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W. N. CORNELL.
PROCESS OF UTILIZING WASTE PRODUCTS FROM THE
MANUFACTURE OF PAPER.
APPLICATION FILED FEB. 18, 1903.

NO MODEL.

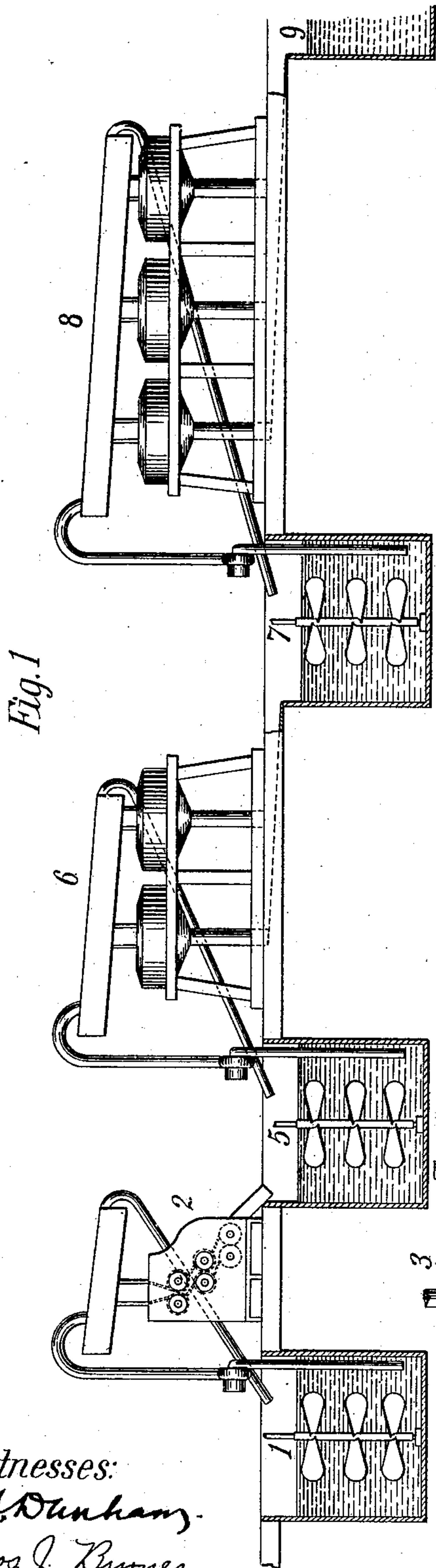


Fig. 1

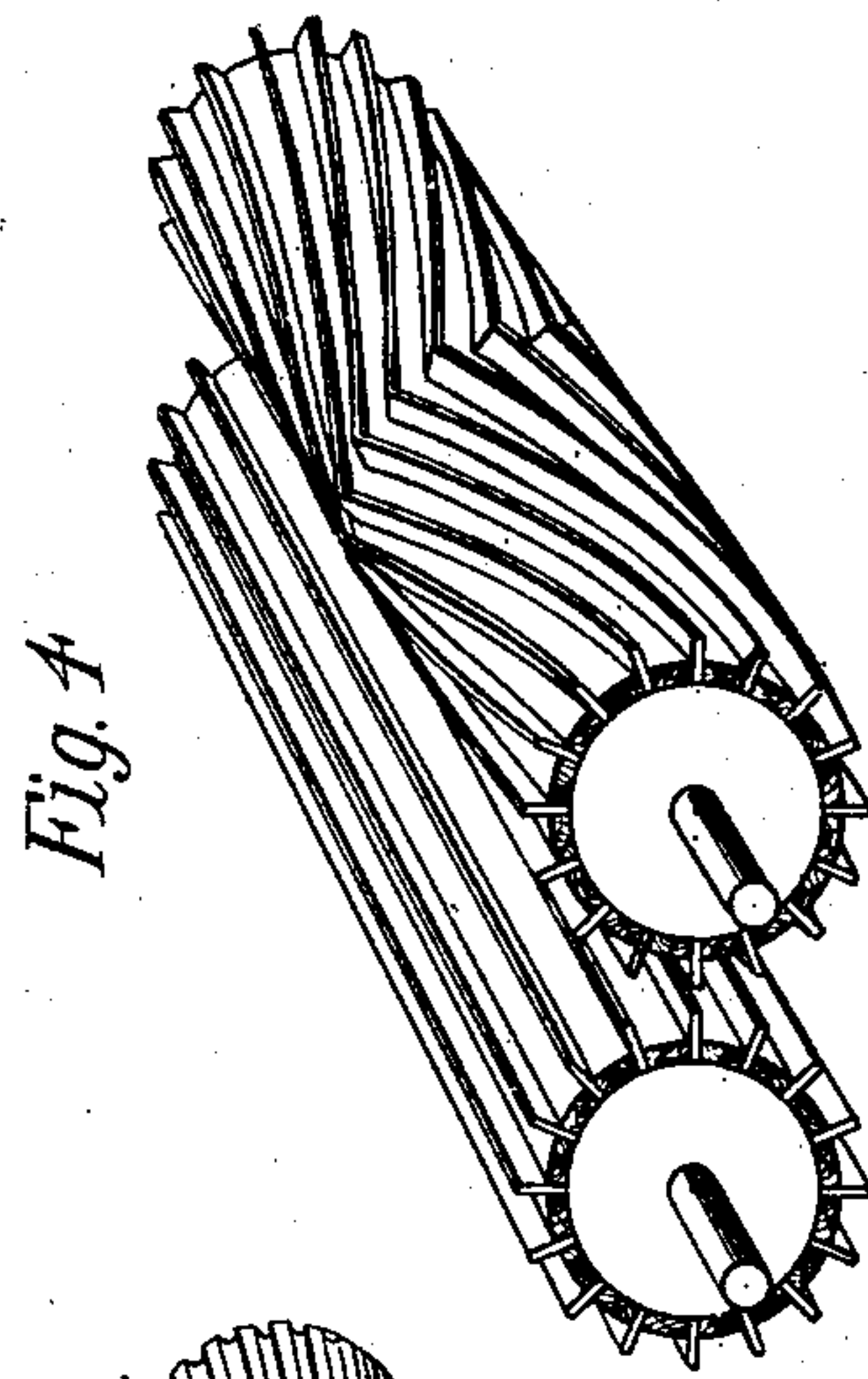


Fig. 4

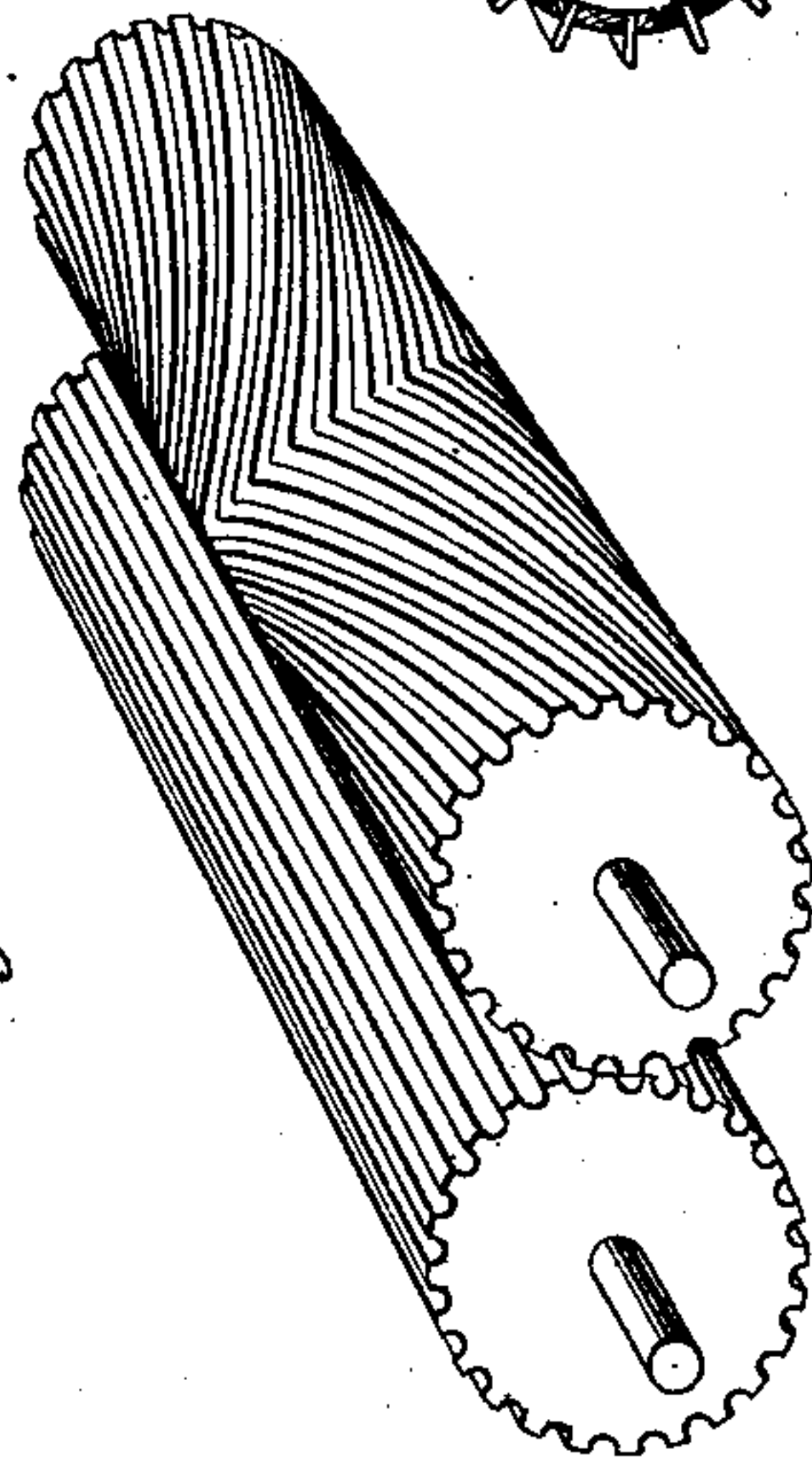


Fig. 3

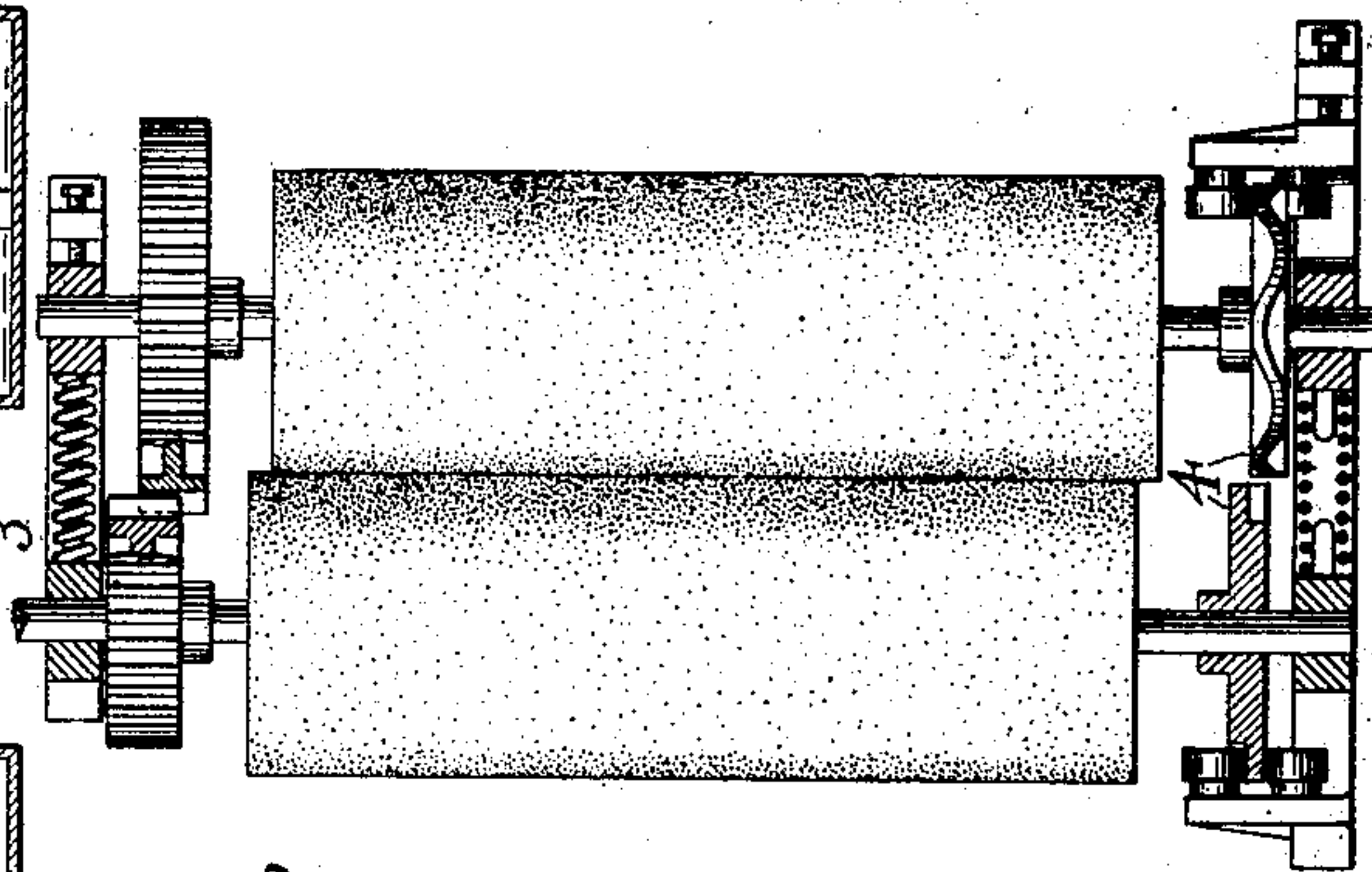


Fig. 2

Witnesses:
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UNITED STATES PATENT OFFICE.

WILLIAM NORRIS CORNELL, OF MASSENA, NEW YORK.

PROCESS OF UTILIZING WASTE PRODUCTS FROM THE MANUFACTURE OF PAPER.

SPECIFICATION forming part of Letters Patent No. 756,214, dated April 5, 1904.

Application filed February 18, 1903.

Serial No. 143,887. (No specimens.)

To all whom it may concern:

Be it known that I, WILLIAM NORRIS CORNELL, a citizen of the United States, residing at Massena, county of St. Lawrence, State of New York, have invented a new and useful Process of Utilizing Waste Products from the Manufacture of Paper, of which the following is a specification, reference being had to the drawings accompanying and forming part of the same.

My invention relates to methods of reducing coarse wood particles to a condition of pulp, irrespective of how such coarse particles were originally produced; but its chief object is to utilize for making paper, paper-board, or similar product, the "screenings" which, being too coarse to pass through the screens into the stock, are disposed of as mere waste without value. The final product of my process is intended to be a paper-stock at least equally as good as the stock from which the screenings were originally separated. The method of making the stock, however, is radically different. In fact, in an experience in the paper industry extending over many years I have never known a process similar to mine used either for the same or an analogous purpose. The process as a whole is new so far as I am aware, as also are certain of the individual steps which together constitute the same.

It should first be understood that the task of making paper-stock from coarse wood particles varying in size from those just too large to pass through the meshes of the screen to others of many times that diameter presents difficulties not met in producing stock from large blocks of wood. In the latter case the blocks can be conveniently and easily held with the grain in the proper direction and the greater part ground to almost any degree of fineness and afterward further reduced, if necessary, by a beating-engine or other suitable means. Mere particles of wood, however, cannot be held and ground in the ordinary way, and screenings having already been passed through a beating-engine or equivalent machine cannot be further reduced by such means. I have therefore been led to devise the present invention, which may be de-

scribed as follows: The first step of the process is to separate the fibers from each other with as little transverse breakage as possible, so that the final stock will be composed of comparatively long fibers instead of short bits. The most suitable way of accomplishing this disintegration of the particles is to crush them, at the same time accompanying the crushing effect by a slight drawing action. The result is that most of the fibers are separated without being broken. Since the drawing is always in the same direction with reference to individual particles, practically only those will be broken transversely which are presented with their fibers lying substantially in with the direction of the drawing action. At the end of this step the fibers will be found separated or the particles flattened out and the fibers only very slightly connected together. In the former case I do not wish to be understood to mean that each individual elementary fiber is freed from the adjacent fibers, but rather that the most of them are in minute bundles of several fibers each and are either small enough to be pulped immediately or but comparatively little larger than the proper size for the stock. If the material is not in condition for the stock, either because the component particles are too large or have not been well separated from each other, it should be again reduced, this time preferably by a grinding or rubbing action continued until the particles are fine enough for the purpose desired. If the original particles after being crushed and drawn are not small enough even for proper reduction by grinding, it may be necessary to again subject the material to crushing and drawing and then to grind or rub it down. In fact, I have found that these last-mentioned steps are in most cases necessary for best results, and accordingly it is desirable not to attempt to produce the entire reduction by one step to put the material in condition for pulping or even for grinding, but instead to first give it a preliminary crushing and drawing with comparatively slight resulting reduction, then to one or sometimes more similar treatments before it is subjected to the grinding or rubbing. I have also found it necessary in some instances

to repeat the last step—the grinding or rubbing—a number of times before the material is brought to the proper condition of fineness.

I have devised a number of forms of apparatus for conveniently practicing the process described above, and of these I illustrate in the accompanying drawings the apparatus which has been found to perform the various steps in the most satisfactory manner.

Figure 1 shows the entire apparatus diagrammatically, partly in section. Fig. 2 shows the first set of rolls in detail, and Figs. 3 and 4 the succeeding rolls.

In carrying out the process with this apparatus the screenings or other material are mixed with water and pumped or otherwise withdrawn from the tank 1 into the machine 2. The latter has a series of roll-sets between which the material passes successively. The first set is preferably made of sandstone, dressed smooth. The surface of each roll, however, being necessarily incapable of taking a polish is therefore slightly rough, due to the grain of the stone. They are preferably mounted in movable bearings 3 for ready adjustment toward or from each other, so that any desired degree of crushing action may be produced. In order to secure a simultaneous drawing effect, one roll may be geared to rotate faster than the other, or one or both may be given an endwise vibration—as, for example, by means of the face-cams 4 and coacting mechanism shown in Fig. 2. The second set of rolls are also, preferably, of sandstone; but instead of being smooth are corrugated—as, for example, in the manner illustrated in Fig. 3. They should be mounted in adjustable bearings and rotate at different speeds with an endwise vibration as the former set. The third set of rolls are intended to effect the third and what under ordinary conditions would be the final step of reduction. The rolls themselves are preferably constructed in a manner similar to the well-known “Jordan” engine, but have a crushing and drawing action analogous to the other rolls, though preferably not to the same extent, since the material by the time it has passed through the first two sets is very nearly fine enough for the stones and needs only slight further reduction. The rolls are made with blades or bars, as shown, projecting above the surface. The bars may be of iron, with wooden slats or bars between them. The latter when soaked with water swell, and thus bind the blades and hold the same secure in position. These rolls should be mounted in adjustable bearings like the others and should of course be rotated at different speeds. They need not, however, be reciprocated like the others.

From the foregoing it will be evident that the raw material as it is fed into the machine 2 will first be given a preliminary crushing and drawing, the extent of this action being determined at will by the nearness of the rolls

to each other, the difference of their speeds, and the extent and rapidity of their endwise vibration. In passing through the second set the material is again crushed and drawn, the extent of the action being determined as before. The step performed by the third set is generally sufficient to put the material in condition for the grinding or rubbing. From the machine 2 the partly-prepared material is discharged into a tank or vat 5, where it may be thoroughly stirred to mix intimately with the finer particles. The coarser bits which may have escaped the rolls or not have been fully acted upon. From this tank it is conveyed to the millstones 6 to be ground, as before described. The stones are preferably of the under-run type and may be dressed in the ordinary manner or specially, according to the needs of a particular case. For the purpose of applying this step to large quantities of material at one time I provide a number of sets with conduits communicating with the same hopper, so that a part of the material runs into each. From the first group of stones 6 the stock is discharged into a tank 7, where it may be stirred and mixed, as in the other vats, and from thence is conveyed to another group of stones 8, where the rubbing and grinding is repeated until the material is brought to the proper degree of fineness and discharged into the tank 9. Here it may be stirred again and finally run out on to the screens, as in the usual process of paper-making.

The foregoing description of process and apparatus is sufficient to enable persons skilled in the art of paper manufacture to practice my invention with satisfactory results. It should be understood, of course, that under varying conditions the various steps must be modified, as in extent or duration of operation, to secure the best results; but such changes are entirely within the skill of the expert, and I therefore do not consider them outside the scope of my invention.

What I claim is—

1. The herein-described process of reducing to pulp the waste product known as screenings, which consists in subjecting the screenings to a crushing and drawing action, and then to a grinding or rubbing action, for the purposes set forth.

2. The herein-described process of reducing to pulp the waste product known as screenings, which consists in subjecting the screenings to a plurality of crushing and drawing actions, then to a grinding or rubbing action, for the purposes set forth.

3. The herein-described process of reducing to pulp the waste product known as screenings, which consists in preliminarily crushing and drawing the screenings, crushing and drawing them again, and finally grinding or rubbing the screenings to further reduce them to the desired size, for the purposes set forth.

4. The herein-described process of reducing
to pulp the waste product known as screen-
ings, which consists in preliminarily crushing
and drawing the screenings, crushing and
5 drawing them again, crushing and drawing
them a third time, thoroughly stirring the
crushed screenings in a liquid, grinding or
rubbing the screenings, stirring them again
in the liquid, and again grinding or rubbing
them, substantially as and for the purposes so
set forth.

WILLIAM NORRIS CORNELL.

Witnesses:

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