HOT-WATER MASK-WASHING MACHINE

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ABSTRACT

Masks to be cleaned are immersed in a tank in which liquid circulation is maintained at and past the masks, and over a filtering weir. This circulation is induced by a high-volume, low-pressure, and low-velocity system that creates a gravity pressure head to maintain the circulation with a minimum of energy loss. In the preferred form of the machine, the pressure system centers in a shrouded axial-flow propeller driving downward the liquid in a low-pressure portion of the tank to establish the pressure head differential. Provision is made for controlling the deposit of condensate accumulating on the cover of the heated tank.

1 Claim, 16 Drawing Figures
BACKGROUND OF THE INVENTION

This is a division of Application Ser. No. 243,601, filed Apr. 13, 1972 now Pat. No. 3,812,869.

Masks used in spray-painting procedures must be cleaned periodically to remove deposits of paint over the areas where the mask has interrupted the flow of paint onto the work pieces. Two different procedures have been developed for this cleaning operation. One of these is to immerse the masks in a conventional solvent for whatever types of paint have been involved. The second procedure is more recent, and centers in the coating of the masks initially with a material which is solidified at room temperature, but becomes liquefied at temperatures below the boiling point of water. A mask coated with this material, and then used in spray-painting operations, accumulates the paint on the outside of the coating material, so that the paint can be removed by liquefaction of the coating material and the consequent release of all material accumulated on top of the coating. The liquefaction of the coating is normally provided by immersion of the mask in hot water. Both the solvent and hot-water cleaning procedures will normally involve pumping systems of some sort for maintaining a circulation across the masks to facilitate the removal of the accumulated materials. Where the liquefied coating is used, the mask is re-coated during or after the cleaning operation has been completed.

The arrangements for maintaining the circulation of the solvent or hot water within the cleaning tank have usually involved pumps and piping operating at relatively high pressures, which produces a variety of problems. One of these is the cost of the pumps and the piping (including installation), and the other is the maintenance of adequate circulation in the presence of the relatively high losses necessarily associated with piping conducting liquid at substantial velocities. Mask-cleaning operations usually require a circulation which moves a high volume of liquid, and the confinement of this volume within piping of reasonable size results in the velocities tending to produce high energy losses. These losses are responsible for the necessity of using pumps of considerably greater power and pressure capacity than would seem to be necessary in the working area of the machine.

It is the usual practice to provide tank-type cleaning machines with a relatively stagnant area somewhere in the liquid circulating system where entrained particles have an opportunity to settle out. These settling basins are periodically cleaned out with shovels or scrapers, producing the usual cost and machine down-time associated with manual servicing operations. It may be noted in passing here that the separation of entrained paint particles from the cleaning liquid has been facilitated by the recent development of additives which "kill" the paint, in the sense that the paint is altered from a sticky consistency to a rubbery material which does not tend to adhere to surfaces on which the entrained particles may impinge. In conventional mask-cleaning machines, this new development has both advantages and disadvantages. While the removal of entrained particles is more complete, the accumulation of these in the settling basins is also more rapid.

SUMMARY OF THE INVENTION

The present invention has been directed at the problems noted above. Masks are immersed in a tank in which a low-pressure and high-volume circulation is maintained at and past the immersed masks. Substantially the entire circulation path of the liquid is traversed with a low, but sufficient velocity to eliminate any tendency for the entrained particles of paint to settle out. In contrast to the settling-basin arrangement for removing the particles, the present invention utilizes a filtration weir traversed preferably by the entire circulation in the tank. The weir structure involves an overflow point in a partition separating the tank into high and low-pressure sections, and a perforate panel extends at a downward inclination from the partition permitting liquid to fall through into the low-pressure tank portion. Particles of a size in excess of that permitted to pass through the perforate panel are moved downwardly by the overflow, and ultimately fall into a filtration bag which can be removed periodically and emptied. The particular angle of downward inclination of the perforate panel is preferably selected so that almost all of the liquid will fall through the panel, leaving just enough flow to continually urge the particles entrapped on the panel to roll downwardly into the bag.

The system for maintaining the circulation of the liquid in the tank centers in a shrouded axial-flow propeller, which is preferably oriented to drive liquid taken from the low-pressure side of the tank in a downward direction. The liquid is then diverted across the bottom of the tank and upward into a manifold extending along a vertical wall of the tank. A number of openings are provided in this manifold, which produces a pattern of discharge parts directing the tank liquid laterally against the masks. The masks are disposed at an angle which produces a deflection of the liquid in an upward direction generally toward the overflow weir, which facilitates the maintenance of removed particles in suspension, and inhibits the collection of these on the bottom of the tank. A placement of the masks in a spaced relationship to the bottom of the tank also provides a degree of flow velocity directly along the bottom which further tends to minimize the possibility of accumulation of particles in this area, particularly when in conjunction with a curved and inclined configuration of the tank surfaces in this area tending to maintain this relatively low velocity, compared to that of high-pressure jets in conventional machines. Where the machines are used in conjunction with the hot-water cleaning procedures, the cover on the tank is actuated to the open position by a mechanism which tilts the cover into a position where accumulations of condensate fall inward into the tank area in a position where they do not impinge on cleaned masks which are being dried after being removed from the tank.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front perspective view of the machine, showing the operating condition of the machine with the tank cover closed.

FIG. 2 is a front perspective view from the opposite side of the machine from that of FIG. 1.

FIG. 3 is a rear perspective of the machine, from the same side as that of FIG. 1. Access covers have been removed from the rear of the machine to expose the interior arrangement.

FIG. 4 is a front elevation of the machine shown in FIGS. 1 to 3.
FIG. 5 is an end elevation of a modified form of the machine from that shown in FIG. 4.

FIG. 6 is a partial sectional front elevation of the machine illustrated in FIG. 4, on an enlarged scale.

FIG. 7 is a fragmentary sectional elevation at the rear of the machine shown in FIG. 4.

FIG. 8 is a top view of the machine shown in FIG. 4, on an enlarged scale.

FIG. 9 is a sectional view taken of the plane 9-9 of FIG. 11, which is a horizontal plane.

FIG. 10 is a vertical sectional view through the machine, taken at the plane 10-10 of FIGS. 4 and 9.

FIG. 11 is a sectional elevation on the plane 11-11 of FIGS. 4 and 9.

FIG. 12 is a vertical sectional view taken at the plane 12-12 of FIGS. 4 and 9, with the cover and the mask rack in the elevated position.

FIG. 13 is a perspective view of the perforated panel extending from the overflow weir.

FIG. 14 is a perspective view of a filter bag placed at the down stream end of the perforated panel shown in FIG. 13.

FIG. 15 is a fragmentary sectional elevation on the plane 15-15 of FIG. 16, showing the structural details of the filtration system.

FIG. 16 is a fragmentary rear view of the filter bag and perforated weir plate taken at the plane 16-16 of FIG. 15.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The machine illustrated in FIG. 1 and the related figures has an upper housing 20 and a tank structure generally indicated at 21. Referring to FIG. 10, the tank structure includes the exterior paneling 22, the watertight interior liner 23, and the insulation 24 interposed between these components. Conventional electric heating probes 25 and 26 traverse the rear portion of the tank, and extend adjacent the bottom of the liner 23 to maintain an elevated temperature of the liquid in the tank. The machine illustrated in these drawings is adapted primarily for the use of hot water, and in conjunction with masks coated with a releasable material that is liquefied by temperatures on the order of 180°F to 200°F.

The opposite guideways 27 and 28 (refer to FIGS. 1 and 2) are mounted on the housing 20, and extend downward into the tank area as illustrated in FIG. 12. Carriage units 29 and 30 engage these guideways, and are interconnected by the beam 31. Brackets as shown at 32 in FIG. 12 are secured to the carriages 29 and 30 to support the rack structure 33 on which masks are placed for immersion into the tank. This rack structure is formed by the lower rail 34 and the upper rail 35 interconnected by the end members 36 and 37 and the series of spaced rods 38 arranged in vertical planes.

The vertical movement of the mask rack becomes evident by comparison of FIGS. 10 and 12. The mechanism responsible for this movement is mounted on the top of the housing 20, and is illustrated in FIG. 8. The cylinder 39 is secured to the top 40 of the housing, and the piston rod 41 carries the pulley 42 rotatably mounted in the fork 43 secured to the end of the piston rod 41. Cables 44 and 45 extend from the bracket 46 secured to the top 40 of the housing around the double pulley 42. The cable 45 extends to the pulley 47 rotatably mounted in the bracket 48, and the pulley 44 around the idler pulley 49 rotatably supported by the bracket 50 and to the pulley 51 rotatably mounted in the bracket 52. These brackets are all secured to the top of the housing 40, and the pulleys 47 and 51 change the course of the cables 45 and 44, respectively, downward to points of connection with the carriages 29 and 30 within the guideways 27 and 28. Extension of the piston rod 41 will therefore result in lowering the mask rack, and retraction of the piston rod 41 will raise the mask rack to the position shown in FIG. 12, both at a two-to-one movement ratio of the rack with respect to the piston.

The cover 53 is preferably constructed of spaced stainless steel sheets 54 and 55 separated by the insulation 56. This cover rests on the shelf structure 57 defining a top opening in the tank. The closed position of the cover is illustrated in FIG. 10. The raising of the mask rack moves the cover to the open position shown in FIG. 12 by the action of the brackets 58 secured to the carriages 29 and 30, respectively. These brackets have supporting flanges 59 which engage the underside of the cover 53, and are disposed at an angle (to the closed position of the cover) downwardly to the rear, as shown in FIG. 12, so that condensate accumulating on the underside of the cover will move downwardly along the cover and drip off into the tank at the rear portion of the opening defined by the shelf 57. The bolts 60 are fixed with respect to the cover 53, and loosely engage a suitable hole in the flange 59 to prevent lateral displacement of the cover with respect to the brackets 58. The lateral extension of the cover 53 is beyond the vertically-projected boundaries of the mask rack structure, so that the movement of droplets of condensate downwardly along the cover to the rear edge provides a shelter for the masks carried by the rack structure. Masks are therefore permitted to dry in the position of the machine shown in FIG. 12, and they may be re-sprayed with coating material in this position. This stage of the process can take place without contamination by droplets of condensate.

A circulation of water within the tank structure is maintained by the pump system shown best in FIGS. 7 and 11. An axial-flow propeller 61 is mounted on the shaft 62, the lower end of which is supported in the bearing 63. This bearing is located with respect to the propeller shroud 64 by radially-extending and angularly-spaced legs 65. The shroud 64 is supported on the central structure 66 secured to the floor of the tank, this structure having an opening registering with the inside of the shroud 64 to provide a passage for the flow of liquid under the action of the propeller 61. Flow is conducted downward to the propeller 61 through the conduit 67, and extends from the discharge point of the shroud 64 into the bottom ducts 68-70 which are integral with the structure 66. (Refer to FIG. 9.) These feed ducts provide a supply of liquid to the vertical discharge duct defined by the wall of the tank and the perforate panel 71. (Refer to FIG. 11.) The openings in this panel function as exhaust ports directing a plurality of streams of liquid laterally from the front to the rear of the tank at and past the rack structure and any masks which happen to be supported by it. The angular orientation of the front surfaces of the rails 34 and 35 of the mask rack have a tendency to deflect flow upwardly as it moves to the rear toward the top of the inclined partition 72 in the tank, which separates the tank into high and low pressure areas. The top of this partition forms
an overflow point from the front high-pressure portion of the tank to the rear low-pressure portion having a lower static pressure head (shown at 73 in FIG. 10) than that shown at 74 associated with the front portion of the tank. The duct 67 intersects the tank partition 72, and forces the liquid overflowing from the opposite sides of the partition to follow the flow path shown in FIG. 7. The lower extremity of the duct 67 is open; and its presence tends to equalize the inflow of liquid into the top of the propellor shroud 64. It is preferable to incorporate arcuate corners as shown at 75-77 in FIGS. 7 and 11 at the turns in the liquid flow to reduce losses as much as possible.

The removal of entrained particles of paint is accomplished by the structure shown in FIGS. 10 and 13-16. This structure is duplicated at the opposite sides of the machine, and includes the perforate weir panels 75, which extend downwardly from the edge of the partition 72 along a distance defined by the spacing of the integral end-plates 76 and 77. The lower edge 78 of these perforate panels is placed over the edge of the filtration bags 79 having the handle rods 80 and 81 secured to the marginal edges of the bags, and extending to provide support for the bag by interengagement of the horizontal portions of the rods with the shelves 82 and 83 shown in FIG. 7. The bags 79 are within the low-pressure portion of the tank, and the inclination of the perforate plate 75 is selected preferably so that water overflowing at the upper edge of the plate continues in diminished quantity to a degree such that just a sufficient amount of liquid flows over the lower edge 78 to carry with it particles of paint that have been entrapped on the plate, and carry them into the collecting bag 79. This bag functions as a filter, and permits accumulations of liquid to return to the low pressure portion of the tank along with that passing through the perforate panel 75. This panel acts as the floor of an overflow conduit.

Ventilation for the machine is provided by the blower system shown best in FIG. 11. The shaft 62 carrying the propellor 64 extends upwardly through the bearing 84 mounted on the tank structure, and also through the bearings 85 and 86 carried by the star-shaped brackets 87 and 88 secured to the exhaust ducting 89 mounted on the top of the housing 20. The shaft 62 may be provided in a plurality of sections interconnected by couplings as shown at 90, if desired. A pulley 91 is fixed with respect to the shaft 62, and carries one or more belts 92 to the pulley 93 on the motor 94 through a suitable opening 95 in the exhaust ducting 89. The blower impellor 96 is preferably an axial flow unit, and is driven along with the propellor 61 by the motor 94. Operation of the blower system establishes a reduction in pressure in the exhaust ducting 89 producing a suction tending to purge the tank area, and also the space at the rear of the partition 72. An opening 97 is provided in the inclined central panel 98 causing the reduction in pressure to remove accumulations of vapor in this area. The lower perforate panel 101 at the rear communicates with the interior of the vertical exhaust duct 100 via the passage defined by the panel 101 and the access covers 102 (refer to FIG. 11). These arrangements also provide for the continual removal of vapors when the covers 102 (refer to FIG. 10) are removed, and prevent seepage of the vapors around these covers so that locked fits and seals are not necessary.
operation of the propeller 61 is preferably selected at approximately 6 inches, and the level in the tank can be determined by a conventional float valve (not shown) operative to control a supply pipe communicating with any convenient place on the tank. In view of the relatively small loss of liquid through vapor, the filling of the tank can also be controlled manually, if desired.

I claim:

1. An immersion-processing machine including a tank, having an opening and a cover for said opening, and a rack for supporting articles for immersion in said tank, and also including an elevating mechanism operative to raise said rack, wherein the improvement comprises:

opening means carried by said elevating mechanism and engageable with said cover to raise said cover substantially continually within the space defined by the vertically projected area of the closed position of said cover on upward movement of said rack, said opening means supporting said cover in an inclined position with respect to the closed position of said cover as supported by said tank, said cover extending laterally beyond the vertically projected boundaries of said rack, and the lower edge of said cover in the inclined position thereof being within the vertical projection of the opening in said tank associated with said cover.

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