Aug. 14, 1945. J. F. ROCHE, JR 2,382,026

WATER CURTAIN DISTRIBUTING MEANS FOR SPRAY BOOTHS

Filed June 1, 1940 2 Sheets-Sheet 1

Fig. 1.

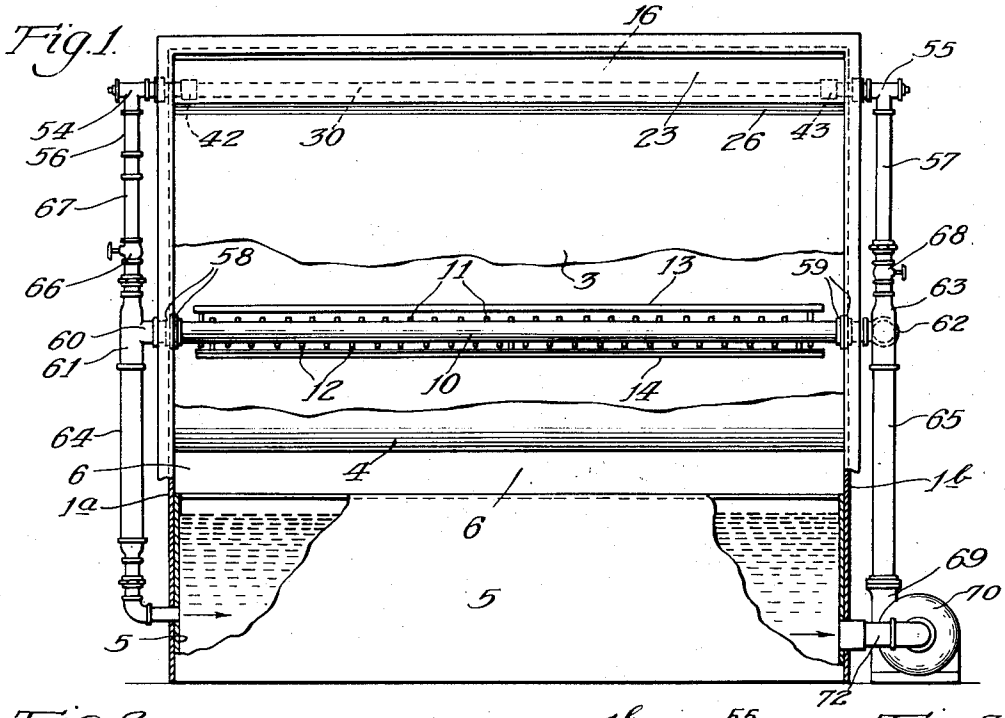


Fig. 2.

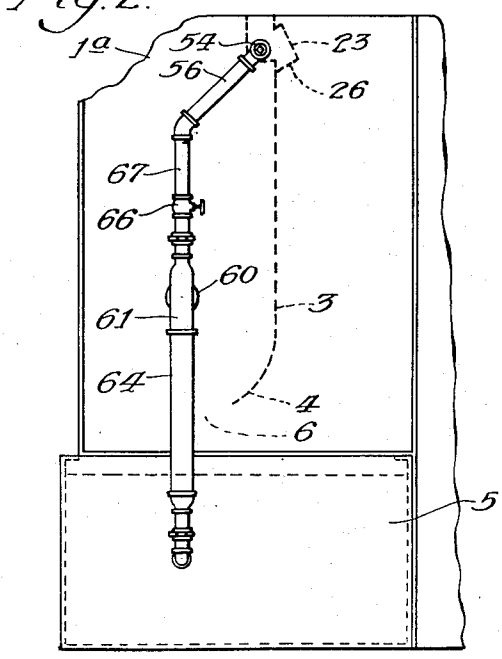
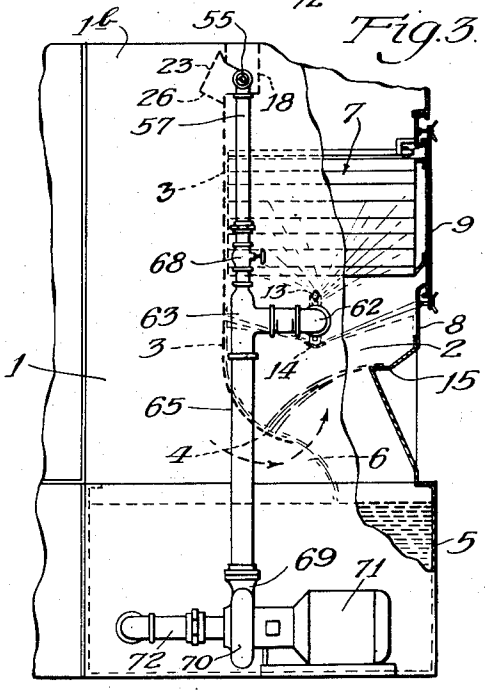


Fig. 3.



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Fig. 4.

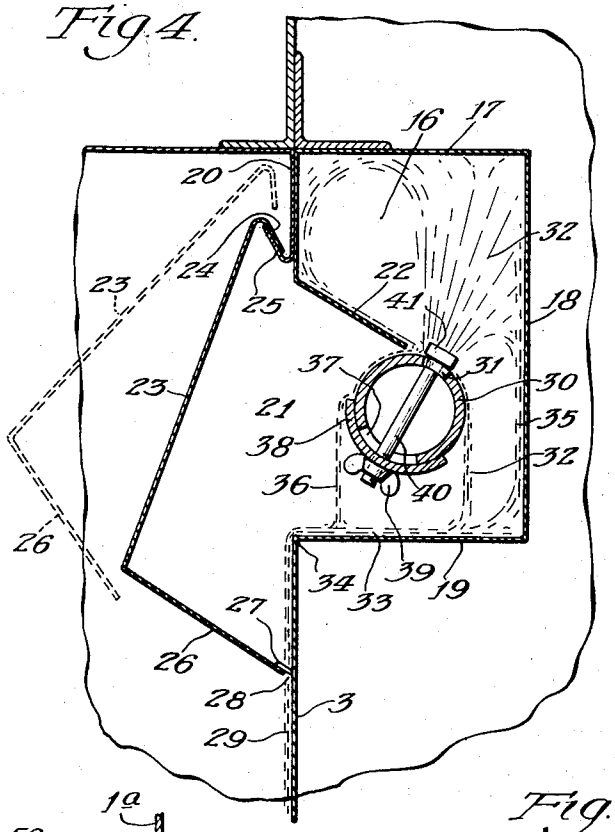


Fig. 7.

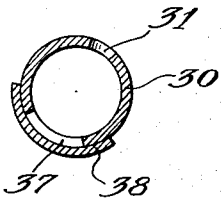


Fig. 5.

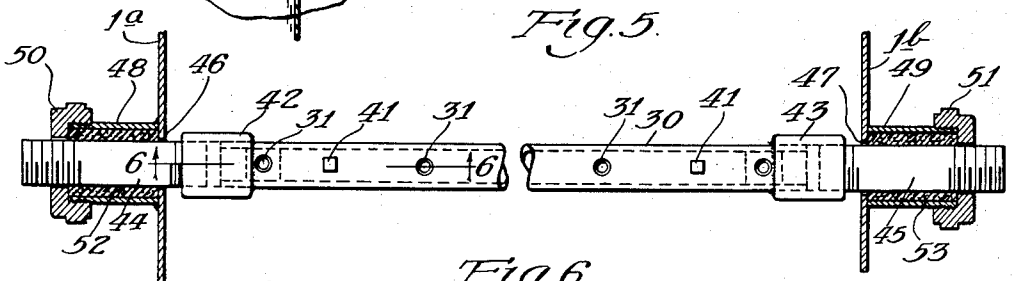


Fig. 6.

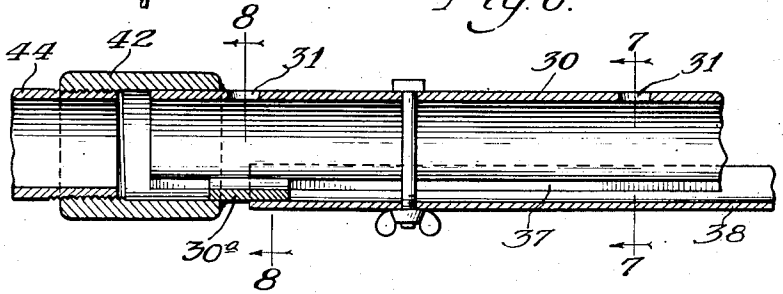
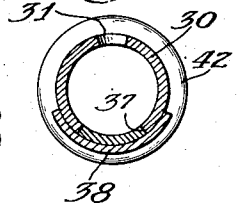


Fig. 8.



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UNITED STATES PATENT OFFICE

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WATER CURTAIN DISTRIBUTING MEANS FOR SPRAY BOOTHS

John F. Roche, Jr., River Forest, Ill., assignor to Binks Manufacturing Company, Chicago, Ill., a corporation of Delaware

Application June 1, 1940, Serial No. 338,392

11 Claims. (Cl. 261—36)

The present invention relates to gas cleaning means of the wash type and, more particularly, of the kind usually called spray booths, such as those in which work is sprayed with coating material such as paint, lacquers, vitreous enamels, etc.

In such a device it is desired to form and to cause the flow of a sheet or curtain of liquid, such as water, down over the face of a wall or apron opposite which the operation on the work is performed, so that the particles of material which may be projected or otherwise moved toward such apron will be caught by the flowing liquid sheet and be carried down and received in a liquid container or reservoir spacedly located beneath the lower end of the apron, from which lower end flows the liquid sheet with the captured particles into the reservoir.

Also such devices usually have means for washing out particles that are received and carried by the air in the work locus or chamber. Such air is caused to flow from such locus to a wash chamber behind the apron and through the opening provided between the lower end of the apron and the reservoir, whereby the liquid sheet flowing across such opening will wash out the particles carried in the air stream. The air passes up through the washing chamber where further sheets of liquid wash out what other particles may not have been washed out by the liquid curtain flowing across the opening referred to.

An object of the present invention is to provide a novel means for forming and controlling the liquid sheet which flows down over the face of the apron in continuous unbroken form and with such a thickness as is best for the particular kind of material that may be used on the work in the work locus. Particles of certain kinds of material will, when projected toward the curtain, more easily pierce it than other kinds. If particles pierce the liquid curtain they may adhere to the surface of the apron and accumulate, thus causing streak-like openings in the curtain. In order to prevent this, the present invention comprehends means for not only varying or regulating the thickness but also the speed of flow of the curtain down over the face of the apron, so as to capture all of such projected particles.

Another object of the invention is to provide novel means for supplying the liquid where there will be no possibility of entrained particles accumulating and packing in any part of the liquid course, as in dead ends or pockets, and hence clogging the sheet producing and controlling means. This is effected in the present invention by feeding or conducting the liquid to a manifold type of distributor of the forming means into both ends of the distributor, whereby the liquid streams meet within the distributor and freely flow out to produce the particular liquid sheets desired. This includes means such as valves for regulating and adjusting both such streams. Also, the invention comprehends means for maintaining a continual circulation of liquid so as to prevent entrained particles from coming to rest or substantially so, whereby they might accumulate.

A further object of the invention is to provide novel means for affording facile access to the liquid forming means, particularly the distributor thereof, for the purpose of cleaning out any material that may have adhered to the walls of such distributor. This comprehends also a cover or closure means detachably connected to the distributor and also a cover or closure means for the forming means in such position as to afford ready access to the interior of the forming means and to the distributor.

The invention also comprehends a novel forming means which comprises a chamber with an opening at the upper end of the apron and having wall portions against which the liquid may be directed from the distributor located in the chamber to distribute the liquid into the form of sheets which will flow down and unite to form a resultant sheet, which in turn will flow over the face of the apron in a smooth, continuous, unbroken sheet or curtain.

Other objects, advantages, capabilities, and features are comprehended by the invention as will later appear and as are inherently possessed by the invention.

Referring briefly to the drawings:

Fig. 1 is a front view in elevation with parts broken away or removed to show interior structure.

Fig. 2 is a view in side elevation of a side of the device with parts broken away.

Fig. 3 is a view in side elevation of an opposite side of the device with parts broken away.

Fig. 4 is a transverse sectional view on an enlarged scale of the means for forming the liquid curtain or sheet.

Fig. 5 is a fragmentary part sectional view showing the upper manifold structure.

Fig. 6 is a fragmentary sectional view taken in a plane represented by line 6—6 in Fig. 5.

Fig. 7 is a transverse sectional view taken in a plane represented by line 7—7 in Fig. 6.

Fig. 8 is a transverse sectional view taken in a plane represented by line 8—8 in Fig. 6.

Referring more in detail to the drawings, the embodiment selected to illustrate the invention is shown with a spray booth type of gas cleaner, such as is disclosed in the copending application of John F. Roche, Jr., et al., Serial No. 322,472, filed March 6, 1940 (now Patent 2,266,335, dated Dec. 16, 1941), for Wash type spray booths and method of gas cleaning, having a work chamber or locus 1, a washing chamber 2 at the rear of the booth structure with a liquid curtain apron

or wall 3 between them. The lower end portion 4 of the apron is curved rearwardly and ends spacedly above a tank or reservoir 5 located in the rear bottom portion of the booth to receive the liquid, the space between the lower end 4 of the apron and the reservoir 5 constituting the communication or opening 6 through which particle-laden gas, such as air, flows from the work chamber to the washing chamber, as shown by arrows.

In the washing chamber 2 is a series of eliminator units 7 suitably supported between the forward wall 3 and the rear wall 8 of this chamber. Each unit comprises upwardly extending tortuous passages for the upward passage of air, where the air is washed and the moisture in the air is eliminated so that the air passed upward from the units 7 to the exhaust means (not shown) will be dry and clean. The rear wall 8 has a suitable opening normally closed by a closure 9. The units may be passed through this opening for assembling or removing.

Below the units is a liquid projecting means of manifold type and comprising a pipe 10 provided with a plurality of liquid projecting tubes 11 and 12, a deflector 13 above the tubes 11 and against which the liquid is projected to be deflected and distributed in the form of upwardly diverging sheets of liquid which are projected into the lower portions of the tortucus passages of the unit 7, to flood the same so as to thoroughly wash and clean the air of all residual particles of material the air may carry as it rises in the tortuous passages referred to.

Below the manifold 10 is another deflector 14, against which the liquid from the tubes 12 is projected to be deflected and distributed in liquid sheets projected across the chamber and against the walls 3 and 8, whereby the liquid flows as sheets down over the faces of such walls. The liquid sheet on wall 3 flows down to the lower wall portion 4 to be directed in sheet form across the communication 6 between the chambers and into the reservoir 5. The rear wall 8 has a deflector 15 so located and formed as to deflect the liquid sheet flowing down over the face of the rear wall 8 across the chamber 2 and against the lower portion 4 of the wall 3 to unite with the liquid sheet flowing thereon to form a resultant sheet, which is directed across the communication 6 as above described.

At the upper end of the wall or apron 3 is a liquid curtain or sheet forming means comprising a forming chamber 16 (see Fig. 4) which has upper, rear and bottom walls 17, 18 and 19, and also a forward wall portion 20, the chamber 16 having a forward opening 21. Inclining rearwardly and downwardly is a deflecting or distributing wall or part 22 for forming a liquid sheet thereon, as will be later more fully described. The upper end of the wall 3 unites with the forward edge of the bottom wall 19. The opening 21 is normally covered by a plate 23 freely hung by a hinge flange 24 on an upturned hinge flange 25 formed as part of the wall part 20, as shown in Fig. 4. The cover 23 has an inclined lower portion 26 which may act as a distributing plate for the liquid flowing down from the bottom wall 19 to and over the front face of the apron 3. The lower edge of the plate 26 is held spacedly away from the front face of the apron 3 by a series of spaced projections 27 fixed to the plate 26 and having their free ends contacting the apron 3 so as to provide a slot-like opening 28 between the lower edge of the plate 26 and the front face of the apron 3, for the free flow of the liquid sheet or curtain 29 downwardly over the front surface of the wall 3.

The liquid is supplied to the chamber 16 by a projecting or distributing means of the manifold type comprising a pipe 30 extending through the chamber 16 from side wall 1a to side wall 1b of the booth structure (see Fig. 5), such pipe being provided with outlet orifices 31 to project and direct copious streams 32 of liquid upwardly and rearwardly against the top and rear walls 17 and 18, where the liquid is distributed with part of it to flow in the form of a sheet along the walls 17 and 20, and thence over the distributing plate 22 to and over the pipe 30 to fall as a sheet 32 upon the bottow wall 19, and thence to flow as a sheet 33 over the edge 34 into sheet 29 on the front face of the wall 3; and with part of it to flow down over the wall 18 in the form of a sheet 35 which unites with the sheet 33, the latter being a resultant of sheets 32 and 35. Some of the liquid will also flow over the forward portion of the pipe 30 and fall as a sheet 36 to unite with the sheet 33 on the bottom 19.

The pipe 30 is provided throughout its length with a wide slot or opening 37 which is normally closed by a cover plate or cap 38 of arc shape in cross section. This plate is held in closed position by thumb nuts 39 or the like screwed to the threaded ends of the bolts 40. These bolts extend transversely through the pipe and through apertures provided in the opposite wall of the pipe, where they have heads 41 fixed to the pipe by welding or the like. When the thumb nuts are unscrewed and the cover 38 removed, access is had to the pipe with a suitable tool to remove, as by scraping, the coating of material that has formed on the inner wall of the pipe and on the bolts. To give such access the cover 23 is simply lifted off the supporting hinge flange 25, by which the cover 23 is supported by way of the hinge flange 24 in a hanging fashion.

The ends of the pipe 30 extend part way in couplings 42 and 43 where they are welded, see Figs. 5 and 6. Suitable short metal filler pieces 30a are placed in the portions of the slot 37 within the couplings 42 and 43 to make for completely round welded joints between the couplings and the pipe 30. To the outer ends of the couplings are screwed short pipes 44 and 45. These pipes extend through and beyond holes 46 and 47 provided in the side walls 1a and 1b. Around the exterior portions of these pipes are short tubes 48 and 49 welded at their inner ends to the side walls 1a and 1b and concentrically located with respect to the holes 46 and 47. The outer or free ends of these tubes are threaded for reception of slip nuts 50 and 51. In the annular spaces between the pipes 44 and 48, and pipes 45 and 49, are packings 52 and 53 which are compressed by the heads of the slip nuts 50 and 51 when screwed upon the threaded ends of the pipes or tubes 48 and 49. To the threaded ends of the pipes 44 and 45 are secured T fittings 54 and 55, to which in turn are secured pipes 56 and 57, see Figs. 1, 2 and 3.

The lower manifold 10 extends through suitable apertures in the side walls 1a and 1b, and is held in place by suitable flange plates 58 and 59 secured to the pipe 10 and to such side walls. The outer ends of the pipe 10 are connected by way of suitable fittings 60, 61, 62 and 63 to pipes 64 and 65. Fitting 61 is connected by way of a valve 66 and a pipe 67 to pipe 56, and fitting 63 is connected by way of a valve 68 to pipe 57. The

lower end of the pipe 64 is connected by suitable fittings to the reservoir 5, while the lower end of the pipe 65 is connected to the discharge 69 of a pump 70 operatively connected to a motor 71. From the pump 70 runs an intake 72 connected to the reservoir 5.

The liquid is conducted, supplied, distributed, circulated, and recirculated by way of the pump, the piping or conductor arrangement, and other features described. The particles washed down into the reservoir, in the main, float upon the liquid therein, but some of the particles of material are entrained with the liquid and may adhere to the inner wall of the upper manifold 30. If the liquid were fed into the pipe 30 at one end, and if the other end of this pipe were capped, such particles would accumulate at such dead end of the pipe and eventually clog one or more of the orifices of discharge for the liquid from such pipe. Even the clogging of one orifice would cause an open streak in the curtain 29 flowing down over the apron 3, whereby projected particles such as paint spray would contact and stick to the uncovered streak part of the apron 3. An important object of the present invention is to have at all times a completely continuous, smooth, unbroken curtain or sheet of liquid flowing down over the apron or wall 3.

Therefore, in the present invention, the liquid is fed or conducted into the upper manifold at both ends where there is no dead end or pocket for any accumulation of particles. The course of flow or conduction is from the reservoir 5 by way of the pump 70 into the conducting pipes, and the connected valves and fittings, 69, 65, 63, 68, 57 and 55 to one end of the upper manifold 30, whence this liquid meets the liquid entering at the other end thereof and both flow out through the orifices 31. From the fitting 63 is a branch liquid conducting means comprising pipes, fittings and valve 62, 10, 61, 66, 67, 56 and 54 to the other end of the upper manifold pipe 30, whence the liquid meets the other liquid entering at the other end of such manifold, as above described. While the liquid flows through the lower manifold pipe 10, some of that liquid flows out of the projecting tubes 11 and 12 to supply liquid in the cleaning chamber 2, as above described. Here also there is no dead end or pocket for accumulation of the particles.

In order to obtain a sort of balance between the liquid portions entering the two ends of the upper manifold 30, the valves 66 and 68 are so adjusted as to effect such balance in the upper manifold. Also, these valves are used to adjust the thickness of the liquid curtain 29 flowing over the front face of the apron 3.

Furthermore, there is a constant return or passing back of liquid by way of pipe and fitting 61 to 64 to the reservoir 5. In other words, the liquid supplied by the pump is in excess of that required at the manifolds so that there is a continual flowing back and circulating of the liquid to the reservoir. In this way, the liquid is in constant movement, whereby no particles are at rest, but are maintained on the move so as not to accumulate. Some few particles may adhere to the inner wall of the upper manifold pipe 30, but the rate of such adherance is very low and the device can be operated for a very long period of time before it becomes necessary to open up the upper manifold pipe 30 to clean it of such particles.

While I have herein described and upon the drawings shown an illustrative embodiment of the invention, it is to be understood that the invention is not limited thereto, but comprehends other constructions, details, arrangements of parts, features, or the like, without departing from the spirit of the invention.

Having thus disclosed the invention, I claim:

1. In a spray booth type of gas cleaner having an upright apron disposed for the flow of a sheet of liquid downwardly over a face thereof; a liquid sheet forming device comprising a chamber provided with an opening at the upper end of the apron and having forward, upper, rear and lower wall portions with the forward edge of said lower wall portion ending at said upper end of said apron and said opening, a manifold type of distributor in said chamber for directing liquid to flow over the faces of said wall portions in the form of sheets to flow as a resultant sheet of liquid to and over said face of said apron and a liquid supply means including a reservoir, a pump, and a liquid conducting means connected to said distributor for supplying liquid thereto.

2. In a spray booth type of gas cleaner having an upright apron disposed for the flow of a sheet of liquid downwardly over a face thereof; a liquid sheet forming device comprising a chamber provided with an opening at the upper end of the apron and having forward, upper, rear and lower wall portions with the forward edge of said lower wall portion ending at said upper end of said apron and said opening, a distributing plate in said chamber inclined rearwardly and downwardly from said forward wall portion, a manifold type of distributor in said chamber for directing liquid to flow over the faces of said wall portions and said distributor in the form of sheets to flow as a resultant sheet of liquid to and over said face of said apron, a liquid supply means including a reservoir, a pump, and a liquid conducting means connected to said distributor for supplying liquid thereto.

3. In a spray booth type of gas cleaner having an upright apron disposed for the flow of a sheet of liquid downwardly over a face thereof; a liquid sheet forming device comprising a chamber provided with an opening at the upper end of the apron and having a wall portion ending at said upper end of said apron and said opening, a cover for said opening and having means for freely hanging said cover from said forward wall portion with the lower edge portion of the cover provided with means for holding said lower edge portion spacedly forward of said face of said apron to provide an opening between said lower edge portion and said face of the apron.

4. In a spray booth type of gas cleaner having an upright apron disposed for the flow of a sheet of liquid downwardly over a face thereof; a liquid sheet forming device comprising a chamber provided with an opening at the upper end of the apron and having a wall portion ending at said upper end of said apron and said opening, a manifold type of distributor in said chamber for directing liquid to flow over said wall portion in the form of a sheet to flow through said opening and down over said face of the apron in the form of a sheet, a liquid supply means including a reservoir, a pump, and a liquid conducting means connected to both ends of the distributor for simultaneously supplying liquid thereto from both ends thereof, a cover for said opening and having means for freely hanging said cover from said forward wall portion with the lower edge portion of the cover provided with means for holding said lower edge portion

spacedly forward of said face of said apron to provide an opening between said lower edge portion and said face of the apron, said distributor being provided with a clean-out opening, to afford access to the interior of the distributor, a closure for said opening, and means for detachably holding the closure in closing position, said chamber opening being opposite said clean-out opening for affording access to said distributor through said chamber opening.

5. In a spray booth of the class described, liquid sheet forming apparatus comprising a plurality of longitudinal manifold type distributor units conductive of liquid throughout their length, liquid supply means including a reservoir, conduit means communicative with one end of each of said distributor units, a pump connected between the reservoir and said conduit means for delivering liquid from the former and through the latter into said distributor units, and additional conduit means communicative between the other ends of said units, the relative flow capacity of each of said conduit means and of said units from end to end being such that part of the liquid pumped into the one end of one of said units will be carried therethrough and through the additional conduit means into the other end of the other unit whereby delivery to said other unit occurs at both of its ends, and a recirculation conduit communicative between said additional conduit means and the reservoir for bleeding a portion of the pumped liquid back to the reservoir to increase the required pump discharge and turbulence of the liquid.

6. In apparatus for creating a liquid sheet to flow downwardly over a declining face upon an apron or the like, a chamber including a bottom wall, a back wall and a front wall of which the lower edge is in spaced relation with the bottom wall to effect a front wall opening, liquid distributing means in said chamber and operable to spread a liquid discharge therefrom generally as sheets respectively upon the front and back walls, the back and bottom walls being disposed for guiding the back wall sheet downwardly onto and forwardly along the bottom wall, the front wall being disposed for directing the sheet thereon into confluency with the sheet guided along the bottom wall and to form therewith a resultant sheet, and the forward edge of the bottom wall effecting a brink contiguously with said downwardly directed face whereby the resultant sheet is discharged onto such face.

7. In apparatus for creating a liquid sheet to flow downwardly over a declining face upon an apron or the like, a chamber including a bottom wall, a back wall and a front wall of which the lower edge is in spaced relation with the bottom wall to effect a front wall opening, liquid distributing means in said chamber and operable to spread a liquid discharge therefrom generally as sheets respectively upon the front and back walls, the back and bottom walls being disposed for guiding the back wall sheet downwardly onto and forwardly along the bottom wall, an arched baffle member disposed longitudinally beneath the lower edge of the front wall to divide the front wall sheet into sheet components as it descends from such lower edge and to direct these sheet components onto the bottom wall sheet for forming a resultant sheet therewith, and the forward edge of the bottom wall effecting a brink contiguously with said downwardly directed face whereby the resultant sheet spills over such edge onto said face.

8. In apparatus for creating a liquid sheet to flow downwardly over a declining face as upon an apron, a chamber including a bottom wall, a back wall and a front wall of which the lower edge terminates above the bottom wall, a longitudinal manifold type of distributor in said chamber for directing liquid to flow generally as sheets upon said front and back walls, the back and bottom wells being disposed for guiding the back wall sheet downwardly onto and forwardly along the bottom wall, said distributor being arranged longitudinally beneath the front wall lower edge to serve as a baffle member in intercepting the front wall sheet to divide the same into sheet components as it descends from said lower edge and to direct these sheet components onto the bottom wall sheet for forming a resultant sheet therewith, and the forward edge of the bottom wall effecting a brink contiguously with said downwardly directed face whereby the resultant sheet spills over such edge onto said face.

9. In apparatus for creating a liquid sheet to flow downwardly over a declining face as upon an apron, liquid sheet forming apparatus comprising a tubular distributor manifold provided with a plurality of discharge openings distributed lengthwise thereof for issuing streams to complementally form said liquid sheet, said manifold also having an opening extending lengthwise within a side wall portion substantially coextensive with the discharge openings and to provide means of access to the interior of said manifold for the cleaning thereof, a longitudinal closure member for said lengthwise opening, and means for detachably securing said closure member in closing relation with said opening.

10. In a spray booth type of gas cleaner having an upright apron disposed for the flow of a sheet of liquid downwardly over a face thereof; a liquid sheet forming device comprising a manifold type of distributor for projecting liquid to be formed into a sheet, a wall extending spacedly around the distributor for the spreading of the liquid directed thereagainst by the distributor in sheet form, said wall being provided with an opening in the plane of said apron for discharging the liquid in sheet form onto said face of the apron, and a liquid supply means connected to said distributor for supplying liquid thereto under pressure.

11. In a spray booth type of gas cleaner having an upright apron disposed for the flow of a sheet of liquid downwardly over a face thereof; a liquid sheet forming device comprising a manifold type of distributor for projecting liquid to be formed into a sheet, a wall extending spacedly around the distributor for the spreading of the liquid directed thereagainst by the distributor in sheet form, said wall being provided with an opening in the plane of said apron for discharging the liquid in sheet form onto said face of the apron, and a liquid supply means connected to said distributor for supplying liquid thereto under pressure, said liquid supply means having branches connected to the opposite ends of said distributor and having another branch for overflow of surplus liquid.

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