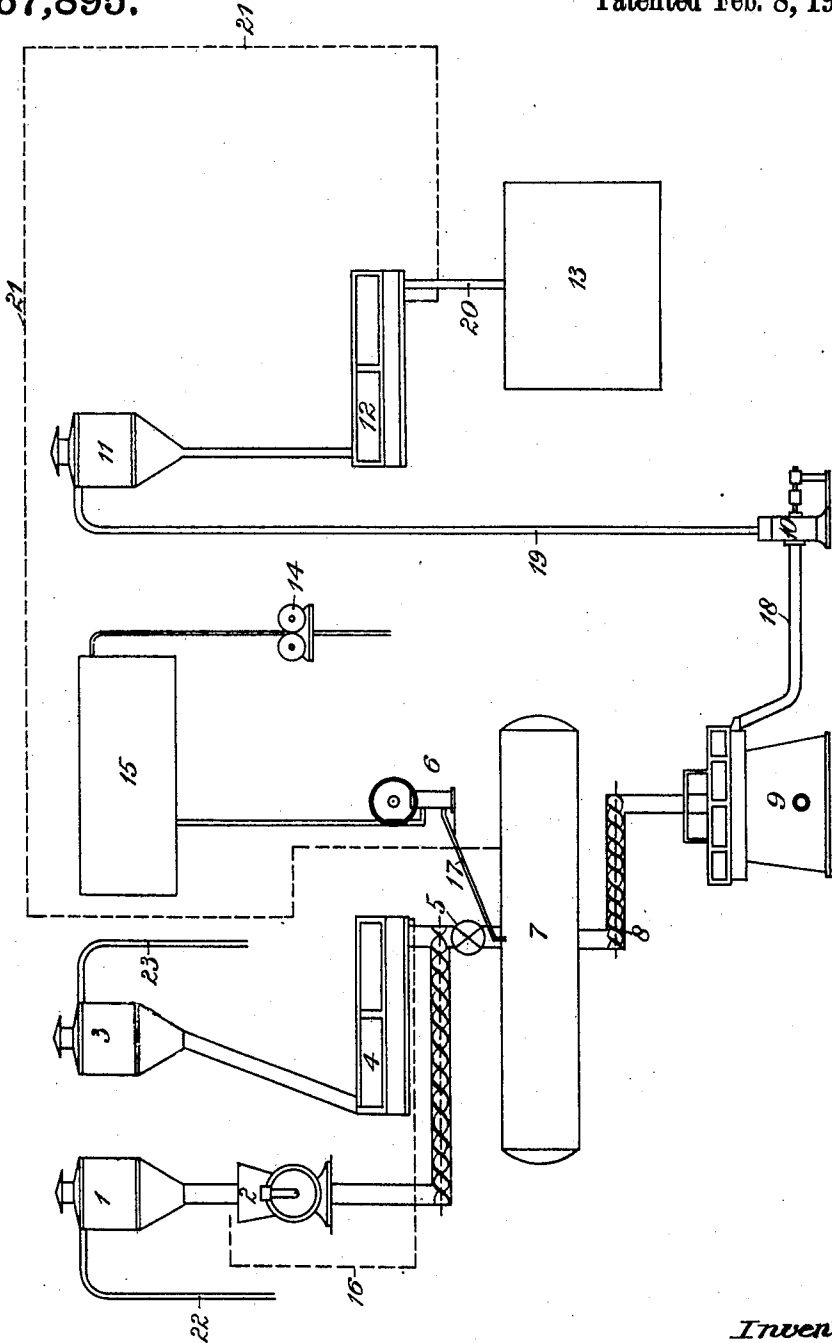


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 PROCESS FOR THE MANUFACTURING OF FIBROUS MATERIAL FROM WOOD OR THE LIKE.
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UNITED STATES PATENT OFFICE.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, FRANS KAREL LOUIS SCHOUTEN, subject of the Queen of the Netherlands, residing at Zaandam, Kingdom of the Netherlands, have invented certain new and useful Improvements in Processes for the Manufacturing of Fibrous Material From Wood or the like, of which the following is a specification.

The invention relates to a process for converting wood, woody products or other materials containing cellulose, which have hitherto been waste products or have been regarded as worthless or of little value, as for instance, straw, chaff, cane or other suitable materials, into a valuable fibrous material of lighter color than that of the parent material; this improved material is suitable valuable industrial products, such as various kinds of paper, material for linoleum, or the like, and indeed for making materials generally which require fibrous material in their manufacture.

Such waste materials as for instance wood shavings, sawdust, bark or other cellulose containing materials; for treatment by this invention the materials must, if necessary, be suitably comminuted.

It has long been attempted to convert such materials or waste products, particularly sawdust and shavings, which in countries having a large wood industry accumulate in part in huge quantities, into a highly valuable industrial product; hitherto, however, no process has become known by means of which it would be possible to produce from the said materials in a commercially remunerative manner, a fibrous substance of color equally as light as that of the parent material.

One of the known methods consists in grinding the wood waste at ordinary temperature in dry condition, whereby a gritty non-fibrous, product is obtained, inapplicable for certain technical purposes, for instance as a substitute for wood pulp in paper making.

The reason for this unsuitability is that the known methods of grinding break up the comminuted wood in all directions, producing what is known as a dead-ground product

in which the original fibrous structure of the woody material has almost completely disappeared.

The present invention has solved the problem of finding these conditions under which such a destruction or crushing of the fibrous structure in grinding can be avoided.

A series of experiments has shown that three technical conditions must be fulfilled in order to attain the desired object.

The first of these is that during the preparation of the parent material the elasticity or flexibility of the wood or other cellulose fibers must be increased up to the highest possible limit.

My investigations have shown that this can be attained by breaking up the parent material into fibers in presence of a certain amount of moisture and at a suitable temperature.

The second condition consists in so conducting or carrying through the breaking up or transformation into fibers that the fibers of the parent material which have become elastic, can be easily separated from each other without breaking.

I have found that the second condition can be fulfilled if the heating of the parent material containing a certain proportion of moisture is so far increased during the breaking-up or transformation process that there is a loosening of the separate fiber elements.

The third condition to be fulfilled is that the material to be treated, before it is subjected to the preparation according to this invention, is exposed to the action of moisture in such a manner that each element of the total mass is completely saturated with moisture; and this action of moisture must be carried so far that the core of each element is uniformly and completely moistened.

This effect may be produced by subjecting the material, before it undergoes the aforesaid preparation, for a certain time corresponding with its nature, for instance throughout one or several days or during a shorter or longer period, to the action of a measured proportion of water.

This saturation of the core may be accelerated by treating the material with water or subjecting it either directly or indirectly

to the action of steam; or the material may be subjected in closed vessels to the action of compressed air or with water or steam under pressure, in which case the operation may be

5 such that the water or steam is brought into contact with the mass to be treated and previously suitably comminuted in the form of fine rain or spray, so that each particle of the material is saturated with moisture.

10 The core may also be saturated with water by moistening the parent material in a vacuum.

The proportion of moisture introduced into the core must be so chosen that during

15 the following operation of breaking up into fiber the core of the material must retain sufficient moisture until the end of the breaking up process, notwithstanding the evaporation which is necessary to the operation owing to

20 the development of heat therein. The careful adjustment of the proportion of moisture is of the greatest importance for the obtaining of a product of proper quality and for the commercial conduct of the

25 process. If the content of the moisture is too small there is only a partial breaking up into fibers, the core of the material is indeed crushed and broken but not into fibers; and

30 the product obtained does not possess the soft woolly grip; but feels more or less hard. On the other hand if moisture is present in excess the process of breaking up into

35 fibers is so lengthy that the excess of moisture is evaporated before the operation has proceeded far enough to produce the valuable product, to say nothing of the useless consumption of power. Many experiments have also shown that

40 there is a certain correlation between the aforesaid conditions, and that the moisture contained in the parent material to be worked must be so chosen, that during the whole process that temperature is attained

45 and is kept as constant as possible which is necessary for procuring the maximum of elasticity of the cellulose fibers and the separation of the several fibrous elements during the grinding process. The new technical effect following upon

50 these three conditions is that in contradistinction to previous methods which produce a so-called dead-ground or crushed material and in which therefore the crushed material

55 has to be considered as the most valuable final product, according to the present invention the following twofold effect is attained.

a. A fibrous material is obtained.

60 b. The material produced is of considerably lighter color not only than the parent material, but also than the final products which can be obtained by the grinding processes hitherto known.

65 Under the microscope the crushed prod-

ucts made by the previous grinding processes (dead-grinding) are seen to consist of broken wood particles, whereas the product made by the present invention is seen to be

a lightly coherent mass of fibers. This fibrous structure which distinguishes the product of the invention from the so-called dead-ground material, can be recognized even by the eye and much more decidedly under the microscope; it is also to

70 be detected by the grip. It follows that the process of the invention, in contradistinction to that of the known processes, is a process of separating into fibers.

The degree of moisture which appears to be advantageous and at which the separation into fibers can be conducted most effectively is attained when some more as 60 and till

80 about 120 parts of water have been added to 100 parts of the parent material, reckoned as absolutely dry. Originally I was of the opinion that a suitable effect could be obtained by adding water

85 to the dry parent material to an amount not exceeding 60 per cent. I have found, however, that such an addition of water is not sufficient to yield a completely useful material, but that for this purpose, that is to say a rational separation

90 of the parent material into fibers, it is necessary to add at least 60 per cent. of water which, according to the nature of the material under treatment, may be raised to about 120 per cent. If one compares the present process in its

100 application for the production of wood fiber or in its application to the manufacture of paper or paste board in general, with the hitherto usual process, there are found the following differences. According to the known processes the

105 parent material is ground or cut with an excess of water; the latter washes the comminuted wood particles from the stone and runs away, as is known, from under this

110 stone as a milky liquid, and the liquid mass must then be sorted and more or less freed from water. This mode of operation is avoided, according to the present invention.

On the contrary the invention starts from the conception that the parent material, for example sawdust or other woody material, or material containing cellulose brought to

120 the required degree of fineness, should be subjected to the treatment in presence of only a small measured proportion of moisture, that is to say only in moistened condition and at a high temperature, so that during

125 the process the separation of the material into fibers or an unfeeling of the material can occur, whereby the fibrous form is produced. The new process must therefore be so con-

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ducted that the formation of a pulpy condition of the mass, that is to say the existence of a fluid condition or excess proportion of water, is avoided.

5 A further feature of the invention resides in the fact that the heat developed by friction during the process of transformation into fibers is used for partly evaporating the moisture in the mass.

10 As already stated, the proportion of moisture in the mass of wood to be operated upon must be so chosen:

15 a. That the rise of temperature necessary for carrying out the process must be attained during the operation of transformation into fibers (the presence of large proportions of water would exclude the attainment of this object).

20 b. That the evaporation of the moisture existing in the woody material under operation is so encouraged during the process of separating into fibers that the final product shows a content of moisture of at most 40 per cent. without artificial drying.

25 c. That to the fibrous material of the product under treatment such a flexibility or ductility is imparted that breaking of the fiber is practically excluded.

30 d. That a partial decolorization of the mass occurs so that a fibrous material is obtained which is of lighter color than the product obtainable by application of the processes hitherto known to the same parent material, and lighter also than that of the
35 parent material itself.

It would appear from the foregoing, and this is to be regarded as a technical progress attained by the process:

40 I. That in consequence of the transformation of the parent material into fibers a new product is obtained, which in case of its being applied to for the manufacture of paper, may without any intermediate treatment or intermediate working be directly
45 fed to the vat of the paper machine.

50 II. That a material of relatively high content of dry matter is obtained and indeed merely through the heat of friction developed during the process of transformation into fibers, by means of which heat there is brought about such an evaporation of the
55 moisture which has been added to the parent material that any artificial evaporation or drying is unnecessary.

The wood pulp produced by the processes hitherto known has the disadvantage that it contains much water, so that in transporting the material, much water must be carried with it and be paid for, unless the said material has previously been subjected to a
60 special treatment for being freed from the excess of water therein.

The following is an example for carrying my invention into practice:

65 Wood or wood waste, or a material con-

taining cellulose which has been brought to the required degree of fineness, for instance into the fineness of sawdust in any desired manner, is first mixed with—for example—
70 60 to 120 per cent. of its weight of water, and the mixture is thoroughly stirred. Separation of water in excess for the production of a pulpy consistence of the mass being worked, is to be avoided. The mass is now
75 allowed to stand until it has the necessary homogeneous content of moisture, for example three days, during which time it is advantageous to stir the mass.

The mass prepared in this manner is now introduced into a suitable machine for trans-
80 forming it into fibers, for instance between millstones.

In this machine the material is now subjected to the process of transformation into fibers in such a manner that during the op-
85 eration a temperature of 70°–100° C. is produced, so that the heat of friction produced during the process is used in partly evaporating the moisture present in the mass. This evaporation should be such that the
90 moisture content of the final product amounts at maximum to about 40 per cent.

Hereby the fibrous material is obtained of a light color.

A considerable technical advantage of the
95 present process consists in the fact that, as already stated, in contradistinction to the wood pulp obtained according to the usual grinding processes which, for the purpose of being worked up into paper or paste-board,
100 must be subjected to the operation of a koller-gang (grinding crusher or grinding mill) and a hollander, the fibrous product obtained by the process of the invention can
105 be fed directly to the vat of the paper machine without any intermediate mechanical treatment.

Any portion of the material which, in consequence of special conditions, for example owing to lack of uniformity of the parent
110 material (knots or the like) is not completely split up into fibers and any powdered particles of stone are separated by mechanical sorting (sifting or the like).

These separated wood particles may be
115 subjected again to the treatment according to the invention.

An example of an apparatus suitable for practising the invention is illustrated diagrammatically in the accompanying drawing by way of example.

From the reservoir 1 the material which is still to be comminuted and then further worked up according to the invention is fed to a comminuting device 2. The comminuted
125 material may then be fed directly to the conveyer 5. By another path the material already brought to the corresponding degree of fineness may, however, be fed independently of the material from reservoir 1,
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through a by-pass to the comminuting or grinding device from a separate reservoir 3 directly to the sorting apparatus 4.

Insufficiently finely ground particles are conducted back from the sorting apparatus 4 through a suitable duct 16 into the comminuting device 2 which simultaneously serves as a sorting apparatus, in order that they may be further comminuted. The material sorted to suitable fineness in the comminuting device 2 and sorting apparatus 4 (for instance wood or woody or cellulose waste products) is carried forward to the vessel 7 into which is fed, by means of a pump 6 through the pipe 17, a measured quantity of water from the water reservoir 15.

In this vessel the moistened mass is advantageously left until every separate or individual particle of it is saturated into the core with moisture.

The vessel 7 may be so arranged that the material in it can be subjected directly or indirectly to the action of steam, or so that the material can be treated with compressed air, or in a vacuum.

Water is supplied to the reservoir 15 by means of the pipe 14.

When the material has been supplied with the proper proportion of water it is transferred by the conveyer 8 to the mill 9, where the breaking-up of the material into fibers is accomplished.

The product from this machine is removed in a suitable manner for instance by means of the exhauster 10 which is connected with the machine 9 by the pipe 18.

The exhauster 10 is connected by pipe 19 with the cyclone 11 for the purpose, on the one hand, of conveying the material to the sorting apparatus 12, and on the other hand of exhausting the excess of air into the open.

The finished product passes through the

pipe 20 to the collecting chamber 13, while the material retained in the sorting apparatus 12 is conducted by means of pipe 21 back to the vessel 7 for further treatment.

When shavings are being worked, the introduction into the reservoir 1 is by way of pipe 22.

Pipe 23 is for feeding to the reservoir 3 such material as has already been comminuted to the suitable degree of fineness, for instance saw-dust.

Having thus described the nature of the said invention and the best means I know of carrying the same into practical effect, I claim:—

1. Process of converting comminuted ligno-cellulose material into fibrous pulp, which consists in grinding the material with such small quantities of moisture that the production of a pasty condition of the mass is avoided, using the frictional heat developed during the grinding process exclusively for evaporating the moisture present in the material to be treated.

2. Process according to claim 1 in which the amount of water added to the material to moisten it is about 120% of the weight of the theoretically dry substance.

3. Process according to claim 1 in which the operation is conducted under such conditions of temperature that the final product contains no more than 40% of moisture.

4. Process according to claim 2 in which the operation is conducted under such conditions of temperature that the final product contains no more than 40% of moisture.

In testimony whereof I have affixed my signature in presence of two witnesses.

FRANS KAREL LOUIS SCHOUTEN.

Witnesses:

H. VAN WESTERN, Jr.,
A. VAN DE MORY.