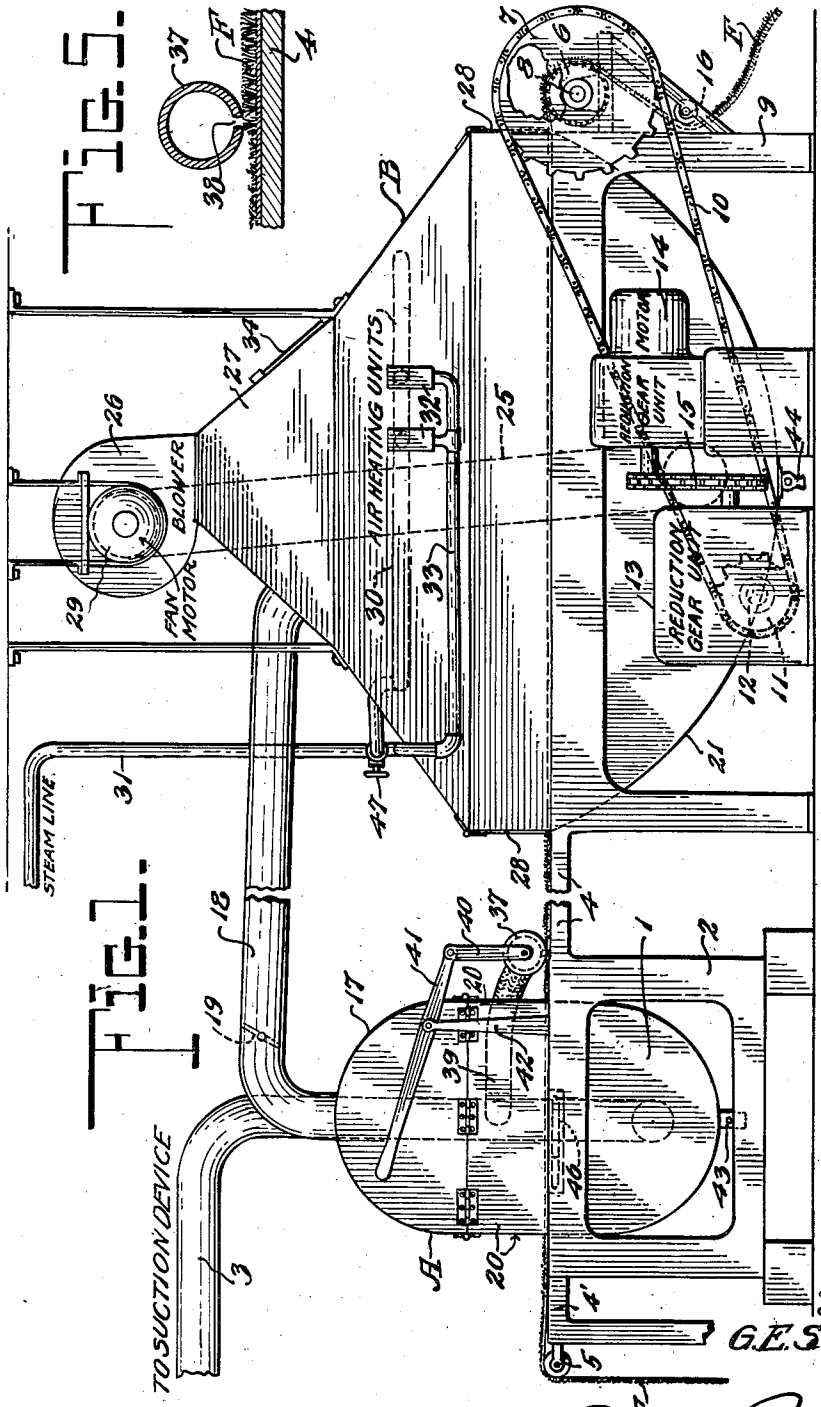
May 27, 1941. G. E. SCHULZ 2,243,396

METHOD OF AND APPARATUS FOR REMOVING MOISTURE FROM FLOOR COVERINGS AND THE LIKE

Filed Feb. 28, 1939 3 Sheets-Sheet 1



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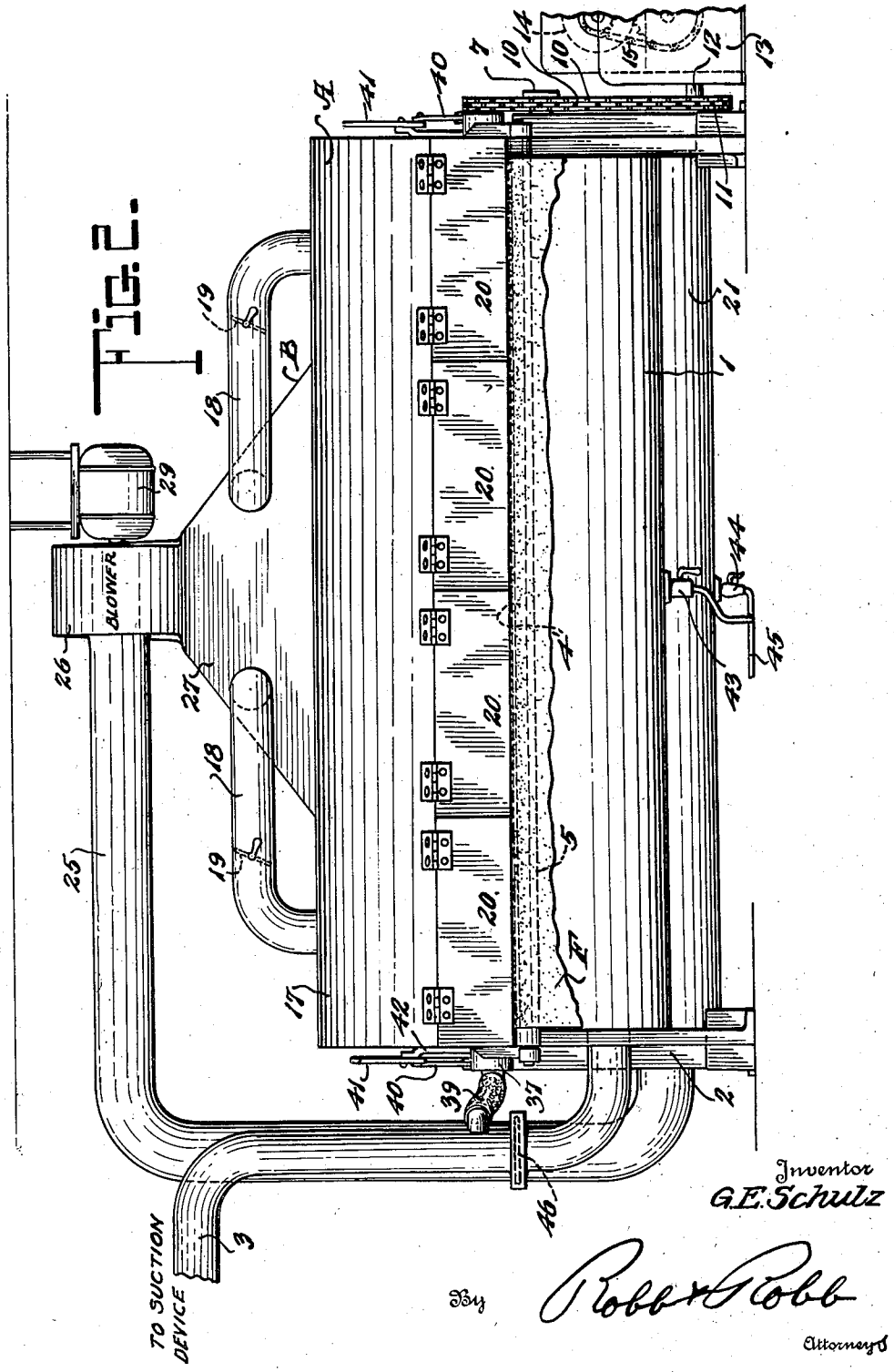
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Fig. 2.



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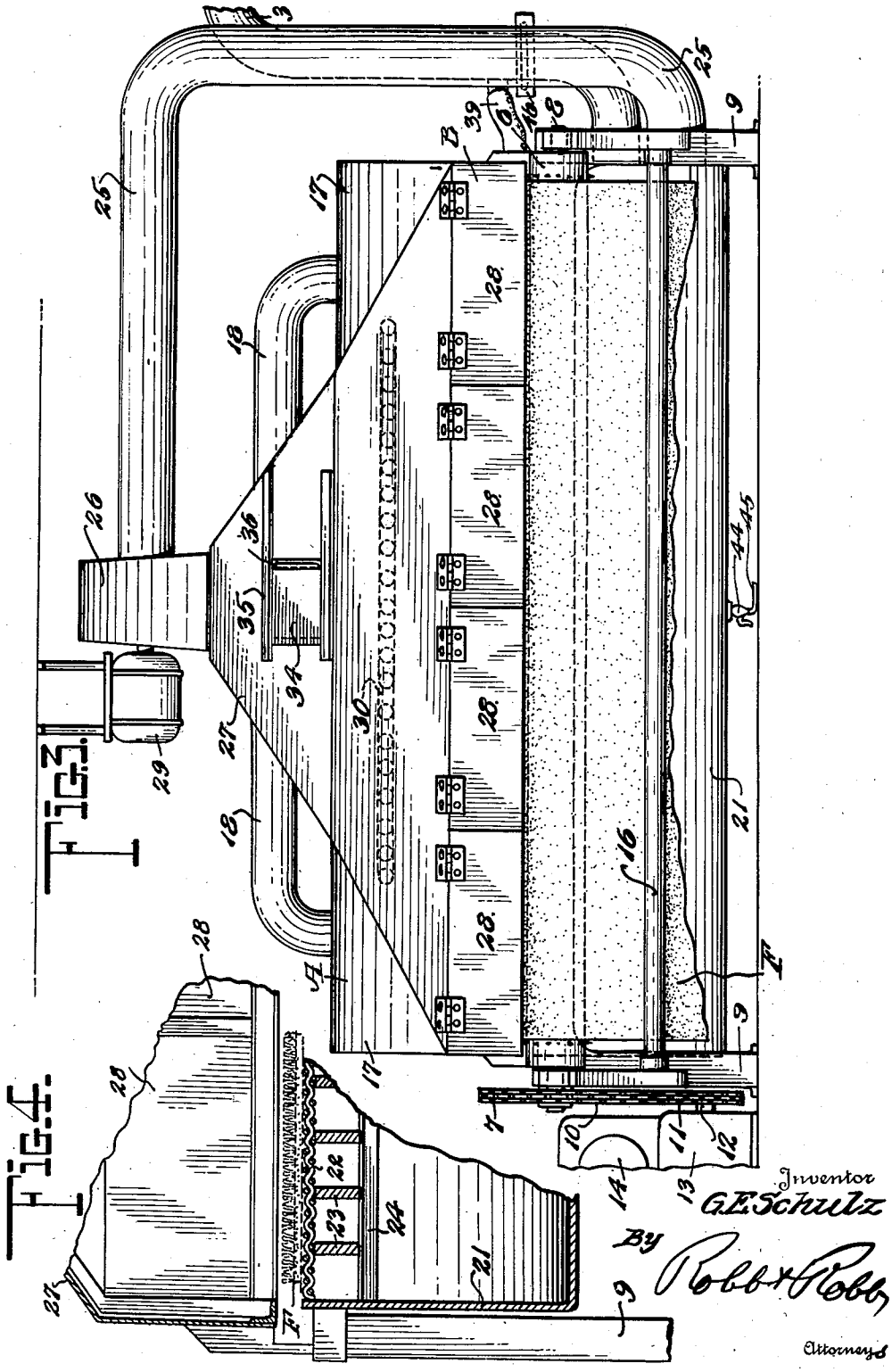


Fig. 3.

Fig. 4.

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2,243,396

METHOD OF AND APPARATUS FOR REMOVING MOISTURE FROM FLOOR COVERINGS AND THE LIKE

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3 Claims. (Cl. 34—12)

This invention appertains to an improved method of and apparatus for removing moisture from floor coverings and the like, and more especially, to the removal of both free and hydroscopic moisture from carpets, rugs, and similar textile materials.

Heretofore, the removal of moisture has usually been accomplished in two stages, the first of which is primarily devoted to the extraction of free moisture, and the second stage of which is primarily devoted to a final drying operation. As to the extracting stage, there have been two methods commonly employed, one of which may be termed the centrifuge method, and the other of which is known as the wringer method. In the centrifuge method, the rug or carpet material is placed in a basket or spinner which is adapted to be rotated at high speed. Usually, the carpet must be folded in order to get it into the spinner, and this is especially difficult where the carpet is comparatively large and bulky. Due to the pressures created within the spinner during rotation thereof at high speed, the yarn arrangement, yarn construction, and back construction are distorted, and particularly at the folds, which leave crease marks when unfolded. These defects cannot be fully eliminated in this type of moisture extraction, and, of course, the limitations as to the space available for and the practical size of the extracting apparatus impose limitations upon the size of the carpets which can be handled.

The second commonly used extracting process is practiced through the use of a wringer fashioned much on the order of a conventional household washing machine wringer, the carpet being passed between two rolls which exert a pressure upon the fabric to squeeze the water out of the same. Due to this squeezing pressure, the carpet pile is crushed or laid, and even extraction of moisture cannot be obtained because of the deflection of the rolls and consequent unequal pressures at different points along the rolls.

The final drying of the carpet fabric has likewise been heretofore performed by either of two common methods. The first of these methods involves the suspension of the carpet upon frames disposed within a drying room or chamber, within which heated air is circulated at relatively low velocity. The other drying method above referred to is known as the impingement method, deriving its name from the fact that heated air is blown at relatively high velocity against the surface of the fabric.

In the different stages of the processes heretofore employed, considerable manual handling of the carpet is required, and the processes are consequently time-taking and costly. Moreover, the removal of the moisture cannot be controlled within satisfactory limits. It is recognized by those skilled in the art that the moisture may be removed from carpets, rugs, and other fabrics, to such a degree that the natural chemical moisture of the fibers embodied in the fabric will be materially affected, thus seriously injuring the fabric.

It is the principal aim of my invention to provide an improved method of and apparatus for removing moisture from carpets, rugs, and similar material, of comparatively simple and economical nature and devoid of the defects and disadvantages above referred to in connection with the former practices.

To the above end, my invention contemplates the extraction of free water from the carpet or other material, as the case may be, by an application of pressure through a medium such as air or an equivalent aeriform fluid, whereby to cause said medium to pass through the material. This is preferably accomplished through the application of a partial vacuum or subatmospheric pressure to one side of the carpet, thus drawing air from the opposite side of the carpet through the same. For convenience, the carpet may be supported across the open side of a normally open vacuum chamber, the carpet being held stationary or progressively advanced across the chamber, as desired. The pressure medium, which for practical purposes may be air, may or may not be heated, according to the degree of moisture extraction desired and the quality and condition of the fabric at the commencement of the moisture extracting operation.

I have found that the aims of my invention can be best fulfilled by the removal of the moisture in two stages, but it is to be understood that the invention is not limited to a two-stage principle. However, where the two-stage principle is employed, the free moisture remaining in the fabric after a washing, wetting, cleaning, or dyeing treatment is first removed by the subjection of the fabric to the action of a vacuum applied at one side of the fabric, thereafter followed by the application of a vacuum of the same or a lesser degree to preferably the same side of the fabric, the second vacuum application being performed in conjunction with the application of heat to the fabric for the purpose of effecting a final drying of the hydroscopic moisture remaining in the fabric after the initial free water extraction performed by the first vacuum application. If

desired, heat may be also utilized in the initial free water extraction step to produce a pre-drying action on the fabric, but it is to be understood that this is not essential.

A further object of the invention is to provide an effective control in the practice of my improved method herein referred to, whereby the humidity of the air or other medium which is passed through the fabric may be regulated as required to prevent the attainment of such moisture removal as would injuriously affect the natural chemical moisture within the fibers of the fabric. To this end, the invention contemplates the provision of intercommunicating air chambers disposed adjacent to the fabric during the vacuum application or applications, and preferably located at the side of the fabric opposite to the vacuum chamber or chambers, together with regulating means for controlling the interchange of air between said air chambers.

Still another object of the invention is to provide an improved method of and apparatus for producing a combing effect on the pile surface of pile fabrics, whereby to raise the pile and lay or set the same uniformly, and thus better condition the fabric for shearing as one of the final treatments to which such fabrics are ordinarily subjected. This combing operation is preferably performed in conjunction with the moisture removal, but after the initial extraction of the free water.

Other and further objects and advantages of the invention will be hereinafter described, and the novel features thereof defined in the appended claims.

In the drawings:

Figure 1 is a generally diagrammatic view in side elevation of one form of apparatus which is practically adapted for the removal of moisture from carpet and rug fabrics, the same being constructed as a two-stage device;

Figure 2 is a view in end elevation of the apparatus shown in Figure 1, as viewed from the righthand end thereof at which the carpet leaves the apparatus upon completion of the moisture removing operations;

Figure 3 is a view in end elevation as seen from the opposite end of the apparatus from that of Figure 2;

Figure 4 is a fragmentary sectional view through one corner of the apparatus, showing more particularly the details of construction of the vacuum chamber, the carpet supporting means disposed at the upper end thereof, and the hood or dome arranged above the vacuum chamber; and

Figure 5 is a sectional view, taken through the pile combing device and illustrating the action thereof on the pile of the fabric.

Like reference characters designate corresponding parts in the several figures of the drawings.

My new method of extracting moisture from carpets, rugs, and similar fabrics after washing, wetting, dyeing, or the like, comprises, in its broad aspect, applying a vacuum to one side of the fabric so as to cause a moisture absorptive medium such as air to be drawn from the opposite side through the fabric. I have found that the moisture may be removed in the same or less time as by the use of the methods heretofore employed, but with the marked advantage of more uniform moisture removal and without distortion of or defacing the fabric. In the case of carpets and rugs, particularly those having a pile surface, the vacuum is preferably applied to the back of the fabric. This facilitates the removal of the moisture which is present in a greater quantity in the cotton and stuffer or filler yarns which compose the back construction. During the application of the vacuum, the fabric may be held stationary or moved over the face of a vacuum chamber at a predetermined rate, depending upon the weight of the fabric, its water content, porosity, and pressure utilized. The air which is drawn through the fabric may or may not be maintained in a heated condition, depending upon the degree of moisture removal required. On the other hand, the moisture extracting operation may be split into two or more stages for convenience, in which case, the first stage is primarily directed to the extraction of the free moisture, and the further stage or stages directed to the removal of hydroscopic moisture by the forcing of hot air through the fabric in any suitable manner, and preferably by the application of vacuum at the back side of the fabric so as to cause the hot air to be drawn from a hot air chamber disposed at the opposite side of the fabric. At some convenient point in the moisture removing operation, preferably intermediate the stage of free moisture extraction and the stage or stages of final drying by the removal of hydroscopic moisture, the pile surface of the fabric is subjected to a "combing" treatment to raise and straighten the pile so that it will be substantially uniform over the entire face of the fabric. Ordinarily, there is more or less matting or disarrangement of the pile strands in the usual wetting, washing, and dyeing operations, and unless some provision is made for straightening the pile strands so that they stand substantially upright, the pile surface cannot be uniformly sheared after the fabric has been dried. To produce the pile combing effect which is contemplated by my invention, I preferably subject the pile surface of the fabric to suction or vacuum confined to a relatively narrow area extending across the fabric.

My new method of moisture removal may be practiced by any suitable apparatus which is capable of producing the results referred to above, and I have shown in the drawings one form of apparatus which I have found to be eminently suited for my purposes. The apparatus illustrated is of the two-stage type, wherein A generally designates the free moisture extractor unit and B the hydroscopic moisture removing and final drying unit, both of these units being of the vacuum type and operating in substantially the same general manner.

Considering first the unit A, this unit comprises a semi-cylindrical tank 1 mounted in a frame 2 so as to be supported with its upper side disposed at the desired elevation. The tank 1 defines a vacuum chamber within the same, and is constructed of metal or any other suitable material which is capable of withstanding the pressures to which the same is subjected in its normal operation. 3 designates a suction line connected with one end of the tank 1 and leading to a suction or vacuum producing apparatus of any appropriate type (not shown). I have found that suction equipment capable of developing five or six inches of vacuum is adequate for practical purposes, and for the average carpet or rug, the suction is so adjusted as to produce a vacuum within the vacuum chamber formed by the tank 1 sufficient to produce a pressure on the fabric of about three

to four pounds per square inch. The upper side of the tank 1 has the form of a perforate plate or foraminous screen which is coextensive with the table 4 of the machine. At the front of the machine, the table is extended, as at 4' and provided with a roller 5 extending transversely thereacross at its forward edge to facilitate the feeding and guiding of the fabric F onto the table 4 and across the upper perforate side of the vacuum chamber formed by the tank 1, as clearly shown in Figure 1, the fabric being preferable disposed with its back side down as it passes across the vacuum chamber and table of the machine. At the opposite end of the table 4, there is mounted a spiked roll 6 extending transversely thereacross, this roll being power driven by a sprocket 7 mounted upon the shaft 8 which carries the roll, the shaft being journaled in bearings supported by the frame 9 at the end of the table at the side of the vacuum chamber opposite to the roll 5. The sprocket 7 is connected by a drive chain 10 to a sprocket 11 on the power take-off shaft 12 of a reduction gear unit 13, this latter unit being driven by a motor 14 operatively connected with the reduction gear unit 13, as by means of a sprocket and chain connection 15. It is to be understood that the drive just described may be modified as desired and the disclosure of the same is intended merely for the purposes of illustration.

When the forward end of the fabric F is engaged with the spiked roll 6, and the roll is set into operation by means of its driving instrumentalities, the fabric will be fed slowly across the table 4 to progressively advance the fabric and subject it to the action of the vacuum produced in the vacuum chamber formed by the tank 1. The vacuum causes air to be drawn through the fabric from a point above the same, and the free moisture will be effectively removed from the fabric. The speed of rotation of the spiked feed roll 6 is adjusted to accord with the weight of the fabric, its moisture content, porosity, etc., and I have found that for practical purposes the moisture may be effectively removed from the fabric while traveling at a linear speed of from one to three feet per minute. This construction materially simplifies the handling of the fabric during the moisture removing operation and is adapted to accommodate fabrics of unlimited length in a continuous operation. Small rugs, carpets, or other pieces of fabric may be handled by placing the same upon the upper perforate side of the vacuum chamber and allowing them to remain stationary for a time which is sufficient to cause the moisture to be removed therefrom to the desired degree.

At the discharge end of the table 4, where the spiked roll 6 is located, the fabric is preferably passed around a guide bar or roll 16 to maintain the same in operative feeding engagement with the spiked roll. Beyond the guide bar or roll 16, the fabric may be wound upon a spindle or drum (not shown), or otherwise allowed to collect in a folded or rolled condition, whichever is most convenient for the further handling of the fabric after the moisture removing operation.

So much of the apparatus as has just been described may be used without additional equipment where the type of fabric and the moisture content is such that the moisture may be removed to the desired degree by suction only. However, provision is preferably made for heating the air as it is drawn through the fabric during the suction action, and to this end I provide a dome 17 mounted upon the frame 2 and disposed with its lower open end slightly spaced above the upper foraminous side of the tank 1 so that the fabric F is free to pass beneath the lower end of the dome. The air may be heated by heating instrumentalities disposed directly within the dome 17, or hot air may be fed from any suitable source to the dome through one or more conduits 18 having adjustable valves or dampers 19. The dome 17 is preferably provided with hinged doors 20 around its lower sides and ends to provide for convenient access to the interior of the dome as when the end of a long piece of fabric is first introduced into the machine and in placing smaller pieces in position for moisture removal. Of course, small pieces of fabric and small rugs and carpets can be temporarily sewn or otherwise secured together so that they can be run through the machine in a continuous operation.

The width of the machine, including the tank 1 forming the suction chamber and the dome 17, is preferably great enough to accommodate fabrics of the maximum width normally encountered in moisture removing operations of this sort. Where the fabric is substantially less in width than the width of the machine, a covering member of convenient form such as an air impervious fabric, may be placed over the portion of the foraminous upper end of the vacuum chamber which is left exposed by the fabric which is being subjected to the moisture removal operation. This prevents any substantial loss in vacuum head.

Passing now to the unit B, this unit as illustrated is generally similar to the unit A, and includes a tank 21 of any suitable form such as semi-cylindrical, closed on all sides excepting at the upper side which is normally open and provided with a perforate or foraminous cover over which the fabric F is adapted to be passed. In Figure 4, the tank 21 is shown provided with a foraminous cover 22 supported by means of transversely extending laterally spaced bars 23 suitably secured to the tank by welding or otherwise. An angle iron 24 mounted interiorly of the tank 21 and extending along the opposite sides thereof may be availed of for supporting the bars 23. This construction illustrated in Figure 4 may be a duplicate of the construction utilized for the tank 1 which forms the vacuum chamber for the initial free water extracting stage in unit A. While the foraminous member 22 is illustrated in the form of a coarse wire screen, it is to be understood that any other grid-like structure can be substituted therefor, as desired. The foraminous member 22 is horizontally disposed and substantially coextensive with the table 4, as best seen in Figure 1, and serves to support the fabric as it passes over the vacuum chamber.

A conduit 25 is connected at one end to the tank 21 and leads to the intake side of a blower or fan 26, the latter having its outlet side connected to the upper end of a dome or hood 27 disposed above the tank 21. The hood 27 may be of any suitable construction, and for convenience, may be made of sheet metal reinforced or braced by angle irons, as generally illustrated in Figure 4. The dome or hood 17 of unit A may be constructed in a form similar to the hood or dome 27 of unit B, instead of in the form illustrated in the drawings, but this is a matter of choice and is not material to the invention.

The hood 27 is preferably tapered downwardly and outwardly so that its lower end is disposed over a substantial area of the fabric F which is adapted to pass beneath the dome as it moves over the foraminous upper end of the tank 21 which defines a secondary suction chamber. Hinged doors 28 are preferably provided around the lower end of the dome 27 for affording convenient access to the interior of the dome in the same manner and for the same purposes as previously described in connection with the doors 20 of the dome 17 of unit A. The blower or fan 26 is driven by a motor 29, and is of such capacity as to handle a considerable volume of air, while at the same time creating a vacuum within the tank 21. I have found that a blower capable of developing one and one-half to two inches of vacuum is satisfactory, and in the normal operation of the machine, the blower 26 is operated so as to produce a pressure differential at opposite sides of the fabric, of approximately three-quarters to one pound per square inch at the unit B. The conduits 18 leading to the dome 17 of unit A are preferably connected to the dome 27 of unit B, thereby acting to bleed off some of the air from the dome 27 to the dome 17 and establishing communication between the air chambers within the two domes. Having in mind that the primary purpose of unit B is to remove hydroscopic moisture and effect a final drying of the fabric, provision is preferably made for heating the air as it is sucked through the fabric at unit B. Any suitable heating means may be availed of for this purpose, and in Figures 1 and 3, I have illustrated steam heating coils, generally designated 30, mounted within the dome 27 and operatively connected to a steam supply line 31. The coils 30 may be of the sectional unit type, each having an outlet connected to a trap 32, which in turn may be connected through a common return 33, to the steam line 31, as illustrated in Figure 1. The capacity of the heating coils 30 depends upon the condition of the fabric from which the moisture is to be removed and the volume of air which is passed through the fabric, it being the purpose of the invention to subject the fabric to heated dry air in sufficient continuous volume to quickly absorb the moisture within proper limits of moisture control so as not to cause the elimination of chemical moisture in the fabric or injury to the fabric. For practical purposes, the air passed downwardly through the hood 27 should be heated from approximately 100 to 200 degrees Fahrenheit, according to the conditions previously mentioned, and the proper temperature for any given set of conditions can be readily determined from experience. In the final drying operation through unit B, a minimum handling of the fabric is required, and the fabric is dried uniformly throughout the entire area of the fabric at a predetermined and controlled rate in exact proportion to the area of the fabric under treatment. Due to the intercommunication of the hood 27 of unit B with the hood 17 of unit A as established by the conduits 18, some of the partially cooled moisture laden air starting down through the upper end of the hood 27 can be expunged to the hood 17 of unit A, where it becomes available for further moisture absorption as it is passed through the fabric at unit A. This heated expunged air is also utilized to create a predrying of the fabric before it reaches unit B, this being sometimes desirable. The valves or dampers 19 afford a ready means for controlling the flow of heated air between hood 27 and hood 17. Thus the construction above described provides for recirculation of air within heat and moisture limits. Fresh air or additional make-up air may be introduced into the system as by providing one or more adjustable ports in the hood 27 or the hood 17, or both. In Figure 3, I have shown a slidable gate or cover 34 operating in guideways 35 so as to cover, more or less, an opening 36 formed in the hood 27. Of course, some of the make-up air may be derived from the air which is permitted to pass into the lower ends of the respective hoods 17 and 27, and which need not be sealed or in close contact with the upper side of the fabric F as the fabric passes beneath the hoods. However, the air is substantially confined within the respective hoods and the system may be characterized as a closed pressure system involving the application of vacuum to one side of the fabric, and pressure to the other side.

Referring now to Figures 1 and 5, I have illustrated a means for effectively "combing" the upper pile surface of a pile fabric, thereby causing those pile fibers which have been disarranged previous to the moisture removing operation, to become uniformly rearranged in a substantially upright position. The "combing" action is illustrated on a somewhat exaggerated scale in Figure 5, and is produced by means of a pipe 37 arranged transversely across the machine and preferably disposed intermediate the units A and B so as to be effective upon the fabric F after completion of the initial free moisture extracting operation performed by unit A. The pipe 37 is provided with a relatively narrow slot 38 at its lower side and extending longitudinally for the full length of the pipe. One end of the pipe is closed, and its opposite end is connected to a source of vacuum. This source of vacuum may be the same as that established in the vacuum chamber formed within the tank 1. In other words, the pipe 37 may be connected to the suction conduit 3 preferably by means of a flexible connection 39 which allows vertical movement of the pipe 37 towards and away from the fabric F. Any suitable means for effecting vertical movement of the pipe 37 may be availed of, and to this end, I have shown the pipe suspended at its opposite ends by means of links 40 having their upper extremities pivotally connected to operating levers 41 located at the opposite ends of unit A and supported by standards 42 mounted on the frame 2. By rocking the levers 41 in a counterclockwise direction, as viewed in Figure 1, the pipe 37 may be elevated a substantial distance above the table 4 to permit the fabric F to be advanced therebeneath at the commencement of the moisture removing operation. When the pipe 37 is lowered into close proximity to the pile surface of the fabric F, the suction effect at the slot 38 is confined to a relatively narrow area of the fabric, thereby causing the pile fibers to rise substantially upright. This effect is progressively continued on successive relatively narrow areas of the fabric as the fabric is advanced through the machine, and when the fabric is discharged at the end of the machine beyond unit B, the pile surface will be substantially uniform in its upright arrangement of the fibers, with the result that a greatly improved and more uniform shearing action may be performed upon the pile surface of the fabric in the usual final treatment thereof.

It will be understood that the units A and B may be constructed and operated separately

and/or independently of each other, but in the preferred form of the invention they are associated for enabling the moisture to be removed from the fabric in a continuous operation.

The moisture which is removed from the fabric at the respective units A and B will be collected in the tanks 1 and 21, from which it may be removed from time to time as occasion arises. In the drawings, I have illustrated draincocks 43 and 44 at the bottom of the respective tanks 1 and 21, said draincocks being connected to a common waste line 45. Instead of manually operated draincocks, the drainage of the moisture may be automatically effected by any suitable form of automatic dump valve means. This detail is not material to the invention.

46 designates a slidable gate valve disposed in the suction conduit 3 for selectively opening the conduit and closing the same to interrupt the suction or vacuum normally produced within the tank 1 when the valve 46 is open. The motor 29 for the fan or blower 26 may be provided with suitable controls (not shown) for starting and stopping the fan at will. A valve 47 disposed in the steam line 31 serves to permit the heating elements 30 in dome 27 to be shut off and turned on at will. Electric heaters may be used in lieu of those illustrated herein, if preferred.

While the specific details have been herein shown and described, the invention is not confined thereto, as changes and alterations may be made without departing from the spirit thereof as defined by the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is—

1. The method of treating wet rugs, carpets and similar textile fabrics having pile surfaces, which comprises removing the free moisture therefrom by the application of vacuum to the back side of the fabric, thereafter subjecting the pile side of the fabric to a suction action confined to a relatively narrow suction zone, whereby to lift the pile fibers and cause the same to assume a substantially erect position, and finally removing the hydroscopic moisture from the fabric by the passage of a heated moisture absorptive medium through the fabric responsive to a further vacuum application.

2. Apparatus of the class described, comprising a foraminous support of substantial area adapted to receive rugs, carpets and similar textile fabrics thereon, a vacuum chamber disposed at the opposite side of the support and adapted to create a pressure differential at opposite sides of the fabric, whereby to draw air through the fabric, means disposed at the side of the fabric opposite to the vacuum chamber for substantially confining the air to the area of the fabric acted upon by the vacuum chamber, said last-named means comprising a hood having its lower open side disposed contiguous to the fabric as it passes over the support and having an air inlet therein, a second foraminous support disposed in advanced relation to the first-named support and adapted to receive the fabric from the latter, a second vacuum chamber disposed at one side of the second foraminous support, and a hood disposed at the opposite side of said second foraminous support with its lower open end arranged contiguous to the fabric as the fabric paasses over the second support, means for establishing a circulation of air through the second-named hood so as to cause the same to pass through the fabric, heater means disposed in said second-named hood for heating the air, and means for bleeding a portion of the air from the second-named hood to the air inlet of the first hood.

3. Apparatus of the class described, comprising means for supporting a fabric in a substantially flat condition, means for successively removing free moisture and hydroscopic moisture from substantial areas of the fabric while so supported, said last named means including vacuum chambers disposed one in advance of the other at one side of the fabric supporting means, means for creating a vacuum in said chambers of a magnitude which serves to produce the moisture removal as aforesaid, a hood disposed at the opposite side of the fabric over each of the vacuum chambers, means for establishing communication between said hoods, and heater means disposed in one of said hoods and serving to heat a moisture absorptive medium therein for passage through the fabric responsive to the pull of the vacuum in the respective vacuum chambers.

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