S. M. ALLEN.

Manufacture of Paper-Pulp from Wood.

No. 201,083. Patented March 12, 1878.

Fig. 1.

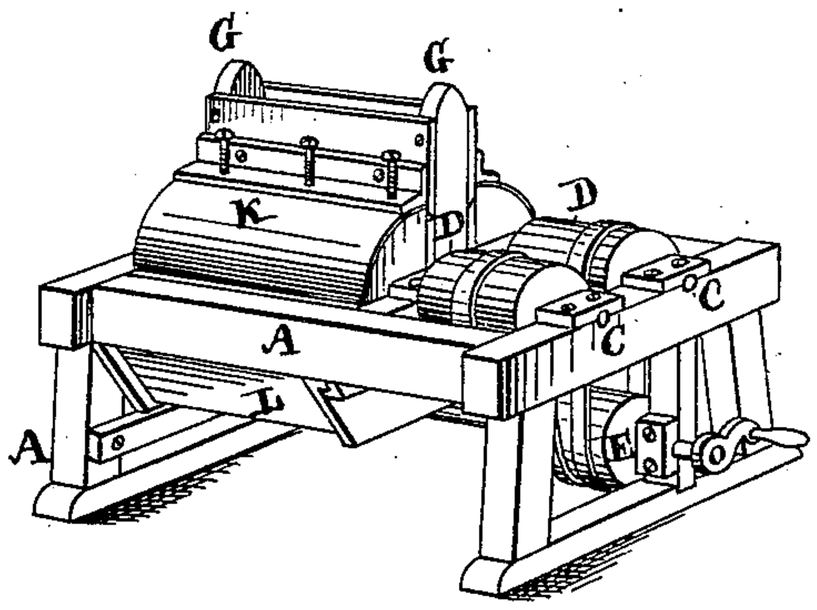


Fig. 2.

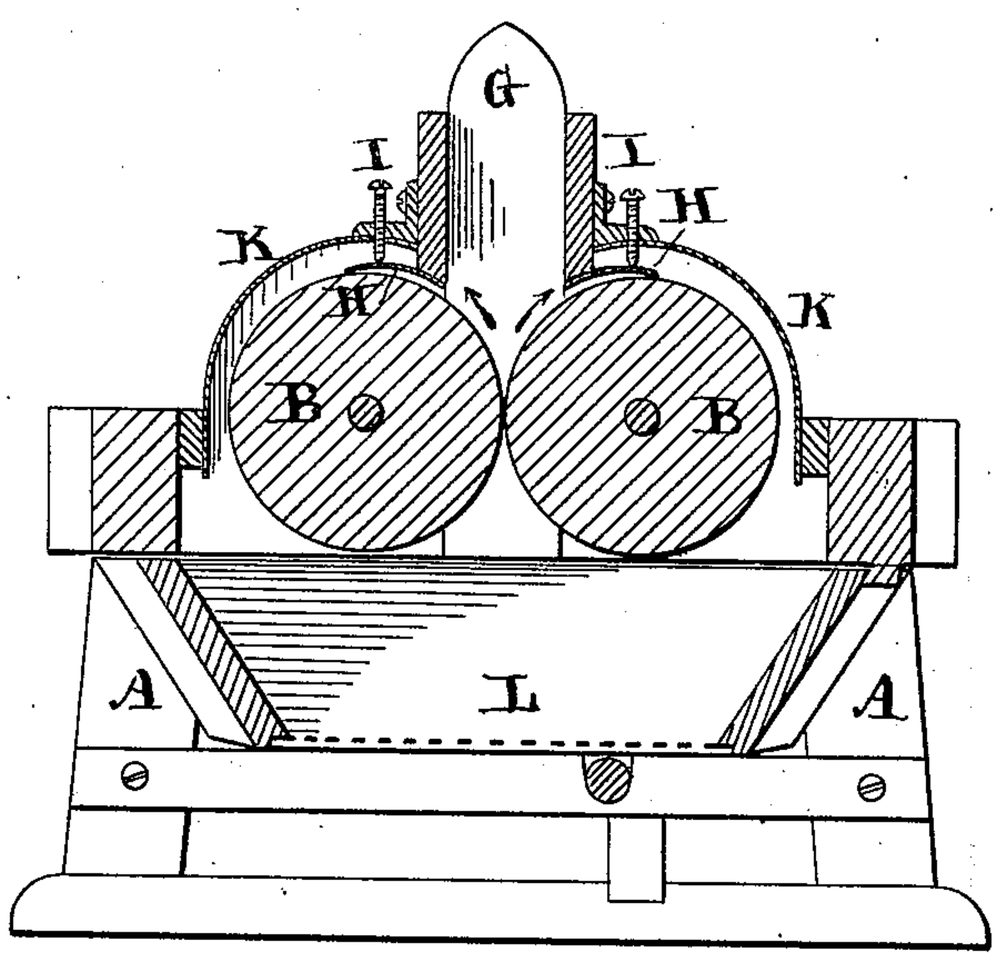
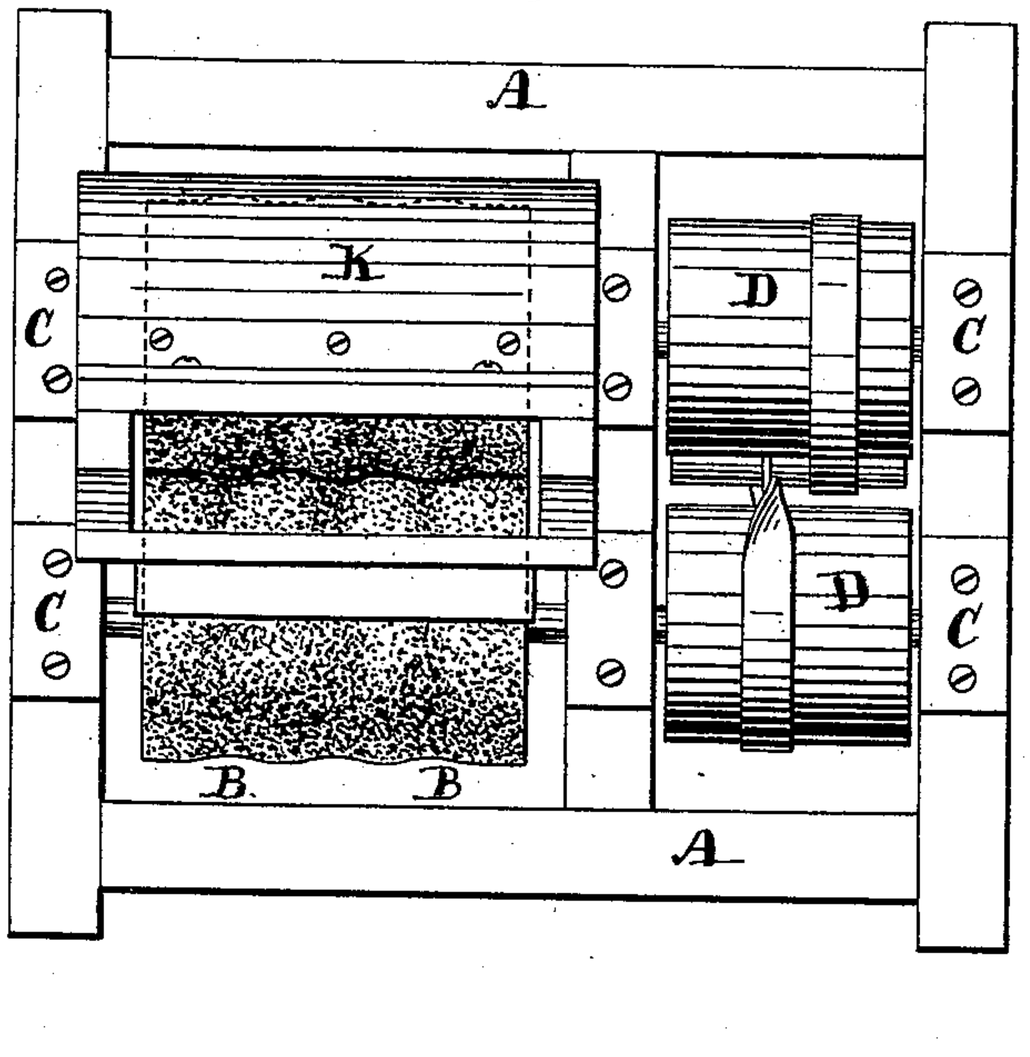


Fig. 3.



Witnesses:

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UNITED STATES PATENT OFFICE.

STEPHEN M. ALLEN, OF DUXBURY, MASSACHUSETTS.

IMPROVEMENT IN THE MANUFACTURE OF PAPER-PULP FROM WOOD.

Specification forming part of Letters Patent No. **201,083,** dated March 12, 1878; application filed December 20, 1877.

To all whom it may concern:

Be it known that I, STEPHEN M. ALLEN, of Duxbury, in the county of Plymouth and State of Massachusetts, having invented a new and Improved Method of Disintegrating, Crushing, and Grinding Wood and other Fiber into Pulp for Paper and for other purposes, in addition to my invention for making wood pulp and paper, dated March 21, 1863, No. 38,020, where special reference is had to crushing and grinding wood between rollers, and in other ways, so as to preserve the integrity of the fiber in a longitudinal direction, and having constructed machinery and a new system of facial grinding of wood into fiber and pulp for the purpose before named, which I desire to have patented, I hereby describe my new machine and the process of grinding and making pulp from woody and other fiber, as follows:

The success of manufacturing paper-pulp and paper from wood must ever be from the proper disintegrating and crushing of the wood fiber without too often cutting it across its axis and flouring the same, or making it so fine as to be without strength when manufactured. The importance of this is fully set forth in my previous patent above referred to.

Any disintegrating, crushing, and grinding machine which does not provide for retaining the length of the fiber within reasonable limits is practically valueless, as good paper can never be made without sufficient length and fineness of the fiber to interlace and bind the sheet together when ready for use. Wood fiber, therefore, must be crushed longitudinally as well as across its diameter within certain limits, according to the nature of the wood, and in the process of grinding must be eliminated and left as long as it is possible to preserve a uniform diameter before it is beaten and run into pulp and paper.

It has been proved by experience that the best way to accomplish this object in most cases and with most kinds of wood is to loosen the fibrils longitudinally so far as possible under laminated cuttings across their axis when grinding, and tear out the filaments from the annual ring deposits upon and with the plane of their strata.

It has been also well established that some kinds of wood filaments separate easier on being steamed or steeped in warm water whenever the same is not held together by albuminous compounds; but where the sap of the same is thin or acidulous, it can thus be dissolved and the fiber best separated when it is warm.

While the length of fiber in crushing wood should be preserved to the highest practical extent, unless provision is made for cutting the same across its length at given distances, there is a limit to which the same can be disintegrated with revolving grinding rollers or surfaces on a plane parallel with the fiber without slivering the wood. In such cases it is too apt to split off in long filaments, which are wasted, and with which other good fiber is also destroyed. This is true of processes heretofore used, where it is claimed that by the system of long parallel grinding-surfaces the integrity of the fiber is wholly preserved, although, in fact, it is not. The character of the grinding in such cases partakes of two extremes—viz., one in making part of the fiber too short from no positive defined point of cutting across its length while being removed from the stick, and thereby flouring the same, owing to the tenacity of its hold, and the other by splitting off long filaments, as before described, which become waste, thus leaving the majority of the fiber used too short and powdered to make good paper.

In processes heretofore used, where the fiber has been cut diagonally across its axis by grinding-rollers, so far as I have been able to judge, the same has been by a too positive and frequent angular cut, thereby leaving the fiber not only very short, but much smaller at the extremity than in the center, being, in fact, egg-shaped, and thus very difficult to "set" in sheet of paper for the want of suction properties.

To remedy these difficulties, as well as to improve my own process, as before named, patented in 1863, I use an indented, fluted, or corrugated grinding-surface, to which the wood or fiber is exposed sidewise by strong contact.

The line of indentation or corrugation being perpendicular, or as nearly so as may be, to the direction of the fiber, a positive cut across the same at short and proper given distances

is secured, whereby the formation of long slivers or bundles of filaments being stripped off the stick, which would be useless, is avoided.

From the peculiarity of the tearing or grinding cut of the corrugated surface, the fiber is left of sufficient length, and is crushed slender and even, and by no means unequal in diameters from points to center. The effect of grinding wood or other fiber upon such a surface is to loosen the same between the points, and more effectually crush them within their confined limits, both transversely and longitudinally, so that, the motion of the face of the grinder having cut the same diagonally or at right angles in certain lengths by alternate projections and recessions across the axis of the fiber, the same is crushed and disintegrated by revolutions over and over till the same is ejected perfect for use.

So far as my experience enables me to judge, an indented or corrugated surface will grind faster and crush and tear out the fiber better than plain grinding-surface, while it presents none of the difficulties that are encountered in the process used for pulping wood where a short angular or diagonal cut across the axis of the fiber is resorted to.

In dressing the grinding-surface I sometimes cross the projecting lines of indentation or corrugation, in which case the fiber is torn off a little more rapidly; but in many kinds of wood this is not necessary.

The size and length of corrugation or indentation that I prefer for ordinary wood-grinding is where the projecting lines from center to center of the parts cross their axis once in about one inch in length of the fiber, while their projections and recessions from an axial line would be about from a thirty-second to a sixteenth of an inch on each side, or the whole depth, though more can be used, if desired.

The best form of machine for grinding pulp, according to my experience, is by two rollers, as hereinafter described, though I do not confine myself to that number, sometimes using but one, and sometimes three or four for the purpose. I also sometimes use, instead of corrugations or indentations, though not often, short-cut starting-lines upon the grinders, which cut off the fiber in like manner while grinding.

The operation of my machine as improved may be understood as subjecting sticks of wood, either round, split, or sawed, to a crushing, tearing, and grinding process between the jaws of two parallel crushing corrugated or indented rollers, upon which the wood is made to bear.

In the accompanying drawing I show my improved machine, Figure 1 representing a perspective view of the whole structure; Fig. 2, a vertical cross-section of the same on an enlarged scale, and Fig. 3 a plan view on the same scale as Fig. 2.

In said drawings, A A is the frame upon two parallel cross-pieces. In suitable journal-bearings C are supported the shafts or journals of the rollers B, to which rotary motion in opposite direction is imparted by pulleys or drums D and belts passing over them, and a third pulley, E, to which power is applied.

The rollers are usually made of stone, but sometimes of some suitable composition or metallic substance, and are made to revolve, as indicated by arrows in Fig. 2, from the upper sides of the wood, which rests upon the cylinder, outward parallel to and as near each other as possible without touching.

The wood to be fibrilized is entered the machine through a hopper or box, G, erected upon the frame on the sides of and over the rollers, so as to direct the wood to be pressed down into the cavity or pit formed between the crushing-rollers, the log bearing upon each, and thereby its face is ground or fibrilized from the outer surface toward the center, the extreme lower point of wood being crushed and ground by contact with both rollers at the same time.

The two grinding-rollers B B are generally between one and four feet long, and in diameter from eighteen to thirty-six inches.

I suit the length and diameter of the rollers to the kind and size of wood to be ground, and the amount of power conveniently at hand for use. These rollers are made to revolve outwardly at any desired speed, but generally from one hundred and fifty to five hundred revolutions per minute. They are hammered or rough-dressed in straight or angular lines across the points or pits of corrugation, approaching the fiber longitudinally, as well as cutting the same diagonally or at right angles as the rollers revolve, in such a manner, either with coarse or fine faces, as shall suit the character of the wood or other fiber to be ground, and produce the desired result.

I prefer to use a follower, which may be a weight or other device, for pressing the wood and keeping it pressed upon the grinding-surfaces, and so that it may be worked up entirely, or nearly so.

The casing-plates H H, extending from the bottom of the hopper partially round the grinding-roll, so confine the pulp by compression that it is reground, if necessary, before passing down and out for use. Set-screws I raise or depress these plates to govern the fineness of fiber made. The metallic screens K K, inclosing the grinding-cylinder, catch the fiber as fast as disintegrated, and the same is carried down by the water-jets to the sieves L, where the coarser fiber is separated from the finer. I apply one or more jets of water to the grinding-rollers from below, which floods the wood when grinding, as also water through the hopper, if necessary.

In conclusion, I would observe that in some instances a single corrugated roller may be used, or such roller in connection with a plain grinding-roller.

Having thus described my process and machine, I would observe I do not claim, broadly, grinding wood by means of rollers, nor do I

claim the use of two rollers, and whether the same revolve in opposite or the same direction; but

What I claim is—

1. Grinding wood or other fibrous substance by means of two grinding-rollers revolving in opposite directions and supporting wood, as described.

2. Grinding wood or other fibrous substance by means of undulating or transversely-corrugated rollers, as and for the purposes set forth.

3. In combination, a feed-hopper arranged over and between the two rolls, with adjustable plates extending partially round the grinding-cylinders, as and for the purposes set forth.

4. The screens or casings, in combination with the rollers, adjustable plates, and hopper, substantially as shown and set forth.

5. In combination, a machine or parts thereof for grinding wood and other fibers, composed of two grinding-rollers, corrugated or indented, as described, with plain or angular dressing on their face, for operation substantially as herein set forth.

In testimony whereof I have hereunto signed my name this 30th day of June, A. D. 1877.

STEPHEN M. ALLEN.

Witnesses:

SUSAN A. WALKER,

HORACE G. ALLEN.