May 30, 1933. K. J. R. ROBERTSON 1,911,926

CLEANING BATH EMPLOYING VOLATILE SOLVENTS

Filed June 12, 1929

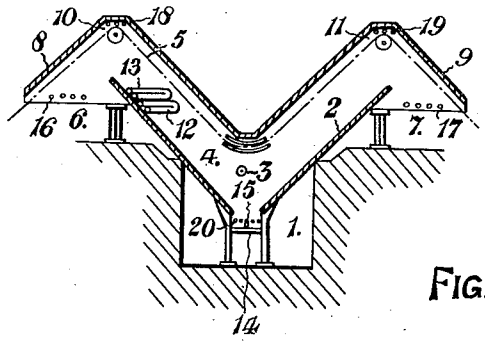


FIG. 1.

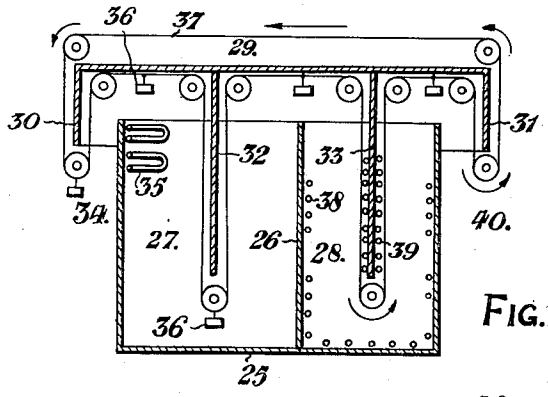


FIG. 2.

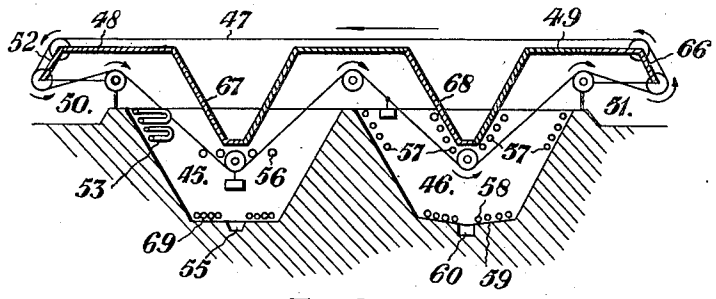
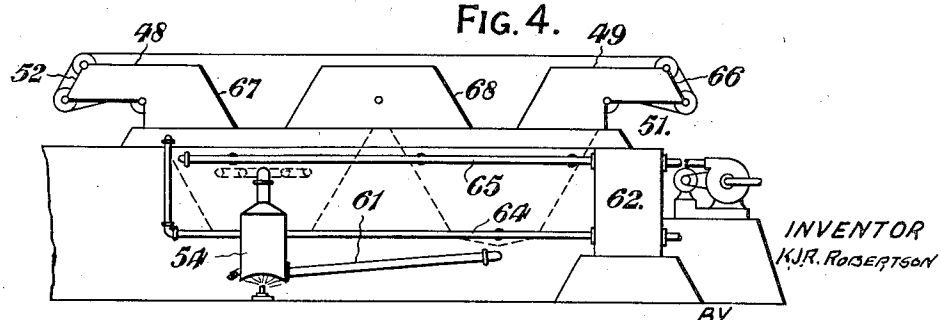


FIG. 3.

FIG. 4.



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CLEANING BATH EMPLOYING VOLATILE SOLVENTS

Application filed June 12, 1929, Serial No. 370,423, and in Great Britain January 30, 1929.

This invention relates to cleaning plants in which the articles to be cleaned are subjected to a vapour solvent, and has more especial application to continuous cleaning plants in which the articles are traversed through a solvent vapour zone where condensation of the solvent and consequent solution of the grease is effected, for instance as in co-pending application Serial No. 302,038.

In plants of this character a conveyor is usually employed to effect the traverse of the articles, and vapour losses are likely to ensue owing to the entrainment effect of the conveyor and the articles, as well as the diffusion of the vapour into the ambient atmosphere at the entry and exit locations of the conveyor into the vapour zone, and the present invention has for its object to provide means for preventing vapour losses by such diffusion or entrainment, and further to definitely locate the vapour within the precincts of the plant, even under circumstances when overgeneration would normally fill the plant to overflowing. Further and favourable features will be apparent from the following description.

In accordance with the invention an air cushion is interposed between the vapour solvent and the ambient air and conveniently the cushion is maintained in position by a temperature control.

The cushion may be retained in juxtaposition with the vapour by making the outlets from the bath (i. e. the vapour exits) of elbow or similar form whereby a cushion is trapped and in this construction the elbow may be provided with heating means to ensure that the cushion is maintained in its desired position.

To further prevent the escape of vapours from the bath the upper regions of the bath may contain a refrigerating zone which limits the level of the vapour in the bath, and conveniently the elbow adjacent the exit end of the bath is arranged as a refrigerating zone so that any vapour diffusing or entrained from the bath is condensed and returned either to the bath or to the vapour regenerating means associated with the bath.

Reference will now be made to the accompanying drawing in connection with which the invention will be more fully described.

In the said drawing:

Fig. 1 is a longitudinal section of a vapour cleaning bath including canopies over its exit and entry according to the invention to prevent the escape of the vapour solvent;

Fig. 2 shows diagrammatically a longitudinal section of a vapour bath and associated liquor trap in the form of a canopy provided with refrigerating means for effecting condensation of any solvent vapour entrained or diffusing through the discharge orifice of the bath;

Figs. 3 and 4 are respectively a longitudinal section and a side elevation of a vapour cleaning plant embodying the cushion forming canopies according to the invention, and including a liquor trap juxtaposed to the discharge end of the vapour bath.

The solvent vapours employed, usually trichlorethylene or carbon tetrachloride, are heavier than air, and the articles to be cleaned are traversed through a zone of vapour while at a temperature below the condensation temperature of the vapour, so that condensation of the vapour is effected on the articles with consequent solution of any grease or other soluble matter contained thereon.

In the embodiment illustrated the vapour cleaning plant comprises a well or trough 1 in which is located a casing 2 in the form of a V-shaped conduit, a vapour inlet 3 being shown at the apex of the said conduit to permit of the introduction of solvent vapour into the conduit 2 to constitute the vapour zone 4 required to effect the necessary purgative action on the articles to be cleaned.

Suitably suspended near the upper walls of the conduit 2 is a conveyor system 5 by which the traverse of the articles is effected and adjacent the entry 6 and the exit 7 of said conveyor 5 into the conduit 2 the upper wall of the conduit depends in the form of a canopy indicated at 8 and 9 respectively.

The canopy construction at 8 and 9 provides elbows in the conduit 2, and in the upper localities 10 and 11 bodies of air are located which remain substantially quiescent and form cushions between the solvent va-

pour in the zone 4 and the ambient atmosphere at the entry 6 and exit 7 respectively of the conduit 2 constituting the cleaning plant.

As before mentioned the solvent vapours employed are customarily heavier than air and accordingly only a small quantity of solvent will diffuse into the air cushions 10 and 11 and this may be removed at intervals by refrigeration although preferably a refrigerant zone is located between the vapour zone 4 and the air cushions 10 and 11, say in the form of stacks of pipes 12 and 13 carrying cooling medium so that solvent vapour attaining the zone of the pipes 12 and 13 is condensed and falls to the base of the conduit 2.

Liquor falling to the base 14 of the conduit 2 discharges through a pipe 15, say to regenerating stills (not shown) where the vapour is regenerated and resupplied to the vapour zone 4 through the vapour inlet 3.

To assist in maintaining the air cushions 10 and 11 in position adjacent the canopies 8 and 9 a series of heating coils 16 and 17 may be located at the atmospheric ends of the canopies to cause a slight upward trend in the air located adjacent the mouth of the conduit 2, while pipes 18 and 19 shown in the upper zones of the canopies may be thermostatically controlled and pass refrigerant at required times to reduce the temperature of the air cushion below dew point and thereby effect condensation of any solvent vapour which might have diffused into the body of air constituting the cushion.

Supplementary to or as an alternative to the regenerator stills aforementioned, heating coils 20 may be provided in the base of the vapour zone and may serve to revapourize any liquor falling to the base 14 of the bath or may be employed simply to maintain the desired temperature conditions within the vapour zone 4, and in this event may conveniently be thermostatically controlled by a thermostat element located so as to be effected by the conditions prevailing in the vapour zone 4.

As will be seen the arrangement described provides a compact cleaning plant which may be readily and cheaply erected and economically operated, very little vapour being lost in use, and a continuity of articles fed to the plant at 6 having the grease and other soluble matter effectively removed by passage through the vapour zone 4, and when discharged at the delivery end 7 are cleaned as required.

In the embodiment illustrated in Fig. 2 the cleaning plant is arranged in the form of a tank 25 having an upstanding partition 26 dividing the tank into a vapour bath 27 and a liquor and vapour trap 28, a canopy 29 being provided depending at 30 and 31 over the entry and exit of the plant and having partitions 32 and 33 depending respectively into the vapour bath 27 and the liquor trap 28.

The vapour bath 27 is maintained charged with solvent vapour and diffusion into the ambient atmosphere at the entry 34 is prevented by the depending canopy 30 and further by the refrigerating zone provided by the stack of pipes 35 containing cooling medium which effect condensation of any solvent vapour attaining their vicinity.

The articles to be cleaned, diagrammatically represented at 36, are traversed through the vapour bath 27 by a conveyor 37 which by a system of guide pulleys then passes through the liquor trap 28.

The liquor trap 28 may be maintained at a temperature below the condensation temperature of the particular solvent employed by any suitable means, preferably by a series of coils 38 adjacent its walls and base, further coils 39 being provided on the depending partition 33. The conveyor 37 with the articles 36 thus traverses a cool zone after passage through the vapour bath 27, with the result that any solvent entrained by the conveyor or the articles is condensed and falls to the base of the liquor trap 28 whence it may be returned to the vapour bath 27 or to the means associated with said bath for generating the vapour.

Accordingly, the articles 36 are delivered at 40 cleaned as required and only a limited quantity of solvent vapour, if any, lost by entrainment or diffusion into the ambient atmosphere, the vapour bath 27 being in substance isolated from the ambient atmosphere by the depending canopy 30 and the refrigerating zone produced by the pipes 35 at the entry 34 and by the depending canopy 31 of the liquor trap 28 on the discharge side.

Referring now to the plant illustrated in Figs. 3 and 4 the vapour bath 45 is in the form of a shallow trough or duct and a second trough or duct 46 constitutes the liquor and vapour trap, a conveyor 47 being employed to traverse the articles in sequence through the vapour bath 45 and the liquor and vapour trap 46.

Canopies 48 and 49 located over the article entry 50 and the discharge 51 respectively are extended inwardly so as to constitute a cover for the plant which leaves the bath 45 open to atmosphere only at the entry 50 and the liquor trap 46 only at the discharge 51.

Loss of solvent vapour by diffusion to the ambient atmosphere at the entry 50 is substantially eliminated by the depending wall 52 of the canopy 48, and further by the refrigerating zone provided at the mouth of the vapour bath 45 by the cooling coils 53, the supply of cooling medium to which may be thermostatically adjusted to maintain the desired level of vapour within the bath 45.

In Fig. 4 a regenerator still 54 is shown for maintaining the vapour bath 45 supplied

with clean vapour, a conduit 55 conveying grease-charged solvent from the base 56 of the bath 45 to the still where the vapour is regenerated and resupplied to the bath through inlets 56, the residue grease being discharged and collected.

The liquor trap 46 is juxtaposed to the vapour bath 45 on the delivery side and the conveyor passes in sequence through the vapour bath and the liquor trap delivering the articles to the discharge end 51 of the plant.

The liquor trap 46 is maintained at a temperature below the condensation temperature of the particular solvent employed in the vapour bath 45 by means of stacks of cooling pipes 57 adjacent the entry and exit, further cooling pipes 58 being provided on the base 59 of the trap if desired, and a conduit 60 being located in the base of the trap to which any vapour condensed in the trap is directed, whence as condensate, it is returned to the still 54 for regeneration through a pipe line 61.

The refrigerating media for the cooling pipes 53, 57 and 58 is circulated through a cooling plant 62 by means of a pipe system 64 and 65 any suitable control for the cooling plant 62 being provided, preferably a thermostatic control at the instance of the temperature conditions prevailing in the vapour bath 45.

The canopy 49 is provided with a depending flange 66 adjacent the discharge 51 corresponding with the entry flange 52 on the canopy 48 so that the finished structure is in substance uniform.

Conveniently the canopies 48 and 49 and the central extensions may be made of metal, the V portions 67 and 68 depending into the vapour 45 and the liquor trap 46 respectively serving to support the conveyor 47 and to carry the cooling pipes 53 and 57 providing the refrigerating zones.

A series of heating pipes 69 are shown in the base of the vapour bath 45 and these may be employed as a supplement of the generating still 54 or alternative thereto as required or may simply be employed to maintain substantially constant temperature conditions within the vapour bath 45.

It will be seen that a plant according to the present invention provides for the continuous and efficient cleaning of a plurality of articles with minimum expenditure small quantities only of liquid solvent being required to maintain the bath 45 constantly charged with clean vapour and the liquor and vapour trap 46 serving to minimize the vapour losses so that the apparatus can continue in operation for considerable periods without the necessity of replenishing the vapour bath.

If desired the canopies 48 and 49 at the entry and discharge may be provided with heating coils as indicated at 16 in Fig. 1, on the lips of the flanges 52 and 66 respectively to induce a slight upward trend of air into the canopies, while further if desired refrigerant pipes may be associated with the entry canopy 48 and may be thermostat controlled to a temperature below the dew point of the solvent to effect condensation of any solvent vapour diffusing from the bath 45 into the body of air located by the canopy 48 whereby such solvent is recovered and returned to the bath.

A vapour cleaning plant in which the articles are traversed through a solvent vapour zone while at a temperature below the condensation temperature of the particular vapour is described in copending application Serial No. 302,038 and no claim is here made to any of the features therein claimed.

What I claim is:

1. A cleaning plant of the character described comprising a reservoir for solvent vapour, means for immersing articles to be cleaned within the reservoir, a canopy for said reservoir, said canopy being formed to provide pockets adjacent the extremities of the reservoir and heating means for providing a layer of warm air within said pockets for preventing colder air entering the plant.

2. A cleaning plant of the character described comprising a reservoir for vapour, means for supplying vapour to said reservoir, means for subjecting in succession articles to be cleaned within the reservoir, a covering for said reservoir forming pockets at the extremities of said reservoir, and heating means for maintaining a layer of warm air within said pockets.

3. Apparatus of the character described comprising a reservoir for vapour, a condensing chamber adjacent said reservoir, said reservoir and chamber constituting a single unit, and a canopy for said unit, said canopy providing pockets at the extremities of said unit for confining banks of air at a level above the vapor.

4. A cleaning plant comprising a unit having a plurality of sections, one of said sections being arranged to contain a solvent in vapour form, another of said sections being arranged to condense vapour to liquid form, a canopy over said sections, heating means in combination with said canopy, said heating means being arranged to maintain banks of warm air within and at the extremities of the canopy.

5. Cleaning apparatus comprising a unit for containing liquid vapour, and open to the atmosphere, a canopy over said unit having projecting ends depending below the top level of the unit, means for condensing vapour seeking to rise above the top level of the unit, and means for heating banks of air within the canopy at said ends thereof.

6. A cleaning plant of the character described including a unit for containing va-

pour, means for condensing said vapour, and means for regenerating vapour condensations, a canopy over the unit, an endless conveyor supported by said canopy leading articles in succession within the unit and removing them therefrom, and means for maintaining banks of warm air between the vapour in said unit and outer atmosphere, said unit being open to the atmosphere.

7. A cleaning plant of the character described comprising a reservoir for vapor, means for supplying vapor to said reservoir, means for immersing articles to be cleaned within the reservoir, a canopy for said reservoir, said canopy being formed to provide pockets adjacent the extremities of the reservoir, said pockets being adapted to confine a layer of air above the vapor in said reservoir.

In testimony whereof I affix my signature.

KENNETH JAMES RENNIE ROBERTSON.