MOISTURE EXTRACTION APPARATUS

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This invention relates to moisture extraction and it has more particular reference to a method and apparatus whereby the surplus liquid content of saturated textile material is recovered incident to drying and carbonizing.

An object of this invention is to increase the efficiency of the drying and carbonizing operation, in the manufacture of textile materials, by vacuum extraction of the excess moisture, after such materials leave the saturating medium, in a manner to reduce the moisture content to approximately sixty-five percent of the dry weight.

Another object is to provide an apparatus adapted to efficiently extract surplus moisture from textile materials, after saturation with a suitable medium for effecting elimination of foreign and injurious matters.

A further object is the provision of a novel apparatus and method well adapted to effect considerable economy in the drying and carbonizing of woolen and worsted fabrics after saturation either with a solution of sulphuric acid or aluminum chloride to remove cotton particles and other impurities.

With the above general and other objects in view, the various features whereby my invention is characterized will hereinafter be pointed out with particularity in the claims; but for a full understanding of its objects and advantages reference is to be had to the following detailed explanation taken in connection with the accompanying drawings.

In the drawings:

Fig. 1 is a side elevation of an equipment embodying the present invention; and,

Fig. 2 is an end view looking towards the left hand of the preceding illustration.

Before proceeding to a detailed explanation of the drawings, and by way of outlining a typical adaptation of my invention suitable for use in connection with the recovery of acid, employed in connection with cloth saturating processes for example, it is to be remarked such cloth is usually treated with a weak solution of either sulphuric acid or aluminum chloride before entering the drying and carbonizing equipment.

In accordance with this invention the surplus acid contained in the cloth is extracted by vacuum after the latter leaves the saturating tank, such extraction being effected by passage of the saturated cloth over a perforated or slotted suction pipe into which the excess liquid is drawn for return to the saturating tank.

In the equipment illustrated, the numeral 1 designates a longitudinally slotted or perforate vacuum pipe over which the material M, to be dried and carbonized, is conducted after leaving the saturating vat or tank 2; said material being drawn out of the saturating tank 2 over a guide roll 3 by means of suitably driven pinch rolls 4, in an obvious manner.

The vacuum pipe 1 is conveniently supported at the ends by brackets or standards 5 sustained by an appropriate frame structure 6, and mediately of its length it is provided with a branch 7 connecting into a strainer 8 which communicates, by way of interconnecting piping 9, into a separator tank 10.

The separator tank 10 communicates by way of a valve connection 11 into an equalizing tank 12, in turn having a valve outlet 13, and pipe connection 14, to a centrifugal pump 15, which is direct-driven by means of a suitable motor 16; said pump in the typified form of the invention serving, as later on explained, to return recovered acid by way of piping 17 into the saturating tank 2.

The vacuum is maintained by an appropriate vacuum pump 18 connected by a suction pipe 19 into the upper region of the separator tank 10.

All the piping connections are arranged so that a mixture of air vapors and the liquid drawn in by way of the vacuum pipe 1 are conducted into the separator tank 10 which effects the requisite separation of the liquid from the gases; the latter being withdrawn by the pump 18 and dischaged into the atmosphere.

A pipe 20, in continuation of the interconnecting piping 9, extends downwards into, and near, the bottom of the separator tank 10, while an internal baffle 21 in the upper region of said tank serves to effect a thorough separation of the liquid from the entrained vapors; note being had of the fact that the baffle 21 is located proximately below the connection of the suction pipe 19 into the tank 10.

In order to return the liquid separated in the tank 10, in which a high vacuum is maintained, back into the saturating vat or tank 2, without breaking the vacuum in the system used for extracting said liquid from the cloth M by way of the pipe 1, I make use of an equalizer line or pipe connection 22, between the tanks 10 and 12, said connection being opened or closed by means of an automatic control valve 23, while a second control or pressure relief valve 24 is also arranged in the equalizer connection 22 and communicates with the atmosphere.

Now, when the automatic control valve 23 in the equalizer line 22 is open, and the pressure
relief valve 24 closed, the same relative vacuum will exist in the separating tank 10 and in the equalizing tank 12. Therefore, any liquid accumulating in the separating tank 10 will flow into the equalizing tank 12 by gravity, with the check valve 25 in the valve connection 11 away from its seat, or in open position, because of the equal pressure conditions in said tanks. A check valve 26 located in the pipe connection 39 below the equalizing tank 12, however, will be closed because of the pressure differential between the atmospheric pressure on the outside, and the relative vacuum on the inside of said equalizing tank.

During the course of operation of the apparatus, the surplus liquid drawn out of the material M during its passage over the slotted or perforate pipe 1, after separation in the tank 10, will accumulate in the equalizing tank 12, and, as it rises in level, will elevate a ball float 27, lifting a valve 28. This float valve controls, in the equipment illustrated, flow of water from a service line 29, through an internal connection 39, in the tank 12, to an automatic pressure control 31, and to a needle valve 32 controlling the flow of such water. Attention is drawn to the fact that the piping 29, 39 has no flow connection into the tank 12.

Closing of the float valve 28 incident to rising of the liquid level in the equalizing tank 12, effects a throttling of the water stream and, therefore, causes a decrease in pressure in the internal connection 39 from the float valve 28 to the needle valve 32, which acts upon the automatic pressure controller 31.

This automatic controller 31 will, as a result of the stream throttling just described, simultaneously effect closure of the valve 23 in the equalizer connection 22, hereinbefore referred to, with concurrent opening of the pressure relief valve 24, both by air pressure admitted by the controller 31 from an air supply line 33, thereby admitting atmospheric pressure into the equalizing tank 12, a vacuum thus generated, the liquid in the tank 12 falling through the connection 39 to the separating tank 10 and the equalizing tank 12, to close while at the same time the check valve 26 in the connection 13 opens, whereupon the centrifugal or acid return pump 15 operates to discharge the accumulated liquid from said equalizing tank, under such atmospheric pressure, back to the separating tank 2.

From the foregoing it will be readily seen that return of the accumulated liquid, from the equalizing tank 12 to the separating tank 2, is accomplished without breaking the vacuum existing in the system from the pipe 1 to the pump 18, whereby a continuous extraction operation is maintained. The liquid level in the equalizing tank 12 will then drop, causing the float 27 to open the valve 28, with the result that the pressure is again built up in the water line 30, thus again acting on the automatic pressure control 31 and thereby opening the valve 23 in the equalized connection 22, while concurrently effecting closure of the atmospheric relief valve 24 to the equalizing tank 12. Therefore, any liquid trapped in the system above the level of the equalizing tank 12 rises to a predetermined level adapted to actuate the valve 28.

Without departure from the described system of liquid return the centrifugal pump 15 might be employed, by simply erecting the whole system above the level of the equalizing tank 12; or, in other words, positioning the equalizing tank 12 at an elevation to empty or drain by gravity into the separating tank 2, whereupon the hereinbefore described cycle of operation admits air at atmospheric pressure into the equalizing tank 12, in an obvious manner.

Furthermore, it will also not involve departure from the scope of my invention to employ a different type of arrangement than that specifically described, provided such control be actuated by the differences in liquid levels in the equalizing tank 12, differences in the hydrostatic pressure of the liquid column or differences in the weight of liquid, to operate the equalizer valve 23 and the pressure relief valve 24, by opening the former and closing the latter simultaneously, or closing the former and opening the latter concurrently.

Again, it is evident that my improved method and apparatus for extracting and returning liquid in a vacuum apparatus may be employed for the recovery and reuse of other fluids than that specifically mentioned above, and in connection with other processes than the one particularly set forth.

Finally, it is to be expressly understood that I do not intend to limit the invention to the exact details herein shown and described, except as called for by the following claims, but that I include within the scope of my invention all reasonable equivalents both as regards the method involved as well as the apparatus.

Having thus described my invention, what I claim is:

1. Apparatus for extracting surplus moisture from saturated fabric in readiness for drying and conditioning comprising, an apertured vacuum pipe over which the fabric is passed, a connected liquid and gas separator tank for the extracted moisture, an associated accumulator tank for the separated liquid, a pipe connection intermediate the tanks aforesaid having pressure-equalizing and pressure-relief valves, pump means to maintain a vacuum throughout the apparatus, and float--actuated means governing said valves to cause automatic return of liquid from the accumulator to the source of saturation under atmospheric pressure when said liquid attains a predetermined level.

2. Apparatus for extracting surplus moisture from saturated fabric in readiness for drying and conditioning comprising, an apertured vacuum pipe over which the fabric is passed, a connected liquid and gas separator tank for the extracted moisture, an associated accumulator tank for the separated liquid, a pipe connection intermediate the tanks aforesaid having pressure-equalizing and pressure-relief valves, pump means to maintain a vacuum throughout the apparatus, and float--actuated means governing said valves to cause automatic return of liquid from the accumulator to the source of saturation under atmospheric pressure when said liquid attains a predetermined level.

3. Apparatus for extracting surplus moisture from saturated fabric in readiness for drying and conditioning comprising, an apertured vacuum pipe over which the fabric is passed, a connected liquid and gas separator tank for the extracted moisture, an associated accumulator tank for the separated liquid, a pipe connection intermediate the tanks aforesaid having pressure-equalizing and pressure-relief valves, pump means to maintain a vacuum throughout the apparatus, and float--actuated means governing said valves to cause automatic return of liquid from the accumulator to the source of saturation under atmospheric pressure when said liquid attains a predetermined level.
the apparatus, conduit means including a pump operative to return liquid collected in the accumulator tank to the source of saturation, and float-actuated means governing said valves to initiate such return of the liquid when it attains a predetermined level.

4. Apparatus for extracting surplus moisture from saturated fabric in readiness for drying and conditioning comprising, an apertured vacuum pipe over which the fabric is progressed, a connected liquid and gas separator tank for the extracted moisture, an associated accumulator tank for the separated liquid, check valves controlling outflow of liquid from both of said tanks, a pipe connection intermediate the tanks aforesaid having pressure-equalizing and pressure-relief valves, pump means to maintain a vacuum throughout the apparatus, conduit means including a pump operative to return liquid collected in the accumulator tank to the source of saturation, and float-actuated means governing said valves to initiate such return of the liquid when it attains a predetermined level.

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