June 5, 1934. G. A. RICHTER ET AL 1,961,914

PAPER PRODUCT

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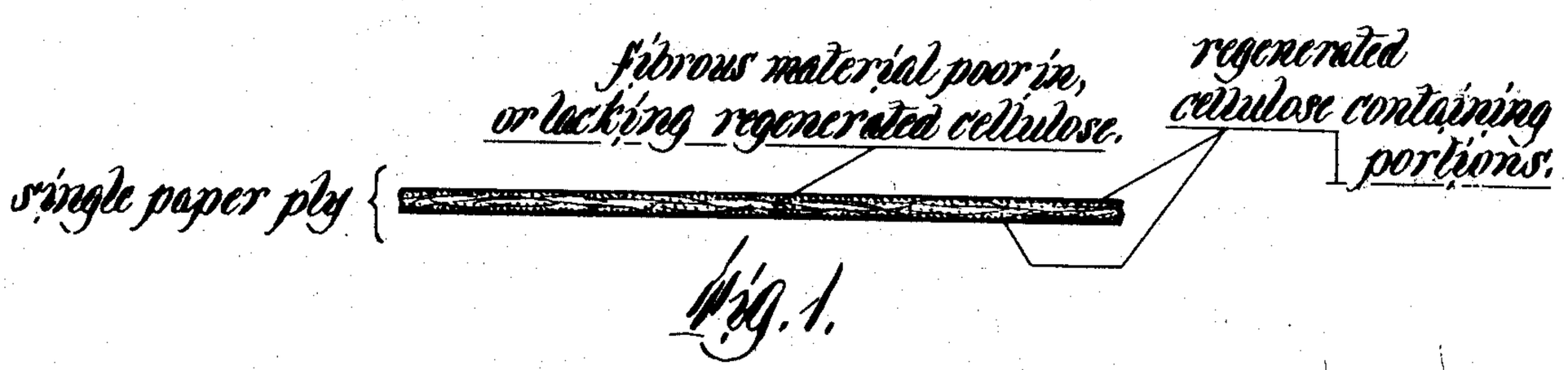

Fig. 1.

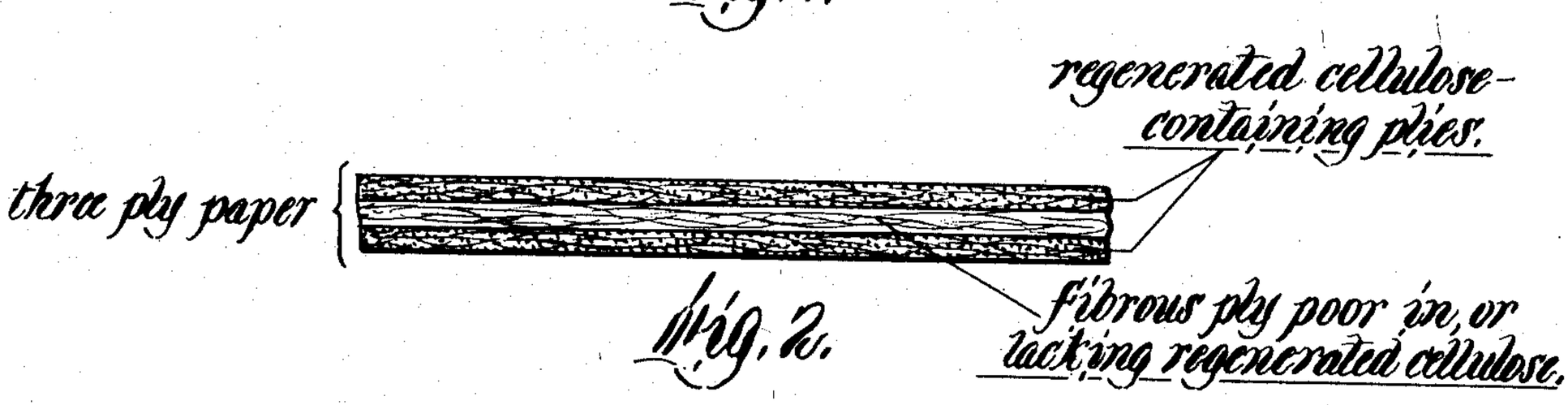

Fig. 2.

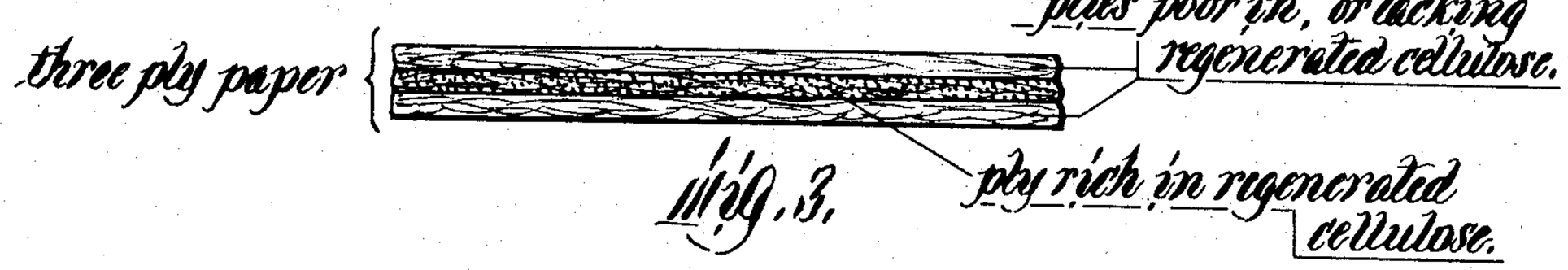

Fig. 3.

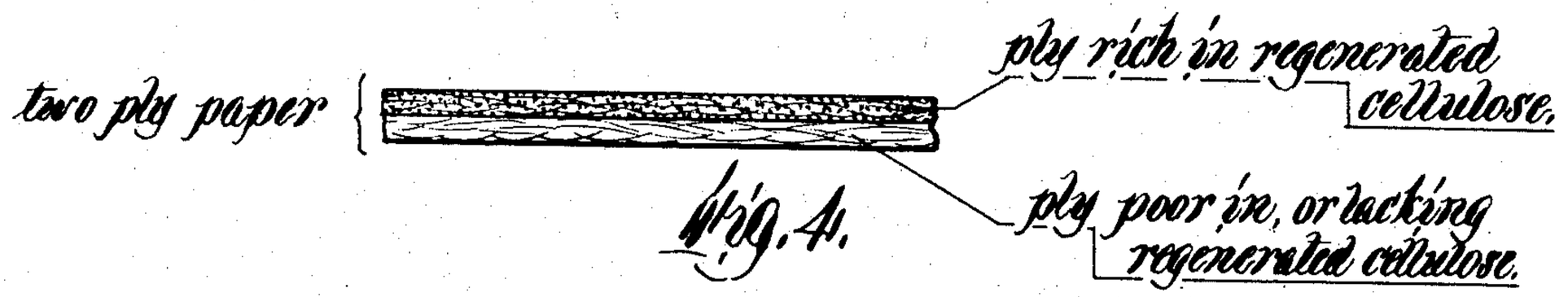

Fig. 4.

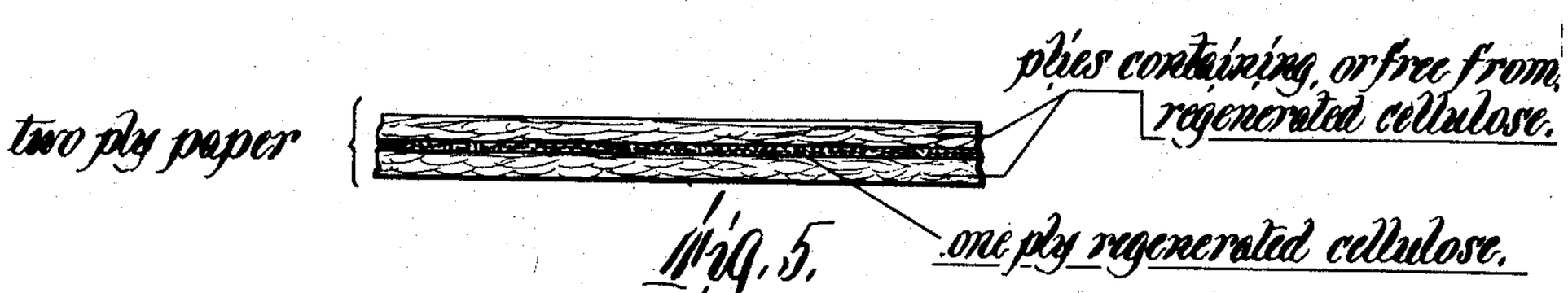

Fig. 5.

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UNITED STATES PATENT OFFICE

1,961,914

PAPER PRODUCT

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Application November 21, 1930, Serial No. 497,331

11 Claims. (Cl. 154—46)

This invention relates to a paper product, and more particularly one which is associated with a strength-giving agent, such as regenerated cellulose, which does not detract appreciably from the absorbency of the product. While not restricted thereto, the paper product of the present invention is intended more especially for use as towelling or in other situations where a low-priced sheet material having the quality of absorbency, coupled with that of high wet strength, is desired.

When a strength-giving agent, such as regenerated cellulose, is introduced throughout a waterleaf paper such as intended for use as towelling, for instance in amount as low as 1%, it is found that the wet strength of such paper may be quadrupled, or even more greatly increased, without detracting appreciably from its absorbency. In accordance with the present invention, a paper sheet is produced in which the strength-giving agent, and more especially regenerated cellulose, is non-uniformly distributed depthwise, that is, so that a cross-section through the paper is made up of layers varying in their contents of regenerated cellulose. On the accompanying drawing, Figures 1 to 5, inclusive, represent enlarged sections through paper products embodying different forms of our invention, with the appropriate legends thereon. For instance, the surface portions or outer layers of the paper sheet may advantageously contain more regenerated cellulose than its inner portion or layer, which, in fact, may be entirely devoid of regenerated cellulose, as illustrated in Figure 1. The resulting sheet as a whole is strong, especially when wet, because of the tough outer layers; the outer surfaces are resistant toward linting upon abrasion; the inner layer is preserved soft, fluffy, and highly absorbent; and the sheet as a whole has a high capacity for absorbing water. Such a sheet may be made as an integral or unitary structure, as by applying viscose to the surfaces of a waterleaf paper sheet in amount and concentration only sufficient to sink into the outer layers of the sheet, fixing regenerated cellulose, as a continuous phase in situ in such layers, as by immersing the sheet in a solution of a suitable cellulose-regenerating agent, such as boric acid or alum, and finally drying the sheet. A comparable product may be made from three or more independent paper plies, two of these plies containing regenerated cellulose and being intended as the outer layers of the multi-ply product, and the remaining ply or plies lacking regenerated cellulose and being intended as the inner layer or layers of the product, as illustrated in Figure 2. The plies may be bonded together as through interfelting or matting of the contacting surface portions while they are wet, or through the cementing action of gelatinized cellulose, freshly-formed regenerated cellulose, or the like. When the greatest softness and flexibility are desired in the multi-ply product, as when it is to be used as towelling, the plies may be superposed without bonding to one another. The tendency in such a multi-ply product for the plies to separate when the towelling is put to use and the difficulties of cutting, folding, assembling, and laying up into packages may be obviated and coherence of plies may be realized without material sacrifice of softness and flexibility in the multi-ply product, if the plies are cemented or otherwise united merely locally or at their edges.

In some cases, it is desirable to have the outer plies free from or poor in regenerated cellulose while having the inner ply or plies rich in this strength-giving agent, as illustrated in Figure 3. This is true if the outer plies are to be preserved particularly soft, as is desirable when the product is intended as bandage or diaper material. Should it be an important consideration to produce a product at lower cost, only two plies may be employed, one of which contains more regenerated cellulose than the other, which may, in fact, be devoid of this element, as illustrated in Figure 4.

The principles of the present invention extend to multi-ply products comprising one or more exceedingly thin plies made entirely of regenerated cellulose or "Cellophane", for instance a multi-ply product comprising an inner ply of "Cellophane" associated with outer plies of paper containing regenerated cellulose or free from regenerated cellulose, as illustrated in Figure 5. Thus, a product comprising an inner p'y of "Cellophane" adhesively united with outer plies of paper containing about 1% of regenerated cellulose, which paper piles are, as hereinbefore indicated, absorptive, may be of advantage for use as a bed-sheet, especially in hospitals, or as a bandage material, as both these uses call for a sheet material of high wet strength.

By the expression "continuous phase of regenerated cellulose" as used in the foregoing description and in the appended claims, we mean regenerated cellulose existing as a continuous body, for instance, as a preformed film termed "Cellophane", or as an impregnant extending substantially uninterruptedly in the surface portions, interior, or throughout paper. We do not mean to include thereby an interrupted or localized

impregnation of paper, as along spaced lines in either one or more directions, with regenerated cellulose, as this means that the impregnated areas will respond differently to wetting action than the unimpregnated areas and that the impregnant will impart to the paper a non-uniform feel, especially in the presence of water.

What we claim is:

1. A porous paper product possessed of a uniform feel and containing more regenerated cellulose as a continuous phase in the pores of its surface portions than in the pores of its inner portion.

2. A porous paper product possessed of a uniform feel and containing regenerated cellulose as a continuous phase in the pores of its surface portions but devoid of regenerated cellulose in the pores of its inner portion.

3. A porous paper product possesed of a uniform feel and containing more regenerated cellulose as a continuous phase in its inner portion than in the pores of its surface portions.

4. A porous multi-ply paper possessed of a uniform feel and whose plies contain in their pores at least two different concentrations of continuous phases of regenerated cellulose.

5. A multi-ply paper possessed of a uniform feel and made up of at least three paper plies, the outer plies containing in their pores regenerated cellulose as continuous phases but the rest of the plies being substantially devoid of regenerated cellulose.

6. A multi-ply paper possessed of a uniform feel and made up of at least three paper plies bonded together, the outer plies containing in their pores regenerated cellulose as continuous phases but the rest of the plies being substantially free from regenerated cellulose.

7. A multi-ply paper possessed of a uniform feel and made up of at least three paper plies, the outer plies containing in their pores regenerated cellulose as continuous phases but the rest of the plies being substantially free from regenerated cellulose, said plies being locally bonded together.

8. A multi-ply paper made up of at least three paper plies, the outer plies containing in their pores regenerated cellulose as continuous phases but the rest of the plies being substantially free from regenerated cellulose and being bonded together at their edges only.

9. A multi-ply product comprising an inner, continuous ply of regenerated cellulose adhesively united to outer absorptive plies of paper containing in their pores regenerated cellulose.

10. A multi-ply product comprising an inner, preformed ply of regenerated cellulose adhesively united to outer absorptive plies of paper containing in their pores regenerated cellulose.

11. A multi-ply product comprising an inner, preformed ply of regenerated cellulose united to outer absorptive plies of paper containing in their pores about 1% of regenerated cellulose.

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