UNITED STATES PATENT OFFICE.

ALBERT H. FISHER, OF BELLOWS FALLS, VERMONT, ASSIGNOR TO A. N. BURBANK, OF LAWRENCE, MASSACHUSETTS.

IMPROVEMENT IN REDUCING WOOD TO PULP FOR PAPER.

Specification forming part of Letters Patent No. **203,437**, dated May 7, 1878; application filed February 21, 1878.

To all whom it may concern:

Be it known that I, A. H. FISHER, of Bellows Falls, in the town of Rockingham, county of Windham, and State of Vermont, have invented a new and useful improvement in the art of reducing wood to fiber or pulp from which paper may be made; and that the following is a full, true, and exact description thereof.

Prior to the date of my invention, wood has been reduced to pulp by subjecting the wood to the action of grinding-surfaces of various forms and of various kinds, the fiber of the wood being acted upon in various directions and manners by the grinding-surface. For instance, wood has been ground upon the periphery of cylindrical and conical grindstones, upon the interior surface of cylindrical or conical grinding-surfaces, and upon flat surfaces like that of a millstone; and it has been submitted to the action of these grinding-surfaces in the manner of the two Voelters, in the way patented by Brooman, and in other ways. Also, prior to the date of my invention, wood had been subjected to the action of steam in closed vessels, to the action of water at a higher temperature than that of boiling, to the action of steam at atmospheric pressure, and to the action of water boiling in open vessels; but the wood was always so treated before it was subjected to the action of the grinding-surfaces. The object of such preparatory treatment of the wood was to save power in grinding, and in some cases either to make a better pulp or a better-colored pulp.

Now, I have discovered a new process, which consists in heating the wood in presence of water by the act and during the process of grinding, by which I produce, as I think, better pulp—pulp finer or more attenuated in diameter, more regular in both length and thickness, a little whiter, and of superior felting quality. At any rate, I am able to use, in making paper from this pulp, a larger percentage of it, in proportion to rag pulp, than has heretofore been possible, and at the same time produce equally good paper.

In the ordinary operation of reducing wood to pulp by grinding, in the several modes and by the various forms and kinds of grinding-surfaces heretofore alluded to, it has been customary to furnish an ample supply of water to the grinding-surfaces, of whatever character they might be, so as to substantially cool down the grinding-surface and the wood to the temperature of the water, or, in other words, to furnish such an ample supply of water as would practically prevent either the wood being ground or the grinding-surface from attaining a temperature substantially higher than the water supplied to the wood and to the grinding-surface.

The friction between the wood and the stone of course develops heat, and there is a tendency to heat up both the grinding-surface and the wood; but this heat was always, so far as I know, prevented from increasing, to any considerable extent, by the presence of an ample supply of running water. Now, I have discovered that this old practice did not produce the best results, and that the true plan is to diminish the usual supply of water and suffer the wood to heat up, in the same way that a piece of steel or iron heats up when ground upon a grindstone insufficiently supplied with water; but care must be taken that the supply of water is so regulated that the wood will not char or discolor. This is the upward limit of the heat, and I find that wood thus heated during the operation and by the action of grinding furnishes, as before stated, a superior pulp.

In the ordinary operation of reducing wood to pulp upon a grindstone, the practice has been to run the stones about as fast as they can be run without danger of bursting. I find it necessary to run them no faster, and can even run them slower, provided the supply of water to the stone be reduced and the wood be fed to the stone so fast that the attrition of the stone and the wood will generate a heat which will heat up the wood and stone above the heat of the water supplied thereto, whether that water be hot, warm, or cold.

In practice, I prefer to use an ordinary grindstone, and to apply the wood thereto Henry Voelter fashion, or in some modification thereof; and as for the rule or standard of supply of the water, I get the best results when the supply is such that steam rises from the wa-

ter at the points where grinding is going on, and the water in the trough below the stone (which has been, of course, cooled in falling) is not below milk-warmth in temperature. This is the apparatus and temperature I prefer; but I do not limit myself to the precise apparatus, nor to the precise mode of submitting the wood thereto, nor to the precise temperature to which the water or wood is raised; but the supply of water must be so short or scanty that it is heated materially by the heat derived from the wood and stone, and not so scanty that the wood chars or dissolves. As far as I can ascertain, the best results are produced when that part of the wood in contact with the grinding-surface is of a temperature about that of or above the boiling-heat of water. I cannot measure the temperature at this point by a thermometer; but I judge by the steam or vapor rising from the stone and wood that the heat is, at the place of contact of the two, about the same or a little above that of the boiling-point of water.

I am not able to give the exact, or any exact, reason why my process is so successful as practice proves it to be. I suppose that the heat existing in the wood at the moment of grinding melts the starchy, resinous, or glutinous matter which cements the fibers together, and permits the stone to drag out fibers nearly approximating to ultimate fibers, instead of dragging out small bundles composed of attached ultimate fibers, as happens when the wood is not subjected to a moist heat during the process and by the operation of grinding. This may or may not be the rationale of my process; but I do know that it produces a more regularly fine pulp, a pulp more homogeneous in the size of its fibers, a good—in fact a superior—felting-pulp, and a pulp a little whiter than is produced when the wood is not permitted to heat up during the operation of grinding by the heat developed during the process of grinding.

Any operator skilled in the usual practice of reducing wood to pulp can work out my process by watching the wood being ground and the supply of water, and reducing this supply until steam or clouds of vapor rise into the air from the surfaces of contact of the wood and the grinding-stone, the operator at the same time being careful not to lessen the supply of water to so great an extent that the wood will char or torrefy or become discolored.

My process does not depend upon the use of any special kind or form of grinding-surface, or upon any special way or manner of applying the grain of the wood to such surfaces, or upon any particular method of feeding the wood so that it may be ground by the stone or other grinding-surface; and

I claim and desire to secure by Letters Patent—

As an improvement in the art of reducing wood to pulp, heating the wood in the presence of water during the process and by the act of grinding, substantially as described.

A. H. FISHER.

Witnesses:

WHITFIELD TERRIBERRY,

THOS. W. HYATT.