

March 5, 1935.

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1,993,407

DRY CLEANING APPARATUS

Filed March 16, 1932

4 Sheets-Sheet 1

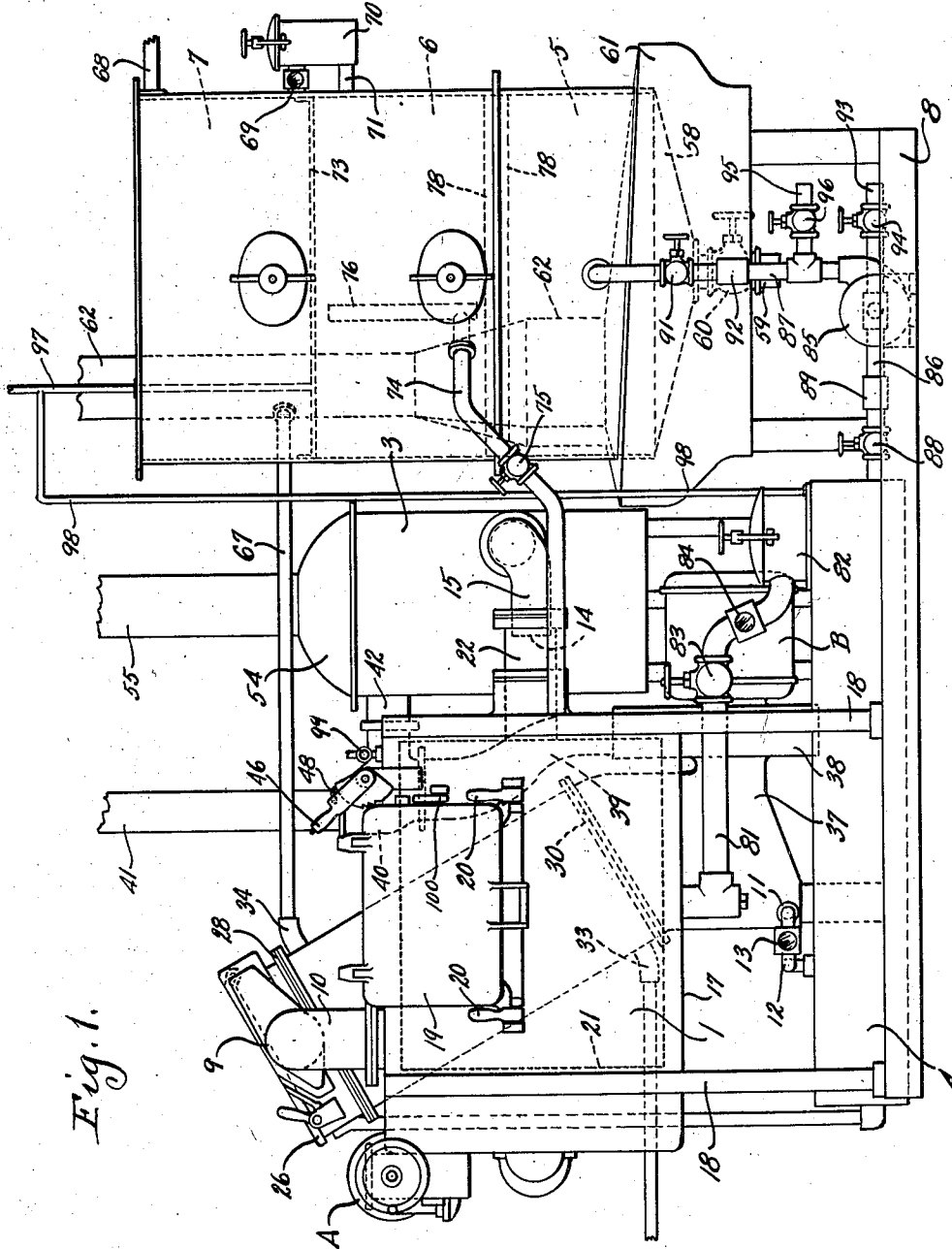


Fig. 1.

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4 Sheets-Sheet 2

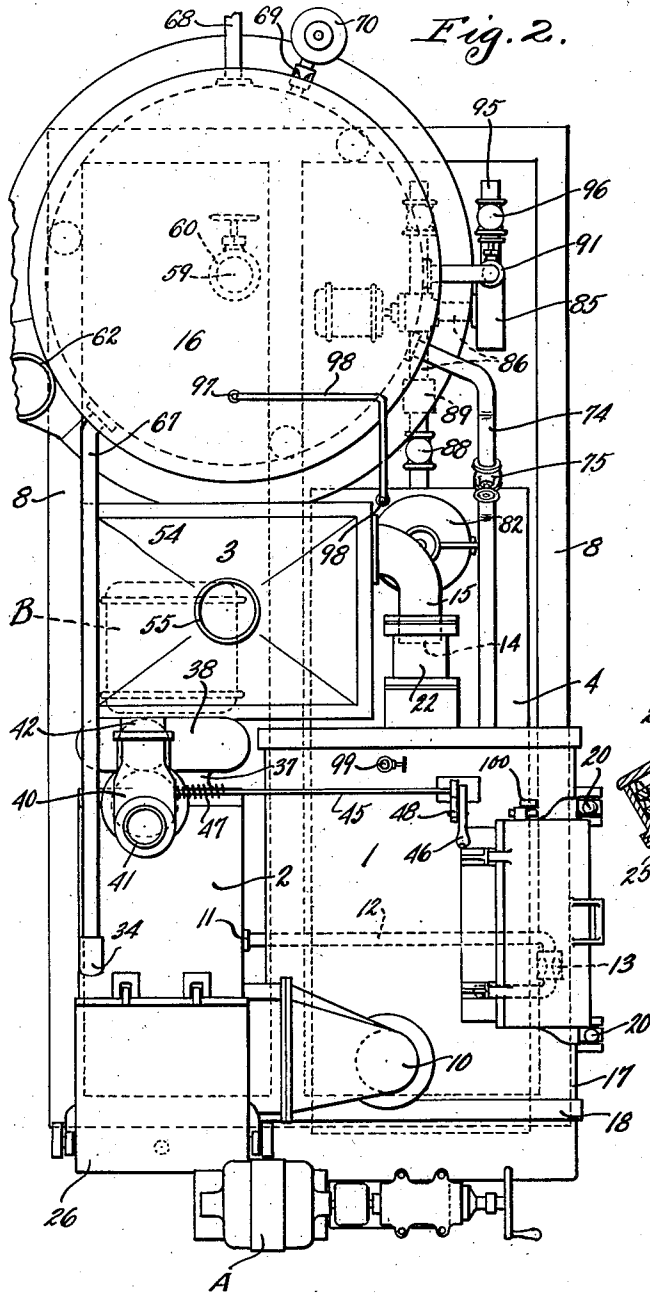


Fig. 2.

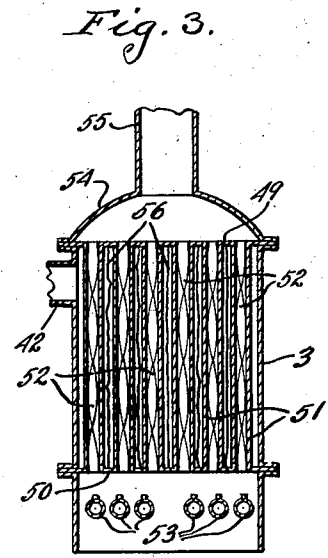


Fig. 3.

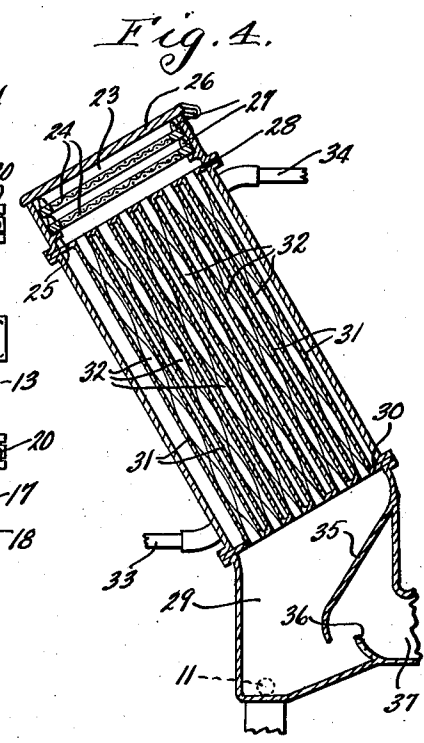


Fig. 4.

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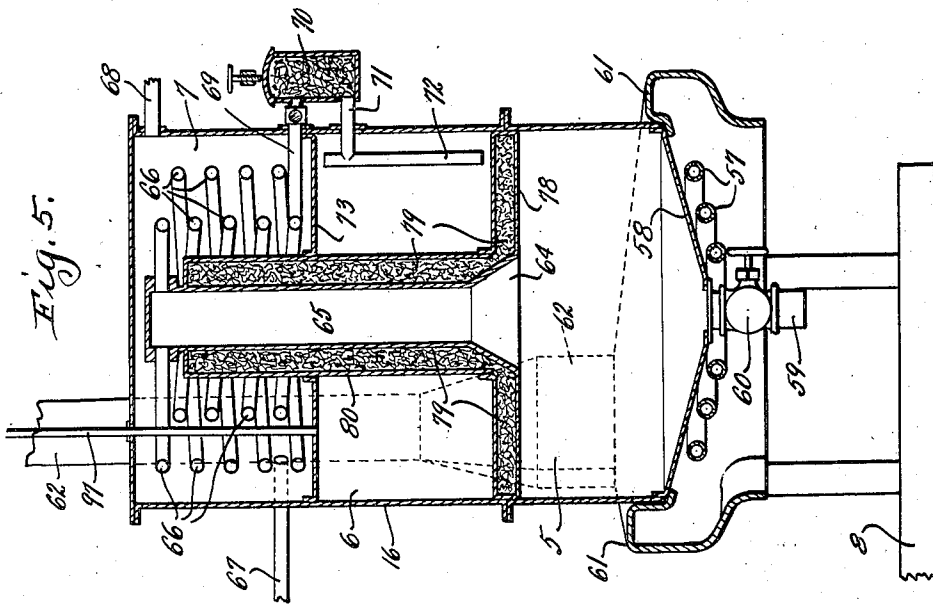
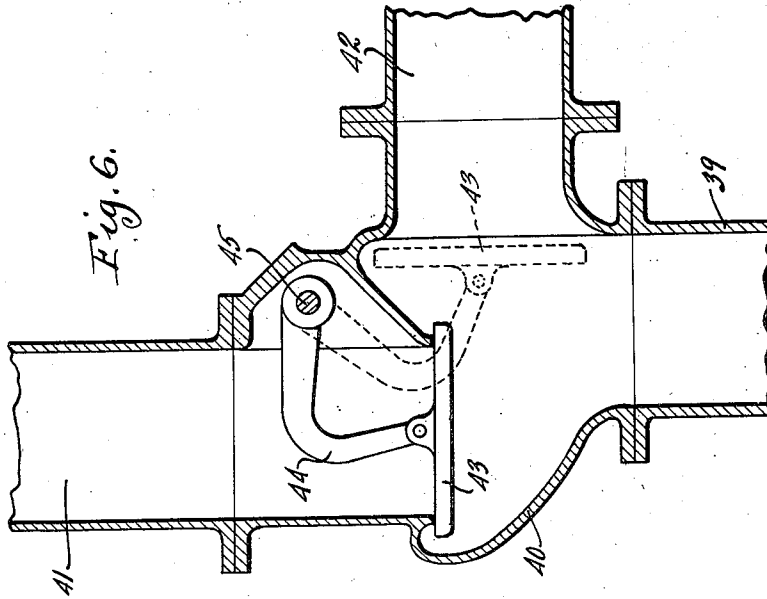
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4 Sheets-Sheet 3



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4 Sheets-Sheet 4

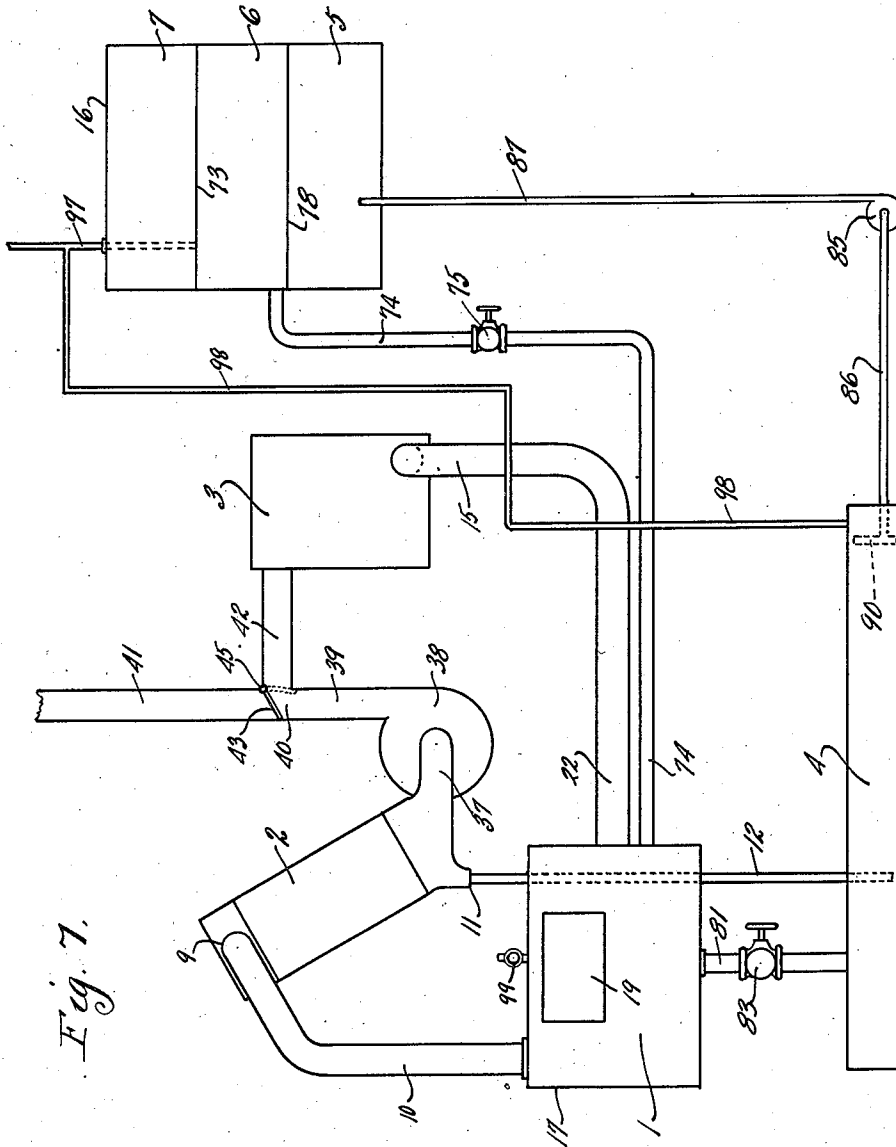


Fig. 7.

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1,993,407

DRY CLEANING APPARATUS

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Application March 16, 1932, Serial No. 599,127

7 Claims. (Cl. 68—38)

My invention relates to apparatus for treating fabrics and, particularly, to an apparatus for treating fabrics with a volatile detergent having a low boiling point and for removing foreign matter from the detergent after treating operations whereby the same detergent may be used in subsequent operations with full effect. The apparatus is such that there will be small loss in the volume of the detergent.

In fabric treating apparatus, it is desirable to be able to repeatedly use the same detergent and to have the detergent equally effective in each operation. It is also desirable to have the entire system as nearly closed to the outside atmosphere as possible to prevent loss of volatile detergent into the atmosphere. However, means are preferably provided for giving sufficient access to the atmosphere to prevent the formation of excess vacuum and pressure conditions within the apparatus. Further, it is highly desirable to have all of the necessary apparatus and pipe connections, if any, arranged in as compact a form as possible so as to conserve space and avoid leaky joints and fittings.

It is the object of my invention to provide a novel, compact and efficient fabric treating apparatus wherein a volatile detergent is adapted to be used, the apparatus including, in particular, a sealed fabric container or washer in which the fabric is subjected to the treating medium in being cleaned, rinsed and dried, a combined condenser and lint screen, a gas tight three-way valve, a gas operated air heater, and a novelly constructed reclamation unit including an evaporator, a storage tank, and a condenser in one container, the parts being so arranged as to require a minimum space for the entire apparatus and make it possible to use short pipe connections to thereby minimize the undesirable feature of leaky joints and fittings. Likewise, all parts are tinned or otherwise protected against attack by any acid formed with or by the treating medium where it has been found to be necessary or desirable.

Various other 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 an elevation of a fabric treating apparatus constructed in accordance with my invention; Fig. 2 is a plan view of the apparatus shown in Fig. 1; Fig. 3 is a vertical sectional view of the air heater forming a part of the apparatus; Fig. 4 is a vertical sectional view of the

condenser used in the fabric drying circuit of the apparatus; Fig. 5 is a vertical sectional view of the treating medium reclamation unit including the storage tank, evaporator and condenser; Fig. 6 is a vertical sectional view showing the three-way valve which I employ as a part of the apparatus; and Fig. 7 is a diagrammatic view showing the arrangement of parts of the entire apparatus and the connections therebetween.

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 operation, comprising a fabric treating compartment 1 provided on its interior with the usual rotatable fabric container which is adapted to be driven in alternately reverse directions by a motor or power unit A (see Figs. 1 and 2) that is operatively connected to the goods container by the usual speed reduction mechanism, not shown.

The treating compartment 1, together with a drying condenser 2 and an air heater 3 that form a part of a fabric drying and deodorizing circuit, and a reclamation unit embodying a sump tank 4, an evaporator 5, a storage tank 6, and a condenser 7 are all positioned on a suitable base in compact arrangement so that the necessary conduit and pipe connections between the different specific parts of the apparatus are very short and can easily be made gas tight. That is, the intake 9 of the drying condenser 2 is at the upper end of the drying condenser and in a plane but slightly above the horizontal plane of the top of the treating compartment 1 to which it is connected by a short air duct 10; the drain 11 of the drying condenser 2 is at the lower end of the drying condenser and in a plane a short distance above the sump tank 4 to which it is connected by a short drain pipe 12 having the usual sight glass 13 therein; the discharge from the air heater 3 is located in substantially the same horizontal plane as the intake opening 14 of the treating compartment to which it is connected by a short air duct 15; and the evaporator 5, storage tank 6, and condenser 7 of the reclamation unit are all three embodied in one container 16 located in proximity to the other parts of the apparatus just mentioned so that all pipe connections between the several parts of the apparatus are as short as possible.

The treating compartment 1 consists of the

usual outer cylindrical tub 17 supported on a suitable frame 18 and provided with a door 19 mounted to swing on hinges and be tightly clamped in closed position by cam levers 20.

5 Within the tub 17 is suitably mounted a clothes container cylinder 21 provided with one or more sliding doors to permit placing of goods to be treated inside the cylinder. One of the trunnions which supports the cylinder, the trunnion 10 22, is hollow and extends outwardly through the adjacent end of the tub 17 where it connects with the duct 15 leading from the discharge opening of the air heater 3. The parts are so arranged that the hot air coming from the heater 15 3 passes through the duct 15, thence through the hollow trunnion 22, and into the container cylinder 21 where it mingles with the goods and then passes out of the tub 17 through the duct 10 and into the upper end of the drying condenser 2. 20 Thus, hot air may be injected directly into the mass of goods in the cylinder.

As shown in Fig. 4, the drying condenser 2 is provided at its uppermost end with a small compartment 23 which has a plurality of removable 25 screens 24 therein, the inlet of the duct 10 being in the space above the uppermost screen. The frame of the lowermost screen 24 rests on an integral ledge 25 on the inner wall of the condenser frame and a removable cover 26 is clamped on 30 the open top of the condenser to provide a closure therefor. A gasket 27, preferably mounted on each screen 24, forms a dust-proof joint between the outer periphery of each screen 35 frame and the inner surface of the walls of the condenser frame, the screens being held in place by force of gravity whereby they may be lifted out for cleaning purposes when the cover 26 is removed.

The central and major portion of the condenser 2 consists of a water compartment separated from the upper compartment 23 by a 40 partition wall 28 and from a lower compartment 29 by a partition wall 30. A plurality of tubes 31 have their ends secured in the partitions or end heads 28 and 30 and provide free 45 communication between the upper compartment 23 and the lower compartment 29, and each tube 31 is preferably provided with a twisted flat sheet metal band 32 through its entire 50 length which tends to retard the flow of fluid passing through the tubes. These bands 32 also serve as depositories for lint that may pass the screens 24, such lint being completely 55 removed with the bands 32 when they are drawn from the tubes.

In the operation of this condenser, cold water is admitted to the space about the tubes 31 through an inlet pipe 33 and passes out of the condenser through an exhaust pipe 34, the 60 water being effective to cool the tubes and condense vapors passing downwardly through the tubes from the compartment 23 towards the compartment 29 and the condensed vapor in the form of liquid flows into the compartment 29. 65 As shown, the lower compartment 29 is provided with a downwardly extending baffle 35 and an upwardly extending baffle 36 which serve to prevent any liquid, resulting from condensation from passing through air exhaust opening 37 70 whereby all of the liquid passes through the exhaust opening 11 by gravity. The liquid exhaust opening 11 is connected with the sump tank 4 by means of the pipe 12 provided with the sight glass 13 as hereinbefore described, the 75 lowermost end of the pipe 12 being disposed adja-

cent the bottom of the sump tank 4 whereby a liquid seal is formed by the treating medium normally retained in the sump tank by means hereinafter described.

The air exhaust opening 37 is connected to the 5 suction side of a fan 38 (see Figs. 1, 2, 6 and 7) whose discharge opening is connected by a duct 39 to the intake of a three-way valve casing 40. One discharge opening of the valve casing 40 is 10 connected to a duct 41 leading to the atmosphere and the other discharge opening of the casing 40 is connected by a duct 42 to the air heater 3. As shown in Fig. 6, a valve 43 in the casing 40 is 15 arranged to close either one of the discharge openings in the conduits 41 and 42 and is loosely mounted on the free end of a lever 44 which is 20 rigidly mounted on a rock shaft 45 which has its bearings in the casing 40 with one end extended outwardly within easy reach of an operator where a suitable handle 46 is provided. A suitable spring 25 47 is provided to normally yieldingly hold the valve 43 in a position to seal the opening leading to the atmosphere duct 41. Therefore, a locking means 48 is provided for holding the valve 43 in a position to close the opening leading to the heater 3 30 through the duct 42.

As shown in Fig. 3, the air heater 3 consists of a box-like structure closed at its upper end by a 35 top plate 49 and at its lower end by a bottom plate 50. A plurality of tubes 51 extend between and have their open ends secured in suitable perforations in the plates 49 and 50 and a spirally formed flat sheet metal strip 52 is preferably placed in 40 each tube 51 to act as retarder for any fumes or gases that pass through the tubes. Immediately and directly below the bottom plate 50 are arranged a plurality of gas burners 53, the hot 45 fumes from which pass upwardly through the tubes 51, thence into a hood 54 mounted above the plate 49, and thence upwardly through a stack 55 to the atmosphere. The air duct 15 is connected to the lower right-hand portion of the front side of the heater 3 so that air passing from the air 50 duct 42 to the exhaust duct 15 hereinbefore described must pass between the mass of hot tubes 51 in a diagonal direction and suitable baffles 56 are provided to make the path of the air take a zigzag course between the tubes 51.

Referring to Fig. 5, the reclamation unit including evaporator 5, storage tank 6 and condenser 7, consists, in this instance, of suitable gas 55 burners 57 provided below the inverted conical bottom 58 of the evaporator 5, a pipe 59 provided with a valve 60 being connected to the lowest point of the conical bottom 58 for cleaning out 60 purposes. The fumes and hot gases from the burners 57 impinge upon the bottom 58 and thence pass out radially along the lower side of the bottom 58 and into an inverted trough 61 encircling the lower end of the evaporator 5 from whence 65 the gases pass upwardly through the stack 62 to the atmosphere. The inverted trough 61 increases from a very small cross sectional area at a point remote from the stack 62 to a large cross sectional area adjacent the stack to provide for the 70 increased quantity of burned gases and to obtain the greatest amount of heat possible from the gases.

The center of the top of the evaporator 5 is cone-shaped as at 64 and terminates in a central 75 pipe 65 which extends vertically through the central portion of the storage tank 6 and condenser 7. At its upper end, the pipe 65 connects with a plurality of coiled pipes 66 immersed in cold water which enters the condenser compartment

through a pipe 67 and leaves the condenser compartment through a pipe 68. The lower ends of the coil pipes 66 connect with a header pipe 69 which connects with a moisture trap 70 mounted on the exterior of the condenser. A short pipe 71 connects the lower portion of the trap 70 with a vertically extending pipe 72 in the storage tank 6.

Both ends of the pipe 72 are open, the upper end terminating a short distance below a horizontal partition 73 forming the division wall between the condenser 7 and storage tank 6 and the lower end of the pipe 72 terminating a short distance above the floor of the storage tank 6. Thus, any liquid entering the storage tank 6 through the pipe 71 will escape into the tank through the lower end of the pipe 72 whereby agitation of the liquid within the tank will be substantially reduced or prevented.

The top open end of the pipe 72 serves to vent the condenser 7. As shown in Fig. 1, the outlet from the storage tank 6 is similarly arranged. That is, the outlet pipe 74 that leads to the treating compartment 1 and is controlled by a valve 75 terminates in a vertically extending pipe 76 having its upper and lower ends adjacent the top and bottom respectively of the storage and having these ends open. Thus, a syphon effect is not produced and the liquid flowing out of the storage tank 6 through the pipe 74 is taken from the lower end of the tank, the connection between the pipe 74 and the pipe 76 being substantially above the bottom of the storage tank whereby a predetermined solvent level is provided in the storage tank 6.

Referring to Fig. 5, the floor of the storage tank 6 is insulated from the evaporator 5 by having a space between the horizontal partitions 77 and 78 and having this space filled with heat insulating material 79. Similarly, the pipe or duct 65 extending vertically through the tank 6 and condenser 7 is insulated from the surrounding liquid by having the space between its outer wall and the inner wall of a vertical pipe 80 filled with heat insulating material 79.

As shown in Fig. 1, the cold water pipe 67 is conveniently connected to the discharge pipe 34 of the condenser 2 whereby cold water may be caused to flow through the pipe 33 into the drying condenser 2, through the drying condenser 2, out of the condenser 2 and through pipe 34, through pipe 67, through condenser 7, and out of the condenser 7 through the pipe 68 to waste. The discharge pipe 74 under the control of valve 75 provides a means for supplying treating medium to the treating compartment 1 from the storage tank 6 as hereinbefore described and, as shown in Fig. 1, the bottom of the treating compartment tub 17 is provided with a drain pipe 81 which connects with a trap 82 and is provided with a valve 83 and an observation glass 84. The trap 82 is located on the upper part of the sump tank 4 and serves as a strainer to catch or retain any foreign matter which may have been placed in the treating compartment cylinder with soiled goods.

A pump 85 is provided to draw the cleaning medium out of the sump tank 4 and deliver the liquid into the evaporator 5 and for this purpose a pipe 86 connects the suction side of the pump 85 with the sump tank 4 and another pipe 87 connects the discharge side of the pump 85 with the evaporator 5. The pipe 86 is provided with a valve 88 and a check valve 89 to prevent flow of liquid from the pump 85 towards the sump tank 4, and the pipe 86 terminates within the

sump tank in a vertical T connection 90 open at top and bottom, see Fig. 7, for the purpose of drawing liquid from the bottom of the sump tank only and to provide a syphon relief effect whereby a certain amount of liquid, or sufficient to maintain a liquid level below the pipe 12, will be maintained in the sump tank, the amount of liquid being determined by the height of the connection with the vertical portion of the T within the sump tank. The pipe 87 is provided with a valve 91 and a check valve 92 to control the flow of treating medium to the evaporator 5 and prevent back flow toward the pump.

To provide a means for filling the system with treating medium, the pipe 86 connected to the suction side of the pump 85 is provided with a branch pipe 93 under the control of a valve 94. A hose or other conduit leading from the source of supply may be attached to the pipe 93, the valves 94 and 91 are opened, the valve 88 closed, and the pump 85 operated to draw liquid from the source of supply and deliver it to the evaporator 5 to remove all possible impurities before delivery to the storage tank 6. For emptying the system of treating medium, the pipe 87 connected to the discharge side of the pump 85 is provided with a branch pipe 95 under the control of a valve 96 whereby the system may be emptied by opening the valves 88 and 96, closing valves 91 and 94, and placing the pump in operation to draw the liquid from the sump tank 4 and discharge it through the pipe 95.

Suitable means are provided for properly venting the system to permit escape of air from the different containers during the time the treating medium is being supplied to such containers and also to admit air into the containers during the time liquid is being removed therefrom. This vent means consists of a small vent pipe 97 leading from the storage tank 6 through the cold water in the condenser 7 to condense solvent fumes passing therethrough, the pipe 97 being adapted to vent the storage tank. Another similar vent pipe 98, also open to the atmosphere, is connected to the upper part of the sump tank 4. Thus, all parts except the fabric treating circuit are vented to the atmosphere.

As to the fabric treating circuit, means are provided for maintaining this circuit substantially sealed against free communication with the atmosphere to prevent escape of treating medium vapors to the atmosphere during the time the fabric is being subjected to treating medium and during the deodorizing step hereinafter described. Referring to Figs. 1 and 7 of the drawings, a negative check valve 99 is provided on the treating compartment 1, the valve being such as to admit air into the treating compartment to relieve vacuum conditions but to prevent passage of vapor from the treating compartment into the atmosphere. Likewise, as hereinbefore described, the pipe 12 leading from the condenser 2 to the sump tank 4 for delivering condensed treating medium to the sump tank terminates at a point adjacent the bottom of the sump tank and below a supply of treating medium that is always maintained therein as hereinbefore described. Thus, with the door 19 of the treating compartment in closed and locked position and the supply line valve 75 in closed position, it will be seen that the fabric treating circuit which includes the treating compartment 1, condenser 2, air heater 3 and associated parts is effectively sealed against free communication with the atmosphere.

In the operation of the apparatus, after the storage tank is filled with a sufficient quantity of treating medium, the fabric to be cleaned is placed inside the container cylinder 21 within the tub 17 and the tub door 19 is closed to seal the tub and provide a substantially closed circuit. Then, a motor A is placed in operation to rotate the washer cylinder 21 continuously and alternately in reverse directions.

The valve 75 is then opened to permit the desired quantity of treating medium to flow from the storage tank 6 into the treating compartment 1 through the pipe 74 and the cylinder 21 is continuously rotated in its alternately reverse directions until the fabric has been subjected to the treating medium the desired length of time. Then, the dirty treating medium is allowed to flow into the sump tank 4 by opening the valve 83 in the pipe 81, the operation of filling and emptying the treating compartment 1 being repeated more or less times according to the class and condition of the fabric being treated.

After the fabric has been sufficiently treated with treating medium and the bulk of the treating medium drained from the treating compartment 1, a motor B is placed in operation to operate the fan 38, the valve 43 being in the position shown in Figs. 6 and 7 to close off the pipe 41 to the atmosphere. Operation of the fan 38 will force air through the pipe 42, air heater 3 where the air is heated, pipe 15, and into the treating compartment 1 where it passes through the fabric to pick up the treating medium still remaining in the fabric. The treating medium laden air is forced through the pipe 10 and into and through the drying condenser 2 where the treating medium is condensed from vapor form and passes in liquid form through the pipe 12 to the sump tank 4. The air from which the treating medium has been removed is then drawn into the fan 38 through the pipe 37 and is again forced through the circuit just described. This operation is what is known as the drying operation.

After the fabric has been sufficiently dried, which is at a time when all of the treating medium has been removed therefrom, as seen through sight glass 13, the valve 43 is moved to the dotted line position shown in Figs. 6 and 7 which closes off the pipe 42 and opens the pipe 41 to the atmosphere. At the same time, the door 19 of the treating compartment 1 is held partially opened by the manually operated catch 100 whereby operation of the fan 38 will draw atmospheric air through the door 19, through the treating compartment 1 and the fabric therein, through the pipe 10, through the drying condenser 2 where any treating medium carried by the air in vapor form will be condensed out of the air and be delivered to the sump tank, through the fan 38, and out of the pipe 41 to the atmosphere. This process is continued until all of the odor is removed from the clothes and the operation is known as the deodorizing step and, after this deodorizing step, the fabric may be removed from the treating compartment 1.

With the above construction, I have provided a simple, compact and efficient apparatus for treating fabric necessitating a minimum of floor space and with the parts of the apparatus so arranged as to practically eliminate the heretofore prevalent danger of leaky joints and fittings. Also, I have provided an apparatus wherein it is possible to subject fabric to a highly volatile treating medium in a closed circuit wherein the

loss of treating medium to the atmosphere is negligible. Further, I have provided a new and advantageous combined condenser and lint strainer, air heater, and reclamation unit wherein an evaporator, a storage tank and a condenser are combined in a single container.

What I claim is:

1. In dry cleaning apparatus for treating fabrics with volatile detergent, a condenser for recovering vaporized detergent, comprising a casing provided with a door closing a detergent vapor receiving chamber, vapor conducting tubes in said condenser communicating with said chamber and accessible through its door opening and lying within a chamber for conducting condensing medium, and lint collecting screens lying within said vapor receiving chamber and removable through the door opening.

2. In In dry cleaning apparatus for treating fabrics with volatile detergent, a condenser for recovering vaporized detergent, comprising a casing provided with a door closing a detergent vapor receiving chamber, vapor conducting tubes in said condenser communicating with said chamber and accessible through its door opening and lying within a chamber for conducting condensing medium, and a plurality of separate lint collecting screens lying in superposed relation within said vapor receiving chamber and removable individually through the door opening.

3. In dry cleaning apparatus for treating fabrics with volatile detergent, a condenser for recovering vaporized detergent, comprising a casing provided with a door closing a detergent vapor receiving chamber, vapor conducting tubes in said condenser communicating with said chamber and accessible through its door opening and lying within a chamber for conducting condensing medium, and a plurality of separate lint collecting screens lying in superposed relation within said vapor receiving chamber and removable individually through the door opening, each of said screens having a border frame and a screen member, and gaskets lying between the frames of contiguous screens.

4. In dry cleaning apparatus for treating fabrics with volatile detergent, a condenser for recovering vaporized detergent, comprising a casing provided with a door closing a detergent vapor receiving chamber, vapor conducting tubes in said condenser communicating with said chamber and accessible through its door opening and lying within a chamber for conducting condensing medium, a lint collecting screen lying within said vapor receiving chamber, and lint collecting members lying within said tubes, said lint collecting screen and members being removable through the door opening.

5. In dry cleaning apparatus for treating fabrics with volatile detergent, a condenser for recovering vaporized detergent, comprising a casing provided with a door closing a detergent vapor receiving chamber, vapor conducting tubes in said condenser communicating with said chamber and accessible through its door opening and lying within a chamber for conducting condensing medium, a lint collecting screen lying within said vapor receiving chamber, and twisted metal bands lying within said tubes and adapted to collect lint which passes the lint screens, said lint collecting screen and twisted metal bands being removable through the door opening.

6. Dry cleaning apparatus of the character described, comprising a fabric treating compartment, a sump tank below the same, an air heater

5 horizontally opposite the treating compartment,
 a fan below the air heater, and a condenser at one
 side of the treating compartment and at sub-
 10 stantially the same level, the upper portions of the
 treating compartment and condenser lying close-
 ly adjacent and communicating with each other
 at one end of the treating compartment, the low-
 er end of the condenser communicating with both
 the sump tank and fan and lying closely adja-
 15 cent to the fan, the fan communicating with the
 upper portion of the heater, and the heater hav-
 ing an outlet connection closely adjacent to and
 communicating directly with the other end of
 the treating compartment.

15 7. Dry cleaning apparatus of the character de-
 scribed, comprising a fabric treating compart-
 ment, a sump tank below the same, an air heater

horizontally opposite the treating compartment,
 a fan below the air heater, and a condenser at
 one side of the treating compartment and at sub-
 stantially the same level and inclined downward-
 5 ly from one end of said compartment toward the
 fan, the upper portions of the treating compart-
 ment and condenser lying closely adjacent and
 communicating with each other, the lower end
 of the condenser communicating with both the
 10 sump tank and the fan and lying closely adjacent
 to the fan, the fan communicating with the up-
 per portion of the heater, and the heater having
 an outlet connection closely adjacent to and com-
 15 municating directly with the other end of the
 treating compartment.

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