

[72] Inventor **Sylvester Bergman**
Midland, Mich.
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[73] Assignee **The Dow Chemical Company**
Midland, Mich.

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Primary Examiner—William I. Price
Assistant Examiner—Philip R. Coe
Attorneys—Griswold & Burdick, Glwynn R. Baker and C. E. Rehberg

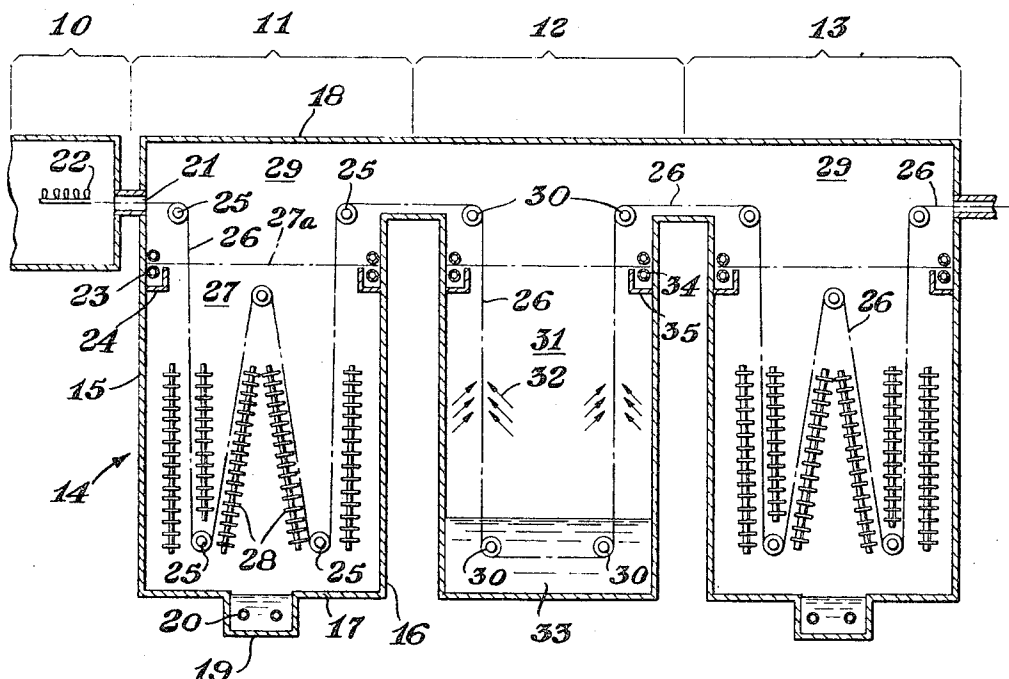
[54] **APPARATUS FOR TREATING FABRICS FROM AN ORGANIC SOLVENT**
3 Claims, 4 Drawing Figs.

[52] U.S. Cl. 68/5,
68/18
[51] Int. Cl. D06f 43/06,
D06c 1/06
[50] Field of Search 68/5, 9, 18,
20, 27

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ABSTRACT: The present invention relates to an apparatus for treating fabrics from an organic solvent, e.g. dyeing, which apparatus comprises: a formulation application module having means associated therewith to apply an agent to a fabric, a first chamber, in fluid communication with the formulation application module and having means to maintain a zone within the chamber filled with vapors of an organic solvent, means to remove solvent vapors, and means, which may be the solvent vapors, to exchange heat into the fabric, a second chamber having means to flush and wash the fabric, and, a third chamber which is substantially identical with the first said chamber.



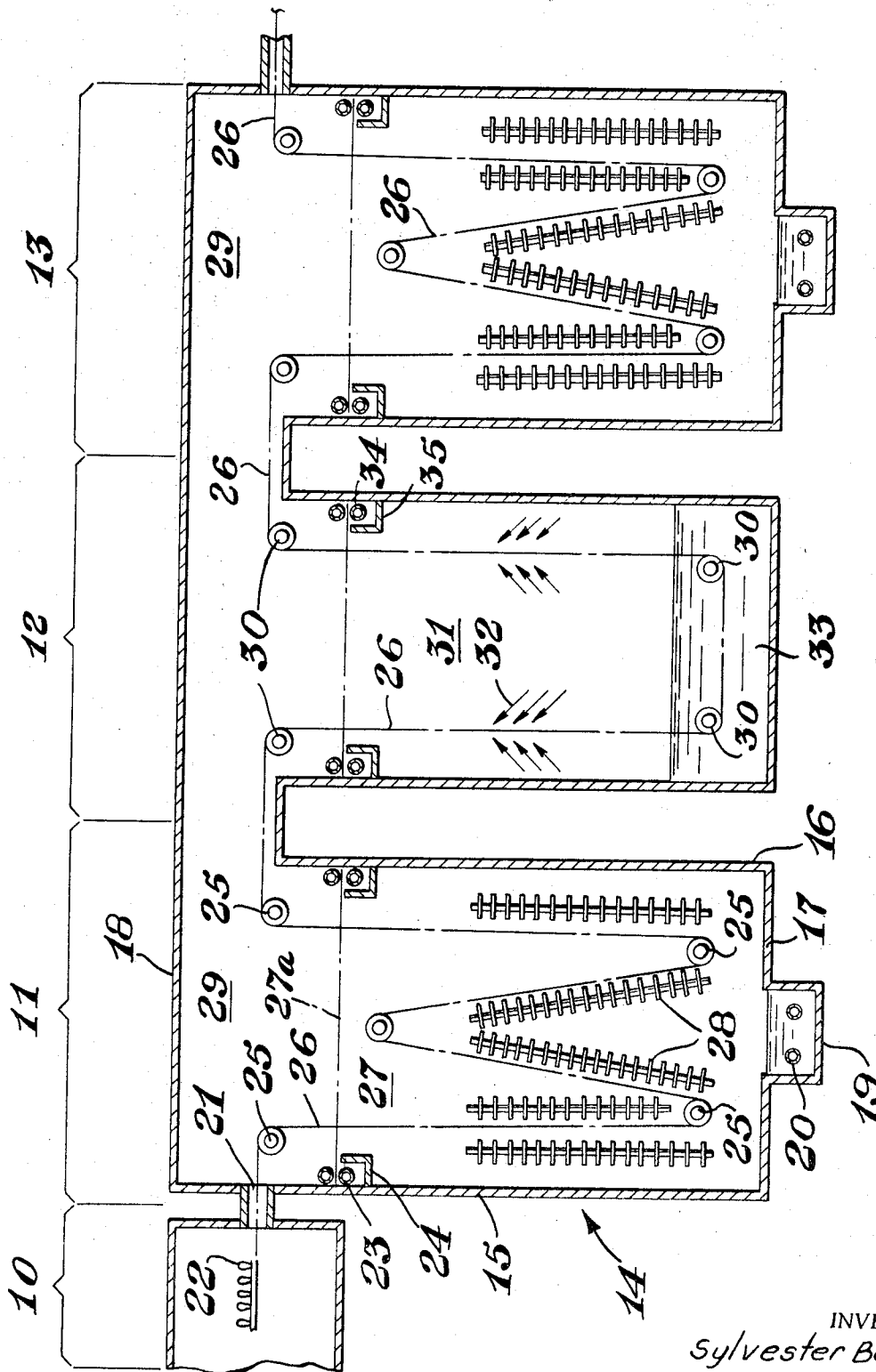
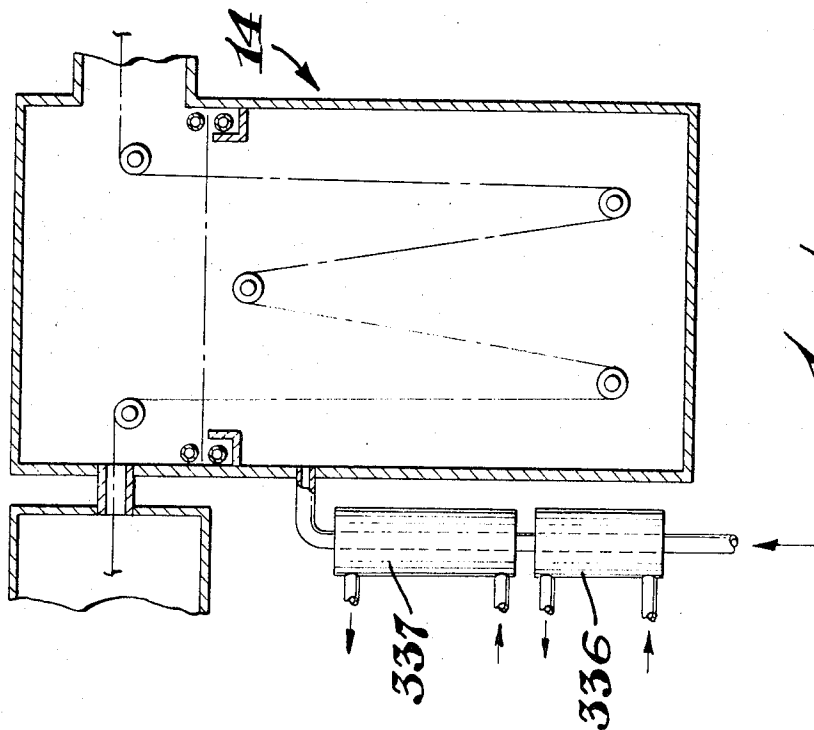


Fig. 1

INVENTOR.
Sylvester Bergman
BY
Glenn R. Baker
ATTORNEY



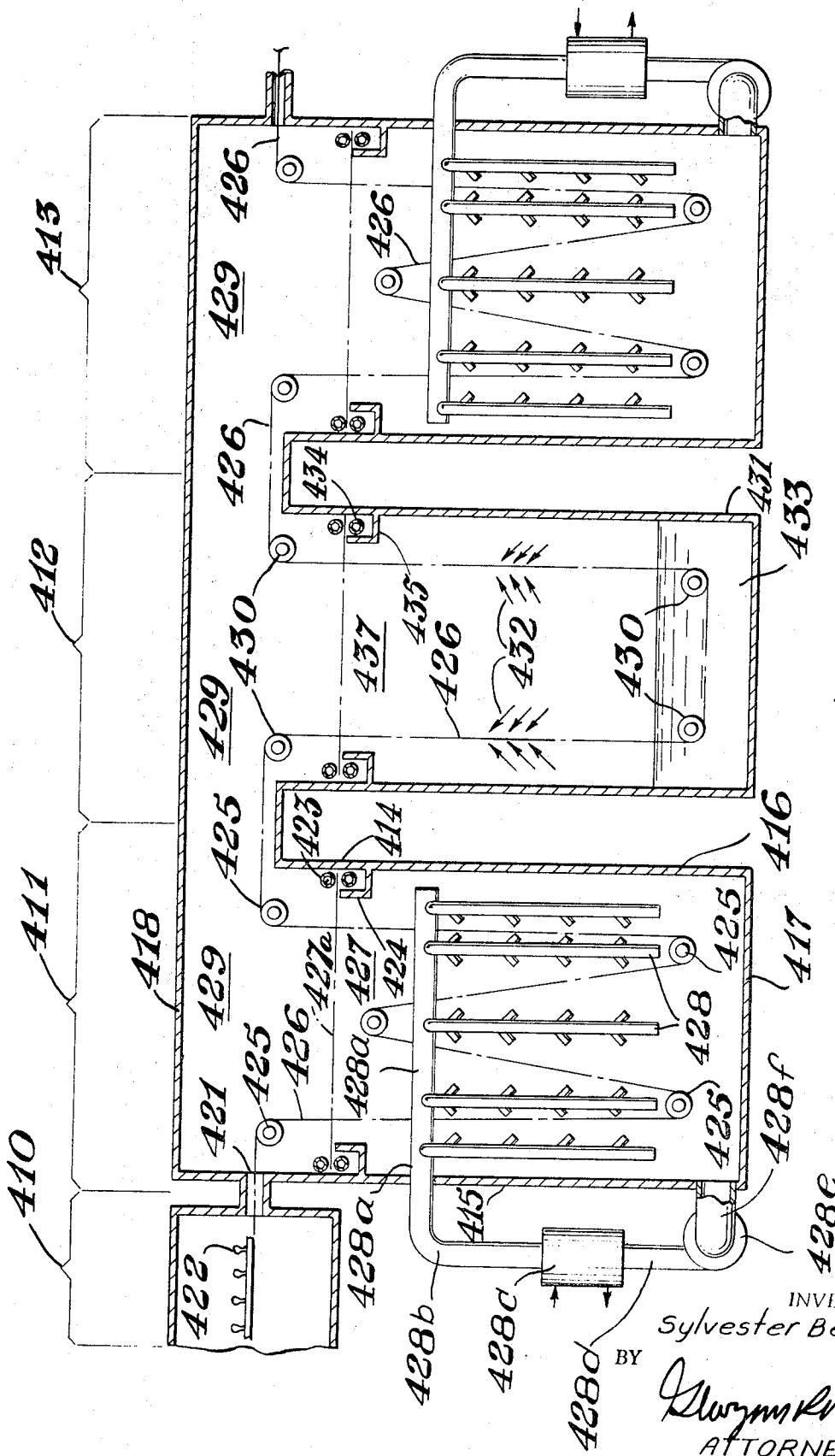


Fig. 4

INVENTOR.
Sylvester Bergman

BY
Glynn R. Baker
ATTORNEY

APPARATUS FOR TREATING FABRICS FROM AN ORGANIC SOLVENT

BACKGROUND OF INVENTION

Recent developments in continuous treatment of fabrics with chemicals dissolved or dispersed in an organic solvent have necessitated the development of equipment to carry out these processes.

Neither the equipment which has been used for years to carry out batch processes nor the equipment which is used in treating fabrics on a continuous basis is suitable for use with the new processes. Further, the present day equipment is large and expensive to build as well as operate. While some of the equipment now in use might be adapted to carry out, say the dyeing of carpets, the equipment presently employed to carry out process steps subsequent to the actual dyeing is not readily adaptable to the continuous processing employing solvents.

It is therefore an object of the present invention to provide an apparatus which will enable the recently developed solvent dyeing processes and solvent-based fabric treating processes to be employed in a continuous manner.

It is another object of the present invention to provide an apparatus capable of conducting a textile treating process from a volatile solvent, fixing the treating agent in the fabric and recovering the solvent in an economical manner.

These and other objects will become apparent to those skilled in the art to which the invention pertains from the following specification and claims.

BRIEF DESCRIPTION OF INVENTION

The apparatus of the present invention is illustrated in the drawings:

FIG. 1 represents in schematic cross section one embodiment of an apparatus of the present invention comprised of a formulation application module, an agent infusion and volatile solvent removal section, a rinse or scouring section and a rinse-medium removal section;

FIGS. 2, 3 and 4 each illustrate different means by which solvent vapors can be provided in the infusion and rinse removal sections.

DETAILED DESCRIPTION OF INVENTION

One embodiment of the apparatus of the present invention for carrying out the chemical treatment of fabrics from organic solvents is illustrated in FIG. 1. The illustration consists of a side elevation, in schematic diagram, of a structure provided with an application module and three distinct chambers, each associated with the others for passage of a base material, e.g., floor covering, from the ambient environment into and out of each chamber and return to the ambient environment.

The description of the embodiment of the apparatus of FIG. 1 will have specific reference to its use to dye floor covering; however, it is to be understood that change in size and line speeds may be made to enable the dyeing of lighter weight fabrics.

The drawing FIG. 1 has been divided into four sections, the first section 10 being the agent application module, the exact nature of which is not a part of the present invention or apparatus since existing commercial applicators can be employed. The second section 11 is the agent infusion and fixation chamber. The third section 12 is the rinse chamber and the fourth section 13 depicts the final drying section.

The agent infusion and fixation section 11 comprises a chamber 14 having six walls, two of the sidewalls 15 and 16, a bottom 17 and a top 18 are illustrated. The bottom 17 has, as illustrated a well 19 which is provided with heating means 20. The heating means may be electrical, steam, or flame systems, commercially available and operative under the conditions here employed, e.g., nature of solvent to be heated, etc. Along the sidewall 15 is an opening 21 which is located near the

upper extent of the sidewall 15. This opening 21 provides ingress into the interior of the chamber 14 of a base material 22, e.g., floor covering to which a formulation has been applied. Located within the chamber 14 extending peripherally around the interior walls at a point just below the opening 21 in sidewall 15 is a series of coils 23 which serve as condensing surfaces for vapors which are generated within chamber 14. These coils 23 establish the upper extent of the vapor zone 27 within chamber 14.

Located directly below said coils 23 is a trough 24 to collect the condensate from coils 23. The trough 24 is in fluid communication with a storage tank not shown and/or the well 19 supplying liquid vaporizable solvent to the well 19 as well as solvent for preparation of dye formulations.

The interior of the chamber 14 is provided with idler rolls 25 located in a manner to direct the base material 22 into chamber 14 in a path 26 to maintain the base material 22 within the zone of vapors 27 established between the condensing coils 23 and the bottom 17 of the chamber 14. Positioned along the path 26 of the base material 22 through zone 27 of chamber 14 are a series of superheaters 28. These superheaters 28 are illustrated as steam-heated finned radiators, although other means such as electrical heaters, gas-fired radiators and microwave generators as well as provisions for introducing superheated vapors as shown in FIG. 2 are suitable in their stead.

The location of the condensing coils 23 is such that above the vapor level 27a established thereby is a substantially vapor-free zone 29 which is essentially quiescent in nature. This zone 29 extends across and above each of the other units 12 and 13.

A series of idler rolls 30 are located within unit 12 to direct material 22 along path 26 into chamber 31 which is the rinse unit 12. Located within rinse unit 12 chamber 31 are a series of nozzles 32 which are connected to a pressurized source of rinse liquid. The lower portion of chamber 31 is designed to hold a quantity of rinse liquid 33 sufficient to engulf the base material 22 during its passage through chamber 31. The nozzles are positioned in a manner such that their force is directed against the normal flow of liquid down the base material thus offsetting to some extent the effect of cascading created by liquid flowing downwardly over the fabric, particularly heavy nap of the floor covering wherein such flow causes the nap to bend with the flow. The chamber 31 has been provided with a series of condensing coils 34 to condense vapors which might be generated within chamber 33 and a trough 35 to collect the condensed vapor thus preventing vapors from escaping into zone 29.

Unit 13 is similar in construction to unit 11 but is somewhat of a mirror image thereof. Unit 11 provides a means for removing rinse solvent from the base material and recovering the so-removed solvent.

Oftentimes it will not be economical or desirable to employ radiators 28 such as shown in FIG. 1. When such is not desired, it will be expedient to employ zones defined by plates traversing the path 26 of the fabric as illustrated in FIG. 2 at 228. When such is employed, the well 19 and its associated heating coils 20 may be dispensed with. When employing the plates 228, it is of course necessary to provide a solvent vaporizer 236 and a solvent vapor superheater 237.

Further, even the plates 228 illustrated in FIG. 2 are not always essential. As shown in FIG. 3, a vaporizer 336 and superheater 337 are supplied with liquid and vapors and open directly to the interior of chamber 14.

Other modifications will become apparent to those skilled in the art.

The operation of the apparatus illustrated in the figures is self-evident and is readily seen to permit conducting the novel method treating textile fabrics hereinbefore described. The treatment of textiles in the apparatus of the present invention has been carried out employing a prototype of the apparatus described in FIG. 1 with good results.

In the operation of the apparatus described hereinabove, the loss of solvent was about 5 percent of that introduced into the apparatus either in the agent formulation or as vapor and/or rinse liquor.

It is to be understood that when rinsing is not necessary to remove excess agent, or unfixed agent or other assistants, etc., the rinse section 12 and the drying unit 13 need not be employed. Thus one can treat a fabric satisfactorily in an apparatus such as illustrated in FIG. 3.

Another embodiment of an apparatus for carrying out the present invention, as illustrated in FIG. 4, comprises a structure having three distinct chambers, each associated with the others for passage of a base material, e.g., floor covering, from the ambient environment into and out of each chamber and return to the ambient environment. The description of the embodiment of the apparatus of FIG. 4 will have specific reference to its use to treat floor covering; however, it is to be understood that change in size and line speeds may be made to enable the treatment of lighter weight fabrics.

FIG. 4 has been divided into four sections, the first section 410 being the agent applicator which is not a part of the present invention or apparatus since existing commercial dye applicators can be employed. The second section 411 is the agent infusion and fixation chamber. The third section 412 is the rinse chamber and the fourth section 413 depicts the final drying section.

The agent infusion and fixation section 411 comprises a chamber 414 having sidewalls 415 and 416, a bottom 417 and a top 418. The sidewall 415 is provided with vapor-heating means 428c. The heating means may be electrical steam, or flame systems, commercially available and operative under the conditions here employed, e.g., nature of solvent to be heated, etc. Along the sidewall 415 is an opening 421 which is located near the upper extent of the sidewall 415. This opening 421 provides ingress into the interior of the chamber 414 of a base material 422, e.g., floor covering to which a formulation has been applied. Located within the chamber 414 extending peripherally around the interior walls at a point just below the opening 421 in sidewall 415 is a series of coils 423 which serve as condensing surfaces for vapors which are generated within chamber 414. These coils 423 establish the upper extent of the vapor zone 427 within chamber 414.

Located directly below said coils 423 is a trough 424 to collect the condensate from coils 423. The trough 424 is in fluid communication with a storage tank not shown supplying liquid vaporizable solvent to the treating agent formulations as well as that necessary to the heating means 428c to insure zone 427 is full of vapors.

The interior of the chamber 414 is provided with idler rolls 425 located in a manner to direct the base material 422 into chamber 414 in a path 426 to maintain the base material 422 within the zone of vapors 427 established between the condensing coils 423 and the bottom 417 of the chamber 414. Positioned along the path 426 of the base material 421 through zone 427 of chamber 414 are a series of nozzles 428. These nozzles 428 are supplied with superheated vapors of a solvent through header 428a which is connected to the exterior piping 428b, a superheater section 428c, a pipe 428d, a fan or blower 428e and a pipe 428f which is connected through the sidewall 415 of section 411.

The location of the condensing coils 423 is such that above the vapor level 427 a established thereby is a substantially vapor-free zone 429 which is essentially quiescent in nature. This zone 429 extends across and above each of the other units 412 and 413.

A series of idler rolls 430 are located within unit 412 to direct material 422 into chamber 431 which is the rinse unit 412. Located within rinse unit 412 chamber 431 are a series of nozzles 432 which are connected to a pressurized source of rinse liquid. The lower portion of chamber 431 is designed to hold a quantity of rinse liquid 433 sufficient to engulf the base material 421 during its passage through chamber 431. The nozzles are positioned in a manner such that their force is

directed against the normal flow of liquid down the base material thus offsetting to some extent the effect of cascading created by liquid flowing downwardly over the fabric. The chamber 431 has been provided with a series of condensing coils 434 to condense vapors which might be generated within chamber 433 and a trough 435 to collect the condensed vapor thus preventing vapors from escaping into zone 429.

Unit 413 is similar in construction to unit 411 but is somewhat of a mirror image thereof. Unit 411 provides a means for removing rinse solvent from the base material and recovering the so-removed solvent.

Other modifications will become apparent to those skilled in the art.

In a representative operation of the apparatus described hereinabove to dye carpets, the loss of solvent was about 5 percent of that introduced into the apparatus either in the formulation or as vapor and/or rinse liquor.

I claim:

1. An apparatus which comprises:

a formulation application module having means associated therewith to apply an agent dissolved in an organic solvent to a fabric;

a first chamber in fluid communication with the formulation application module and having means therein to maintain a zone within the chamber filled with vapors of an organic solvent, means to condense the solvent vapors and remove the condensate, and means to exchange heat into the fabric;

a second chamber in fluid communication with said first chamber and having means to flush and wash the fabric; and,

a third chamber in fluid communication with said second chamber and having means therein to maintain a zone within the chamber filled with vapors of an organic solvent, means to condense the solvent vapors and remove the condensate, and means to exchange heat into the fabric.

2. An apparatus for removing volatile organic solvent from base materials containing the same which comprises:

a first chamber having means of ingress and egress to said chamber, means to maintain a zone within the chamber filled with superheated vapors of an organic solvent, means to condense the vapors of said solvent and to remove the condensate from said zone;

a second chamber in fluid communication with said first chamber through an ingress and in fluid communication with a third chamber through an egress, having means to flush and wash the fabric consisting of series of spray nozzles located above a zone within said chamber which form a bath; and,

a third chamber in fluid communication with the second said chamber having means of ingress and egress to said chamber, means to maintain a zone within the chamber filled with superheated vapors of an organic solvent, means to condense the vapors of said solvent and to remove the condensate from said zone.

3. An apparatus comprising:

1. a first chamber having:

a. means for ingress and egress to its interior from the ambient surroundings,

b. means to condense a low boiling solvent vapor located below said ingress and egress and surrounding the interior walls of said chamber,

c. means associated with said chamber to provide vapors of a low boiling solvent,

d. means within said chamber to direct in a continuous manner a textile web through said chamber and maintain the web below the condensing means during a major portion of the travel of the web through said chamber;

2. a second chamber having:

a. an ingress and egress to and from its interior, said ingress being in fluid communication with the egress of said first chamber,

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- b. means within said second chamber to direct a textile web through said chamber,
- c. means associated with said chamber to provide a zone of liquid through which the web will pass during its course through the chamber;
- 3. a third chamber having:
 - a. an ingress and fluid to and from its interior, said ingress being in fluid communication with said egress of said second chamber,
 - b. means to condense a low boiling solvent vapor located

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- below said ingress and egress and surrounding the interior walls of said chamber,
- c. means associated with said chamber to provide vapors of a low boiling solvent,
- d. means within said chamber to direct in a continuous manner a textile web through said chamber and maintain the web below the condensing means during a major portion of the travel of the web through said chamber.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,593,543 Dated 20 July 1971

Inventor(s) Sylvester Bergman

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 69, insert -- along path 426 -- between "422" and "into".

Column 5, Claim 3, line 7, delete "fluid" and insert -- egress --.

Signed and sealed this 7th day of March 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents