UNITED STATES PATENT OFFICE.

WILLIAM LATIMER, OF WILMINGTON, NORTH CAROLINA.

PINE FIBER.

SPECIFICATION forming part of Letters Patent No. 409,608, dated August 20, 1889.

Application filed May 3, 1889. Serial No. 309,453. (No specimens.)

To all whom it may concern:

Be it known that I, WILLIAM LATIMER, a citizen of the United States, residing at Wilmington, in the county of New Hanover and State of North Carolina, have invented certain new and useful Improvements in Pine Fibers as a new Article of Manufacture; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention consists in a new and useful vegetable fiber produced from the leaves or "pine-needles," as they are commonly termed, of the *Pinus Australis* or other coniferous trees by both chemical and mechanical treatment, whereby I obtain a new product or article of manufacture termed by me "pine fiber," a fiber which will felt or can be spun and woven with substantially the same facility as ordinary wool.

In order that others may fully understand the nature of my improved product, I will proceed to describe the mode of treatment of the pine-needles which I have adopted and the peculiarities with which it is invested, and in order that such description may be fully understood it becomes necessary to refer, generally, to the nature of the vegetable matter from which I produce my new fiber.

The acicular leaves of pines, firs, and conifers in general occur in the form of fascicles of from two to five needle-shaped evergreen leaves inclosed at the base in a thin scarious bud-scale sheathing. These leaves or needles are generally called "pine-straw," and it is from such product of nature that I produce my novel article of manufacture which I denominate "pine fiber," and which I acquire by four different and distinct operations, whereby the chemical nature and physical structure and environment of the basis of this product as it exists in nature in the pine-straw is so radically changed and altered as to enable it to afterward be spun and woven upon flax, jute, and hemp machinery.

I take the natural pine-straw and first cook or treat it in suitable tanks with a solution of caustic soda or potash and wash in the manner substantially as described in Letters Patent of the United States granted to me February 5, 1889, No. 397,240, by which operation or treatment the needed chemical change is made in the constituents of the pine-straw, and a change is also made in the atomic or structural arrangement of the same, which enables it to readily yield to the subsequent treatment applied. The resultant product of the treatment just described is then passed through a suitable rubbing or decorticating machine—such as was specially designed for this purpose—as illustrated in Letters Patent of the United States granted to A. Scott April 14, 1885, No. 315,666. By the rubbing and decorticating a further physical change is made in the structure of the pine-straw, which is then carded or combed in a card or combing machine such as is used in the treatment of jute, &c., though I prefer to use machinery especially adapted for this step. The card or combing machinery produces a still further structural change in the straw, which is finally passed in mass through a drying-machine, to which artificial heat is applied, the mass being preferably confined and pressed against itself. My novel product or new fiber, which is the result of the several steps named, can then be spun or woven on flax, jute, and hemp machinery; but the results produced by no one of the several steps named would, separately considered, be such as to render the fiber capable of being either spun or woven. In other words, in the production of the new article of manufacture to which my invention is directed not only must the pine-needles be subjected to the alkali treatment in such manner as not to disintegrate, weaken, or deteriorate the ultimate fiber which it is my object to obtain, but the needles after this treatment must be further treated mechanically in such manner as to separate the treated fiber from the other constituents, and this fiber after separation must be dried.

The pine-straw of the *Pinus Australis*, which, by preference, I employ in the production of my new fiber, occurs in fascicles of three. Their average length is about twelve inches, though they sometimes grow to the length of twenty-seven inches, and they are

substantially triangular in cross-section, resembling one-third of a circle. They are composed of cellulose, (which consists of carbon, hydrogen, and oxygen,) volatile oil, chlorophyll, succinic acid, tannin, silica, ash, pectose, and an albuminoid. The cellulose in its physical form consists of numerous fine filaments made up of the elongated primitive cells running the whole length of the leaves, forming a sort of tube, inclosing the sap, &c., traversed by the sap filaments in every direction incased by chlorophyll with the oleoresin secretions, tannin, silica, &c., as is well represented in Figures 1 and 2 on page 103 of the *American Journal of Pharmacy* for February, 1885.

It will be understood by those familiar with pine-straw that there exists in nature a certain regular order in the physical structure or atomic arrangement of the leaf, and it is well known that when thoroughly protected from the weather it will grow brown in color and become very dry and brittle, but may be kept for a long time, while if exposed to the weather or buried in the earth it will soon ferment and decay and be resolved into the original elements taken by the tree in its growth.

The fibrous constituent of pine-straw in its natural state—that is to say, in the condition in which it naturally exists and finds place in the "straw"—is not in any sense fitted or adapted to be spun or woven, because the long filaments are cemented with sap filaments in one mass and are incased in a silicious covering of insoluble gum or resins, the consequence being that it is impossible to separate them into fine filaments sufficiently strong to bear the necessary strain of manufacturing without disintegrating the whole into primitive cells about one tenth of an inch long, while in any event constituents of the natural filament (even supposing the latter would be obtained in a state of nature) which render that filament brittle and fragile must be removed in order to render it sufficiently pliable and strong to be spun and woven.

The new product which forms the subject-matter of my invention is readily distinguishable from the natural fiber existing in the needles or straw.

My improved product is composed of long fine twisted filaments having serrated or rough surfaces intertwined and clasping each other dry and practically devoid of moisture, and sufficiently strong, soft, and piable to withstand the unavoidable and necessary strain incident to its manipulation in spinning and weaving, and, unlike the natural fiber, it will withstand exposure to the weather without fermentation or decay. It not only looks unlike the natural fiber, but can be readily distinguished from the latter by chemical analysis, or by micro-chemical analysis or microscopic examination.

It must also be observed that my new product cannot be obtained by the process of "retting" the natural pine-straw in the manner of retting flax, hemp, and other vegetable fibers, because the process will inevitably destroy such basis as exists in its natural state for the production of such new fiber, nor can it be produced by merely steaming the pine-straw, since such steaming practically leaves its chemical and physical structure unchanged, and it is still hard, brittle, and weak as ever, if not more so, when dried.

The "mercerising" process to which I subject the needles or pine-straw not only has the effect of dissecting the fiber vascular bundles, but the contour of the fibrils are also altered. By the constant circulation of the alkaline solution and subsequent washings with water, as described, in the process patented to me, as hereinbefore recited, the pores or cells are thoroughly permeated, a great deal of foreign matter is driven out, and the place of the old natural constituents is taken by the new chemical compounds. By the decorticating process a great deal of organic matter is rubbed out and the teeth of the cards are enabled to readily take hold of the mass to finally remove all foreign and objectionable matter and to effect the shredding of the leaves, which may be done to a greater or less degree to produce a fiber of fine or coarser grade, as desired. The drying step of the process described drives out the moisture and causes the mass to curl and intertwine upon itself, the serrated projections along the filaments catching and clinging to each other and practically forming a sort of slightly-felted mass, from which a long unbroken sliver composed of these intertwining filaments can be easily and readily drawn for spinning and weaving.

I am aware that it has been suggested that filaments may be produced "from pine-leaves for hygienic and other purposes" by "boiling the leaves in a bath of caustic alkaline lye," the caustic alkaline and the pine-leaves being taken in equal parts, and the boiling being continued for from ten to twelve hours, the leaves or needles being stirred from time to time during the operation, and being afterward removed from the caustic lye and washed one or more times in hot water, and finally passed through cold water and dried. The product of the operation or process is wholly unlike mine in external appearance and otherwise. It is not a fiber or filament, but is comparatively thick and brittle and unfitted to be spun or woven. Moreover, it is liable to rot, it is materially deficient in tensile strength, and is not applicable to the purposes for which my new product is particularly adapted and suited.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

As a new manufacture, the herein-described product, termed by me "pine fiber," composed of long fine twisted filaments having serrated or rough edges or surfaces intertwined and clasping each other, dry and practically devoid of moisture, and sufficiently strong, soft, and pliable to withstand the unavoidable and necessary strain incident to its manipulation in spinning and weaving, as hereinbefore set forth.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM LATIMER.

Witnesses:

HENRY SAVAGE,

THOS. F. BAGLEY.