Sept. 17, 1940. G. M. VON HASSEL 2,214,893

PROCESS FOR THE EXTRACTION OF FIBERS FROM FIBER-CONTAINING MATERIAL

Filed April 1, 1937

Fig. 1

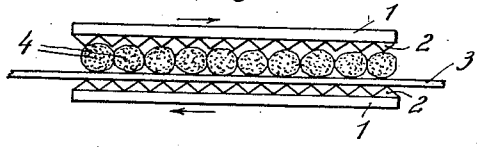


Fig. 2

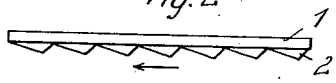


Fig. 3

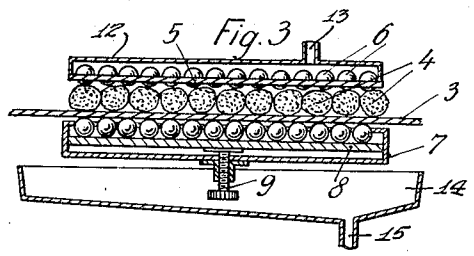


Fig. 4

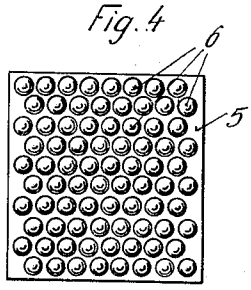
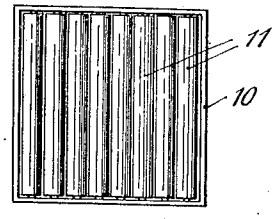


Fig. 5



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2,214,893

PROCESS FOR THE EXTRACTION OF FIBERS FROM FIBER-CONTAINING MATERIAL

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4 Claims. (Cl. 19—5)

This invention relates to a process and a device for extracting from fiber-containing plant material, fibers in a pure condition and of high mechanical firmness, without damaging them. Boiling with solutions of suitable chemical substances, used in chemical treatment, has a weakening effect on the fibers. The roasting process, proposed to be applied prior to mechanical treatment in the manufacture of flax, is also injurious to the fibers. For the extraction of a fibrous substance from wood shavings, such shavings, after having undergone a boiling process, were subjected to a grinding process making use of sand. Damage to the fibers could not be avoided in this case either.

According to the invention extraction of the fibers is carried out by a mechanical, and if called for, simultaneously also by a chemical treatment in such a manner, that the fiber-containing material is treated in a damp condition by the aid of rubbing devices by grains or powder of varying hardness or varying sizes of grains or mixtures thereof and possibly in the presence of chemically acting substances, until the individual fibers are loosened or detached, whereupon the material is dried and freed from the grains or powder by sifting or sieving.

The fiber-containing material is disintegrated in this manner without any injurious effects. It is subjected to a mild pulling, but not tearing treatment. The individual fibers are loosened and denuded by one operation in such a manner, that their constitution remains unchanged. The new process permits of treating any fiber-containing vegetable material, such as wood, bark, leaves, needles, stalks, stems, etc., fibers, waste of natural fibers and the like.

Hard grain material or powder material consists, for instance, of sand, corundum, glass, flint, infusorial earth. Soft grain material or powder material consists, for instance, of wood shavings, sawdust or wood flour and the like. When operating with granular or pulverised separating agents of varying sizes of grains, the finely-powdered portion constitutes the soft material, which is to lodge between the separated individual fibers to keep them separated until the drying process has been done. Separating agents of varying sizes of grains may be of the same kind and origin. When operating in the presence of chemically acting substances there will inevitably be formed in consequence of the chemical action exerted on the fiber-containing material a softer or finely-powdered material, so that in such case it will not be necessary to use from the start the separating agent in a physically varying condition as regards the hardness or/and the size of the grains.

For operating with chemically acting substances present, such substances may also be applied in a dissolved or suspended state to chemically indifferent grain material or powder material. Thus there may be used sand, corundum, glass, flint, infusorial earth, sawdust, wood shavings, etc., in form of grains or powder to act as vehicles for the chemically acting substances and to serve as means for mechanical treatment.

Any desired means for chemical treatment may be used with the aid of the carrier substances, such as alkali, acid, salt, solvents or inorganic and organic nature, also if they are in a liquid state. In the same way as the disintegrating agents may be applied fiber refining agents to the fibers, such as magnesium chloride or calcium chloride, rendering the fibers flexible, or colouring matter. In all cases there will take place a dry chemical treatment, as it were, since the total mass will be merely damp. Wood shavings and wood flour are especially well suited to simultaneously apply in connection with the mechanical treatment, also solvents or chemically acting disintegrating, refining or/and purifying agents. There are used for this purpose wood shavings or wood flour impregnated with oil, such as Turkey red oil, purifying agents or/and chemically acting loosening agents. If necessary the material may be washed prior to drying, or the fibers extracted as result of the process may be washed.

Chemically acting substances may also and simultaneously serve as means for mechanical treatment. The chemically acting substances are used for this purpose in the form of grains or/and powder. Thus lime, salt, alkalies, and acids are used in form of grains or/and powder.

Operations may also start without the presence of chemically acting substance with a mechanical treatment only, followed up after the fibers have already been exposed more or less, by simultaneous mechanical and chemical treatment.

The rubbing treatment is preferably carried out in such a manner, that the fiber-containing material, to which separating agents have been added, is passed in a damp condition in a straight direction by means of a travelling band or the like between rubbing or frictional devices having rubbing or frictional surfaces provided with ribs, balls arranged in series or rollers arranged in succession.

Prior to starting the rubbing treatment, the

fiber-containing material may be pressed together with the grain material or the powder material. This method is preferably used in the case of highly resistant fiber-containing material so as to cause the fiber separating agent to enter into the fiber-containing material as deeply as possible and act directly inside the material as soon as the rubbing treatment starts. The material is preferably passed through the rubbing devices in a bundled condition. Instead thereof or in addition thereto the fiber-containing material may also be passed through the rubbing device surrounded by a wrapper or covering. Coverings of fabric or metal may, for instance, be used for covering or wrapping up the fiber-containing material. It will be of advantage to use porous coverings in which the pores are distributed in such a manner, that detached short fibers may pass out through them under the action of the rubbing and pressing treatment. In this manner it will be possible to attain, simultaneously with the mechanical or mechanical-chemical disintegrating process, sorting into long fibers and short fibers in one operation.

For the purpose of facilitating the rubbing work and the work connected with the separation, if any, of short fibers, a liquid may be directed to and flowing over the material through openings provided in the rubbing surfaces. If deemed called for, such admission of a liquid may take place only towards the end of the rubbing treatment for the purpose of washing the material.

For separating short fibers it will be advantageous to select for the covering special sizes and forms of the pores or openings, for instance, in the case of webbings made of fabric or wire, so that only the flexible and thin short fiber can pass through it. Thus a rectangular form of pore might be selected through which the fine short fiber may squeeze, whereas the coarser fiber and the granular fiber separating agent will be kept back.

The working is carried out to advantage in the same direction, or, if called for, to and fro, preferably in the longitudinal direction of the fiber or across thereto. It will be advisable in order to prevent tearing or breaking of the fibers to use, when working across the longitudinal direction of the fiber, a softer grain material or powder material, as for instance, sawdust impregnated with chemicals.

The rubbing work may be done by means of plate-shaped or roll-shaped devices.

The accompanying drawing shows in plan view a device for the carrying out of the process in accordance with the invention:

Figure 1 shows the rubbing part of a device

Figure 2 shows an individual rubbing device

Figures 3 and 4 show an arrangement of the rubbing device provided with balls.

Figure 5 shows the arrangement of rollers as rubbing device.

The rubbing devices 1 are provided with ribs 2. The fiber-containing material 4, arranged in bundles or wrapped up in coverings, is passed in straight direction between the rubbing devices on a conveyer belt 3. The fiber-containing material proper contains as an admixture or pressed therein the granular separating agent or/and the pulverised separating agent. The rubbing devices 1 can be arranged at the lower or upper side of the conveyer belt and move to and fro or in continuous direction, for instance, as part of an endless belt or band. If rubbing devices 1 are provided at the upper and lower side of the conveyer belt 3, the rubbing movements will take place in opposite directions to each other, as shown by Figure 1. The rubbing devices 1 may be even or curved. One or both of these devices is provided with ribs which are arranged transversely to the direction of movement of the rubbing device. The ribs 2 may be exchangeable so that according to the nature of the fiber-containing material ribs suitable thereto may be attached. The ribs may be arranged rigidly or movably. In the case of rigid ribs being selected it is advisable to use, according to Figure 2, ribs having slightly inclined rubbing surfaces, so as to cause a mildly pressing, effective and repeated rubbing action. The rubbing movement of such plate takes place in the direction of the position of the surfaces with slight angle of inclination.

Movable ribs are preferably made up by balls arranged in series or rollers provided in succession. As shown by Figures 3 and 4, the balls 6 are held in place by a holding plate 5, but instead thereof and in accordance with Figure 5 the rollers 11 may be arranged in a frame 10.

As shown on Figure 3, the frame 5 may have a box-like structure 12 which is provided with an inlet pipe 13 for supplying water or a suitable fluid. The fluid can pass through the spaces between the ball or roller bearing to the fibrous material. Collecting tank 14 with discharge pipe 15 carries off the fluid passing from the fibrous material.

In order to be able to regulate freedom of movement or movability of the balls 6 or the rollers 11, or limit it according to requirements, there may be coordinated to them a pressure plate 8 arranged in a suitable guide arrangement 7, which by the aid of the spindle 9 may be pressed to a varying degree against the balls or the rollers.

Rubbing devices and the conveyer belt may be designed as endless bands, which are coupled with each other in accordance with the required movements.

The duration of the rubbing treatment, which may also be carried out manually with the aid of suitable tools, depends upon the nature of the fiber-containing material to be treated at the time. If deemed necessary, the progress made by the loosening process may be checked by the taking of samples.

The properly arranged moist fiber-containing material, to which separating agents have been added and which perhaps may have been more or less pretreated, may be subjected to the rubbing treatment also if placed between two travelling bands. In all cases separation must be effected by the harder or coarser grain material or powder material. The separating agent being movable in all directions and in consequence thereof being able to follow the constitutional structure of the fiber-containing material without any hindrance, the individual fibers will remain whole and undestroyed.

The rubbing treatment being completed, the mass, consisting of fibers and granular substances, is dried, rubbed and separated in the two components, fibers and granular substance, by the aid of sieves or agitated air.

When proceeding in accordance with the invention, the fibers obtained will not be shortened and may be completely free from lignine and other incrustations, possessing high mechanical firmness.

I claim:

1. Process for isolating the fibers of plant ma-

terials, comprising mixing the plant material with fine granular material including lime which has a chemical loosening effect on the cementing matter of the plant material, and then rubbing the plant material and granular material together with the latter in moist condition until the fine granular material has penetrated the plant material and the individual fibers are loosened and detached, whereupon the material is dried and separated from the fine granular material.

2. Process for isolating the fibers of plant materials, comprising mixing the plant material with fine granular material including wood flour, and then rubbing the plant material and granular material together with the latter in moist condition until the fine granular material has penetrated the plant material and the individual fibers are loosened and detached, whereupon the material is dried and separated from the fine granular material.

3. Process for isolating the fibers of plant materials, comprising mixing the plant material with fine granular material, covering the mixed materials with a porous wrapper, then rubbing the plant material and granular material together with the latter in moist condition until the fine granules have penetrated the plant material and the individual fibers are loosened and detached, the pores of the wrapper being of such size that the short fibers which become detached can pass out through said pores under the action of the rubbing treatment, then drying the mixed material and separating the fibrous plant material from the granular material.

4. Process of separating fibers from interfiber matter of vegetable material comprising mixing the material with fine granular material and first subjecting it to only mechanical loosening manipulation and then rubbing the material with lime in a fine-granular condition which has a chemically loosening effect.

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