

May 21, 1946.

H. V. WRIGHT ET AL

2,400,726

APPARATUS FOR TREATING FABRICS

Filed Sept. 26, 1935

6 Sheets-Sheet 1

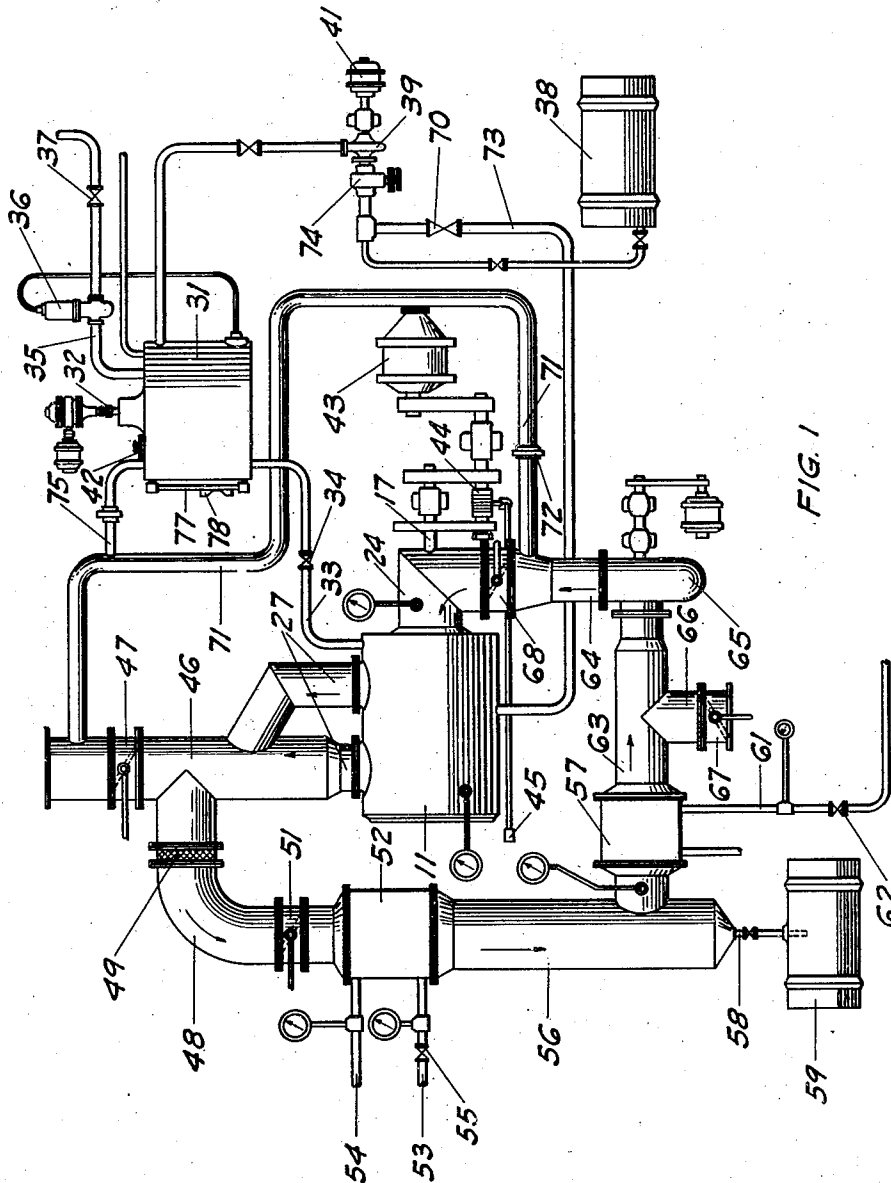


FIG. 1

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6 Sheets-Sheet 2

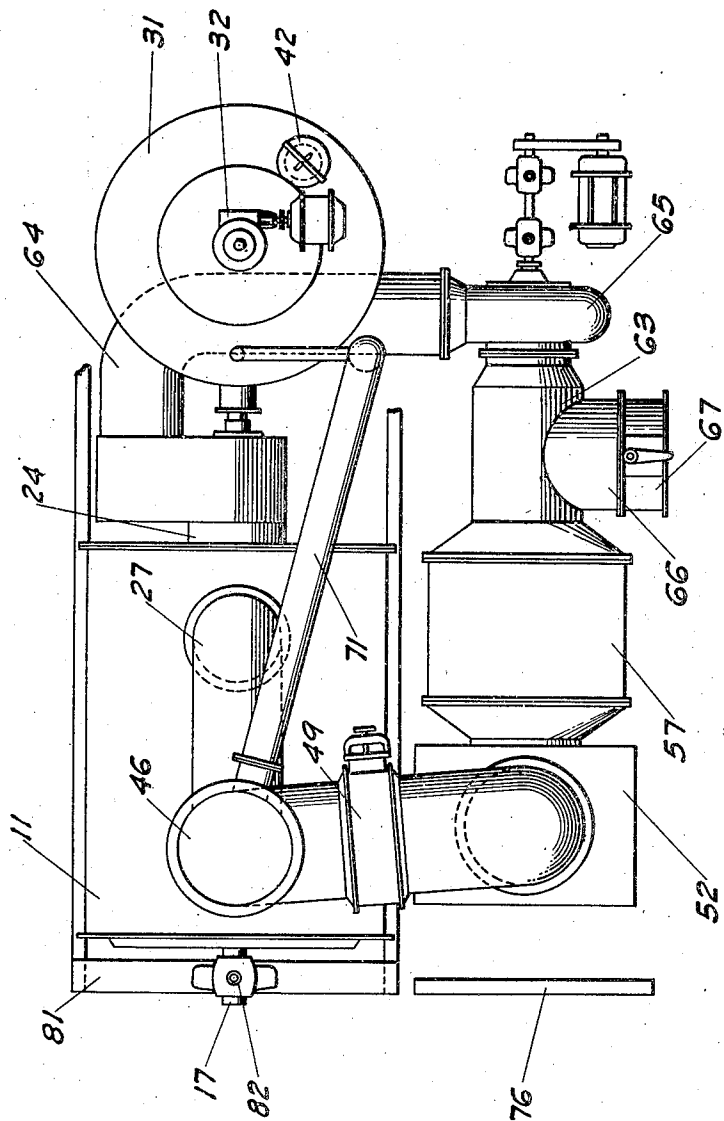


FIG. 2

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6 Sheets-Sheet 3

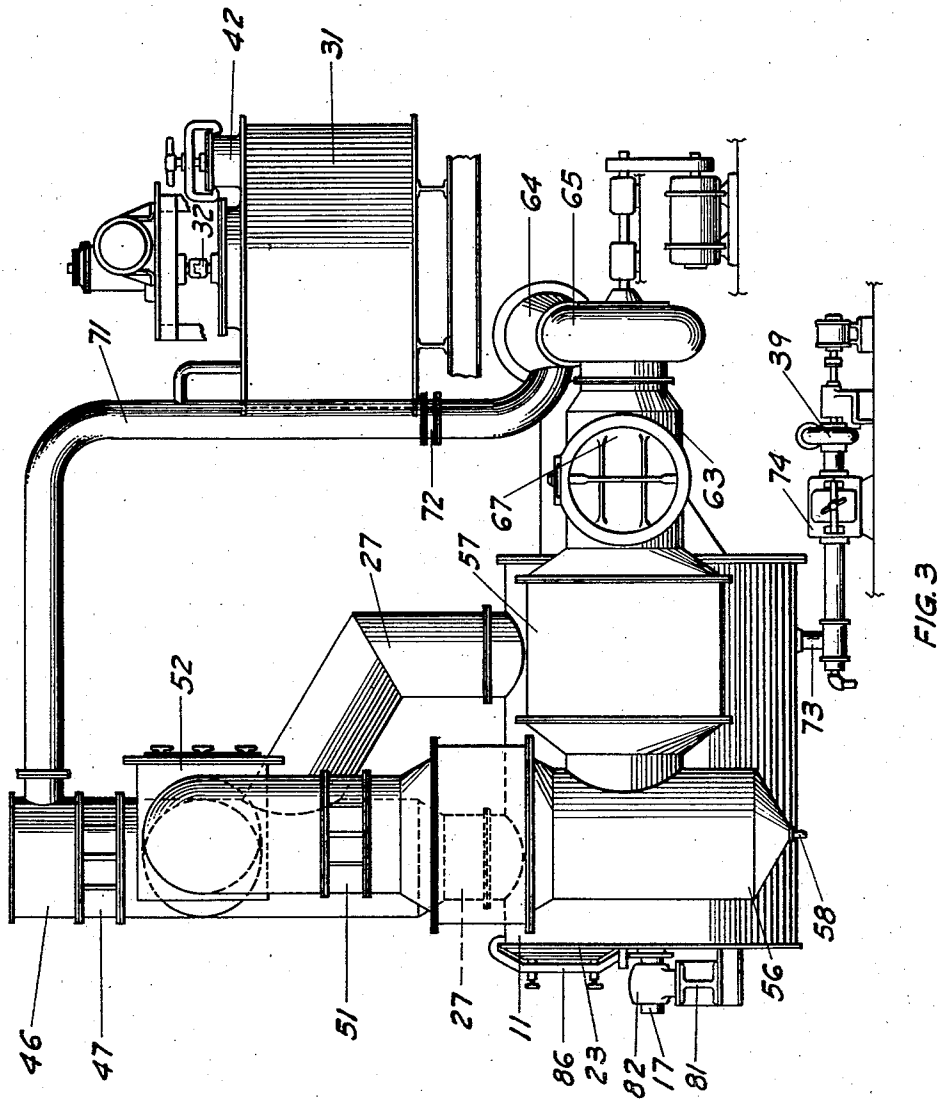


FIG. 3

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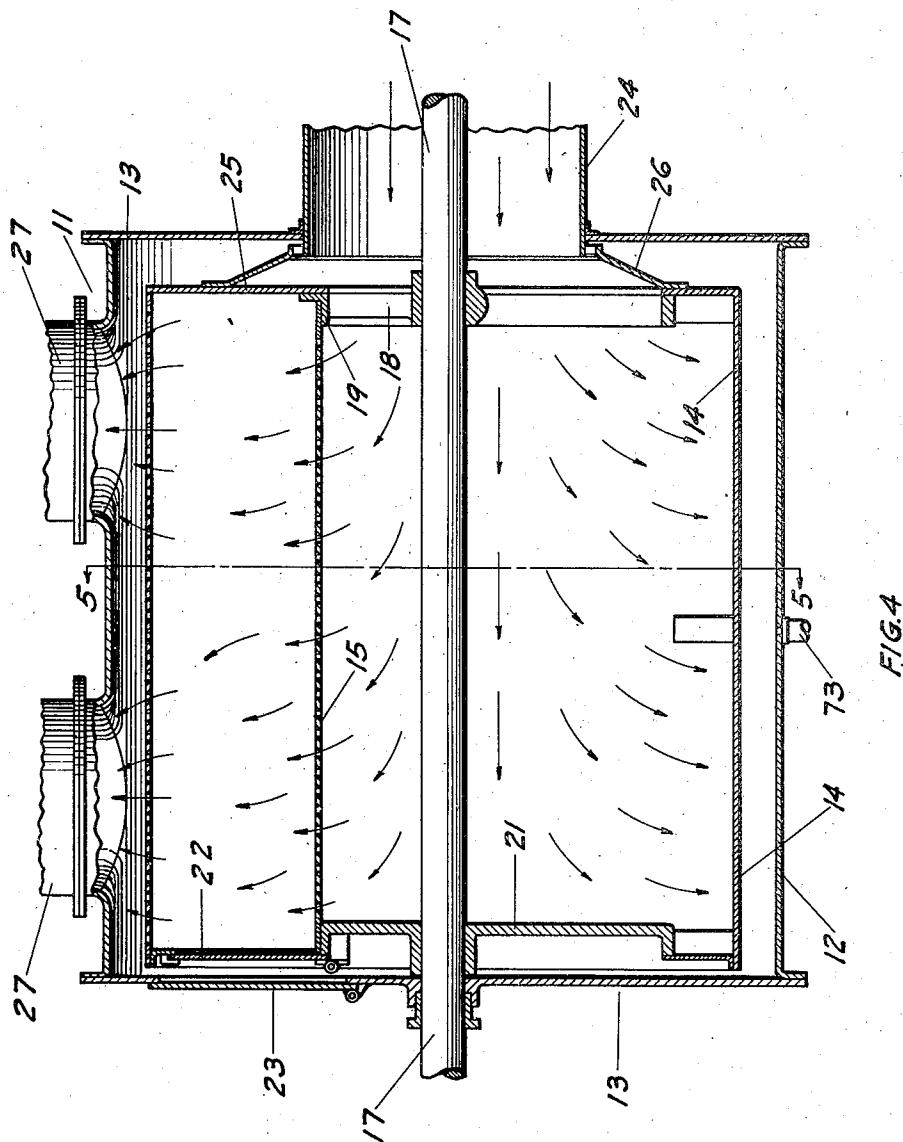
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APPARATUS FOR TREATING FABRICS

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6 Sheets-Sheet 4



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APPARATUS FOR TREATING FABRICS

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6 Sheets-Sheet 5

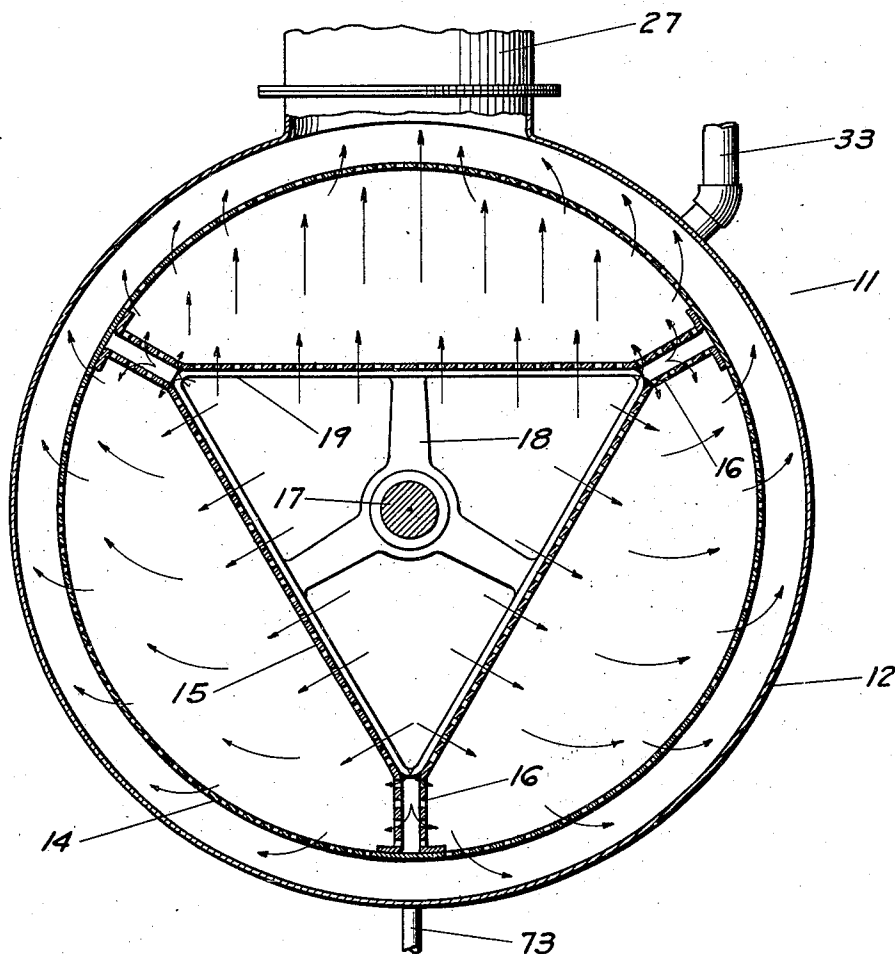


FIG. 5

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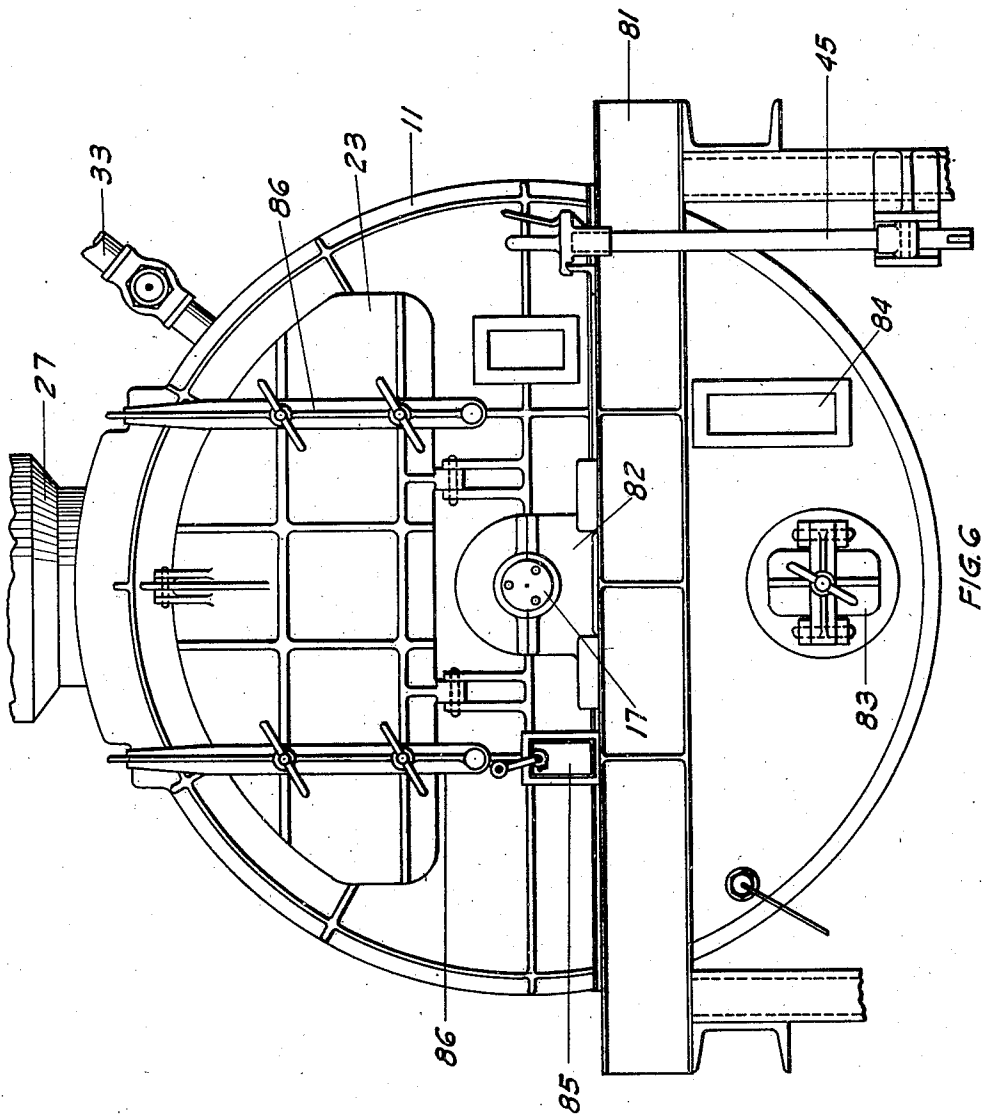
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APPARATUS FOR TREATING FABRICS

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6. Sheets-Sheet 6



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UNITED STATES PATENT OFFICE

2,400,726

APPARATUS FOR TREATING FABRICS

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Application September 26, 1935, Serial No. 42,332

5 Claims. (Cl. 91—55)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to us of any royalty thereon.

This invention relates to an apparatus for treating fabrics, and more particularly to an apparatus for the impregnation of fabrics to render them resistant to the passage of vesicant gases and vapors.

It is well known that the vapor of mustard gas (bis-(beta-chlorethyl) sulphide) and similar vesicant substances penetrate ordinary clothing and cause serious irritations of the skin. Many attempts have been made to protect persons exposed to mustard gas and similar substances by providing protective clothing which would prevent the vesicant vapors and gases contacting the wearer's skin. Impermeable suits have been provided which exclude the gases and vapors, but such suits are uncomfortable to the wearer since they prevent the passage of air to and from the wearer's skin.

Chemicals have been produced which can be impregnated into ordinary fabrics or clothing which permit the normal passage of air and moisture, but which will react with the vesicant gases and vapors to render them harmless. The present invention, although not limited thereto, relates more particularly to a method and apparatus for impregnating fabrics or clothing with such chemicals.

One object of this invention is to provide an improved apparatus whereby protective chemicals may be readily and expeditiously impregnated into and affixed to fabrics and clothing.

Another object of this invention is to provide an apparatus of the above-indicated character wherein all of the operations of impregnating, draining, centrifuging, drying, and cooling of the fabrics and clothing are done in a closed chamber such that the personnel is protected at all times from harmful gases and vapors of the impregnating solution.

Another object of this invention is to provide an apparatus of the above-indicated character in which the amount of the impregnant affixed to the fabric or clothing may be readily varied.

A further object of this invention is to provide an apparatus of the above-indicated character which is highly efficient with respect to the amount of chemicals used, the unused solution being recovered and used over again.

These and various other objects of the invention will be apparent from the following description and appended claims, it being understood

that apparatus and the steps involved in the procedure may be widely varied without departing from the spirit of the invention or exceeding the scope of the appended claims.

In general, the procedure comprises placing the fabric or clothing in a pocketed rotary drum positioned within a closed casing, thoroughly soaking the fabric or clothing with the impregnating solution while oscillating the drum, draining the excess solution, centrifuging the fabric or clothing for such time and at such speed as to remove a predetermined quantity of the impregnating solution, forcing heated air through the fabric or clothing to vaporize the solvent used in the solution, forcing cool air through the fabric or clothing, and removing the same from the drum.

Referring to the drawings,

Figure 1 is a diagrammatic view of the complete system.

Figure 2 is a top plan of the apparatus.

Figure 3 is a right side elevation thereof.

Figure 4 is a longitudinal section of the chamber in which the fabric is treated.

Figure 5 is a section on line 5—5 of Figure 4.

Figure 6 is a front elevation of the treating chamber.

In the system herein shown and described for the purposes of illustration, the fabric such as woolen or cotton garments or the like are placed in a closed treating chamber 11, the details of which will first be described. The treating chamber 11 includes a cylindrical outer casing 12 having end walls 13, and a rotary drum 14 therein which is cylindrical, with a perforated outer wall. The interior of drum 14 is divided into a plurality of pockets, shown as three in number, these pockets being formed by a triangular partition 15 which extends longitudinally of the drum and is also perforated. As seen in Figure 5, the triangular partition 15 does not extend outwardly to the drum 14, there being radially extending portions 16 which are riveted or otherwise secured to drum 14. These portions 16 are likewise perforated, and are in effect extensions of the sides 15.

The drum 14 and triangular partition is secured to a central shaft 17 by spider 18 secured to an open triangular frame 19 which in turn is secured to walls 15. Spider 18 as seen in Figure 4 is adjacent one end of the drum. The opposite end of drum 14 is closed by a partition 21 which has three doors 22 thereon, each door pivoted on hinges to swing toward shaft 17 and normally held closed by suitable catches. These three doors provide access to the three pockets

between the triangular partition 15 and rotary drum 14, whereby clothing or goods may be positioned therein for treatment.

As seen in Figures 4 and 6, the end of outer casing 12 is provided with a door 23 which may swing downwardly toward shaft 17, whereby the inner doors 22 may be exposed for opening. When door 23 is open, one of the doors 22 may be aligned therewith by manual rotation of the drum 14 if necessary. The charge of fabric or clothing may then be positioned in the exposed pocket, inner door 22 closed and secured, drum 14 turned until the next adjacent door 22 is aligned, and this next pocket may be similarly charged with fabric or clothing.

It will be seen that the construction described provides a central longitudinal duct of triangular cross-section with perforated walls 15. This duct is for the purpose of passing air or other gas over and through the clothing for evaporating the solvent or other fluid from the clothing. To this end, the rear end wall 13 of outer casing 12 has an enlarged opening around shaft 17 into which extends a pipe 24. This end of rotary drum 14 is closed by an unperforated wall 25 secured to the flanges 19 of spider 18, this wall 25 having a central triangular opening corresponding to the triangular duct within the rotary drum. A frusto-conical hood 26 is secured to end wall 25 and closely surrounds the inner end of pipe 24, so that entering air passes into the triangular duct.

The outer casing 12 is provided with two outlets 27 in its upper portion for the exit of the air. As seen from the arrows in Figures 4 and 5, the air is forced into the central duct and out of the perforations in walls 15 and also through the perforations in radially extending portions 16, into outer casing 12, and out of pipes 27. Thus the air passes through and around all of the clothing, including that which is in the corners of the drum.

The rotary shaft 17 is driven by any suitable means, preferably an electric motor having control means such that the drum 14 may be oscillated at relatively slow speed, and rotated continuously in one direction at relatively high speed, which may be varied in accordance with the fabric being treated and the size of the drum.

Referring now to Figures 1, 2 and 3, the complete system will be described. As heretofore indicated, this invention is directed primarily to the impregnation of cloth with a protective compound such as to render it impermeable to vesicant gases and vapors such as may be encountered in warfare. Impregnants of this character have been developed which are suspended or dissolved in volatile solvents, the impregnants when properly applied to the cloth reacting with mustard gas or similar vesicants to render them harmless.

The impregnating solution is stored in tank 31 provided with a motor actuated stirring device 32 and connected to tumbler drum casing 11 by a gravity feed pipe 33 having a valve 34. Tank 31 is provided with a steam heating coil connected to steam pipe 35 having an automatic temperature controlled valve 36 and shut-off valve 37. The solvent may be pumped into tank 31 from drum 38 through suitable piping by pump 39 operated by motor 41. The impregnant may be added to tank 31 through man-hole 42.

The rotary drum within casing 11 is driven by motor 43 connected by suitable drive mechanism to shaft 17. Interposed in this drive mechanism is a clutch 44 operated by handle 45 accessible at

the front of the apparatus. Suitable control means are provided for motor 43 whereby shaft 17 and drum 14 may be oscillated in order to thoroughly saturate the liquid compound into the cloth, or may be run at high speed in one direction to centrifuge the excess liquid out of the cloth.

The air conduits or pipes 27 connected to the upper portion of casing 12 are connected to a stack 46 having a valve 47 therein. An air recirculating duct 48 is connected to stack 46 below valve 47, and this duct has a filter element 49 therein for the air, preferably of mesh wire screen. By-pass duct 48 has a cut-off valve 51 and is connected to a condenser 52 containing a suitable condensing element connected to cool-water inlet 53 and outlet 54, the inlet water being controlled by valve 55.

From condenser 52, the recirculating duct 56 extends to a heater 57. The solvent condensed from the air in condenser 52 drains into a sump and is run off by pipe 58 to recovery solvent container 59. Air heater 57 has a vaned heating element therein into which steam from pipe 61 enters, the steam flow being controlled by valve 62. From heater 57 the heated air flows through recirculating ducts 63 and 64 back to duct 24 leading into casing 11 as heretofore described. A fan 65 between ducts 63 and 64 causes the air to flow as described.

Recirculating duct 63 has an air inlet duct 66 controlled by valve 67 and duct 64 has a valve 68 therein between fan 65 and inlet 24.

A by-pass air duct 71 having a damper 72 is connected to duct 64 on the fan side of damper or valve 68 and to stack 46 above damper 47. A pipe 73 is connected to the lower portion of casing 11 in order to drain off the excess impregnating solution, the opposite end of pipe 73 being connected to pump 39 whereby this solution may be returned to solution tank 31. A screen filter 74 having a removable filter element is positioned in pipe 73 in front of the pump in order to extract lint, tags, buttons, and other foreign matter from the drained solution, flow in this line being controlled by valve 70.

A vent pipe 75 is connected to the top of the solution tank and to stack 46 by way of by-pass duct 71. A plurality of thermometers are connected to the various points in the system wherein knowledge of temperature ranges are desirable, as indicated on Figure 1. These thermometers have not been given separate reference characters, for the sake of clearness in the drawings. The indicating dials of these thermometers are all grouped on a control panel 76, Fig. 2, adjacent the front of the machine, this panel also carrying the electric switches and speed controls for the motors, and the operating handles for the valves. The solution tank 31 is provided with a gauge glass 77 and an indicator 78 visible from the front of the machine whereby an operator may open valve 34 and drain into tumbler drum 11 the required amount of solution.

The complete cycle of operations will now be described. It has been found that certain of the impregnating solutions and particularly certain solvents are corrosive to many metals in the presence of water. Therefore the clothing or other fabric to be impregnated is first de-humidified to remove moisture therefrom when the presence of moisture is undesirable. This preliminary drying may be accomplished in the usual laundry drying machine, or may be done in drum 11 by oscillating the clothing while passing heated air

over and through it by the apparatus above described.

The impregnating operation is more efficiently carried out when the temperature of the solution is raised above room temperature. Therefore the required amounts of impregnant and solvent are placed in solution tank 31, steam is admitted to the heating coil therein from steam pipe 35, and the solution thoroughly mixed by agitator or stirrer 32. Then valve 34 is opened, as is valve 70 in drain pipe 73, and pump 39 is started, in order to circulate the hot solution into and through the drum so as to warm up the metal surfaces, it being understood that all doors of casing 11 are closed during this warming-up step, as are also all dampers of the air ducts, so that there will be no condensation of liquid in the air ducts.

Pump 39 is then stopped and valves 70 and 34 are closed. Since some of the solvents used with certain impregnating liquids are volatile, it is desirable that the gases and vapors thereof be confined to the system and not escape into the atmosphere, not only for the sake of economy but for safety and comfort of personnel operating the system, since some of these vapors are unpleasant or even dangerous. Therefore the fan 65 is next started, by-pass valve 72 is opened, recirculating duct damper 51 is also opened, stack damper 47 and inlet damper 68 remaining closed. When door 23 is now opened, the fan causes a draft of air into casing 11 through the open door, outlet ducts 27, recirculating ducts 48, 56, 63, 64, and by-pass duct 71 to stack 46. With door 23 open, one of the inner doors 22 is aligned therewith and opened, so that a charge of clothing or fabric may be placed in one of the pockets of rotary drum 14. Door 22 is then closed, and the other pockets of the drum similarly charged by aligning each door thereof with door 23. After door 23 is securely closed, fan 65 is stopped, drive motor 43 is started for oscillatory motion and clutch 44 is correctly positioned to oscillate the drum. The speed of oscillation may be varied in accordance with the amount and kind of clothing being impregnated, but it has been found that a speed of about 30 R. P. M. with reversal of rotation every one-half minute is generally satisfactory.

The correct amount of impregnating solution is then run into casing 11 by opening valve 34, oscillation of the drum 14 being continued for several minutes after the flow of solution into the casing 11 has been cut off. The clothing is thus thoroughly saturated with the solution. Then the excess solution is drained off by opening valve 70 and starting pump 39, oscillation of the drum preferably being continued during draining. It will be understood that there is no air flow during these saturation and draining steps. Next the motor 43 is set to operate at relatively high speed in one direction, for example 150 to 300 R. P. M. and clutch 44 operated to connect the drum to the motor. This causes the excess solution to be centrifuged out of the clothing through the perforations in drum 14, the solution draining to the bottom of casing 12 and being drawn off and returned to tank 31 by pipe 73 and pump 39.

After the excess solution has been thus extracted, the motor 43 is set for oscillation, valve 70 in drain line 73 is closed, and steam is turned into air heater 57. Stack damper 47 remains closed, damper 51 is opened, cooling water is admitted to condenser 52, inlet 66 remains closed, damper 68 is opened, and valve or damper 72 in by-pass 71 is closed. Fan 65 is started, causing

a closed circulation of heated air from the fan into the central triangular duct of drum 14. This air passes through the perforations in plates 15 and extensions 16 thereof and through and over the clothing or fabric. Due to the oscillations of drum 14, the position of the clothing changes periodically, so that a complete extraction of the volatile solvent occurs.

The temperatures of the entering air and of the clothing are controlled so that no damage to the cloth will occur due to over-heating. The temperature within the casing or tumbler drum 11 is a guide as to when extraction of the solvent by air is complete, since normal vaporization of the solvent keeps the temperature down, and as this temperature rises the completion of the drying operation is indicated. The air carrying the extracted solvent passes through filter 49 to remove the lint and fine particles of foreign matter and thence goes to the condenser where the solvent is chilled and condensed. The condensed solvent continually drains into drum 59, and this drainage also is an indication as to the completion of this step. The air then passes into heater 57, is heated, and returns through the fan to chamber 11.

The next step is to cool the clothing so that it may be readily handled and to also drive off the last traces of the volatile solvent. For this purpose, stack damper 47 is opened, damper 51 in recirculating duct 48 is closed, and damper 67 opened. This draws cool air in at 66 for circulation through the clothing and out of stack 46. When the temperature of the clothing is down to a suitable range for handling, the motor 43 is stopped. If the fumes of the solvent are particularly dangerous, it is well to so position the air dampers that a draft of air will enter the door of casing 11, as previously described. Generally, however, this is unnecessary as all dangerous fumes will have been carried off.

Doors 23 and 22 are opened to remove the clothing and to insert a new charge thereof into the pockets of the drum.

Due to the arrangement of a central air duct through the drum, and the perforated clothing pockets, an efficient vaporization and cooling flow of air is obtained. Some of the clothing will rest upon the bottom 15 of the uppermost pocket, whereas in the lower pockets the clothing will lie against the outer surface 14 of the drum. Thus much of the air will flow downwardly instead of passing directly to the outlet pipes 27. As the drum revolves, the flow of air through and over the clothing is reversed. This air also flows outwardly through the corners of the pockets due to perforations in extensions 16. Thus very uniform, rapid, and thorough drying, deodorizing, and cooling of the clothing is obtained.

It will be understood that the machine is mounted on a suitable supporting frame, as seen in Figures 3 and 6. An I beam 81 extends across the front of the machine and supports shaft 17 in bearing 82. As seen in Figure 6, a clean-out door 83 and sight glass 84 are provided in the front of casing 11, and a safety cut-out switch 85 which controls the electric circuit for driving motor 43 of the drum. As long as locking handles 86 of door 23 are in their upright latched position as seen in Figure 6, the switch is closed and motor 43 may be operated. When the left lever 86 of door 23 is swung to the left (see Figure 6) the safety switch 85 opens to cut off the motor.

In the preceding description and appended claims, we use the word air to include air or

other gas, since obviously gas other than air may be circulated for extracting, cooling, or deodorizing. Furthermore, although the form of rotating drum herein shown is preferred, obviously other arrangements of goods pockets may be provided, such as two pockets, or four or more such pockets.

We have used the term perforated to include all forms of drums wherein free and complete circulation of air or liquid may be obtained while retaining the clothing or fabric in the drum.

While we have shown and described the preferred embodiment of our invention, we wish it to be understood that we do not confine ourselves to the precise details of construction herein set forth by way of illustration, as it is apparent that many changes and variations may be made therein by those skilled in the art, without departing from the spirit of the invention or exceeding the scope of the appended claims.

We claim:

1. A system of the character described comprising in combination a goods-treating apparatus or washer, means for introducing impregnating liquid into said apparatus and withdrawing it therefrom, means including valved supply and exhaust connections for passing air through said treating apparatus, a valved recirculating duct between said exhaust and supply connections including a solvent recovery device and an air heater, a valved air-vent from the aforesaid supply connection to the atmosphere, and valve means for controlling said supply connection interposed between said exhaust connection and said treating apparatus.

2. A system of the character described comprising in combination a goods-treating apparatus or washer, means for introducing volatile liquid solvent into said apparatus and withdrawing it therefrom, means including a valved supply connection with a blower interposed therein for supplying air to said treating apparatus, a

valved air-vent connection from said treating apparatus to the atmosphere, a valved recirculating duct between said air-vent and supply connections, including a solvent recovery device and an air heater, valve means for controlling said supply connection interposed between said blower and said treating apparatus and a valved air-vent to atmosphere from said supply connection, between said blower and said valve means.

3. In an apparatus for impregnating goods or clothing, a closed casing, a rotary cylindrical drum mounted therein having a foraminous peripheral wall, longitudinally extending partitions within said drum forming a plurality of separate goods pockets within the drum, doors on one end of said drum giving access to said pockets, and a door in the end of said casing with which the drum doors may be aligned by rotation of said drum.

4. In an apparatus for impregnating goods or clothing, a closed casing, a rotary cylindrical drum therein having a foraminous peripheral wall, longitudinally extending partitions within said drum forming a plurality of separate goods pockets, doors on said drum each giving access to one pocket, and a door on the outer casing with which the doors on the drum may be aligned by rotation of the drum.

5. An apparatus for impregnating goods or clothing with a protective impregnant comprising a closed casing, a rotary cylindrical drum therein having a foraminous peripheral wall, a plurality of longitudinal partitions in said drum forming a plurality of goods pockets therein, air inlet and outlet ducts in said casing, a fan for forcing air through said casing by way of said ducts, a normally closed door on said casing whereby access may be had to said goods pockets, and means for causing said fan to draw air into said casing through the door opening.

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