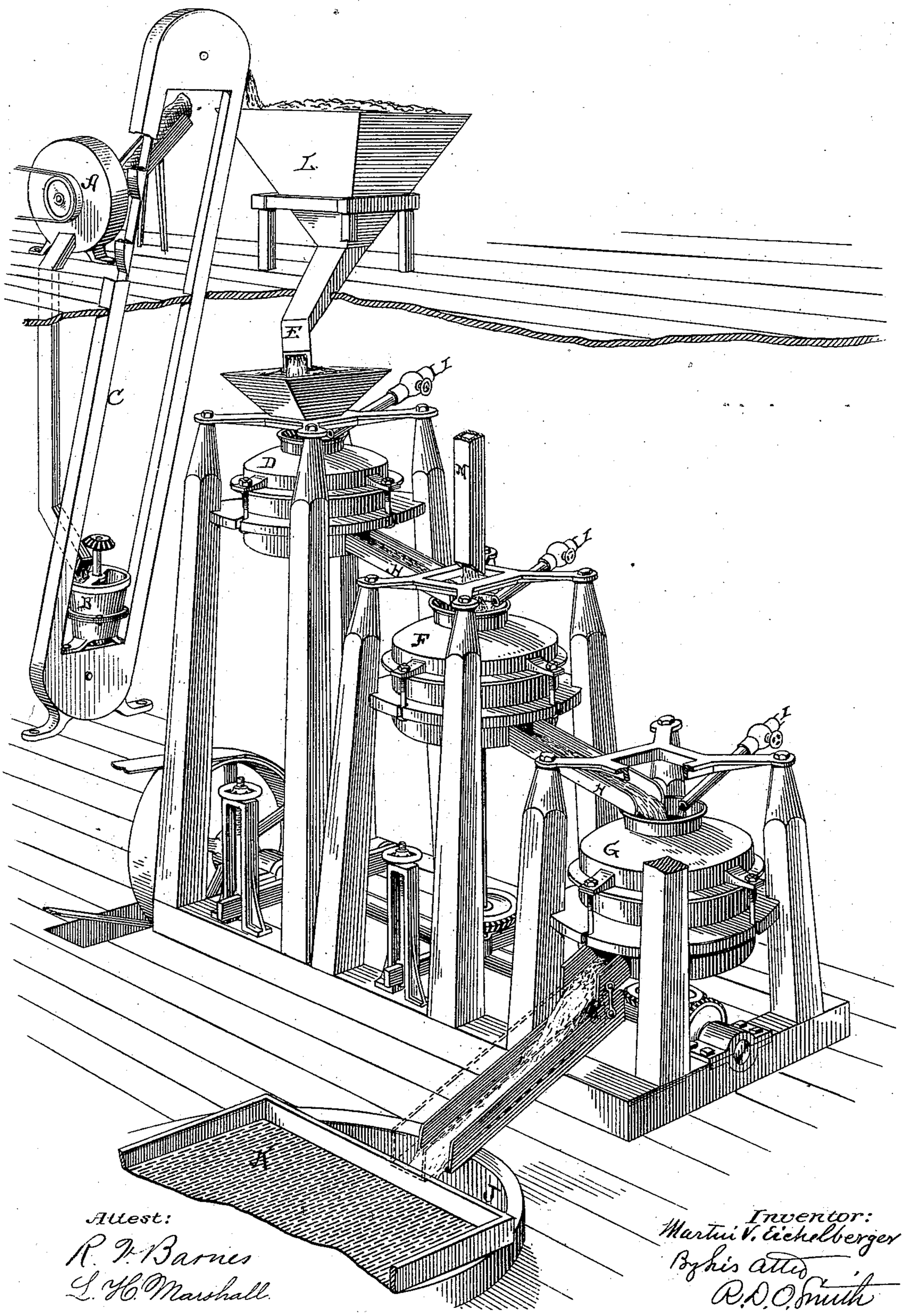
(Model.)

M. V. EICHELBERGER.

Process and Mode of Manufacturing Pulp.

No. 237,839. **Patented Feb. 15, 1881.**



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PROCESS AND MODE OF MANUFACTURING PULP.

SPECIFICATION forming part of Letters Patent No. 237,839, dated February 15, 1881.

Application filed December 15, 1880. (Model.)

To all whom it may concern:

Be it known that I, MARTIN V. EICHELBERGER, of Dayton, in the county of Montgomery and State of Ohio, have invented new and useful Improvements in the Mode and Process of Manufacturing Pulp from Wood, Straw, or other Fiber, Vegetable or Animal; and I do hereby declare that the following is a full and exact description of the same.

Pulp from wood and other vegetable fibers has been made by both chemical and mechanical treatment. To the former no further allusion need be made, because it is entirely foreign to my invention. I will, however, briefly indicate the principles involved in the mechanical treatment of wood as heretofore practiced to reduce the same to pulp, in order to clearly distinguish said modes of treatment from my improvement.

In referring herein to mechanical processes for making pulp from vegetable fibers it is to be understood that natural fibers, such as cotton, or fibers already reduced, such as linen, are not referred to, reference herein being confined to fiber in the natural or crude condition at the time of commencing the process of gradual reduction herein described.

I am not aware that pulp has ever been made by purely mechanical means from sawdust, straw, grass, or other of the fibers, vegetable or animal, excepting wood in blocks or chips. My process is applicable to fibers other than wood; but for convenience I will confine my description to the reduction of wood to pulp without designing to confine myself thereto.

Hitherto in reducing wood to pulp the process has consisted in tearing or cutting the wood by means of grinding-stones. Sometimes logs or bolts were applied to the grinding-surface, and sometimes the wood was previously cut into small blocks or pieces by saws, knives, &c. In direct grinding from the log the wood has been applied with the end grain to the grinding-surface, and also with the end grain oblique to or parallel with the grinding-surface. In the first and second named the wood was ground to dust, the fiber being cut so short as to be destroyed and rendered practically worthless, except as a filling or shoddy for paper. In the third-named case the fibers were torn out in more or less unequal masses, greatly varying in length. To obviate this disadvantage the fibers so torn out were subjected to a regrinding by being required to pass between the grinding-stone and other blocks of wood likewise undergoing the grinding process. By this process the fiber which was torn from the first block in the series was successively passed under the remaining blocks of the series, and was discharged in company with the fibers derived from each of said succeeding blocks. These fibers, having undergone less regrinding according to the remove from the terminus of the series, when finally discharged, exhibited as many grades as there were blocks, and it was therefore necessary to separate and sort out or grade the fibers for different uses, according to grade. In all these modes it was necessary to press the block against the grindstone with great force, and even though water may have been employed to facilitate the abrasion the great pressure of the block upon the stone excluded the water and made the process one of dry-grinding with a large percentage of useless waste in the form of dust.

Other machines have been employed wherein the wood was presented in a coarsely-comminuted form, as in chips and small blocks, and ground between stones or other grinding-surfaces. I am aware on these grinding-surfaces the dress has become finer toward the discharge; but it does not follow from that, that the product was all reduced to a uniform grade, because it is evident that, whereas some of the product would be of the desired fineness, other portions of it would be as coarse as could possibly pass from the grinders; and it is also evident that in the constant forcible feed of these grinders, wherein the entire reduction takes place at a single continuous operation, the coarser parts would be continually crushed down and the fibers more or less broken, and, being in company with the fibers already separated and sufficiently reduced, these latter will be still further reduced and broken. In all these wood-grinders, however, so far I am aware, the process has been rapid and has been finished at a single operation, and in this is

the essential difference between the methods of grinding heretofore in use and the method of gradual reduction which forms the subject of this patent.

The preservation of fiber in its natural condition is the prime object in the manufacture of wood pulp, and it appears evident that the more rapid the action of a disintegrating agent the more violent and destructive it will be, and the greater will be the percentage of waste in the form of useless dust. The evolution of heat in the process of rapid reduction is also injurious, and has heretofore been counteracted by the employment of undue quantities of water, the subsequent separation of which was attended with further waste of fiber.

My invention obviates all the disadvantages above mentioned through the medium of gradual reduction or reduction by several successive stages, each producing a uniform product and complete in itself. By these means the fibers are treated more gently and removed as fast as separated, so that the exterior fibers of a mass are not crushed and broken up by the force necessary to crush down and immediately separate the interior fibers; and it therefore consists in the mode or method of reducing wood, straw, or other crude fibers to pulp by a series of successive reductions, whereby the fibers are gradually separated and reduced.

That others may fully understand my invention, I will more particulary describe the process and the apparatus whereby it is made effective, having reference to the accompanying drawing, in which is represented in perspective an apparatus adapted to my process.

The wood is first divested of the bark and roughly reduced, by saws or knives, in a machine which, for illustration, is represented at A, and is then broken up by some suitable machine, such as a bark-mill, shown at B. By these means the wood is reduced to particles—say of the size of kernels of corn—and without any material disturbance of the fibers. The cutter A and mill B have a capacity many fold greater than the reducers, and it is therefore convenient to store the wooden grains in a bin, L, which may be located at any desirable or proper place. If on a higher level than the mill B, then the wooden grains may be transported and delivered into said bin by an elevator, C, to be drawn away and fed to the first reducer, D, by means of a chute, E, as required.

When referring herein to the reducers I do not include the machines A B, because these machines, while necessary, are preliminary in their function, and do not disturb the fibers to any great degree. Their operation may be entirely disconnected, both as to time and place, and do not enter intimately into the continuous part of the process whereby the fibers are actually gradually separated and reduced.

From the storage-bin L the wooden grains are fed to the first reducer, D, and are rubbed by passing with a small stream of water between stones of said reducer D, which have a very coarse dress of deep furrows and narrow faces, and are thereby reduced to a pulpy mass of coarse strands or fibers mixed with water. From the first reducer this pulpy mass is conducted to the second reducer, F, wherein the stones are set closer and have a finer dress, and the pulpy mass suffers further separation and reduction as to fineness of the fibers. In like manner it may be passed through a third reducer, G, of still finer dress, and, if desired, the reduction may be carried still further by passing successively other reducers; but in practice no more than three reducers are usually required.

It will be observed that there is no violent cutting action of the stones upon the wood-fibers, but a pressing and rubbing action which rolls the fibers over each other and effects their gradual disintegration without cutting or breaking them. This also takes place in company with water, which softens the fiber and is not excluded by the pressure applied to the material under treatment. The product is practically of uniform quality as it leaves each reducer, and for the production of pulp for any special purpose the reduction may be stopped at any stage desired.

In the foregoing description, for convenience, I have referred to stones as being the active reducing agents, because I have found burr-stones to be well adapted to the successful application of the process; but I do not propose to limit myself to the use of stones, because artificial stones or other materials may be successfully substituted.

In practical working the reducers will be placed in successive order, one on a lower level than the preceding, so that the pulp will travel by gravity from one to the other successively; but this is an economic arrangement and not a necessary one, because a similar result will be accomplished if the pulp is gradually reduced in disconnected mills and at irregular intervals of time. In the economic arrangement shown the pulp travels from one reducer to another through an open trough, H, so that the attendant can momentarily inspect it and be immediately apprised of any irregularity in the feed or reduction.

If desired, hot water may be supplied through the water-pipe I to the first reducer, or a bleaching-fluid may be introduced by said pipe.

Ordinarily water need only be admitted at the first reducer; but water-pipes ought to be provided for introduction of water at the succeeding reducers, if required.

When sawdust is employed it may be fed from a separate bin through a spout, M, and introduced at the second reducer, E, because the dress of the first reducer is so coarse that it will have little or no effect upon sawdust.

If any of the pulp passed through the reducers is found to be insufficiently reduced, it may be returned for re-reduction.

From the last reducer of the series the pulp may be discharged into a vat, J, from whence

it may be removed to the "wet-machine," wherein it is partly drained of its water and formed into sheets of convenient size and thickness for commercial purpose.

It is sometimes necessary to temporarily separate the stones in the last reducer to relieve them from clogging matter, and in doing so a quantity of pulp will be passed without reduction therein. To prevent the contamination of the mass in the vat with this coarser pulp a screen, K, is temporarily employed to arrest the coarse pulp, so that it can be returned to the reducer above.

I have herein referred to the dress of the stones; but I do not propose to include that in this patent, because I propose to make it the subject of a subsequent patent.

Having described my invention, what I claim as new is—

1. The herein-described mode and process of making pulp from vegetable or animal fiber, which consists in the gradual reduction of said fiber by a consecutive series of rubbings between moving surfaces of progressively finer dress, substantially as set forth.

2. The herein-described mode and process for the gradual reduction of fiber, vegetable or animal, to pulp, which consists in first roughly comminuting the substance without material disturbance of the fibers, and afterward subjecting them to successive rubbings between surfaces progressively of finer dress, whereby the fibers are separated without breaking them up into dust.

3. In the manufacture of pulp from fiber, animal or vegetable, a series of instruments consisting, essentially, of a cutter, A, a mill, B, and reducers D F G, or their equivalents, arranged in consecutive order, so that as the fiber passes through them it will be treated successively and reduced to pulp, substantially as set forth.

4. A series of reducers, D F G, &c., each consisting of a pair of burr-stones or their equivalents, each succeeding pair being finer in dress, so that as the fiber passes through said reducers it will be successively reduced finer in grade, substantially as set forth.

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Witnesses:

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