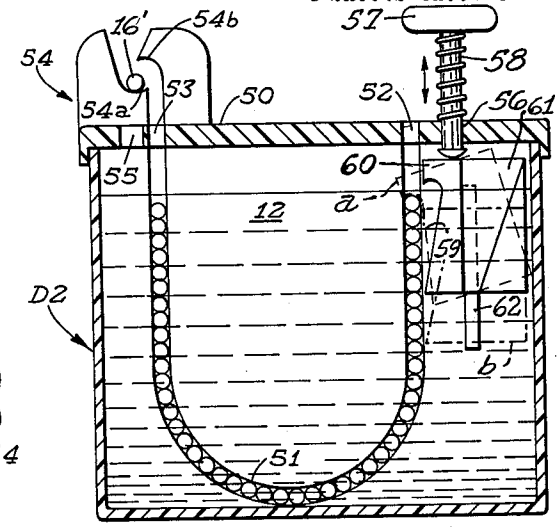


Fig 10

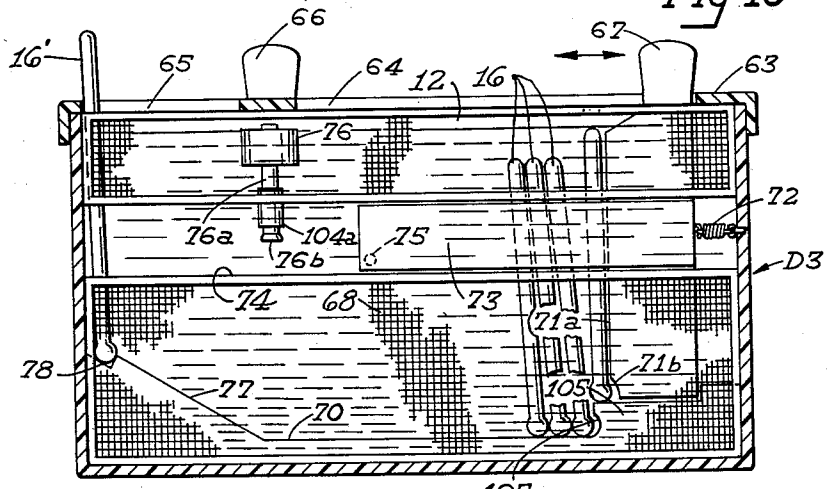


Fig 11

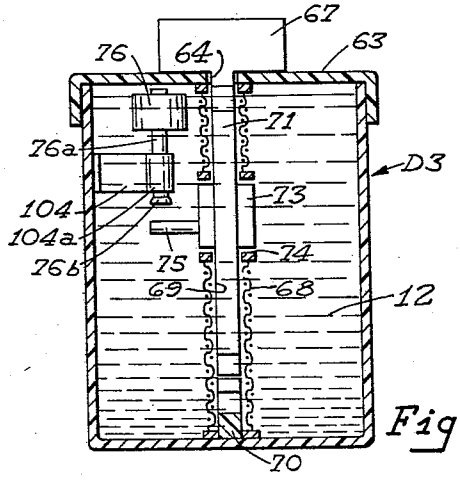


Fig 12

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THERMOMETER DISPENSER AND STERILIZER

Filed Jan. 15, 1960 4 Sheets-Sheet 4

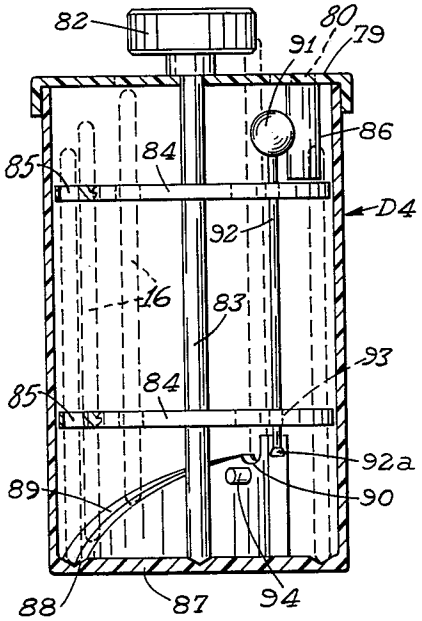


Fig 13

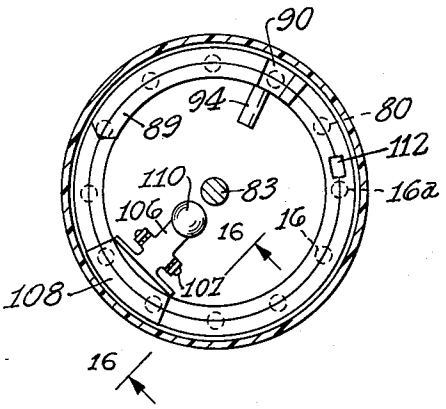


Fig 15

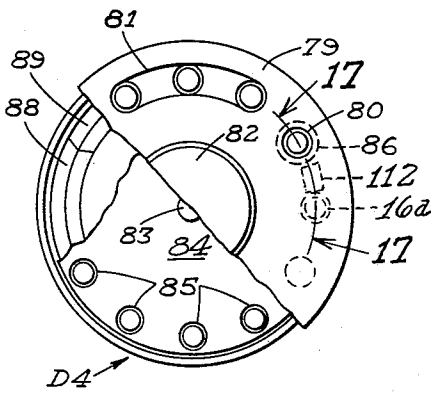


Fig 14

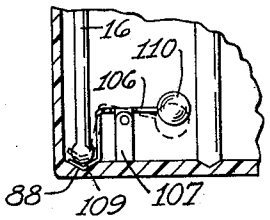


Fig 16

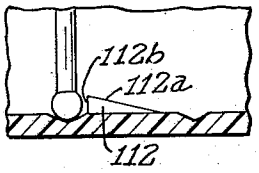


Fig. 17

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United States Patent Office 3,090,089 Patented May 21, 1963

3,090,089

THERMOMETER DISPENSER AND STERILIZER

Edwin E. Emerson, Osakis, Minn.

Filed Jan. 15, 1960, Ser. No. 2,640
20 Claims. (Cl. 21—87)

This invention relates to a novel device for storing, sterilizing and dispensing instruments and particularly clinical thermometers. At the present time, clinical thermometers in a physician's office are commonly sterilized by immersing the thermometers in some form of receptacle containing a bath of sterilizing fluid, where the thermometers are grouped together haphazardly, with no orderly arrangement provided for insuring that the thermometers will remain in the fluid or sterilizing bath a sufficient length of time to completely sterilize and decontaminate the thermometers after use since all of the thermometers are mixed together at the time a used thermometer is returned to the bath. Thus, a thermometer last returned to the sterilizing bath may be the one next used by the physician when he withdraws one of the group of thermometers from the bath, and, if he is using them in quite a rapid succession it is quite likely that the thermometer next used will not have been in the sterilizing bath a sufficient length of time.

Another disadvantage associated with presently available thermometer sterilizers is the fact that they either do not provide for complete submersion of the thermometers in the bath or if they do, they require that the physician insert his fingers into the sterilizing solution to remove a thermometer therefrom, thereby inconveniently wetting the fingers of the physician and unduly increasing the degree of contamination of the sterilizing fluid.

Therefore, an important object of my invention is a novel device which is capable of performing the multiple functions of storing, sterilizing and mechanically dispensing clinical thermometers.

Still another object is a sterilizing and dispensing device of the class described which is adapted to maintain a plurality of thermometers in a completely submerged condition in a bath of sterilizing fluid until they are dispensed for use.

Still another object is a thermometer sterilizing and dispensing device which insures complete sterilization and decontamination of a thermometer before the re-use thereof and which permits the thermometers to be conveniently and mechanically dispensed one at a time from the dispenser without requiring the insertion of the physician's fingers into the sterilizing bath.

Still another object is a thermometer sterilizer and dispenser with warning means for forcefully drawing the physician's attention to the fact that the fluid level of the sterilizing bath has sunk to an undesirably low level.

Still another object is a thermometer, sterilizer and dispenser of the class described which insures that a desirable minimum of thermometers be maintained in the sterilizing bath at all times.

Still another object is a thermometer, sterilizer and dispenser of the class described which insures that a used thermometer inserted therein cannot be re-obtained for re-use until all of the preceding thermometers located in the dispenser are first used thereby insuring a variable but significant time interval between uses of each individual thermometer for proper and complete sterilization thereof.

Still another object is a thermometer sterilizer and dispenser of the class described in which the dispensing action causes agitation of the sterilizing solution and increases the cleansing action thereof.

These and other objects and advantages of my invention will more fully appear from the following description made in connection with the accompanying drawings wherein like reference characters refer to the same or similar parts throughout the several views, and in which:

FIG. 1 is a perspective view of one preferred form of my invention;

FIG. 2 is a side view in vertical longitudinal section of FIG. 1;

FIG. 3 is a broken top plan view in partial section of FIG. 1 with the cover removed;

FIG. 4 is a transverse section taken on the line 4—4 of FIG. 2;

FIG. 5 is a partial side view in vertical section of the apparatus of FIG. 1 showing the ejector mechanism when the supply of liquid has become inadequate;

FIG. 6 is a partial vertical longitudinal side sectional view of the front end of an alternate form of my invention;

FIG. 7 is a top plan view of the alternate form of my invention as shown in FIG. 6;

FIG. 8 is a side view partly in section and partly in elevation of still another form of my invention;

FIG. 9 is a partial top view partly in plan and partly in section of FIG. 8;

FIG. 10 is a side view in vertical longitudinal section of still another form of my invention;

FIG. 11 is a side view in vertical longitudinal section of another form of my invention;

FIG. 12 is a transverse vertical section of FIG. 11;

FIG. 13 is a side view in vertical longitudinal section of still another form of my invention;

FIG. 14 is a top view partially in plan and partly in section of FIG. 13;

FIG. 15 is a horizontal cross sectional view of an alternate form of the invention shown in FIG. 13;

FIG. 16 is a partial vertical section taken on the line 16—16 of FIG. 15; and

FIG. 17 is a partial view in vertical section taken along the line 17—17 of FIG. 14.

Reference is now made to the drawings for a more complete description of my invention. One preferred embodiment of my invention is illustrated in FIGS. 1 through 7 inclusive and comprises a boxlike container or housing D having a tray-like bottom portion 10 and a removable cover 11, the container being of any suitable water proof rigid construction such as plastic and adapted to confine a bath of suitable sterilizing fluid or germicidal liquid 12 therein. The main body portion or bottom portion 10 of the dispenser is provided with a pair of elongate longitudinally disposed laterally spaced apart upstanding interior guide panel members 13 which are spaced inwardly from the outer side walls 14 of the dispenser, each of the guide panels 13 being provided with a generally U-shaped thermometer receiving guide slot 15 which provides a track upon which the thermometers 16 rest for guided movement into and out of the dispenser. Each of the guide slots 15 include the generally vertically disposed section

15*a* located towards the back of the dispenser, a generally horizontal middle section 15*b* and an upwardly and forwardly inclined front section 15*c*, the back section 15*a* extending to the upper marginal edge of the guide panel 13 and being in alignment with a used instrument return opening in the cover 11, the front section 15*c* extending to the front marginal edge of the guide panels 13 to provide a discharge opening therein. It will be noted that the point of juncture between the various sections of the guide slots are suitably rounded or curved as at 17 to break or resist the shock of the falling thermometers down the vertical slot 15*a* and direct them forwardly into the slot 15*b* and at 18 so as to prevent any interference with the free movement of the thermometers along the track provided by the guide panels 13 and the slots 15 when the thermometers are slid or rolled back and forth on the track and in the guide slots.

The middle section 15*b* of the guide slot 15 may be of any length desired but is preferably of a length sufficient to hold an adequate number of thermometers which will insure that the thermometers remain in the germicidal fluid long enough to complete the sterilization thereof. It has been found that a middle section 15*b* of sufficient length to hold anywhere from 11 to 17 thermometers in parallel side-by-side relationship is adequate for the average physician. The horizontal sections 15*b* of the guide slots 15 are preferably disposed slightly above the bottom of the dispenser to insure complete submersion of the thermometers in the sterilizing fluid 12 and to insure proper functioning of the ejector or impeller locking mechanism hereinafter to be described.

The top marginal edge of the front wall 19 of the dispenser is disposed beneath and in spaced apart relationship with the upper marginal edge of the front guide slot section 15*c* to provide the thermometer discharge opening 20 therebetween. The upper marginal edge of the front wall 19 is beveled or tapered as at 19*a* to provide a continuous uninterrupted track with the lower edge of the front guide slot 15*c*. The front of the guide panels 13 are provided with a forwardly extending overhanging portion 21 providing a catch or abutment for the thermometers being dispensed, the under portion of the overhang 21 having a semi-circular recess portion 22 in alignment with the slot 15*c* and which is adapted to receive and against which the leading thermometer abuts when the entire group of thermometers are pushed forwardly for ejection from the dispenser. The inner end of the semi-circular recess 22 is preferably disposed in substantial alignment with the outer marginal edge of the front wall 19. Thus, when the thermometers are pushed forwardly for dispensing of one of them, the leading thermometer 16' is pressed into the semi-circular recess 22 and momentarily held thereagainst by the remaining thermometers. Upon release of the ejector mechanism, the thermometer next adjacent the leading thermometer and all of the succeeding thermometers fall by gravity back down the front guide slot 15*c* to the middle guide slot 15*b*. Upon disengagement of the leading thermometer with the next adjacent thermometer, the leading thermometer 16' falls directly downwardly through the opening 23 between the front wall 19 and the depending lip 21*a* onto the spaced apart forwardly extending rest members 24 which are mounted on the front wall 19. The upper marginal edge of the rest members 24 slightly decline forwardly and terminate in an upstanding abutment member 24*a* against which the dispensed thermometer comes to rest. Thus, located, the thermometer 16' which has been dispensed is suspended between the rest members 24 and may be readily grasped by the fingers of the physician. A drip pan 25 is mounted on the front wall 19 beneath the rest members 24 and is adapted to receive any excess sterilizing fluid which may drip from the dispensed thermometer resting on the rest members 24.

The ejector or impeller mechanism for dispensing or ejecting the thermometers consists of an I-shaped member indicated generally by E, said member having a vertical shank portion 26, a horizontally disposed upper supporting plate 27 and a lower horizontally disposed thermometer engaging ejector plate 28. The leading edge 28 of the ejector plate is disposed in horizontal alignment with the middle guide slot section 15*b* and is adapted to engage and bear against the rearwardmost of the thermometers in slot 15*b* to push the entire group of thermometers forwardly along the guide slot for ejection and dispensing thereof. The ejector is adapted for free reciprocating movement longitudinally of the dispenser. The ejector is suspended from the cover 11, with the upper supporting plate 27 overlying the top of the cover 11 and freely slidable thereon. The vertical shank portion 26 extends downwardly through an elongate longitudinally disposed slot 29 provided in the cover 11 and is guided thereby during its longitudinal reciprocating movement. The vertical shank 26 is also provided with guide members 30 on each side thereof which are adapted to underlie the cover 11 in contiguous relationship therewith, the guide members 30 substantially preventing any substantial vertical movement of the ejector, the guide members 30 and the upper supporting plate 27 cooperating to define guide slots for receiving the cover 11.

For convenience in operating the ejector mechanism, a thumb hold or grip member 31 is mounted atop the cover 11 adjacent the forward end of the slot 29. A finger grip member 32 is mounted atop the upper supporting plate 27 so that the thumb grip 31 and the finger grip 32 may be conveniently grasped and pulled together to enable the ejector to be pulled forwardly to eject a thermometer from the dispenser.

A spring member 33 is provided which is connected at one end to the vertical shank portion 26 and at the other end to the back wall 34 of the dispenser to retract the ejector after a thermometer has been dispensed and the grips 31 and 32 released. The cover is also provided with a transversely disposed used instrument return slot 35 which intersects the longitudinal slot 29. The slot 35 is in alignment with and registers with the vertical guide slot section 15*a* to provide an inlet opening for returning a used thermometer to the sterilizing bath.

The leading edge of the vertical shank 26 is provided with an abutment member 36 having a downwardly and rearwardly inclined portion 36*a*, the lower edge of which is disposed adjacent the plane of the upper edge of the guide slot section 15*b* and is adapted and designed to push or press a thermometer still remaining in the vertical guide slot 15*a* which for one reason or another may not have been able to completely descend into the horizontal guide slot 15*b*. The inclined surface translates the forwardly applied force to a generally downwardly applied force or resultant force against the thermometer still located in the vertical slot 15*a* to force the same downwardly into the horizontal slot 15*b* during forward ejecting motion or movement and thereby prevent either jamming of the mechanism or possible breakage of the thermometer still located in the vertical slot 15*a*, which would occur if the inclined surface 36*a* was not provided.

The cover 11 is provided with depending side flange members 11 which are adapted to contiguously overlie the upper edge portions of the outer side walls 14 to permit guided sliding movement of the cover with respect thereto. The front marginal edge of the cover is provided with a depending flange 11*b* which is adapted to abut with the overhang 21 of the guide panel 13 to limit the rearward movement of the cover with respect to the bottom portion of the dispenser and to insure that the transverse return slot 35 in the cover will always be in proper alignment with the vertical guide slot section 15. The back marginal edge of the cover is not provided with any depending flange members to enable the cover to be freely slid forwardly with respect to the bottom portion of the dispenser to at least partially open

the bottom to enable sterilizing fluid to be added thereto, and to enable the cover to be easily completely removed or slid unto the bottom tray when desired.

During use, the sterilizing fluid in the dispenser ultimately becomes depleted to a point where the fluid level is below the top of the thermometers and the thermometers are no longer completely immersed in the sterilizing fluid. To warn and advise the physician when this situation occurs, a float member is provided. In the form shown, the float includes a horizontally disposed elongate generally C-shaped buoyant member **37** having a longitudinally disposed opening or slot **37***a* therein for receiving and partially enclosing the vertical shank **26** of the ejector permitting free reciprocating movement of the shank therein.

The main body portion **37** of the float is provided with a pair of depending legs **38**. The float member is of such size as to extend substantially to full width of the interior between the panels **13** so that substantial lateral movement thereof is prevented so that the vertical shank **26** is always adapted to move freely in the slot **37***a*. The float member is adapted to normally float on the sterilizing fluid when a sufficient amount of fluid is in the bath so as not to interfere with the operation of the ejector and the free reciprocating movements thereof. However, when the level of the sterilizing fluid reaches a predetermined undesirably low level so that it no longer adequately covers the thermometers, the float sinks to a level where the leading edges **38***a* of the legs **38** engage the rear marginal edges **28***b* of the ejector plate **28** and thereby prevents complete retraction thereof, causing the upper supporting plate **27** to overlie the transverse return slot **35** in the cover **11** to prevent return of the used thermometers to the dispenser until such time as a sufficient amount of sterilizing fluid has been added to the bath to raise the float and move it out of locking position. When this occurs, the physician is immediately notified of the undesirably low level of the sterilizing fluid in the dispenser when he finds himself unable to return a used thermometer to the dispenser.

It will also be noted that the device is so arranged that all of the thermometers cannot be dispensed from the dispenser by the ejecting mechanism since it travels only to the forward end of the slot **15***b*. The arrangement is such that more thermometers are required than the number which will fill the forward inclined guide slot **15***c* to capacity to enable the dispensing of a thermometer. Thus, when the number of thermometers in the dispenser has been reduced to a predetermined minimum allowable amount, the dispenser will no longer function to eject the remaining thermometers therefrom and the physician is placed on notice that an insufficient number of thermometers remain in the dispenser to insure a suitable time interval for proper and complete sterilization thereof and the number of thermometers in the dispenser must be added to and built up to a number which will again permit the dispensing of the thermometers from the mechanism.

A pair of triangular guide members **95** may be mounted atop the cover **11**, said members providing a downwardly and rearwardly inclined track **95***a* terminating adjacent the return slot **35** to guide the used thermometers thereinto. A pair of opposing float stop members **96** may also be provided adacent the guide panels **13** so as to flank the ejector plate **28** in non-interfering relationship therewith but being disposed in front of the float member **37** so as to prevent the float from moving forwardly and confining the float to the back of the dispenser.

In operation, a thermometer is dispensed from the dispenser D by simply grasping the grips **31** and **32** between the thumb and forefinger and pulling the same together, thereby causing the ejector to move forwardly and the ejector plate **28** to push the thermometers from the normal solid line rest position, best seen in FIG. 2, on the slot section **15***b* to and up the inclined slot **15***c* to assume

the broken line position of FIG. 2, whereupon the leading thermometer **16'** is pushed into the recess **22**. Upon release of the grips, the spring **33** returns the ejector to its normal position at the rear of the dispenser, causing all of thermometers except the leading one to fall by gravity back down the slot **15***c* to the slot **15***b*. This releases the leading thermometer **16'** and permits it to fall downwardly unto the rest members **24** where it may be readily grasped by the physician. After use, the dispensed thermometer is returned to the dispenser through the return opening **35** to take its place at the rear of the group of thermometers and await its turn for re-dispensing, which cannot take place until all of the preceding thermometers have been dispensed, thereby insuring that the thermometer will remain in the germicidal bath long enough to complete the sterilization thereof. It will also be noted that the movement of the ejector and thermometers through the bath during each dispensing operation agitates the bath to effect a more thorough cleaning of the thermometers.

If the level of the bath falls to a predetermined undesirably low point such that there is an insufficient amount of germicidal liquid remaining in the dispenser, the float member sinks to a level where it engages the back edge **28***b* of the ejector plate **28** and prevents complete return of the ejector to its normal position. This causes the upper supporting plate **27** to overlie the return opening **35** as in FIG. 5 and prevents the return of any further thermometers to the dispenser, thereby advising the physician to refill the dispenser with liquid. If the thermometers after dispensing are not returned for one reason or another, such as breakage or neglect, the number of thermometers in the dispenser are depleted to a number which will no longer fill the slot **15***c* to capacity, thus preeventing further dispensing until more thermometers have been added to the dispenser. This is an important feature since there should be a predetermined minimal number of thermometers in the bath at all times to prevent the used theromometers from being reused until sterilization ha sbeen completed.

FIGS. 6 and 7 illustrate an alternate form of the dispenser D shown in FIGS. 1–5 inclusive. In this alternate form of FIGS. 6 and 7, the dispenser has been modified to the extent of eliminating the drip pan **25** and providing means for permitting the excess fluid on the dispensed thermometer to be returned directly to the germicidal bath in the dispenser. In this alternate form, the front guide slot **15***c* communicates with a discharge opening or slot **97** in the cover **11**, the guide track for the thermometers being dispensed being extended above the cover **11** by means of a pair of rest member **98** mounted on the cover **11** adjacent the front marginal edge thereof. The rest members provide an inclined track **98***a* which is in direct alignment with the track surface of the slot **15***c* and terminates in a recessed portion **99** formed in the rest members **98** for receiving and holding the dispensed thermometer in readily available position above the dispenser. A transverse drain opening or slot **100** in the cover is positioned directly below the recess or pocket **99**, and permits the excess fluid on the dispensed therometer to fall directly unto the bath **12** disposed therebelow. Guide members **101** are mounted atop the cover **12** in spaced apart opposition to the track **98***a* of the rest members **98** to define an extension of the guide slot **15***c* to guide and confine the thermometers as they are pushed upwardly towards the pocket **99**. A slightly downturned lip **101***a* is provided for directing the thermometers into the pocket **99**, the members **98** and **101** cooperating to permit only a single thermometer to be dispensed and received in the pocket **99** at one time.

FIGS. 8 and 9 illustrate another alternate form of my invention in which the dispenser D1 containing the usual bath of sterilizing fluid **12** is provided with a generally U-shaped guide slot **39** formed in the interior guide panels **13** which terminates at one end in the instrument re-

turn or entrance opening or slot 40 and terminates at the other end in the discharge or delivery opening or slot 41. Spaced apart upstanding guide members 42 which are similar to the guide members 101 of FIGS. 6 and 7 and rest members 43 which are similar to the rest members 98 of FIGS. 6 and 7 are mounted atop the top or cover 44 of the dispenser and define therebetween a vertical guide slot 39*a* which is a continuation of the guide slot 39 and terminates in the recessed portion 45 where the dispensed thermometer rests within easy reach of the physician. To eject or dispense the thermometers from the container D1, an actuating knob 46*a* is mounted on the tranversely disposed rotatable shaft 46 which carries thereon thermometer engaging arms 47 having downturned lips 47*a* at the outer end thereof for engaging the rearwardmost of the thermometers resting at the bottom of the guide slot 39 so as to push all of the thermometers forwardly upon rotation of the knob and arms to force all of the thermometers upwardly along the forward portion of the guide slot or track 39 and deliver the leading thermometer to the recessed portions 45. The knob and arms are spring loaded by any suitable means such as the spring 48 and is adapted to resist the turning dispensing movement of the arms and actuating knob and return them to their normal position upon release thereof after one of the thermometers has been dispensed as desired.

A float member 49 is also provided which is adapted to warn the physician when the liquid level has fallen to an undesirable predetermined low to warn him to refill the container. The float member 49 is adapted for free floating vertical movement, but is restrained from any substantial horizontal movement by means of the float restraining and guiding members 102 which are secured to the cover or may be secured to the tray like bottom portion of the dispenser. The top portion of the float is provided with a forwardly extending abutment portion 49*a* which normally is disposed above and out of the way of a catch member 103 carried by the shaft 46 and which extends upwardly from said shaft when in normal inactive position, the catch normally swinging freely in the area beneath the abutment portion 49*a*. However, when the fluid level sinks to a predetermined point wherein it is deemed advisable to refill the dispenser with germicidal solution, the float also sinks correspondingly therewith, the abutment 49*a* thereupon becoming disposed opposite said catch 103 to engage the same and prevent turning movement of the knob 46*a* and shaft 46, the physician thus being warned by this inability to turn knob 46*a* to refill the dispenser. A stop member 111 extends inwardly from the guide panels 13 and is adapted to engage and limit the dispensing movement of the arms 47 to prevent dispensing of all of the thermometers and insure that a predetermined minimum number of thermometers will be present in the dispenser at all times, the physician being advised that more thermometers should be added when the mechanism fails to dispense a thermometer.

Thus, the principle employed in this form of my invention is the same as that for the forms of the invention previously described, the only difference being in the actuating mechanism for ejecting the thermometers from the sterilizing bath and the container.

The form of my invention illustrated in FIG. 10 is still another alternate form of those previously above described which employs the same principles but employs a somewhat different and more simplified actuating or ejection mechanism. In the form shown, the dispenser D2 having a bath of sterilizing fluid 12 and a cover 50 is provided with guide panels having a U-shaped thermometer guide slot and track 51 which communicates at one end thereof with the instrument return slot 52 in the cover and communicates at the other end with the delivery or dispensing slot 53 also provided in the cover. The thermometers are adapted to be maintained in a generally horizontal side by side position beneath the level of the sterilizing fluid so as to be completely immersed therein to suitably cleanse and decontaminate the used thermometers, the used thermometers being inserted into the container through the return slot 52 and dispensed therefrom one at a time through the delivery slot 53. The delivery slot communciates with a rest receiving unit indicated generally by 54 similar to those previously hereinabove described for suspending the dispensed thermometer above the top of the container within easy reach of the physician and permitting the same to drip excess sterilizing fluid back into the bath through a suitable drain slot 55 provided in the cover. The dispensed thermometer receiving pocket or recess 54*a* is adapted to receive a single thermometer at a time, and the curved guide track portion 54*b* for directing the leading thermometer into the pocket 54*a* also insures that the remaining thermometers other than that dispensed will fall back into the bath when the ejector is released.

The actuating mechanism for this form of my invention comprises a spring loaded plunger 56 having an actuating knob 57 and adapted for vertical reciprocation and continuously urged upwardly into normal non-actuating position by any suitable means such as the coil spring 58. The ejector consists of a float member 59 disconnected from the plunger 56 and having a forwardly extending downturned thermometer engaging hook portion 60, said float being adapted for free floating vertical movement but limited in its horizontal movement. The float member is guided in its vertical reciprocating movement by the recessed truncated triangular cut-outs 61 in the sides of the float and suitable vertical guide members 62, which prevent any substantial horizontal movement except for the tilting thereof. To dispense a thermometer, the plunger is simply pressed downwardly against the float 59. The float 59 is thereby pushed downwardly and tilted forwardly in its downward movement by the plunger which is positioned forwardly of the vertical center line of the float 59 causing the float to tilt forwardly to the broken line position *a* shown and the hook portion 60 thereof to overlie and move into engagement with the rearwardmost and uppermost of the thermometers, the continued downward movement of which pushes all of the thermometers down one side of the guide slot and up the other and causes the leading thermometer 16' to be pushed through the delivery slot 53 and retained on the recess 54*a* of the rest receiving unit 54 in the manner hereinbefore described. When the level of the sterilizing fluid becomes too low, the float 59 fails to rise above the last of the thermometers in the slot 51 upon its upward return after having been released by the plunger 56. When this occurs, the front face 60*a* of the hook is disposed opposite to the thermometers rather than above them as when there is enough fluid in the dispenser. Thus, when the plunger is depressed to dispense another thermometer, the front face 60*a* of the hook portion is pressed against the thermometers and fails to engage them, as shown by the broken line position *b* of FIG. 10, and instead of being tilted forwardly as during usual dispensing operation, the float simply rides downwardly between the back of the thermometers and the vertical guides 62, failing to engage and dispense the thermometers, and thereby advising the physician that the dispenser needs refilling. When the number of thermometers in the dispenser is reduced below the minimum needed to insure the dispensing of a thermometer, the dispenser will also fail to dispense a thermometer upon actuation of the plunger, thereby warning the physician of the necessity for adding more thermometers to the device.

The form of my invention illustrated in FIGS. 11 and 12 illustrates still another form of my invention employing the same basic principles as the mechanisms hereinbefore described but functioning in a somewhat different manner. In this form of my invention, the dispenser D3, having a cover 63, contains the usual bath of sterilizing fluid 12. The cover is provided with a

longitudinally extending ejector guide and return slot **64** and a delivery slot **65** in alignment with slot **64** as well as an upstanding stationary finger hold **66** and a reciprocating upstanding finger hold **67** which is adapted for reciprocating movement towards and away from the finger hold **66**. The thermometers **16** are adapted to be inserted vertically into the container through the return slot **64** and are maintained in that position by a pair of vertically disposed spaced apart perforate guide panels **68** defining a vertical longitudinal guide slot **69** within the dispenser for receiving and holding the thermometers in a generally vertical position therebetween, the thermometers resting on a supporting surface or track **70**. The ejection mechanism includes a vertically disposed plate-like ejector member or shank **71** which is adapted for free sliding guided movement in the guide slot **69** between the panels **68**, so that the leading edge **71***a* thereof may engage and push forwardly the latter most of the thermometers standing in the slot **69** and push all of the thermometers therein forwardly to dispense one of the thermometers therefrom. The ejector **71** is connected at its upper end to the finger hold **67** so as to be reciprocated thereby by gripping the holds **66** and **67** between the thumb and forefinger and pulling them together. The ejector is also provided with a suitable spring member **72** for automatically retracting the ejector after a thermometer has been dispensed and the holds **66** and **67** released. The ejector is provided with a pair of laterally extending guide members or keys **73** which travel in suitable longitudinally extending guide slots, openings or keyways **74** in the guide panels **68** to guide the ejector **71** in its reciprocating movements and prevent vertical displacement thereof. A float catch or arm **75** extends laterally from the side of one of the guides or keys **73**.

A float member **76** is provided and adapted to float upon the surface of the bath **12**. The float member has a leg **76***a* depending therefrom, the leg **76***a* having an enlarged lower end portion **76***b*. A float retaining member **104** extends inwardly from the side wall of the dispenser and has a collar **104***a* mounted on the outer end thereof, which collar loosely encloses the depending float leg **76***a* to limit the horizontal movement thereof while permitting the float **76** and leg **76***a* to move freely up and down. When the level of the bath is high enough to completely cover the thermometers, the leg **76***a* and enlarged portion **76***b* are disposed above the float catch **76** so as not to become engaged therewith. However, when the supply of germicidal liquid becomes inadequate and the bath level falls below the tops of the thermometers so that they are no longer completely submerged therein, the float sinks correspondingly with the bath level and the enlarged lower end **76***b* of the leg moves into alignment with the float catch **75** so as to engage the same and thereby either limit the forward movement of the ejector or prevent the return thereof to its normal inactive position at the rear of the dispenser, thereby preventing further dispensing of thermometers and notifying the physician that the time has come to refill the dispenser.

To move the thermometer being dispensed from completely submerged condition to a raised delivered dispensed position, a forwardly and upwardly inclined guide track **77** is provided which is in direct communication and alignment with the main supporting surface or track **70** and which progressively raises the thermometers as they are pushed thereover by the ejector until the leading thermometer **16'** is caught and held in the recessed portion or pocket **78** provided at the upper end of the guide track **77**. Thus, when the ejector is pushed forwardly to dispense a thermometer, the entire mass of thermometers are moved forwardly, the leading ones being pushed up the inclined guide track **77** until the forwardmost of the thermometers is caught and held in the recess **78**, the ejector then being released to return to its normal position and the remaining thermometers returning to their normal position due to gravity for continued complete submersion in the sterilizing fluid. In its raised position, the top portion of the dispensed thermometer **16'** is disposed above the cover **63** and may be readily grasped by the physician. The device may also be tilted at a slight angle on the order of five degrees to facilitate the return movement of the thermometers.

The rear end of the thermometer supporting surface or track **70** terminates in a raised portion or ledge **105** having an abutment notch or recess **105***a* disposed somewhat ahead of the leading edge **71***a* of the ejector when the same is in normal fully retracted position to prevent the thermometers from piling up or massing along the front edge of the ejector when they fall back following the dispensing stroke. This leaves an open space between the front edge **71***a* of the ejector and the rearwardmost of the thermometers for receiving a used thermometer through the slot **64** and positioning same at the rear of the line of thermometers and also prevents the returned used thermometer from falling on the thermometers already in the dispenser and causing breakage thereof. The lower end of the front marginal edge **71***a* of the ejector is provided with a notch or recess **71***b* to engage the bulb of the thermometer and prevent the thermometers from riding or climbing up the ejector during the dispensing stroke. As in the other forms of my invention hereinbefore described, the ejector will not operate to dispense a thermometer unless a predetermined minimum number of thermometers are present in the dispenser, again advising the physician to replenish his supply of thermometers to insure that the thermometers will not be re-used until they have remained in the bath a sufficient length of time to complete the sterilization thereof.

The form of my invention shown in FIGS. 13 through 16 inclusive illustrates still another form of my invention in which the thermometers are vertically maintained in the bath but are serially and independently moved along a circular track rather than a linear one. In this form of my invention, the dispenser D4 contains the usual sterilizing bath, the removable cover **79** of which is provided with a return opening **80** and a delivery slot **81** both of which are maintained on the same radius from the center of the container. A rotatable actuating knob **82** is disposed atop the cover **79** and is mounted on a vertical rotatable spindle **83**. The spindle carries a pair of circular vertically spaced apart plate members **84** which have vertically aligned openings **85** therein for receiving and maintaining the thermometers in a vertical position. The openings **85** are equidistant from one another and from a common radial axis represented by the axis spindle **83** and follow a common circular path thereabout, and are adapted for disposition directly below the return opening **80** and delivery slot **81**. A tubular guide member **86** is mounted on the cover and depends therefrom in alignment with and communication with the used instrument return opening **80** and terminates shortly above the uppermost of the guide plates **84** in alignment with one of the apertures or openings **85**. The tubular guide **86** is adapted to insure that the thermometer returned to the dispenser through the return opening **80** will be guided into the vertically aligned openings **85** of the plates **84**. When the used thermometers are returned to the dispenser through the return opening **80** they immediately fall downwardly to rest on and be received by the circular recessed V-shaped track **88** on the bottom **87** of the container. As the knob is rotated the plates **84** carry or move the thermometers held in the openings **85** around the circular track **88** provided in the bottom **87**. The leading thermometer as it reaches the delivery end of the track is progressively raised to a delivered dispensed position by means of an upwardly inclined semi-spiral guide track **89** which terminates in a recess

portion or pocket 90 for holding the dispensed thermometer in a raised position with the upper end thereof extending above the top of the dispenser so that it may be readily grasped and removed by the physician.

A float member 91 is provided which freely floats on the surface of the sterilizing bath and which is connected to and has a depending leg 92 which extends downwardly through the plates 84 through suitable openings 93 provided therein so as to extend downwardly beneath the lowermost of the plates 84. The lower end of the leg 92 is provided with an enlarged flared out portion 92*a* which is adapted to engage the float catch 94 carried by the inclined spiral guide track 89 and extending radially inwardly therefrom, the float 91 and leg 92 traveling a circular path of shorter radius than the thermometers. Thus, the float and leg are free to move up and down in response to the rise and fall of the bath level, but are limited in their horizontal movement by the plates 84. Thus, when the container has a sufficient amount of sterilizing fluid to maintain the level thereof well above the top of the thermometers immersed therein, the leg 92 and the catch engaging portion 92*a* thereof are disposed above the float catch so as not to engage the catch 94 and the ejection mechanism is free to rotate in the dispenser as the plates 84 are rotated by the turning of the actuating knob 82. However, when the sterilizing fluid has sunk to an undesirable low level so that it no longer completely covers the thermometers, the float sinks correspondingly therewith, thereby dropping the arm and the catch engaging portion 92*a* thereof beneath the level of the float catch so as to cause the float arm 92 and flared portion 92*a* thereof to engage the float catch and prevent further movement of the actuating knob and the plates 84 until the container has been refilled with the necessary amount of fluid. The return opening 80 and the end of the delivery slot 81 closest thereto are preferably spaced from one another the same distance as the spacing between the openings 85 in the plates 84 so that each successive indexing of the plates 84 by the actuation of the knob 82 places the opening 85 previously relieved of its thermometer beneath the return slot 80 for receiving the used thermometer next to be returned to the dispenser.

To prevent the dispenser from operating with too few thermometers, a releasable locking or catch mechanism is provided for preventing rotation of the thermometer carrying and ejection mechanism when the number of thermometers present in the dispenser is less than the desired minimum. This mechanism in the embodiment shown, consists of a balance unit which includes a balance arm 106 pivotally mounted on a suitable supporting bracket 107 for free tilting movement about a horizontal axis. The arm 106 has a thermometer supporting plate 108 mounted on one end thereof, said plate having an recessed track 109 therein adapted to seat in the track 88 and receive the lower ends of the thermometers. The other end of the arm 106 is provided with a counterweight 110. The unit is balanced in such fashion that when a predetermined number of thermometers rest on the plate 108 the weight of the thermometers is sufficient to offset the weight of the counterweight 110, thereby maintaining the counterweight 110 in raised position and the plate 108 in lowered position. However, if one or more of the thermometers are missing from their customary place in the dispenser, the catch mechanism becomes unbalanced when one or more of the empty openings 85 is positioned above the plate 108 due to the lack of a sufficient number of thermometers resting on the plate 108 to offset the counterweight 110, and the catch mechanism thereupon tilts to the broken line position shown, the counterweight 110 assuming a lowered position and the plate 108 a raised position. In this raised position, the plate is disposed in obstructing opposition to the thermometers being moved along the track 88 and prevents further movement thereof, thus preventing further rotation of the plates 84 and knob 82, and advising the physician that additional thermometers are needed in the dispenser.

Another important additional feature of this form of my invention is a reversing catch member 112 disposed in the path of travel of the thermometers and located adjacent the second thermometer position past or beyond the delivery position or the position next adjacent the return opening or position 80 designated by 16*a* in the drawings. The catch member 112 has a slightly inclined upper face 112*a* which permits the thermometers to freely travel thereon and pass thereover when moved in the normal direction of dispensing movement. The catch member 112 also has a generally vertically disposed face 112*b* which stands in the path of reverse travel of the thermometers and provides an abutment or stop for engaging the thermometers and preventing further rotation of the ejection mechanism when so engaged. Thus, situations may occur where several of the thermometers may be dispensed or withdrawn without being immediately returned to the dispenser, so that the ejection mechanism must be rotated in reverse direction to align the empty apertures 85 with the return opening 80 for insertion of the used thermometers therein. This catch member 112 enables the empty openings 85 to be serially positioned automatically beneath the return opening 80, starting with the empty openings 85 next adjacent the last thermometer to have been returned or inserted in the dispenser. Thus, when this situation occurs where several of the thermometers have not been returned to the dispenser immediately after use in the order in which they were used, the ejection mechanism is simply rotated in reverse direction opposite to normal dispensing movement until the last thermometer in the dispenser engages the vertical face 112*b* of catch 112 and prevents further movement thereof. This automatically positions the empty openings 85 immediatly following and next adjacent said last thermometer beneath the return opening 80 to enable a used thermometer to be reinserted therein. The mechanism is then rotated in normal dispensing direction and indexed so that the next empty opening is positioned beneath the return opening and receives a used thermometer and so on until all of the empty openings 85 have been filled.

It will be noted that all of the hereinbefore described forms of my invention have several important novel features in common. These are:

(1) Complete submersion of the thermometers in the germicidal bath;

(2) Successive serial dispensing of the thermometers in the order in which they are inserted in or returned to the dispenser to insure the thermometers remaining in the bath a significant interval of time to complete the sterilization thereof prior to re-use;

(3) Automatic means for advising or warning the physician that the supply of germicidal liquid has become inadequate to thoroughly clean and completely cover the thermometers; and

(4) Means for insuring that at least a desirable predetermined minimum number of thermometers are present in the dispenser at all times to guard against the thermometers being re-used too quickly before sterilization thereof has been completed.

In the light of the foregoing description and the illustrative embodiments of preferred forms of my invention set forth in the accompanying drawings, the advantages, utility and novelty of the instrument sterilizer and dispenser of my invention are readily apparent. The dispenser is capable of storing a large number of thermometers in a compact container, and is easily movable from place to place and exceedingly simple to operate. The provision of a predetermined minimum number of thermometers in the bath at all times and the successive serial dispensing of these thermometers in the order in which they are returned to the dispenser insures that they will

remain in the bath a sufficient length of time under normal usage to complete the sterilization thereof prior to re-use. The automatic means for advising the physician when the quantity of germicidal liquid has been depleted to an amount no longer considered adequate to completely immerse and decontaminate the thermometers eliminates the periodic inspection necessary with such devices presently available and avoids the danger of the thermometers being re-used without being completely sterilized because of a lack of sufficient amount of sterilizing solution to provide complete immersion of the thermometers at all times. The devices of my invention also dispense the thermometers in convenient, readily graspable position and insure that only a single thermometer will be dispensed during each individual dispensing operation.

It should also be noted that the track **88** provided in the rotary form of my invention illustrated in FIGS. 13–17 inclusive may be replaced by a series of semi-spherical or shallow concave depressions or dimples disposed on a common radius corresponding to that of the track **88** and circumferentially spaced the same distance apart as the openings **85** in the plates **84**. These depressions are adapted to receive the lower ends of the thermometers and permit them to readily enter and leave the depressions upon rotation of the plates **84** so as not to interfere with the free movement of the thermometers in the dispenser. These depressions assist in indexing the thermometers as they follow their circular path of travel and properly positioning same to indicate to the operator the completion of any individual indexing of the mechanism due to the slight resistance experienced when the thermometers simultaneously enter or fall into these depressions. These depressions correspond in size and location to the circular broken line positions **16** best seen in FIG. 15.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departing from the scope of my invention.

What I claim is:

1. A sterile instrument dispenser comprising a receptacle adapted to contain a bath of sterilizing fluid, ejection mechanism including a vertically disposed shaft mounted for rotation in said bath, instrument engaging means mounted on said shaft for rotation therewith for receiving the instruments and maintaining same in a generally upright position, supporting means for engaging and holding said instruments in submerged condition in said bath and providing a track for the guided movement of said instruments along a generally circular path of travel upon rotation of said shaft and said instrument engaging means, and upwardly inclined track means disposed in alignment with the path of travel of said instruments and adapted to raise said instruments at least partially out of said bath in raised dispensed position.

2. The dispenser set forth in claim 1 including a float member adapted to float upon the surface of the sterilizing bath and having a depending element connected thereto and adapted for engagement with said instrument engaging means for rotation therewith and freely vertically reciprocable with respect thereto, and means adapted to engage said depending member and prevent rotation of said shaft and instrument engaging means when the fluid bath level falls to a predetermined point to advise the user that the receptacle needs refilling with sterilizing fluid.

3. The dispenser set forth in claim 1 including means responsive to the fluctuation in the fluid level of said bath and adapted to engage said ejection mechanism and prevent dispensing movement thereof when the fluid level falls to a predetermined point.

4. The dispenser set forth in claim 1, including means preventing dispensing movement of said ejection mechanism when the number of instruments in said dispenser falls below a predetermined minimum amount.

5. A sterile instrument dispenser comprising a receptacle adapted to contain a bath of sterilizing fluid and having a cover therefor, a vertically disposed shaft mounted for rotation in said bath, generally horizontally disposed instrument engaging means mounted on said shaft for rotation therewith, said means having a series of equally spaced apart apertures therein for receiving the instruments and maintaining same in a generally upright position, said apertures being disposed on a common radius with respect to said shaft, said cover having instrument return and delivery openings therein in registration with said apertures, supporting means disposed adjacent the bottom of said receptacle for engaging and holding said instruments in submerged condition in said bath and providing a track for the guided movement of said instruments along a generally circular path of travel upon rotation of said shaft and said instrument engaging means, upwardly inclined track means disposed in alignment with the path of travel of said instruments and adapted to raise said instruments at least partially out of said bath and through said delivery opening to successively dispense the instrument first inserted into the dispenser, and retaining means disposed adjacent the upper ends of said inclined track for maintaining an instrument in raised dispensed position, said return and delivery openings being spaced apart from one another the same distance as the circumferential spacing between the instrument receiving apertures so that the aperture immediately preceding that disposed in alignment with the delivery opening is in alignment with the return opening for receiving the last used instrument in the bath.

6. The dispenser set forth in claim 5 and tubular guide means mounted adjacent said return opening and extending into said receptacle from said cover to guide the used instrument through the aperture disposed immediately therebelow.

7. The dispenser set forth in claim 5 including float means adapted to float upon the surface of the sterilizing fluid, extending through said horizontally disposed instrument engaging means through a suitable aperture provided therein for simultaneous rotation therewith and being freely vertically reciprocable with respect thereto, and leg engaging means adapted to engage said leg member and prevent further rotation of said shaft and said horizontal instrument engaging means when the sterilizing fluid falls to a predetermined low level to advise the user to refill the dispenser with sterilizing fluid.

8. The dispenser set forth in claim 5, and means responsive to the number of instruments in said dispenser and adapted to prevent rotation of said shaft when the number of said instruments in the dispenser reaches a predetermined minimum amount.

9. The dispenser set forth in claim 8, wherein said means include a balance unit including instrument supporting means and a counterweight interconnected by a pivotally mounted lever arm, said instrument supporting means being disposed to normally lie across the path of said instruments and receive and support a predetermined minimum number thereof, said support means being adapted to be raised by said counterweight when the number of instruments supported thereby is reduced below said predetermined minimum and disposed in obstructing relationship to the incoming instruments to engage same and prevent further rotation of said shaft and advise the operator that the dispenser must be replenished with additional instruments.

10. The dispenser set forth in claim 5, including catch means disposed in the path of travel of said instruments and located adjacent the instrument position immediately following the return opening in the normal direction of dispensing movement, said means permitting free movement of said instruments in the normal direction of travel and adapted to engage the instrument last inserted into the dispenser when said instrument is moved in reverse direction, the next suceeding aperture adjacent said last

instrument being positioned beneath said return opening when said last instrument is so engaged by said catch means.

11. A sterile instrument dispenser for thermometers and the like comprising a receptacle adapted to hold a bath of sterilizing fluid, guide means adapted to receive said instruments and maintain them in series in a generally vertical upright position in the order in which they are delivered thereto, return and delivery openings provided in said receptacle in registration with said guide means, a main track in alignment with said guide means against which the lower ends of said instruments are adapted to rest to maintain said instruments in submerged condition beneath the normal level of the bath, said main track communicating with an upwardly inclined track disposed generally beneath said delivery openings, retaining means immediately adjacent the upper end of said inclined track for receiving and holding a vertically disposed instrument in raised dispensed position at the upper end of said inclined track independently of the other instruments in said receptacle with at least a portion thereof extending above said bath for ready grasping and removal therefrom, manually movable ejection mechanism adapted for guided movement and adapted to engage the instruments inserted into the bath through the return opening and move all of the instruments disposed in said guide means along said main and inclined tracks causing the leading instrument of said series to be raised by said inclined track upon actuation by said ejection mechanism and deposited in said retaining means in dispeneed condition.

12. A sterilizing and dispensing device comprising a structure for housing a bath of sterilizing fluid, means providing a track through said bath for guided movement of articles to be sterilized therethrough, ejection means for engaging said articles and moving them along said track for successive dispensing thereof, and float means responsive to the change in fluid level of said fluid for engaging said ejection means and interfering with the normal movement thereof to advise the operator that the dispenser needs refilling with sterilizing fluid when the fluid level falls to a predetermined level.

13. A sterilizing and dispensing device comprising structure for housing a bath of sterilizing fluid and having article return and delivery openings, track means for supporting a multiplicity of articles in series in said bath and capable of serially guiding them through said bath from said return to said delivery opening, manually operable ejection mechanism for simultaneously moving all of the articles on said track towards said delivery opening for successive discharge of said articles therefrom, said ejection mechanism being capable of dispensing an article through said delivery opening only when a number of articles in excess of a predetermined minimum plurality are present on said track, said track being capable of carrying a plurality of articles in excess of said predetermined minimum, said ejection mechanism being capable of successively dispensing all of said plurality of articles in excess of said predetermined minimum whereby those articles in excess of said minimum can be successively dispensed by actuation of said ejection mechanism without the addition of more articles to said track until the number of articles on said track has been reduced to said predetermined minimum.

14. A sterilizing and dispensing device comprising a receptacle for housing a bath of sterilizing fluid and having article return and delivery openings, means for supporting articles inserted into said bath through said return opening and guiding them through said bath to said delivery opening, ejection mechanism for moving said articles to said bath to said delivery opening and dispensing them therefrom, and means responsive to the fluctuation in the fluid level of said bath and adapted to engage said ejection mechanism and prevent dispensing movement thereof when the fluid level falls to a predetermined point to notify the operator that the receptacle needs additional fluid.

15. The device of claim 14, including means preventing dispensing movement of said ejection mechanism when the number of instruments in said device falls below a predetermined minimum amount.

16. A sterilizing and dispensing device comprising a receptacle for housing a bath of sterilizing fluid and having article return and delivery openings, means for supporting articles inserted into said bath through said return opening and guiding them through said bath to said delivery opening, ejection mechanism for moving said articles through said bath to said delivery opening and dispensing them therefrom, and means responsive to the fluctuation in the fluid level of said bath and adapted to prevent normal dispensing movement of said ejection mechanism when the fluid level falls to a predetermined point to notify the operator that the receptacle needs additional fluid.

17. A sterlizing and dispensing device comprising a receptacle for housing a bath of sterilizing fluid having article return and delivery openings, means for supporting articles inserted into said bath through said return opening and guiding them through said bath to said delivery opening, ejection mechanism for moving said articles through said bath to said delivery opening and dispensing them therefrom, and means preventing movement of said ejection mechanism when the number of instruments in said device falls below a predetermined minimum amount.

18. A sterilizing and dispensing device comprising structure for housing a bath of sterilizing fluid and having an inlet opening for successively inserting articles into the bath and an opening for discharging sterile articles therefrom, means for underlying and supportingly engaging and maintaining a series of articles in substantially completely submerged state in said bath in the order of their insertion therein, track means for guiding said series of articles to said discharge opening, said track means including an upwardly inclined portion adjacent the discharge opening for raising said articles out of said bath to expose at least a portion of each article for ready grasping thereof, manually operable ejection mechanism adapted to move said series of submerged articles simultaneously along said track to successively dispense them through said discharge opening in the order in which they were inserted into the bath, said ejection mechanism being operated to dispense an article only when a predetermined minimum plurality thereof are present on said track, said track being capable of supporting a plurality of articles in excess of said predetermined minimum, which articles in excess of said predetermined minimum are successively dispensed by actuation of said ejection mechanism, stop means adjacent said discharge opening for engaging and holding the leading article of said series and thereby stopping the dispensing movement of said ejection mechanism, and means adjacent the discharge opening for supporting and maintaining said leading article in raised at least partially exposed dispensed position.

19. The device of claim 18, including means responsive to the fluctuation in the fluid level of said bath and adapted to prevent normal dispensing movement of said ejection mechanism when the fluid level falls to a predetermined point to notify the operator that the receptacle needs additional fluid.

20. A sterilizing and dispensing device comprising a receptacle for housing a bath of sterilizing fluid and having article return and delivery openings, means for supporting articles inserted into said bath through said return opening and guiding them through said bath to said delivery opening, ejection mechanism for moving said articles through said bath to said delivery opening and dispensing them therefrom, and float means responsive to the fluctuation in the fluid level of said bath and adapted to engage said ejection mechanism and prevent normal dispensing movement of said ejection mechanism when the fluid level falls to a predetermined point to notify the operator that the receptacle needs additional fluid, said

ejection mechanism blocking the return opening and preventing further addition of instruments to the dispenser when engaged by said float means.

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