(No Model.) 3 Sheets—Sheet 1.

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PAPER PULP.

No. 344,323. Patented June 22, 1886.

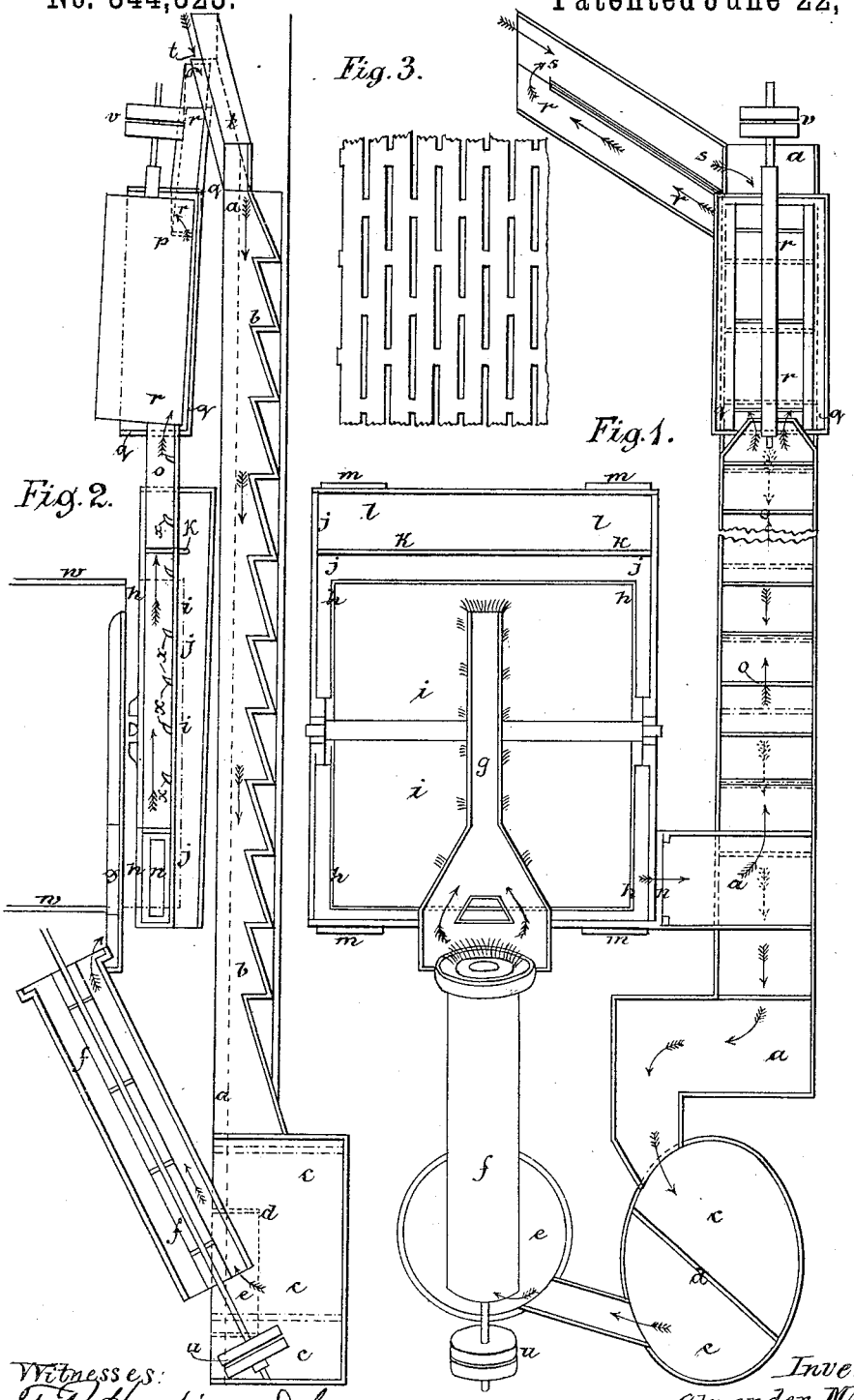

Fig. 3.

Fig. 1.

Fig. 2.

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PAPER PULP.

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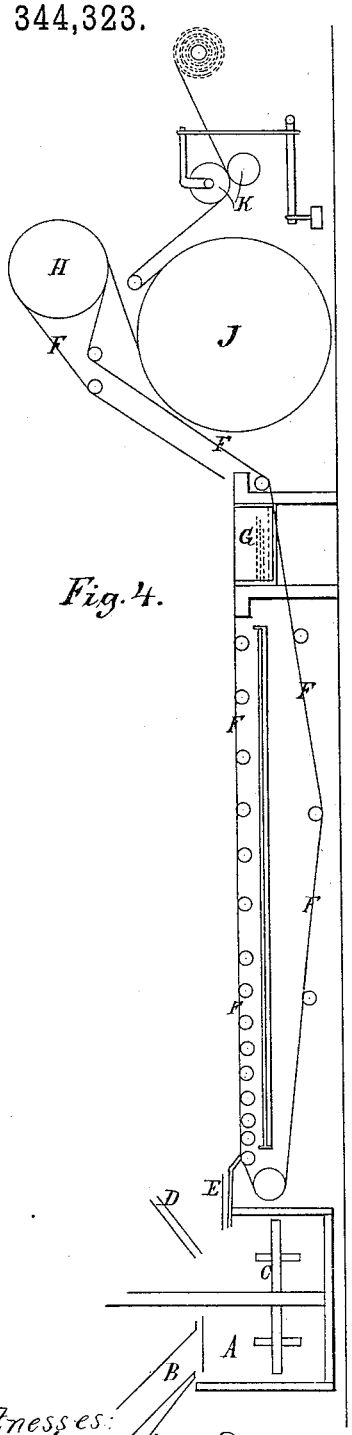

Fig. 4.

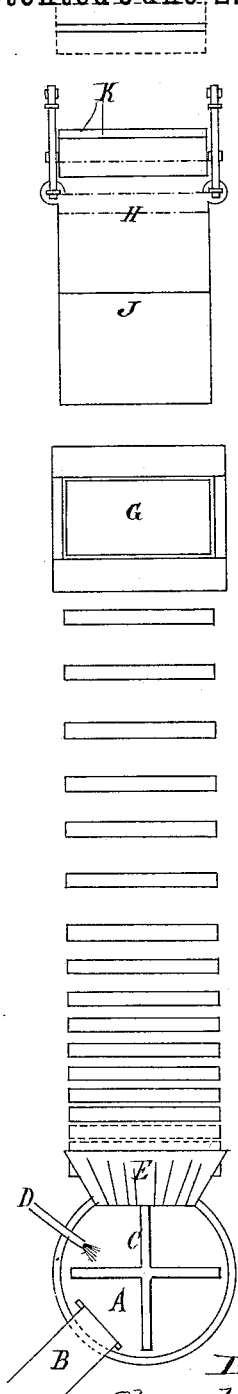

Fig. 5.

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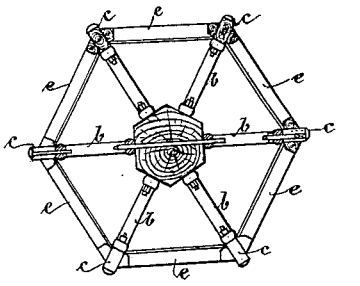

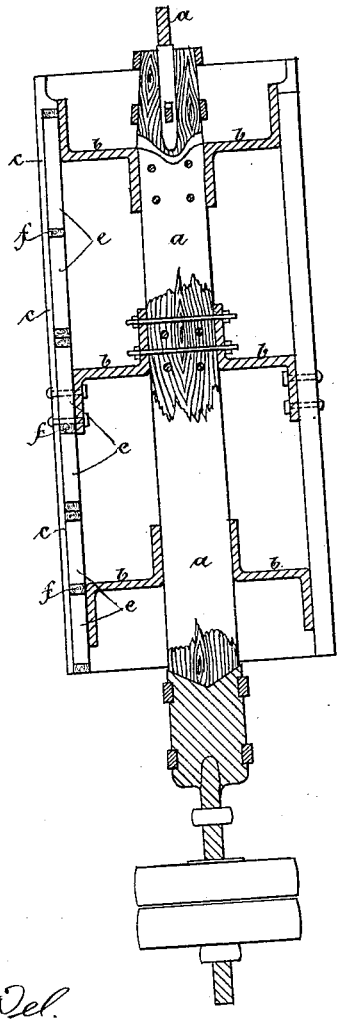

Fig. 6

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UNITED STATES PATENT OFFICE.

ALEXANDER MITSCHERLICH, OF FREIBURG, BADEN, GERMANY.

PAPER-PULP.

SPECIFICATION forming part of Letters Patent No. 344,323, dated June 22, 1886.

Application filed September 12, 1884. Serial No. 142,897. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER MITSCHERLICH, professor of chemistry and doctor of philosophy, a resident in the city of Freiburg, in the Grand Duchy of Baden and German Empire, have invented certain Improvements in the Processes of Manufacture of Paper-Pulp and in the Apparatuses used therefor, of which the following is a specification.

My invention relates to those parts of the process for the manufacture of cellulose fiber in general, and paper-pulp especially, in which this latter (prepared before either by treating the raw material with sulphite solutions or other chemical substances or by a mechanical process) is to be purified and the cellulose fibers, which are in a state of fine distribution, separated from the imperfectly-fluxed particles and the impurities, and also dried and dehydrated in such a manner as to give as result a pure and easily-soluble material.

In the annexed drawings, Figure 1 is a plan, partly in section, of the apparatus which is used in the part of the process relating to the purification; Fig. 2, a sectional side elevation of the same apparatus; Fig. 3, a piece of the sieve used in the process, designed on a larger scale; Fig. 4, a sectional side elevation of the apparatus which is used in the part of the process relating to the complete drying and dehydrating. Fig. 5 is a plan of the apparatus shown in Fig. 4; and Fig. 6 the centrifugal apparatus used in the purification process, designed on a larger scale.

In order to execute the first part of my invention the purification of the paper-pulp, I dilute materials with long fibers—such as, for instance, sulphite cellulose—after having decomposed or disintegrated it into its elementary fibers with an extremely great quantity of water—that is to say, in a volume at least fifteen hundred times greater than that of the cellulose. The liquid obtained in this way I cause to flow slowly and horizontally with a very low velocity through the apparatus described hereinafter and shown in Figs. 1 to 3 of the annexed drawings. The small and finely-distributed particles—that is to say, especially the pure cellulose fibers—will then be carried on with the current of the liquid, while all coarser particles and those of the same specific gravity, but of a greater volume—that is to say, the impurities—will fall down to the bottom of the apparatus. This apparatus, which is represented in Figs. 1 and 2, consists of very long and comparatively broad and deep receptacles or boxes or canals *a a*, with a very slight inclination. These receptacles *a* have on their bottom partitions *b b*, of essentially equal height, so that the impurities deposited on the bottom may not be carried along by the current of the liquid. In these partitions there may be placed advantageously closely-fitting and removable boxes or trays, which may be removed and emptied from time to time. All the particles which are not very finely distributed, and which consist of the impurities of the mass, fall down and are deposited on the bottom in the trays.

At the end of the trough *a* there is annexed a comparatively large vat, *c*, in which a further deposition of the impurities will take place, as the velocity of the current is here much slower. In this vat *c* a partition, *d*, reaches into the liquid to retain the impurities floating or swimming on the surface. From this vat *c* the liquid streams to a smaller vat, *e*, from which it is raised by a lifting apparatus, *f*, of any suitable construction (in the drawings an endless screw or creeper is shown) to a distributer, *g*, and from this to the second apparatus, which is used instead of the pulp-strainer of ordinary construction.

In the ordinary strainer the principle has always been adopted of causing the fibers (diluted at the most with about two hundred times their bulk of water) with violent motion, and accompanied with considerable noise, to pass through slotted plates. In order to obtain a satisfactory production for materials with long fibers—as, for instance, sulphite cellulose—these slots had to be made so broad that hardly any purification took place, or else a great number of such apparatuses had to be employed, which made the old arrangement very complicated and expensive.

The new apparatus receives the liquid as mentioned in a very dilute state, so as to enable the fibers to flow with the water through a large number of slits in the comparatively

large tin sieves. This apparatus consists, as may be seen by Figs. 1 and 2, of a receptacle, *j j*, in which a sieve, *i*, is suspended by a frame, *h*. By means of rods or bars *w* a slow vertically-reciprocating motion is imparted to the sieve *i*, with its frame *h*. The perforations or slits of this sieve, which are shown in Fig. 3 on a larger scale, are of such dimensions as to offer an area of openings of about three hundred square inches for an hourly production of two hundred and twenty pounds of the long fibers which are to be purified—as, for instance, sulphite cellulose—or an area of 0.2 square meter for a production of one hundred kilograms of the materials mentioned. The sieve may also be arranged, for example, in the shape of deep boxes or vertical cylinders, with closed bottoms, which move slowly and vertically or horizontally, alternately, and may also be removable, to withdraw the deposited impurities. The material for these sieves may be of very thin sheet metal, in which the slits are punched or stamped in a very rough manner. The liquid passes the distributer *g*, and can, if necessary, be still further diluted with water entering through a suitable pipe, and then, by reason of the very slight difference between the levels of the liquid above the sieve and the liquid contained in the receptacle *j j*, the liquid flows with a very slow velocity in a vertical direction through the slits of the sieve *i*. By means of this diluted state of the liquid and the described motion of the sieve the deposition of the pure fibers above the sieve is avoided, and the latter will be forced to flow with the water through the slits of the sieve, while the impurities remain partly floating or swimming in the liquid and partly deposited on the sieve itself. The receptacle *j* may sometimes also have a space or portion, *l*, separated from the other part by means of a partition, *k k*, which does not reach the bottom. From this space *l*, which is situated at the lowest part of the receptacle *j*, the impurities which may be deposited therein can easily be withdrawn. For a further cleaning of the receptacle *j j*, the openings *m m* are provided. They are closed during the ordinary working of the apparatus. From the receptacle *j* the liquid, which contains now little besides the cellulose fibers in a finely-distributed state, passes through the opening or overflow *n* in the channel *o*. This opening or overflow *n* is arranged in such a position and manner that the sieve *i* is always covered by the liquid. In the channel *o* some inclined cross-pieces, *x x*, are arranged to obstruct the impurities which the liquid might perhaps yet carry along with it. The great quantity of water in which the cellulose fibers have been distributed during the process mentioned is now removed from the purified cellulose by the apparatus marked *p* in Figs. 1 and 2, and represented on a larger scale in Fig. 6. This apparatus is worked by centrifugal force, and effects with comparatively moderate dimensions the removal of large quantities of water, together with any minute impurities that may be present. This centrifugal apparatus consists of an easily-rotating shaft, *a*, having arms *b*, to which are fixed bars *c c*, forming the frame of a cylindrical or conical shaped drum, open at both ends, the sides of which are wire or hair screens. When using hair screens, special frames *e e*, which have transverse bars *f*, for supporting the screens, may be advantageously employed. The openings of the screens are chosen so large and of such a quantity that the water and also fine impurities, which, perhaps, may yet be in it, can pass through, while the cellulose fibers are retained by the meshes and remain on the inside of screen. This centrifugal apparatus is placed slightly inclined, and the upper opening of it is in connection with the above-mentioned channel *o* by means of a pipe or channel, through which all the great quantity of the liquid is introduced. The apparatus must then be rotated so rapidly that the water with the said impurities is violently thrown through the meshes, but yet not so rapidly that the fabrics may adhere on the inside of the screen. The cellulose thus deposited upon the inside screen-surface rotates therewith till up to the moment when its weight overbalances the centrifugal force, whereupon it falls down and passes, in consequence of the inclined position of the apparatus, to a lower part of the drum. There it is again raised and again falls into a lower part, and so on until it passes out of the drum in a state in which it is dry enough for further working. To insure the effective action of this centrifugal apparatus, it is of course essential that the drum should be placed beyond the liquid and should not dip in it, and this is especially the case for the outlet pipe or channel of the dried cellulose. The discharged water flows from the apparatus into the box *q*, surrounding the latter in this lower part, and may from there either be thrown out and dispensed with, or may be guided through the channel *r* into the channel *s*, in which arrives also the liquid for the receptacles or boxes *a*. In this way a continuously-circulating motion of the water is obtained, and also a continuous working is secured by throwing the material which is to be purified into the channel *t*, Fig. 2. The apparatus may be rotated either with uniform velocity, as described, or also with a variable one, by which the quick rotation effects the removal of the water and impurities, while the slower motion causes the fibers to fall off. The material produced in this way is not yet dry and anhydrous enough to transport it with advantage to a greater distance. In the ordinary way the water which this material still contains is taken off from it by subjecting it to known processes, wherein by more or less pressure a very great quantity of water is separated there-

from. The product thus obtained has only the disadvantage that it cannot be transported in a very dry state, on account of its being then only soluble with very much difficulty. In order to avoid this disadvantage and to obtain a product which is easily soluble and air dry, it is necessary to subject the purified paper material to a drying or dehydrating process, after which pressure may be applied or not. This drying or dehydrating may be done in such a way that the cellulose is now once more diluted with water, and then guided in a thin layer or coating (as is done in the manufacture of paper or pasteboard) onto an endless cloth or wire sieve, through which the water drains and may, if necessary, also be sucked away. The cellulose then remains in a loose state, in which it loses the water by evaporation, so that no pressure at all is used. After this drying or dehydrating pressure may, if necessary, be applied, as now this pressure does not diminish the solubility of the cellulose thus obtained. After the described drying or dehydrating process the paper material is in an easily-soluble and dry state.

In order to carry out this process, the apparatus shown in Figs. 4 and 5 of the annexed drawings may be used. In this apparatus the cellulose is guided by an endless band, B, into a vat, A, in which a revolving beaker, C, is arranged, and in which the necessary water for the diluting of the cellulose is let in by the pipe D. The mass or liquid now floats through a distributer, E, onto an endless sieve, F, through which the water runs away—first, spontaneously, and, lastly, by the action of a suction apparatus, G, placed under the sieve. In this way there remains on the sieve a loose felt, which is now guided from the sieve F over one or more drying-cylinders, H, or another drying apparatus or oven. Here the felt attains strength and coherence enough to pass without any support over a drying-cylinder, J, and being now absolutely dry from here to the pressure apparatus K, if the latter is wanted.

In carrying out the above-mentioned process with sulphite material it has been found that the latter becomes frequently discolored, (gray and brownish.) This occurs even when water free from iron is used, and is due to the presence of small particles of iron from the apparatus, which dissolve in the remaining small quantities of acid in the liquid. This may be avoided either by covering the iron parts of the apparatuses which come in connection with the liquid with wood, linen, or such like materials, or by the addition of free acid or of a soluble acid compound to the water used in the process. The latter must also be done when the use of water which contains iron cannot be avoided.

Having thus described my invention, and also the manner how and the means with which it may be performed, what I claim, and desire to secure by Letters Patent, is—

1. The improved process of purifying and dehydrating cellulose fibers or the paper-pulps prepared by the treatment with sulphite solutions or other chemical substances, or by a mechanical process, consisting in guiding this material in a decomposed and extremely water-diluted state, with a very low velocity, first in a horizontal direction through long and large receptacles or channels, and afterward in a vertical direction through a large and slit sieve, which is arranged within the level of the liquid and is agitated with a slow vertically alternate motion, substantially as described, and for the purpose set forth.

2. The combination of receptacles or channels *a a* of a great extent, which are provided with partitions *b b*, with a vat, *c*, and its partition *d*, for the motion of the liquid in the horizontal direction, substantially as described.

3. The combination of a sieve, *i*, provided with slits, a frame, *h*, a receptacle, *j*, and bars or rods *w*, for moving the sieve for the motion of the liquid in the vertical direction after it has been raised by a lifting apparatus, *f*, and distributed by a distributer, *g*, substantially as described.

4. The combination of the receptacle *j* with a partition, *k k*, which does not reach the bottom of the first one, to enable the withdrawing of the impurities from the receptacle *j*, substantially as described.

5. The improved process of drying or dehydrating paper-pulp by means of a continually and by centrifugal force acting apparatus, in which the water is removed while the paper-pulp remaining on the inside of the screens forming the surface of the apparatus is discharged therefrom, in consequence of the inclined position of the latter, substantially as described.

6. The combination of an inclined axle, *a*, with arms *b*, frames *c*, *e*, and *f*, and wire and hair screens forming a cylindrical or conical shaped rotating drum, open on both sides, substantially as described, and for the purpose set forth.

7. The improved method of completely drying and dehydrating paper-pulp, consisting in guiding the material (after having been distributed into water and freed from the latter in a known manner) without any pressure, with the support on which it lies or another support or without any one, over one or more drying-cylinders or other drying apparatuses or ovens in such a manner that here also no pressure is occurring, substantially as described, and for the purpose set forth.

8. The combination of a vat, A, having a twirling-work, C, and the two conduits B and D, for the pulp to be dried, and the water, with an endless cloth or sieve, F, with or without a sucking apparatus, G, and drying-cylinders H and T, or other drying apparatuses or ovens, substantially as described, and for the purpose set forth.

9. The covering of all iron parts of the ap-

paratuses used in this process which come into connection with the liquid, with wood, linen, and such like materials, substantially as described, and for the purpose set forth.

10. The addition of acids or of soluble acid compounds to the water used in this process, for neutralizing the effect of iron, if the latter is contained in the water, substantially as described.

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

ALEXANDER MITSCHERLICH.

Witnesses:
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