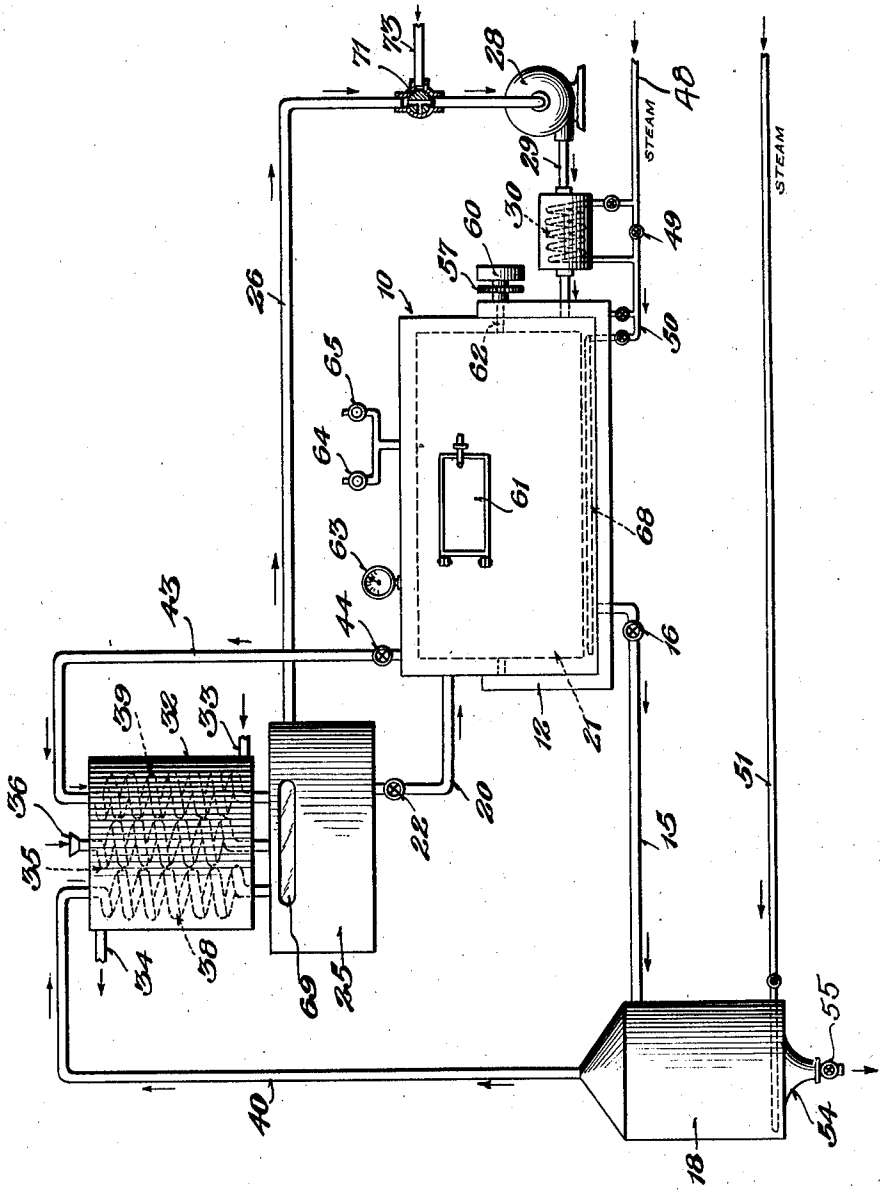
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DRY CLEANING

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DRY CLEANING.

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This invention relates to dry cleaning in general but particularly when using liquid carbon tetrachlorid as the solvent agent and has for its principal object the provision of a practical method of using a volatile solvent on a commercial scale including recuperation of substantially all of the solvent and in so arranging the process that the apparatus used need not be so excessively strong as to prohibit its use in large cleaning establishments or laundries.

A further object of the present invention is the provision of a system of dry cleaning whereby the objects to be cleaned are agitated with the solvent which solvent is later completely volatilized and is condensed to liquid form while maintaining the liquid and gas in constant and free communication with atmosphere whereby the apparatus is saved from the destructive effects of sudden vacuum or pressure conditions.

In purely theoretical consideration it is extremely simple to wash a bit of cloth in a test tube by agitating it with carbon tetrachlorid and then heating the test tube, which now should be secured to the usual laboratory apparatus so as to volatilize and completely recover all of the carbon tetrachlorid, provided some valve means is provided and provided also that the vessels are of sufficient strength to withstand a sudden, accidental chilling and the resulting vacuum. In practice however, it may be safely said that no system of recovery of carbon tetrachlorid can be commercially practical when the system is what is technically known as "closed circuit."

Speaking as a practical man thoroughly conversant with dry cleaning practice I know that a laundry can not possibly afford to build apparatus so strong and sturdy that it could recover carbon tetrachlorid in a closed system and yet have this system compete financially with the ordinary gasoline benzine process. I have tried the closed circuit and have had serious accidents. For example I have actually had my washer collapse in using such a closed system when a door or window was opened letting in a cool current of air. At another time a still in the system exploded during the distilling step because condensed liquid had been held in the condenser due to back pressure caused by the receiving tank having become full of air. In the present system, that forming the subject matter of this application, there can never be a back pressure nor a severe vacuum for the carbon tetrachlorid in every part of the system whether in liquid or gaseous form is constantly and freely in communication with the outside air through an unrestricted opening which is never closed.

The present invention permits the entire elimination of the dangers incident to the ordinary dry cleaning methods utilizing gasoline or other inflammable and explosive liquids while making it possible to compete financially with such systems in spite of the much greater cost of the carbon tetrachlorid.

It has been well known for years that carbon tetrachlorid was admirably suited to the cleaning of raw and manufactured fabric materials such as wearing apparel, rugs, carpets, curtains, etc., but such materials, in the past, in spite of the fire hazards and the danger to employees, have almost invariably been cleaned with gasoline or benzine solely for the reason that the percentage of recovery of carbon tetrachlorid has been entirely too low to permit successful competition. I have been experimenting for some time with the open circuit system of carbon tetrachlorid recovery and have now arrived at a point wherein I can reduce the loss of this expensive solvent to such a low per cent that I can successfully compete with gasoline in the dry cleaning of any material which may be cleaned by gasoline and at the same time I completely eliminate all the fire and danger hazards.

The drawing shows diagrammatically a system of apparatus which may be used for carrying out my process, and is in substantial accord with the actual installation I am now using.

10 is a large washer casing of old and well-known type and may be particularly suitable for the cleaning of some particular article or articles as in factory laundries, or more commonly may be of general utility as in commercial laundries. I have illustrated the washer 10 as a device of the drum type but while this is preferred the invention must be considered as a very broad

one and not limited in any way to the specific details which are shown for illustrative purposes only.

As indicated, the washer casing 10 is surrounded in whole or in part by a heating means here shown as a steam jacket 12 serving to warm the contents of the washer to increase the solvent action. The outer casing 10 of the washer drains through a pipe 15 having a valve 16 to a vessel 18, which is preferably a still. A second liquid pipe 20 leads to the washer casing 10, discharging preferably at a point above a horizontal plane through the axis of the drum 21 of the washer. This pipe 20 which is provided with a shut-off valve 22 leads from a storage tank 25 in which the stock of carbon tetrachlorid is kept, which stock should not fill the tank but should provide appreciable vapor space.

An air paper 26 leads from the top of the storage tank 25 to an air pump 28 and a pipe 29 leads direct from the air pump 28 to a point near the bottom of the washer casing. A heater of any desired type, such for example as the steam coil 30 leading to the steam jacket 12 may be conveniently used for this purpose.

At a point preferably directly above the tetrachlorid storage tank 25, I locate a condenser 32 having a cold water inlet pipe 33 at the bottom and an over-flow pipe 34 at the top. In this condenser tank as the apparatus is now installed I provide a central condensing coil 35 in communication below with the storage tank 25, and having a vent 36 above the tank and open to atmosphere; the vent 36 and the piping connecting it serving as a breather tube to all parts of the system. The condensing coil 38, also within the condenser 32 and communicating with the storage tank is connected by piping 40 with the still 18 and a similar pipe 39 communicates with the tank and with the vapor line piping 43, the latter having a cut-off valve 44 at a low point fairly near to where the pipe line communicates with the washer.

Steam for the still and for the heater may be brought to them in any desired manner, such for example, as by the pipe 48, leading to the coil 30, preferably having a by-pass 49 so that steam may be sent from the pipe 48 direct into the steam jacket 12 by way of the pipe 50. The steam for the still 18 is preferably a separate system, as for example, the piping 51, as the still is only intermittently in operation, and in fact may be used to vaporize the collected carbon tetrachlorid only after a number of separate washings in the washer if so desired. The exact construction of the still is immaterial, save that it be suitable for volatile liquid, having in mind that carbon tetrachlorid boils at a temperature considerably below the boiling point of water. I curve the bottom of the still as at 54, and provide the lower outlet with a cut-off valve 55 through which I draw the collected oils, refuse, dirt and grease remaining after complete evaporation of the volatile solvent. I am at the present time saving this refuse and putting it through a subsequent operation to recover more of the carbon tetrachlorid than can be secured by a single evaporation, but find that the subsequent treatment is hardly worth while as the cost of operation is not appreciably greater than the saving of the solvent due to the efficiency of the recovery in still 18 and condenser 38.

The washer may be of any type now on the market that lends itself to the obtaining of the desired results. My preference is a washer of the type shown in which the drum is of the oscillating or rotating type, the gearing 57 being such that the drum 21 is rotated three or four times in one direction, then three or four times in the other direction, but may whenever desired be rotated constantly in one direction, power in all cases being transmitted to the drum through the pulley 60 on the drum shaft 62. As customary in this art the washer is provided with a fairly large door 61 through which the articles to be cleaned are inserted and are removed when cleaned. Although not essential I much prefer to leave the washer equipped with all of the usual apparatus such for example as the pressure gauge 63, vacuum valve 64, and the pressure valve 65 as illustrated.

The operation is as follows: A batch of dry clothing or other material to be cleaned is placed in the washer thru the door 61 and then a sufficient amount of clean carbon tetrachlorid is admitted from the storage tank 25 thru pipe 20 to fill the washer about one-quarter full. The door is then closed air tight, and the drum of the washer is started to rotate in the oscillating motion described, i. e., it rotates one way about three revolutions and then stops and turns back the same number of times. While material and liquid are thus being agitated steam is preferably admitted to the jacket 12 or to a coil 68 just inside the washer immediately under the cylinder, for while heating of the washer is not necessary at this point, the liquid dissolves the oils and greases more readily if warmed. I find I secure excellent results by maintaining the temperature at this step at from 90° to 110° F. but do not wish to be restricted to these figures. On warming the liquid vapors are given off and would increase the pressure in the washer but for the vent 36. These vapors pass up pipe 43, thru condenser pipe 39, down into tank 25 and the air which has expanded with the gas will pass out thru the vent 36 carrying with it a small quantity of carbon tetrachlorid perhaps, but

not an appreciable amount, for by virtue of its great weight the carbon tetrachlorid vapors at this point force the air out of the system ahead of it. The air and gases and vapors will only pass out as long as expansion is going on in the washer which is only for a short time, but if by accident the washer should be suddenly cooled and contraction should take place air will pass into the system thru the vent 36 as a breather tube, thus preventing the formation of a vacuum in the washer which would cause its collapse.

After the clothes are thoroughly cleansed, most of the liquor is drained off thru the pipe 15 into the still 18 where it is subsequently distilled into tank 25 thru pipe 40 and condenser coil 38. Tank 18 is used for evaporation of the liquid in its recovery and purification, and not as a storage reservoir, and consequently may be made of iron as the presence of oil in the liquor prevents excessive corrosive action of the solvent. I prefer, however, that most of the equipment be zinc or lead lined to increase its life. After the excess liquor is drawn off, the valve 16 under the washer is closed and the air pump 28 is started, passing air heated by the coil 30 to about 200° F. into the washer 10 where it becomes saturated with carbon tetrachlorid vapors and escapes thru pipe 43 into condenser coil 39 where the air and vapors are cooled, part of the vapors being condensed to liquid which drains into the tank 25 while the air and any uncondensed vapor returns to pump 28 thru pipe 26. Here again the vent 36 equalizes any internal or external pressure that might be caused by the air being heated hotter or not quite so hot as the vapors in the washer 10.

When the drying of the clothes has progressed to a point where no more liquid is being condensed, as may be ascertained thru a peep glass 69 in the tank 25, the door 61 of the washer is opened and the valves 44 and 71 are closed, the latter being a three-way valve which opens communication between the pump 28 and atmosphere thru nipple 73 when communication between the pump 28 and pipe 26 is closed. The air thus admitted thru nipple 73 passes thru the washer and out the open door 61 removing the last traces of carbon tetrachlorid and all the dust from the clothes, thus saving the removing of the batch to a tumbler as is customary in the gasoline process. When the clothes are removed from the washer they are free from all greases, oils, fats and dirt, also there are no odors remaining in the material. Under certain circumstances I prefer to give the clothes an extra rinse; in this case I omit the drying step until after completion of the rinse.

I claim—

1. The process of dry cleaning, which consists in agitating the batch to be cleaned in contact with a volatile low boiling solvent liquid while maintaining the liquid at constant pressure during such agitation by providing free communication with atmosphere, volatilizing all of the liquid and condensing the resulting vapor for re-use while maintaining said free communication with atmosphere.

2. The process of dry cleaning, which consists in agitating the batch to be cleaned in contact with carbon tetrachlorid while maintaining the liquid at constant pressure during such agitation by providing free communication with atmosphere, volatilizing all of the liquid and condensing the resulting vapor for re-use while maintaining said free communication with atmosphere.

3. The process of dry cleaning, which consists in agitating the batch to be cleaned in contact with carbon tetrachlorid while maintaining the liquid at constant pressure during such agitation by providing free communication with atmosphere, heating said batch and liquid to facilitate the solvent action.

4. The process of dry cleaning and recovering the solvent for re-use which consists in subjecting the material to be dry cleaned to the action of a volatile cleaning fluid at a temperature below the boiling point of the fluid in a closed vessel having a breather tube open to atmosphere draining off a portion of the fluid, blowing heated air thru the tank to vaporize and carry off the cleaning fluid, chilling a portion of the breather tube to condense the cleaning fluid vapor, collecting by gravity the condensed cleaning fluid and passing the uncondensed cleaning fluid vapor back to the washer.

5. The step in the process of dry cleaning with carbon tetrachlorid which consists in passing a mixture of air and carbon tetrachlorid vapor thru an endless passage open above to atmosphere whereby the heavier carbon tetrachlorid vapor will pass continuously thru the passage and the lighter air will discharge to atmosphere upon expansion of the vapor in the system, and will be drawn in to the system upon contraction of the vapor in the system.

6. The process of dry cleaning which consists in agitating the material to be cleaned in contact with liquid carbon tetrachlorid, warming the material and liquid to increase the solvent action, and providing a U path to atmosphere for the expanding vapors whereby the air may escape and the carbon tetrachlorid is retained in the U for re-use.

7. The process of dry cleaning which consists in agitating the material to be cleaned in contact with liquid carbon tetrachlorid, warming the material and liquid to increase the solvent action, and providing a free U path to atmosphere for the expanding va-

pors whereby the air may escape and the carbon tetrachlorid is retained in the U for re-use, and chilling the vapors as they pass thru said path to condense the carbon tetrachlorid.

8. The process of dry cleaning which consists in agitating the material to be cleaned in contact with liquid carbon tetrachlorid, warming the material and liquid to increase the solvent action, providing a free communication to atmosphere to maintain the liquid at atmospheric pressure, and in chilling the vapors passing thru said free communication to atmosphere to a temperature below the boiling point of the carbon tetrachlorid whereby the latter may be condensed for re-use.

9. The process of dry cleaning with carbon tetrachlorid which consists in performing the following steps while maintaining the carbon tetrachlorid in constant and free communication with atmosphere: agitating the material with liquid carbon tetrachlorid until cleaned; draining off the greater portion of the carbon tetrachlorid; blowing heated gas thru the cleaned material to vaporize and carry off the carbon tetrachlorid remaining in the material; chilling the gas to condense the carbon tetrachlorid; vaporizing the drained carbon tetrachlorid and then condensing it, and finally collecting the condensed carbon tetrachlorid for re-use.

10. In a device of the character described a storage tank, means for providing said tank with free and unrestricted communication with atmosphere, a washer, means for heating the washer, an independent pipe system connecting said washer and tank, condensing means in connection with said system and means for circulating air thru said system including the washer and tank.

11. In a device of the character described, a storage tank, means for providing said tank with free and unrestricted communication with atmosphere, a washer, means for heating the washer, two independent pipe systems connecting said washer and tank, condensing means in connection with one of said systems and means for circulating air thru said system including the washer and tank.

12. In a device of the character described, a storage tank, means for providing said tank with free and unrestricted communication with atmosphere, a washer, means for heating the washer, an independent pipe system connecting said washer and tank, condensing means in connection with said system and means for circulating air thru said system including the washer and tank, a still, piping draining from the washer to the still, piping for conveying still vapor thru the tank to atmosphere, and means for condensing carbon tetrachlorid vapors as they pass thru said last named piping whereby the carbon tetrachlorid will be retained in the tank while the noncondensed gases discharge to atmosphere.

13. In combination a washer, a storage tank, means for heating the washer, means conveying vapor from the washer to atmosphere by way of the tank, said means including a U pipe having the tank as the bottom of its U, and means for chilling one leg of the U, whereby to condense to liquid form certain of the vapors passing thru said leg to cause said liquid to fall into the tank, while permitting other vapors to escape from the system.

14. In combination a washer, a storage tank, means for heating the washer, means conveying vapor from the washer to atmosphere by way of the tank, said means including a U pipe having the tank as the bottom of its U, and means for chilling the two legs of the U, whereby to condense to liquid form certain of the vapors passing thru said U to cause said liquids to fall into the tank, while permitting other vapors to escape from the system.

15. In combination a washer, a still, means for draining the washer into the still, a storage tank, a condenser, three condensing coils in said condenser and communicating with said tank, one of said coils communicating with the atmosphere, the second coil communicating with said still and the third coil communicating with said washer.

16. In combination, a washer, a tank, piping including a condenser portion leading from the washer to the tank, and means independent of said condenser portion for establishing free communication between the washer and atmosphere.

17. In combination, a washer, a tank, means for heating the washer, piping connecting the tank and washer, a condenser, means for conducting vapor from the heated washer to the tank and for condensing the vapor to liquid during such passage, and independent piping establishing free and unrestricted communication between the tank and washer and atmosphere.

In testimony whereof I affix my signature.

JOHN T. AYDELOTTE.