UNITED STATES PATENT OFFICE.

WILLIAM E. FARRELL, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN THE MANUFACTURE OF PAPER-PULP FROM WOOD, &c

Specification forming part of Letters Patent No. **215,728**, dated May 27, 1879; application filed April 18, 1878.

To all whom it may concern:

Be it known that I, WILLIAM E. FARRELL, of the city and county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in the Manufacture of Paper-Pulp from Wood and other Vegetable Fiber; and I do hereby declare the following to be a full, clear, and exact description of the same.

The pulp made from wood and other vegetable fiber, such as straw and various grasses, enters largely into the manufacture of paper; and, although there are many ways of producing the same, all the known means may be reduced into two kinds, viz: the "mechanically-ground pulp," in which the fibers are rasped, torn, cut, filed, or ground off the wood, and the "chemical pulp," in which the wood is subjected to a bath of soda-ash or other alkaline solution in a closed vessel under pressure. The objection to the "ground wood" is that it is harsh, stiff, has no length, strength, or smoothness of fiber, and is really only a filler or make-weight.

My process does not in any way cut, rasp, file, or tear the fiber. The objection to the chemical pulp is that it requires an expensive plant or machinery, costly to manufacture, and, while producing an excellent fiber, is too costly for the cheaper grades of paper.

To enable others skilled in the art to use my invention, I will describe my process.

I cut the wood (which may be wet or dry) into any suitably-sized pieces by any of the well-known devices used for this or similar purposes.

The pieces of wood may be cut parallel with the fiber or at an acute, oblique, or right angle to the grain of the wood, or a combination of any two of the ways named.

Wood cut at right angles with the grain will pulp more rapidly; but wood cut at an acute angle with or parallel with the grain, while taking more time, makes a tougher, softer, longer, and more pliable fiber.

The wood being cut as desired, I prefer to soak it in hot or cold water when in an open vessel or under pressure, or subject it to a bath of soda-ash or other alkaline solutions, either hot or cold, in the open air or under pressure. In any one or all of these conditions it is ready for my process, though the latter may be practiced upon it while it is in its ordinary dry state.

My process is as follows: The wood then being wet or saturated is passed between two or more surfaces, which squeeze, press, compress, or condense the fibers of the wood in and upon the intercellulose matter, or vice versa, which drives out the moisture, and with it a portion of the intercellulose matter, which is held in suspension in the liquid, and is disengaged from the fibers.

When the fibers of the wood have been relieved from the pressure they are comparatively dry and porous, and expand, returning to nearly their original position. In thus expanding, after the removal of the pressure, the fibers begin to separate from each other and the intercellulose matter, as they are not so firmly held together, owing to an increase of the spaces between the fibers, caused by the displacement of all the particles, the increased elasticity of the fibers, and the absence of some of the intercellulose matter, which was displaced by the first compression and passed away from the fibers. This intercellulose matter is held in suspension by the liquor, is then forced out, and the cohesiveness of the fibers is destroyed.

The liquid used may be any one of the above named, and when the fibers have been released from pressure it rushes in to fill the pores of the wood or fiber as it expands, and assists in this expansion. It further dissolves and washes out the intercellulose matter, and in other ways assists in the disintegration of the fibers when next compressed. The liquid also acts as a cushion to prevent excessive compression of the fibers. This process of alternate pressure and expansion of the fibers has the effect of separating them into strings and makes them elastic, tough, pliable, soft, and keeps them at their full natural length, and is kept up until the proper degree of refining is obtained and all the fibers are separated from the intercellular matter, which runs off in the liquor and leaves only the pure fibers. If the liquid contains alkali it may be saved to be used again by the chemical recovered, or by evaporation and incineration. The fibers, long and pliable, may then be passed, as is customary,