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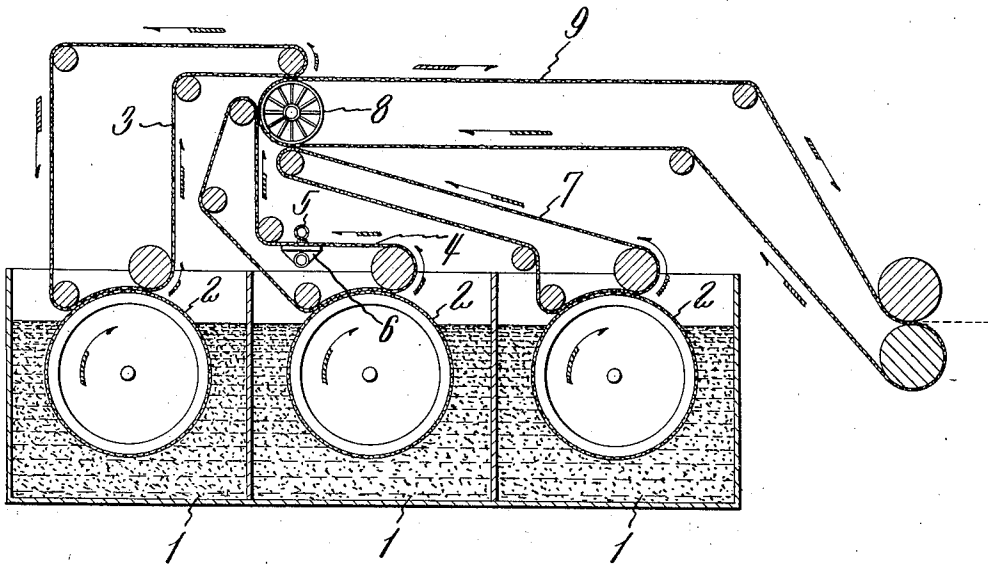
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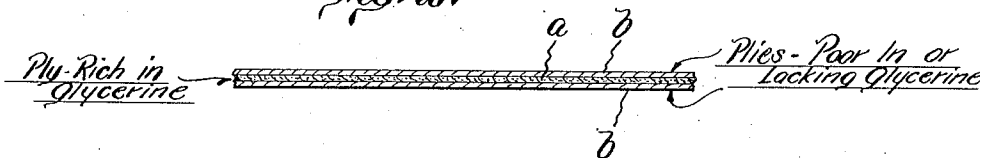
GLYCERINATED PAPER

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*Fig. 1.*



*Fig. 2.*



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## GLYCERINATED PAPER

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Application January 30, 1932, Serial No. 589,867

1 Claim. (Cl. 154—46)

This invention relates to glycerinated papers having a set of characteristics rendering such papers highly desirable for writing, printing, and other purposes.

5 In accordance with the present invention, I prepare glycerinated papers whose glycerine component is non-uniformly distributed there-  
through. This non-uniform distribution extends  
10 inwardly through its body or thickness from its exterior surfaces. More especially, the paper of the present invention is far richer in glycerine in its interior than at its surface layers. In fact, I prefer to have the surface layers substantially devoid of glycerine. Such a paper can conven-  
15 iently be made on a multi-cylinder papermaking machine as a sheet composed of at least three plies, the internal ply being glycerinated and the external plies being substantially devoid of glycerine or of gradually decreasing glycerine con-  
20 centration toward the exterior surfaces. The external plies may, however, advantageously be sized and/or filled with the usual papermaking ingredients so as to have the proper receptivity toward writing and printing inks.

25 A paper embodying the present invention has a valuable combination of qualities. The glycerine component enhances the pliancy and folding endurance of the paper. Nevertheless, the glycerine is not present at the surfaces, where it  
30 would interfere with ink-receiving properties of the paper and impart an objectionable damp and soft feel, as well as a flat appearance thereto. The fact is, that the absence of glycerine at the surface layers permits the paper to exhibit the  
35 desired rattle and hardness, particularly when the surface layers are sized with rosin, glue, casein, starch, silicate, viscose, or the like, even though the interior of the paper is highly glycerinated with a view toward greatly appreciating the pliancy and folding endurance of the paper. Along  
40 with the glycerine present in the interior or inner ply of the paper, may be glue or other sizing agent. So, too, fillers, dyes, or other papermaking ingredients may be present in the interior or  
45 inner ply of the paper, as well as in the surface layers or plies.

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

55 Figure 1 shows diagrammatically and conventionally a type of papermaking machine which lends itself to application in making the paper of the present invention.

Figure 2 represents an enlarged section through a paper embodying the present invention.

The machine shown in Figure 1 is a multi-cylinder papermaking machine comprising three vats and cylinders, and hence serviceable in making a three-ply paper. Of course, a machine  
60 having a larger number of vats and cylinder units might be employed, but for the purpose of illustration I have chosen a machine with the fewest units. Each of the units comprises a vat 1, into  
65 which the paper making stock is delivered at the proper rate as an aqueous suspension of the desired consistency. The stock is deposited as a layer or ply on a rotary cylinder or mould 2, which rotates partially submerged in the aqueous sus-  
70 pension. The layer or ply progressively deposited on the first cylinder, i. e., the left end one of the series, is carried out of the pulp suspension and is picked up by a traveling felt 3, which makes  
75 contact with the unsubmerged portion of the cylinder. A felt 4 picks up the ply from the second cylinder and carries it under a shower of glycerine of the desired strength emitted from a pipe 5. A uniform distribution of the glycerine  
80 through the ply, as well as a removal of excess, may be ensured by causing the felt 4 to pass over a suction box 6 during or after the application of glycerine to substantially the entire upper or exposed surface of the ply. A felt 7 picks up the  
ply from the third cylinder. Each of the pick-up felts can be directed by the appropriately located guide rolls shown, to a suction roll 8 about which passes a transfer felt 9 serving as the carrier for the superposed plies. As shown, the  
ply on the pick-up felt 7 is first sucked onto the felt 9, whereafter the plies on the pick-up felts 4 and 3 are successively laid against the first ply transferred to the felt 7. The wet condition of the plies, as well as the suction applied during their superposition, brings about their interlocking or matting into a unitary sheet, which can be conveyed by the felt 9 to a suitable drier, for instance over a bank of the usual heated drier drums (not shown), which delivers the sheet in a completely dewatered condition.

While there may be some migration of glycerine from the internal glycerinated ply to the external plies, especially while the plies are still wet with water, nevertheless the water present in the external plies will serve to dilute such glycerine as diffuses thereinto in a manner such that the concentration of glycerine will diminish progressively toward the exterior surfaces of the outer plies. The resulting sheet will therefore be one which, as illustrated in Figure 2, has an internal ply  $\alpha$

rich in glycerine, and external plies b poor in or lacking glycerine. Once the water content of the sheet is removed, there is little tendency for the viscous glycerine to enter from the inner ply into the outer plies, especially when the outer plies are sized. The sizing materials may be present in the stock suspension delivered into the cylinder vats for the outside plies. The stock for the outer plies, or, for that matter, all of the plies, may be prepared in beater engines in which the stock is well hydrated or beaten so as to lead to plies of a more or less dense or compact texture and high Mullen strength. When the outer plies are made from such stock, they do not favor the influx of glycerine from the inner, glycerinated ply. Rather than glycerinating a preformed inner ply, it is possible to glycerinate the stock used for this ply. In such latter case, the glycerine may be added either to the beater or to the cylinder vat in which the stock for the inner ply is handled.

The principles of the present invention extend to composite papers or boards made by pasting or sticking together three or more prefabricated paper plies through the use of suitable pastes or adhesives as the bonding agents. In accordance with the present invention, the inner ply or plies of such papers or boards may be thoroughly glycerinated, whereas the outer plies can be sized and contain such fillers as china clay but be practically lacking in glycerine. Such papers or boards may be calendered to present a smooth and glossy surface, which takes writing and printing inks nicely and which is eminently serviceable

for such uses as business or personal cards. The glycerinated interior of such papers or boards improves their flexing quality and folding endurance, without interfering with the surface characteristics sought therein.

The papers of the present invention possess a higher tear resistance and bursting or Mullen strength than when paper is uniformly glycerinated. Moreover, a paper which is well glycerinated throughout tends to undergo deterioration, for upon ageing not only does the paper lose markedly in tear resistance, but the glycerine on the surface tends to oxidize, especially in the presence of air and sunlight, and to acquire a sticky condition. When the glycerine is present in significant concentration only in the interior of the paper, the surface of the paper remains unimpaired, and there is much less tendency for the paper to deteriorate on ageing. It is, of course, possible to produce papers embodying the present invention and yet possessing widely different degrees of flexibility and folding endurance, depending upon such factors as the precise amount of glycerine used in the inner ply and the quality of the stock and the kind and amounts of sizing, filling agent, or other papermaking ingredients used in the outer plies.

What I claim is:

A multi-ply paper composed of at least three plies, the internal ply being glycerinated and the external piles being substantially devoid of glycerine.

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