

UNITED STATES PATENT OFFICE.

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PROCESS OF EXTRACTING THE FIBERS FROM TEXTILE PLANTS.

SPECIFICATION forming part of Letters Patent No. 226,506, dated April 13, 1880.

Application filed November 4, 1879. Patented in France May 16, 1879.

To all whom it may concern :

Be it known that I, PAUL ANDRÉ ARTHUR MARIE AUGUSTE FAVIER, of Paris, France, have invented certain new and useful Improvements in the Process for Extracting the Fibers from Textile Plants, and especially from the *Urtica utilis*; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to use the same.

The means generally employed since the remotest times for extracting the useful fibers from textile plants consists in retting.

In examining a stem of flax, of jute, or of China grass it will be found that the textile fibers adhere on the inner ligneous part, or awn or boon, by means of a gum-like resinous substance, which also glues the fibers together. This adhesive substance, which is generally known under the name of "pectose," is insoluble, and the object of the retting is to transform it into a soluble pectine, so as to cause the separation of the fibers from the awn and from the cortical matter inclosing them, and at the same time the separation of the fibers from each other.

The retting, which is a source of serious danger to the public health in the localities where it is practiced, is a difficult operation, as it requires much hand labor, and if not properly managed it is liable to deteriorate the textile fibers. As regards hemp and flax, the process can be performed in a reliable manner; but this is not the case with the thick stems of jute, the under part of which is hardly retted when the fibers of the upper end are already injured. This explains the difference in the resistance that is met with in the fibers of this textile material.

This operation is impracticable for China grass, in which the fiber is buried in a considerable mass of gum-like resinous substance. The result thereof is that during the retting certain parts of the fiber adhere still to the awn, while others are already injured.

It is a matter of astonishment that the very foundation of such considerable manufactures remains based on empiricism instead of on a solid scientific basis, all the more so that retting is almost impossible in hot countries, and even in the most favorable conditions it

never results in a complete transformation of the pectose into soluble pectine, thus entailing the necessary subsequent operations called "hackling" and "picking" in order to obtain a complete separation of the useful fibers from the awn or boon.

Experiments that I made with regard to the utilization of China grass (*Urtica utilis*) indicated that the retting process is a failure, while the use of any of the existing machines for decorticating this plant, either in its green or in its dry state, proved equally abortive. China grass, whether green or dry, is such a voluminous material that it must of necessity be cut up on the spot. All the machines which treat the plant in the dry state require that its stems be previously dried in an oven. This operation can be effected without much difficulty in factories; but it is not possible in the open country. Machines operating on the green plant do not yield over fifty per cent. of the fibers it contains when the decortication is effected immediately after the cutting; but should eight days elapse between these two operations the yield is altogether insignificant.

The desideratum sought for was clearly laid down by the Indian government offering vainly, as far back as ten years ago, a prize of five thousand pounds for a machine or a process for decorticating China grass in its green state—that is, first, for separating the awn from its cortical envelope, and, second, for separating the fibers from the gummy resinous matter surrounding them. It struck me that this result could be obtained by dividing it, and after a few experiments I succeeded completely.

By subjecting the stems of China grass which may be cut eight days previously in a closed vessel to the action of heat I have obtained a complete separation of the awn from the cortical envelope, which latter contains the entire quantity of useful fibers, the proof of which is that on breaking the former no trace of fibrous material can be found.

In practice, I heat the China grass stems to the proper temperature by injecting steam, hot air, or hot gases in a vessel containing the latter. When the necessary quantity of water can be easily procured steam may be used for this purpose. In this case the apparatus consists, essentially, of a small easily-portable

steam-boiler, with a comparatively large fire-box, to facilitate the burning of the awn. Suitably-arranged pipes conduct the steam into large wooden receptacles, in which the stems are placed as fast as they are cut. Each complete apparatus should have at least three such receptacles, one of which receives the steam, while the second is being filled with stems and the third is being emptied. As soon as the steam begins to escape through the joints of the receptacle the operation is finished, providing that the China grass is freshly cut; but the treatment should be kept up longer in proportion to the time elapsed since the cutting, if the latter has been effected eight days or more. The stems having thus been subjected to the action of the steam, the bark is separated from the awn, which operation is so easy that it can be performed by children without difficulty. One child of ten to twelve years can in one day easily bark off two hundred and fifty to three hundred kilograms of green stems, rendering the cortical envelope in the form of longstrips or bands, which contain the entire quantity of fibers inclosed in the stems, and these fibers are maintained perfectly parallel, whereby the succeeding combing is greatly facilitated.

As the expense of fuel is absolutely naught, because the awn is used as combustible, it can be easily seen at what small cost a ton of green China grass can be decorticated. The steam does not change in any way the nature of the gummy resinous substance surrounding the textile fiber and which attaches the latter to the awn. Its use does not constitute, therefore, a peculiar method of retting. It forms only a simple means of rapidly subjecting the stems to a determined temperature. Under the influence of this temperature the water contained in the stems tends to evaporate, and causes thereby the separation of the awn from its cortical envelope. The gummy resinous substance is nowise modified, and the strips or bands contain the entire quantity of textile fibers and the entire mass of this resinous substance surrounding them.

When water cannot be easily procured the same result can be obtained by using hot air instead of steam.

I have found that this same process is also applicable to flax, hemp, jute, &c. The fibers of all these textiles can be obtained in the shape of bands containing the entire quantity of useful fibers without the slightest trace of awn, these fibers being thus maintained perfectly parallel. These bands can consequently be subjected directly to the action of the combing-machine without having gone through the previous operations of breaking and retting. The fibers being maintained perfectly parallel, the waste produced in the combing will be absolutely insignificant, while with the processes heretofore employed the waste amounts often to fifty per cent. and even more.

The bands of China grass obtained by the

preceding operation contain too large a quantity of gum to admit of being combed immediately with economy. On examining a stem of China grass there will be found, first, on the awn a layer of gum, then the textile fibers, and then a second layer of gum thicker than the first, and finally the exterior brown bark. My experiments have shown that it is possible to separate these different concentric layers so that the useful fiber can simply be drawn out of its envelopes. This is effected either by leaving the stems for a longer period exposed to a temperature a little more than 100° centigrade, or by elevating this temperature, which is, of course, a more practical and more rapid means. For freshly-cut stems a temperature of about 150° centigrade should be used; but this temperature should be raised in proportion with the length of time intervening between the cutting and the treatment.

The most practical method to rapidly expose the stems under treatment to the desired temperature consists in employing as vehicle of the heat superheated steam or air, or gases heated to the proper temperature, and which are injected into the receptacle containing the stems. The stems to be treated by this process are placed in wooden cases, in which they are subjected to the action of the superheated steam or hot air according to the special circumstances. They are then passed over to children, who separate the awn from the cortical envelope, and obtain the useful fiber by simply drawing it off. The latter operation can also be effected mechanically by means of a brush. Thus the useful fibers are obtained in the shape of bands free from the exterior brown bark and from a part of the gum. These bands contain the entire quantity of fibers, all perfectly parallel with each other. They are now ready to be combed and transformed into hackled flax.

I thus suppress the retting and breaking operations, and consequently the loss of raw material, which is the unavoidable result of the same.

This process can equally be used to separate the constituent parts of plants which have no internal awn, like *Pharnium tenax*, aloes, &c., so as to permit the easy drawing off of the useful fibers.

Having thus described the nature of my invention, and the best means known to me to carry the same into practice, I claim—

1. The process of treating textile plants, which consists in exposing them soon after being cut to heat by inclosing them in a vessel into which steam or hot air or gases are admitted, whereby the exterior cortical parts, with the fibers, become easily separable from the central parts and can be drawn off in the shape of bands, whereby the parallelism of the fibers is not destroyed, substantially as specified, and for the purposes set forth.

2. The process of separating the fibers of textile plants from each other and from the

adjacent parts, to which they adhere by means
of a gum-like resinous matter, which consists
in exposing them to a high temperature by in-
closing them in a vessel in which superheated
5 steam or hot air or gases are admitted, and
afterward drawing the fibers off from the ma-
terial of the plant, substantially as herein set
forth, and for the purposes specified.

In witness whereof I have hereunto set my
hand, this 22d day of October, 1879, in the pres- 10
ence of two subscribing witnesses.

PAUL ANDRÉ ARTHUR MARIE AUGUSTE FAVIER.

Witnesses:

AUTIER,

V. H. CARRE.