United States Patent

[11] 3,568,927

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[45] Patented **Mar. 9, 1971**

[54] **DISPLAY DEVICE**
4 Claims, 14 Drawing Figs.

[52] **U.S. Cl.** **239/17,** 239/18, 239/20
[51] **Int. Cl.** **B05b 17/08**
[50] **Field of Search** 239/16, 17, 18, 20, 211

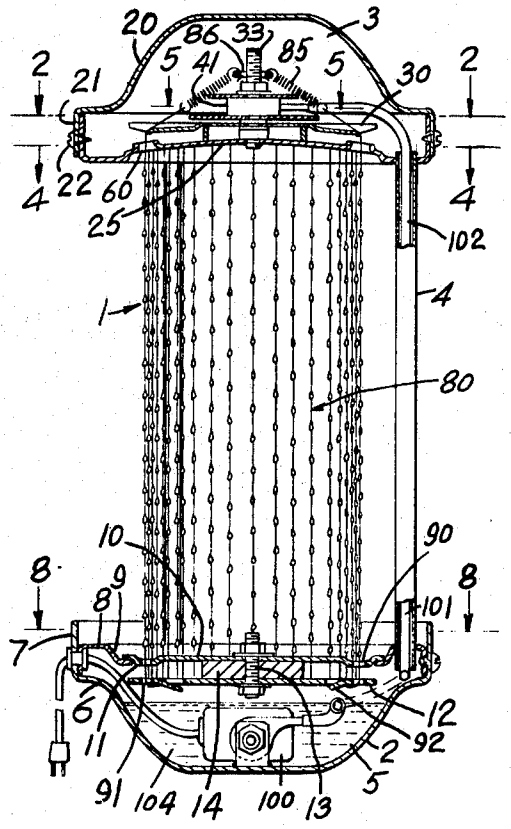
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Primary Examiner—Lloyd L. King
Attorney—J. Calvin Brown

ABSTRACT: The display device has top and bottom members held separated by tubular columns or posts. Extending between the top and bottom members are spaced-apart parallel vertical strings or threads and liquid is placed in a tank in the bottom member and pumped therefrom through a tubular column to the top member where the liquid is directed to a distributor plate, which feeds the liquid evenly to the upper ends of the threads interconnecting the top member and the bottom member, the liquid flowing downwardly on said threads in the form of droplets to be received in the lower tank and recirculated by the pump to the top member. The display device may have surrounding the same various ornamentations such as flowers, plants, and spot lights may play upon the droplets as they move downwardly on the threads.

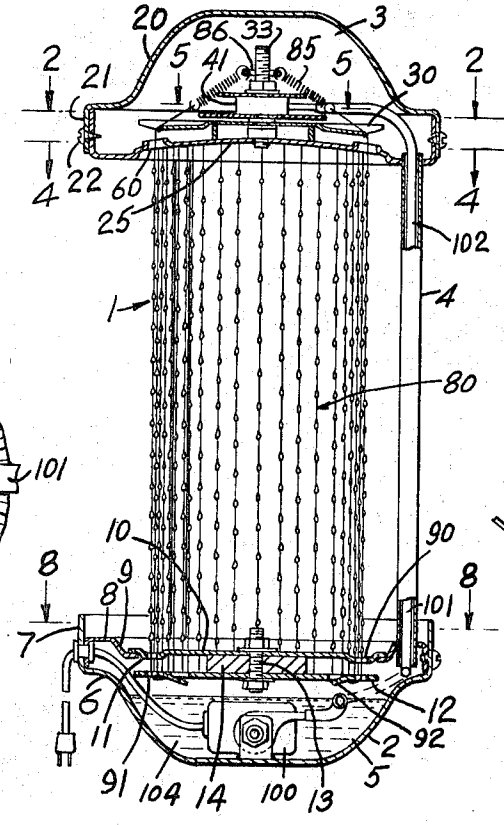


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SHEET 1 OF 2

FIG. 1.



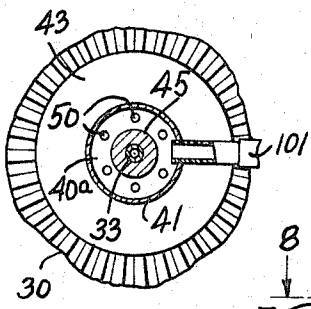


FIG. 5.

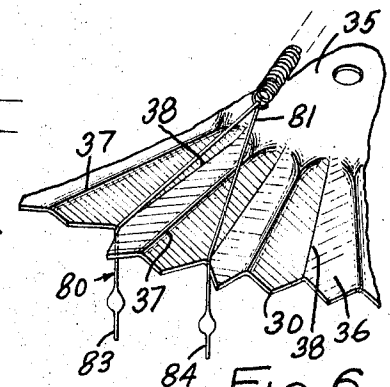


FIG. 6.

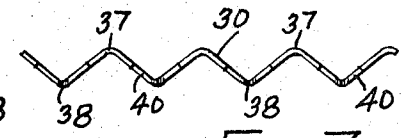


FIG. 7.

FIG. 3.

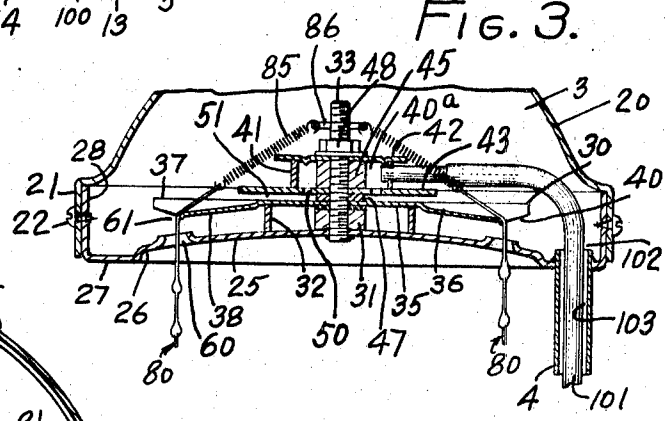
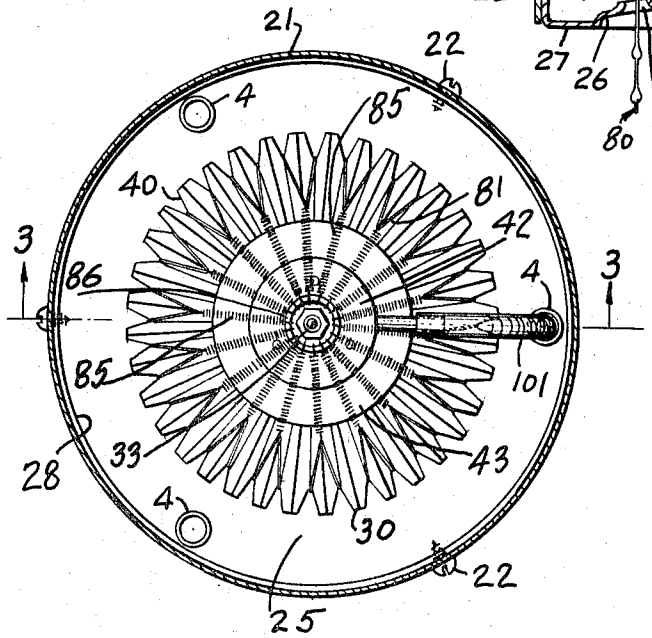


FIG. 2.



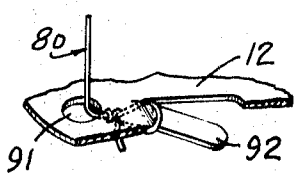


FIG. 12.

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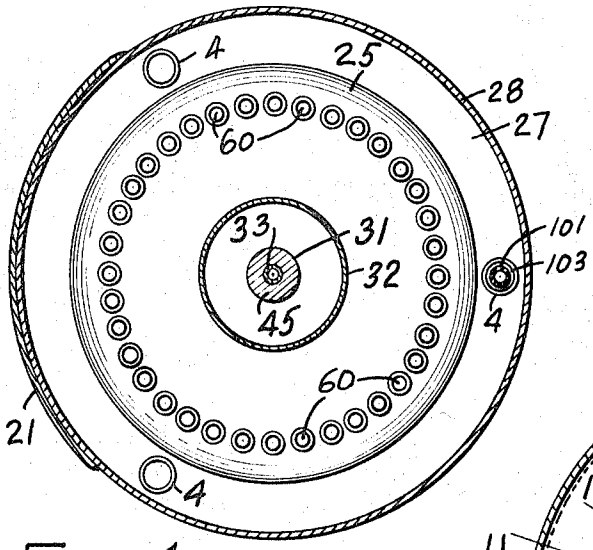


FIG. 4.

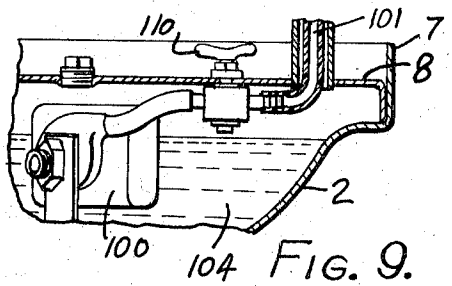


FIG. 9.

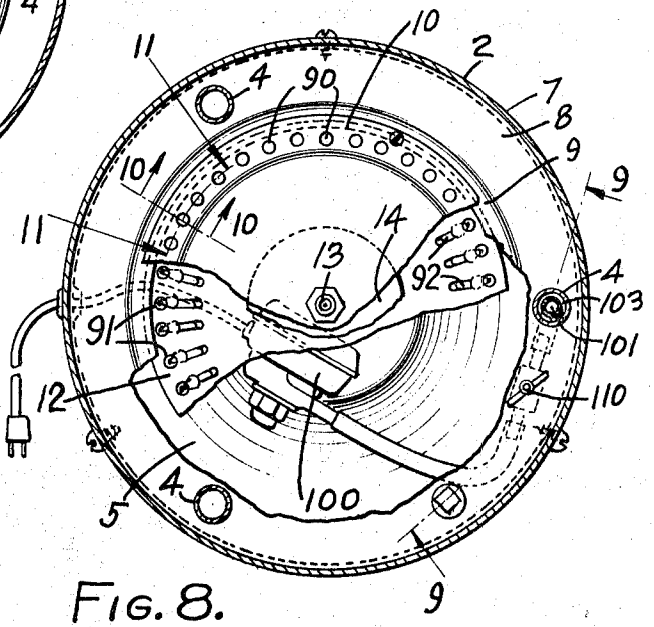
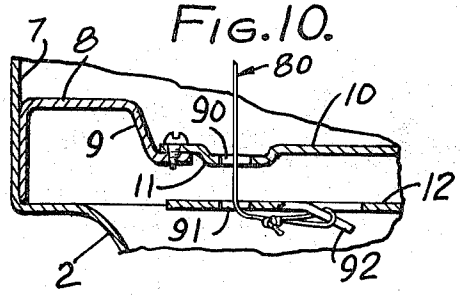


FIG. 8.

FIG. 10.



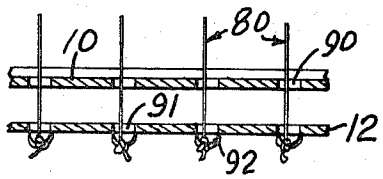
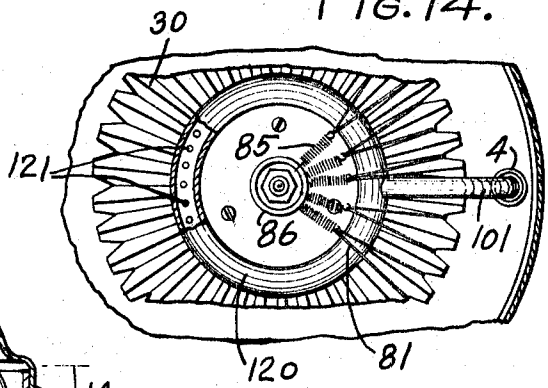


FIG. 11.

FIG. 14.



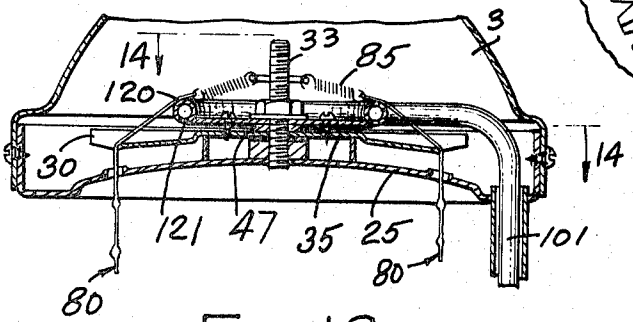


FIG. 13.

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DISPLAY DEVICE

BRIEF SUMMARY OF INVENTION

The present invention solves the problem of providing droplets for movements upon a thread or string in spaced-apart relationship as distinguished from the liquid flowing over the string without the formation of droplets. The droplets are so formed as to be substantially evenly spaced apart during movement upon the string rather than being formed at random. The means of distribution of liquid on the threads is such that no solid stream of liquid is visible on the threads or strings and the liquid is only visible on the threads or strings in the form of spaced apart droplets. Top and bottom members are each provided with tanks or equivalent means for holding liquid and said top and bottom members are held spaced apart by suitable posts or columns which may be of tubular form. The height of the display device may vary within wide limits as may likewise the size of the top and bottom members. The top member is provided with a distributor plate which receives liquid from the bottom tank pumped to the upper tank and this liquid is evenly directed to a liquid distributor plate to the spaced vertical threads or strings which extend between the top and bottom members. The liquid is controlled as to pressure and volume between the two tanks and the distributor plate is so formed as to control liquid movement to develop droplets immediately upon its contacting the threads or strings. The threads or strings are maintained under light tension and the threads or strings engage the distributor plate, the distributor plate being formed with radial corrugations the valleys of which communicate directly with the threads or strings. The structure provides in conjunction with the upper tank means for evenly directing liquid onto the distributor plate for even flow thereover and means for handling any excess overflow of liquid to return the same to the lower tank to direct any unwanted liquid to the lower tank without disturbing in any manner the droplets descending upon the threads or strings between the tanks. In addition to the foregoing the arrangement is such as to render easy access to the pump in the lower tank; controlled communication of liquid in the bottom and top tanks together with accessibility to the space between the threads or strings.

An object of the invention is to provide a display device which may be placed in various locations and which will attract an observer by its beauty, as liquid droplets travel along a string or thread in substantially equally spaced relationship while lights play upon the droplets.

In The Drawings:

FIG. 1 is an elevation, partly in section, and in fragment of the display device as an entirety;

FIG. 2 is an enlarged cross-sectional view on the line 2–2 of FIG. 1;

FIG. 3 is a fragmentary sectional view on the line 3–3 of FIG. 2;

FIG. 4 is an enlarged cross-sectional view on the line 4–4 of FIG. 1;

FIG. 5 is a fragmentary, enlarged view, on the line 5–5 of FIG. 1;

FIG. 6 is a fragmentary perspective view of a sector of the distributor plate;

FIG. 7 is an edge view of the distributor plate shown in FIG. 6;

FIG. 8 is a fragmentary sectional view, on an enlarged scale, taken on the line 8–8 of FIG. 1;

FIG. 9 is a fragmentary sectional view on the line 9–9 OF FIG. 8; and on an enlarged scale;

FIG. 10 is a fragmentary sectional view on an enlarged scale taken on the line 10–10 of FIG. 8;

FIG. 11 is a fragmentary enlarged sectional view on the line 11–11 of FIG. 8;

FIG. 12 is an enlarged fragmentary perspective view of means for anchoring the lower ends of thread or string;

FIG. 13 is a fragmentary, sectional view, on an enlarged scale, detailing the top member and a modified liquid receiving member; and

FIG. 14 is a fragmentary sectional view on the line 14–of FIG. 13.

Referring to the drawings and specifically to FIG. 1, the display device is designated as an entirety by 1 and includes a bottom member 2 and a top member 3 held separated by columns or posts 4. In the present instance, three posts are utilized as shown in FIG. 2, the posts being of tubular form and equidistantly spaced apart. The bottom member 2 provides a lower tank 5 adapted to hold a liquid at a desired level. The lower tank 5 is of bowllike form and the upper edge flares outwardly as shown at 6 and joins an annular flange 7. The annular flange 7 has secured internally thereto a ring 8 provided with an offset portion 9. A disc 10 is supported by the offset portion 9, the disc being depressed at 11 so as to maintain the plate centered within the member 8. The disc 10 and ring 8 constitute the support means for plate 12. The two plates 10 and 12 are centrally secured together by a bolt carrying nuts as shown at 13, there being spacer 14 through which the bolt is passed, the spacer separating the two plates.

The upper member 3, in addition to an inverted cover 20, preferably has the same configuration in cross section as the bowl of the lower member 2 in order to have continuity and a pleasing appearance and like the lower member, the cover or cap is provided with an annular flange 21. Secured to the cover by screws 22 is a base wall 25 of a container 26. The base wall is inwardly convex in form terminating at its rim in two annular flanges 27 and 28 in right angular relationship. Thus the flanges 27 and 28, together with the base wall, provide the container. Coaxial with the base wall 25 and immediately above the same, is a distributor plate 30. The distributor plate is spaced from the base wall 25 by a spacer 31 and by a ring 32 there being an elongated bolt 33 axially passed through the spacer and the base and the distributor plate for purposes as will hereinafter appear.

The distributor plate 30 is centrally provided with a plane area 35 and with a corrugated area 36 radially extending from the plane area to the rim. The corrugations in the present instance have ridges and valleys and may be defined as zigzag. The ridges 37 lie in the plane portion 35 while the valleys 38 slope downwardly, as shown in FIG. 6, which may be a slope of 5° to the plane area 35, by way of example. The rim of the corrugated area, as shown in FIG. 2, is notched or V cut, as indicated between two of the corrugations at 40. Thus in the showing, particularly in FIGS. 2 and 6, it may be said that each trough or valley 38, lies between two vertices or apices 37 and that the notch is cut in the sloping sidewalls of a pair of contiguous corrugations, the apex of each V cut lying in a valley 38. Positioned axially above the distributor plate 30 in that form of the invention shown in FIGS. 1, 2, 3 and 5, is an upper tank or reservoir 40*a*. This reservoir is formed by providing an annular sidewall 41 interposed between top and bottom plates or discs 42 and 43, the discs 42 and 43 constituting top and bottom members for the tank and both discs overlap or extend beyond the side wall 41, as shown in FIG. 3. The base or bottom disc 43, in addition to being secured to the sidewall, includes a spacer 45 between the discs through which spacer the bolt 33 is passed. Also, there is a thin spacer 47 interposed between the disc 43 and the plane surface 35 of the distributor plate 30. The usual nut and washer is carried by the bolt 33, as indicated at 48, for securing the members in working relationship, and so that when said members are assembled as shown in FIG. 3, the disc 43 will extend over the plane portion 35 of the distributor plate 30 and terminate over the root portions of the corrugated area. For clarity, the disc 43 and plane portion 35 are shown in FIG. 3 as widely separated when as a matter of fact they are closely spaced, the disc 43 touching the ridges 38 of the corrugations. This relationship between the disc 43 and plane portion 35 acts as a spreader and evens the flow of liquid from the upper tank to the distributor plate. By way of example, this spacing may be 0.0020 of an inch.

The disc or base member 43 is provided with a series of transverse bores 50 which permits communication between the interior of the upper tank or reservoir and the space designated as 51 between the top of the distributor plate and

the bottom of the reservoir. Base wall 25 of container 26 is provided with a series of transverse holes 60 positioned axially immediately below the apex point of each V cut 38, as indicated at 61.

Adapted to extend between the top 3 and bottom 2 are spaced-apart parallel threads or strings designated generally as 80. The threads are of identical form and may be of braided nylon. The number of parallel threads will depend upon the diameter of the display device. Pairs of threads are joined together and straddle each corrugation, as shown in FIG. 6 at 81. Thus, each two lengths of thread are looped, as shown in FIG. 6, the loop being of V form, and each thread length is received in notches of adjoining corrugations to space the lengths of thread. As stated, this provides two thread lengths 83 and 84 and the ends of said threads are anchored to plate 12. The pair of thread lengths 83 and 84 are passed through two of the spaced holes 60 in the base 25 of the top container 26 and the loop end is attached to one end of a coil spring 85, the opposite end of the coil spring being hooked to a ring 86 surrounding the bolt 33. The ring 86 is positioned above the top plate 40 of the upper tank or reservoir and the coil spring extends from the ring downwardly at an angle, see FIG. 3. The ends of the thread of the lengths 83 and 84 are passed through annular spaced holes 90 in plate 10 and are passed through holes 91 in plate 12 and tied to downwardly extending spurs or tongues 92 punched from the plate 12, as shown in FIG. 12. It is intended that the loop of threads should be maintained in a low tension by low tension springs 85. Thus, each low tension spring will maintain a low tension in two lengths 83 and 84 of threads 80.

The posts 4 may be tubular in form and each post is passed through and secured to the top and bottom members in the manner shown in FIG. 1 wherein each post is passed through the flange 24 so as to have communication with the interior of the top member and likewise passed through the flange 8 for communication with the interior of the bowl of the lower member.

An electric motor-driven pump is indicated at 100 and the intake of said pump is within the well or sump portion of the lower tank 5. The outlet from the pump is connected to a tube 101 which is freely passed through one of the posts 4 such as indicated in FIG. 1 at 102 in such a manner as to leave an annular space 103 between the tube and the interior of the post, as shown in FIG. 3. The tube passes within the top member and directly communicates through the sidewall 41 with the interior of the upper tank or reservoir, as shown in FIG. 3. A suitable electric conducting wire is provided for the motor for connection with an electrical outlet as shown in FIG. 1. Thus, in the form of the invention just described, the lower tank is filled with liquid to a certain level, as indicated in FIG. 1 so as to immerse both the motor and the pump therein, the liquid being indicated at 104. This liquid is preferably a mineral or hydraulic oil of low viscosity and when the motor is in operation and liquid is within the lower tank, the liquid is pumped upwardly through the feed tube to the upper reservoir or tank. A back pressure is built up in the liquid and the liquid is forced evenly by this back pressure through the orifices or holes 50 where it is directed into space 51 for even distribution into the corrugations. It has been found that the flow of liquid is very even and the liquid is directed onto each length of string or thread 80 where it appears in droplet form, the droplets being substantially equally spaced apart, the droplets following the thread to the bottom member where the droplets pass through the holes 90 of plate 10, thence through holes 91 of plate 12 for return to the lower tank. The action is, therefore, continuous, and the flow of liquid from the pump to the upper reservoir or tank is controlled by a valve 110 as shown in FIG. 9.

In FIGS. 8, 13, and 14, a modification of the structure of FIG. 1 is shown. This modification is to the type of device for distributing or directing liquid onto the distributor plate. Thus, while in FIGS. 1, 2, 3 and 5, an upper tank is utilized, in FIGS. 13 and 14 an endless tubular ring 120 is employed. The outlet end of the feed tube 101 communicates with the interior of the ring 120. The ring in turn which is horizontally positioned, is provided with spaced holes 121 on the side of the ring which faces the distributor plate, as shown in FIGS. 13 and 14. When the pump is in operation the liquid is directed through the feed tube 101 into the ring and builds up a pressure therein which causes even flow of the liquid through the holes 121, the liquid then falling upon the top surface of the distributor plate and particularly at the root end of the corrugations, as shown in FIG. 13. It has been found that this construction feeds the liquid evenly to the distributor plate to perform the functions intended by the device.

The display device, when in operation, with lights playing upon the same produces a novel effect in that the droplets pick up the light rays and glisten, while travelling equally spaced apart and flowing downwardly of the strings at a slow rate depending upon the opening of the valve 110 and the viscosity of the liquid. It is important to point out that the liquid is fed either to the upper tank or reservoir or through the openings of the ring type tube 120 at such a rate that there is no jet action of the liquid through the holes. Jet action is not desirable in a display device of this character and will not be found to result in the practice of this invention. As stated, a low viscosity of liquid is desirable. With the present device, the distributor plate feeds liquid to each thread and droplets are instantaneously formed on the thread. The color of the liquid may be varied from transparent to gold or any other color to give different effects when the droplets are lighted or when they are spotlighted. Any overflow of liquid in the top tank is directed into the space 103 between the post 4 and the feed tube back to the lower reservoir or tank. It will be noted in this regard that the openings or holes in the plate 25 are drawn or flared upwardly to direct any overflow liquid to the space 103. It will be noted that the threads 80 may be separated so as to permit access within the cage formed by the parallel threads as the threads are tensioned by the springs 85. The distributor plate method utilized in the invention is far superior to any jet method from a cost standpoint and spring loading of the threads is simple without complicated attachments. Further, the droplets immediately form when touching the threads.

I claim:

1. A display device, including: vertically separated top and bottom members, the bottom member having a liquid tank and the top member having a circular tube provided with ports, means for directing liquid from the bottom tank to the circular tube, a distributor plate provided with radial corrugations below the circular tube for receiving liquid passed through the circular tube ports, a series of spaced apart vertical threads secured at their lower ends to the bottom member and tension means securing the threads to the top member, said threads at the top member engaging the valleys of the corrugations in the distributor plate.

2. In a display device, a top member and a bottom member, spaced apart and in alignment support posts interposed between the top member and the bottom member, said bottom member provided with a tank for holding a liquid, the top member provided with a tank and means for directing liquid from the tank of the lower member to the tank in the upper member, a series of spaced apart vertical threads extending between the top member and the bottom member and a distributor plate for receiving liquid from the upper tank and directing the liquid into contact with said threads, said liquid forming spaced-apart droplets on the thread for travel downwardly of said threads into the tank of the lower member, said distributor plate having a central plane portion and radial corrugations extending from said portion to the rim of the plate, the threads lying in the valleys of said corrugations adjacent the plate rim.

3. The device of claim 2, and means for tensioning each thread between the top and bottom members.

4. In a display device, a top member and and a bottom member, spaced apart in alignement, support posts interposed between the top member and the bottom member, said bot-

tom member provided with a tank for holding a liquid, the top member provided with a tank and means for directing liquid from the tank of the lower member to the tank in the upper member, a series of spaced apart vertical threads extending between the top member and the bottom member and a distributor plate for receiving liquid from the upper tank and directing the liquid into contact with said threads, said liquid forming spaced apart droplets on the thread for travel downwardly of said threads into the tank of the lower member, each pair of threads being looped at the upper ends thereof and coiled spring tensioning means secured to the loops for tensioning each pair of threads between the top and bottom members.