APPARATUS FOR THE VACUUM-DRYING OF LEATHER

Luigi Turato, Thiene, Italy, assignor to Officine di Cartigliano S.p.A., Industria Metalmeccanica, Vicenza, Italy, a corporation of Italy

Filed Feb. 8, 1963, Ser. No. 257,819


6 Claims. (Cl. 34—92)

This invention relates to the vacuum-drying of leather, the term "leather" including tanned and dyed hides and skins, and aims to provide means for rapidly and efficiently drying large amounts of leather, even soaked with water, as it comes from a previous washing or other wet-processing operation, without necessity of driving out a part of the water imbibed in the leather by mechanical means, such as squeezing, or centrifugation.

Another object of the invention is to provide means for quickly drying wet leather by evaporating under vacuum the water soaking it in few minutes (usually from 2 minutes or less for thin or light leather up to 9 minutes for thick leather).

Still another important object of the invention is to provide some improvements in industrial apparatus and a method of using same, so as to permit drying in few minutes large hides or up to 5 square metres (54 sq. ft.) or even more of thick leather at a time, by driving thereout the water soaking same in the form of low-temperature and pressure water vapor, the most part of said vapor (whose volume may reach even 500—600 cubic metres) being extracted by vacuum means in the first two or three minutes of treatment, and this without using excessively powerful vacuum pumps and a correspondingly high power source, but by employing relatively small vacuum pumps in combination with a vacuum accumulator and a vapor condenser specially designed for this purpose.

Another object of the invention is to provide improved means for supplying the necessary heat to the leather to be dried in spread-out condition by heating a leather-supporting plate to a relatively low temperature (usually of the order of 40—70° C. and rarely above said temperature) and to integrate the heat absorbed during the rapid evaporation of the water imbibed in the leather.

Other objects and advantages of the invention consist in providing apparatus for very quickly drying leather by evaporating the water under vacuum without necessity of driving out a part of the water soaked in the leather by mechanical means, said apparatus being so constructed as to permit a semi-automatic operation, which may be stopped automatically as soon as the leather under treatment is sufficiently dry.

Other objects and advantages of the invention will be apparent from the following specification taken in connection with the accompanying drawings, in which:

FIGURE 1 shows diagrammatically the arrangement of the heating and vacuum installation fitted to an apparatus for the vacuum-drying of leather;

FIGURE 2 is a side view of an embodiment of an apparatus for the vacuum-drying of leather provided with the heating and vacuum-forming and accumulating means and with the devices for lifting and lowering the cover of the apparatus;

FIGURE 3 is a horizontal section on line III—III of FIGURE 2, showing the arrangement of the vacuum accumulator, vapor condenser, pumps and other auxiliary parts in the base part of the apparatus;

FIGURE 4 is a vertical longitudinal section of the apparatus, including the cover, said section being taken substantially on line IV—IV of FIGURE 3;

FIGURES 5, 6 and 7 show in vertical section and enlarged scale some details of the apparatus shown in FIGURE 4;

FIGURE 8 is an enlarged vertical cross section on line VIII—VIII of FIGURE 4;

FIGURE 9 is a vertical cross section through a cover provided with a device for regulating the atmospheric pressure upon the flexible means acting upon the leather under treatment;

FIGURE 10 is an enlarged cross section through a second embodiment of cover.

In order to fully understand the invention, a leather vacuum-drying apparatus as designed by the same applicant, but forming no part of the present invention, will be described summarily by way of non-limiting example, in order to render the improvements according to the invention fully understood. It is to be understood, however, that the same improvements may be applied even to other apparatus.

Broadly described, the said prior apparatus of the inventor, as particularly shown in FIGURES 1, 4 and 5, comprises a metallic table 1 having preferably a very smooth bright top surface made of, or plated with, corrosion-resistant material, such as chromium, said table surface being preferably very slightly bulged. Plate 1 forms the top of a heating jacket 101 through which a heating fluid may be fed through a piping system 3. The plate 1 and jacket 101 are mounted upon a base frame 2 supporting the whole apparatus and within which the most part of the auxiliary means now to be described are mounted, as particularly shown in FIGURES 2, 3 and 4.

Above said plate 1 a so-called cover 5 (FIGS. 1, 2 and 4) is mounted upon a two-lever system 7—71 (FIG. 2) hinged by one end at 9 and 10 to upright members 8 projecting upwardly from cover 5, while on the opposite end they are hinged at 11 and 12 to an upright frame member projecting upwardly from the base 2. The said levers 7—71, together with the parts comprised between the hinge points 9—10 and 11—12, form an articulated parallelogram which carries the cover 5 and makes for lifting and lowering said cover 5 (which usually has an area of over 5 square metres and is quite heavy) by means of hydraulic (or pneumatic) cylinders 6 whose piston rods are hinged to the said levers 7—71 in a position intermediate their ends, as shown at 13, while the cylinders 6 are hinged at 14 to the base 2.

By pumping fluid under pressure into and out of the hydraulic cylinders 6 by means of a pump 4 the cover 5 is lifted and lowered parallel to plate 1. This hydraulic operating system is known per se and needs not to be described.

Said cover 5 comprises a substantially rectangular frame 15 and a closed hood 16. To frame 15 a flexible pad 18 is fastened which, as particularly shown in FIGURES 5, 8, 9 and 10, comprises an impervious sheet 17 of slight thickness by its free edge to the cover frame 15, a lower porous sheet 19, which is usually made of non-corrosible metallic fine mesh and an intermediate distance member 20 or spacer, which is usually in the form of large mesh wire net and serves for keeping sheet 17 and mesh 19 apart, thus forming a vacuum-distributing chamber.

As particularly shown in FIGURES 4 and 5, the flexible pad 18 is maintained suitably stretched by means of bolt-and-nut or like members 21 and other fastening-and-pushing members and the cover frame is provided with a peripheral rubber sealing strip 22.

According to the embodiment as shown in FIGURES 4 and 5, a plurality of suction members or ducts 23 are fastened to the edges of corresponding perforations of the rubber sheet 17 and said ducts lead into a manifold 24, FIGURE 4, which extends outside of the cover 5.
3,224,109

which, in prior devices, was directly connected to a source of vacuum by means of a conventional flexible hose.

The operation of the just-described device which, as said, apart from some obstructive details, forms no part of the invention is as follows:

The cover 5 being lifted and plate 1 suitably heated, the wet leather is laid, as it comes from the last washing or other bath, spread out on the plate 1, with the grain side in contact with the bright plate surface. Then the cover 5 is secured by operating the hydraulic cylinders 6 and the vacuum is applied through a flexible hose (not shown) and conduits 25, 24, 23 to the leather tightly enclosed in a vacuum chamber bound by sheet 17, plate 1 and encircling strip 22 and heated, by a hot fluid flowing through jacket 101, across plate 1. The water contained in the wet leather under the action of the heat applied through plate 1 and the vacuum action to the leather grain side, evaporates through the flesh side of the leather and across the fine mesh 19, expands in the chamber formed beneath the rubber sheet 17 and is led as low-pressure and low-temperature water vapor through ducts 23, manifold 24 and conduit 25 to the source of vacuum.

When the leather is dried the completion of the drying being usually detected by the increase of the vacuum measured by a vacuummeter—not shown—the communication with the source of vacuum is interrupted and the communication of the said vacuum chamber with the atmosphere is established by opening vent valve 50 FIGURE 1 and the cover is lifted by means of the hydraulic pistons or other suitable devices and the dried leather can be removed and replaced by a wet one.

As however when starting the drying operation the manifold 25 must be connected to the source of vacuum through a hose, whose flexibility would not permit the lowering and lifting of the cover 5, the size of said manifold 25 had to be limited and thus, with plates 1 having a useful area of over 5 square meters, as required for the drying of large hides, or a sufficient number of leather pieces, even by employing powerful vacuum pumps, the extraction of over 500 cubic metres of water vapor under a considerable depression and at low temperature (which, at the beginning of the operation, is usually in the order of 25° C.) requires a considerable time. Furthermore, during this time, a part of the water vapor would condense under the rubber sheet 17 and in the manifold 24 and thus some condensation water could eventually drip onto and through the fine mesh 19 upon the underlying leather to be dried, thus wetting and even staining same.

Thus, in order to shorten the drying time, the leather was usually subjected to a pre-drying by squeezing or centrifugation, which required much time and subjected the leather to a rough mechanical handling. Furthermore, in order to avoid dripping of condensed water upon the leather being dried, it has been also proposed to mount the whole apparatus much inclined, almost vertically, but by this arrangement it was difficult to maintain the leather in spread-out condition prior to lowering the cover and holding the leather pressed against the heating plate, and thus it was necessary to employ roughened plates upon which the leather was spread out with the flesh side down (in order to avoid that the grain side surface becomes roughened like the plate) and, on the other hand, for the same reason, it was necessary to protect the fine mesh through which the water vapor was sucked with felt or like material, which is not much vapor-transmissive. Thus this apparatus may be employed only in particular cases and must be usually small-sized.

The drawbacks of the prior device are overcome, according to the invention, by the following means:

(1) Connecting the vacuum chamber containing the leather to be dried with a relatively small-sized vacuum pump through a vacuum accumulator and a specially designed vapor condenser. This arrangement is particularly useful for drawing and condensing in the first few minutes a large volume of water vapor emitted by the very wet leather, without necessity of employing excessively powerful vacuum pumps and massive vacuum accumulators. (2) Employing manifold and ducts having a very large flow area for evacuating important amounts (even over 500 cubic metres) of low-pressure and low-temperature water vapor, produced by the operation under vacuum of the water soaking the leather to be dried, in few minutes (usually 2 or 3 minutes).

In order to render this possible, means have been provided, according to the invention, for connecting the vacuum source to the vacuum chamber in which the leather is spread out without the use of flexible tubing and without mounting the heavy vacuum-forming apparatus upon the cover.

With reference to FIGURES 1 to 9 of the drawings, the leather is spread out on plate 1 and when the cover is lowered, is enclosed between plate 1 and mesh 19 of the cover and, when the manifold 24 is connected to a source of vacuum, the leather is pressed against the heated plate 1 by the atmospheric pressure acting upon the sheet 17.

In this condition, a large volume of water vapor is evolved from the heated leather and this vapor is evacuated through a plurality of suction ducts 23 opening through the rubber sheet 17 into the underlying vacuum chamber formed between said sheet 17 of the pad and the plate 1 and closed all around by sealing strips 22. The ducts 23 are formed preferably as shown in FIGURE 6 and comprise an outer bell-shaped shell 223 connected to a base flange of the duct and provided with a nipple for connecting the duct 23 to the manifold 24; an inner bell-shaped member 323 supported by the top section of the said outer shell 223 and ending a little above the said base flange 123 and an inner tube 423 fastened to said flange 123 and opening at its lower end in correspondence of an aperture of sheet 17 and at its top end under the said bell member 323, the whole being so arranged and dimensioned as to form a hydraulic closure when the vapor, by condensing, fills the annular space between the parts 223 and 423 and reaches the lower edge of the bell 323. Thus the condensate cannot flow back through tube 423 and drip on and through mesh 19, FIGURE 5.

In addition the said suction ducts 23 further large suction ducts 230, FIGURE 5, may be arranged at the periphery of the pad 18 and lead directly into said vacuum chamber through the spacer mesh 20.

In the embodiment as shown in FIGURES 1 through 9, the vapor-evacuating suction manifold 24, which has a very large flow area, is provided with a curved neck 25 ending with a sealing ring 26 adapted to engage with a tight fit the underlying top end 127 of a large conduit 27, so that when the cover 5 is lowered upon the plate 1, the manifold 24 comes to be tightly connected to conduit 27.

According to another embodiment of the invention, as shown in FIGURE 10, the large-size suction manifold 124 connected to the vacuum means is mounted underneath plate 1 and is provided with a plurality or crown of suction ducts 330 opening through the edge portion of plate 1 inside the encircling sealing strip 22. In this case, ducts 330 act like the peripheral ducts 230 shown in FIGURES 4 and 5 and there is no need of a joint between manifold end and suction duct. In order to render it possible to rapidly evacuate and condensate the water vapor evolved from the leather being dried, the suction duct 27 is connected to vacuum pump 27 through a specially designed steam condenser 28, an interception valve 39 (which is usually controlled electrically) and a vacuum accumulator 36 which, in practice, is a hermetically closed tank having a possibly
large volume and directly connected to said vacuum pump 37, as shown in FIGURE 1. The steam condenser 28 has a part 44 formed as a heat exchanger and a chamber 43 in communication with the vapor tubes of the exchanger and provided with a well, from which the condensate may be drawn out through a pipe 31 provided with a valve 42.

The operation of the apparatus, improved according to this invention, is as follows:

At the start, the cover 5 is lifted and the leather to be dried is spread out on said plate 1. In the meantime, with valves 39 and 50 closed, the vacuum pump is operated so as to exhaust the air from the vacuum accumulator 36.

When the leather to be dried has been spread out on plate 1, the cover 5 is lowered and the valves 38 and 39 are opened and thus steam is fed in jacket 101 and a very powerful suction is exercised under the rubber sheet 17 and the water vapor at low pressure and temperature is sucked practically instantly as it is developed, through the condenser 28 where it is condensed and accumulates in the well 43 (valve 42 being closed) and thus maintains the vacuum within the vacuum accumulator 36 and parts connected therewith. It is possible to vacuum-dry even large and thick hides in a surprisingly short time (usually, not over 8 minutes) without necessity for the elimination of part of the water by squeezing or the like.

At the same time, the condensate water is allowed to flow from jacket 101 through pipe 32 and valve 33 to the constant level tank 34 where, in order to maintain the water level constant, water is fed by means of a pipe 129 branched off from the pipe 29 to which the cooling water is fed to the water vapor condenser 28. The cooling water is discharged through pipe 30 while the condensation water in tank 34 and some fresh water from pipe 129 are pumped by means of pump 35 and may be fed to the boiler (not shown) which serves for generating the steam to be fed to jacket 101.

It may be also mentioned that in some cases it is convenient to reduce the atmospheric pressure compressing the pad 18 against the underlying leather, due to the vacuum existing beneath the pad sheet 17, and this without reducing the amount of vacuum. In this instance the hood may comprise a part 116 above pad 18 which bounds a hermetically closed space 216 and which may be put into communication with the atmosphere by means of a vent tube which may be closed by a valve 46. The space 216 may also be put into communication with the vacuum source by means of a pipe 49, FIGURE 9, which connects the vacuum gauge which stops the vacuum pump motor each time a sufficient vacuum in the accumulator 36 is attained and starts the same motor each time the vacuum falls below a predetermined value.

As however the above is not difficult to design for those skilled in the art, it need not be described or shown, as is also the case of many other constructive details and variation of details as hereinbefore described and as shown in the accompanying drawings.

1. An apparatus for the vacuum-drying of leather, comprising a heatable plate for receiving leather to be dried, a movable cover for said plate adapted to move into sealing engagement with the periphery of said plate and shaped to form a vacuum chamber housing the leather to be dried, and a vacuum pump connected to said vacuum chamber by a suction line, said suction line including a vacuum accumulator and a water vapor condenser separate from one another and connected in series, a rigid manifold mounted in said cover movable therewith and terminating in a rigid neck having a free outlet end, a lower duct fixed to said vapor condenser having an inlet and facing said outlet end of the manifold neck, and coating sealing means provided on said facing duct and neck ends which co-operate by engagement upon lowering of said cover to sealingly close the suction line and connect the vacuum chamber of the cover manifold with the water vapor condenser.

2. An apparatus for the vacuum-drying of leather, comprising a heatable plate for receiving leather to be dried, a movable cover for said plate adapted to move into sealing engagement with the periphery of said plate and shaped to form a vacuum chamber housing the leather to be dried, and a vacuum pump connected to said vacuum chamber by a suction line, said suction line including a vacuum accumulator and a water vapor condenser separate from one another and connected in series, said cover carrying a pressure pad for engaging leather on said plate, said pad including an upper flexible impervious sheet and a lower impermeable sheet member, a suction manifold and a plurality of suction conduits connecting said vapor transmissive member to said manifold, each of said plurality of suction ducts comprising a base flange carrying an upstanding tube fastened to said impervious sheet in register with an aperture therein, a bell-shaped housing fastened to the base flange concentrically with said tube and provided with a nipple connected with said suction manifold, and an inner bell fastened to the top of said outer bell-shaped housing and encircling the top of said upstanding tube while leaving a space between the lower part of said tube and the lower part of said outer bell-shaped housing in which the vacuum accumulator to establish a hydraulic closure prior to its movement by suction into said manifold.

3. An apparatus for the vacuum-drying of leather, comprising a heatable plate for receiving leather to be dried, a movable cover for said plate adapted to move into sealing engagement with the periphery of said plate and shaped to form a vacuum chamber housing the leather to be dried, and a vacuum pump connected to said vacuum chamber by a suction line, said suction line including a vacuum accumulator and a water vapor condenser separate from one another and connected in series, said cover including a peripheral manifold communicat- ing with said vacuum chamber, and said suction line including a plurality of suction conduits fixed to the periphery of said plate and opening upwardly to engage and communicate with openings in said peripheral manifold when said cover is lowered.

4. Apparatus according to claim 3, wherein said suction conduits open through said plate.

5. An apparatus for the vacuum-drying of leather, comprising a heatable plate for receiving leather to be dried, a movable cover for said plate adapted to move into sealing engagement with the periphery of said plate and shaped to form a vacuum chamber housing the leather to be dried, and a vacuum pump connected to said
vacuum chamber by a suction line, said suction line including a vacuum accumulator and a water vapor condenser separate from one another and connected in series, said cover comprising an air-tight hood tightly closed at its lower end by a pressure pad for engaging the leather to be dried and a peripheral suction manifold communicating with said vacuum chamber which lies under said pressure pad, a vent opening on said hood having a valve establishing and closing communication of the interior of the hood with the exterior, a pipe connecting the interior of said hood with said suction manifold and a valve in said pipe for closing said pipe at will.

6. An apparatus for the vacuum-drying of leather, comprising a heatable plate for receiving leather to be dried, a movable cover for said plate adapted to move into sealing engagement with the periphery of said plate and shaped to form a vacuum chamber housing the leather to be dried, and a vacuum pump connected to said vacuum chamber by a suction line, said suction line including a vacuum accumulator and a water vapor condenser separate from one another and connected in series, said water vapor condenser including a vapor chamber, pipes therein for a coolant, a well for condensate, a condensate discharge duct and a valve therein, said vacuum accumulator having a volume approximately one hundred times the volume of said vacuum chamber to enable removal of substantial quantities of water from leather positioned on said plate, and said suction line further including a duct connecting the said vapor condenser to said vacuum accumulator and a second valve in said duct for opening and closing of the duct, whereby operation of said vacuum pump with said second valve closed evacuates the vacuum accumulator prior to evacuation of said vacuum chamber in the cover.

References Cited by the Examiner

UNITED STATES PATENTS

1,773,494 8/1930 Millican _____________ 34—143
1,910,294 5/1933 Kaminski _____________ 34—143
2,661,543 12/1953 Tyndall et al. __________ 34—153
2,681,512 6/1954 Armstrong _____________ 34—92
2,686,976 8/1954 Houghton _____________ 34—143
2,907,117 10/1959 Parkinson _____________ 34—92
3,077,036 1/1963 Neumann ______________ 34—92

MEYER PERLIN, Primary Examiner.
NORMAN YUDKOFF, ROBERT A. O'LEARY, Examiners.