M. R. FLETCHER.

Apparatus for Making Pulp or Paper Stock from Wood, &c.

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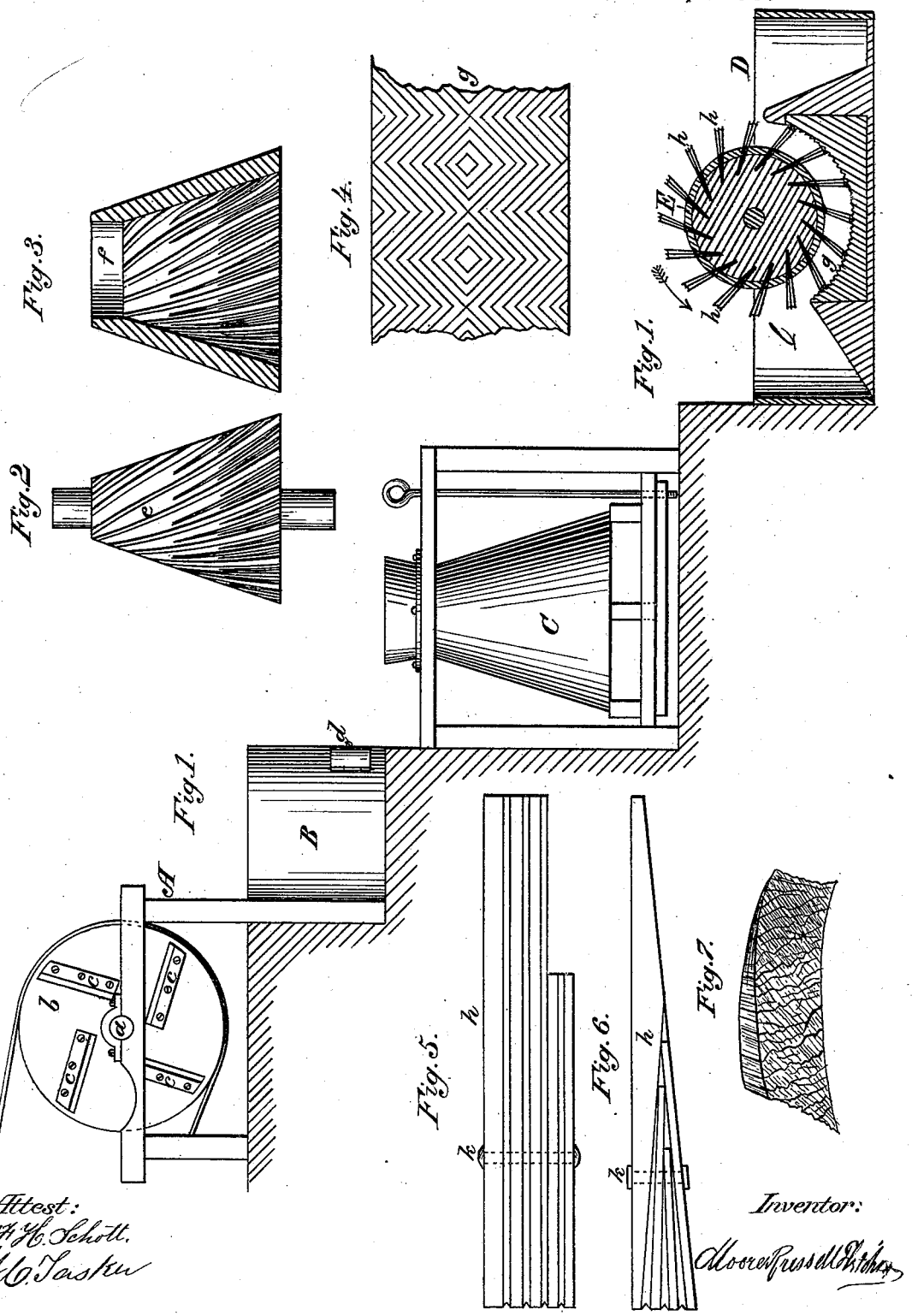

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IMPROVEMENT IN APPARATUS FOR MAKING PULP OR PAPER-STOCK FROM WOOD, &c.

Specification forming part of Letters Patent No. **196,515**, dated October 23, 1877; application filed October 10, 1877.

To all whom it may concern:

Be it known that I, MOORE RUSSELL FLETCHER, of the city of Concord, county of Merrimack, and State of New Hampshire, have invented a new and useful Improvement for Converting Fibrous Vegetable Matter into Paper Stock or Pulp; and I do hereby declare the following to be such an exact description of the same as will enable others skilled in the art to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, similar letters indicating corresponding parts in the different figures, of which—

Figure 1 shows the arrangement of a series of machines consisting of the machine for cutting the material into shreds or shavings, followed by the digesting-tank, so placed that the stock from the cutting-machine is easily discharged into this tank, which is followed by a mill, which further reduces the fiber, and is in turn followed by a pulping-engine, which reduces the material to a proper consistency to be used as paper-stock, or any of the various uses to which such pulp may be applied. Fig. 2 shows the conical serrated runner of the grinding or crushing mill. Fig. 3 represents a sectional view of the case by which the runner is inclosed. Fig. 4 is a partial plan view of the corrugated concave bed-plate used in the pulp-engine. Fig. 5 shows the arrangement of the plates in each blade. Fig. 6 represents a modification of the same. D, Fig. 1, shows the arrangement of the blades in the pulp-engine roll and their adaptation to the bed-plate; and Fig. 7 shows one of the shreds or shavings of wood produced by the cutting-machine.

The object of this invention is to reduce the cost of producing pulp or paper-stock from fibrous vegetable matter, and at the same time furnish as good or a better article than has been heretofore produced by the machines and processes in common use for that purpose; and the invention consists in the construction of the machines and the various steps of the process, as will be hereinafter fully set forth, and then specifically pointed out in the claims.

The materials adapted for making pulp or paper-stock by my improved apparatus are wood and other vegetable substances of a fibrous nature.

For working wood, I construct a machine for making shreds or shavings rapidly, which are peculiarly adapted for after treatment, in the following manner: I make a frame, A, of wood or iron, about two and a half feet high, four and a half feet long, and from one and a half to two and a half feet wide. On this frame I arrange an iron shaft, *a*, three or more inches in diameter, carrying a suitable driving-pulley or other mechanism for producing rotation, and on which, near one side of the frame, is attached an iron cutter-head, *b*, from two to four feet in diameter, and half an inch or more in thickness, and provided with openings or slots, in which are securely fastened two or more knives or blades, *c*, which are made adjustable to regulate the thickness of the shaving desired by means of set-screws. They are also so arranged on the cutter-head that they cut from the outer end of the blade toward the inner end, and are adapted to cut shavings varying in thickness from one-eighth of an inch to an inch. The piece of wood to be reduced to shavings is held against the cutter at an angle, so that the shavings are cut shearing from the stick.

Near the cutter-head on the same shaft may be attached a balance-wheel of from four to five feet in diameter, and of sufficient weight to overcome the resistance of the material to be cut. The cutter-head, balance-wheel, and pulley may be cast all in one piece; but I prefer to make them in separate pieces and securely attached to the shaft *a*. The pulley may be made of any diameter and width of face desired, ordinarily of four to eight inches face, and of a diameter equal to one-half of the diameter of the balance-wheel.

I take any kind of forest trees, in cord-wood dimensions for ease in handling, and hold one end against the cutter-head and apply pressure by the hand or otherwise. As the cutter-head revolves the shavings are cut diagonally to the grain from the end of the stick, and from the position in which the stick of wood is held the fibers of the shaving are much longer than its thickness. These shavings, having been cut by a thick knife or blade, are shattered or broken, as seen in Fig. 7, by which they are peculiarly fitted for after treatment.

In making pulp or paper-stock of fibrous

material it is of great importance to have all the fibers of uniform length. This result is secured by my method of cutting the shavings.

The second part of my process consists in reducing cane-brakes, palm, palmetto, and other fibrous shrubs of coarse growth to a condition convenient for handling, which is done by passing them between rollers, thereby reducing them to a state in which they may be passed through a hay or rag cutter of ordinary construction.

The shavings or other stock for treatment are put into the tank B, Fig. 1, which is filled two-thirds full of water, in which are dissolved and thoroughly mixed (say, for every ton of stock) ten pounds to fifty pounds of soda-ash, or from six pounds to thirty pounds of potash, with from two pounds to five pounds of chloride of lime, or slake from half a bushel to a bushel and a half of fresh lime with from three pounds to eight pounds of chloride of lime, according to the kind of stock under treatment and the quantity of pulp to be made.

I use either of the above alkalies or their equivalent separately in varied proportions, having ascertained that the bond of union in vegetable matter is more speedily and successfully broken down or softened by weak alkalies under a low degree of heat than by caustic or strong alkalies applied under pressure with higher temperature.

The resinous stocks require stronger alkalies and longer cooking or steaming than the non-resinous.

I use alkalies varying in strength, from one-eighth of one degree to one and one-fourth degree.

In the treatment of non-resinous stock—either wood, straw, corn-stalks, or shrubs—the chloride of lime may be omitted with equal results.

I do not require causticity of alkali for softening resinous, albuminous, silicious, or nitrogenous matter, as is ordinarily used. A cover is provided for the tank, to confine the heat, which is added slowly by steam or otherwise, until it reaches 130° or 140°, and kept at that point from two to four hours. The heat may then be increased to the boiling-point, and kept there for six hours, or longer, according to the kind of stock under treatment.

The liquid is then removed, and may be used several times by adding a little more chemicals.

The stock is then removed through a door in the tank *d*, and passed through a grinding or crushing machine, C, constructed as follows: This machine is made of a male cone, *e*, and female cone or case *f*, with grooves cut close together, or elevations on both the male and female cone, and extending diagonally from the top to the lower edge, so that the motion of the male or inner cone, in its revolutions, will tend to carry the fiber along their course through the machine.

The last part of my process consists in passing the material through the pulp-engine D. The bed-plate of this pulp-engine is from thirty-six to forty inches, or more, wide, instead of six or eight inches, ordinarily used. I make it of iron or steel plates, from one-eighth of an inch to half an inch in thickness, with lead, leather, or other hard substance between every two of them. I also make it of stone, that will not readily polish in water. I also make it of chilled cast-iron, with corrugated elevations about one-third of an inch high, and one-third of an inch apart, extending over the entire surface of the bed-plate in a zigzag form from the riser nearly to the back-fall.

The stone bed-plate is grooved in a manner to represent the plates, or cast-iron elevations, as seen in the drawing.

The peculiar construction of this bed-plate or zigzag arrangement of the corrugations insures equable wear of the blades in the roll, as well as the more speedy and perfect reduction of the material operated upon, the angles in the corrugations being so diversified over the whole surface of the plate that the wear upon the blades is equal at all points, while those bed-plates having their angles arranged on lines from the riser toward the back-fall, crossing the blades at fixed points, will soon wear depressions in and greatly injure the blades.

The bed-plate is placed in its position by removing the midfeather and adjusting it from the inside of the tub.

For the pulp-engine E, I make the blades thick on their outer edge, and also of three or more plates of iron or steel in each blade, with lead or other hard substance between every two of them, as seen in Figs. 5 and 6, and securely fastened by rivets *k*.

My roll is secured upon a shaft of iron in the ordinary manner, with iron heads and center, but with the grooves for holding the blades in their position on a slant backward from the center of the roll. These blades are confined in the roll in the ordinary way by iron hoops *l*.

As the blades *h* are composed of several plates, and pass over the bed-plate thirty-six or forty inches wide, with elevations or grooves about three to the inch, every plate in each blade is made to press upon or rub over every elevation or groove on the bed-plate; and it is clearly evident that the rubbing or disintegrating is more extensive and perfect than can be done by the single blade over the ordinary narrow bed-plate.

I am aware that it is not new to make paper-pulp from shavings or cuttings of wood, and other fibrous materials, digested under great pressure and heat in caustic alkali. Neither is it new to reduce these fibrous materials to pulp in an ordinary rag-engine. These I do not broadly claim; but

What I do claim as new, and desire to secure by Letters Patent, is the following:

1. A cutting-machine for reducing wood to

shavings for making pulp, consisting of a disk or cutter-head provided with adjustable knives placed obliquely to its radius, in combination with the devices shown for imparting rotation thereto, substantially as specified.

2. In the manufacture of pulp or paper-stock from wood or other fibrous material, the digesting-vat in which the material is treated, in combination with the grinder and pulping-engine, all constructed, arranged, and operating substantially as and for the purpose specified.

3. In a pulping-engine, the removable bed-plate, provided with a series of corrugations, arranged in the manner herein shown and described, in combination with a rubbing or grinding roll, substantially as specified.

4. In a machine for making pulp or paper-stock, the disintegrating or rubbing roll, provided with blades, consisting of a series of parallel plates secured together, having layers of lead or leather interposed between them and set in the roll obliquely to its radius, substantially as shown and described.

5. The combination of devices for making pulp or paper-stock from wood or other fibrous material, consisting of shaving-cutter, digester, crusher, and pulp-engine, all constructed and operating in the manner and for the purpose herein set forth.

In testimony that I claim the foregoing as my own invention I affix my signature in presence of two witnesses.

MOORE RUSSELL FLETCHER.

Witnesses:
J. C. TASKER,
FRED. E. TASKER.