Feb. 5, 1935. G. A. RICHTER 1,989,885

SPECIALTY PAPER

Filed Jan. 20, 1932

Fig. 1.

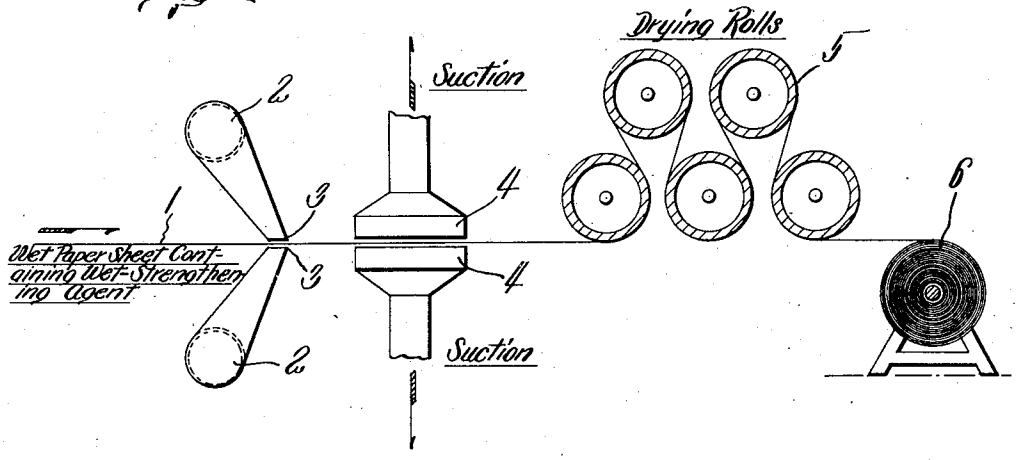
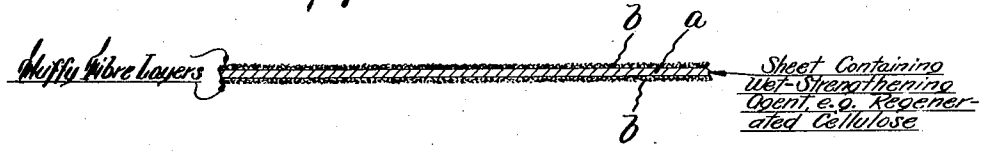


Fig. 2.



Inventor
George A. Richter
by Wright, Brown, Quinby & May
Attys

Patented Feb. 5, 1935 1,989,885

UNITED STATES PATENT OFFICE

1,989,885

SPECIALTY PAPER

George A. Richter, Berlin, N. H., assignor to Brown Company, Berlin, N. H., a corporation of Maine

Application January 20, 1932, Serial No. 587,789

2 Claims. (Cl. 91—68)

This invention relates to papers which are intended for special purposes and which can take the place of textile fabrics in such articles as towels, diapers, handkerchiefs, bandages, bed sheets, and the like. In all such connections, it is desirable that the sheet be possessed of the proper resistance against disintegration when wet and at the same time have high absorbency and softness of feel.

In accordance with the present invention, I prepare a sheet of unwoven fibers of interstitial and hence readily permeable structure whose interior layer or main body portion contains an agent existing as a continuous phase therein, imparting enhanced wet strength thereto but whose surface portions are much poorer in, or substantially devoid of, such agents as compared with the interior layer or main body portion. The agent enhancing the wet strength of the main body portion may be such adhesives as glue or casein, but I prefer to use regenerated cellulose derived from such cellulose derivatives as cellulose xanthate, cuprammonium cellulose, or the like, because of its high effectiveness as a wet-strengthening agent. One of these agents may be used in such amount as to enhance vastly the wet strength of the interior layer of fibers, while at the same time substantially preserving its ultimate water-holding capacity. For instance, through the use of as little as about ½% to 2% of regenerated cellulose, it is possible to effect a multifold increase in the wet strength of the interior layer of fibers without significantly detracting from the original volume of voids or interstices therein i. e., the ready permeability of the layer to water. The wet-strengthening agents do, however, retard the rate at which water is imbibed by the interior layer. Moreover, this layer itself is stiffer and harsher than is desired in articles of the class mentioned. By providing surface layers which are substantially devoid of wet-strengthening agent, these layers are of quicker absorptivity than the interior layer, by which I mean that they imbibe water more quickly than the interior layer. Besides, I prefer that the surface layers be of a fluffy texture conducive to a higher water-holding capacity than the interior layer, which may be of a denser structure than, for instance, the ordinary paper toweling composed of substantially unbeaten cellulose fibers. In fact, the interior layer may consist of a paper web whose fibers have been beaten or hydrated, inasmuch as I do not depend entirely upon the rate of absorptivity or water-holding capacity of the interior layer. This means that I depend upon the surface layers to act as temporary sponges or reservoirs for taking up quickly and holding water and then transferring water to the interior layer, which functions as a backing of high wet strength, preventing disintegration of the composite sheet.

With the foregoing and other features and objects in view, the present invention will now be described in greater detail in conjunction with the accompanying drawing, wherein

Figure 1 illustrates diagrammatically and conventionally some of the instrumentalities which might be employed in preparing a sheet embodying the present invention.

Figure 2 represents an enlarged section through a sheet so prepared.

In making a composite sheet embodying my invention, one may start with a bibulous waterleaf paper, that is, one which is substantially free from sizing or filling materals which diminish its absorptivity. Yet the paper may be fabricated from papermaking stock which has been more or less beaten or hydrated to increase its so-called Mullen or bursting strength. The prefabricated paper web coming continuously from the dry end of the paper machine may be progressively passed through, for instance, a bath of viscose solution of a strength designed to carry away about ½% to 2% of cellulose in the form of xanthate into and throughout the web as a continuous phase. The viscose solution may additionally contain boric acid, acetic acid, or other suitable agent in amount to promote the setting or regeneration of the cellulose as a continuous phase upon the drying of the web under the application of heat, without, however, gelling the solution so as to interfere with its penetrability. In Figure 1 of the drawing, I have shown the paper web 1 at the time when it is still wet with the wet-strengthening agent, say, in the form of viscose solution. The web surfaces are sticky at this stage, so that superficial layers of fibers can be anchored thereto but without much influx of wet-strengthening agent into such layers. A pair of nozzles 2 are shown arranged with their discharge ends 3 facing the web surfaces so as to deliver a current of air carrying fiber units in suspension therein against the surfaces. The fibers are preferably delivered as independent or individual fiber units over substantially all the web surfaces, whereby they are deposited as comparatively thin, fluffy, external layers *b* on the surfaces of the web *a*, as illustrated in Figure 2. Any fibers which do not become anchored to the sticky web surfaces

or do not become firmly entangled with the anchored fibers can be removed as by leading the resulting composite sheet between a pair of suction boxes 4 under sufficient suction to loosen and carry off such fibers without, however, destroying the fluffy texture of the superficial layers as deposited. The sheet can then be heated to cause the setting of the wet-strengthening agent, which, in the case of viscose, is attained by the regeneration of cellulose as a continuous phase in the internal paper web. As depicted, the sheet may be passed over a bank of drier drums 5, through which steam is circulated as usual as the heating medium, whereupon the dried sheet can be accumulated as a roll 6. The sheet may be unwound from the roll 6 and formed into articles of the various kinds enumerated.

The fibers used in forming the external layers may be of any suitable kind, e. g., chemical wood pulps, such as sulphite or kraft, pulps refined to high alpha cellulose content, cotton linters, mechanical wood pulp, etc. These fibers may be used as such or in a mercerized and/or mechanically powdered condition, together, if desired, with more or less noncellulosic fibers, such as wool, hair, and/or synthetic fibers, such as rayon. If desired, water-absorbent materials, e. g., hydrophilic colloids of the nature of soap and/or bentonite or other colloidal clays, may be admixed with the fibers.

The principles of the present invention extend to composite sheets of the character described, which have been prepared from a paper web containing a suitable wet-strengthening agent as a continuous phase and from preformed layers or webs of paper of the requisite texture substantially devoid of wet-strengthening agent. The latter webs may be of a loose, fluffy nature, prepared on papermaking machinery, which differs from the usual machinery in that little, if any, mechanical pressure has been applied to the webs during their traverse of the wet and dry ends of the machine. This means that the webs possess the maximum porosity and absorbency procurable on a paper machine, and so are eminently satisfactory as the top or surface layers for the paper web containing the wet-strengthening agent. The latter web may be treated with a suitable adhesive applied as a continuous film or only locally, to both its faces, whereupon the fluffy surfacing webs may be superposed and the adhesive caused to dry or set and thereby bond the plies into a unitary sheet. When the interior ply is still wet with the wet-strengthening agent, e. g., viscose solution, that present on the surface can be relied upon for bonding the superposed plies thereto.

In those instances when the surface layers of the sheet are formed directly on the paper web containing the wet-strengthening agent, it may be desirable to start with a paper web in which the wet-strengthening agent has already been dried or set. For instance, it may be desirable to start with a dry paper web containing regenerated cellulose distributed therethrough as a continuous phase enhancing the wet strength of the web. In such case, it is necessary to condition the web for receiving and anchoring the loose, individual fiber units sprinkled thereonto, and thereby acquiring an attached layer possessing the desired qualities of absorbency and softness. To this end, the dry paper web containing the wet-strengthening agent may be rewet with an aqueous solution of the same agent but in such dilution that even if it enters into the superficial deposits of fiber, they will contain much less of such agent than the internal paper web. Thus, a dried paper web containing regenerated cellulose may be thoroughly rewet with a highly dilute viscose solution, which appears on the web surfaces as a bonding medium for such fibers as are delivered thereover to form external layers. The resulting sheet may be dried under heat to cause a regeneration of cellulose from the bonding viscose solution, which may be of a dilution such that even if it enters throughout the superficial layers, the latter will have a regenerated cellulose content far lower than the internal paper web. Rather than rewetting the internal paper web with a dilute solution of wet-strengthening agent, such a solution may be sprayed or otherwise applied to the fibers being deposited on the web, so that these fibers cling to the dry web and then become permanently fixed thereto as a layer upon subsequent drying. The solution, e. g., viscose, sprayed onto the fibers should be of such low strength as to be compatible with the formation of applied exterior fiber layers of the desired qualities.

What I claim is:

1. A composite sheet comprising a porous, readily permeable and absorptive paper base containing a wet-strengthening agent selected from a class consisting of glue, casein, and regenerated cellulose, said agent being distributed therethrough in amount occupying only a small fraction of its pores but enhancing vastly its wet strength, and a fluffy layer of cellulose fiber attached to at least one surface of said paper base and being of greater absorptivity but much lower wet strength than said paper base, said fluffy layer taking up quickly and holding water and transferring such water to the paper base and said readily permeable paper base serving as a backing of high wet strength and preventing the disintegration of the composite sheet.

2. A composite sheet comprising a porous readily permeable and absorptive paper base containing regenerated cellulose distributed therethrough in amount occupying only a small fraction of its pores but enhancing vastly its wet strength, and a fluffy layer of cellulose fiber attached to at least one surface of said paper base and being of greater absorptivity but much lower wet strength than said paper base, said fluffy layer taking up quickly and holding water and transferring such water to the readily permeable paper base and said paper base serving as a backing of high wet strength and preventing the disintegration of the composite sheet.

GEORGE A. RICHTER.