Oct. 19, 1965 M. N. STILES 3,212,919

PRINTING PAPER

Filed Jan. 21, 1963 3 Sheets-Sheet 1

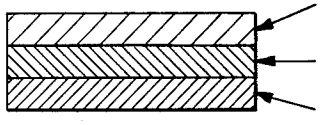


FIG. 1

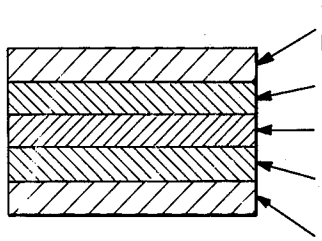
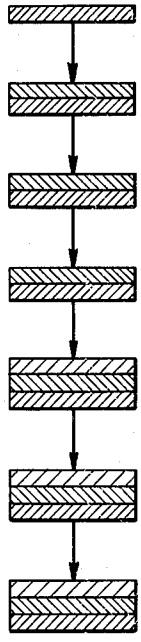


FIG. 2



1. Apply an aqueous prime coating of binder and pigment containing satin white to one side of paper
2. Partially dry
3. Lightly finish (optional)
4. Apply an aqueous top coating of binder and pigment chiefly of platelet structure
5. Partially dry
6. Lightly finish

Printing paper of Fig. I having a light weight double coating on one side thereof

FIG. 3

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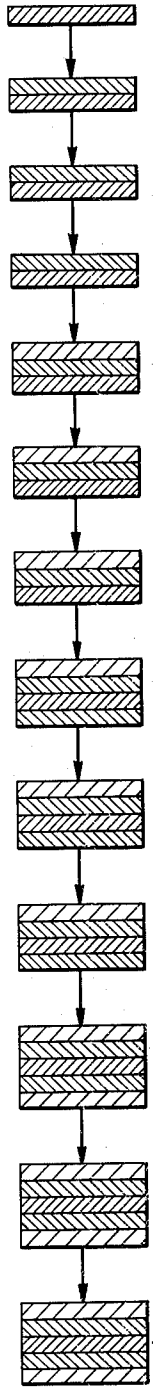

1. Apply an aqueous prime coating of binder and pigment containing satin white to one side of paper
2. Partially dry
3. Lightly finish (optional)
4. Apply an aqueous top coating of binder and pigment chiefly of platelet structure to prime coated side of paper
5. Partially dry
6. Lightly finish
7. Apply an aqueous prime coating of binder and pigment containing satin white to other side of paper
8. Partially dry
9. Lightly finish (optional)
10. Apply an aqueous top coating of binder and pigment chiefly of platelet structure to prime coated side of paper
11. Partially dry
12. Lightly finish

Printing paper of Fig. 2 having a light weight double coating on both sides thereof

FIG. 4

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PRINTING PAPER

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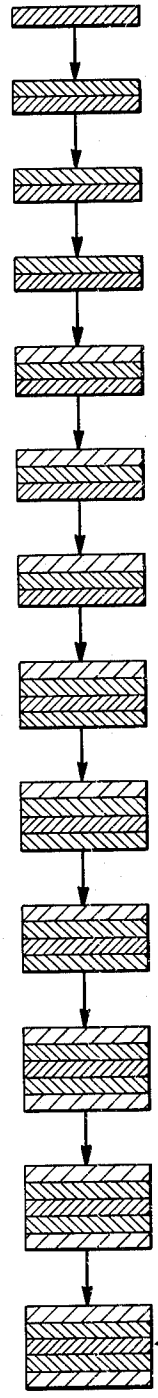

1. Apply an aqueous prime coating of binder and pigment containing satin white to one side of paper
2. Partially dry
3. Lightly finish (optional)
4. Apply an aqueous prime coating of binder and pigment containing satin white to other side of paper
5. Partially dry
6. Lightly finish
7. Apply an aqueous top coating of binder and pigment chiefly of platelet structure to one side of paper
8. Partially dry
9. Lightly finish (optional)
10. Apply an aqueous top coating of binder and pigment chiefly of platelet structure to other side of paper
11. Partially dry
12. Lightly finish

Printing paper of Fig. 2 having a light weight double coating on both sides thereof

FIG. 5

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3,212,919

PRINTING PAPER

Morrison N. Stiles, Westport, Conn., assignor to Time, Incorporated, New York, N.Y., a corporation of New York

Filed Jan. 21, 1963, Ser. No. 252,599
7 Claims. (Cl. 117—68)

This application is a continuation-in-part of my copending application Serial No. 102,924 filed April 14, 1961, now abandoned.

The present invention relates to printing paper, and more particularly to printing paper having a light weight double coating thereon and to a process for producing the same.

Printing paper employed in the publishing industry, such as that used in magazines printed on high quality paper, must possess certain minimum characteristics. Thus, such printing paper must have a smooth printing surface, uniform ink receptivity, high ink holdout, high opacity, high pick resistance, and high brightness.

Heretofore, the industry has produced printing paper by carefully selecting the fibers and fillers to be used in the manufacture of the paper. Such paper generally has been subjected to sizing and finishing operations to further improve its properties. In addition, printing paper has been produced by coating paper with a single coating composed of a pigment and a binder. More recently, the industry has turned to double coated printing paper, i.e., paper having thereon both a prime coat and a top coat formed of a pigment and a binder.

The present day printing papers produced by any of these methods, however, suffer from two very serious drawbacks. Firstly, these printing papers have a heavy coat weight of 11 to 25 pounds per ream or higher. The heavy coat weight of the paper, of course, increases the weight of the publication printed thereon, such as a magazine, and accordingly results in high handling, shipping and mailing costs. Secondly, the present day printing papers, whether uncoated, single coated or double coated, all are produced by using high finishing techniques, such as supercalender operating at 1000 pounds per linear inch pressure and in general at 1700 pounds per linear inch pressure or higher. Such finishing operations are costly, densify the paper, decrease the mechanical strength of the paper due to fiber crushing, and decrease the opacity and brightness of the paper due to the crushing of the air/fiber or air/coating interfaces.

Therefore, it is an object of the present invention to provide a high quality double coated printing paper having high pick resistance, high ink holdout, high opacity, high brightness, high smoothness, and uniform ink receptivity and yet which will have a light coat weight and will be high in caliper or bulk and which can be produced without costly supercalendering. These objects of the present invention are achieved in the manner described below.

In the drawings,

FIG. 1 is an enlarged non-scalar cross-sectional elevational view of one embodiment of the double coated printing paper of the invention;

FIG. 2 is an enlarged non-scalar cross-sectional elevational view of another embodiment of the double coated printing paper of the invention;

FIG. 3 is a flow sheet of an embodiment of the process of the invention for producing the double coated printing paper of FIG. 1; and

FIGS. 4 and 5 are flow sheets of embodiments of the process of the invention for producing the double coated printing paper of FIG. 2.

The paper which is employed in the process of the invention can have any desired basis weight, for example, a basis weight at about 6% moisture content (25" x 38"—500 sheets) of about 17, 24, 26, 30 and 50 pounds per ream. The nature of the fibers and fillers in the paper utilized in the process is not important.

In the first step of the process a prime coat is applied to one or both sides of the paper by means of a coater, such as a doctor coater or roll coater and preferably a trailing blade coater. The weight of the prime coat is from about 1 to about 2 pounds, and preferably about 1.5 pounds, of solids per side per ream.

The prime coating material is an aqueous slurry containing from about 15% to about 50%, and preferably from about 30% to about 36%, of solids made up of a suspended pigment and a dissolved binder. The pigment to binder dry weight ratio in the prime coating material is from about 100:15 to about 100:50, and preferably from about 100:30 to about 100:35.

The pigment in the prime coat is satin white, a needle shaped or acicular pigment, which is calcium sulfoaluminate having the generally accepted formula

$$3CaO \cdot Al_2O_3 \cdot 3CaSO_4 \cdot 31H_2O$$

If desired, however, the satin white pigment can be used in conjunction with other mineral pigments, such as coating clay, calcium carbonate and titanium dioxide, so long as the prime coat pigment is at least 70% satin white. The presence of this large amount of satin white in the prime coat pigment is critical, since it has been found that the use of other mineral pigments as the prime coat pigment does not produce printing paper satisfying the objects of the invention.

The suitability of satin white as the prime coat pigment is believed to be due to the fact that it imparts an unexpectedly low specific gravity, far below the anticipated value, of about 0.95–1.12 grams per cubic centimeter to the dried prime coating through its ability to entrap about 50% of air in the coating structure. Moreover, it has low penetration into paper so that it lays on the surface of the paper and thereby coats most of the fibers rather than leave the topmost fibers uncoated and also fills the surface voids and irregularities. It is also not prone to develop shrinkage cracks when used in the prime coat and therefore gives a smooth coherent surafce. It cannot, however, be used as the sole pigment in the top coat of the double coated paper of the invention, because it is not a good ink receiver, unless it is so heavly calendered that its other desirable properties are impaired, so that flat prints would result.

The binder in the prime coat can be starch, enzyme oxidized starch and other modified starches, casein, styrene-butadiene latex, polyvinyl acetate latex, Saran latex, acrylic latex, polyvinyl alcohol and the like.

Typical examples of aqueous prime coating materials are as follows:

Components	Parts by Weight								
	1	2	3	4	5	6	7	8	9
Satin white	100	100	100	100	74	74	100	75	75
Coating clay					26	26			
Calcium carbonate								25	25
Penford 280 (an ethylene oxide modified starch)	35	35	44		24.3	24.1	30	31	30
Styrene-butadiene latex				30					
Casein				5	6.1	5.9			
Percent Solids	21.7	25.8	27.1	23.9	35.4	34.7	30	33	26.5

After the prime coat has been applied to the paper surface, it is partially dried to a plastic state. In its plastic state the prime coat has a moisture content of from about 6% to about 12%, and preferably from about 8% to about 11%. The moisture content should not be allowed to fall below 6%, because then the subsequent finishing pressures necessary become excessively high. A moisture content above about 12% should also be avoided, for otherwise the pick will tend to be low and the paper is extremely sensitive to pressure, so that, with excessive pressure, opacity and brightness values will be low (a phenomenon known to papermakers as blackening). Wrinkling, of course, is an additional problem. This plastic state is reached in about 2 to 3 minutes drying time at room temperature. The drying time necessary will decrease at elevated temperatures.

The partially dry prime coated paper is then finished without substantially changing the caliper or thickness of the prime coated paper. This finishing is done by lightly calendering the partially dry prime coated paper at a pressure of from about 100 to about 900 pounds per linear inch. This finishing can be achieved by passing the partially dry prime coated paper through the single nip between lightly loaded, unheated calender rolls, one being steel and the other being a hard rubber covered roll. Although this finishing operation is generally performed, it can be omitted, if desired. However, its omission will decrease the pick resistance and increase the cockling of the printing paper.

After the prime coated paper has been finished, there is then applied to one or both surfaces of the finished prime coated paper from about 0.5 to about 1.5 pounds, and preferably about 1 pound, of solids per side per ream of a top coat. This top coating operation is performed by a doctor coater which is preferably a trailing blade coater.

The top coating is applied as an aqueous slurry containing from about 30% to about 60%, and preferably from about 40% to about 50%, of solids. The solids are made up of a suspended pigment chiefly, i.e., about 80% or higher, of platelet structure, such as coating clay or talc, and a dissolved binder, such as starch, enzyme oxidized starch and other modified starches, casein, Saran latex, styrene-butadiene latex and the like. The pigment to binder dry weight ratio in the top coating is from about 100:15 to about 100:50, and preferably from about 100:25 to about 100:35.

Typical aqueous top coating materials are as follows:

Components	Parts by Weight			
	1	2	3	4
Coating clay (Peerless)	100	80	85	100
Satin white		20	15	
Penford 280 (an ethylene oxide modified starch)	35	35	24.8	26
Casein			1.2	
Percent Solids	43	38	47.7	45

The top coated paper is then partially dried to a plastic state. This plastic state is reached when the moisture

content of the top coat is from about 6% to about 12%, and preferably from about 8% to about 11%. Once again, a moisture content below about 6% should be avoided in order to eliminate the necessity for using subsequent excessively high finishing pressures. A moisture content above about 12% should also be avoided, for otherwise the pick will tend to be low and the paper is extremely sensitive to pressure, so that, with excessive pressure, opacity and brightness values will be low (a phenomenon known to papermakers as blackening). This plastic state is generally reached in about 2 to 3 minutes drying time at room temperature. This drying time can be further decreased by using an elevated temperature.

When the top coated paper has been partially dried to a plastic state, it is then finished by lightly calendering the double coated paper at a pressure of from about 300 to 500 pounds per linear inch. This exceedingly low pressure avoids any substantial change in the caliper of the double coated paper and those physical properties normally degraded by ordinary supercalendering, such as brightness, opacity and tear strength. The finishing can be achieved inexpensively at room temperature by passing the double coated paper through the single nip between lightly loaded calender rolls, one being steel and the other being a hard rubber covered roll.

The printing paper produced by the above described process is a high quality printing paper having a light weight double coating thereon of from about 1.5 to about 3.5 pounds per side per ream or a total double coat weight of from about 3 to about 7 pounds per ream if both sides of the paper are double coated. Moreover, the paper has high ink holdout, high opacity, high brightness, high pick resistance, uniform ink receptivity, and high smoothness, which combination of properties has been heretofore unobtainable unless heavy coat weights of 11 to 25 pounds per ream or higher were used. The finished high quality printing paper has a prime coating thereon of from about 1 to about 2, and preferably about 1.5, pounds per side per ream of a pigment and a binder, the pigment being at least 70% satin white, the pigment to binder dry weight ratio being from about 100:15 to about 100:50, and preferably from about 100:30 to about 100:35. The finished printing paper also has a top coating thereon of from about 0.5 to about 1.5, and preferably about 1, pounds per side per ream of a pigment chiefly, i.e., 80% of higher, of platelet structure and a binder, the pigment to binder dry weight ratio being from about 100:15 to about 100:50, and preferably from about 100:25 to about 100:35.

The process and product of the invention will be further illustrated by the following examples.

Example 1

A cellulosic fiber paper having a basis weight at about 6% moisture content (25" x 38"—500 sheets) of 25 pound per ream was coated on both sides by trailing blade coaters with a total of 2.5 pounds of solids per ream (1.25 pounds of solids per side ream) of a prime coat which was an aqueous slurry containing 25% solids made up of satin white pigment and an ethylene oxide modified starch binder, the pigment to binder dry weight ratio being 100:35. The prime coated paper was partially dried at room temperature to a moisture content

of 11.5%. The partially dried prime coated paper was lightly finished by passing it through the single nip between a steel roll and a hard rubber covered roll at a pressure of 900 pounds per linear inch. (One side of the paper was prime coated, dried and finished and then the other side thereof was prime coated, dried and finished.)

Both sides of the finished prime coated paper were coated by trailing blade coaters with a total of 2.5 pounds of solids per ream (1.25 pounds of solids per side per ream) of a top coat which was an aqueous slurry containing 35% solids made up of a coating clay pigment and an ethylene oxide modified starch binder, the pigment to binder dry weight ratio being 100:35. The top coated paper was partially dried to a moisture content of 11.5% and then lightly finished at a pressure of 500 pounds per linear inch by passing it through the single nip between a steel roll and a hard rubber covered roll. (One side of the finished prime coated paper was top coated, dried and finished and then the other side thereof was top coated, dried and finished.)

The high quality printing paper had a light weight double coating of 2.5 pounds per side per ream or a total of 5 pounds per ream.

Example 2

A cellulosic fiber paper of the X paper company having a basis weight at about 6% moisture content (25" x 38"—500 sheets) of 27.5 pounds per ream was coated on the felt side by a trailing blade coater with 0.9 pound of solids per ream of a prime coat which was an aqueous slurry containing 34.7% solids made up of 74.0 parts of satin white (dry basis), 26.0 parts of coating clay (Peerless), 5.9 parts of casein and 24.1 parts of an ethylene oxide modified starch (Penford 280), the pigment to binder dry weight ratio therefor being 100:30. The prime coated paper was partially dried at room temperature to a moisture content of 11.25%.

The wire side of the paper was then coated by a trailing blade coater with 2.0 pounds of solids per ream of the above prime coat, thus making a total prime coat of 2.9 pounds of solids per ream. The prime coated paper was again partially dried at room temperature to a moisture content of 11.25% and then lightly finished by passing it wire side down through the single nip between a lower steel roll and an upper hard rubber covered roll (¼" covering, No. 5 P & J composition) at a pressure of 300 pounds per linear inch.

The wire side of the finished prime coated paper was coated by a trailing blade coater with 1.0 pound of solids per ream of a top coat which was an aqueous slurry containing 47.7% solids made up of 85.0 parts of coating clay (ASP–602), 15.0 parts of satin white (dry basis), 1.2 parts of casein and 24.8 parts of an ethylene oxide modified starch (Penford 280), the pigment to binder dry weight ratio therefore being 100:26. The top coated paper was partially dried at room temperature to a moisture content of 11.25%.

The felt side of the paper was then coated by a trailing blade coater with 1.0 pounds of solids per ream of the above top coat, thus making a total top coat of 2.0 pounds of solids per ream. The top coated paper was again partially dried at room temperature to a moisture content of 11.25% and then lightly finished at a pressure of 300 pounds per linear inch by passing it felt side down through the single nip between a lower steel roll and an upper hard rubber covered roll.

The high quality printing paper has a light weight double coating of 1.9 pounds per ream on the felt side and 3.0 pounds per ream on the wire side or a total of 4.9 pounds per ream.

A comparison between this high quality printing paper having a light weight double coating thereon of 4.9 pounds per ream and two of the outstanding commercially available machine coated publication papers of the X and Y paper companies having a heavy coat weight of 12–13 pounds per ream is set forth below.

	Paper of Example 2	X Paper	Y Paper
Basis Weight of Rawstock (pounds per ream).	27.5	27–28	27–28.
Total Coat Weight (pounds per ream).	4.9	12–13	12–13.
Basis Weight of Coated Paper (pounds per ream).	32.4	40–41	40–41.
B & L Opacity	91.9	90.5	91.5.
G.E. Brightness	70.5	71.9	68.8.
Caliper (inches)	0.0022	0.0020	0.0018.
Pick (I.P.I. tack graded inks).	None with No. 4; slight pick with No. 5.	None with No. 4; slight pick with No. 5.	None with No. 4; slight pick with No. 5.
Smoothness by Zeiss Light Section Microscope (pits of 20 mirons or greater, pits of 10 to 15 microns, pits of 5 to 8 microns).	0–0–0	0–0–10	0–0–12.
Ink Receptivity	Even ink lay	Mottled ink lay	Mottled ink lay.
Gloss Ink Holdout	High	Medium	Medium.

The above comparative data clearly establish the importance of using satin white as the pigment in the prime coat of a light weight double coating and of using very low finishing pressures not heretofore possible.

The comparative data in Example 3 below, wherein the prime coat pigment of four Papers A, B, C and D having a light weight double coating thereon was varied, further demonstrate the importance of using satin white as the prime coat pigment.

Example 3

Four identical cellulosic fiber papers having a basis weight at about 6% moisture content (25" x 38"—500 sheets) of 26.0±0.5 pounds per ream were separately coated on the felt side by a trailing blade coater with 1 pound of solids per ream of a prime coat which was an aqueous slurry containing 30% solids (Paper A) and 46% solids (Papers B, C and D) made up of satin white pigment (Paper A), a scalenohedral-shaped calcium carbonate pigment (Paper B), a rhombic-shaped calcium carbonate pigment (Paper C), coating clay pigment (Paper D) and an ethylene oxide modified starch binder, the pigment to binder dry weight ratio being 100:30. [The above mentoined differing solids content were utilized so that the viscosities of the four prime coat batches would be substantially identical and so that the trailing blade pressures required to apply the constant prime coat weight would be substantially identical.] The prime coated papers were partially dried at room temperature to a moisture content of 11.25%.

The wire sides of the papers were then separately coated by a trailing blade coter with 2 pounds of solids per ream of the above respectively specified prime coats, thus making a total prime coat of 3 pounds of solids per ream. The prime coated papers were again partially dried at room temperature to a moisture content of 11.25% and then lightly finished by passing them felt side down through the single nip between a lower steel roll and an

upper hard rubber covered roll (½" covering, No. 5 P & J composition) at a pressure of 500 pounds per linear inch.

The felt side of the finished prime coated papers was coated by a trailing blade coater with 1 pound of solids per ream of a top coat which was an aqueous slurry containing 45% solids made up of a coating clay pigment and an ethylene oxide modified starch binder, the pigment to binder dry weight ratio being 100:26. The top coated papers were partially dried at room temperature to a moisture content of 11.25%.

The wire side of the papers was then coated by a trailing blade coater with 1 pound of solids per ream of the above top coat, thus making a total top coat of 2 pounds of solids per ream. The top coated papers were again partially dried at room temperature to a moisture content of 11.25% and then lightly finished at a pressure of 500 pounds per linear inch by passing them wire side down through the single nip between a lower steel roll and an upper hard rubber covered roll.

All four papers had a light weight double coating of 2 pounds per ream on the felt side and 3 pounds per ream on the wire side or a total of 5 pounds per ream. Although their composition differed only in the nature of the prime coat pigment, this differentiation produced a significant distinction in their optical properties as shown below:

	Paper A	Paper B	Paper C	Paper D
Prime Coat Pigment	Satin White	Scalenohedral-shaped calcium carbonate.	Rhombic-shaped calcium carbonate.	Coating clay.
B & L Opacity	90.8	90.1	88.8	85.6.
G.E. Brightness	70.3	66.6	66.2	64.3.

The remaining four examples set forth below illustrate further embodiments of the invention and the remarkable properties of the double coated papers produced thereby.

Example 4

A cellulosic fiber paper having a basis weight at 6% moisture content (25" x 38"—500 sheets) of 16.9 pounds per ream was coated on both sides by trailing blade coaters to a total of 3.6 pounds per solids per ream (1.8 pounds of solids per side per ream) of a prime coat which was an aqueous slurry containing 33% solids made up of a mixed pigment (75% satin white plus 25% calcium carbonate) and an ethylene oxide modified starch binder, the pigment to binder dry weight ratio being 100:31. The prime coated paper was partially dried at room temperature to a moisture content of 11.25%. The partially dried prime coated paper was lightly finished by passing it through the single nip between a steel roll and a hard rubber covered roll at a pressure of 500 pounds per linear inch. (One side of the paper was prime coated, dried and finished and then the other side thereof was prime coated, dried and finished.)

Both sides of the finished prime coated paper were coated by trailing blade coaters with a total of 2.0 pounds of solids per ream (1.0 pound of solids per side per ream) of a top coat which was an aqeuous slurry containing 45% solids made up of a coating clay pigment and an ethylene oxide modified starch binder, the pigment to binder dry weight ratio being 100:26. The top coated paper was partially dried to a moisture content of 11.25% and then lightly finished at a pressure of 500 pounds per linear inch by passing it through the single nip between a steel roll and a hard rubber covered roll. (One side of the finished prime coated paper was top coated, dried and finished and then the other side thereof was top coated, dried and finished.)

The high quality printing paper had a light weight double coating of 2.8 pounds per side per ream or a total of 5.6 pounds per ream. The physical properties of the double coated paper are set forth in the following table:

Basis weight of rawstock (pounds per ream)	16.9
Total coat weight (pounds per ream)	5.6
Basis weight of coated paper (pounds per ream)	22.5
B & L opacity	88.0
G.E. brightness	82.3
Caliper (inches)	0.0015
Smoothness by Zeiss light section microscope (pits of 20 microns or greater—pits of 10 to 15 microns—pits of 5 to 8 microns)	0–0–0

Example 5

A cellulosic fiber paper having a basis weight at 6% moisture content (25" x 38"—500 sheets) of 24.3 pounds per ream was coated on the wire side only by a trailing blade coater with 2.3 pounds of solids per ream of a prime coat which was an aqueous slurry containing 33% solids made up of a mixed pigment (75% satin white plus 25% calcium carbonate) and an ethylene oxide modified starch binder, the pigment to binder dry weight ratio being 100:31. The prime coated paper was partially dried at room temperature to a moisture content of 11.25%. The partially dried prime coated paper was lightly finished by passing it through the single nip between a steel roll and a hard rubber covered roll at a pressure of 500 pounds per linear inch.

The wire side of the finished prime coated paper was coated by a trailing blade coater with 1.0 pound of solids per ream of a top coat which was an aqueous slurry containing 45% solids made up of a coating clay pigment and an ethylene oxide modified starch binder, the pigment to binder dry weight ratio being 100:26. The top coated paper was partially dried to a moisture content of 11.25% and then lightly finished at a pressure of 500 pounds per linear inch by passing it through the single nip between a steel roll and a hard rubber covered roll. The high quality printing paper had a light weight double coating of 3.3 pounds per ream on the wire side and was uncoated on the felt side. The physical properties of the double coated paper are set forth in the following table:

Basis weight of rawstock (pounds per ream)	24.3
Total coat weight (pounds per ream)	3.3
Basis weight of coated paper (pounds per ream)	27.6
B & L opacity	89.0
G.E. brightness	70.2
Caliper (inches)	0.0022
Smoothness by Zeiss light section microscope (pits of 20 microns or greater—pits of 10 to 15 microns—pits of 5 to 8 microns)	0–0–1

Example 6

A cellulosic fiber paper having a basis weight at 6% moisture content (25" x 38"—500 sheets) of 50.0 pounds per ream was coated on both sides by trailing blade coaters to a total of 3.2 pounds of solids per ream (1.6 pounds of solids per side per ream) of a prime coat which was an aqueous slurry containing 33% solids made up of a mixed pigment (75% satin white plus 25% calcium carbonate) and an ethylene oxide modified starch binder, the pigment to binder dry weight ratio being 100:31. The prime coated paper was partially dried at room temperature to a moisture content of 11.25%. The partially dried prime coated paper was lightly finished by passing it through the single nip between a steel roll and a hard rubber covered roll at a pressure of 500 pounds per linear inch. (One side of the paper was prime coated,

dried and finished and then the other side thereof was prime coated, dried and finished.)

Both sides of the finished prime coated paper were coated by trailing blade coaters with a total of 2.4 pounds of solids per ream (1.2 pounds of solids per side per ream) of a top coat which was an aqueous slurry containing 45% solids made up of a coating clay pigment and an ethylene oxide modified starch binder, the pigment to binder dry weight ratio being 100:26. The top coated paper was partially dried to a moisture content of 11.25% and then lightly finished at a pressure of 500 pounds per linear inch by passing it through the single nip between a steel roll and a hard rubber covered roll. (One side of the finished prime coated paper was top coated, dried and finished and then the other side thereof was top coated, dried and finished.)

The high quality printing paper had a light weight double coating of 2.8 pounds per side per ream or a total of 5.6 pounds per ream. The physical properties of the double coated paper are set forth in the following table:

Basis weight of rawstock (pounds per ream)	50.0
Total coat weight (pounds per ream)	5.6
Basis weight of coated paper (pounds per ream)	55.6
B & L opacity	98.5
G.E. brightness	74.4
Caliper (inches)	0.0045
Smoothness by Zeiss light section microscope (pits of 20 microns or greater—pits of 10 to 15 microns—pits of 5 to 8 microns)	0–0–2

Example 7

A cellulosic fiber paper having a basis weight at 6% moisture content (25" x 38"—500 sheets) of 30.1 pounds per ream was coated on both sides by roll coaters to a total of 4.4 pounds of solids per ream (2.2 pounds of solids per side per ream) of a prime coat which was an aqueous slurry containing 26.5% solids made up of a mixed pigment (75% satin white plus 25% calcium carbonate) and an ethylene oxide modified starch binder, the pigment to binder dry weight ratio being 100:30. The prime coated paper was partially dried at room temperature to a moisture content of 11.25%. The partially dried prime coated paper was lightly finished by passing it through the single nip between a steel roll and a hard rubber covered roll at a pressure of 500 pounds per linear inch. (One side of the paper was prime coated, dried and finished and then the other side thereof was prime coated, dried and finished.)

Both sides of the finished prime coated paper were coated by trailing blade coaters with a total of 2.0 pounds of solids per ream (1.0 pound of solids per side per ream) of a top coat which was an aqueous slurry containing 45% solids made up of a coating clay pigment and an ethylene oxide modified starch binder, the pigment to binder dry weight ratio being 100:26. The top coated paper was partially dried to a moisture content of 11.25% and then lightly finished at a pressure of 500 pounds per linear inch by passing it through the single nip between a steel roll and a hard rubber covered roll. (One side of the finished prime coated paper was top coated, dried and finished and then the other side thereof was top coated, dried and finished.)

The high quality printing paper had a light weight double coating of 3.2 pounds per side per ream or a total of 6.4 pounds per ream. The physical properties of the double coated paper are set forth in the following table:

Basis weight of rawstock (pounds per ream)	30.1
Total coat weight (pounds per ream)	6.4
Basis weight of coated paper (pounds per ream)	36.5
B & L opacity	94.0
G.E. brightness	70.0
Caliper (inches)	0.0026
Smoothness by Zeiss light section microscope (pits of 20 microns or greater—pits of 10 to 15 microns—pits of 5 to 8 microns)	0–0–2

The process of the invention was performed as an on-machine or as an off-machine operation. If desired, the prime and top coating materials can contain compatible adjuvants, such as dispersants, deformers, dyes, thickeners, etc.

It will be appreciated that various modifications and changes may be made in the process and product of the invention in addition to those described above without departing from the spirit thereof. For example, one side of the paper can be double coated and finished and then the other side thereof can be double coated and finished. Accordingly, the invention is to be limited only within the scope of the appended claims.

What is claimed is:

1. A process for preparing a high quality printing paper having a light weight double coating thereon which comprises applying to the surface of paper from about 1 to about 2 pounds of solids per side per ream of a prime coating material which is an aqueous slurry containing from about 15% to about 50% solids made up of a pigment and a binder, the pigment being at least 70% satin white and the pigment to binder dry weight ratio being from about 100:15 to about 100:50; partially drying the prime coated paper to a plastic state and having a moisture content of from about 6% to about 12%; applying with a doctor coater to the surface of the prime coated paper from about 0.5 to about 1.5 pounds of solids per side per ream of a top coating material which is an aqueous slurry containing from about 30% to about 60% solids made up of a pigment chiefly of platelet structure and a binder, the pigment to binder dry weight ratio being from about 100:15 to about 100:50; partially drying the top coated paper to a plastic state and having a moisture content of from about 6% to about 12%; and lightly finishing the double coated paper at from about 300 pounds to about 500 pounds per linear inch pressure.

2. The process as set forth in claim **1** wherein the partially dried prime coated paper is lightly finished at a pressure of from about 100 to about 900 pounds per linear inch before applying the top coat thereto.

3. The process as set forth in claim **2** wherein one side of the paper is prime coated, partially dried, finished, top coated, partially dried and finished, and then the other side of the paper is so treated.

4. The process as set forth in claim **2** wherein one side of the paper is prime coated and partially dried; the other side of the paper is prime coated and partially dried; both sides are finished; one side of the paper is top coated and partially dried; the other side of the paper is top coated and partially dried; and both sides are finished.

5. A process for preparing a high quality printing paper having a light weight double coating thereon which comprises applying to the surface of paper about 1.5 pounds of solids per side per ream of a prime coating material which is an aqueous slurry containing from about 30% to about 36% solids made up of a stain white pigment and a starch binder, the pigment to binder dry weight ratio being from about 100:30 to about 100:35; partially drying the prime coated paper to a plastic state and having a moisture content of from about 8% to about 11%; lightly finishing the partially dry prime coated paper at from about 100 to 900 pounds per linear inch pressure; applying with a trailing blade coater to the surface of the prime coated paper about 1 pound of solids per side per ream of a top coating material which is an aqueous slurry containing from about 40% to about 50% solids made up of a coating clay pigment and a starch binder, the pigment to binder dry weight ratio being from about 100:25 to about 100:35; partially drying the top coated paper to a plastic state and having a moisture content of from about 8% to about 11%; and lightly

finishing the double coated paper at from about 300 to 500 pounds per linear inch pressure.

6. A high quality printing paper having a light weight double coating thereon which comprises a paper having a prime coating thereon of from about 1 to about 2 pounds per side per ream of a pigment and a binder, the pigment being at least about 70% of satin white, the pigment to binder dry weight ratio being from about 100:15 to about 100:50; and having a top coating thereon of from about 0.5 to about 1.5 pounds per side per ream of a pigment chiefly of platelet structure and a binder, the pigment to binder dry weight ratio being from about 100:15 to about 100:50.

7. A high quality printing paper having a light weight double coating thereon which comprises a paper having

a prime coating thereon of about 1.5 pounds per side per ream of a satin white pigment and a starch binder, the pigment to binder dry weight ratio being from about 100:30 to about 100:35; and having a top coating thereon of about 1 pound per side per ream of a coating clay pigment and a starch binder, the pigment to binder dry weight ratio being from about 100:25 to about 100:35.

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