United States Patent

Rosenberg

[15] **3,678,891**

[45] **July 25, 1972**

[54] COATING APPARATUS

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[21] Appl. No.: **2,212**

[52] **U.S. Cl.** **118/402**

[51] **Int. Cl.** **B05c 3/04**

[58] **Field of Search** ..... 117/39; 118/402, 403; 35/19 R

[56] **References Cited**

UNITED STATES PATENTS

2,053,494	9/1936	Pirie et al.	117/39
2,140,498	12/1938	Dreyer	117/39

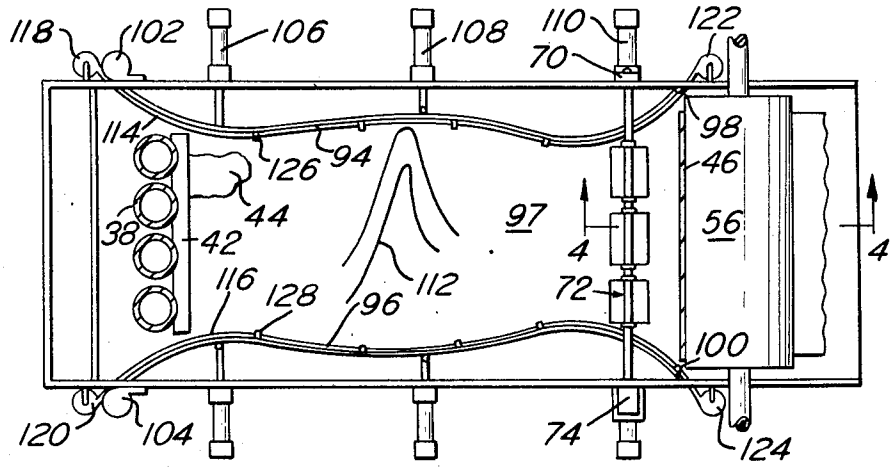
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[57] **ABSTRACT**

The apparatus comprises a tank for retaining a pool of supporting liquid, a dispensing device associated with the tank for placing pigmented material on the surface of the pool, a roller for conveying a substrate to be coated into surface contact with the pool to lift the pigmented material from the pool, and selectively operable manipulating devices arranged to provide a desired pattern on the pigmented material of the pool. Manipulating devices comprise wave-generators, undulating tank side walls, and devices for accelerating and decelerating the substrate, each providing a characteristic visual effect in the finished product.

11 Claims, 6 Drawing Figures



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2 Sheets-Sheet 1

FIG. 1

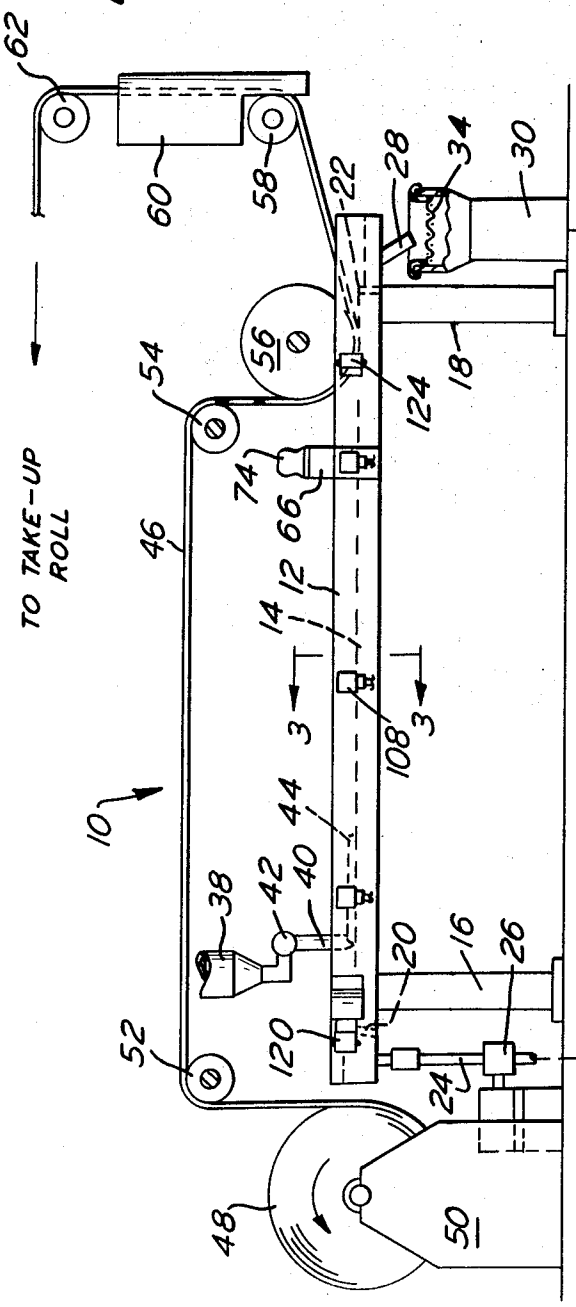


FIG. 3

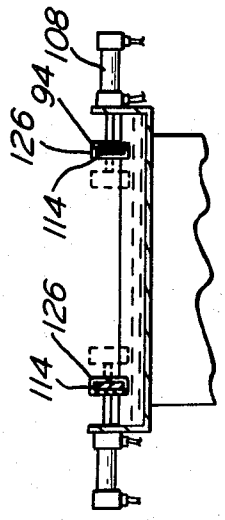
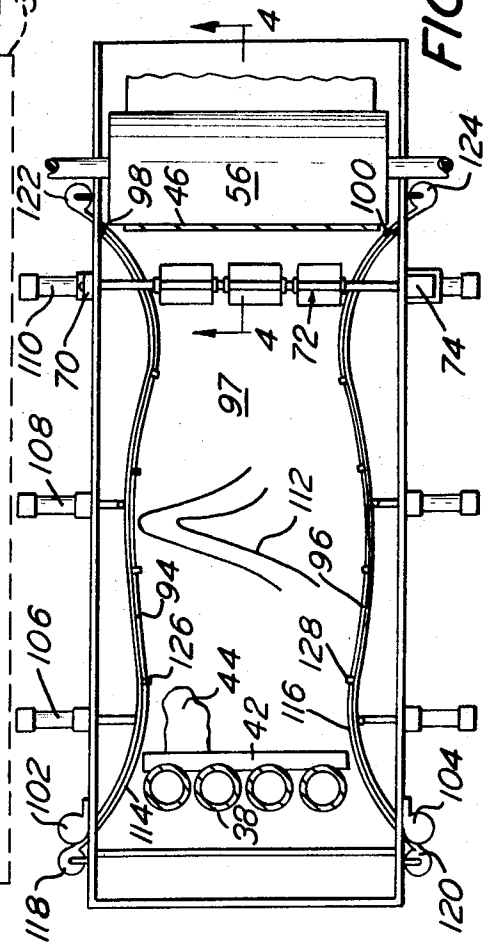


FIG. 2



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FIG. 4

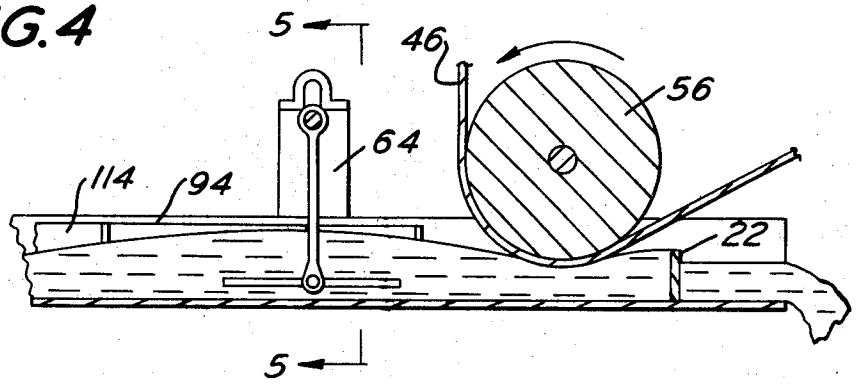


FIG. 5

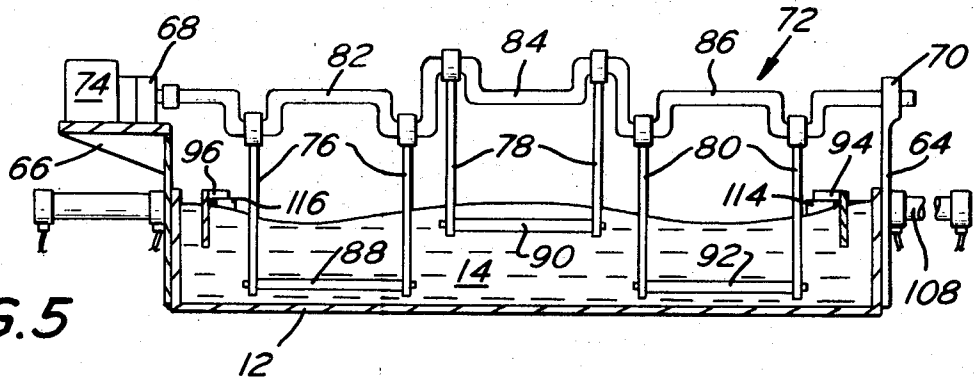
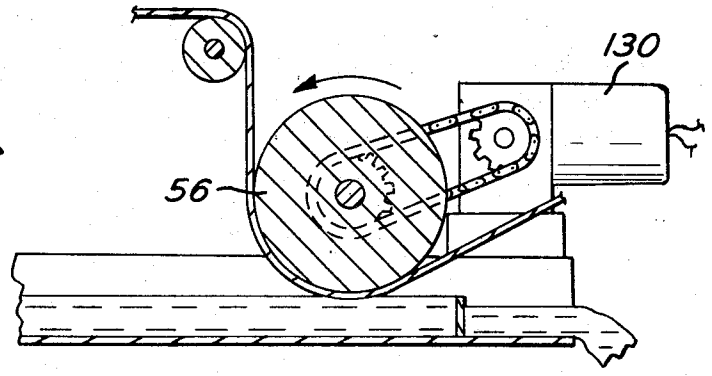


FIG. 6



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COATING APPARATUS

This invention relates to apparatus for applying decorative coloring effects to substrates. More particularly, this invention relates to apparatus wherein pigmented material floating on a body of supporting liquid is applied to a substrate to obtain desired, predictable decorative effects.

"Substrate" as used herein is primarily intended to mean any sheet or web-like material capable of bearing a surface design. The herein disclosed apparatus is believed to have the greatest utility when used in connection with flexible substrates, such as woven and non-woven fabrics, paper, and sheet plastic polymeric materials.

Decorative pigment patterns have heretofore been applied to flexible substrates using the techniques of floatation of the coloring material prior to the application of such material to the substrate.

In accordance with the present invention, apparatus is disclosed wherein the coloring material may be selectively manipulated to provide one of several desired predetermined decorative effects, or a combination of such effects.

In view of the foregoing, it is an object of this invention to provide apparatus for applying decorative coloring effects to substrates.

It is another object to provide apparatus wherein pigmented material may be applied to a substrate to obtain a repetitive characteristic pattern.

It is another object to provide an apparatus whereby pigmented material may be applied to a substrate on a continuous basis.

Other objects will appear hereinafter.

The foregoing and other objects are realized by an apparatus including a tank for retaining a pool of support liquid, a dispenser associated with the tank for placing pigmented material on the surface of the pool, a roller for conveying a substrate to be coated into surface contact with the pool to lift the pigmented material from the pool, and a plurality of selectively operable manipulating devices for altering the configuration of the pigmented material on the pool. One manipulating device comprises a wave-generator for creating a controlled wave pattern within the tank. The film of pigmented material on the surface of the pool contacts the roller in a characteristic pattern determined by the wave pattern. Thus, the manipulated film, when transferred to the substrate, provides a characteristic mottled pattern wherein the film contains "skips" or voids.

Another manipulating device comprises inwardly and outwardly movable side wall members. Periodic movement of such wall members causes movement of the support liquid laterally with respect to the pool, and causes a characteristic "shear" pattern in the pigmented material.

Another manipulating device is a variable speed drive for the roller by means of which the substrate is conveyed into contact with the surface of the pool. Variation in the speed of the roller, if the coating material is relatively wet and pliable when adjacent the roller, results in a characteristic gradual variation in the color density in the direction of movement of the substrate, which may be termed for convenience a "rolling wave" effect. If the coating material is well set when adjacent the roller, variation in the roller speed causes cracks, rips and voids in the film, thus producing yet another characteristic effect. Manipulation of the roller in the above-described manner is one step of a method in accordance with this invention.

For the purpose of illustrating the invention, there is shown in the drawings a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIG. 1 is a side elevation view of the apparatus in accordance with the invention;

FIG. 2 is a top plan view of a portion of the apparatus in FIG. 1;

FIG. 3 is a cross-sectional view taken along the line 3—3 in FIG. 1;

FIG. 4 is a partial cross-sectional view taken along the line 4—4 in FIG. 2;

FIG. 5 is a cross-sectional view taken along the line 5—5 in FIG. 4;

FIG. 6 is a partial cross-sectional view, in side elevation, showing a portion of the apparatus.

Referring now to the drawings in detail, wherein like numerals indicate like elements, there is seen in FIG. 1 an apparatus designated generally by the numeral 10.

The apparatus 10 includes a tank 12 for retaining a body 14 of support liquid. The tank 12 may be supported by legs 16, 18 or the like in a conventional manner.

Support liquid 14 is introduced into the tank 12 through a conduit 24 associated with a pump 26. The support liquid 14 flows over the baffle or weir 20 along a major portion of the length of the tank 12 and then over the baffle or weir 22. The support liquid 14 exits the tank 12 through a conduit 28, and falls into a sump 30. From the sump 30, the support liquid 14 may be recycled through a recycle conduit 32, shown diagrammatically, to the pump 26.

A strainer 34 or the like may be provided in the sump 30 to filter the support liquid 14 prior to recycle.

Associated with the tank 12 is a dispenser 42 for retaining a quantity of the pigmented coated material for application to the surface of the body of support liquid 14. The dispenser 42 may take any suitable form. For example, the dispenser 36 may include one or more hoppers 38 for retaining coated material of a given color, and dispensing nozzles, such as the nozzle 40 in FIG. 1, for applying the material to the surface of the support liquid 14.

The nozzles 40 may be arranged to apply the coating material, designated by the reference numeral 44, to the surface of the support liquid 14 in continuous or intermittent stripes; as a continuous film; or as amorthous bodies. The coating material 44 floats on the support liquid 14, and advances with the support liquid 14 along the length of the tank 12.

The coating material 44 is removed from the surface of the support liquid 14 onto a continuous substrate 46. A feed roll 48 of the substrate material is supported on a stand 50. Guide rollers 52, 54 support the substrate 46, and conducted to a pick-up roll 56. The substrate 46 passes around the roller periphery of the pick-up roll 56, preferably in tangent-line or surface contact with the support liquid 14.

The substrate 46 then passes over a further guide roller 58, through a drying chamber 60, and yet another guide roller 62. The substrate 46 may then be conveyed to a take-up roll, not shown.

As the substrate 46 passes around the pick-up roll 56, it comes into contact with the coating material 44 on the surface of the support liquid 14. The coating material 44 adheres to the substrate 46, and is drawn by it from the surface of the support liquid 14. Upon passing through the drying chamber 60, excess support liquid which may cling to the substrate 46 is removed.

In accordance with the present invention, the coating material 44 is manipulated while on the support liquid 14 and during pick-up to produce desired decorative effects.

Referring to FIGS. 4 and 5, there is seen a wave-generating apparatus used to produce a characteristic mottled effect wherein the film of the coating material 44 transferred to the substrate 56 contains periodic "skips" or voids. Coupled to opposite sides of the tank 12 are upstanding brackets 64 and 66. The brackets 64, 66 provide journals 68, 70 for receiving respective ends of a crankshaft 72. A motor 74 is coupled to one end of the crankshaft 72, and serves to rotate the shaft.

Pairs of links 76, 78 and 80 are pivotably coupled to respective throws 82, 84 and 86 of the crankshaft 72. The links 76, 78 and 80 are coupled to agitator plates 88, 90 and 92, respectively, immersed in the support liquid 14.

Rotation of the shaft 72 thus causes periodic oscillation of the agitator plates 88, 90 and 92, and consequently, establishes in the support liquid 14 a characteristic rhythmic wave pattern.

The presence of a wave crest or trough adjacent any given area of the substrate 46 passing beneath the pick-up roll 56

determines whether coating material is applied to that area. Coating material **44** is transferred from the crests, but not the troughs.

Best seen in FIGS. **2** and **3** is yet another means whereby coating material on the support liquid **14** is manipulated to provide a desired characteristic pattern.

Affixed to opposite side walls of the tank **12** are selectively movable flexible wall-forming members **94** and **96**. The wall-forming members **94** and **96** are spaced from the fixed side walls of the tank **12**, and traverse the surface of the support liquid **14**. Respective opposite ends of the wall-forming members **94** and **96** may be anchored to the sides of the tank **12**, as at the anchorage points **98** and **100**, or associated with self-retracting torsional spring members **102** and **104** affixed to the tank **12**. Operators, such as fluid motors **106**, **108** and **110** are associated with the wall-forming members **94** and **96**.

The wall-forming members **94** and **96** affect the disposition of coating material **44** on the support liquid **14** in two respects. In the first place, the fluid motors **106**, **108**, and **110** can be actuated to give to the wall-forming members **94** and **96** a configuration wherein they define a constriction **97** in the effective width of the tank **12**. Thus, coating material **44**, in passing the constriction, is "squeezed" together to form a more dense color field. Moreover, if the coating material is slightly dry when passing the constriction, the presence of the constriction causes local doubling and perhaps cracking of the paint film, which lends to the film a characteristic appearance when transferred to the substrate **56**. In addition, the fluid motors **106**, **108** and **110** can be operated sequentially by any well known control means to provide a rapid bellows-like movement of the wall-forming members **94** and **96** in a direction transverse to the width of the tank **12**. The coating material **44**, it has been found, tends to follow the movement of the wall-forming members **94** and **96** during retraction of the fluid motors. Thus, movement of the wall-forming members **94** and **96** can be used to accelerate the coating material **44** in a direction transverse to the direction of the support liquid **14**. The result of such transverse movement of the coating material is a characteristic color gradation or striation extending transversely with respect to the principal direction of movement of the coating material **44**. An example of such striation is designated by the reference numeral **112** in FIG. **2**.

Movable tapes **114** and **116** are disposed on juxtaposed faces of the wall-forming members **94** and **96**, where such members are apt to contact the coating material **44**. The tapes **114** and **116** may be drawn from storage rolls **118**, **120**, across the faces of the wall-forming members **94** and **96**, to motor-driven take-up rolls **122**, **124**. Guides **126** and **128** on the faces of the wall-forming members **94** and **96** maintain the tapes **114** and **116** in conformity with such faces.

The tapes **114** and **116** are preferably drawn at a speed approximating the speed of movement of the support liquid **114** in the tank **12**. When thus moved, the tapes **114** and **116** prevent an undesirable eddying or tearing of the film of coating material **44** at its edges. These undesirable effects occur, it has been found, where the moving coloring material contacts a fixed boundary, such as the wall of the tank **12**.

Referring now to FIG. **6**, yet another technique for obtaining a desired decorative effect is illustrated.

The pick-up roll **56**, previously described, is driven by a motor **130** providing a selectively variable shaft speed. Variation of the speed of the motor **130** causes a corresponding variation in the speed of the pick-up roll **56**, and consequently, the speed of the substrate **46**. Acceleration and deceleration of the substrate **46** with respect to the support liquid **14** and coating material **44**, it has been found, causes a variation in color density of the coating material **44** on the substrate **46**. Thus, a momentary increase in speed of the substrate **56** causes an instantaneous stretching of the film of coating material **44** at the instant of pick-up, thus reducing the color density in a characteristic line extending across the width of the substrate **46** in a direction parallel to the axis of rotation of the pick-up roll **56**. The effect of momentary deceleration of the substrate **56** is precisely opposite. It has been found that the acceleration of the substrate **56** can be made sufficiently rapid, if desired, to produce actual discontinuities in the film of coating material **44** applied to the substrate **56**. Those skilled in the art will understand that the above-described techniques for producing desired patterns in the coating material **44** transferred to the substrate **56** are not mutually exclusive. Rather, the various techniques can be used together in concert to provide unitary cumulative effects not obtainable using any one technique. The individual techniques can, however, be used individually to produce their individual characteristic effect, if desired.

The use of a roller, such as the pick-up roll **56**, to remove a film of coating material from a support liquid and place it on a substrate, is not per se, novel. For example such a technique was disclosed in U.S. Pat. No. 1,930,036. The above-described technique of accelerating and decelerating the pick-up roll **56** to produce the desired decorative effects constitutes, however, a novel process whereby the effects can be obtained on a predictable basis.

The coating material **44** referred to herein can be any suitable paint, ink or other pigmented material. For example, the foregoing techniques have been used successfully with a vinyl paint comprising the vinyl concentrate (Vinyl resin and aromatic solvents) sold under the trademark SERASCREEN by Alfa Ink & Chemical Company, and suitable diluents. One formulation comprised 250 ml. red vinyl concentrate, 100 ml. vinyl thinner comprising two-thirds high flash naptha and one-third isophorene. The support liquid **14** may be water.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof.

I claim:

1. Apparatus comprising a tank for retaining a pool of support liquid, means associated with said tank for maintaining said support liquid in flowing condition in said tank, means associated with said tank for placing a quantity of pigmented coating material on the surface of the support liquid, a pick-up roll associated with said tank for guiding a substrate into surface contact with said support liquid to transfer the coating material to the substrate, means associated with said tank for manipulating the coating material to produce a desired decorative effect on the substrate including apparatus for generating a wave pattern in said tank, said last-mentioned means including at least one movable side wall member disposed in said tank, and means coupled to said wall member for selectively moving said wall member laterally inwardly with respect to a fixed side wall of said tank in a direction generally transverse with respect to the direction of flow of the support liquid in said tank.

2. Apparatus in accordance with claim **1** wherein said movable side wall member is flexible, and said side wall member moving means being a motor means connected to said movable side wall member for moving a portion of the side wall member in a transverse direction to change the width of the flow path for the support liquid in the tank.

3. Apparatus in accordance with claim **2** including a tape movable along said side wall member in a position for contact with the support liquid, and means connected to the tape for moving the tape at a speed approximating the speed of movement of the support liquid.

4. Apparatus in accordance with claim **1**, and a movable wall member associated with each sidewall of said tank, said means coupled to each of said movable wall members causing said movable wall members to move inwardly toward each other.

5. Apparatus in accordance with claim **4**, and flexible web means coupled to said movable wall members and movable with respect thereto in a direction generally parallel to the direction of flow of the support liquid in said tank, and means coupled to said web means for moving said web means with respect to said movable wall members.

6. Apparatus in accordance with claim **5**, wherein said apparatus includes variable speed drive means coupled to said pick-up roll so that variations in the rotative speed of said pick-up roll produce variations in the color density of the coating material transferred to the substrate.

7. Apparatus in accordance with claim **1**, wherein said apparatus for generating a wave pattern in said tank comprises a crankshaft disposed above said tank, and at least one agitator plate normally disposed in said support liquid and pivotably coupled to said crankshaft.

8. Apparatus in accordance with claim **1**, wherein said apparatus includes variable speed drive means coupled to said pick-up roll so that variations in the rotative speed of said pick-up roll produce variations in the color density of the coating material transferred to the substrate.

9. In apparatus comprising a tank for retaining a support liquid, means associated with the tank for maintaining the support liquid in flowing condition in the tank, means associated with the tank for placing a quantity of pigmented coating material on the surface of the support liquid, and means associated with the tank for transferring the coating material from the support liquid to a substrate, means associated with the tank for manipulating the coating material on the support liquid to produce a desired decorative effect, said manipulating means comprising at least one movable side wall member disposed in said tank and having means coupled thereto for selectively moving said wall member laterally inwardly with respect to the sides of said tank in a direction generally transverse with respect to the direction of flow of the support liquid in the tank.

10. In apparatus in accordance with claim **9**, a movable wall member associated with each side wall of said tank and having means coupled thereto for selectively moving it laterally inwardly with respect to a side of said tank, said means coupled to said movable wall members causing said wall members to move inwardly toward each other.

11. In apparatus in accordance with claim **10**, flexible web means coupled to said movable wall members and movable with respect thereto in a direction generally parallel to the direction of flow of the support liquid in said tank, and means coupled to said web means for moving said web means.

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