

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 808 248 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:

28.10.1998 Bulletin 1998/44

(21) Application number: **96906264.5**

(22) Date of filing: **06.02.1996**

(51) Int. Cl.⁶: **B41F 35/00**

(86) International application number:
PCT/US96/01393

(87) International publication number:
WO 96/24492 (15.08.1996 Gazette 1996/37)

(54) OSCILLATOR SCREEN CLEANING APPARATUS

SCHABLONENREINIGUNGSVORRICHTUNG MIT HIN- UND HER-BEWEGUNGSEINRICHTUNG

APPAREIL DE NETTOYAGE DE TRAME D'IMPRESSION A OSCILLATEUR

(84) Designated Contracting States:
**AT BE CH DE DK ES FR GB GR IE IT LI LU MC NL
PT SE**

(30) Priority: **07.02.1995 US 384737**
24.10.1995 US 547654

(43) Date of publication of application:
26.11.1997 Bulletin 1997/48

(73) Proprietor:
**INTERCONTINENTAL CHEMICAL
CORPORATION**
Cincinnati, OH 45232 (US)

(72) Inventors:
• **CORD, Albert, B.**
Cincinnati, OH 45249 (US)
• **CORD, Cameron, W.**
Cincinnati, OH 45249 (US)

• **GEHRICH, David, N.**
St. Paul, IN 47272 (US)
• **JENSEN, Gregory, N.**
Westchester, OH 45069 (US)

(74) Representative:
Findlay, Alice Rosemary
Lloyd Wise, Tregear & Co.,
Commonwealth House,
1-19 New Oxford Street
London WC1A 1LW (GB)

(56) References cited:
EP-A- 0 057 966 **WO-A-90/05065**
WO-A-91/15370 **DE-A- 3 017 180**
US-A- 3 580 261

• **PATENT ABSTRACTS OF JAPAN vol. 7, no. 246**
(M-253) [1391], 2 November 1983 & JP,A,58
132562 (FUJI XEROX K.K.), 6 August 1983,
• **ECS Perfecta 's' XP002006526**

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 0 808 248 B1

Description

This invention relates generally to screen printing and specifically to apparatuses and methods for cleaning printing ink and other materials from printing screens and frames used in screen printing.

Screen printing, also known as serigraphics, is the process of transferring an image to a substrate by the use of a printing screen through which ink is squeezed. The ink is then deposited in all places on the substrate except where the screen has been processed by a photographically applied image depicting the places where ink is not to be forced through the screen mesh. The imaged screen mesh is normally made of silk, plastic or metal and is held in place by a screen frame made of wood, plastic or metal. The ink contains pigment or dye in an appropriate vehicle.

Screen cleaning requires the removal of all ink residue from the screen and frame when the printing is completed. Methods currently utilized to clean printing screens involve spraying the screen with pressurized solvent from a nozzle or gun structure. Many spraying techniques, however, result in overspray which directs solvent where it is not desired thereby wasting solvent and increasing the costs and inefficiency of the procedure. Additionally, spray cleaning methods usually require the use of paid workers thus raising the costs of cleaning and also exposing the workers to the solvent and solvent fumes.

Several attempts have been made to develop a cleaning procedure and apparatus which eliminates the various drawbacks of the above-mentioned procedures. For example, U. S. Patent No. 3,580,261 discloses a printing screen cleaner which utilizes two vertically oriented lines of nozzles which oppose each other inside a cleaning enclosure. A screen is passed on a conveyor belt through the opposing nozzle lines whereupon it is sprayed with pressurized solvent. While eliminating several of the drawbacks of the above-discussed existing methods, the cleaner has other drawbacks which prevent the efficient and effective cleaning of a printing screen. Specifically, it utilizes only two opposing lines of spray nozzles within the enclosure and, therefore, each area of the screen is sprayed only once as the screen passes through the opposing nozzle lines. The screen is generally not adequately cleaned when the cleaning cycle has been completed and, therefore, the screen must be taken and passed through the cleaner additional times for additional cleaning cycles until it is sufficiently clean. As may be appreciated, such a task is time consuming and costly, and requires continuous worker supervision of the cleaning machine. For example, the work involves handling the screen by insertion into the machine, removal and manual brush agitation, then reinsertion, to insure adequate cleaning. Therefore, the cleaner disclosed in the '261 patent is not very efficient or cost effective.

JP-A-58-132562 relates to a screen plate cleaning

device comprising an upper cover and lower cover held against opposite sides of the screen. Solvent is emitted from nozzles above the screen within the upper cover.

WO-A-91/15370 relates to a device for cleaning screens in which solvent is sprayed onto both sides of the screen within a hermetically sealed container. WO-A-90/05065 discloses a device for cleaning photopolymer printing plates.

The screen washing apparatus of U. S. Patent No. 3,656,493 utilizes an enclosure and a single spray nozzle which is directed over the screen by a control mechanism to spray a predetermined pattern. Specifically, the nozzle sweeps horizontally in one direction across the screen to an end position and is then ratcheted down a few rows of the screen whereupon it sweeps in the opposite direction to an opposite end position and is ratcheted down to begin the process again. The nozzle continuously sweeps and ratchets until it reaches a bottom position which is pre-set by an operator. The screen is swept only once by the nozzle and if any portions remain dirty, the operator must remove the nozzle and manually spray the screen. Furthermore, the single nozzle only sprays a small area of the screen at any given time. Again, such a screen washing apparatus is neither efficient nor cost effective because the cleaning process has to be monitored to ensure that the single sweep was sufficient to remove the printing ink and the screen must be manually sprayed if the single sweep was not sufficient. Furthermore, the gun is controlled with manual pre-sets which must be adapted to spray a particular screen size, and insertion of a different size screen into the washing apparatus requires additional programming of the spray pattern of the device, thus further reducing the efficiency and cost effectiveness of the apparatus. Additionally, the operator is exposed to solvent fumes whenever it is necessary to manually direct the gun to completely clean the screen.

The screen cleaning apparatus of U. S. Patent No. 4,420,004 utilizes a single row of adjacent nozzles which moves horizontally with respect to a screen to spray the screen and remove the printing ink as well as the stencil or print pattern. The single row of spray nozzles requires a continuous back and forth sweeping motion of the nozzle row which must be repeated until the screen is adequately cleaned. Since there is only a single line of nozzles, only a small area of the screen is sprayed at any one time leaving the remaining area unsprayed until the nozzle line again passes over that area. This increases the time that is required to adequately clean the screen because when one small area of the screen is being sprayed, the remaining area of the screen is dormant. As a result, the cleaning cycle of the apparatus in the '004 patent is inefficient and, therefore, not cost effective.

DE-A-3017180 also describes a screen cleaning apparatus which includes a single vertical row of nozzles. The nozzles are movable parallel to the plane of the screen.

There is still a need in that art for screen cleaning apparatuses which are versatile, reliable and low-cost, and which provide superior cleaning without taking up a large amount of valuable floor space. Various currently available screen cleaning apparatuses utilize a variety of different integrated systems which must be operably coupled together for proper screen cleaning. Such apparatuses also utilize numerous adjustable or movable parts or elements that must be constantly maintained or replaced. The various separate systems coupled together for cleaning, as well as the various movable parts increases the overall manufacturing and operating costs of the cleaning apparatus.

For example, existing apparatuses include elements or sections which must be constantly adjusted to wash screens of different sizes. While the apparatuses will wash short screens and tall screens or narrow screens and wide screens, they must constantly be adapted for each different screen size. As may be appreciated, the necessity of adjusting the apparatuses for different size screens requires manual attention, and therefore, increases labor and operating costs. Additionally, the various adjustable mechanisms associated with such systems are more expensive to manufacture thus increasing the manufacturing costs in addition to the increased operating costs.

Furthermore, the different integrated systems of the cleaning apparatuses include coupling and connecting points and associated seals which are often subject to wear and failure. For example, the various fluid lines, valves, pumps and seals interconnected between the liquid supply and the cleaning chamber may present potential points of leakage. In addition to the mess and waste associated with such leakage, the leakage may also pose environmental concerns. The maintenance or replacement of the various separate system components further increases the overall costs associated with each cleaning apparatus. Still further, the various separate and integrated systems increase the overall size of the cleaning apparatus and take up valuable floor space.

Cleaning liquid or solvent waste is also a problem with some currently available systems because the screens and the frames often retain a certain amount of solvent when removed from the cleaning apparatus. Such excess solvent usually drips off of or is shaken from the screens and falls to the floor to be discarded or to evaporate. Therefore, solvent is constantly being removed from the system and must be periodically replenished at an increased cost to the operator of the apparatus. The operator is also exposed to the excess solvent.

Accordingly, and in view of the above background, there is a need for a screen cleaning apparatus which is versatile, durable, reliable and which may be manufactured and subsequently used at a relatively low cost. Specifically, it is desirable to provide a screen cleaning apparatus that does not have to be repeatedly custom-

ized for different size screens. Furthermore, it is desirable for such a screen cleaning apparatus to utilize a minimum number of physically separated systems which must be operably coupled to the apparatus to thereby reduce the number of connection points and possible leaking or failure points in the system. It would also be highly desirable to reduce the necessary maintenance of the system while maintaining the desirable cleaning aspects. There is a further need in the art to reduce the overall size of the screen cleaning apparatus to efficiently utilize valuable floor space. There is still a further need in the art to reduce waste associated with excess cleaning solvent which clings to the screen and frame and is discarded when it is removed from the cleaning apparatus.

The present invention is directed at an apparatus for cleaning a screen with a sprayed cleaning liquid comprising a housing forming a cleaning chamber for receiving a screen, a plurality of spray nozzles positioned inside the cleaning chamber to spray, with cleaning liquid said screen within the chamber, and a supply reservoir coupled to the plurality of spray nozzles for supplying cleaning liquid to the spray nozzles. According to the invention, the apparatus comprises an oscillating mechanism to move said screen in an oscillating motion within the cleaning chamber in front of the spray nozzles to clean said screen, and the plurality of spray nozzles comprises a grid pattern of horizontally and vertically spaced-apart nozzles, whereby the oscillating movement and plurality of spray nozzles yields repeated and increased screen coverage by the spray cleaning liquid for improved cleaning and removal of undesired contaminants from said screen.

The apparatus is operable to remove undesired printing inks and other contaminants from the screen and surrounding frame in a single cleaning cycle. As the screen is oscillated, the entire screen area can be constantly sprayed with solvent. Preferably, the opposing grids of spray nozzles are operable to deliver sprayed cleaning solvent to a screen at a rate, for example, of about 225 to about 815 litres (60 to 215 gallons) per minute, depending on the machine size, to effectively clean the screen.

The invention is also directed at a method for cleaning a screen with a sprayed cleaning liquid, comprising placing a screen within a cleaning chamber proximate a plurality of spray nozzles positioned inside the chamber. In accordance with the invention, the method comprises supplying cleaning liquid to a grid pattern of horizontally and vertically spaced apart spray nozzles to spray the screen and remove contaminants therefrom, and moving the screen in an oscillating motion proximate the grid pattern of spray nozzles whereby to increase the coverage of the sprayed cleaning liquid over the screen for improved cleaning and removal of undesired contaminants therefrom.

The reservoir may be positioned beneath the pluralities of spray nozzles to catch used cleaning liquid

which falls from the screen, and a pump may be coupled between the reservoir and the nozzles to pump the used cleaning solvent to the nozzles to thereby recycle the solvent. The high recirculation of the cleaning solvent provided by the pump keeps the ink particles suspended in the solvent to prevent the reservoir from becoming clogged with ink sludge which would reduce its effectiveness. In addition, a reservoir which is kept clean requires less maintenance. Preferably, a filter is coupled between the pump and the spray nozzles to remove filterable particles from the recycled cleaning fluid. The supply reservoir which holds the recycled cleaning solvent may also be connectable to a decantation drum which receives used solvent from the reservoir and holds the solvent for settling of the suspended contaminants and subsequent decanting of the cleaning solvent for re-use. The cleaning apparatus is enclosed in a housing to prevent the cleaning solvent and solvent fumes from entering the atmosphere or area adjacent the cleaning apparatus. Further, a vapour recovery system may be coupled to the housing to remove vaporized cleaning solvent.

In one embodiment of the present invention, the oscillating mechanism moves the screen in an oscillating motion having a period of motion in the range of about 8 to about 51cm (3 to 20 inches), and preferably around 25cm (10 inches). The mechanism operates to move the screen in a complete cycle of the oscillating motion (i.e., forward and then backward) approximately 20 times per minute. The continuous oscillation of the screen in combination with the opposing grids of spray nozzles provides repeated application of the spray pattern onto the screen for excellent cleaning coverage. Furthermore, during the entire cleaning cycle of the oscillator screen cleaning apparatus of the present invention, each area of the screen is continually being sprayed resulting in a faster more efficient cleaning cycle which does not have to be continually repeated as required with other known screen cleaning apparatuses. The embodiment of the present invention thus provides rapid cleaning of ink and other printing materials from a printing screen and surrounding frame with the attainment of very clean screens and screen frames.

Another embodiment of the oscillator screen cleaning apparatus of the present invention also utilizes two opposing pluralities of spray nozzles wherein the individual nozzles of each plurality are arranged in opposing grid patterns at horizontally and vertically spaced-apart nozzle positions. The screen is oscillated back and forth between the opposing nozzle pluralities preferably in approximately 20 to 25 cm (8-10 inch) periods or ranges of motions and the grid patterns provide increased screen coverage with the sprayed cleaning liquid or solvent. As the screen is oscillated, the entire screen area is constantly being sprayed with solvent. The opposing grids of spray nozzles of the embodiment are operable to deliver sprayed cleaning solvent to a

screen at a rate, for example, of about 225 to about 815 litres (about 60 to about 215 gallons) per minute, depending on the machine size, to effectively clean the screen.

For guiding screens of various heights, opposing pluralities of fixed guide brackets are mounted to the pluralities of spray nozzles to provide guidance to the screen as it is oscillated. The opposing guide brackets define a narrow path therebetween and also between the spray nozzles for passage of the screen. The guide brackets maintain the screens generally perpendicular to the spray patterns or streams from the nozzles for effective cleaning. The brackets are mounted at an angle to the spray nozzles so as not to interfere with the spray from the nozzles. In accordance with the principles of the present invention, the guide brackets support the screen from the side and thereby do not restrict the screen from the top frame edge. Versatility is increased because screens of various different sizes may be readily sprayed with the apparatus without constantly customizing the cleaning chamber. Since the brackets are essentially fixed, an assembly of various moving parts is not necessary, thus reducing manufacturing costs and the labor costs associated with adapting the apparatus for different screen sizes. The fixed brackets are also more durable, requiring very little or no maintenance or repair.

A reservoir is positioned proximate the spray nozzles and is integrated with the cleaning chamber to hold the cleaning liquid which is sprayed on the screen. The reservoir also holds recaptured cleaning liquid falling from the screen. Particularly, the integral reservoir includes a sloping wall or tray positioned directly beneath the spray nozzles and oscillating screen to catch the used cleaning liquid which drips therefrom. The integral sloping wall directs the used liquid into the reservoir and eliminates the need to pump recaptured liquid from a separate tank. The integral reservoir thus reduces necessary piping and leakage associated with the piping.

A vertically-oriented pump is coupled between the reservoir and the nozzles and pumps the cleaning solvent to the nozzles to thereby constantly cycle and recycle the solvent. A portion of the pump is mounted inside of the reservoir such that the cleaning liquid is pumped directly from the reservoir to the spray nozzles. The internal pump of the invention reduces the number of exposed fluid lines, valves and seals which, in turn, prevents leaks associated with failure of one of the lines, valves or seals. Additionally, the internal pump prevents any leaks which may occur as a result of a failure of the pump seal. Liquid from a line, valve or seal leakage is directed back into the reservoir.

The pump is preferably a higher capacity pump, and the high recirculation of the cleaning solvent provided by the pump keeps the ink particles suspended in the solvent to prevent the reservoir from becoming clogged with ink sludge which would reduce its effec-

tiveness and increase required maintenance. A filter coupled between the pump and the spray nozzles removes filterable particles from the recycled cleaning fluid. A dump valve in the line between the pump and spray nozzles provides drainage of the system into the reservoir. The supply reservoir which holds the recycled cleaning solvent may also be connected to a decantation drum which receives used solvent from the reservoir and holds the solvent for settling of the suspended contaminants and subsequent decanting of the cleaning solvent for re-use. The cleaning apparatus is enclosed in a housing to prevent the cleaning solvent and solvent fumes from entering the atmosphere or area adjacent the cleaning apparatus. Further, a vapor recovery system is coupled to the housing to remove vaporized cleaning solvent and to control odor associated with the cleaning procedure.

The oscillating mechanism moves the screen in an oscillating motion having a period of motion in the range of about 8 to about 51 cm (about 3 to about 20 inches), and preferably around 20-25 cm (8-10 inches). The mechanism operates to move the screen in a complete cycle of the oscillating motion approximately 20 times per minute. The continuous oscillation of the screen in combination with the opposing grids of spray nozzles and the guidance of the screens by the guide brackets generally perpendicular to the nozzles provides repeated application of the spray pattern onto the screen for excellent cleaning coverage. Furthermore, during the entire cleaning cycle of the oscillator screen cleaning apparatus of the present invention, each area of the screen is continually being directly sprayed resulting in a faster more efficient cleaning period which does not have to be continually repeated as required with other known screen cleaning apparatuses.

As may be appreciated, the screen is sprayed repeatedly during a cleaning period using the present invention and when the period has ended, the screen and any associated frame member will contain a significant amount of excess cleaning fluid. One embodiment of the invention further comprises a wipe down booth positioned proximate an open end of the enclosed housing. A screen is manually transferred to the wipe down booth after it is cleaned and excess cleaning liquid is removed, such as by a cloth or a squeegee. The wipe down booth is configured to capture the excess cleaning liquid from the screen. The wipe down booth includes a sloped floor and is operably coupled to the enclosed housing such that any excess cleaning liquid removed from the screen is directed into the housing and subsequently into the reservoir. In that way, excess cleaning liquid is not wasted when the screen is removed from the enclosed cleaning chamber. The advantages of the apparatus include a high impingement spraying system to improve ink removal; full screen and frame cleaning through oscillating motion; a low maintenance integral reservoir tank to contain and recapture the cleaning liquid; a vertical pump contained

within the integral reservoir to further contain the cleaning liquid and prevent leaks and spills; high volume/low maintenance filter system to reduce nozzle maintenance; quick drain system to empty risers of product which decreases cycle time (no need to wait for nozzles to stop spraying); air curtain venting system to reduce operator exposure to fumes; fixed guide brackets for guiding various differently sized screens without requiring constant adaptation; and a wipe down booth which captures excess cleaning liquid after the screen is cleaned and directs the excess liquid to the reservoir and adjustable stop guide for varying screen sizes.

Two embodiments of the invention will now be described by way of example and with reference to the accompanying drawings wherein:

Fig. 1 is a side view, in partial cross-section, of an embodiment of the oscillator screen cleaning apparatus of the present invention.

Fig. 2 is an end view of the embodiment of the present invention shown in Fig. 1 taken along lines 2-2 of Fig. 1.

Fig. 3 is a side view in partial cross section of another embodiment of an oscillator screen cleaning apparatus in accordance with the principles of the present invention.

Fig. 4 is a cross-sectional view of the embodiment shown in Fig. 3 along lines 4-4 of Fig. 3.

Fig. 5 is a perspective view of a wipe down booth of the embodiment shown in Fig. 3.

Fig. 6 is a cross-sectional view along lines 6-6 of Fig. 4 to illustrate the oscillating mechanism of the embodiment of Fig. 3.

One embodiment of the oscillator screen cleaning apparatus 10 of the present invention as illustrated in Fig. 1 includes an enclosed housing 12 which forms a cleaning chamber 14 therein for receiving a printing screen 16 (See Fig. 2). Housing 12 is preferably formed of fourteen gauge stainless steel and is supported above a floor surface by legs 17. A plurality of spray nozzles 18 are connected, via a supply line 20, to a reservoir 22 containing an amount of cleaning solvent or cleaning liquid 24. Suitable cleaning compositions are disclosed in U.S. Patent No. 4,664,721, and components of those compositions may also be used as cleaning liquids.

The cleaning solvent 24 is pumped from reservoir 22 by pump 23 through line 20 to nozzles 18 which spray the screen 16 with solvent to remove printing inks or dyes from the screen 16 so that the screen may be re-used.

While screen 16 is being sprayed, an oscillating mechanism 25 moves screen 16 back and forth within chamber 14 in front of the spray nozzles 18 to more effectively and more efficiently clean the screen. Oscillating mechanism 25 comprises a push-pull device 26, which is connected to a movable track 28 which holds

and supports screen 16 at a bottom edge 19 of the screen (See Fig. 2). The push-pull device 26 is mounted on a support platform 27 which extends from the rear end 21 of housing 12, and push-pull device 26 includes an actuable plunger 29 which extends in a longitudinal direction with respect to housing 12. The plunger 29 of push-pull device 26 is coupled to track 28, and when the push-pull device 26 is actuated, the plunger slides the track 28 and screen 16 lengthwise back and forth inside housing 12 in an oscillating motion. The oscillating movement provided by oscillating mechanism 26 ensures that the plurality of spray nozzles 18 repeatedly cover all areas of the screen 16 with sprayed cleaning solvent 24.

Preferably, and as discussed in greater detail below, the plurality of nozzles 18 are arranged in two separate grid patterns one on each side of the cleaning chamber 14 to spray both sides of screen 16 simultaneously. This provides improved cleaning and removal of undesired printing inks and other contaminants from the screen 16. The floor 32 of housing 12 is sloped to form a funnel-shaped surface so that used sprayed cleaning solution or solvent, which drips from the sprayed screen 16, falls against floor 32 and is drained into reservoir 22 through a drain opening 33. The collected solvent may then be pumped again back through line 20 and nozzles 18 to be resprayed against screen 16. In this way, the cleaning solvent 24 is re-used repeatedly rather than wasted, thus resulting in substantial cost savings. The high capacity spray capability of the present invention ensures effective cleaning of screen 16 with the reused spray as will be discussed in greater detail below.

To clean a printing screen 16, the screen is placed into housing 12 and cleaning chamber 14 through an access opening 34 formed in one end of housing 12. Access opening 34 is covered by a hinged door 36 or some similar closure to completely seal the cleaning chamber 14 within housing 12. A drip pan 37 extends outwardly from the front end 39 of housing 12 beneath access opening 34 to catch cleaning solvent which drips from the screen 16 when it is removed from the cleaning chamber 14 after it has been sprayed and cleaned. This prevents cleaning solution or solvent 24 from being spilled on the floor surface and entering the environment. Inside the cleaning chamber 14, the bottom edge 19 of screen 16 is placed onto a movable track 28 which is moved back and forth or oscillated by push-pull device 26 of the oscillating mechanism 25. Track 28 moves within a larger channel 38 and specifically slides lengthwise in channel 38. Channel 38 is mounted longitudinally within housing 12 to support track 28 and screen 16 above the sloped floor 32 of housing 12. A layer 43 of a low friction material, such as ultra high molecular density polyethylene (UHMDPE) is inserted between track 28 and channel 38 to ensure smooth movement and oscillation of track 28 within channel 38. As shown in Fig. 2, a top edge 35 of screen 16 engages a guide channel 40 which is suspended from a top wall

41 of the housing 12. The guide channel 40 ensures that the screen 16 is held generally vertically between the opposing grids of spray nozzles 18 for more effective cleaning of the screen. Guide channel 40 also preferably includes a layer 45 of the low friction UHMDPE to ensure smooth movement of screen edge 39 along the guide channel 40.

The oscillating mechanism 25 moves track 28 within channel 38 and oscillates screen 16 back and forth in front of the opposing grids of spray nozzles 18. As mentioned, the oscillating mechanism 25 includes a push-pull device 26 such as a pneumatically operated solenoid. Other mechanically oscillating devices might also be utilized in place of push-pull device 26. The device 26 is shown on the outside of the body 47, but also may be mounted on the inside. The plunger 29 of the push-pull device 26 moves longitudinally in a straight direction inside a body 47 of the push-pull device 26 when the device is actuated, such as by pressurized air. The plunger 29 is coupled through a coupling fixture 48 to an arm 49 which is fixed at one end to track 28. Arm 49 extends into housing 12 through a liquid seal 50 which guides arm 49 to ensure a smooth, straight and generally longitudinal movement of arm 49 and track 28 inside the cleaning chamber 14. The liquid seal 50 protects from loss of cleaning liquid through hole in housing 12. When the push-pull mechanism 26 is actuated, plunger 29 moves back and forth thereby pulling and pushing track 28 and oscillating screen 16 between the spray nozzles 18.

Generally, push-pull device 26 of the present invention and arm 49 should be dimensioned to provide a range or period of motion of from about 8 to about 51 cm (about 3" to about 20") and preferably around 25 cm (10"). That is, it has been determined that movement of screen 16 in a cycle of approximately 25 cm (10") in a forward motion and then 25 cm (10") in a rearward motion in accordance with the principles of the present invention provides excellent cleaning. However, greater or lesser periods of motion might be utilized. Further, it has been determined that an oscillator frequency of approximately 20 cycles per minute for the oscillating mechanism 25 of the present invention is a sufficient oscillating motion to provide an efficient and effective screen cleaning. A single cycle of the oscillating mechanism 26 involves moving the track 28 the full range or period of the motion, e.g., 25 cm (10"), and then back again. Of course, a faster or slower oscillation frequency may be utilized as appropriate to sufficiently clean screen 16.

The oscillator screen cleaning mechanism of the present invention will now be described in greater detail with respect to its operation and the delivery of the sprayed cleaning solution or solvent 24 to the screen 16. Specifically, a cleaning liquid or cleaning solvent 24 is placed in reservoir 22 which may be made of stainless steel and preferably has a capacity of, for example around 208 litres (55 gallons), depending upon the size

of the machine. A suitable cleaning solvent for cleaning printing screen 16 in accordance with the teachings of the present invention is disclosed in U.S. Patent No. 4,664,721. However, the oscillator screen washing apparatus 10 of the present invention is not limited to the use of a particular solvent, and other appropriate solvents might be placed within reservoir 22.

When the oscillator screen cleaning apparatus 10 is actuated, the solvent is pumped through the supply line 20 by pump 23. Pump 23 is preferably a high capacity pump, to deliver, for example, about 225 to about 815 litres (about 60 to about 215 gallons) per minute, depending on machine size as stated above. A short section 54 of supply line 20 connects reservoir 22 and pump 23 and includes manual valves 55 and 56 which may be closed to prohibit solvent 24 from exiting reservoir 22 or draining back from pump 23, respectively, such as when it is desirable to remove reservoir 22 for maintenance.

When valves 55, 56 are open, the pump 23 pumps solvent 24 through line section 54 and up through a filter line section 58 into a filter unit 59. Filter unit 59 removes foreign particles and contaminants within the cleaning solvent 24 in line 20 before the solvent 24 is delivered to the spray nozzles 18. A suitable filter for such a purpose is the 50 micron bag filter which removes different materials such as tape, mesh, adhesive, dry ink and stencil particles. Filter unit 59 allows the solvent 24 to be continually re-used to spray screen 16. As mentioned above, the re-use of the solvent 24 amounts to a substantial cost savings, because the used solvent may be collected and filtered rather than continually replaced with new solvent. After the solvent is filtered, it is directed through line 20 to the spray nozzles 18. A valve 60 is connected in the supply line 20 and may be closed to prevent liquid 24 in line 20 from back flowing into filter 59 during filter maintenance.

The supply line 20 branches at a point along its length, such as point 61, to direct cleaning solvent to the spray nozzles 18 on both sides of the cleaning chamber. Specifically, as shown in Fig. 2, the solvent is directed into supply branches 64, 66 located proximate the top of the cleaning chamber 14. The branches 64, 66, in turn, feed into pluralities of vertically extending finger lines 68, 70, respectively, which are coupled to their respective supply branches 64, 66 and extend generally vertically from the top of the cleaning chamber 14 to the bottom of the cleaning chamber. Referring now to Fig. 2, branch 64 feeds the first plurality of finger lines 68 while branch 66 feeds a second plurality of finger lines 70. Each vertical finger line contains a plurality of spray nozzles 18 arranged in a generally straight vertical line thereon. The nozzles 18 are vertically spaced apart along the lengths of each finger line. The individual finger lines of the pluralities 68, 70 are horizontally spaced apart one from the other and extend generally parallel with each other from their respective supply branches. The finger lines of each plurality 68, 70 are also gener-

ally co-planar with each other such that each plurality of finger lines 68, 70 defines a spraying plane of nozzles 18 as illustrated in Fig. 2. The spraying planes of nozzles 18 are generally vertically oriented and are parallel the side walls, such as side walls 72, 73, of the housing 12. The combination of the horizontally spaced apart finger lines 68, 70 and the vertically spaced apart nozzles 18 creates opposing grids of spray nozzles 18 within cleaning chamber 14. The opposing grids of spray nozzles ensures that, while screen 16 is oscillated within the cleaning chamber 14, the entire screen area is constantly being sprayed with cleaning solvent 24 to effectively and efficiently clean the screen.

Referring again to Fig. 2, each nozzle 18 forms a generally V-shaped flat spray pattern 75 on screen 16. Cleaning solvent impingement created by nozzles helps remove ink and dye residue. The flat spray pattern 75 is vertically oriented so that the horizontal oscillating motion provided by oscillating mechanism 25 moves the screen 16 perpendicular to the flat spray pattern of each nozzle 18. The nozzles 18 of each finger line, such as finger line 74, are spaced along the finger line 74 to provide pattern overlap of the spray patterns. For example, nozzles 76 and 77 of finger line 74 provide flat spray patterns 78, 79, respectively. The nozzles 76, 77 are spaced such that their spray patterns overlap at area 80. The overlapping spray patterns ensure complete coverage of screen 16 with the sprayed solvent. A nozzle suitable for use within the present invention yields a spray pattern approximately ten inches wide.

The oscillator screen cleaning apparatus of the present invention is capable of delivering a high quantity of sprayed cleaning solvent to screen 16 during a cleaning cycle. Specifically, the spraying system of the present invention, including high capacity pump 23 and the opposing grids of spray nozzles 18, is operable to deliver sprayed cleaning solvent to the screen 16 at a rate in the range of about 225 to about 815 litres (about 60 to about 215 gallons) per minute. The high solvent delivery rate and the continual coverage over the area of the screen in combination with the oscillating screen motion of the present invention yields a very efficient cleaning cycle.

As discussed above, the cleaning solvent 24 is continually filtered and re-used within the oscillator screen cleaning apparatus of the present invention. Specifically, the cleaning solvent 24 sprayed onto screen 16 by nozzles 18 drips from the screen and falls onto the sloped floor 32 of housing 12 where it is directed through drain opening 33 back into reservoir 22. The used solvent is again pumped through line 20 and filter unit 59 to be directed to the grids of spray nozzles 18. As discussed, continual re-use of the cleaning solvent yields substantial cost savings and the high spray capacity and suspension of ink particles within the solvent ensures that the re-used cleaning solvent effectively cleans screen 16.

After several cleaning cycles, the used solvent

within reservoir 24 may need to be recycled. To do so, the used solvent may be transferred to a decantation tank either manually or through a line and pump coupled to the reservoir 22. Referring now to Fig. 1, in one embodiment of the present invention, decantation tank 82 is coupled to reservoir 22 through line 84 and pump 86. The used cleaning solvent is pumped into the decantation tank 82 wherein the ink and other contaminant particles which are suspended in the solvent are allowed to settle. The decanted solvent may then be removed from tank 82 and transferred back into reservoir 22 for additional use within the oscillator screen cleaning apparatus 10.

The spraying system of the oscillator screen cleaning apparatus 10 of the present invention is configured to be quickly drained when desired such as for decantation and recycling of the cleaning solvent 24. Specifically, referring to Fig. 1, each finger line of the finger line pluralities 68, 70 terminates in a respective draining branch 90, 92. The draining branches 90, 92 extend generally parallel to the respective supply branches 64, 66, respectively, and receive any solvent which is not sprayed through the nozzles 18. The draining branches 90, 92 beneath the cleaning chamber 14 converge at point 94 and are connected through a dump valve 96 into reservoir 22. When the dump valve 96 is actuated, either manually or pneumatically, the entire system including supply branches 64, 66 and finger lines 68, 70, is drained of cleaning fluid in approximately 5 seconds. This provides rapid draining of fingers to decrease cycle time and to reduce vapors in chamber.

Housing 12 completely encloses the finger lines 68, 70 and spray nozzles 18 to ensure that all of the cleaning solvent 24 is contained within cleaning chamber 14 and that little or none of the solvent escapes into the atmosphere or the environment around the oscillator screen cleaning apparatus 10. This provides a safer, healthier environment for personal working near the cleaning apparatus 10. Further, the housing 12 has a flue 98 formed in the top thereof which is coupled to a vapor recovery system 100 through an opening 102 in flue 98. The vapor recovery system ensures that vaporized solvent from cleaning chamber 14 does not escape into the atmosphere to be breathed in by workers, thereby further creating a more healthy work environment. A removable cover 104 on the top wall 41 of housing 12 allows access to the cleaning chamber 14 from above.

Figs. 3, 4, 5 and 6 illustrate another embodiment of an oscillator screen cleaning apparatus. The oscillator screen cleaning apparatus 110 of the present invention as illustrated in Fig. 3 includes an enclosed housing 112 which forms a cleaning chamber 114 therein for receiving a printing screen 116 (see Fig. 4.) Housing 112 is supported above the floor surface by a skid 117. Skid 117 provides easy mobility of the cleaning apparatus 110. A plurality of spray nozzles 118 are connected via a supply line 120 to a reservoir 122 containing an

amount of cleaning solvent or cleaning liquid 124. Suitable cleaning compositions are disclosed and discussed hereinabove. The cleaning liquid 124 is pumped from the reservoir 122 to the supply line 120 and the nozzles 118 by a vertically oriented pump 123. Pump 123 includes an intake end 125 which is operably coupled to a motor 127 for drawing liquid through the intake end 125 and pumping it to the nozzles 118 to be sprayed therefrom.

In accordance with the principles of the invention, an oscillating mechanism 128 is coupled to the chamber 114 for moving screen 116 back and forth within the chamber in front of the spray nozzles 118 to more effectively and efficiently clean the screen (see Fig. 6). Referring to Fig. 6, the oscillating mechanism 128 comprises a push-pull device 130, such as a pneumatically operated cylinder, which is connected to a movable track 132 that supports the screen 116 at a bottom edge thereof. The push-pull device 130 is mounted to a support structure 133 which extends below the spray nozzles 118 in chamber 114. Push-pull device 130 includes an actuatable plunger 134 which is coupled to a tang 135 which depends downwardly from track 132. When the push-pull device 130 is actuated, plunger 134 moves back and forth and slides the track 132 lengthwise inside the cleaning chamber 114 in an oscillating motion. An appropriate slot 137 is formed in the support structure 133 to achieve movement of the tang 135 on track 132. Preferably, opening 137 is dimensioned to allow an oscillating stroke or period of approximately 20-25 cm (8-10 inches). As discussed above, the oscillating movement of the screen insures that the plurality of spray nozzles 118 repeatedly cover all areas of the screen 116 with sprayed cleaning liquid 124.

Referring to Fig. 3, the plurality of nozzles 118 are preferably arranged in two separate grid patterns, one on each side of the cleaning chamber 114, to spray both sides of the screen 116 simultaneously. The cleaning liquid 124 is pumped by pump 123 through the supply line 120 and through a filter 138 before it is sent through the nozzles 118. The filter is preferably a 50 micron bag filter which removes different materials such as tape, mesh, adhesive, dry ink and stencil particles to allow the cleaning liquid to be continually reused in the invention.

To capture the sprayed cleaning liquid for reuse, the reservoir 122 includes an integrally formed sloping wall 140 which is positioned below cleaning chamber 114 to capture the sprayed cleaning liquid which drips from the screen and subsequently direct the captured liquid into reservoir 122. As illustrated in Fig. 3, the housing 112 integrally forms both the reservoir 124, the cleaning chamber 114 and the sloping wall 140. In that way, the entire system is enclosed to prevent loss of cleaning liquid and further to control fumes and odors and to reduce exposure of an operator to the cleaning liquid. Any fumes in cleaning chamber 114 are directed through an outlet 142 which is preferably coupled to a

vapor recovery system 145 or other venting system. A top opening 147 covered by lid 149 provides access to the cleaning chamber, such as for maintenance.

In accordance with the principles of the present invention, the cleaning liquid is contained so that it may be reused and the prevention of cleaning liquid loss amounts to a cost savings for the operator of the invention. The integration of the reservoir tank 122 with the cleaning chamber 114 eliminates the need for a separate reservoir tank which must then be coupled to pump 123 through various supply lines, valves and seals which are subject to failure and leakage. Therefore, the integral reservoir 122 and chamber 114 of the present invention eliminates leakage and waste associated with the various valves and seals.

Additional linkage and waste is reduced by the vertically oriented pump 123 which is mounted inside of the reservoir 122. The internal pump having its intake end 125 positioned in the reservoir 122 eliminates the need for an external pump and thereby generally eliminates any leakage from the system associated with the failure of a pump seal or other pump components. Any leakage from the pump will be contained within the reservoir 122 until the pump or seal can be repaired. The combination of the integrally formed reservoir 122 and vertically oriented pump 123 reduces cleaning liquid loss from the system, amounting to a cost savings and further preventing operator exposure and the mess associated with such leakage. The invention also reduces labor costs associated with containing and cleaning a spill or leak.

To clean a printing screen 116 in apparatus 110, the screen is placed in the housing 112 and cleaning chamber 114 through an access opening 146 covered by a door 148 or a similar closure to completely seal the cleaning chamber 114. The cleaned screen is also removed through the access opening 146. A drip pan 150 extends outwardly from the housing beneath the access opening 146 to catch cleaning liquid which drips from the screen 116 when it is removed from the cleaning chamber 114 after it has been sprayed and cleaned. Furthermore, the drip pan 150 provides coupling to a wipe down booth 152 which further captures excess cleaning liquid from the screen and directs it to the reservoir 122 as described further hereinbelow.

The screen is positioned on movable track 132 to be oscillated back and forth by the oscillating mechanism 128 (see Fig. 6). Referring to Fig. 4, the movable track 132 moves or oscillates within a larger channel 154 and specifically slides lengthwise within the channel 154. Various strips of low friction material 156 such as Teflon[®] are positioned between the channel 154 and movable track 132 at the sides and beneath the track 132 to insure movement and oscillation of the track. The oscillating mechanism preferably moves the screen at approximately 20 cycles per minute to provide efficient and effective screen cleaning. A cycle comprising full movement of the screen in one direction and then back,

i.e., 25 cm (10") forward and then 25 cm (10") back.

The oscillating mechanism 128, pump motor 127 and a dump valve 169 for draining the system are preferably coupled to appropriate electrical controls and air controls. The controls are preferably be positioned above or adjacent to reservoir 122 as illustrated in phantom in Fig. 3 by an electrical control cabinet 158 and air control cabinet 160. When the oscillator screen apparatus 110 is actuated at the beginning of a cleaning cycle, the solvent 124 is pumped by pump 123 through the supply line 120. Pump 123 is preferably a high capacity pump to deliver, about 225-815 litres (about 60-215 gallons) per minute depending upon the requirements for the screens being cleaned. The supply line branches at point 162 to provide fluid to various riser lines or finger lines 164 which support the nozzles 118 to form opposing spray nozzle grids. The pumped fluid is directed up the riser lines 164 and through the nozzles 118 to spray both sides of the screen 116 as illustrated in Fig. 4 by the spray patterns 166. The spray patterns 166 are preferably vertically oriented and overlap vertically one with the other to provide complete coverage of screen 166. The nozzles 118 are preferably maintained generally co-planar in vertical planes within each grid by the riser lines 164. In that way, spraying planes are defined by the nozzle grids and the spray planes coincide generally in the center of the cleaning chamber 114 where the screen passes (See Fig. 4). As the screen 116 is oscillated between the spraying grids, the entire screen area is constantly sprayed with cleaning liquid 124 to effectively and efficiently clean the screen.

For effective cleaning, the screen is preferably guided between the nozzle grids generally parallel to the grids and perpendicular to the spray patterns 166. The oscillator screen cleaning apparatus 110 readily accepts screens which have different sizes. While the screen 116 is oscillated by the contact of its bottom edge with track 132, the top edge 168 of screen 116 is not engaged or otherwise restricted. In that way, screens with various heights and widths may be cleaned without constantly adapting the apparatus 110. In accordance with the principles of the invention, adjustably fixed guide brackets 170 are mounted to the various riser lines 164 of the spray nozzle grids. Referring the Fig. 4, each bracket 170 is preferably U-shaped and extends vertically with the riser lines 164 at an angle thereto (See Fig. 3). For example, guide bracket 170a extends at an angle between riser line 164a and riser line 164b. The brackets are angled between the riser lines 164 so as to not interfere with the spray from spray nozzles 118. The guide brackets 170 engage the sides of the screen 166 to guide it and maintain it in an upright position. Preferably, pairs of guide brackets 170 are mounted between the opposing spray nozzle grids as illustrated in Fig. 4 to cooperate and confine the screen 116 between the nozzles in a plane generally parallel with the planes of the nozzle grids. The fixed

guide brackets 170 extend between each riser line 164 and thus maintain the screen in an upright vertical position while being oscillated in the cleaning chamber 114. Thereby, the screen 116 is maintained in a proper position for cleaning without restricting the screen upper edge 168. The adjustably fixed guide brackets 170 eliminate the need for constantly adjusting a guide mechanism to customize the cleaning apparatus 110 for screens of different heights and/or widths. As will be appreciated, the guide brackets 170 of the invention reduce the cost of manufacturing the apparatus because they eliminate specially fabricated adjustable parts which are subject to wear and subsequent replacement. Furthermore, labor costs are reduced because an operator is not required to adjust the guide brackets 170 every time a different sized screen is being cleaned. Furthermore, the oscillating screen cleaning apparatus 110 utilizing guide brackets 170 is more durable and eliminates maintenance normally required with an adjustable screen guiding assembly.

Referring again to Fig. 4, the ends of the U-shaped guide brackets 170 are preferably threaded and are held to the riser lines 164 by nut pairs 172 which fit on a threaded portion 173 at the end of each guide bracket 170. In that way, the fixed guide brackets 170 may be adjusted inwardly or outwardly as necessary with respect to the spray nozzle grids for handling screens with different widths. It is anticipated that such adjustment will not often be necessary but is available in accordance with the principles of the present invention to adapt the apparatus to wash unusually wide screens.

Referring again to Fig. 4, each nozzle 118 forms a generally V-shaped flat spray pattern 166 which is vertically oriented so that the horizontal oscillating motion provided by oscillating mechanism 128 moves a screen 116 perpendicular to the flat spray pattern. The nozzles 118 are spaced along each riser line 164 to preferably provide pattern overlap of the spray patterns 166 for a full spray coverage of the screens. A suitable spray nozzle 118 would produce a spray pattern of approximately 25 cm (10 inches) wide. The cleaning solvent 124 is continually filtered and re-used within the oscillator screen cleaning apparatus 110. Specifically, a major portion of the cleaning liquid 124 sprayed onto screen 116 will drip from the screen 116 and fall onto the sloped wall 140 to be directed back into reservoir 122. While most of the liquid will drip from the screen in the cleaning chamber 114, the screen and any frame utilized therewith will usually retain a certain amount of liquid. It will be appreciated, that the surface tension of the liquid often fills the small squares of a screen and is held therein. The liquid is removed or evaporates from the screen when it is taken from the cleaning apparatus 110 and is irretrievably lost from the system thereby increasing frequency at which the cleaning fluid must be replenished and increasing the cost of operation. The present invention utilizes a wipe down booth 152 to capture and recirculate residual cleaning liquid from the

screen 116 after it is removed from the cleaning chamber 114.

Referring to Fig. 5, the wipedown booth 152 comprises a back wall 176, a side wall 177, and a sloping floor 178. The top 179 of booth 152 is open as is the side 180 closest to the cleaning apparatus 110 and the front 182 of the booth. The front 182 of booth 152 includes a short wall 184, preferably 7.6 cm (3 inches), high, which contains fluid runoff from a screen placed in the wipedown booth. The sloped floor 178 feeds to a drainage lip 186 which couples to the drip pan 150. Floor 178 slopes in the direction of the cleaning apparatus 110, and therefore any accumulated liquid flows down floor 178 to lip 166 and into drip pan 150 and subsequently to the sloping wall 140 where it is drained into reservoir 122. Booth 152 is supported on legs 188 which may be appropriately adjusted as necessary to change the height of the booth and to couple the lip 186 and drip pan 150 together for proper liquid flow.

When screen 116 is removed from the cleaning apparatus 110 through opening 146, it is immediately slid into the wipedown booth 152. Therein, the excess cleaning liquid and any residue are wiped off of the screen, such as with a squeegee, and the excess liquid drains to the reservoir 122 as previously described. The screen 116 can then be wiped off and dried, such as with a cloth. The side wall 177, back wall 176 and short front wall 184 ensure that the excess liquid is contained and appropriately drained back into the cleaning apparatus 110 and the reservoir 122. In that way, excess cleaning fluid is not wasted, resulting in greater cost saving to the operator. Furthermore, with less wasted liquid, the reservoir 122 does not have to be refilled as often.

The spray system of the oscillator screen cleaning apparatus 110 is configured to be quickly drained, such as for decantation and recycling of the cleaning liquid 124. To that end, a dump valve 169 is coupled in the supply line 120 between filter 138 and the spray nozzles 118. When the dump valve 169 is actuated, either manually or pneumatically, the entire system, including the liquid and supply line 120 and the riser lines 164 are drained directly into the reservoir 122.

Claims

1. Apparatus (10, 110) for cleaning a screen (16, 116) with a sprayed cleaning liquid comprising a housing (12, 112) forming a cleaning chamber (14, 114) for receiving a screen (16, 116) a plurality of spray nozzles (18, 118) positioned inside the cleaning chamber (14, 114) to spray, with cleaning liquid, said screen within the chamber, a supply reservoir (22, 122) coupled to the plurality of spray nozzles (18, 118) for supplying cleaning liquid to the spray nozzles, and a mechanism (25, 128) for moving said screen (16, 116) within the cleaning chamber (14, 114) in front of the spray nozzles (18, 118) to clean

said screen, characterised in that the mechanism (25, 128) is an oscillating mechanism for moving said screen (16, 116) in an oscillating motion and the plurality of spray nozzles comprises a grid pattern of horizontally and vertically spaced-apart nozzles, whereby the oscillating movement and grid pattern plurality of spray nozzles (18, 118) yields repeated and increased screen coverage by the spray cleaning liquid for improved cleaning and removal of undesired contaminants from said screen.

2. Apparatus (10, 110) as claimed in Claim 1 wherein the plurality of spray nozzles (18, 118) comprises another grid pattern of horizontally and vertically spaced-apart spray nozzles to oppose the other grid pattern of spray nozzles, the nozzles of one grid pattern being operable to spray in a direction opposite the nozzles of the other grid pattern, and the oscillating mechanism (25, 128) being operable to move said screen (16, 116) between the opposing grid patterns of spray nozzles for further improved cleaning of the screen.
3. Apparatus (110) as claimed in either Claim 1 or Claim 2 comprising a pump (123) coupled to the reservoir (122) to supply cleaning liquid to the spray nozzles (118), a portion of the pump being positioned inside the reservoir for reduced leakage during screen cleaning.
4. Apparatus (10, 110) as claimed in Claim 1 or Claim 2 wherein the reservoir (22, 122) is positioned below the height of the spray nozzles (18, 118) to catch used cleaning liquid which falls from said screen (16, 116) when said screen is sprayed, the apparatus comprising a pump (23, 123) coupled to the reservoir to supply used cleaning liquid to the spray nozzles thereby recycling the cleaning liquid.
5. Apparatus (10, 110) as claimed in Claim 3 or Claim 4 wherein the pump (23, 123) and the spray nozzles (18, 118) are operable to deliver sprayed cleaning liquid to said screen (16, 116) at a rate in the range of about 225 to about 815 litres (60 to 215 gallons) per minute to more effectively clean said screen and to suspend contaminants within the cleaning liquid for further effective cleaning of said screen.
6. Apparatus (10) as claimed in Claim 4 or Claim 5 as appendant to Claim 4 comprising a decanting reservoir (82) coupled to the supply reservoir (22) to receive used cleaning liquid from the supply reservoir and hold the used cleaning liquid to settle suspended contaminants for subsequent decanting.
7. Apparatus (10, 110) as claimed in any one of Claim

4, Claim 5 as appendant to Claim 4 or Claim 6 comprising a filter (59, 138) coupled between the pump (23, 123) and the spray nozzles (18, 118) to remove filterable particles from used cleaning fluid before the fluid is sprayed onto said screen (16, 116).

8. Apparatus (10, 110) as claimed in any preceding claim wherein the supply reservoir (22, 122) is coupled to the cleaning chamber (14, 114) to catch used cleaning liquid which falls from said screen (16, 116) when the screen is sprayed, thereby recycling the cleaning liquid.
9. Apparatus (10, 110) as claimed in Claim 8 wherein the supply reservoir (22, 122) includes a sloped wall (32, 140) for catching used cleaning liquid beneath said screen (16, 116) and directing said liquid to an accumulation area in the reservoir.
10. Apparatus (110) as claimed in any preceding claim comprising guide brackets (170) mounted in the housing (112) for engaging and guiding said screen (116) during oscillation, the guide brackets operable to engage a side of said screen and leave a top edge (168) of said screen unrestricted such that screens of different heights may be cleaned while the brackets remain fixed, whereby screens (116) of different heights are readily washed in the apparatus (110) without attention to manual adjustments to the apparatus by an operator thereby resulting in cost savings.
11. Apparatus (110) as claimed in Claim 10 wherein the nozzles (118) are positioned on either side of the chamber (114) to spray the screen from opposing sides, the brackets (170) extending into the chamber between the nozzles to guide said screen generally perpendicular to spray cleaning liquid from the nozzles.
12. Apparatus (110) as claimed in Claim 11 wherein the brackets (170) are positioned as cooperating pairs of brackets, one on either side of the chamber (114), a space being formed between the brackets for passage of said screen (116).
13. Apparatus (110) as claimed in Claim 12 wherein the brackets (170) are adjustable horizontally to be moved away from each other to widen the space therebetween for accommodating screens (116) of different widths.
14. Apparatus (10) as claimed in any of Claims 1 to 10 wherein the oscillating mechanism (25) includes a moving track (28) to hold one edge (19) of said screen (16) and move said screen in the oscillating motion and a guide track (40) to receive another edge (35) of said screen (16) and hold said screen

in a position to be sprayed by the spray nozzles (18) while said screen is oscillating.

15. Apparatus (10, 110) as claimed in any preceding claim wherein the oscillating mechanism (25, 128) moves the screen (16, 116) in an oscillating motion having a period of motion in the range of about 8 to about 51 cm (3 inches to 20 inches). 5
16. Apparatus (10, 110) as claimed in any preceding claim wherein the cleaning liquid is a solvent. 10
17. Apparatus (10, 110) as claimed in any preceding claim wherein the housing (12, 112) completely encloses the cleaning chamber (14, 114) and spray nozzles (18, 118) to prevent the cleaning liquid from entering the atmosphere. 15
18. Apparatus (10, 110) as claimed in any preceding claim wherein the oscillating mechanism (25, 128) moves the screen (16, 116) in a complete cycle of the oscillating motion approximately 20 times per minute. 20
19. Apparatus (10, 110) as claimed in any preceding claim comprising a vapour recovery system (100, 145) coupled to the cleaning chamber (14, 114) to remove cleaning liquid which is vaporized during the cleaning of said screen (16, 116). 25
20. Apparatus (110) as claimed in any preceding claim comprising a wipe down booth (152) positioned proximate the cleaning chamber (114), the wipe down booth configured for receiving a cleaned screen (116) from the chamber and capturing excess cleaning liquid dripping from said screen. 30 35
21. Apparatus (110) as claimed in Claim 20 wherein the wipe down booth (152) is coupled to the cleaning chamber (114) and directs the excess cleaning liquid back into the chamber. 40
22. Apparatus (110) as claimed in Claim 21 wherein the wipe down booth (152) includes a sloping wall (178) for directing the excess cleaning liquid back into the chamber (114). 45
23. A method for cleaning a screen (16, 116) with a sprayed cleaning liquid, comprising placing a screen within a cleaning chamber (14, 114) proximate a plurality of vertically spaced spray nozzles (18, 118) positioned inside the chamber, supplying cleaning liquid to the spray nozzles to spray the screen and remove contaminants therefrom, and moving the screen proximate the spray nozzles, characterised in that the method comprises supplying cleaning liquid to a grid pattern of horizontally and vertically spaced apart spray nozzles (18, 118) 50 55

to spray the screen (16, 116) and remove contaminants therefrom, and moving the screen in an oscillating motion proximate the grid pattern of spray nozzles (18, 118) whereby to increase the coverage of the sprayed cleaning liquid over the screen for improved cleaning and removal of undesired contaminants therefrom.

24. A method of Claim 23 wherein the cleaning chamber (14, 114) includes another grid pattern of horizontally and vertically spaced-apart spray nozzles (18, 118) opposite the other grid pattern, the spray nozzles of respective grid patterns spraying cleaning liquid in opposite directions, the method comprising moving the screen (16, 116) between the grid patterns of spray nozzles to clean the screen from both sides.
25. A method of Claim 24 or Claim 25 comprising spraying the cleaning liquid on the screen (16, 116) at a rate in the range of about 225 to about 815 litres (60 to 215 gallons) per minute.
26. A method of any one of Claims 23 to 25 comprising collecting used cleaning liquid after it has been sprayed on the screen (16, 116) and supplying the used cleaning liquid to the spray nozzles (18, 118) to recycle the cleaning liquid.
27. A method of Claim 26 comprising filtering the used cleaning liquid before supplying the used cleaning liquid to the spray nozzles (18, 118).
28. A method of any one of Claims 23 to 27 comprising moving the screen (16, 116) in an oscillating motion with a period of motion in the range of 8 to 51 cm (3 inches to 20 inches).
29. A method of any one of Claims 23 to 28 comprising moving the screen (16, 116) in a complete cycle of the oscillating motion approximately 20 times per minute.
30. A method of any of Claims 23 to 29 comprising recovering cleaning liquid which has been vaporized during the cleaning of the screen (16, 116).
31. A method of any of Claims 23 to 30 comprising engaging the screen (116) at its sides and guiding the screen in front of the spray nozzles (118) during oscillation without restricting a top edge (168) of the screen such that screens of different heights may be readily cleaned.
32. A method of Claim 31 comprising spraying the screen (116) on both sides thereof and guiding the screen with guide brackets (170) extending into the chamber (114) from both sides thereof to guide the

screen generally perpendicular to the sprayed cleaning liquid from the nozzles (118).

33. A method of any one of Claims 23 to 32 comprising pumping cleaning liquid to the spray nozzles (118) from a reservoir (122) using a pump (123) and positioning a portion of the pump inside the reservoir for reducing leakage during screen cleaning.
34. A method of any one of Claims 23 to 33 comprising wiping a cleaned screen (116) down within a wipe down booth (152) positioned proximate said cleaning chamber (114) for recapturing used cleaning liquid.

Patentansprüche

1. Eine Vorrichtung (10, 110) zur Reinigung eines Siebes (16, 116) mittels einer aufgesprühten Reinigungsflüssigkeit, bestehend aus einem Gehäuse (12, 112), das eine Reinigungskammer (14, 114) zur Aufnahme eines Siebes (16, 116) bildet, einer Vielzahl von Sprühdüsen (18, 118), die sich innerhalb der Reinigungskammer (14, 114) befinden, um jenes sich innerhalb der Kammer befindliche Sieb mit der Reinigungsflüssigkeit einzusprühen, einem Vorratsbehälter (22, 122), der mit der Vielzahl von Sprühdüsen (18, 118) verbunden ist, um die Reinigungsflüssigkeit zu den Sprühdüsen zu fördern, sowie einem Mechanismus (25, 128) zur Bewegung des Siebes (16, 116) innerhalb der Reinigungskammer (14, 114) vor den Reinigungsdüsen (18, 118) zur Reinigung des Siebes, dadurch gekennzeichnet, daß es sich bei dem Mechanismus (25, 128) um eine Schwingvorrichtung handelt, mit der das Sieb (16, 116) in eine Schwingbewegung versetzt wird, und daß die Vielzahl von Sprühdüsen ein Gitternetz von waagerecht und senkrecht zueinander versetzt angeordneten Sprühdüsen (18, 118) bildet, wobei die Schwingbewegung und das Gitternetz der Vielzahl von Sprühdüsen (18, 118) eine mehrmalige und verstärkte Erfassung des Siebes durch die aufgesprühte Reinigungsflüssigkeit bewirken, was zu einer verbesserten Reinigung und zur Entfernung unerwünschter Verunreinigungen aus dem Sieb führt.
2. Eine Vorrichtung (10, 110) entsprechend Anspruch 1, bei der die Vielzahl von Sprühdüsen (18, 118) ein weiteres Gitternetz von waagerecht und senkrecht zueinander versetzt angeordneten Sprühdüsen bildet, das sich dem anderen Gitternetz von Sprühdüsen gegenüber befindet, wobei die Düsen des einen Gitternetzes in der Lage sind, in eine Richtung entgegengesetzt zu den Düsen des anderen Gitternetzes zu sprühen, und wobei der Schwingmechanismus (25, 128) dazu in der Lage ist, das Sieb (16, 116) zwischen den einander gegenüber-

liegenden Gitternetzen von Sprühdüsen zu bewegen, um eine weitere Verbesserung der Siebreinigung zu erzielen.

3. Eine Vorrichtung (110) entsprechend Anspruch 1 oder Anspruch 2, bestehend aus einer Pumpe (123), die an den Vorratsbehälter (122) zur Förderung der Reinigungsflüssigkeit zu den Sprühdüsen (118) angeschlossen ist, wobei ein Teil der Pumpe sich innerhalb des Vorratsbehälters zur Verringerung von Flüssigkeitsverlusten während des Siebreinigungs befindet.
4. Eine Vorrichtung (10, 110) entsprechend Anspruch 1 oder Anspruch 2, bei der der Vorratsbehälter (22, 122) unterhalb des Niveaus der Sprühdüsen (18, 118) angeordnet ist, um die genutzte Reinigungsflüssigkeit aufzufangen, die vom Sieb (16, 116) dann herabtropft, wenn das Sieb eingesprüht wird, wobei die Vorrichtung eine Pumpe (23, 123) umfaßt, die an den Vorratsbehälter angeschlossen ist, um die genutzte Reinigungsflüssigkeit zu den Sprühdüsen zu fördern, wodurch die Reinigungsflüssigkeit zurückgeführt wird.
5. Eine Vorrichtung (10, 110) entsprechend Anspruch 3 oder Anspruch 4, in der die Pumpe (23, 123) und die Sprühdüsen (18, 118) dazu geeignet sind, die versprühte Reinigungsflüssigkeit zum Sieb (16, 116) in einer Menge von etwa 225 bis etwa 815 Litern (60 bis 215 Gallonen) pro Minute zu fördern, um eine effektivere Reinigung des Siebes herbeizuführen und Verunreinigungen in der Reinigungsflüssigkeit in Suspension zu halten, um die Reinigung des Siebes noch effektiver zu gestalten.
6. Eine Vorrichtung (10) entsprechend Anspruch 4 und Anspruch 5 als Beifügung zu Anspruch 4, bestehend aus einem Dekantiergefäß (82), das mit dem Vorratsbehälter (22) verbunden ist, um die genutzte Reinigungsflüssigkeit aus dem Vorratsbehälter aufzunehmen und zu erfassen, damit sich in Suspension befindliche Verunreinigungen für den nachfolgenden Dekantierprozeß absetzen können.
7. Eine Vorrichtung (10, 110) entsprechend Anspruch 4 oder Anspruch 5 als Beifügung zu Anspruch 4 oder Anspruch 6, bestehend aus einem Filter (59, 138), der zwischen der Pumpe (23, 123) und den Sprühdüsen (18, 118) angebracht ist und dazu dient, herausfilterbare Teilchen aus der genutzten Flüssigkeit zu entfernen, bevor die Flüssigkeit auf das Sieb (16, 116) aufgesprüht wird.
8. Eine Vorrichtung (10, 110) entsprechend allen vorausgehenden Ansprüchen, in der der Vorratsbehälter (22, 122) mit der Reinigungskammer (14, 114) verbunden ist, um die genutzte Reinigungsflüssig-

keit aufzufangen, die vom Sieb (16, 116) während des Einsprühens des Siebes heruntertropft, wodurch die Reinigungsflüssigkeit zurückgeführt wird.

9. Eine Vorrichtung (10, 110) entsprechend Anspruch 8, in der der Vorratsbehälter (22, 122) eine geneigte Wand (32, 140) zum Auffangen der genutzten Reinigungsflüssigkeit unterhalb des Siebes (16, 116) aufweist, um diese Flüssigkeit in Richtung einer Speicherfläche innerhalb des Behälters zu richten. 5
10. Eine Vorrichtung (110) entsprechend allen vorausgehenden Ansprüchen, bestehend aus Führungsschienen (170), die im Gehäuse (112) für das Eingreifen und die Führung des Siebes (116) während des Schwingvorganges angebracht sind, wobei die Fültrungsschienen dazu geeignet sind, eine Seite des Siebes aufzunehmen und die Oberkante (168) des Siebes derart frei zu belassen, daß Siebe mit unterschiedlicher Höhe gereinigt werden können, während die Schienen feststehend bleiben, so daß Siebe (116) unterschiedlicher Höhe auf einfache Weise in der Vorrichtung (110) gewaschen werden können, ohne daß manuelle Einstellungen an der Vorrichtung durch einen Bedienmann vorgenommen werden müssen, wodurch Kosten eingespart werden. 10
11. Eine Vorrichtung (110) entsprechend Anspruch 10, in der die Düsen (118) auf beiden Seiten der Kammer (114) derart plziert sind, daß das Sieb von entgegengesetzt liegenden Seiten her besprüht wird, wobei die Schienen (170) sich bis in die Kammer hinein zwischen den Düsen erstrecken, um das Sieb lotrecht zur Reinigungsflüssigkeit zu führen, die von den Düsen aus versprüht wird. 15
12. Eine Vorrichtung (110) entsprechend Anspruch 11, in der die Schienen (170) als zusammengehörige Schienenpaare plziert sind, und zwar jeweils eine auf jeder Seite der Kammer (114), wobei ein Zwischenraum zwischen den Schienen für den Durchgang des Siebes (116) gebildet wird. 20
13. Eine Vorrichtung (110) entsprechend Anspruch 12, in der die Schienen (170) waagerecht einstellbar sind, um voneinander weg bewegt werden zu können, damit der dazwischenliegende Raum zur Aufnahme von Sieben (116) verschiedener Breite vergrößert werden kann. 25
14. Eine Vorrichtung (110) entsprechend den Ansprüchen 1 bis 10, in der der Schwingmechanismus (25) eine bewegliche Führungsbahn (28) besitzt, um eine Kante (19) des Siebes (16) festzuhalten und das Sieb in die Schwingbewegung zu versetzen, sowie eine Führungsbahn (40) zur Aufnahme

der anderen Kante (35) des Siebes (16) und zum Festhalten des Siebes in der Stellung, in der das Besprühen mit den Sprühdüsen (18) stattfindet, während jenes Sieb Schwingungen ausführt.

15. Eine Vorrichtung (10, 110) entsprechend allen vorausgehenden Ansprüchen, in der der Schwingmechanismus (25, 128) das Sieb (16, 116) in eine Schwingbewegung versetzt, wobei die Schwingperiode im Bereich von etwa 8 bis etwa 51 cm (3" bis 20") liegt. 30
16. Eine Vorrichtung (10, 110) entsprechend allen vorausgehenden Ansprüchen, in der es sich bei der Reinigungsflüssigkeit um ein Lösungsmittel handelt. 35
17. Eine Vorrichtung (10, 110) entsprechend allen vorausgehenden Ansprüchen, in der das Gehäuse (12, 112) die Reinigungskammer (14, 114) und die Sprühdüsen (18, 118) vollkommen umschließt, um zu verhindern, daß die Reinigungsflüssigkeit an die Außenluft austritt. 40
18. Eine Vorrichtung (10, 110) entsprechend allen vorausgehenden Ansprüchen, in der der Schwingmechanismus (25, 128) das Sieb (16, 116) im vollständigen Arbeitszyklus der Schwingbewegung etwa 20 mal pro Minute bewegt. 45
19. Eine Vorrichtung (10, 110) entsprechend allen vorausgehenden Ansprüchen, bestehend aus einem Dampfaufbereitungssystem (100, 145), das an die Reinigungskammer (14, 114) angeschlossen ist, um Reinigungsflüssigkeit zu entfernen, die während der Reinigung des Siebes (16, 116) verdampft ist. 50
20. Eine Vorrichtung (110) entsprechend allen vorausgehenden Ansprüchen, bestehend aus einer Abstreifzelle (152), die sich nahe der Reinigungskammer (114) befindet, wobei die Abstreifzelle so ausgestattet ist, daß sie ein gereinigtes Sieb (116) von der Kammer aufnehmen und überschüssige Reinigungsflüssigkeit auffangen kann, die vom Sieb heruntertropft. 55
21. Eine Vorrichtung (110) entsprechend Anspruch 20, in der die Abstreifzelle (152) mit der Reinigungskammer (114) verbunden ist und die überschüssige Reinigungsflüssigkeit in die Kammer zurückführt.
22. Eine Vorrichtung (110) entsprechend Anspruch 21, in der die Abstreifzelle (152) eine geneigte Wand (178) umfaßt, die dazu dient, die überschüssige Reinigungsflüssigkeit zurück in die Kammer (114) zu leiten.

23. Ein Verfahren zur Reinigung eines Siebes (16, 116) mittels einer aufgesprühten Reinigungsflüssigkeit, darin bestehend, daß ein Sieb innerhalb einer Reinigungskammer (14, 114) in der Nähe einer Vielzahl von senkrecht in einem bestimmten Abstand platzierten Sprühdüsen (18, 118) angebracht wird, die sich innerhalb der Kammer befinden, daß den Sprühdüsen Reinigungsflüssigkeit zum Einsprühen des Siebs und zur Entfernung von Verunreinigungen von dort zugeführt wird und das Sieb in der Nähe der Sprühdüsen bewegt wird, dadurch gekennzeichnet, daß das Verfahren die Förderung der Reinigungsflüssigkeit auf ein Gitternetz von waagrecht und senkrecht auf Abstand platzierten Sprühdüsen (18, 118) zur Besprühung des Siebes (16, 116) und zur Entfernung von Verunreinigungen von dort sowie das Bewegen des Siebs in einer Schwingbewegung in der Nähe des Gitternetzes der Sprühdüsen (18, 118) umfaßt, wodurch die Verteilung der aufgesprühten Reinigungsflüssigkeit über dem Sieb zur Erreichung eines verbesserten Reinigungseffektes und der Entfernung unerwünschter Verunreinigungen erhöht wird.
24. Ein in Anspruch 23 beschriebenes Verfahren, in dem die Reinigungskammer (14, 114) ein weiteres Gitternetz von waagrecht und senkrecht auf Abstand platzierten Sprühdüsen (18, 118) umfaßt, die sich gegenüber dem anderen Gitternetz befinden, wobei die Sprühdüsen des jeweiligen Gitternetzes die Reinigungsflüssigkeit in entgegengesetzten Richtungen versprühen und das Verfahren die Bewegung des Siebes (16, 116) zwischen den Gitternetzen der Sprühdüsen einschließt, um das Sieb von beiden Seiten reinigen zu können.
25. Ein in Anspruch 24 oder Anspruch 25 beschriebenes Verfahren, bei dem die Reinigungsflüssigkeit auf das Sieb (16, 116) mit einer Menge von etwa 225 bis 815 Litern (60 bis 215 Gallonen) pro Minute aufgesprüht wird.
26. Ein Verfahren nach den Ansprüchen 23 bis 25, bei dem die genutzte Reinigungsflüssigkeit nach dem Aufsprühen auf das Sieb (16, 116) gesammelt und die genutzte Reinigungsflüssigkeit zu den Sprühdüsen (18, 118) gefördert wird, um die Reinigungsflüssigkeit zurückzuführen.
27. Ein Verfahren nach Anspruch 26, bei dem die genutzte Reinigungsflüssigkeit gefiltert wird, bevor die genutzte Reinigungsflüssigkeit den Sprühdüsen (18, 118) zugeführt wird.
28. Ein Verfahren nach den Ansprüchen 23 bis 27, bei dem das Sieb (16, 116) in eine Schwingbewegung versetzt wird, wobei die Bewegungsperiode im Bereich von 8 bis 51 cm (3" bis 20" liegt).
29. Ein Verfahren nach den Ansprüchen 23 bis 28, bei dem das Sieb (16, 116) im vollständigen Arbeitszyklus der Schwingbewegung etwa 20 mal pro Minute bewegt wird.
30. Ein Verfahren nach den Ansprüchen 23 bis 29, bei dem die Reinigungsflüssigkeit zurückgewonnen wird, die während der Reinigung des Siebes (16, 116) verdampft ist.
31. Ein Verfahren nach den Ansprüchen 23 bis 30, bei dem sich das Sieb (116) an seinen Seiten im Eingriff befindet und das Sieb vor den Sprühdüsen (118) während der Schwingbewegung geführt wird, ohne daß eine Begrenzung der Oberkante (168) des Siebes vorhanden ist, so daß Siebe unterschiedlicher Höhe auf einfache Weise gereinigt werden können.
32. Ein Verfahren nach Anspruch 31, bei dem das Sieb (116) auf beiden Seiten besprüht und das Sieb mittels der Führungsschienen (170) geführt wird, die sich in die Kammer (114) hinein von beiden Seiten erstrecken, um das Sieb lotrecht zur mittels der Düsen (118) aufgesprühten Reinigungsflüssigkeit zu halten.
33. Ein Verfahren gemäß den Ansprüchen 23 bis 32, bei dem die Reinigungsflüssigkeit zu den Sprühdüsen (118) von einem Vorratsbehälter (122) durch Einsatz einer Pumpe (123) und die Platzierung eines Teiles der Pumpe innerhalb des Vorratsbehälters zur Verringerung von Flüssigkeitsverlusten während des Siebreinigens gepumpt wird.
34. Ein Verfahren nach den Ansprüchen 23 bis 33, bei dem ein gereinigtes Sieb (116) innerhalb einer Abstreifzelle (152) abgewischt wird, die sich nahe der Reinigungskammer (114) befindet, damit die genutzte Reinigungsflüssigkeit wieder eingefangen werden kann.

Revendications

1. Appareil (10, 110) pour nettoyer un écran (16, 116) avec un liquide de nettoyage pulvérisé, comprenant un boîtier (12, 112) formant une enceinte de nettoyage (14, 114) pour recevoir un écran (16, 116), un ensemble de buses de pulvérisation (18, 118) placées à l'intérieur de l'enceinte de nettoyage (14, 114) pour pulvériser le liquide de nettoyage sur ledit écran à l'intérieur de l'enceinte, un réservoir d'alimentation (22, 122) couplé à l'ensemble des buses de pulvérisation (18, 118) pour alimenter en liquide de nettoyage les buses de pulvérisation et un mécanisme (25, 128) pour déplacer ledit écran (16,

- 116) à l'intérieur de l'enceinte de nettoyage (14, 114) devant les buses de pulvérisation (18, 118) pour nettoyer ledit écran, caractérisé en ce que le mécanisme (25, 128) est un mécanisme oscillant pour déplacer ledit écran (16, 116) selon un mouvement oscillant et l'ensemble des buses de pulvérisation compose un motif de grille de buses espacées horizontalement et verticalement, afin que le mouvement oscillant et l'ensemble de motif de grille des buses de pulvérisation (18, 118) donnent une couverture d'écran répétée et accrue par le liquide de nettoyage pulvérisé pour un nettoyage et une élimination améliorés des contaminants indésirables dudit écran.
2. Appareil (10, 110) selon la revendication 1, dans lequel l'ensemble des buses de pulvérisation (18, 118) compose un autre motif de grille de buses espacées horizontalement et verticalement opposé à l'autre motif de grille de buses de pulvérisation, les buses de l'un des motifs de grille pouvant fonctionner de façon à effectuer la pulvérisation dans un sens opposé aux buses de l'autre motif de grille, et le mécanisme oscillant (25, 128) pouvant fonctionner de façon à déplacer ledit écran (16, 116) entre les motifs de grille opposés des buses de pulvérisation pour un nettoyage encore amélioré de l'écran.
 3. Appareil (110) selon la revendication 1 ou la revendication 2, comprenant une pompe (123) couplée au réservoir (122) pour envoyer un liquide de nettoyage vers les buses de pulvérisation (118), une partie de la pompe étant placée à l'intérieur du réservoir pour réduire les fuites pendant le nettoyage de l'écran.
 4. Appareil (10, 110) selon la revendication 1 ou la revendication 2, dans lequel le réservoir (22, 122) est placé sous les buses de pulvérisation (18, 118) pour récupérer le liquide de nettoyage usé qui tombe dudit écran (16, 116) lorsque ledit écran est aspergé, l'appareil comprenant une pompe (23, 123) couplée au réservoir pour envoyer le liquide de nettoyage usé vers les buses de pulvérisation, afin de recycler le liquide de nettoyage.
 5. Appareil (10, 110) selon la revendication 3 ou la revendication 4, dans lequel la pompe (23, 123) et les buses de pulvérisation (18, 118) peuvent fonctionner de façon à envoyer le liquide de nettoyage pulvérisé sur ledit écran (16, 116) à un débit dans la gamme d'environ 225 à environ 815 litres (60 à 215 gallons) par minute pour nettoyer plus efficacement ledit écran et pour mettre en suspension les contaminants dans le liquide de nettoyage pour un nettoyage plus efficace dudit écran.
 6. Appareil (10) selon la revendication 4 ou la revendication 5 dépendante de la revendication 4, comprenant un réservoir de décantation (82) couplé au réservoir d'alimentation (22) pour recevoir le liquide de nettoyage usé provenant du réservoir d'alimentation et pour retenir le liquide de nettoyage usé pour que se déposent les contaminants en suspension en vue d'une décantation ultérieure.
 7. Appareil (10, 110) selon l'une quelconque des revendications 4, 5 dépendante de la revendication 4, ou 6, comprenant un filtre (59, 138) couplé entre la pompe (23, 123) et les buses de pulvérisation (18, 118) pour éliminer les particules pouvant être filtrées du fluide de nettoyage usé avant que le fluide ne soit pulvérisé sur ledit écran (16, 116).
 8. Appareil (10, 110) selon l'une quelconque des revendications précédentes, dans lequel le réservoir d'alimentation (22, 122) est couplé à l'enceinte de nettoyage (14, 114) pour récupérer le liquide de nettoyage usé qui tombe dudit écran (16, 116) lorsque l'écran est aspergé, afin de recycler le liquide de nettoyage.
 9. Appareil (10, 110) selon la revendication 8, dans lequel le réservoir d'alimentation (22, 122) comprend une paroi inclinée (32, 140) pour récupérer le liquide de nettoyage usé en dessous dudit écran (16, 116) et pour envoyer ledit liquide vers une zone d'accumulation dans le réservoir.
 10. Appareil (110) selon l'une quelconque des revendications précédentes, comprenant des supports de guidage (170) montés dans le boîtier (112) pour enclencher et guider ledit écran (116) pendant l'oscillation, les supports de guidage pouvant fonctionner de façon à enclencher un côté dudit écran et laisser libre le bord supérieur (168) dudit écran de sorte que des écrans de hauteurs différentes puissent être nettoyés alors que les supports restent fixes, afin de laver facilement des écrans (116) de hauteurs différentes dans l'appareil (110) sans qu'un opérateur ait à réaliser des ajustements manuels de l'appareil, conduisant ainsi à des économies.
 11. Appareil (110) selon la revendication 10, dans lequel les buses (118) sont placées de chaque côté de l'enceinte (114) pour asperger l'écran à partir des faces opposées, les supports (170) se prolongeant dans l'enceinte entre les buses pour guider ledit écran généralement perpendiculairement au liquide de nettoyage pulvérisé par les buses.
 12. Appareil (110) selon la revendication 11, dans lequel les supports (170) sont placés en paires de supports coopérants, un de chaque côté de l'enceinte (114), un espace étant formé entre les

supports pour le passage dudit écran (116).

13. Appareil (110) selon la revendication 12, dans lequel les supports (170) peuvent être ajustés horizontalement pour être écartés les uns des autres pour élargir l'espace entre ceux-ci pour accepter des écrans (116) de différentes largeurs.

14. Appareil (10) selon l'une quelconque des revendications 1 à 10, dans lequel le mécanisme oscillant (25) comprend une piste mobile (28) pour maintenir un bord (19) dudit écran (16) et pour déplacer ledit écran selon un mouvement oscillant et une piste de guidage (40) pour recevoir un autre bord (35) dudit écran (16) et maintenir ledit écran en position pour être aspergé par les buses de pulvérisation (18) pendant que ledit écran oscille.

15. Appareil (10, 110) selon l'une quelconque des revendications précédentes, dans lequel le mécanisme oscillant (25, 128) déplace l'écran (16, 116) selon un mouvement oscillant ayant une période de déplacement dans la gamme d'environ 8 à environ 51 cm (3 pouces à 20 pouces).

16. Appareil (10, 110) selon l'une quelconque des revendications précédentes, dans lequel le liquide de nettoyage est un solvant.

17. Appareil (10, 110) selon l'une quelconque des revendications précédentes, dans lequel le boîtier (12, 112) enferme complètement l'enceinte de nettoyage (14, 114) et les buses de pulvérisation (18, 118) pour empêcher l'échappement du liquide de nettoyage dans l'atmosphère.

18. Appareil (10, 110) selon l'une quelconque des revendications précédentes, dans lequel le mécanisme oscillant (25, 128) déplace l'écran (16, 116) sur un cycle complet du mouvement oscillant environ 20 fois par minute.

19. Appareil (10, 110) selon l'une quelconque des revendications précédentes, comprenant un système de récupération de vapeur (100, 145) couplé à l'enceinte de nettoyage (14, 114) pour éliminer le liquide de nettoyage qui se vaporise pendant le nettoyage dudit écran (16, 116).

20. Appareil (110) selon l'une quelconque des revendications précédentes, comprenant une cabine d'essuyage (152) placée à proximité de l'enceinte de nettoyage (114), la cabine d'essuyage étant configurée pour recevoir un écran nettoyé (116) sortant de l'enceinte et pour récupérer l'excès de liquide de nettoyage s'égouttant dudit écran.

21. Appareil (110) selon la revendication 20, dans

lequel la cabine d'essuyage (152) est couplée à l'enceinte de nettoyage (114) et renvoie l'excès de liquide de nettoyage dans l'enceinte.

22. Appareil (110) selon la revendication 21, dans lequel la cabine d'essuyage (152) comprend une paroi inclinée (178) pour renvoyer l'excès de liquide de nettoyage dans l'enceinte (114).

23. Procédé pour nettoyer un écran (16, 116) avec un liquide de nettoyage pulvérisé, comprenant le fait de placer un écran à l'intérieur d'une enceinte de nettoyage (14, 114) à proximité de plusieurs buses de pulvérisation espacées verticalement (18, 118), placées à l'intérieur de l'enceinte, d'envoyer un liquide de nettoyage vers les buses de pulvérisation pour asperger l'écran et en éliminer les contaminants, et de déplacer l'écran à proximité des buses de pulvérisation, caractérisé en ce que le nettoyage comprend le d'envoyer un liquide de nettoyage sur un motif de grille de buses de pulvérisation espacées horizontalement et verticalement (18, 118) pour asperger l'écran (16, 116) et en éliminer les contaminants, et le fait de déplacer l'écran selon un mouvement oscillant à proximité du motif de grille des buses de pulvérisation (18, 118) afin d'augmenter la couverture du liquide de nettoyage pulvérisé sur l'écran pour un nettoyage et une élimination améliorés des contaminants indésirables de celui-ci.

24. Procédé de la revendication 23, dans lequel l'enceinte de nettoyage (14, 114) comprend un autre motif de grille de buses de pulvérisation espacées horizontalement et verticalement (18, 118) opposé à l'autre motif de grille, les buses de pulvérisation des motifs de grille respectifs pulvérisant le liquide de nettoyage dans des sens opposés, le procédé comprenant le déplacement de l'écran (16, 116) entre les motifs de grille des buses de pulvérisation pour nettoyer l'écran des deux côtés.

25. Procédé de la revendication 24 ou de la revendication 25, comprenant la pulvérisation du liquide de nettoyage sur l'écran (16, 116) à un débit dans la gamme d'environ 225 à environ 815 litres (60 à 215 gallons) par minute.

26. Procédé de l'une quelconque des revendications 23 à 25, comprenant la récupération du liquide de nettoyage usé après qu'il a été pulvérisé sur l'écran (16, 116) et l'envoi du liquide de nettoyage usé dans les buses de pulvérisation (18, 118) pour recycler le liquide de nettoyage.

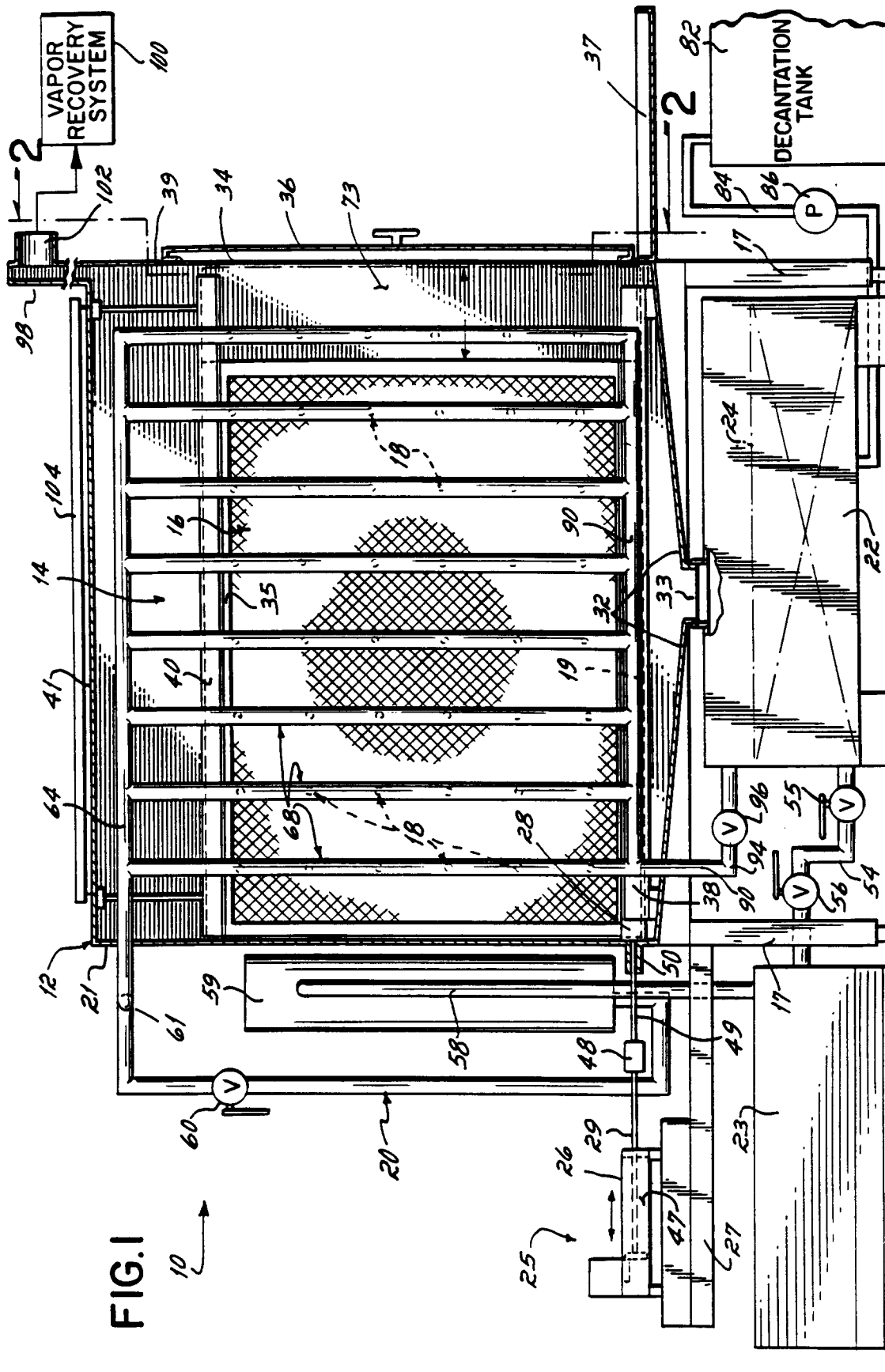
27. Procédé de la revendication 26, comprenant la filtration du liquide de nettoyage usé avant l'envoi du liquide de nettoyage usé dans les buses de pulvéri-

sation (18, 118).

28. Procédé de l'une quelconque des revendications 23 à 27, comprenant le déplacement de l'écran (16, 116) selon un mouvement oscillant ayant une période de déplacement dans la gamme de 8 à 51 cm (3 pouces à 20 pouces). 5
29. Procédé de l'une quelconque des revendications 23 à 28, comprenant le déplacement de l'écran (16, 116) sur un cycle complet du mouvement oscillant environ 20 fois par minute. 10
30. Procédé de l'une quelconque des revendications 23 à 29, comprenant la récupération du liquide de nettoyage qui a été vaporisé pendant le nettoyage de l'écran (16, 116). 15
31. Procédé de l'une quelconque des revendications 23 à 30, comprenant l'enclenchement de l'écran (116) par ses côtés et le guidage de l'écran devant les buses de pulvérisation (118) pendant l'oscillation sans maintenir le bord supérieur (168) de l'écran, de sorte que des écrans de différentes hauteurs puissent être facilement nettoyés. 20
25
32. Procédé de la revendication 31, comprenant l'aspersion de l'écran (116) des deux côtés de celui-ci et le guidage de l'écran par des supports de guidage (170) se prolongeant dans l'enceinte (114) de part et d'autre de celui-ci pour guider l'écran généralement perpendiculairement au liquide de nettoyage pulvérisé par les buses (118). 30
33. Procédé de l'une quelconque des revendications 23 à 32, comprenant le pompage du liquide de nettoyage dans les buses de pulvérisation (118) à partir d'un réservoir (122) à l'aide d'une pompe (123) et le placement d'une partie de la pompe à l'intérieur du réservoir pour réduire les fuites pendant le nettoyage de l'écran. 35
40
34. Procédé de l'une quelconque des revendications 23 à 33, comprenant le fait d'essuyer un écran nettoyé (116) dans une cabine d'essuyage (152) placée à proximité de ladite enceinte de nettoyage (114) pour récupérer le liquide de nettoyage utilisé. 45

50

55



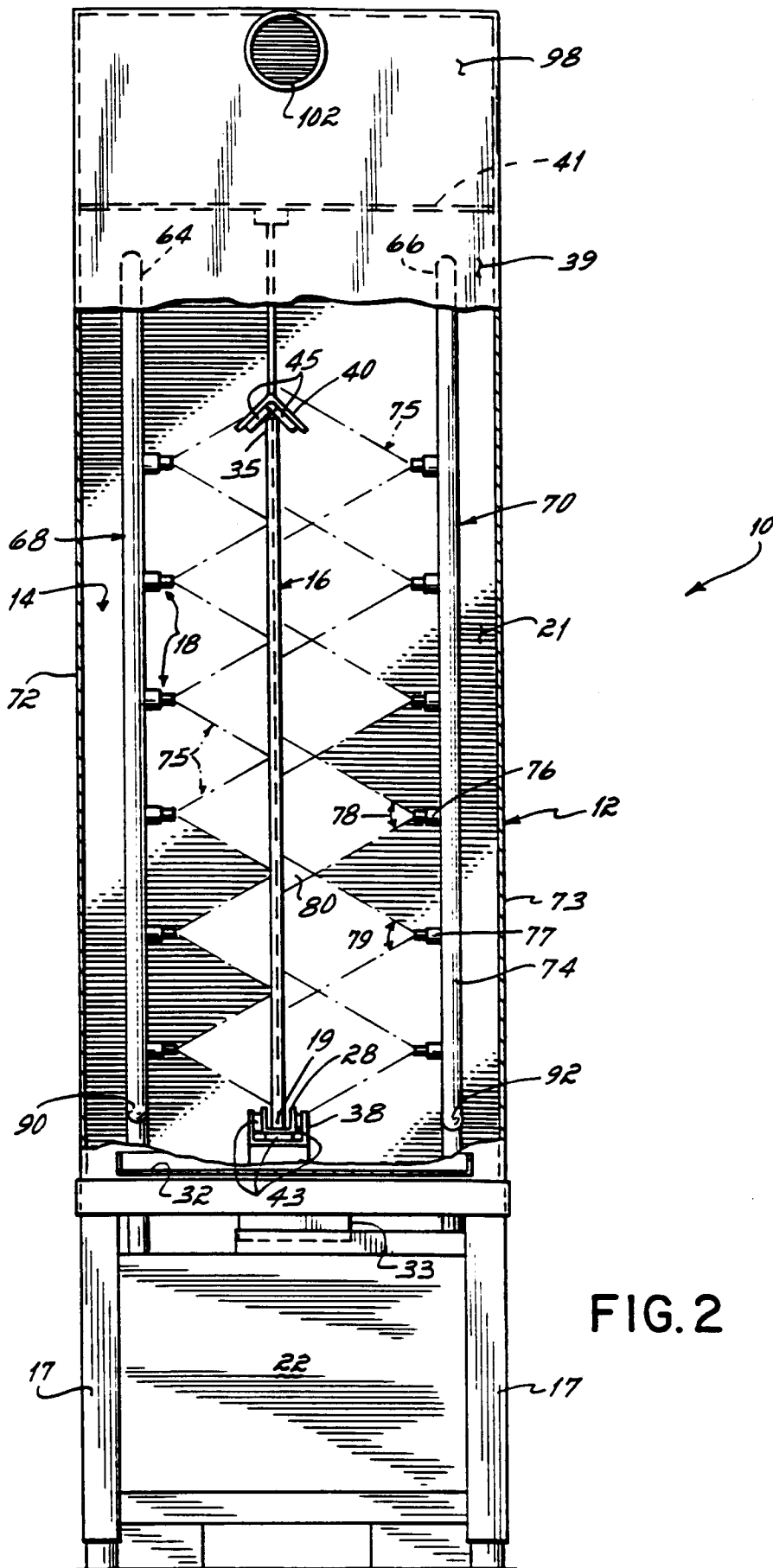


FIG. 2

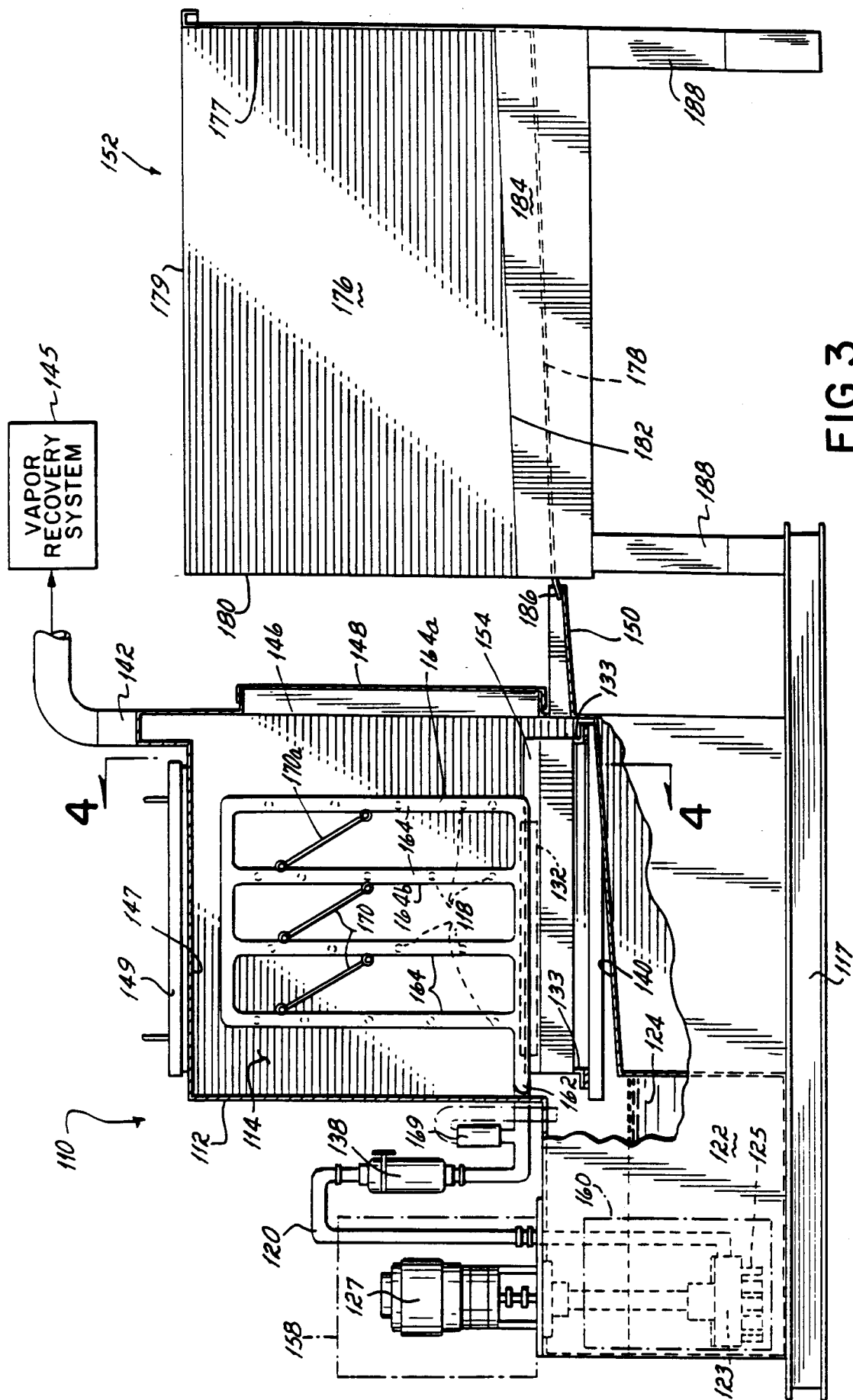


FIG. 3

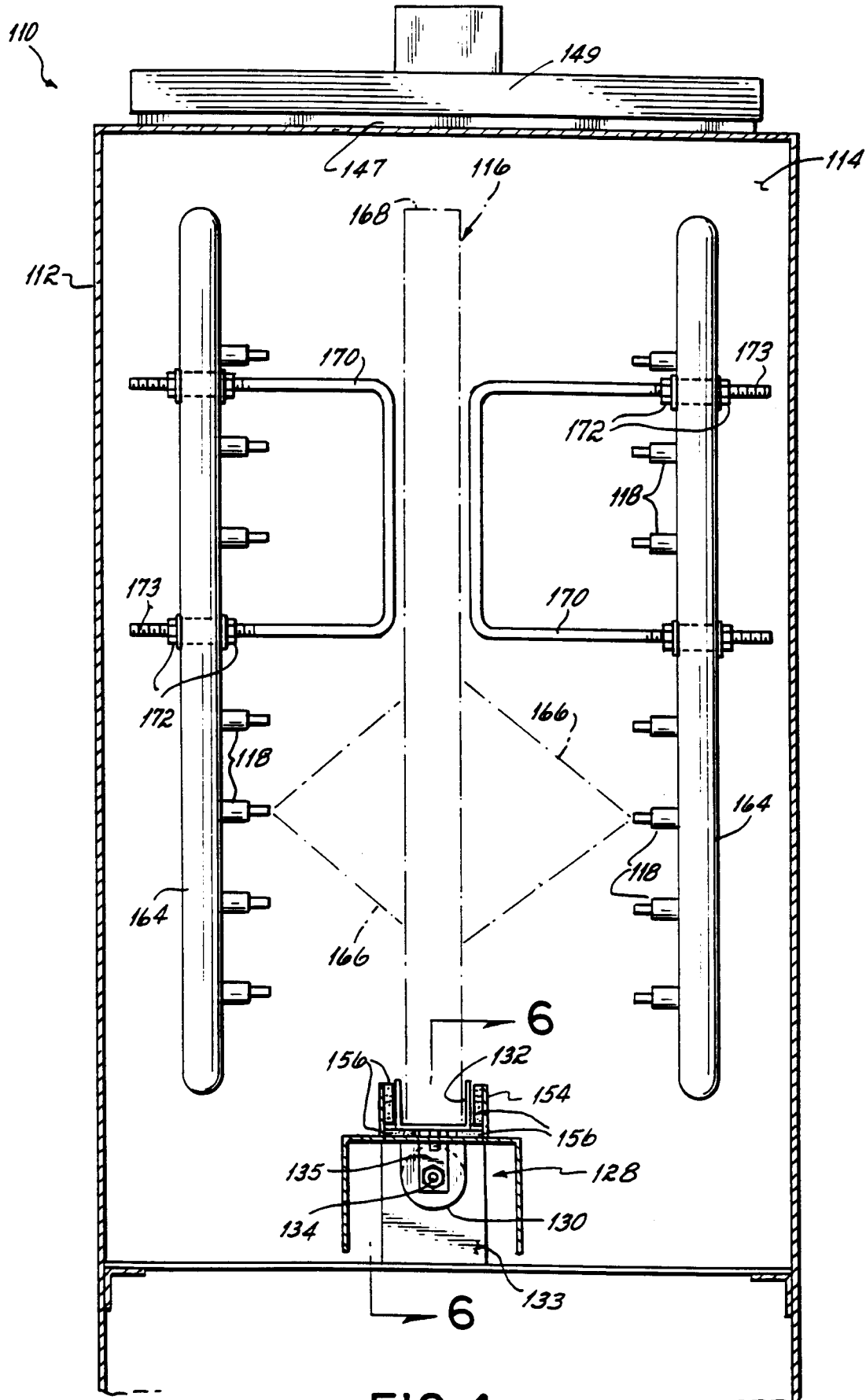


FIG. 4

