

1,065,168.

Patented June 17, 1913.

Fig. 1.

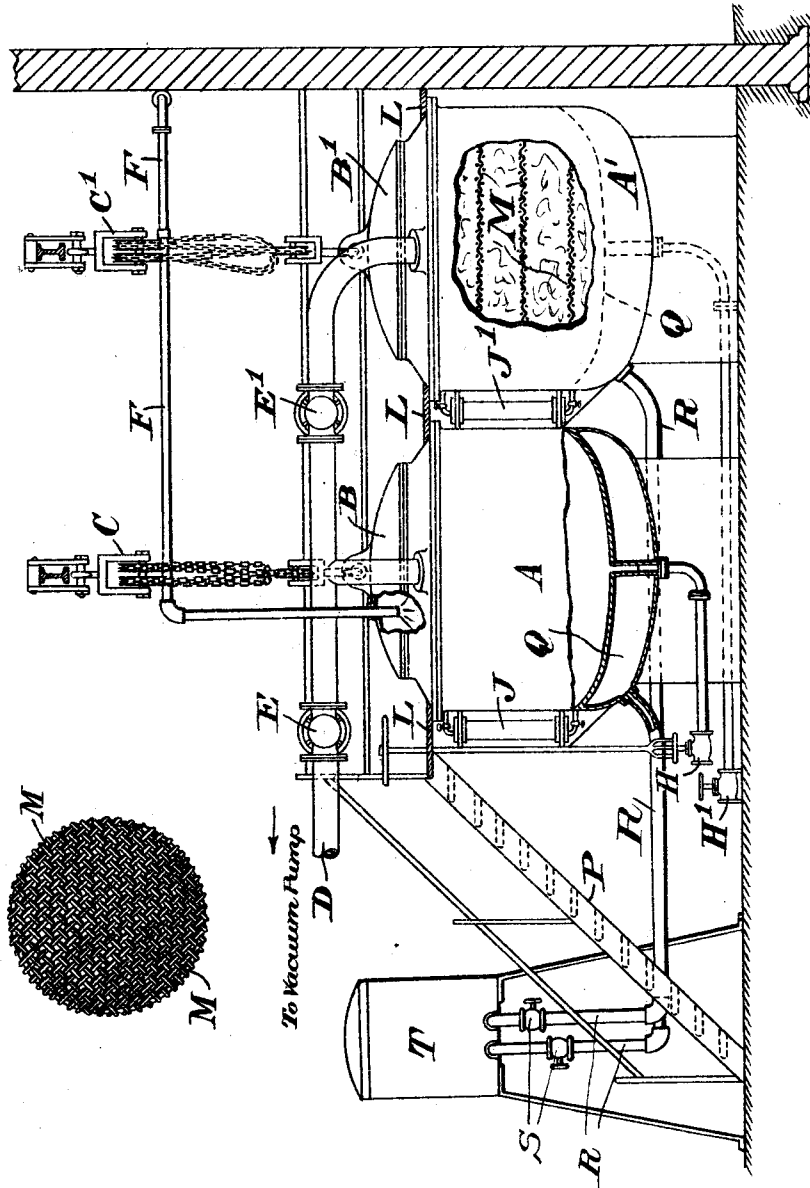
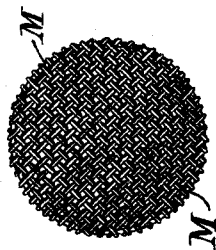


Fig. 2.



Witnesses
P. E. Babcock
J. M. Coppenhaver.

Inventor
Chas. W. Nance
by
W. H. Babcock
Attorney.

UNITED STATES PATENT OFFICE.

CHARLES WESLEY NANCE, OF LONDON, ENGLAND.

TANNING.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, CHARLES WESLEY NANCE, a subject of the King of Great Britain, residing in London, in the Kingdom of England, have invented certain new and useful Improvements in Tanning, of which the following is a specification.

My invention relates to the tanning of hides for the production of leather, and consists in a process hereinafter stated in detail, comprising essentially the following steps after the usual or preliminary depilating treatment. First, the hides are immersed in a tanning solution of usual character, in a tank which is hermetically sealed against the atmosphere. A high vacuum is then produced in the chamber of about $\frac{1}{2}$ lb. to the square inch absolute pressure. When the vacuum reaches this point, the temperature of the solution is raised momentarily or for a brief period, to a point at which water will boil, that is, at or about 65° to 70° Fahr., the temperature being preferably kept just below the point at which the tanning solution will, under like vacuum, boil or vaporize. Or, and particularly in relatively warm weather, instead of raising the temperature, the vacuum may be increased or made more nearly perfect, so that water, and it may be the tanning solution itself, will be thrown into ebullition, and the water caused to vaporize or to pass into steam. As a result of this treatment, water which is contained in the pores of the hides will be caused to vaporize, and hence will force its way out of the pores by reason of its expansion and pressure. The water vapor, condensing as the temperature or the vacuum is permitted to fall slightly, a partial vacuum is created in the pores of the hides, and the tanning solution enters to fill the same. The tannin of the solution unites with the gelatin of the hide, leaving water behind, and partially occupying the pores of the hide. The temperature or the vacuum being again raised, this water is vaporized, and through repetitions of the process is finally completely removed from the pores of the hides and replaced by tannin, which combines with and converts the hide into leather of peculiarly fine quality.

The strength or degree of concentration of the tanning solution will vary according to the quality and character of the hide or hides under treatment, and the solution

should from time to time be renewed or replenished, to compensate for the tannin taken up by the hides.

It is essential to the economical carrying out of the process on a commercial scale, and to the production of leather of fine quality, that the vacuum be high or nearly perfect, and I have found that for good commercial working, the absolute pressure should be not more than $\frac{1}{2}$ lb. to the square inch, the lower the better. I have also found by thorough tests, that while the tanning operation is improved and hastened when carried on *in vacuo*, the curve representing the decrease in time, which as practically co-incident with the curve of improvement in quality, is a peculiar one, and that a given hide, which without vacuum would take about five months to tan, will with say 13 lbs. absolute pressure, take about two months or a little less; with 10 lbs. absolute pressure, about forty days; with about 4 lbs. absolute pressure, approximately twenty-five days; and with about 1 lb. absolute pressure, approximately twenty days; but with $\frac{1}{2}$ lb. absolute pressure, it can be done in two days.

It will thus be seen that there is a sudden drop at about from 1 lb. to $\frac{3}{4}$ lb. absolute pressure, and this is owing to the fact that at about $\frac{1}{2}$ lb. per square inch of absolute pressure pure water boils at a little lower temperature than the tanning solution, and just before the hide begins to boil, the comparatively pure water in the pores of the hide boils or vaporizes in advance of the boiling of the tanning solution proper, and with the gases, escapes from the pores of the hide in the form of steam or vapor. Hence when the liquid in the pores is reduced to vapor a partial vacuum is formed in the pores, and, when boiling ceases, fresh tan liquor enters to fill the same. This tan liquor in turn similarly acts upon the walls of the pores, the tannin being absorbed by the hide, and the pure water left behind being caused again to boil and the remaining gases to be expanded, both being thus expelled.

In carrying out my invention I may use any suitable form of apparatus admitting of treatment in the manner above described, but I prefer the apparatus shown in the accompanying drawings, wherein:

Figure 1 is a side elevation of the plant, partially broken away to show the arrange-

ment of the wickerwork separators placed between the hides; Fig. 2, a face view of one of said wickerwork separators.

In these drawings, A and A' indicate vacuum pans of usual construction, having removable lids B and B' capable of hermetically sealing at times as is customary, and C, C', indicate pulley block devices for lifting the lids, and in case of need, for handling the hides.

D indicates an exhaust pipe coupled to the vacuum pump on the one end and to the tanks on the other, the vacuum pump not being represented in the drawing but merely indicated, as no particular type of pump is essential to the carrying out of my process, except it must be one capable of forming a very high vacuum, of which type there are several now existing, nor is any special construction of pump claimed herein.

E, E', indicate valves in the pipe D, whereby communication of either or both tanks with the vacuum pump may be shut off. A further valve may, of course, be placed between the tank A and pipe D if desired, so as to permit the two tanks to be handled wholly independently of each other, but this being a common expedient requires no special illustration. F indicates a supply pipe for the tanning liquor. Its branches enter the tanks A and A', and the entering ends are preferably brought into fairly close proximity to the inner walls of the tank, so that the liquid escaping therefrom under head or pressure will be broken into fine spray. From the lowest point of each tank extends a discharge pipe for conveniently emptying the tanks when desired. These pipes are respectively furnished with valves H and H', by which they may be opened and closed as required.

J and J' indicate glass cylinders, each coupled at its upper and lower ends to one or the other of the vacuum tanks, and designed to receive small pieces of hide which, by reason of the communication between the tanks and the cylinder, will be subjected to precisely the same conditions as those in the main tanks. To permit removal of the cylinders J and J' for the purpose of examining their contents, the pipes by which they are placed in communication with the cylinders are provided with cocks, as shown in Fig. 1, so that they may be closed while the cylinder is removed.

M indicates a wickerwork mat or separator, of which a suitable number will be provided for each tank. The purpose of these separators is to hold apart individual hides or groups of hides, while permitting the tanning solution to come into contact with every portion thereof, above and below. Each tank A, A', has its lower portion surrounded by a water jacket Q supplied by pipes R from the warm water tank T, and

having cocks S by which to open and close communication between the tank and the water jacket. The purpose of this water jacket is to raise the temperature within the tanks to a point sufficiently high to beget vaporization of the water contained in the pores of the hides, but not sufficient to injure the hides, and preferably not sufficiently high to produce ebullition of the tanning liquid. If, however, the temperature be not sufficient to injure the hides, and I find that a temperature from 65° to 70° Fahr. is a safe one, slight ebullition of the tanning liquid will occasion no harm, but is somewhat beneficial in that it causes the bubbles of air and gas which tend to adhere to the surfaces of the hides, to be detached therefrom and to rise to the surface of the liquid. There is further shown in Fig. 1 a platform L with steps P by which to reach the same.

Any usual or convenient form of vacuum pan adapted to withstand the high vacuum indicated may be employed; and the provisions for heating may be any of those commonly employed, though I prefer a water jacket or heating coil. Owing to the relatively low temperature, 65° to 70° Fahr., at which water will boil under the high vacuum indicated, application of heat is unnecessary in mild or warm weather, but provision is, of course, made for the application of heat whenever the same is required.

The following account of a trial conducted before numerous witnesses for the purpose of testing and demonstrating the process will further illustrate the invention, but it is to be understood that the test was illustrative merely, and need not be arbitrarily followed in detail in practical commercial working. The tanks being properly supplied with hides separated in the manner indicated, were duly sealed, and the vacuum pump started to produce the desired vacuum. When the vacuum was well advanced, a weak tannin solution was sprayed in against the wall of the chamber until the hides were well covered. The vacuum was increased occasionally up to the boiling point of the tannin liquor, but was not allowed to be at this point for more than five minutes at a time. As the tanning liquid gradually evaporated, further weak liquor was run in until the extract was fairly concentrated, after which the liquor was never allowed to boil except momentarily. From time to time a little of the liquor was withdrawn and fresh liquor, preferably unconcentrated, was passed in. After the expiration of two days air was let in, the solution withdrawn, and the hides taken out, washed, and air dried and finished, and were pronounced by experienced tanners present to be better leather than any they had ever tested.

Obviously, the washing and drying of

the hides may be effected in the vacuum pan, if desired. So, too, it is not essential to begin with weak liquors and concentrate them in the operating vessel, but liquor of any desired strength, or a succession of liquors of varying strengths, may be used, according to the character of the hide under treatment. It is also possible to employ tan bark as a separating material between the hides, and to extract the tannin therefrom and produce the solution in the tank, but better and more uniform results may be attained and in less time, by introducing a prepared solution of suitable strength or concentration in the first instance, the grids of wickerwork or equivalent material being in such case employed to separate the hides.

I am aware that others have heretofore proposed to carry on the tanning process *in vacuo*, and that in some instances high or nearly complete exhaustion has been suggested in general terms, but without specifying the degree of vacuum, or being aware of the sudden decrease in time required and improvement in quality of leather produced, as the vacuum rises to about $\frac{1}{2}$ lb. per square inch absolute pressure of vacuum, unobtainable with the old piston air pumps. So, too, the necessity of maintaining a relatively low temperature, 65° to 70° Fahr. or thereabout, has not hitherto been appreciated, nor has the relation between temperature on the one hand and vacuum on the other, in its bearing or effect upon the tanning solution and upon the leather, been understood or apparently investigated. It is by reason of maintaining a vacuum so high that evaporation of the moisture may take place at a temperature so low as to avoid injury to the hide and the resulting leather, that I am enabled to secure the vastly improved results incident to my process of tanning.

Having thus described my invention, what I claim is:—

1. The process of tanning hides, which consists in placing depilated hides in a tank containing a tanning liquor, the hides being separated by permeable bodies incapable of injuring or being injured by the solution, producing and maintaining in this chamber a vacuum equal to about $\frac{1}{2}$ lb. per square inch absolute pressure, and maintaining normally in said chamber a temperature below the boiling point but occasionally raising the temperature for brief periods to the boiling point in such vacuum.

2. The improvement in the process of tanning hides, which consists in placing the hides in a vacuum tank, sealing the same against the atmosphere, producing a high vacuum in said tank, introducing tanning

solution in the form of a fine divergent spray at a point above the level of the solution until the hides are completely immersed, whereby the air contained in the fresh liquor is liberated, and occasionally for a brief period bringing the temperature to a degree at which the solution will boil in the high vacuum in the exhaust tank, but at no time permitting it to rise sufficiently high to injure the hides or the resultant leather, but keeping it at or below the ordinary normal temperature.

3. The process of tanning hides, which consists in immersing the hides in a tanning solution in a chamber sealed to the atmosphere, reducing the pressure in such chamber, and maintaining it at about $\frac{1}{2}$ lb. per square inch absolute pressure, and from time to time so proportioning the temperature of the liquid and the degree of vacuum that water contained in the hides will be converted into steam, while under the tanning liquor, but without permitting the temperature to rise above 65 to 70 degrees Fahr.

4. The process of tanning hides, which consists in placing the depilated hides in tanning solution in a chamber closed to the atmosphere, producing in the chamber a vacuum of about $\frac{1}{2}$ lb. per square inch absolute pressure, and periodically raising the temperature of the tanning solution at this vacuum to a point at which the water will boil, the intervals between such elevations of temperature serving to permit the tannin of the tanning solution in the pores to separate from the water of the solution and unite with the gelatin of the hides, and the successive elevations of temperature serving to convert the free water in the pores into steam and thus to remove the water from the pores of the hides.

5. The process of tanning hides, which consists in immersing the depilated hides in a tanning solution of moderate strength in a chamber closed to the atmosphere, producing and maintaining in said chamber a vacuum of about $\frac{1}{2}$ lb. to the square inch absolute pressure, periodically raising the temperature of the solution to a point at which the water will boil under that vacuum, and permitting it to fall again below such point, and from time to time adding fresh tanning solution.

In witness whereof, I have hereunto signed my name this 26th day of November, 1909, in the presence of two subscribing witnesses.

CHARLES WESLEY NANCE.

Witnesses:

WILLIAM REGINALD ORMANDY,
HERBERT D. JAMESON.