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APPARATUS FOR PROVIDING SUPPLEMENTARY HEAT AND MOISTURE IN TEXTILE STEAM PROCESSING CHAMBERS

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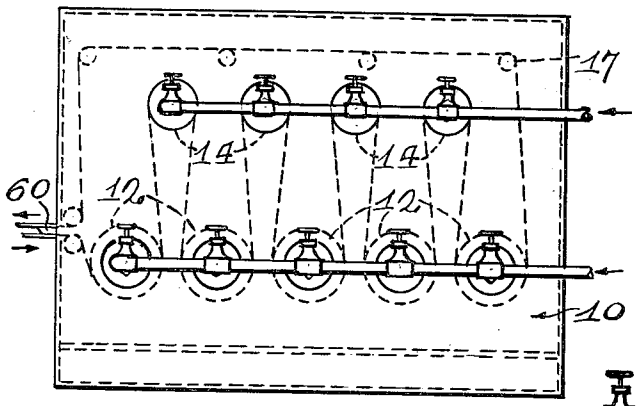


Fig. 1

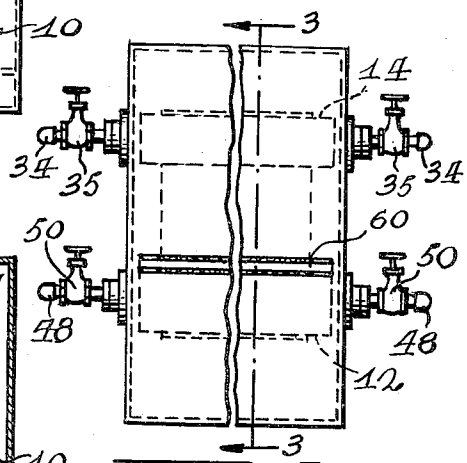


Fig. 2

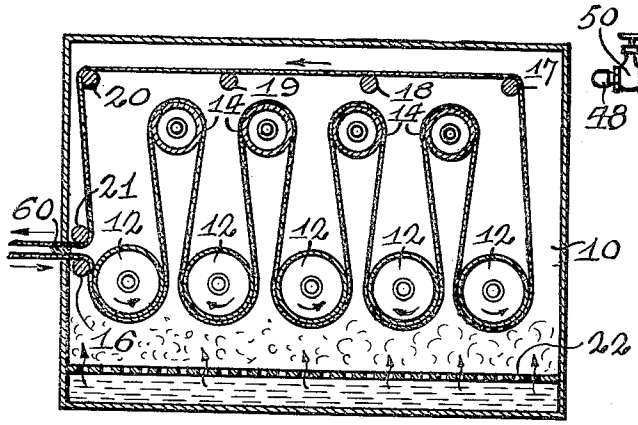


Fig. 3

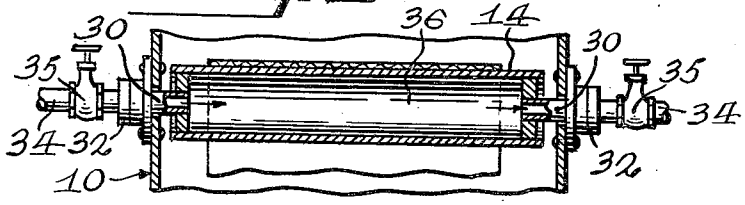


Fig. 4

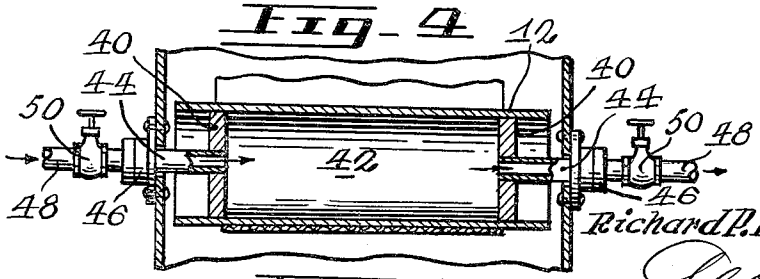


Fig. 5

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APPARATUS FOR PROVIDING SUPPLEMENTARY HEAT AND MOISTURE IN TEXTILE STEAM PROCESSING CHAMBERS

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The present arrangement relates to the processing of materials, textile or plastics, and more particularly to improvements in the apparatus utilized for steaming or treating vat colour prints, dyes, discharge prints or the like by chemical reduction methods.

As is well known, when processes of this nature are carried out, it is necessary to exclude air from the material being steamed. This is generally accomplished by passing the material into and through an enclosure or steaming chamber from which air is excluded by the saturated steam. It is necessary that steps must be taken to prevent the steam from becoming too dry during the process or superheated steam will result having temperatures in excess of 212° F. This as apt to slow down and cause uneven chemical reactions and consequently undesirable effects in the dyeing and/or discharging of the prepared material.

Attempts have been made in the prior art to overcome this problem by various expedients to supply replacement moisture to the steam and/or to the prepared material being so treated. For example, it has been proposed that steam be introduced to the interior of the steam cabinet through a tank of water provided in the lower portion.

A further development was to provide spaced apart troughs of water with moisture conducting strips extending between the troughs. These prior art arrangements are not too satisfactory and the present invention aims to provide positive means of providing additional moisture direct to the material in an air free steam chamber together with an alternating and direct heat application to the prepared material at selected points in the steaming chamber.

The applicant has overcome these problems by the provision of three-phase heat exchange units in combination with supplementary heated rollers over which the material is conveyed.

One preferred structure of these three-phase units, consists essentially of a metal cylinder similar to an ordinary textile drying cylinder which includes hollow shaft ends adapted to protrude through the side of a steam chamber (Ager type), with sealed bearings to prevent the admission of air into the chamber. In this construction, the rotary unit or units is placed within the air-free steaming chamber so as to be parallel with the usual material guiding rollers so that the material can be run over and around the heat exchange cylinders spaced at intervals from entrance to exit of the steam chamber.

In accordance with the invention, each cylinder has a portion or portions that are maintained at a lower temperature than that of the saturated steam supplied to the chamber so as to ensure moisture (condensed steam) for transfer to the material from each cylinder over which it passes. The condensed steam or moisture thus supplied is constantly replaced by fresh saturated steam entering the chamber. The reduction in temperature within the interior of the cylinders is accomplished and is maintained constant by passing water, by means of the hollow supporting shaft, through the cylinder at the desired lower temperature.

In accordance with the present invention, there is provided an addditional apparatus which when combined with the heat exchange units previously described provides means for a more perfect and complete control of

heat and moisture in the dyeing and/or discharge processes. The effective action of the heat exchange units are thus amplified and accelerated.

In accordance with the present invention, heated rollers or cylinders, preferably of lesser diameter than the heat exchange cylinders are mounted within the air-free chamber to alternate with the heat exchange units. The present heated roller units and the moisture providing heat exchange units will be disposed in staggered relationship so that the prepared textile web can pass continuously and alternately over and around such units.

More specifically, the heat exchange units would be preferably arranged along the lower part of the chamber with control sections below 212° F., producing moisture for chemical reactions for dyeing and/or discharging while the heated roller units, in accordance with the present invention, would be preferably arranged along the top section of the chamber.

The heated roller units of the present invention are to be maintained at a controllable higher temperature up to or above 240° F., and it is contemplated that both the heat exchange units and the heated roller units could be individually controlled so as to vary the amount of moisture provided and the amount of heat applied to the material between each moisture application during the progress of the material through the air-free steam chamber.

It is known that the required chemical reactions, in the prepared material, start immediately the material enters the air-free steam chamber. It is claimed that the alternative low temperature moisture forming and the relatively high temperature direct contact zones will considerably facilitate the reaction of dyeing and/or discharging to completion.

The present application is a continuation-in-part of United States application Serial No. 436,649 filed June 14, 1954, now abandoned.

Having thus generally described the nature of the invention, particular reference will be made to the accompanying drawings, wherein there is shown by way of illustration a construction of a steam chamber embodying heater units for treating prepared textile materials, and in which:

FIGURE 1 is a diagrammatic view in side elevation, partially in section, of a preferred steam chamber and alternate heat exchange and heated roller units in accordance with the invention.

FIGURE 2 is a view in end elevation of the construction shown in FIGURE 1 showing the end portions only.

FIGURE 3 is a longitudinal section of the construction shown in FIGURES 1 and 2 to illustrate an arrangement of alternate heat exchange and heated roller units.

FIGURE 4 is an enlarged detailed view partially in section of a typical heated roller in accordance with the invention.

FIGURE 5 is an enlarged diagrammatic view partially in section of a typical rotary heat exchange unit as previously described.

With particular reference to FIGURES 1–3, the complete textile treating process of the invention is shown as it may be carried out with the combination of the three-phase heat exchange units and the heated roller units of the present invention. This arrangement gives a two-zone temperature effect in an air-free steaming chamber of the Ager type.

In FIGURE 1, the air-free steam or processing chamber **10** is shown diagrammatically wherein spaced apart three-phase heat exchange units **12** are journalled for rotation between the side walls of the chamber **10** in an arrangement substantially along the lower portion of the chamber. In a corresponding straight line arrangement

adjacent the upper portion of the chamber, there is mounted a spaced apart row of heated rollers **14**. The rollers **14** are also mounted for rotation with means being provided to supply heat to the interior of the rollers as will be described in more detail later.

A plurality of spaced apart material supporting rollers **16, 17, 18, 19, 20, 21** are also provided so as to support the run of the material after it passes over the processing rollers. In the construction shown, saturated steam is introduced to the cabinet through a perforated false bottom plate **22** mounted within the enclosure so as to maintain the necessary air-free steam atmosphere within the chamber.

In one preferred construction, see FIGURE 4, the heated rollers **14** are shown as comprising hollow cylinders closed at each end and supported on hollow shafts **30** mounted in suitable rotary bearings and coupling **32**. Heated fluid is provided through the conduits **34** and the shafts **30** to the interior **36** of each heated roller **14**. A control valve **35** is provided at each side of the roller **14** in the conduits **34**. Since the atmosphere within the chamber is already at an elevated temperature, about 212° F., the additional heat to the rollers **14** will be under thermostatic control to the temperature required.

As described, the three-phase heat exchange units **12** are each provided with a cylindrical body partitioned trans-axially with spaced apart partions **40** positioned adjacent each end. In this construction, the interior **42** of the units **12** are provided with cooling fluid through hollow shafts **44** which are mounted in bearing and rotary joints **46**. Fluid is supplied to the shafts **44** through a conduit **48** controlled by a valve **50**. In operation, fluid of a lower temperature than that of the steam filling the processing chamber is supplied to the centre portion **42** of each of the heat exchange units **12**. This, as is well known, causes condensation and provides a thin film of moisture on the exterior of the heat exchange cylinder which is supplied by contact to the material as it passes over these cylinders.

Preferaly, in accordance with the invention, the heated roller units **14** are supplied with fluid so that their exterior surfaces are controlled at a temperature above 212° F. and up to or above 240° F. This ensures that the surface of the rollers **14** are dry and due to their higher temperatures, are adapted to exert heating action to the material passing around each unit after moisture has been applied by the heat exchange units.

Accordingly, since the units **12** and **14** are arranged in staggered relationship a web of prepared textile material when fed through the entry **60** of the steam chamber **10** and alternately over the rollers **12, 14** as shown, will be subjected to an alternate moistening and heating process which will in conjunction with the air-free steam considerably accelerate the chemical reactions required to complete the dyeing and/or discharging of the prepared material.

As will be appreciated, the number of units **12, 14** initially installed can be varied to suit the maximum requirements to which the textile material is to be subjected, and as the units can be individually controlled, a greater or lesser degree of moisture can be applied by the heat exchange units **12**, and a greater or lesser heating action can be performed by the heated units **14**.

This arrangement provides a great versatility in moisture and temperature control as applied to air-free steaming of prepared textile materials which has not been possible in the prior art structure available up to the present time.

I claim:

1. An apparatus for the controlled forming of supplementary moisture and the application of supplementary heat in the treating of prepared textile fabrics for the controlled acceleration and completion of the chemical and physical reactions involved in the steaming process development, comprising in combination, a steam processing chamber, material inlet and outlet means on said chamber, a plurality of three-phase heat exchange cylinder units mounted within said chamber, each of said heat exchange cylinder units having an outer shell possessing a high degree of heat conductivity and being partitioned internally to provide three separate sections of varying surface temperatures under operating conditions, means for supplying a relatively cool fluid connected to one of said sections whereby it is adapted to be maintained at temperatures lower than that of saturated steam supplied to said chamber so as to provide by condensation extra moisture applied by direct supporting and rolling contact with the material being processed, a plurality of heated rollers mounted within said chamber and having temperatures up to and slightly above 240° F., each of said rollers being a hollow cylinder and means for supplying heated fluid connected to each cylinder whereby said rollers are adapted to provide extra heat by direct supporting and rolling contact with the material being processed, a plurality of material supporting and guiding rollers mounted within said chamber, all of said heat exchange cylinder units, heated rollers, and material guiding and supporting rollers being mounted for rotation in parallel spaced relationship with each other within said chamber, and a source of steam connected to said chamber adapted to supply a continuous flow of saturated steam during all process times.

2. An apparatus as claimed in claim 1, wherein said heat exchange cylinder units are mounted for rotation within said chamber along the lower portion of said chamber.

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