

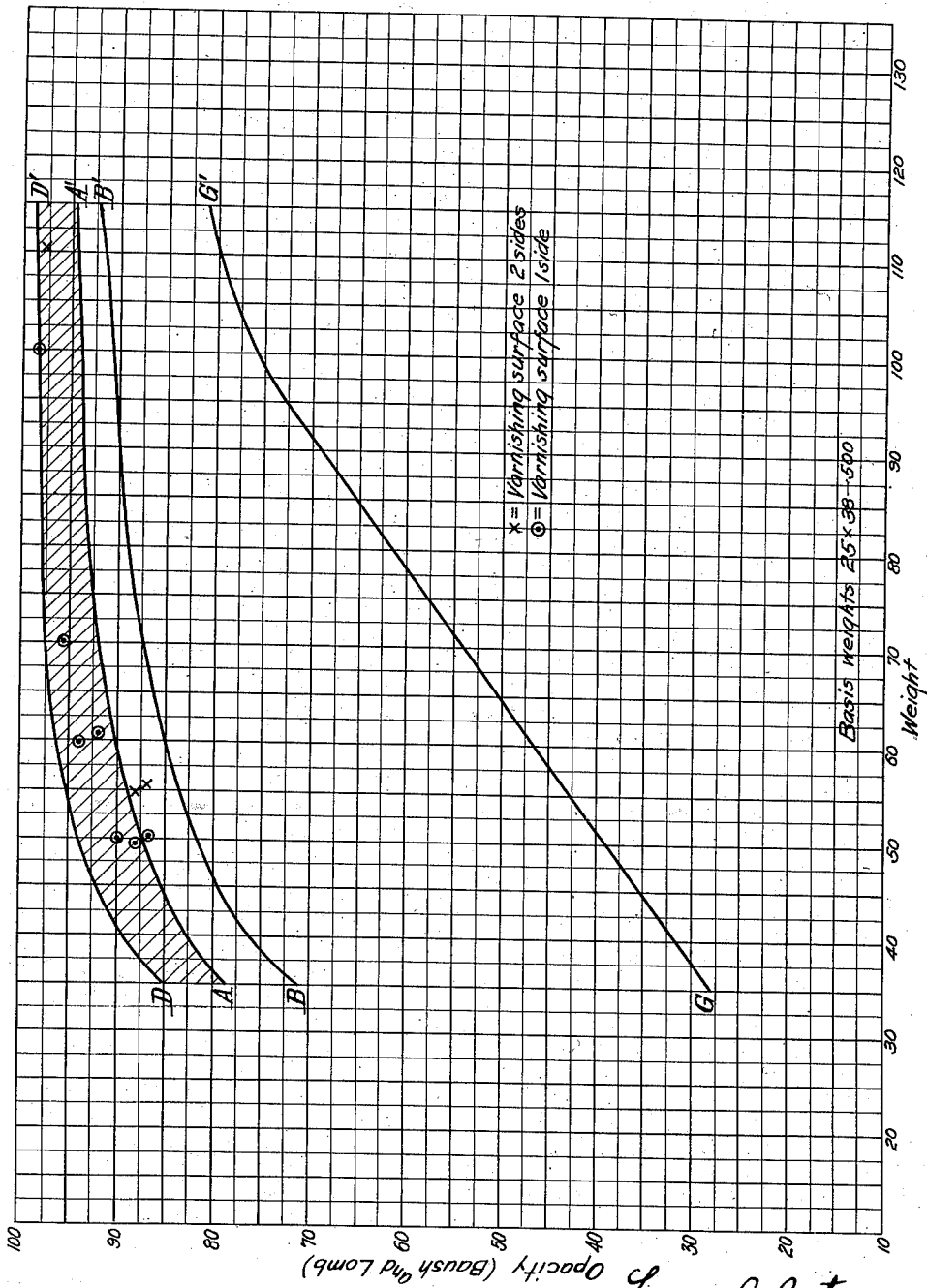
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PAPER

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10 Claims. (Cl. 92—68)

This invention relates to an improved uncoated paper for printing and varnishing, and it comprises a bright, well formed, opaque paper stock having an extremely smooth, highly finished, dense, closed up surface uniformly impenetrable to varnish. The paper embodies a novel combination of superior printing and varnishing properties which renders it particularly valuable for brilliant and attractive can, bottle and package labels, posters, liners, covers and the like.

There is a large demand for paper of a type suitable for receiving a coating or printing of varnish. In some cases certain uncoated printing papers have been used for this purpose, but the excessive penetration of the varnish into the sheet has restricted the usefulness of uncoated papers to inferior grades of work. For the better jobs it has been necessary to resort to special kinds of coated paper, employing a varnish resistant coating. Varnishing quality coated label paper is not only more costly than uncoated label paper, but also costlier even than regular coated label paper. The present invention offers an entirely satisfactory, inexpensive, uncoated substitute for the varnish quality coated paper. Moreover, my paper is superior to coated paper in that it is free from any tendency to crack along the fold when the paper is sharply creased.

A paper to have good varnishing qualities must have a smooth, impervious surface, so that penetration by the varnish is minimized, and it must retain the varnish film uniformly on the surface. This means that the varnish, whether spirit varnish applied by a roll, brush or scraper, or oil varnish applied by a printing operation (overprint varnish) should give a high glossy finish without mottle; it should not enter and discolor the paper appreciably, and it should not produce an appreciable increase in the transparency of the paper. As stated above, these qualities are usually associated only with certain grades of specially coated paper, but my paper, although uncoated, has varnishing qualities substantially equal to those of the better grades of varnish quality coated papers.

My product has a number of the properties of glassine, but is fundamentally different from glassine in that it is opaque. Glassine is smooth and highly impervious, and possesses excellent varnishing qualities, but its transparency renders it entirely unsuitable for the purposes to which varnishing grades of paper are put. Generally speaking, my new paper may be said to have the surface characteristics of glassine, and the body stock characteristics of good print-

ing paper. Thus, like glassine, the paper has a slick, dense, impervious, uniform, extremely smooth surface, which resists penetration by varnish. On the other hand, the body of the paper has the brightness, opacity and uniform formation of a supercalendered book paper. As for printing qualities, its smooth surface permits the faithful reproduction of fine half tones and deep, uniform solid blacks. Ink absorption, although slight, is uniform. The ink in this case dries largely by oxidation and gives a brilliant, glossy effect of exceptional merit. It should be noted that a paper having good printing and varnishing properties embodies an unusual combination. The paper of the present invention, which combines these qualities, and which is nevertheless free of any special loading, coating or impregnating materials, is new in the art.

In manufacturing this paper I may use the fibrous materials ordinarily used in a book or label paper. The beating, jordaning and paper machine operations should be carried out to produce a paper having the uniform, closed up formation of a book paper, rather than the "wild" formation characteristic of a bond or kraft paper. At the same time it should not have the "dead beaten" properties of a glassine. Undisintegrated fiber clumps alternating with comparatively open areas are to be avoided. They prevent uniform ink and varnish reception. It is desirable that the stock have a high densometer value, for example, 300 seconds or more, as determined on the Gurley densometer instrument. If desired, it may carry a surface filling or surface sizing.

The paper is then supercalendered. A supercalender employing alternating smooth metal and yielding rolls is suitable for this operation. The side of the paper first contacting with the metal supercalender rolls is well moistened just prior to its contact with the metal roll. This may be done by the direct application of liquid water by means of a roll dipping into a bath whereby an excess is applied to the paper and the paper then passes over a small rod and the excess is removed. Or a heavy steam shower may be applied to the paper or to the metal calender roll. The applied moisture is not permitted to distribute itself through the sheet, but is confined as much as possible to the surface. The combination of heavy pressure in the supercalender and the moist surface on the aforesaid stock produces a paper having the desired smooth, dense, impenetrable surface, without adversely affecting the body characteristics of the paper. The surface layers resemble glassine. This pro-

cedure, it should be noted, is directly the opposite of the normal supercalendering practice of uniformly compacting the paper. If only one side of the paper is to be given a high finish of the kind described, it may be given only a single pass through a calender stack in which only one side is contacted with the metal rolls, and then as it leaves the calender stack, the other side may be steamed or otherwise moistened sufficiently to remove the curl produced by the one side calendering as described in my application Serial No. 749,109. If, however, both sides of the paper are to be finished, the steaming to remove the curl is omitted and the paper is returned for another passage through the calender stack in which the other side of the paper is moistened and contacted with the metal rolls of the calender stack as described.

Certain processes of water finishing and calender staining have been applied to various wrapping papers, bag papers, etc., where strength and finish are important factors. But papers produced in these ways are well recognized as being entirely unsuitable as varnishing papers on account of uneven absorption. A varnish job on such papers is mottled and spotty in contrast to the uniform high gloss of my product. My paper is further characterized by having a high even finish. The finish has the uniformity of a good supercalendered book paper, but is considerably higher. When tested on the Bausch & Lomb glossmeter the finish in general is in excess of 40. Supercalendered book papers commonly give readings of 22 to 32, and water finished bag paper and M. G. papers usually give readings between 27 and 42.

My invention includes paper of all basis weights. As stated above, one of the requirements for my new paper is that the fibers be evenly matted together to give a well formed, closed up, uniform formation to the paper, such as corresponds to a good grade of book papers. Quantitative measurements and standards for formation have been established in the industry. Numerical measurement of formation depends to some extent on basis weight. Thus a double thickness of a sheet having a given formation would appear to have a better formation than it really has. The formation value required for my paper may be defined as that of a sheet of 60 pounds basis weight (25 x 38 inches—500 sheets), with a formation of at least 66 as defined by the Central Grading Committee (executive authority) of the Book Paper Manufacturers' Association (1934). In other words, a heavy sheet, for example, would have to have the formation equal to a 60 pound sheet having a formation value of at least 66; the determination of which is a simple matter for those skilled in the art, by an examination of the surface structure. Formation should be equal to or better than that required in a B grade machine finished book paper, as defined by the aforesaid committee.

The paper embraced by my invention is readily distinguished from glassine by its much greater brightness and opacity. It is characterized by having a brightness of at least 66 as defined by the Central Grading Committee (executive authority) of the Book Paper Manufacturers' Association (1934). The opacity of my paper approximates that of a supercalendered book paper. If both sides of the paper are provided with the varnishing quality surface, the opacity will be somewhat lower.

In the accompanying drawing I have shown

graphically the opacities of several samples of my paper of different basis weights, opacity determination being made on the Bausch & Lomb opacimeter and basis weights being expressed as pounds for 500 sheets 25 x 38 inches. The area between the curves AA' and DD' embraces the opacities of white supercalendered book papers as ordinarily manufactured. The curve GG' is typical of glassine. It will be seen that the opacities of samples of varnishing surface one side paper lie within or very close to the supercalendered zone, while the samples of varnishing surface two sides paper are a trifle less opaque. In any case, the opacity of my paper for any given weight will exceed that shown by the curve BB'. It will be noted that this is far in excess of opacities for glassine. Colored or tinted paper made according to the present invention is a very attractive product.

My paper, although uncoated, has varnishing qualities substantially equal to those of coated papers generally recognized in the art as being of varnish quality. On brushing a definite quantity of standard spirit varnish on the new paper and on varnish quality coated papers, by way of comparison, it is seen that the new paper shows gloss, lack of discoloration and lack of transparency equal or superior to the average sample of varnish quality coated papers.

Although there is no generally accepted quantitative test for the varnishing quality of paper, it has been observed that the time required for castor oil to completely saturate a sheet of uncoated paper bears a definite relation to the absorption of printing ink and certain kinds of varnish. A method of performing this test is to lay a piece of the paper to be tested on the surface of the oil and note the time in seconds required for complete saturation. The paper should be conditioned and the test conducted at 70° F. and 50% relative humidity. U. S. P. castor oil should be used and should have a viscosity of about 9 poises at the time of the test.

The time for saturation of machine finished and supercalendered book papers, other things being equal, is roughly proportional to the square of the basis weight. The average saturation time for book papers is approximately one eighteenth of the square of the basis weight (25 x 38 inches—500 sheets) and will rarely if ever exceed this value by more than 150 seconds. The papers of my invention, on the other hand, will always exceed the value stated by more than 200 seconds and will in general exceed it by 300 seconds or more.

One paper within the scope of the invention is exemplified by the following: The stock consists of about equal proportions of sulfite and soda pulp, with a small amount of mineral filler and moderately sized with rosin size, and both sides having a varnishing surface.

Basis weight (25 x 38 inches—500 sheets)	
Smoothness (Bekk)	55
Densometer (Gurley)	1000
Brightness	74
Opacity (Bausch & Lomb)	88
Formation	75
Finish (Bausch & Lomb glossmeter)	50
Varnish—Equal to varnish quality coated paper	

This application is a continuation-in-part of my application Serial No. 749,109, filed October 19, 1934.

I claim:

1. A varnishing quality, uncoated, printing paper produced by the process defined in claim 8 and characterized by having a smooth, dense, uniformly impervious surface of the nature of glassine, a brightness of at least 66, a formation at least equal to that of a paper of basis weight 60 pounds (25 x 38 inches—500 sheets) having a formation of 66 as defined by the Central Grading Committee of the Book Paper Manufacturers' Association (1934), an opacity on the Bausch & Lomb opacimeter greater than about 71 for basis weight 35, 76 for basis weight 40, 79 for basis weight 45, 81 for basis weight 50, 83 for basis weight 55, 85 for basis weight 60, 86 for basis weight 65, 87 for basis weight 70, 88 for basis weight 75, 89 for basis weight 80, 90 for basis weight 90, 91 for basis weight 105, and 92 for basis weight 115, as shown on curve BB' of Figure 1, and varnishing properties substantially equivalent to those of a varnish quality coated paper.
2. An uncoated printing paper produced by the process defined in claim 8 and having a varnish quality substantially equal to that of a commercial varnish quality coated paper, said paper being characterized by having a smooth, dense, uniformly impervious surface of the nature of glassine, and an opacity when measured on the Bausch & Lomb opacimeter greater than about 71 for basis weight 35, 76 for basis weight 40, 79 for basis weight 45, 81 for basis weight 50, 83 for basis weight 55, 85 for basis weight 60, 86 for basis weight 65, 87 for basis weight 70, 88 for basis weight 75, 89 for basis weight 80, 90 for basis weight 90, 91 for basis weight 105, and 92 for basis weight 115, as shown on the curve BB' of Figure 1.
3. An uncoated printing paper produced by the process defined in claim 8 and having a varnish quality substantially equal to that of commercial varnish quality coated paper, said paper being characterized by having a smooth, dense, uniformly impervious surface of the nature of glassine, a finish of at least 40 on a standard Bausch & Lomb glossmeter and an opacity, when measured on the Bausch & Lomb opacimeter greater than about 71 for basis weight 35, 76 for basis weight 40, 79 for basis weight 45, 81 for basis weight 50, 83 for basis weight 55, 85 for basis weight 60, 86 for basis weight 65, 87 for basis weight 70, 88 for basis weight 75, 89 for basis weight 80, 90 for basis weight 90, 91 for basis weight 105, and 92 for basis weight 115, as shown on curve BB' of Figure 1.
4. A varnishing quality, uncoated, printing paper produced by the process defined in claim 8 and characterized by having a smooth, dense, uniformly impervious surface of the nature of glassine, a formation at least equal to that of a paper of basis weight 60 pounds (25 x 38 inches—500 sheets) having a formation of 66 as defined by the Central Grading Committee of the Book Paper Manufacturers' Association (1934), an opacity on the Bausch & Lomb opacimeter greater than about 71 for basis weight 35, 76 for basis weight 40, 79 for basis weight 45, 81 for basis weight 50, 83 for basis weight 55, 85 for basis weight 60, 86 for basis weight 65, 87 for basis weight 70, 88 for basis weight 75, 89 for basis weight 80, 90 for basis weight 90, 91 for basis weight 105, and 92 for basis weight 115, as

shown on curve BB' of Figure 1, and varnishing properties substantially equivalent to those of a varnish quality coated paper.

5. An uncoated printing paper produced by the process defined in claim 8 and characterized by having a smooth, dense, uniformly impervious surface of the nature of glassine, a brightness of at least 66, an opacity on the Bausch & Lomb opacimeter greater than about 71, 76, 79, 81, 83, 85, 86, 87, 88, 89, 90, 91 and 92 for basis weights 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 90, 105 and 115, respectively, and when conditioned and tested at 70° F. and 50% relative humidity, a saturation time in seconds of not less than 200 plus one eighteenth of the square of the basis weight in the flotation test on U. S. P. castor oil having a viscosity at the time of the test of about 9 poises.

6. An uncoated printing paper produced by the process defined in claim 8 and characterized by having a smooth, dense, uniformly impervious surface of the nature of glassine, an opacity on the Bausch & Lomb opacimeter greater than 71, 76, 79, 81, 83, 85, 86, 87, 88, 89, 90, 91 and 92 for basis weights 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 90, 105 and 115, respectively, a finish of at least 40 measured on a standard Bausch & Lomb glossmeter, and when conditioned and tested at 70° F. and 50% relative humidity, a saturation time in seconds of not less than 200 plus one eighteenth of the square of the basis weight, in the flotation test on U. S. P. castor oil having a viscosity, at the time of the test, of about 9 poises.

7. Paper as defined in claim 5 further characterized by a finish of at least 40 on a standard Bausch & Lomb glossmeter.

8. Process of making a varnishing grade of uncoated paper which comprises, temporarily softening at least one surface of an evenly formed paper web by adding sufficient moisture thereto to produce when supercalendered a surface of the nature of glassine, and supercalendering the web before the moisture has had time to penetrate and soften more than the surface layers of the paper with the softened surface against the metal supercalender rolls.

9. Process as defined in claim 8 in which only one surface of the paper is moistened and supercalendered and the other surface is moistened, subsequent to the supercalendering operation, to a degree sufficient to substantially eliminate the curl caused by the supercalendering.

10. An uncoated printing paper produced by the process defined in claim 8, one surface of said paper having a varnish quality substantially equal to that of a commercial varnish quality coated paper and being characterized by having a smooth, dense, uniformly impervious surface of the nature of glassine and the other surface being substantially free of supercalender finish, said paper being substantially free of curl and having an opacity when measured on the Bausch & Lomb opacimeter greater than about 71 for basis weight 35, 76 for basis weight 40, 79 for basis weight 45, 81 for basis weight 50, 83 for basis weight 55, 85 for basis weight 60, 86 for basis weight 65, 87 for basis weight 70, 88 for basis weight 75, 89 for basis weight 80, 90 for basis weight 90, 91 for basis weight 105, and 92 for basis weight 115, as shown on the curve BB' of Figure 1.

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