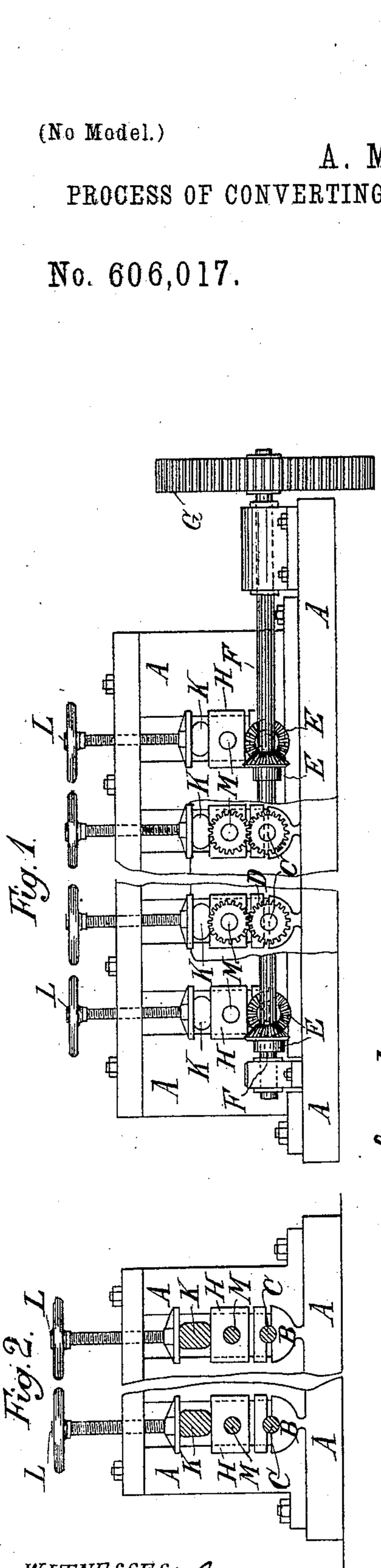
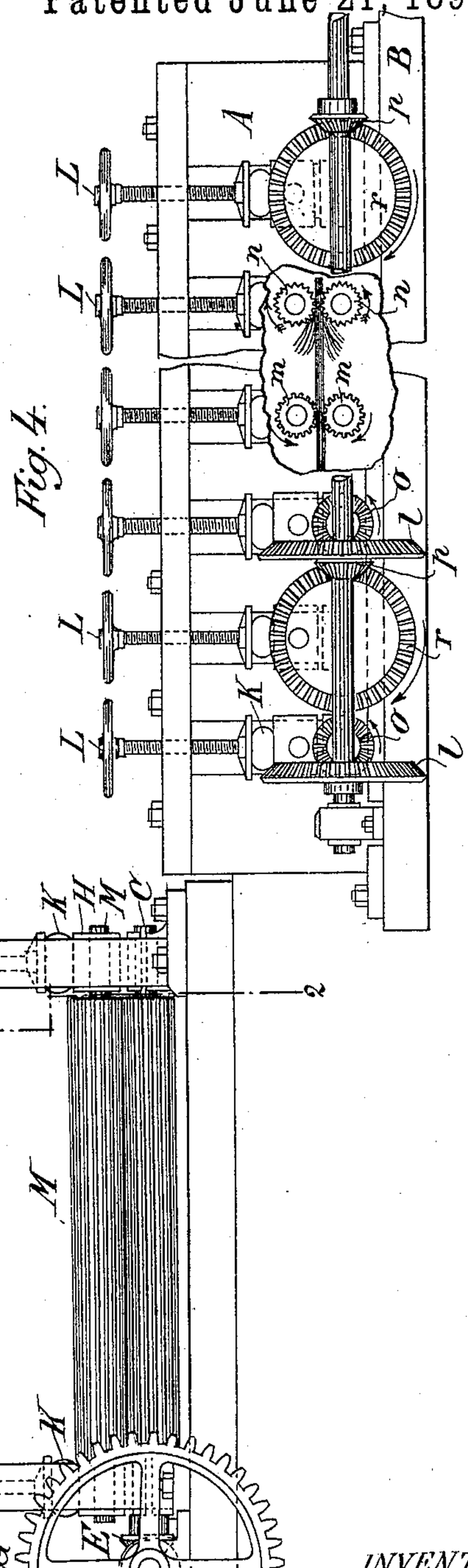
(No Model.)

A. MITSCHERLICH.

PROCESS OF CONVERTING WOOD INTO FIBERS SUITABLE FOR USE IN THE ARTS.

No. 606,017. Patented June 21, 1898.





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UNITED STATES PATENT OFFICE.

ALEXANDER MITSCHERLICH, OF FREIBURG, GERMANY.

PROCESS OF CONVERTING WOOD INTO FIBERS SUITABLE FOR USE IN THE ARTS.

SPECIFICATION forming part of Letters Patent No. 606,017, dated June 21, 1898.

Application filed February 24, 1894. Serial No. 501,453. (No specimens.) Patented in France February 23, 1891, No. 211,621; in Germany June 9, 1891, No. 69,217; in Switzerland June 27, 1891, No. 4,120; in England July 4, 1891, No. 11,331; in Norway July 6, 1891, No. 2,542; in Italy September 30, 1891, XXV, 30,046, LIX, 305; in Belgium July 5, 1892, No. 100,375, and in Austria-Hungary September 30, 1892, No. 19,145 and No. 38,640.

To all whom it may concern:

Be it known that I, ALEXANDER MITSCHERLICH, professor of chemistry and doctor of philosophy, a subject of the King of Prussia, Emperor of Germany, residing at Freiburg, in the Grand Duchy of Baden, German Empire, have invented new and useful Improvements in Processes of Converting Wood or Woody Parts into Fibers Suitable for Use in the Arts, (for which Letters Patent were granted to me in Germany, No. 69,217, dated June 9, 1891; in Belgium, No. 100,375, dated July 5, 1892; in France, No. 211,621, dated February 23, 1891; in Norway, No. 2,542, dated July 6, 1891; in Switzerland, No. 4,120, dated June 27, 1891; in Austria-Hungary, No. 19,145, Tom 42, Fol. 2,410, and No. 38,640, Tom XXVI, Fol. 2,394, dated September 30, 1892; in Italy, Reg. Gen., Vol. XXV, No. 30,046, Reg. Att., Vol. LIX, No. 305, dated September 30, 1891, and in England, No. 11,331, dated July 4, 1891,) of which the following is a specification.

The invention consists in splitting the wood into small boards or slabs, superposing two or more boards or slabs one above the other, so that the projecting darker parts of the annual rings are at the outside, and then subjecting the so-arranged superposed boards or slabs by means of quickly-applied blows to a successively-repeated bending or cracking operation until the disintegrated fibrous mass is obtained, as will be hereinafter described, and then pointed out in the claim.

In the accompanying drawings, Figure 1 represents a side elevation of an apparatus which may be used in my process of rolling wooden slabs into a fibrous mass. Fig. 2 is a vertical longitudinal section of the same on line 2 2, Fig. 3. Fig. 3 is an end elevation of the parts; and Fig. 4 is a side elevation of a modified form of the apparatus, partly in vertical longitudinal section, through two pairs of rollers.

Similar letters of reference indicate corresponding parts.

In carrying out my improved process of converting wood or woody parts into fibers the wood to be disintegrated—for instance, fir-wood—is freed from its knots or branches and split radially into small boards or slabs of two or three millimeters in thickness, twenty-five millimeters in length, and fifty millimeters in width. These slabs are then placed into a diluted aqueous solution of sulfurous acid, preferably of 0.5 per cent., to which 0.1 per cent. of lime is added. The slabs are allowed to stand in the solution at ordinary temperature for about eight days and are then subjected to the action of fluted rollers. The sulfurous acid produces, in addition to a lighter coloration of the wood, the softening of the incrusting matter without causing any other perceptible chemical action on the wood, so that a slight degree of disintegration is produced. The lime added to the sulfurous-acid solution prevents the formation of free sulfurous acid.

The apparatus employed for rolling the slabs into a fibrous mass may consist of a frame A A, on which are mounted about thirty or more sets of rollers C C of a diameter of about thirty-five millimeters. The rollers C C are supported in stationary bearings B B and are provided with ribs D D, which are arranged parallel to the axis of the rollers, said ribs being rounded off at the outer edges and also at the bottom of the recesses between the ribs, the thickness as well as the height of the ribs being two millimeters and the ribs being three millimeters apart from each other. The ribs may also be provided with interruptions, recesses, or the like, extending in a curve around the rollers; but this does not afford any essential advantage. The rollers C C are actuated by bevel gear-wheels E E, of which one gear-wheel of each pair is secured to a common main shaft F, which is rotated by a driving-wheel G, to which rotary motion is transmitted in any suitable manner. Above the lower set of rollers C C are arranged similar rollers M, which are supported in bearings of movable blocks H H, that are guided by the upright portions of the frame A A, said movable blocks being acted upon by cushioning-blocks K of elastic material, which are interposed between the blocks H H and the lower en-

larged ends of screw-spindles L L. By the cushioning-blocks K a certain yielding motion is imparted to the upper rollers M, so that when there are small differences in the thickness and quality of the small boards or slabs to be treated the movable rollers M "give" sufficiently, so that the gradual and uniform conversion of the slabs into a fibrous mass is obtained.

To avoid fractures of the slabs, which might take place easily by the quick working of the apparatus, the slabs are placed together in sets of two and subjected in this manner to the action of the rollers. This is done for the following reasons: On observing the small slabs which are split in the manner described it will be found that on one side of the boards or slabs the darker parts of the annual rings are slightly projecting, while on the other side the rings are correspondingly depressed. When the depressed sides of the slabs are subjected to the pressure of the ribbed or fluted rollers, they are liable to crack, while this is far less the case when the side at which the annual rings are projecting are subjected to the pressure of the rollers, for the reason that the slight projections exert a greater resistance to the bending pressure than the opposite side. By superposing the small boards or slabs in such a manner that the sides having the darker parts of the annual rings projecting are placed on the outside, while the sides provided with the depressions are placed at the inside, so as to face each other, and placing then the superposed slabs in contact with the ribbed or fluted rollers the slabs are less exposed to cracks and fracture. The superposed boards or slabs are then subjected to the pressure of the rollers until they are somewhat softened, after which they are separated from each other and passed again through the rollers in such a way that they are passed consecutively, two by two, through the slowly-revolving rollers with an intermediate space between them, which, however, has to be as small as possible, so that two small boards or slabs are not finished simultaneously.

For the above-mentioned thickness and width of the small boards or slabs a pressure of one hundred and thirty kilograms has been found most advantageous. For small boards of uniform thickness the passage through eight sets of rollers has been found sufficient, but usually a more frequent passage of the boards through the rollers is advantageous. Any impregnation during this operation is unnecessary.

The rolling process is continued until the fibers can be separated from each other by the action of the fingers throughout the entire board or slab. By continuing the rolling operation the individual fibers may be still more disintegrated, but this is not necessary in view of the further treatment of the same.

For the further treatment the properly broken up and disintegrated boards or slabs are slightly moistened and then impregnated with a suitable oil and treated with flexible cards made of thin wire, by which operation fine but short fibers are taken off. The moistening with oil or with similar substances has proved very satisfactory, as it is possible thereby to obtain longer and thinner fibers from the wood. In this condition of the wood the work done by the cards is, however, relatively unimportant, as the cards often tear the naturally weak fibers, to which strength is imparted in the spinning, or, better, in the twisting, process. When, however, the fibers are to be obtained from a partly-fibrous and a partly-soft woody mass, the carding operation cannot be dispensed with, as there are no better means for removing the fibers from the soft and disintegrated mass. Before carding the wood it is advantageous to subject the same to the action of the modified rolling apparatus, shown in Fig. 4, which is similar to the apparatus shown in Figs. 1, 2, and 3. The modified rolling apparatus consists of a frame A, the bottom of which has large openings for the passage of the obtained product. About forty sets of rollers are supported on the frame in such a manner that a set of rollers having sharp ribs alternates with a set of rollers having rounded-off ribs. The rollers with rounded-off ribs move the small boards slowly through the apparatus and exert a similar pressure of the boards or slabs as that to which they are subjected in the primary rolling apparatus. The rollers having sharp ribs are rotated quickly and in a direction opposite to the rollers with rounded-off ribs. The upper rollers receive a proportionately low pressure, say about three kilograms on slabs of the width of one hundred millimeters, which pressure, however, acts uniformly on the small boards or slabs. The rollers with sharp ribs, however, have to be at such a distance from each other that the ribs can never touch each other during their operation. From time to time brushes are passed over the sharp ribs in order to remove the fibers which have lodged in the spaces between the same and by which the cutting action of the ribs may be impaired.

The auxiliary rolling apparatus is operated as follows: When passing the slabs first through the same, the rollers with sharp ribs are raised and four small boards, superposed two by two, are placed on the first set of rollers. As soon as the small boards have entered for one-half of their length two other pairs are pushed in the rollers between the first set of boards. As soon as the second pair of boards has entered for nearly half its length a third pair is introduced in the same manner. This arrangement is continued without any interruption. As soon as boards are supplied to all the sets of rollers the rollers with sharp ribs are then lowered. By the action of the rollers with sharp ribs the disintegration of the boards takes place

rapidly, as the fibrous mass falls gradually through the openings in the bottom of the frame. The number of the rollers and the pressure exerted by them are so determined that the small boards or slabs coming out of the apparatus are disintegrated to such an extent that they are as thin as shavings at those parts upon which the sharp ribs have worked. Should this not be the case, they are passed again in the same manner through the apparatus. According to the pressure exerted upon the upper rollers either a small quantity of the fine fibers or a large quantity of coarse fibers are drawn off. After having been passed once through the apparatus the boards are introduced again into the same in such a manner that the thicker parts of the boards are now exposed in the disintegrating direction to the action of the rollers with sharp ribs, as shown by the arrows in Fig. 4, whereby they are converted almost entirely into a fibrous mass.

The better the disintegration of the small boards has been effected the finer are the fibers produced by the rolling apparatus.

By means of the rolling-machines longer fibers can be produced even from the raw wood, though these fibers cannot be compared with those obtained from the prepared wood. The fibrous mass obtained by the process described possesses characteristics, as compared to the fibers heretofore used in the textile industry, which can be recognized partly even by the naked eye. While in the finer textile fibers the complete insulation of the cells is desired and advantageous, the separation of the cells in the hereinbefore-described process for manufacturing textile fibers is not so advantageous, as the wood-cells in the insulated condition are too short for being spun. These wood fibers consist of bundles of cells and have, owing to the separation of a single or more cells from the bundle, a strange appearance, showing ramifications of the same. Under the microscope the wood-cells, separately or in bundles, are always distinctly recognized, and they can be distinguished from the cells of wood cellulose, as the former appear as full hoses and the latter as empty or collapsed ones.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

The process herein described of converting wood or woody parts into fibers suitable for use in the arts, which consists in splitting the wood into small boards or slabs, superposing two or more boards or slabs one above the other so that the projecting darker parts of the annual rings are at the outside, and then subjecting the so-arranged superposed boards or slabs by means of quickly-applied blows to a successively-repeated bending or cracking operation until a disintegrated fibrous mass is obtained, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ALEXANDER MITSCHERLICH.

Witnesses:

HUBERT TERRY,

MIRFARL MULFUR.