

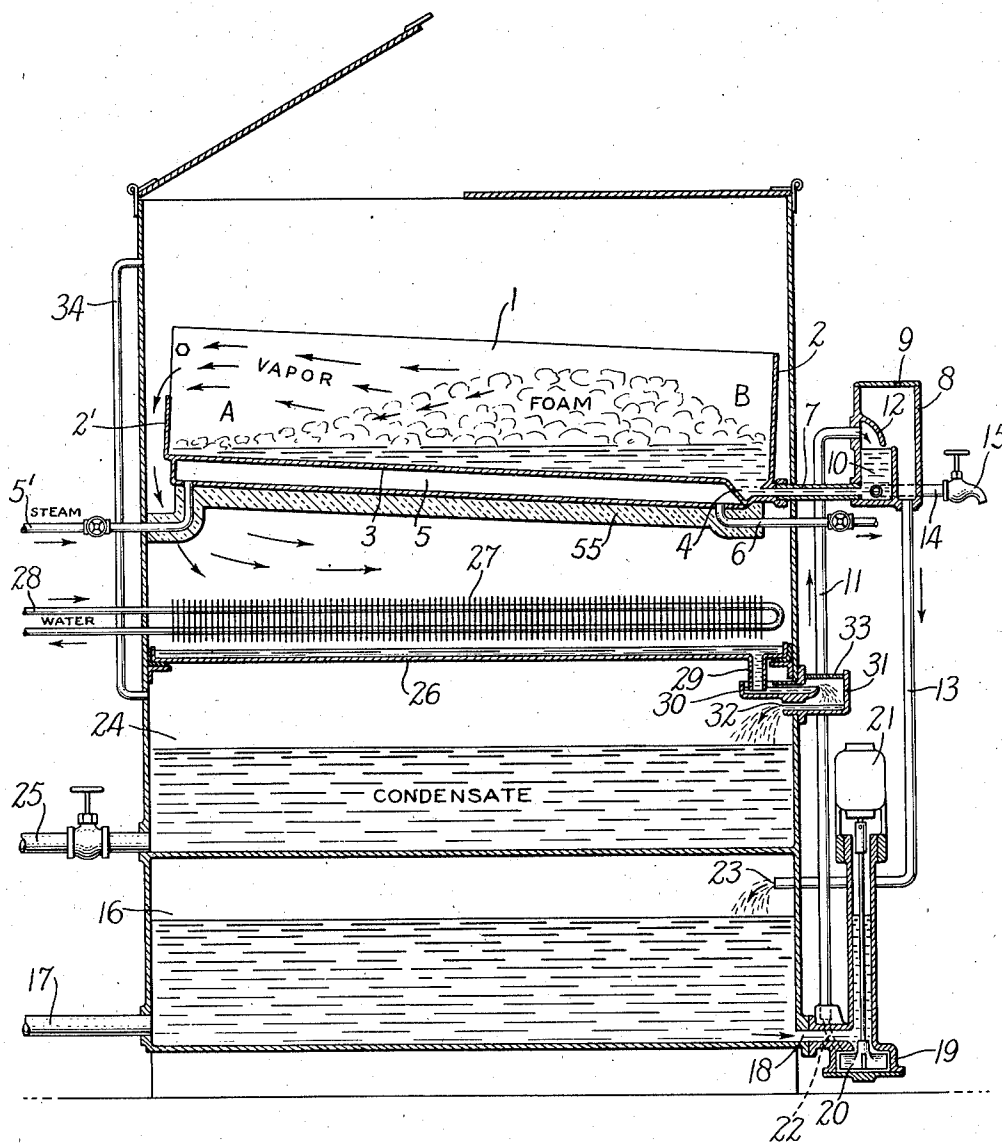
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STILL FOR DISTILLING OR RECLAIMING

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STILL FOR DISTILLING OR RECLAIMING

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The present invention relates to an improve-
ment in stills for distilling or reclaiming. In
commercial dry cleaning, for example, the liquid
solvent employed for cleaning becomes fouled
with oils, soap, etc. which cannot readily be re-
moved by filtering. Previously known practice
for reclaiming such solvents, as by distillation,
has involved unduly complex, expensive and, in
some cases, unsafe apparatus; or has been only
partly acceptable due to excessive foaming of the
oil or other dirty component of the liquid under
normal pressure at boiling temperatures. Foul-
ing of the condensate and other disadvantages
frequently accompany these conditions.

One object of the present invention has been
to provide a still which can be embodied in a
compact design and made at relatively low cost
for its capacity. A further object has been to
provide apparatus for and a method of rapid
vaporization of volatile substances at substan-
tially atmospheric pressure and wherein foaming
is controlled to prevent its fouling the condensate.
Other objects of the invention and beneficial re-
sults thereof will be apparent from the following
description and accompanying drawing illustrat-
ing one embodiment of apparatus and steps of
method according to the invention.

The single figure of the drawing, which is in
central vertical section, shows a still of a form
more particularly designed for employment with
a solvent reclaimer unit to be conveniently as-
sembled with commercial dry cleaning apparatus,
although the invention is obviously not limited
to such specific purpose or field of use.

Referring to the drawing, one form of still
according to the invention comprises a vaporizing
device, as a pan having an inclined bottom 3
which forms a shallow liquid holding portion at
zone A and a deeper portion and a trough 4 at
zone B. A peripheral wall including the upright
portions 1 and 2 retains the liquid in vaporizing
position on said inclined bottom of the pan. The
bottom 3 is heated by steam supplied to a steam
chamber 5 by pipe 5' and discharged by pipe 6,
said chamber 5 being insulated from adjacent
condensing surfaces by any suitable insulating
means as a layer 55 of insulating material cov-
ering the bottom surface of steam chamber 5.

Liquid to be vaporized is fed into the trough
4, zone B, of said pan 1 through an inlet pipe 7
which opens into said trough below the level of
the bottom at shallow portion, zone A. A prede-
termined level of liquid in the pan is maintained
by any suitable level maintaining device, as a
chamber 8 having a vent 9 and a weir or overflow

partition or wall which forms with other wall
portions of said chamber a well 10 connected
with the interior of said pan by said inlet pipe 7.

Liquid is delivered to chamber 8 and well 10
through pipe 11 opening opposite a baffle 12. Any
excess of liquid thus supplied beyond that re-
quired to maintain the level of liquid in said pan
at the level of the weir flows over said weir into
the return pipe 13. A pipe 14 and nozzle 15 con-
nect with well 10 near its bottom and may be
employed to discharge the contents of the pan
and said well if desired.

The liquid to be vaporized or cleaned is con-
veniently supplied from any suitable source, as a
reservoir 16 which need not be an integral part
of the reclaiming unit, but which, in the ap-
paratus shown, has an inlet pipe 17 and an outlet
18 into a hollow fitting 19 enclosing a pump 20
actuated by a motor 21. Pump 20 discharges
through a duct 22 in fitting 19 and thence into
feed pipe 11. The lower open end 23 of return
pipe 13 extends into the inside of reservoir 16 so
that any excess of liquid fed to well 10 as afore-
said returns by gravity to reservoir 16.

Another suitably located reservoir 24 receives
the reclaimed solvent or other condensate re-
sulting from cooling of the vapors produced in
the vaporizing pan. Condensate is withdrawn
from reservoir 24 through valve controlled pipe
25. Above reservoir 24 in the apparatus shown
in the drawing is a horizontal partition 26 which
forms the floor of a vaporizing and condensing
chamber provided with a cooling device or con-
denser 27 having a cold water supply pipe 28.
Said condenser or others for a like purpose and
the cool walls of said chamber provide convenient
surfaces for effectively condensing the vapors
formed in said pan.

A condensate discharge outlet pipe 29 opens
through floor 26 and into a sealing receiver 30,
one portion of which extends into an overflow
box 31 which delivers condensate through port
32 into the interior of reservoir 24. Box 31 is
fitted with suitable means, as a glass top wall 33,
to permit observations regarding the presence
and rate of flow of condensate therein. A vent
or pressure equalizing pipe 34 connects the in-
side of reservoir 24 with the inside of said vapor-
izing and condensing chamber.

In the embodiment shown in the drawing, the
vaporizing pan is supported in the upper portion
of said vaporizing and condensing chamber with
the outer surfaces of its walls spaced from adja-
cent interior surfaces of said chamber to permit
the free flow of vapors of trichlorethylene, for

example, from said pan through a discharge opening C toward said condenser 27, and into contact with inside surfaces of the chamber which are ordinarily cool enough to effect condensation of such vapors. To expedite this flow and thus to facilitate vaporization without substantial accumulation of vapor pressure above the liquid in the pan, said discharge opening C is arranged above the level of the vaporizing liquid and below the level of top edge portions of the peripheral wall, which thus tends to laterally confine the vapor produced in the pan.

The method of distilling or reclaiming according to the present invention may conveniently be practiced in connection with use of the above described or other suitable vaporizing apparatus. Where the material to be treated or reclaimed is dirty liquid solvent, for example trichlorethylene after employment in dry cleaning operations, a supply of such dirty liquid is delivered into well 10 at a rate to maintain a suitable level of liquid in the vaporizing pan. The inclination of bottom 3 is such that the layer of liquid at zone A is comparatively thin, i. e. the liquid there is of shallow depth as compared to the depth at zone B and in trough 4. In a small installation for reclaiming twenty gallon batches for example, the pan bottom may be so inclined and the liquid level so regulated that during vaporization the liquid in the pan will vary in depth from about one-eighth of an inch at the shallow portion (zone A) to about one inch at the deep portion (zone B).

For reclaiming used trichlorethylene with the above described apparatus, steam at from five to six and one-half pounds pressure is admitted to steam chamber 5 and thence supplies heat to the liquid in the pan. Where the dirty liquid so heated contains relatively nonvolatile oils or other usual residual matter, a certain amount of foaming takes place along with active vaporization. At zone A, the layer of liquid is relatively thin and farther from the inlet and therefore hotter than that at zone B. Vaporization is also more rapid at zone A and foam is produced faster there than at zone B due in part to the fact that rapid vaporization at zone A effects a concentration of residue which under the there existing conditions of temperature and pressure produces rapid foaming. However, the volume of liquid per unit of area at zone A is relatively small and therefore the total volume of foaming there produced is less than at zone B. The foam bubbles originating at and near zone B are relatively large and seem to flow toward zone A, as indicated by the small arrow in the drawing; but these bubbles burst rapidly and do not pile up as foam in zone A. This permits the vapors to be drawn off freely from zone A through outlet opening C (somewhat as shown by the long arrows) at a level not substantially above that of the liquid without entraining foam and consequently without fouling the condensate.

Where the vapor is heavier than air, as is the case with trichlorethylene, vaporization is preferably effected at atmospheric pressure and no unusual precautions need be taken to seal or close the top of the vaporizing and condensing chamber as long as condensation proceeds at a sufficiently rapid rate to liquefy the vapor substantially as fast as it is produced in the pan.

After the pump 20 ceases to deliver liquid to well 10, continued vaporization of liquid in the pan brings substantially the whole volume thereof to a degree or state of residue concentration

which produces violent foaming of increasing volume from zone A to zone B; and the residual oil gradually runs toward and into trough 4 as vaporization proceeds, due to the downward pitch of pan bottom 3. But the maximum foaming volume produced at zone A is still insufficient to run over into the condenser chamber through outlet opening C, while the greater volume of foam at zone B is effectively confined within the pan by the well portions adjacent thereto.

When substantially all of the solvent or other substance has been vaporized out of the liquid contents of the vaporizing pan, the residue collected in trough 4 is discharged therefrom in any suitable manner as through pipe 14 and nozzle 15. The solvent or reclaimed liquid precipitated from the vapor phase on the interior wall surfaces of the condenser chamber or by condenser 27 collects on floor 26 and discharges therefrom through pipe 29 into receptacle 30 wherein said liquid accumulates to a level which seals the open discharge end of pipe 29. Additional condensate delivered through pipe 29 flows over an edge of receptacle 30 into box 31 and thence through 32 into the reservoir 24.

The apparatus above described may also be usefully employed in recovering volatile substance, as a liquid solvent, from fouled or saturated filter bags. For this purpose, the bags containing filter aid and liquid are inserted through the top opening of the vaporizing chamber and laid on the bottom 3 of said pan. Heat is applied thereto as in vaporizing free liquid and the resulting vapors are recovered and condensed in any desired manner or as above described. This involves only the cost of heating which is ordinarily low enough to make the process a very economical one for the recovery of solvent from the filter aid.

A still embodying the structural features above described and as shown in the drawing requires in its construction only ordinary assembling skill and a minimum of hand work as compared to known stills of equivalent capacity for a similar purpose. It operates at substantially atmospheric pressure in all parts, is economical in concentrating heat on the vaporizing pan, and requires no skilled attention either for results or for safety.

In distilling according to the method hereinabove disclosed, the amount of liquid in the pan, its depth differential from one portion of the pan to another, and its temperature differential from the shallow portion to the deeper portion all maintained or controlled during heating, permit very rapid and effective vaporization with substantially no wasted heat, no accumulation of vapor pressure above the liquid and no fouling of the condensate or other undesirable result from foaming.

We claim:

1. An evaporator for liquids containing a vaporizable component of which the vapor is heavier than air, comprising an open top pan having an inclined bottom, a peripheral wall arranged and adapted to retain liquid and vapor therefrom within the boundary of said wall, means for maintaining a supply of liquid to be vaporized in the pan normally at or below a predetermined level, said pan having a vapor discharge opening above said predetermined level and below top edge portions of said peripheral wall, means for heating liquid in the pan, and said inclined bottom, discharge opening, and peripheral wall being so positioned and related

that vapor produced from liquid in the pan collects above said liquid and within the boundary of said wall and is discharged across the highest portion of the inclined bottom and through said vapor discharge opening.

2. An evaporator for liquids containing a vaporizable component of which the vapor is heavier than air, comprising an open top pan having an inclined bottom, a peripheral wall arranged and adapted to retain liquid and vapor therefrom within the boundary of said wall, means for maintaining a supply of liquid to be vaporized in the pan normally at or below a predetermined level, said peripheral wall having a vapor discharge opening below a top edge portion thereof and above said predetermined level, means for heating liquid in the pan, and said inclined bottom, discharge opening, and peripheral wall being so positioned and related that vapor produced from liquid in the pan collects above said liquid and within the boundary of said wall and is discharged across the highest portion of the inclined bottom and through said vapor discharge opening in the peripheral wall.

3. In distilling apparatus of the character described, a pan having an inclined bottom wall and a peripheral side wall structure with a portion of the side wall structure cut away adjacent the highest portion of the pan bottom to thereby provide a vapor outlet, and means to heat said pan to cause a piling up of foam within said pan at a zone remote from said vapor outlet.

4. Apparatus as described in claim 3 wherein, said means to heat said pan is in the form of a steam chamber immediately below said bottom wall and formed by a sheet extending substantially parallel to said bottom wall and sealed thereto at its edges and having means to supply steam to aid steam chamber adjacent the highest portion of the pan bottom and to withdraw condensed steam adjacent the lowest portion of the pan bottom.

5. In distilling apparatus of the character described, a casing forming a well, a pan positioned within said well near the top thereof and having

an inclined bottom wall and a peripheral side wall structure with a portion of the side wall structure cut away adjacent the highest portion of the pan bottom to thereby provide a vapor outlet through which the vapor may flow to the bottom of the well, means to heat said pan to cause a piling up of foam within said pan at a zone remote from said vapor outlet, and means constituting a vapor condenser positioned at the bottom of said well to condense the vapor.

6. Apparatus as described in claim 5 wherein the bottom of said well is formed by a condensate collecting wall and the condensate is discharged through a liquid trap into a condensate chamber immediately beneath said well.

7. In distilling apparatus of the character described, a pan formed by a side wall structure and a bottom wall with the bottom wall having a high portion and a low portion and with the side wall structure being arranged and adapted to retain liquid and vapor therefrom within the boundary of said wall structure, means for maintaining a supply of a liquid to be distilled in the pan at a predetermined level to provide a shallow layer of liquid at the highest portion of the pan and a relatively deep layer of liquid at the lowest portion of the pan and with unrestricted flow therebetween, said pan having a vapor discharge opening adjacent the highest portion of the pan bottom and above said predetermined level and below the top edge portions of said peripheral side wall structure, and means for heating said pan to cause a piling up of foam within said pan above the lowest portion of the pan bottom.

8. An evaporator as described in claim 1 wherein said means for maintaining a supply of liquid to be vaporized is in the form of a gravity feed system wherein the liquid is pumped from a supply into a chamber at the level of said pan and having a liquid connection thereto and wherein the liquid is pumped into said chamber to overflow said chamber and the liquid which overflows returns by gravity to the supply.

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