

Aug. 13, 1935.

J. B. SANDO

2,011,083

APPARATUS FOR CLEANING FABRICS

Filed March 11, 1931

2 Sheets-Sheet 1

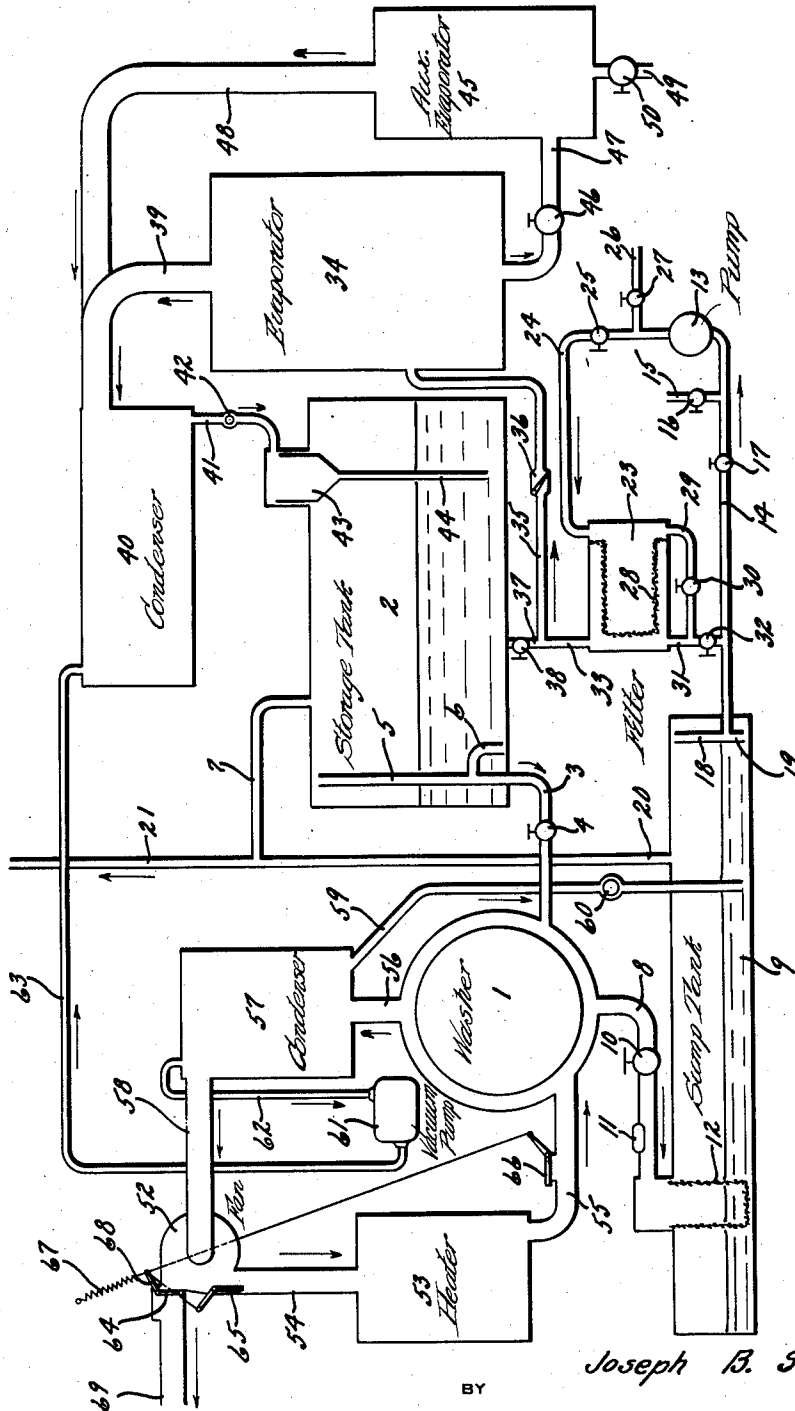


Fig. 1.

INVENTOR

Joseph B. Sando

BY

Brockett, Hyde, Higley & Meyer
ATTORNEYS

Aug. 13, 1935.

J. B. SANDO

2,011,083

APPARATUS FOR CLEANING FABRICS

Filed March 11, 1931

2 Sheets-Sheet 2

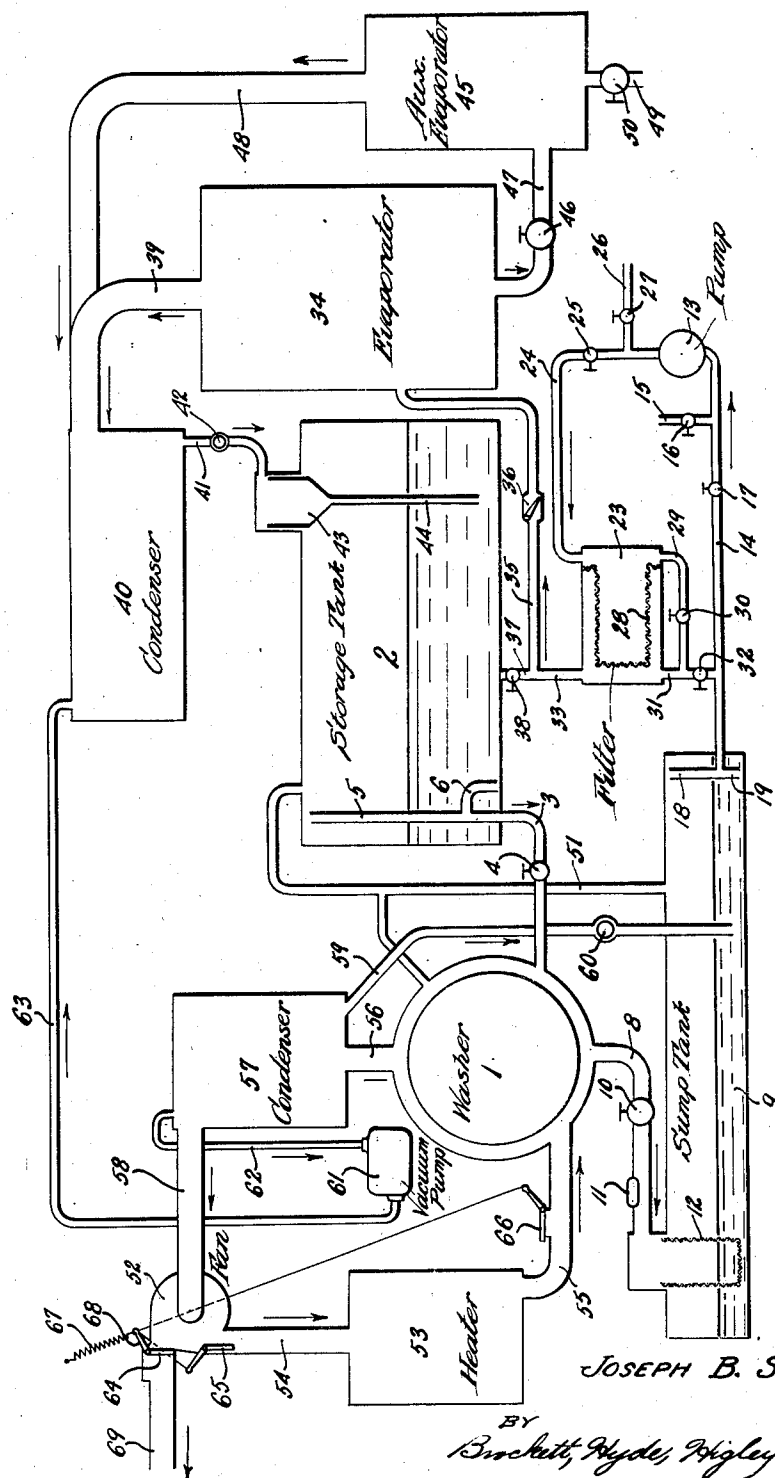


Fig. 2.

INVENTOR

JOSEPH B. SANDO

BY
Brockett, Hyde, Wigley & Meyer
ATTORNEYS

UNITED STATES PATENT OFFICE

2,011,083

APPARATUS FOR CLEANING FABRICS

Joseph B. Sando, Norwood, Ohio, assignor to The American Laundry Machinery Company, Cincinnati, Ohio, a corporation of Ohio

Application March 11, 1931, Serial No. 521,805

4 Claims. (Cl. 68—38)

My invention relates to fabric treating apparatus and, particularly, to means for decreasing the time necessary for a complete fabric treating operation, which consists in providing means in a fabric treating circuit including a treating compartment, a condenser, air moving means, and an air heater interconnected together to form a circuit closed against free communication with the atmosphere, for creating and maintaining a sub-atmospheric pressure in the circuit and particularly in the treating compartment thereof, to lower the condensation point of the volatile treating medium and thereby increase the speed of operation of the apparatus during the fabric drying operation wherein treating medium is volatilized and removed from the fabric in the treating compartment by air currents carried to the condenser and removed from the air stream by condensation.

Various objects and advantageous features of my invention will be seen in the following description and one embodiment thereof may be seen in the accompanying drawings wherein similar characters of reference designate corresponding parts, and wherein Fig. 1 is a diagrammatic view of the apparatus employed for treating fabric; and Fig. 2 is a view similar to Fig. 1 but showing a modified form of apparatus.

Referring to the drawings, I have shown an apparatus for treating fabric together with a means for supplying a volatile detergent to a treating compartment, removing the detergent from the treating compartment after the treating operation and then removing the foreign matter from the detergent and transferring it to a supply tank ready for use in a subsequent cleaning operation comprising a fabric treating compartment 1 provided on its interior with the usual rotatable goods container which may be rotated in alternately reverse directions by any suitable power means. A storage tank 2 is located adjacent to the compartment 1 to provide a means for supplying the volatile liquid used in the treating operation to the treating compartment, the liquid being preferably, although not necessarily, carbon tetrachloride. As shown, a conduit or pipe 3 connects the bottom of the storage tank 2 with the treating compartment 1, the conduit or pipe being provided with a valve 4 for regulating the quantity of treating medium which passes from the storage tank to the treating compartment.

In order to prevent any water or moisture which may collect or float on the surface of the treating medium within the storage tank 2 from gravitating into the treating compartment 1 through

the conduit 3, the portion of the conduit disposed within the storage tank is provided with two branches. One of these branches, the branch 5, extends upwardly to a position adjacent the top of the tank 2 that is always above the level of the top surface of the treating medium within the storage tank. The other branch 6 preferably takes the form of a 90° elbow having its lower end but slightly above the bottom of the storage tank whereby the medium flowing out of the storage tank through a conduit or pipe 3 always flows from the lowermost part of the storage tank. A small vent pipe 7 is connected to the top of the storage tank 2 and preferably extends to the exterior of the building, the pipe being open to permit air to enter the storage tank when treating medium is withdrawn therefrom and to permit escape of air from the tank when treating medium is supplied thereto. However, the vent pipe may be valve controlled. This forms the storage circuit.

A conduit 8 leads from the bottom of the treating compartment 1, which, of course, during the treating operation is closed, to a sump tank 9 located below the treating compartment, the conduit being provided with a valve 10 for controlling the flow of treating medium from the compartment to the sump tank and a sight glass 11 for determining when all of the medium has been drained from the compartment and has passed into the sump tank.

The outlet end of the conduit 8 discharges into a strainer basket 12 that is conveniently located within the confines of the sump tank and is made removable therefrom through a top opening normally closed by an air-tight cover. Such basket 12 is made of suitable wire mesh material and may be provided with means whereby it may be easily removed or replaced. Thus, means are provided for catching and retaining any small particles of foreign matter above a given size that may have become separated from the goods in the treating compartment, the size of the particles depending on the size of the wire mesh, thereby preventing such foreign matter from lodging in the sump tank or other parts of the apparatus and possibly interfering with the proper operation thereof.

In order to recirculate the treating medium and renovate the used medium prior to its return to the storage tank 2 from which it is supplied to the treating compartment 1 for subsequent treating operations, a pump 13 is provided as well as a suitable power unit for operating the pump. The intake side of the pump is connected to the sump

tank 9 by a conduit 14 which is provided with a branch conduit 15 under the control of a valve 16 and terminating in a free end to provide a pipe or hose connection. Conduit 14 is provided with a control valve 17 for regulating the flow of medium from the sump tank 9 to and through the pump 13, the valve 17 being normally open while the valve 16 is normally closed. However, when a fresh supply of treating medium from some outside source is to be supplied to the apparatus, the valve 17 is closed and the valve 16 is opened, at which time a pipe or hose may be attached to the pipe or hose connection and the fresh supply of medium drawn into the apparatus by operation of the pump 13.

As shown, the portion of the pipe 14 extending within the sump tank 9 terminates in a vertically extending T-connection whose upper end 18 is adjacent the top of the sump tank and whose lower end 19 is adjacent the bottom thereof. The purpose of a T-connection of this type is to always have the intake of medium from the sump tank at a point adjacent the bottom of the tank and to provide a means for regulating the lowest level of the treating medium in the sump tank, which will be at the point where the conduit 14 joins the T-connection. This is highly important in that it will maintain a liquid seal for the lower end of the pipe 19. A vent 20 extends upwardly and outwardly from the top of the sump tank to the outside atmosphere. As shown, this vent pipe may join the vent pipe 7 leading from the storage tank 2, the two vent pipes extending to the atmosphere in a common vent pipe 21.

As a first step in the recirculation of the treating medium from the sump tank 9 to the storage tank 2, the medium is passed into a filter 23 by way of a conduit 24 leading from the discharge side of the pump 13 and under the control of a valve 25, and a pipe or conduit 26 under control of a valve 27 leads from the pump discharge side or conduit 24 and terminates in a pipe or hose connection. Normally, when the apparatus is operating, the valve 27 is closed and the valve 25 is open. However, if for any reason it becomes necessary to empty the system of treating medium, the valve 25 is closed and the valve 27 is opened and a suitable hose or pipe attached to the pipe 26 whereby the medium may be discharged from the system to any desired point.

As shown, the filter 23 embodies a filter bag 28 and the end of the shell adjacent the inner side of one end of the filter bag is cored out to provide passageways connecting the interior of the filter bag with the conduit 24 and with a conduit 29 under the control of a valve 30. Such conduit 29 connects the interior of the filter bag 28 with a conduit 31 under the control of a valve 32 which, in turn, connects the interior of the filter bag with the sump tank 9 through the conduit 14. A pipe or conduit 33 connects the filter 23 with an evaporator mechanism 34 by way of a conduit 35 which is provided with an automatic operating valve 36 for preventing return of fluid or medium from the evaporator 34 to the filter 23. It will be noted that the conduit 29 is adapted to drain the medium from the interior of the filter bag 28 while the conduit 31 is adapted to drain the medium from the outside of the filter bag. Therefore, both of these conduits are disposed at and connected to the bottom side of the filter shell. A branch pipe 37 under control of a valve 38 connects the filter shell of the filter 23 outside of the filter bag 28 with the storage tank 2 through the conduit 33.

In the operation of this part of the apparatus which is substantially all of the sump circuit, when the system is in operation, the valve 25 is open and the valves 30, 32 and 38 are closed whereby the treating medium may be pumped from the sump tank 9 by the pump 13 and through the pipe 24 into the interior of the filter bag 28, through the bag and into the outer shell of the filter, and thence through the conduits 33 and 35 into the evaporator 34 where the filtered medium is converted into vapor which thereafter rises and passes into a conduit 39 and thence into a condenser 40. Within this condenser, the vapor is converted into liquid which gravitates through a conduit 41 provided with a sight glass 42 and into the storage tank 2, the medium passing through a waste trap 43 and into the storage tank by way of a conduit 44 that extends downwardly into the storage tank to a point a short distance above the bottom thereof whereby a liquid seal for the conduit 44 is provided at all times to prevent any agitation of the contents of the storage tank by liquid entering through the conduit 44. Skimming valves may be provided in the storage tank if desired.

At times, it becomes necessary to clean out the filter 23 and at such time the valve 25 in the conduit 24 is closed and the valves 30 and 32 are opened which will permit the treating medium within the filter to gravitate through the conduits 29 and 31 and a part of the conduit 14 into the sump tank 9 whereupon the filter bag may be removed and cleaned. After cleaning, the filter bag may be replaced in the filter shell whereupon the filter is again in condition to properly function.

While the capacity of the evaporator 34 is preferably sufficient to supply treating medium to the storage tank 2 to permit continuous operation of the apparatus and, at the same time, maintain a generous supply of medium in the storage tank 2, an auxiliary evaporator 45 is provided to remove the medium from the sludge removed from the main evaporator 34. This auxiliary evaporator is preferably positioned at a lower level than the main evaporator 34 so that it is only necessary to open a valve 46 in a conduit 47 that leads from the bottom of the evaporator 34 and into the evaporator 45 to supply the sludge to the auxiliary evaporator. A vapor discharge pipe or conduit 48 leads from the top of the auxiliary evaporator 45 and into the discharge conduit 39 leading from the top of the main evaporator to the condenser 40. In addition, a drain pipe 49 under control of a valve 50 is provided on the bottom of the auxiliary evaporator 45 for cleaning out purposes. It is understood that both evaporators have suitable heating and cooling pipes connected thereto and a means may be provided for automatically controlling the supply of heating and cooling medium to the evaporators.

Fig. 2 shows an arrangement in which the upper portions of each of the treating compartment 1, the storage tank 2, and the sump tank 9 are connected by suitable piping 51, so that their vapor spaces are in open communication. If the vent pipe 21 of Fig. 1 is omitted, as in Fig. 2, the system is then completely closed to the atmosphere. The omission of the pipe 21, Fig. 1, is not essential, and, in any case, the pipe 59 connecting the condenser to the sump is always utilized as a drain connection for the condenser and to assist in equalizing pressures throughout the apparatus.

In addition to the hereinbefore described apparatus for recirculating and renovating the treating medium, suitable apparatus forming a part of

the cleaning circuit has been provided for drying and deodorizing the fabric as a part of the treating operation and before removal of the fabric from the washing compartment, as well as a means for bringing about an increased capacity of the unit by a reduction in drying time through the use of means provided for lowering the pressure within the drying apparatus during the drying operation and thereby reducing the vaporization temperature of the carbon tetrachloride evaporated from the fabric during the drying process. As shown, a fan 52 is located near the treating compartment 1, the fan being driven by any suitable power means. One discharge of the fan is connected to an air heater 53 by means of a duct 54, the air heater being, in turn, connected to the treating compartment 1 by a duct 55. A duct 56 connects the compartment 1 with a condenser 57 and the air discharge of this condenser is connected to the intake side of the fan 52 by a duct 58. The liquid discharge from the condenser 57 passes through a pipe or conduit 59 to a point within and close to the bottom of the sump tank 9. Such pipe or conduit is provided with a sight glass 60 for determining when liquid is flowing from the condenser 57 to the sump tank.

In accordance with my invention, a suitable vacuum pump 61 leads from the vapor space of the condenser 57, through which the carbon tetrachloride vapor from the treating compartment 1 normally passes and which usually contains suitable cooling apparatus, by way of a conduit or pipe 62, the pipe or conduit leading to the intake side of the vacuum pump 61. A pipe or conduit 63 connects the exhaust or delivery side of the vacuum pump 61 with the main condenser 40 connected to the storage tank 2 in the manner hereinbefore described.

In the drying operation, it being understood that the pressure of the air in the condenser 57 is normally slightly below atmospheric pressure and the pressure of the air in the heater 53 is normally slightly greater than atmospheric pressure due to the resistance to the flow of air through the closed system and to the action of the centrifugal fan, the pressure within the drying apparatus is reduced to a point further below atmospheric pressure by operation of the vacuum pump 61. Then, the fan 52 is placed in operation whereby air from the heater 53 will be forced through the compartment 1 and will gather vapor from the goods therein and carry such vapor through the conduit 56 to the condenser 57 where the treating medium is condensed, the air passing onwardly through the duct 58, fan 52, duct 54, and heater 53 back through the compartment 1 while the liquid removed therefrom by condensation passes through the pipe or conduit 59 to the sump tank 9. It will be understood that the air is reheated at each passage through the heater 53 and is continuously circulated through the compartment 1 until the treating medium picked up thereby and later condensed in the condenser 57 ceases to pass through the pipe or conduit 59. That is, until there is no more treating medium in the goods to be picked up by the moving air.

Means are also provided for deodorizing the fabric in the treating compartment 1 after the treating operation has passed the drying stage. To do this, suitable air valves 64, 65 and 66 are provided at convenient places in the various parts of the air circulating system and are operable simultaneously by a single means and held in normal closed position by a spring 67. After the drying operation, the vacuum pump 61 is shut

down, the air valves 64 and 66 are opened and the air valve 65 is closed by moving a suitable lever 68 which will permit atmospheric air to be drawn into the system through the port controlled by valve 66, passed through the dried goods in the compartment 1 and thence discharged through the duct 56, condenser 57, duct 58, fan 52, valve 64, and duct 69 to the atmosphere, it being understood that suction created by the fan 52 will cause such circulation and that the passage of air through the heater 53 is prevented by closing of the valve 65. Such forced circulation of atmospheric air through the treated fabric is continued until the fabric is thoroughly deodorized after which it may be removed from the compartment 1 and a fresh batch to be treated introduced in its place.

A part of this method for treating fabrics consists in the provision of an apparatus of such construction that the treating medium does not have free communication with the atmosphere during the treating operation up to the deodorizing step as does the treating medium in the storage tank 2 which has free communication with the atmosphere at all times through the vent pipe 7. As hereinbefore described, the vent pipe 20 for the sump tank 9 has its open end above the surface of the medium in the sump tank but the inlet to the sump tank from the compartment 1 may be closed off by the valve 19 while the connection between the condenser 57 and the sump tank has its delivery end below the liquid in the sump so that a liquid seal is provided against any free communication between the treating compartment 1 and the atmosphere when the apparatus is in operation. Thus, vent means is provided wherein any excess pressure in the drying circuit may be relieved through the connection 59, sump tank liquid and pipe 21, a liquid seal vent means being formed by this arrangement as well as a solvent drain means from the condenser 57 to the sump tank 9. It is understood, of course, that the valves 64 and 66 are maintained in closed position up to the deodorizing step.

With the above construction, a method and apparatus for treating fabrics is provided which includes a fabric cleaning circuit, a storage circuit, and a sump circuit including means for renovating used cleaning medium, all of which are operatively connected, and a cleaning circuit that is sealed against free communication with the atmosphere throughout all steps with the exception of the deodorizing step as well as one in which the cleaning medium is reclaimed whereby it may be used over and over again. In addition to this, a method and apparatus is provided that is of a nature to substantially decrease the time necessary for the fabric drying step whereby the work capacity of the apparatus may be greatly increased. This is accomplished by providing means for creating a sub-atmospheric pressure within the fabric cleaning circuit during the drying operation and the reason that the drying time is lessened by the creation of such sub-atmospheric pressure in the cleaning circuit is due to the fact that the temperature at which the treating medium will evaporate and the speed of evaporation or vaporization of the treating medium varies directly with the degree of pressure within the cleaning circuit. For example, under normal atmospheric pressure, the treating medium will only evaporate at a relatively high temperature whereas with a sub-atmospheric pressure, the treating medium will evaporate at a

much lower temperature and at a greatly increased rate of speed. Various other advantageous features will be readily apparent.

What I claim is:

5 1. An apparatus for treating fabric with a volatile solvent, drying the fabric and removing the volatile solvent therefrom comprising a compartment containing the fabric to be treated, means for withdrawing the solvent from the
10 treating compartment, means for removing the foreign matter and volatilizing the solvent, means for reclaiming said solvent including a condenser, means for drying said fabric comprising an air moving means, a heater and a condenser
15 connected in series relationship with said treating compartment to form a circuit which is closed against communication with the atmosphere, said air moving means serving to force air through said heater and then through the treating compartment to volatilize and carry the solvent
20 vapors into the condenser in the drying circuit, and means for withdrawing vapors from the drying circuit and conveying them to the condenser in the reclaiming circuit, thereby creating a sub-atmospheric pressure in the drying circuit to decrease the drying time.

2. An apparatus for treating fabric with a volatile solvent, drying the fabric and removing the volatile solvent therefrom comprising a compartment containing the fabric to be treated, means
30 for withdrawing the solvent from the treating compartment, means for removing the foreign matter and volatilizing the solvent, means for reclaiming said solvent including a condenser, means for drying said fabric comprising an air moving means, a heater and a condenser connected in series relationship with said treating compartment to form a circuit which is closed
35 against communication with the atmosphere, said air moving means serving to force air through said heater and then through the treating compartment to volatilize and carry the solvent va-

pors into the condenser in the drying circuit, and means including a conduit and a pump arranged between the reclaiming condenser and the drying circuit for creating a sub-atmospheric pressure in the treating compartment of the drying circuit to decrease the drying time.

3. An apparatus for drying fabric which has been treated with a volatile solvent comprising a compartment containing the treated fabric, a condenser and air moving means in series relationship with said compartment to form a circuit which is closed against free communication with the atmosphere, said air moving means serving to force air through said compartment and then through said condenser, thereby volatilizing
15 the solvent in the treating compartment and carrying it into the condenser, means outside of said circuit but communicating therewith for withdrawing vapors from the drying circuit, thereby maintaining subatmospheric pressure
20 conditions within the treating compartment of said circuit to decrease the time of drying, and means for recovering the volatile solvent which is withdrawn from the drying circuit.

4. An apparatus for treating fabric with a volatile solvent comprising a treating container, a sump tank, means for conveying the volatile solvent from the treating container to the sump tank, a condenser, means closed against free communication with the atmosphere for moving
30 air through the treating container and condenser to dry the fabric in the treating container, means for conveying the condensed solvent to the sump tank, means outside of said conduit for withdrawing vapors and maintaining subatmospheric pressure conditions within said container for decreasing the time of the drying operation, and means for recovering the volatile solvent vapors which have been withdrawn from the drying circuit.

JOSEPH B. SANDO.