APPLYING FOR A STANDARD PATENT

KANZAKI PAPER MFG. CO., LTD., a company organized and existing under the laws of Japan of 9-8, 4-chome, Ginza, Chuo-ku, Tokyo-to, Japan hereby apply for the grant of a Standard Patent for an invention entitled

"METHOD OF PRODUCING MEDIUM-GRADE COATED PAPER CONTAINING HIGH YIELD PULPS FOR WEB OFFSET PRINTING"

which is described in the accompanying complete specification.

DETAILS OF BASIC APPLICATION(S):-

Number of basic application: 54-048348
Name of Convention country in which basic application was filed: JAPAN
Date of basic application: 17th April, 1979

Our address for service is: F.B. RICE & CO.,
101 Mort St,
Balmain N.S.W. 2041

Dated this 16th day of April 1980.

KANZAKI PAPER MFG. CO., LTD.

By: Patent Attorney

TO: The Commissioner of Patents
COMMONWEALTH OF AUSTRALIA

F.B. RICE & CO.,
Patent Attorneys,
Sydney.

LODGED AT SUB-OFFICE
17 APR 1980
Sydney
DECLARATION IN SUPPORT OF AN APPLICATION OR A CONVENTION APPLICATION FOR A PATENT OR PATENT OF ADDITION

In support of the Convention Application made by KANZAKI PAPER MFG. CO., LTD.

for a patent for an invention entitled: "METHOD OF PRODUCING MEDIUM GRADE COATED PAPER CONTAINING HIGH YIELD PULPS FOR WEB OFFSET PRINTING.

Tsuneo Miyake Managing Director of and care of the applicant company do solemnly and sincerely declare as follows:

*(1) I am authorised by the applicant for the patent to make this declaration on its behalf.

*(2) The basic application(s) as defined by section 141 of the Act was made in JAPAN on 17th April, 1989 by

*(3) See back hereof.

% are the actual inventor(s) of the invention and the facts upon which KANZAKI PAPER MFG. CO., LTD. % are entitled to make the application are as follows: The applicant is a person who would if a patent were granted upon application made by the actual inventors be entitled to have the patent assigned to it under the provisions of Section 34 (1) (fa) of the act.

*(4) The basic application(s) referred to in paragraph 2 of this Declaration is/are the first application(s) made in a Convention country in respect of the invention the subject of the application.

Declared at TOKYO this 27th day of July 1980.

To: The Commissioner of Patents, Commonwealth of Australia.

This Form is suitable for any type of Patent Application. No legalisation required.

Inventors: Kazuhiko Suzuki of 6-12, 1-chome, Higashinaruo-cho, Nishinomiya-shi, Hyogo-ken, Japan, Yasuhiro Fujiki of 9-5, Nishiota-cho, Ibaraki-shi, Osaka-fu, Japan and Akira Takada of 1-8, 7-chome, Nishiokamoto, Higashinada-ku, Kobe-shi, Hyogo-ken, JAPAN.
(54) METHOD OF PRODUCING MEDIUM GRADE PAPER FOR WEB OFFSET PRINTING

(71) KANZAKI PAPER MFG. CO., LTD

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(72) KAZUHIKO SUZUKI, YASAHIRO FUJIKI AND AKIRA TAKADA

(74) Ri

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(57)

Claim

1. A method of producing medium-grade coated paper for web offset printing, which comprises applying a coating composition to both surfaces of a base paper so that the total coating weight on both surfaces thereof is above 5 g/m²,

said coating composition containing natural ground calcium carbonate with a specific surface area of 1.5 m²/g to 5 m²/g under the following conditions:

(i) when said specific surface area is 1.5 m²/g to 2.5 m²/g:

10% to (90S-125)% by weight of the total pigment content where "S" represents a specific surface area (m²/g);

(ii) when said specific surface area is 2.5 m²/g to 5 m²/g:

10% to 100% by weight of the total pigment content,

said base paper containing one or more high-yield pulps in an amount equal to 10% to 100% by weight of the fiber content thereof and one or more chemical pulps in an amount equal to 0% to 90% by weight of the fiber content thereof, said high-yield pulp component having a 42-mesh fiber fraction content of less than 30% by weight.
Complete Specification for the invention entitled:

"METHOD OF PRODUCING MEDIUM-GRADE COATED PAPER CONTAINING HIGH YIELD PULPS FOR WEB OFFSET PRINTING"

The following statement is a full description of this invention including the best method of performing it known to us:-
The present invention relates to a method of producing medium-grade coated paper for web offset printing, the base paper of which contains high yield pulps. More particularly, it relates to a method of producing medium-grade coated paper for web offset printing, in which paper heat-set roughening has been reduced.

Recently, the importance of coated paper for printing as a medium of publication, advertisement, publicity, etc. has been reperceived. Particularly, the demand for coated paper of grade No. 3, No. 4 or No. 5 (hereinafter referred to as "medium-grade coated paper") has been rapidly increasing because of the need of reducing the weight and cost of paper. Generally, medium-grade coated paper is widely used in the field of lightweight paper of 45 to 80 g/m² as compared with high-grade (grade No. 1 or No. 2) coated paper which does not contain high yield pulps. Therefore, to compensate for the reduction of opacity resulting from the decrease of paper weight and to reduce the cost of paper, the base paper of medium-grade coated paper contains, 5 to 100% by weight of its pulp composition, high yield pulps as follows: mechanical pulp (hereinafter referred to as "MP"), pressure stone-ground pulp (hereinafter referred to as "SGP"), refiner-ground pulp (hereinafter referred to as "RGP"), or thermo-mechanical pulp (hereinafter referred to as "TMP"); chemi-mechanical pulp (hereinafter referred to as "CMP") such as chemi-thermo-mechanical pulp (hereinafter referred to as "CTMP") or chemi-ground pulp (hereinafter referred to as "CGP"); and semi-chemical pulp (hereinafter referred to as "SCP").

In many cases, medium-grade coated paper is subjected to web offset printing, which is high-speed printing, because of its use and purposes. However, the web offset printing, in which continuous hot drying is performed after printing, is liable to produce unfavourable phenomena of blisterring and...
heat-set roughening that are not seen in other printing processes such as sheet offset printing, rotogravure printing and letter press printing. These phenomena are serious disadvantages exerting bad influences upon printing.

Blistering is seen both in high-grade and medium-grade coated papers, and has been found to be attributable to the fact that, in a hot drying process conducted immediately after printing, moisture remaining in the base paper is instantaneously evaporated by heat exceeding 100°C and the expanded vapor pushes up the paper surface. A number of methods for eliminating such blistering have been provided.

Heat-set roughening, a phenomenon that the paper surfaces become rough after web offset printing, is seen only in medium-grade coated paper, not in high-grade coated paper. Neither causes of such heat-set roughening nor remedies therefor have been made sufficiently clear yet. This has been considered to be the most difficult technical problem in the manufacture of medium-grade coated paper for web offset printing.

The inventors et al. have continued study for a long period of time with a view to reducing heat-set roughening. As a result, it has been found that even if fiber bundles, shives and the like of high yield pulps, which were considered to be the main cause of heat-set roughening, are removed from the pulp composition, heat-set roughening still occurs when a coating composition on both surfaces is above 16 g/m², and this tendency is more remarkable when the coating composition has been applied by means of a blade coater. Further study has revealed that heat-set roughening is attributable to the essential difference in property between high yield pulps and chemical pulps contained in the base paper. That is, the causes of heat-set roughening are as follows: under drying and finishing conditions of coated paper required for obtaining the same smoothness and gloss, the high yield pulps in the base paper contain more moisture
than the chemical pulps therein, and therefore in a hot
drying process in web offset printing the moisture not only
in shives of the high yield pulps but also in single fiber
pieces thereof evaporates instantaneously; furthermore, the
fiber of the high yield pulps is very rigid and its bonding
strength is small.

On the basis of such finding, the inventors, et al. have
made further study not only of the base paper but also of the
coating composition in order to reduce heat-set roughening in
medium-grade coated paper for web offset printing. As a
result, the inventors et al. have successfully obtained
medium-grade coated paper in which heat-set roughening is
reduced, by comprising the base paper of high yield pulps
having a certain fiber length distribution and by comprisin:
the coating composition of certain natural ground calcium
carbonate in a limited proportion.

It is an object of the present invention to provide a
method of producing medium-grade coated paper for web offset
printing, in which paper heat-set roughening has been reduced.

It is another object of the present invention to provide
a method of producing medium-grade coated paper of excellent
quality at very small cost.

These and other objects have been attained by a method
which comprises applying a coating composition to both
surfaces of base paper,
said coating composition containing natural ground
calcium carbonate with a specific surface area of 1.5 m²/g
to 5 m²/g under the following conditions:
   (i) when said specific surface area is 1.5 m²/g to
   2.5 m²/g,
   10% to (90S-125)% by weight, of whole pigments
   ("S" represents a specific surface area (m²/g)).
   (ii) when said specific surface area is 2.5 m²/g to
   5 m²/g:
   10% to 100%, by weight, of whole pigments,
said base paper containing one or more high-yield pulps in an amount equal to 10% to 100% by weight of the fiber content thereof and one or more chemical pulps in an amount equal to 0% to 90% by weight of the fiber content thereof, said high-yield pulp component having a 42-mesh fiber fraction content of less than 30% by weight.

Other and further objects and advantages of the invention will appear more fully from the following description.

The attached drawing shows the relationship between the specific surface area and proportion of natural ground calcium carbonate used as a pigment in a coating composition. In the present invention, the specific surface area and proportion of natural ground calcium carbonate are selected from the shadowed portion in this drawing.

The high yield pulps used in the present invention are conventional high yield pulps such as MP (SGP, RGP TMP or the like), CMP (CTMP or the like) or SCP, and consist of unbleached pulps, semibleached pulps and/or bleached pulps which are widely used in newsprint paper, paper board, medium-grade paper, medium-grade coated paper, groundwood paper, etc. Selectively used in the present invention are high yield pulps which, irrespective of their kinds, are below 30%, or preferably below 20%, or more preferably below 10% in 42-mesh on fiber fraction content. High yield pulps generally used in paper making have 42-mesh on fiber fraction contents as follows: approx. 25 to 40% for SGP, approx. 30 to 60% for RGP, and approx. 35 to 75% for TMP. In the present invention, high yield pulps are adapted to have the above-mentioned 42-mesh on fiber fraction contents by properly adjusting the manufacturing conditions of the high yield pulps, refining conditions of the high yield pulps,
refining conditions, screening conditions, post refining conditions, etc. Particularly, high yield pulps with a 42-mesh on fiber fraction content of below 5% are the most preferable because they combine with a certain coating composition of the present invention to reduce heat-set roughening very remarkably. If the 42-mesh on fiber fraction content is too low, however, the yield of pulps is reduced and additional power rates are required for refining, post refining, etc. Therefore, the 42-mesh on fiber fraction content is adjusted according to the desired quality of medium-grade coated paper, proportion of high yield pulps, content of coating composition, etc.

Among high yield pulps having said 42-mesh on fiber fraction contents, particularly a high yield pulp which is below 80%, preferably below 70%, in the ratio of containing fiber fractions passing through a 150-mesh screen (hereinafter referred to as "150-mesh through fiber fraction content") is preferable because it effectively reduces heat-set roughening and prevents blistering. When more than one kind of high yield pulp is used in the present invention, the 42-mesh on fiber fraction content and the 150-mesh through fiber fraction content are determined after the high yield pulps are mixed together. Lignin is sometimes removed from high yield pulps by oxidation or deoxidization. Because in this case the high yield pulps become like a chemical pulp, heat-set roughening is reduced, but the original objects to improve opacity and reduce paper cost by using high yield pulps cannot be attained. Therefore, such treatment is preferably limited to such an extent that the high yield pulps show brightness of below 80% when determined by means of a Hunter multipurpose reflectometer, and this applies also to the case of bleached waste paper.

The base paper of medium-grade coated paper used in the present invention contains said high yield pulps at least 10% by weight, and is produced as follows: The high yield pulps
are mixed with chemical pulp, waste paper pulp, broke pulp, etc. and, according to need, with auxiliary agents such as filler, size, retention aid, paper strengthening agent, dyestuff, alum, pitch control agent, anti-foaming agent, etc. Then, a pulp composition thus prepared is made into paper acidly or alkalinely by means of a regular single-wire or double-wire paper machine. Alkaline paper making is preferable from a point of view of reutilizing broke. If necessary, it is possible to apply starch, polyvinyl alcohol, polyacrylamide or the like as a surface size by means of a size press, gate roll coater or the like in the paper making process.

A coating composition applied to the base paper thus obtained contains pigments and adhesives as its chief ingredients in the same manner as conventional coating compositions. In the present invention, the coating composition contains natural ground calcium carbonate, having a specific surface area of 1.5 m²/g to 5 m²/g, in the proportion of 10 to 100%, by weight, of the whole pigments. When the specific surface area of the natural ground calcium carbonate is 1.5 to 2.5 m²/g, the upper limit of the proportion thereof is (90S-125)%, by weight, of the whole pigments. ("S" represents the specific surface area of the natural ground calcium carbonate.)

If natural ground calcium carbonate having a specific surface area of below 1.5 m²/g is used or if natural ground calcium carbonate having a specific surface area of 1.5 m²/g to 2.5 m²/g is used in excess of the aforesaid range, heat-set roughening is reduced but the smoothness of coated surfaces is seriously affected, printed matter obtained being inferior in printed surface smoothness and ink gloss in spite of the reduction of heat-set roughening. Consequently, in the present invention, natural grown calcium carbonate having a specific surface area of above 1.5 m²/g is used within the aforesaid range. In case of natural
ground calcium carbonate having a specific surface area of above 5 m\(^2\)/g, ink gloss and printed surface strength are reduced, and therefore it is necessary to increase the amount of adhesives in the coating composition, which results in a rise in production cost and an increase of heat-set roughening. Consequently, in the present invention, natural ground calcium carbonate having a specific surface area of below 5 m\(^2\)/g is used.

Natural ground calcium carbonate is made as follows:

Limestone, sparite, micrite, marble, calcite, natural chalk or the like is ground into fine particles one to several times by a dry or wet process by mechanical means such as a crusher, pebble mill, hammer mill, micron mill, ball mill, jet mill, attritor mill, sand mill, attrition mill, etc., and is, as required, classified by air elutriation, hydraulic elutriation, etc., and is further condensed and dried. Natural ground calcium carbonate for paper coating thus obtained in the form of slurry or dry powder is used in the present invention.

Particularly, it is preferable to use natural ground calcium carbonate adapted to satisfy formula (1) below, more preferably formula (2) below, as disclosed in Japanese Patent Laid-Open Publications No. Sho 53-81709, Sho 53-40462, etc., by being mechanically ground by a wet process, either continuously or batch by batch, by means of a sand mill, attrition mill, attritor, agitation mill, etc., with natural or synthetic particles not exceeding approx. 5 mm in diameter, such as Ottawa sand, glass beads, ceramic beads, silicate beads, zirconium beads, etc. as a medium of grinding, (hereinafter referred to as "sand mill treatment")

\[
\begin{align*}
\frac{P}{N} & \geq 0.5 + N \quad \text{----- (1)} \\
\frac{P}{N} & \geq 0.8 + N \quad \text{----- (2)}
\end{align*}
\]

("N" represents a specific surface area (m\(^2\)/g) before...
sand mill treatment. "P" represents a specific surface area (m²/g) after sand mill treatment.

A coating composition containing such natural ground calcium carbonate adapted, by said sand mill treatment, to have a specific surface area of above 2 m²/g is excellent in fluidity and water retention, and free from streaks, and even if such natural ground calcium carbonate is used in a high proportion of above 20% by weight of whole pigments, coated surface smoothness, printed surface smoothness and ink gloss are maintained in good condition.

Pigments contained, along with said natural ground calcium carbonate, in the coating composition of the present invention may be conventional pigments for paper coating such as kaolin, clay, barium sulfate, precipitated calcium carbonate, aluminum hydroxide, satin white, titanium dioxide, calcium sulfite, zinc sulfate, plastic pigment, etc. mixed according to their respective properties. It is to be understood that these are merely examples and pigments used in the present invention are not limited thereto. In the present invention, one kind, or more than one kind, of adhesives are chosen, according to the desired paper quality, from conventional adhesives for paper coating as follows: natural adhesives including casein, soyabean protein, yeast protein, starch, oxidized starch, esterified starch, etherified starch, cationic starch, other modified starches and cellulose derivative; and synthetic resin adhesives including conjugate dien copolymer latexes such as styrene-butadiene copolymer and methyl methacrylate-butadiene copolymer, acrylic polymer latexes such as polymer or copolymer of acrylic and/or methacrylic acid ester, poly-vinyl acetate latexes such as ethylene-vinyl acetate copolymer, and other alkali non-sensitive or alkali sensitive synthetic resin emulsions. Generally, adhesives are used in a range of 5 to 25 parts by weight to 100 parts pigments by
weight. However, it is desirable to use adhesives in a range of 10 to 20 parts by weight thereto in order to obtain excellent smoothness, opacity, paper gloss and ink gloss by increasing coating weight and to reduce heat-set roughening. It is of course possible to mix the coating composition, as required, with auxiliary agents such as dispersant, flow modifier, anti-foaming agent, dyestuff, lubricant, insolubilizer and water retention agent which are contained in conventional coating compositions.

In the present invention, the base paper is single-coated or multiple-coated on both surfaces with said coating composition by means of an on-machine or off-machine coater so that a coating weight on both surfaces is above 5 g/m². The makeup of the coating composition on each surface and that of the coating composition forming each layer in multiple coating may be changed suitably. Coating may be done by any process and by means of any conventional coating machines, for instance, as follows: in-air knife coater, roll coater, puddle-type or inverted blade coater with bevel or bent blade, roll blade coater, twin blade coater and Chompflex coater.

Among these coating machines, particularly the blade coaters have been preferably used in producing high-quality coated papers because they give smoother coated surfaces. However, if the blade coaters are used in producing medium-grade coated paper for web offset printing, the possibility of heat-set roughening increases particularly when a coating weight on both surfaces is above 16 g/m², because the pigments in the coating composition is liable to show orientation and the vapor permeability of coated layers is decreased. Consequently, to obtain medium-grade coated paper without heat-set roughening by means of the blade coaters, it has been generally considered necessary, for instance, to reduce coating weight at the sacrifice of paper quality including paper gloss, smoothness and ink gloss, or
to decrease moisture in the product considerably. However, according to the present invention, it is not necessary to take such measures as decreasing moisture in the product when a coating weight on both surfaces is above a given value. It is possible to finish medium-grade coated paper with offset printing having excellent paper gloss, smoothness and ink gloss by means of finishing machines such as a mat calender, super calender and gloss calender.

It is not clear why such advantages are obtained. However, it is surmised that this is because a very good balance is maintained between the quality of medium-grade coated paper, such as paper gloss, smoothness and ink gloss, and the reduction of heat-set roughening owing to the improvement of vapor permeability, by applying the coating composition containing natural ground calcium carbonate with a certain specific surface area in a limited proportion to the base paper which has reduced heat-set roughening owing to the use of high yield pulps with a certain fiber length and orientation.

Thus, according to the present invention, it is possible to reduce heat-set roughening and to obtain medium-grade coated paper of excellent quality for offset printing. Furthermore, particularly when the coating composition contains natural ground calcium carbonate in an adequate weight thereof, coated paper with high brightness and white density, therefore it is possible to put a larger quantity of low-priced high yield pulps into the base paper and to produce medium-grade light weight coated paper having good opacity at very small cost.

The present invention will now be described in detail with reference to examples. It is to be understood that the present invention is not limited to the examples. In the examples, "parts" or "%" (percent) means "parts" or "%" by weight unless otherwise stated.

Inventive Example 1

Base paper of 40 g/m² for medium-grade coated paper
was obtained from paper stuff comprising 1 part rosin size, 7 parts alum and 5 parts filler of talc being respectively added to a pulp composition consisting of 15 parts SGP, adapted, by post refining, to have a 4L-mesh fraction content of 4% and a 150-mesh through fraction content of 67%, 65 parts needle-leaved bleached kraft pulp (hereinafter referred to as "NBKP") having a Familon Standard Freeness (hereinafter referred to as "FSF") of 30 CC and 20 parts broad-leaved bleached kraft pulp (hereinafter referred to as "LBKP") having a CFS of 450 CSF. The last three "parts" means parts, by weight, of the respective materials. The composite composition with a concentration of 6% was obtained by dispersing 15 parts natural ground calcium carbonate with a specific surface area of 1.6 m²/g "Super Thin" made by Maruo Calsium, Co., Japan and 65 parts of "W-300" made by Engelhard Minerals & Chemicals, Inc., in an amount with 0.2 part sodium polycarboxylate as dispersing agent and added to a solid matter concentration of 5% to 15% in aid of thereto 10 parts cooked cellulose "Sodium" made by Nippon Shokuhin Kako KK, Japan in the form of solid matter and 7 parts styrene-butadiene rubber "SR-1600" made by Japan Synthetic Rubber Co., Ltd., Japan in the form of solid matter. The coating composition was applied to said base paper by means of a blade coater to give a dry coating weight in both surfaces of 1.4 mg. Then, the paper was dried, and treated in a paper folder. Thus medium-grade coated paper of 110 g/m² was obtained. The medium-grade coated paper was put to paper quality tests, the results of which are shown in Table 1. The specific surface area of the natural ground calcium carbonate was measured as follows: means of a powder surface area determinator (made by Shimadzu-Corp., Japan): A 3g sample was put into a sample tube 10 mm x 1 cm, and the specific surface area was calculated from the time required for 20 cc air to pass through it in a 600 mm water column.
(In all of the following examples, the specific surface area of natural ground calcium carbonate was measured in this way).

In Comparative Example 1, medium-grade coated paper was obtained in the same way as in Inventive Example 1 except that the proportions of natural ground calcium carbonate and kaolin in the coating composition were changed to 30 parts and 70 parts respectively. The medium-grade coated paper thus obtained was put to paper quality tests, the results of which are shown in Table 1.

**Inventive Example 2**

Base paper for medium-grade coated paper was obtained in the same way as in Embodiment 1 except that the pulp composition consisted of 35 parts RGP adapted to have a 42-mesh on fiber fraction content of 9% and a 150-mesh through fiber fraction content of 51%, 40 parts NBKP having a CSF of 350 CC and 25 parts LBKP having a CSF of 450 CC.

A coating composition was obtained in the same way as in Inventive Example 1 except that 40 parts natural ground calcium carbonate with a specific surface area of 1.9 m²/g, ("Eascalon 2000" made by Sankyo Seihan KK., Japan) and 60 parts kaolin "HI CLAY" made by EMG, USA) were used as pigments. The coating composition was applied to said base paper and dried in the same way as in Inventive Example 1. The coated paper was treated by means of a super calender to obtain medium-grade coated paper. The medium-grade coated paper thus obtained was put to paper quality tests, the results of which are shown in Table 1.

In Comparative Example 2, medium-grade coated paper was obtained in the same way as in Inventive Example 2 except that the 42-mesh on fiber fraction content of RGP was 35%. The medium-grade coated paper thus obtained was put to paper quality tests, the results of which are shown in Table 1.

**Inventive Example 3**

Base paper for medium-grade coated paper was obtained in the same way as in Inventive Example 1 except that the pulp...
composition consisted of 35 parts TMP adapted to have a 42-mesh on fiber fraction content of 9% and a 150-mesh through fiber fraction content of 42%, 32.5 parts NBKP having a CSF of 550 CC, and 32.5 part LBKP having a CSF of 450 CC. Natural ground calcium carbonate with a specific surface area of 1.5 m²/g ("Softon 1500" made by Bihoku Funka Co., Japan) was adapted to have a specific surface area of 2.1 m²/g by dispersing it in water by means of a turbine type agitator and with 0.2% sodium polyacrylate as dispersant so as to give a solid matter concentration of 70%, and by grinding the slurry thus obtained by means of a sand grinder (model "32G" made by Igarashi Kikai Seizo Co., Ltd., Japan) at a speed of 1,000 rpm and a flow of 400 liters per hour, and with glass beads of approx. 2.5 mm in average diameter as a medium of grinding. A coating composition was obtained in the same way as in Inventive Example 1 except that 50 parts natural ground calcium carbonate thus obtained and 50 parts kaolin ("Hydrasheen 90" made by Huber Corporation, USA) were used as pigments. The coating composition was applied to said base paper and dried in the same way as in Inventive Example 1.

The coated paper was treated by means of a super calender to obtain medium-grade coated paper. The medium-grade coated paper thus obtained was put to paper quality tests, the results of which are shown in Table 1.

In Comparative Example 3, medium-grade coated paper was obtained in the same way as in Inventive Example 3 except that the pigments in the coating composition consisted of 75 parts natural ground calcium carbonate and 25 parts kaolin. The medium-grade coated paper thus obtained was put to paper quality tests, the results of which are shown in Table 1.

**Inventive Example 4**

Base paper of 35 g/m² for medium-grade coated paper was obtained from paper stuff comprising 0.5 part rosin size, 3 parts alum, 3 parts filler of kaolin and 0.3 part paper strengthening agent of polyacrylamide resin being
YIELD PULPS FOR WEB OFFSET PRINTING

The following statement is a full description of this invention including the best method of performing it known to us:

respectively added to a pulp composition consisting of 30 parts TMP adapted to have a 42-mesh on fiber fraction content of 25% and a 150-mesh through fiber fraction content of 35%, 20 parts SGP which was the same as used in Inventive Example 1 and 50 parts NBKP which was also the same as used in Inventive Example 1.

Natural ground calcium carbonate with a specific surface area of 1.5 m²/g ("Softon 1500" made by Bihoku Funka Co., Japan) was adapted to have a specific surface area of 2.3 m²/g by dispersing it in water with a dispersant so as to give a solid matter concentration of 60%, and by treating the slurry thus obtained by means of an attrition mill having silicate beads of approx. 1 mm in average diameter. A coating composition was obtained in the same way as in Inventive Example 1 except that 75 parts natural ground calcium carbonate thus obtained and 25 parts kaolin ("UW-90" made by EMC, USA) were used as pigments. The coating composition was applied to said base paper and dried in the same way as in Inventive Example 1. The coated paper was treated by means of a super calender to obtain medium-grade coated paper. The medium-grade coated paper thus obtained was put to paper quality tests, the results of which are shown in Table 1.

In Comparative Example 4, medium-grade coated paper was obtained in the same way as in Inventive Example 4 except that the pigment in the coating composition consisted of 100 parts natural ground calcium carbonate. The medium-grade coated paper thus obtained was put to paper quality tests, the results of which are shown in Table 1.

Inventive Example 5

Base paper for medium-grade coated paper was obtained in the same way as in Inventive Example 1 except that the pulp composition consisted of 20 parts RGP adapted to have a 42-mesh on fiber fraction content of 25% and a 150-mesh through fiber fraction content of 50%, 20 parts NBKP having a
CSF of 550 CC and 60 parts NBKP having a CSF of 450 CC. Natural ground calcium carbonate with a specific surface area of 0.1 m²/g was adapted to have a specific surface area of 3 m²/g by dispersing it in water with 1.0% sodium polyacrylate as dispersant so as to give a solid matter concentration of 70%, and by treating the slurry thus obtained by means of a sand mill. A coating composition was obtained in the same way as in Inventive Example 1 except that 100 parts natural ground calcium carbonate thus obtained was used as a pigment. The coating composition was applied to said base paper and dried in the same way as in Inventive Example 1. The coated paper was treated by means of a super calender to obtain medium-grade coated paper. The medium-grade coated paper thus obtained was put to paper quality tests, the results of which are shown in Table 1.

Inventive Example 6

Base paper for medium-grade coated paper was obtained in the same way as in Inventive Example 1 except that the pulp composition consisted of 70 parts SGP adapted to have a 42-mesh on fiber fraction content of 5% and a 150-mesh through fiber fraction content of 55% and 30 parts NBKP having a CSF of 550 CC. Natural ground calcium carbonate with a specific surface area of 0.08 m²/g was adapted to have a specific surface area of 4.5 m²/g by dispersing it in water with 0.6% sodium polyacrylate and 0.2% tetrasodium pyrophosphate as dispersents so as to give a solid matter concentration of 73%, and by treating the slurry thus obtained by means of a horizontal type sand mill ("Dynomill" made by Willy A. Bachofen AG, West Germany).

A coating composition with a solid matter concentration of 58%, comprising 100 parts natural ground calcium carbonate thus obtained, adhesives of 5 parts oxidized starch (solid matter) and 12 parts styrene-butadiene copolymer latex ("SN 304" made by Sumitomo Naugatuch Co., Ltd., Japan) (solid matter), some dyestuff, some anti-foaming agent and some
insolubilizer, was applied to said base paper by means of a blade coater so as to give a dry coating weight on both surfaces of 26 g/m². Then, the paper was dried, and treated by a super calender to obtain medium-grade coated paper. The medium-grade coated paper thus obtained was put to paper quality tests, the results of which are shown in Table 1.

**Inventive Example 7**

Medium-grade coated paper was obtained in the same way as in Inventive Example 1 except that the pulp composition consisted of 35 parts RGP adapted to have a 42-mesh on fiber fraction content of 15% and a 150-mesh through fiber fraction content of 50%, and 65 parts LBKP having a CSF of 500 CC, and that the pigments in the coating composition consisted of 40 parts natural ground calcium carbonate adapted to have a specific surface area of 2.5 m²/g by means of an attritor, and 60 parts kaolin ("HT Clay" made by EMCC USA). The medium-grade coated paper thus obtained was put to paper quality tests, the results of which are shown in Table 1.

**Inventive Example 8**

Base paper of 50 g/m² for medium-grade coated paper was obtained from paper stuff comprising 0.05 part size of alkylketene dimer ("Hercon 40" made by Dic Hercules Co., Japan), 0.05 part fixing agent of polyamide epichlorhydrin ("Kymene" made by Dic Hercules Co., Japan); 1.0 part paper strengthening agent of cationic starch and 3 parts filler of natural ground calcium carbonate being respectively added to a pulp composition consisting of 30 parts SGP adapted to have a 42-mesh on fiber fraction content of 20% and a 150-mesh through fiber fraction content of 45%, 55 parts NBKP having a CSF of 550 CC and 15 parts LBKP having a CSF of 450 CC.

A coating composition was obtained in the same way as in Inventive Example 1 except that the pigments therein consisted of 30 parts natural ground calcium carbonate whose specific surface area was changed from 1 m²/g to 4 m²/g.
by treatment at a concentration of 65% by means of an attrition mill, 50 parts kaolin ("HT Clay" made by EMC, USA) and 20 parts aluminum hydroxide ("Higilite H-42" made by Showa Denko KK, Japan). The coating composition was applied to said base paper and dried in the same way as in Inventive Example 1. The coated paper was treated by means of a super calender to obtain medium-grade coated paper. The medium-grade coated paper thus obtained was put to paper quality tests, the results of which are shown in Table 1.

Comparative Example 5

Medium-grade coated paper was obtained in the same way as in Inventive Example 1 except that the pigment in the coating composition consisted of 100 parts kaolin. The medium-grade coated paper thus obtained was put to paper quality tests, the results of which are shown in Table 1.

Comparative Example 6

Medium-grade coated paper was obtained in the same way as in Inventive Example 2 except that the pigments in the coating composition consisted of 50 parts precipitated calcium carbonate ("PZ" made by Shiraishi Kogyo KK, Japan) and 50 parts Kaolin ("HT Clay" made by EMC, USA). The medium-grade coated paper thus obtained was put to paper quality tests, the results of which are shown in Table 1.

Comparative Example 7

Medium-grade coated paper was obtained in the same way as in Inventive Example 1 except that the paperstuff comprised 1 part rosin size, 3 parts alum, 0.2 part polyacrylamide resin and 5 parts talc being respectively added to a pulp composition consisting of 50 parts SGP adapted, by post refining, to have a 42-mesh on fiber fraction content of 0% and a 150-mesh through fiber fraction content of 85%, and 50 parts NBKP having a CSF of 550 CC. The medium-grade coated paper thus obtained was put to paper quality tests, the results of which are shown in Table 1.
As seen from Table 1, medium-grade coated paper obtained in each inventive example was satisfactory and well-balanced in heat-set roughening, printed surface smoothness, ink gloss, picking and blistering as compared with medium-grade coated paper in any Comparative Example.

The results of the paper quality test shown in Table 1 were obtained as follows:

1. Gloss: Gloss was measured at an angle of incidence of 75° by means of a specular gloss meter.

2. Heat-set roughening: By means of an RI printing tester made by Akira Industry Co., Japan, 1 cc ink for web offset printing was distributed, and both surfaces of the medium grade coated paper were printed therewith. Immediately after that, the paper was dried by heating both surfaces at a temperature of 200°C, and heat-set roughening on both surfaces was visually measured.

3. Printed surface smoothness: The same procedure was taken as in (2) above except that the heating temperature was 150°C. The smoothness of the printed surfaces was visually measured.

4. Ink Gloss: The ink gloss of the printed matter obtained in (3) above was visually measured.

5. Picking: The medium-grade coated paper was printed with ink having a large value of tackiness, by means of an RI printing tester. Picking was visually measured.

6. Blistering: The same procedure was taken as in (2) except that the heating temperature was 250°C. Blistering was visually measured.

7. Evaluation: The results of the visual measurements in (2) to (6) are represented by the following four relative grades:

- Very Good
- Good
- Bad
- Very Bad
As many apparently widely different embodiment of this invention may be made without departing from the spirit and scope thereof, it is to be understood that the invention is not limited to the specific embodiments thereof except as defined in the appended claims.
<table>
<thead>
<tr>
<th>Gloss Roughening</th>
<th>Heat-set Smoothness</th>
<th>Printed surface smoothness</th>
<th>Ink Gloss</th>
<th>Picking</th>
<th>Blistering</th>
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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method of producing medium-grade coated paper for web offset printing, which comprises applying a coating composition to both surfaces of a base paper so that the total coating weight on both surfaces thereof is above 5 g/m².

   said coating composition containing natural ground calcium carbonate with a specific surface area of 1.5 m²/g to 5 m²/g under the following conditions:
   (i) when said specific surface area is 1.5 m²/g to 2.5 m²/g:
       10% to (90S-125)% by weight of the total pigment content
       where "S" represents a specific surface area (m²/g):
   (ii) when said specific surface area is 2.5 m²/g to 5 m²/g:
       10% to 100% by weight of the total pigment content,
   said base paper containing one or more high-yield pulps in an amount equal to 10% to 100% by weight of the fiber content thereof and one or more chemical pulps in an amount equal to 0% to 90% by weight of the fiber content thereof, said high-yield pulp component having a 42-mesh fiber fraction content of less than 30% by weight.

2. A method as claimed in Claim 1, wherein said high-yield pulp component has a below 150-mesh fiber fraction content of less than 80% by weight.

3. A method as claimed in Claim 1, wherein said high-yield pulp component has a 42-mesh fiber fraction content of less than 20% by weight.

4. A method as claimed in Claim 1, wherein said high-yield pulp component has a 42-mesh fiber fraction content of less than 5% by weight.

5. A method as claimed in Claim 1, wherein said natural ground calcium carbonate is adapted to have a specific surface area of 2 m²/g to 5 m²/g by sand mill treatment, and the proportion of said natural ground calcium carbonate
in said coating composition is above 20% by weight of the total pigment content.

6. A method as claimed in Claim 1, wherein the total coating weight of said coating composition on both surfaces of the base paper is above 16 g/m² (solid matter).

DATED this 19th day of October 1983

KANZAKI PAPER MFG. CO., LTD.
Patent Attorneys for the Applicant:

F.B. RICE & CO.
Base paper of 40 g/m² for medium-grade coated paper
PROPORTION OF NATURAL GROUND CALCIUM CARBONATE (%)

SPECIFIC SURFACE (m²/g)

AREA

57537 /80

FOR 50 cc AIR TO PASS THROUGH IT IN 460 m WT WATER COLUMN, specific surface area was calculated from the time required.
PROPORTION OF NATURAL GROUND CALCIUM CARBONATE (%)