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(54) **Process for finishing colour developer paper.**

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Description

The present invention relates to a process for finishing colour developer paper of the type which is used in pressure-sensitive copying systems and particularly copying systems of the transfer type.

In such a transfer system an upper sheet (hereinafter referred to as a CB sheet) is coated on its lower surface with microcapsules containing an oily solution of at least one colourless colour former and a lower sheet (hereinafter referred to as a CF sheet) is coated on its upper surface with a colour developing co-reactant such as an acidic clay, a phenolic resin or certain organic acid salts. If more than one copy is required, one or more intermediate sheets (hereinafter referred to as CFB sheets) are provided each of which is coated on its lower surface with microcapsules and on its upper surface with colour developing co-reactant material. Pressure exerted on the sheets by writing or typing ruptures the microcapsules thereby releasing colour former solution on to the colour developing co-reactant material and giving rise to a chemical reaction which develops the colour former and so produces an image.

One of the main uses of pressure sensitive copying systems is in business forms. It is important that the coated paper which is to be used for the business forms should be easily printable and should be of good handleability for ease of feeding into a printing machine.

In particular colour developer paper should be smooth and of a certain stiffness and bulk to provide the desired handleability.

Generally, in order to obtain the required smoothness, colour developer paper is cold calendered (although the calender rolls may become warm when a hot paper web passes between them as may happen for example when the web passes straight from the drying section). However an acceptable smoothness is often only obtained at the expense of stiffness and bulk.

It is an object of the present invention to produce colour developer paper which is of excellent smoothness but is also of good handleability.

According to a first aspect of the present invention there is provided a process for finishing colour developer paper for use in a pressure sensitive copying system, comprising the step of passing a paper web carrying a coating of inorganic colour developing co-reactant material through a nip between two calendering rolls, characterized in that the calendering rolls are both heated other than solely by contact with the web such that their surfaces are at a temperature of at least 105°C.

In a second aspect the present invention provides colour developer paper which has been finished according to said first aspect.

In a third aspect the present invention provides a pressure sensitive copying system utilizing colour developer paper finished according to said first aspect.

Heating may be achieved by means of, for example, any one of the following media high pressure steam, pressurised water or oil. The heating media may pass through either a central reservoir in the calendering roll or round an annular space within the roll (this type of roll is known as a displacer roll and provides a more even temperature across the roll).

In general suitable calendering rolls may be any of those conventionally used in the paper industry for example chilled iron rolls.

The present process is suited for use with papers in which the colour developing co-reactant material is an acidic clay or other inorganic material.

Preferably the colour developing co-reactant material is an acid washed dioctahedral montmorillonite clay such as that sold by Mizusawa Industrial Chemicals of Japan under the trade mark "Silton" or that sold by Sud-Chemie A.G. of West Germany under the trade mark "Copisil".

Additionally the colour developer coating may incorporate a filler such as kaolin or calcium carbonate. A binder such as latex may also be included in the coating.

As well as affording improved smoothness without the corresponding deterioration in stiffness and bulk usually experienced, the present invention also affords the benefit of considerable cost savings in so much as an increased amount of filler may be added to the base paper, thus reducing the amount of expensive fibre needed without affecting the stiffness and bulk of the resulting colour developer sheet for a given smoothness.

In order that the present invention be more readily understood reference will now be made to the accompanying drawing which illustrates diagrammatically and by way of example an embodiment thereof, and which is a schematic side view of apparatus for finishing colour developer paper.

A paper web generally indicated 1 carrying a coating of colour developer material on its surface 3 is unwound from a reel 4 in the direction shown by the arrow and then passes around guide rolls 2. The web then passes between two calender rolls 6. The calender rolls 6 are of chilled iron and are supplied with high pressure steam such that their surface is at a temperature of the order of 105°C. The rolls 6 form a pressure nip 9 at their point of contact. The nip 9 is protected by a nip guard 8.

The web 1 then passes around two further guide rolls 2 before being wound up into a roll 5.

Instead of being unwound from a reel 4, the paper web may alternatively pass straight from a coating section at which it has just been coated and dried to the calender rolls.

The invention will now be illustrated by the following example.

Example

A web of clay coated colour developer paper ("Idem" CF 57 supplied by Wiggins Teape) was passed through a hot calendering nip as shown in the drawing with the coated side down. The surfaces of the calendering rolls were maintained at a temperature of 105°C. The nip pressure was varied as was the speed at which the web passed through the hot calendering nip.

A control was also run by passing a similar web through a cold calendering nip, the surfaces of the calendering rolls being at a temperature of 18°C.

The bulk and stiffness of the paper were then measured to give an indication of the handleability of the resulting paper. Bendtsen and Parker roughness were also measured to indicate the degree of smoothness of the colour developer coating. The stiffness was measured in Taber units using the method according to International Standard (IS) No. 2493 in both the machine direction (MD) and the cross section (CD) of the web. The bulk was measured according to British Standard BS3983. The Bendtsen roughness was measured according to British Standard BS4420 : 1969 for both the colour developer coated side of the paper web and also the uncoated side.

The Parker roughness was measured in a similar manner to that described in the British Paper and Board Industry Federation (BPBIF) proposed procedure No. PP 59.

Parker roughness may be measured under a variety of conditions. The Parker roughness in this case was measured with a standard soft backing (Neoprene Litho blanket 85° Shore) at a clamping pressure of 20 kgf cm^{-2}. This is indicated as S-20 in the tables of results.

For both Bendtsen and Parker roughness a high value indicates a rough surface therefore the lower the value the smoother the surface. All the results quoted are mean values of several readings. In order to illustrate that hot calendering does not impair the functional properties of the colour developer paper a calender intensity test was also carried out. The calender intensity (CI) test involved superimposing strips of paper coated with encapsulated colour former solution onto a strip of the coated paper under test, passing the superimposed strips through a laboratory calender to rupture the capsules and thereby produce a colour on the test strip, measuring the reflectance of the thus coloured strip (I) and expressing the result (I/I_0) as a percentage of an unused control strip (10). Thus the lower the calender intensity value (I/I_0) the more intense the developed colour. The CI values were recorded after 2 minutes and again after 48 hours.

The results are shown in Table 1, in which nip pressures are quoted as linear pressures since it is difficult to quote an absolute value, as is well understood in the art.

TABLE 1

Temp. of calender rolls °C	web speed ms^{-1} ($mmin^{-1}$)	nip pressure kNm^{-1} (PLI)	Bulk $cm^3\ g^{-1}$	Taber (Taber units)		Bendtsen mls^{-1} ($mlmin^{-1}$)		Parker µm (S-20)		CI (%)	
				MD	CD	Coated Side (C)	Uncoated Side (U)	C	U	2 min	48 hr
18	2.5 (150)	12.26 (70)	1.22	0.47	0.22	0.68 (41)	2.6 (156)	1.7	3.3	—	—
		26.27 (150)	1.13	0.43	0.19	0.5 (30)	1.45 (87)	1.4	2.8	50.3	39.8
	5.83 (350)	12.26 (70)	1.24	0.49	0.20	1.02 (61)	3.55 (213)	1.8	3.7	—	—
		26.27 (150)	1.15	0.42	0.20	0.58 (35)	1.73 (104)	1.4	2.9	—	—
		43.78 (250)	1.07	0.41	0.18	0.38 (23)	0.97 (58)	1.3	2.5	—	—
105	2.5 (150)	12.26 (70)	1.105	0.49	0.22	0.32 (19)	0.97 (58)	1.4	2.5	51.1	39.7
		26.27 (150)	1.04	0.43	0.19	0.25 (15)	0.58 (35)	1.04	2.3	51.3	39.1
	5.83 (350)	12.26 (70)	1.19	0.52	0.24	0.68 (41)	2.1 (126)	1.7	3.2	51.3	39.7
		26.27 (150)	1.11	0.45	0.21	0.38 (23)	1.1 (66)	1.4	2.6	50.9	39.2
		43.78 (250)	1.07	0.46	0.22	0.37 (22)	0.81 (49)	1.24	2.4	51.3	40.1

Abbreviations: PLI = pounds per linear inch; MD = machine-direction; CD = cross-direction

The above procedure was then repeated but this time the colour developer web was hot calendered with the coated side uppermost. Again a control was run at 18°C.

The results are shown in Table 2.

TABLE 2

Temp. of calender rolls °C	web speed ms^{-1} ($mmin^{-1}$)	nip pressure KNm^{-1} (PLI)	Bulk $cm^3\ g^{-1}$	Taber (Taber units)		Bendtsen mls^{-1} ($mlmin^{-1}$)		Parker µm (S-20)		CI (%)	
				MD	CD	C	U	C	U	2 min	48 hr
18	2.5 (150)	17.51 (100)	1.14	0.35	0.18	0.75 (45)	2.02 (121)	1.41	3.09	—	—
		35.03 (200)	1.04	0.31	0.17	0.42 (25)	1.15 (69)	1.1	2.5	48.3	38.5
		52.54 (300)	0.99	0.29	0.17	0.37 (22)	0.68 (41)	1.00	2.1	—	—
	5.83 (350)	17.57 (100)	1.13	0.35	0.19	0.77 (46)	2.12 (127)	1.38	3.17	—	—
		35.03 (200)	1.06	0.31	0.17	0.47 (28)	1.17 (70)	1.2	2.5	—	—
		52.54 (300)	1.01	0.3	0.16	0.40 (24)	0.77 (46)	1.0	2.1	—	—
120	2.5 (150)	17.51 (100)	1.02	0.32	0.17	0.30 (18)	0.82 (49)	1.09	2.3	47.9	38.1
		35.03 (200)	0.94	0.30	0.17	0.17 (10)	0.33 (20)	0.8	1.7	49.6	39.3
		52.54 (300)	0.92	0.30	0.16	0.17 (10)	0.33 (20)	0.8	1.7	49.9	39.4
	5.83 (350)	17.51 (100)	1.19	0.4	0.2	0.9 (54)	3.2 (192)	1.6	3.4	48.2	38.7
		35.03 (200)	1.09	0.36	0.19	0.52 (31)	1.6 (96)	1.26	2.85	47.8	37.9
		52.54 (300)	1.02	0.31	0.17	0.32 (19)	0.82 (49)	1.0	2.3	49.2	39.2

It will be seen from the results that the general effect of hot calendering was to reduce the bulk and increase the smoothness for a given line pressure. Stiffness also increased for a given smoothness.

Hot calendering does not appear to have any significant effects on the functional properties of the CF as evidenced by the CI values obtained. The CI values obtained for hot calendered paper are not substantially different from those obtained for cold calendered paper.

Although it appears from the results that the absolute values obtained when calendering at 105°C as compared to 120°C are different, the proportional benefits of hot calendering are the same in each case. These differences are likely to be due to variations in web moisture content before calendering or slight basis weight variations.

Claims

1. A process for finishing colour developer paper for use in a pressure sensitive copying system comprising the step of passing a paper web carrying a coating of inorganic colour developing co-reactant material through a nit between two calendering rolls characterised in that the calendering rolls are both heated other than solely by contact with the web such that their surfaces are at a temperature of at least 105°C.

2. A process as claimed in Claim 1 wherein the colour developing co-reactant material is an acidic clay.

3. A process as claimed in any preceding claim wherein the colour developing co-reactant material is an acid washed dioctahedral montmorillonite clay.

4. A pressure sensitive copying system utilising colour developer paper finished by the process as claimed in Claim 1.

Ansprüche

1. Verfahren zum Appretieren von Farbentwicklungspapier zur Verwendung in einem druckempfindlichen Kopiersystem, umfassend den Schritt des Durchführens einer Papierbahn, die eine Beschichtung eines anorganischen Farbentwicklungs-Coreaktantenmaterials trägt, durch einen Walzenspalt zwischen zwei Kalandrierungsrollen, **dadurch gekennzeichnet**, daß beide Kalandrierungsrollen auf andere Weise als nur durch Kontakt mit der Bahn derart aufgeheizt werden, daß ihre Oberflächen auf einer Temperatur von mindestens 105°C sind.

2. Verfahren nach Anspruch 1, worin das Farbentwicklungs-Coreaktantenmaterial ein saurer Ton ist.

3. Verfahren nach einem der vorhergehenden Ansprüche, worin das Farbentwicklungs-Coreaktantenmaterial ein mit Säure gewaschener dioktaedrischer Montmorillonit-Ton ist.

4. Druckempfindliches Kopiersystem unter Verwendung von Farbentwicklungspapiers, das nach dem Verfahren nach Anspruch 1 appretiert wurde.

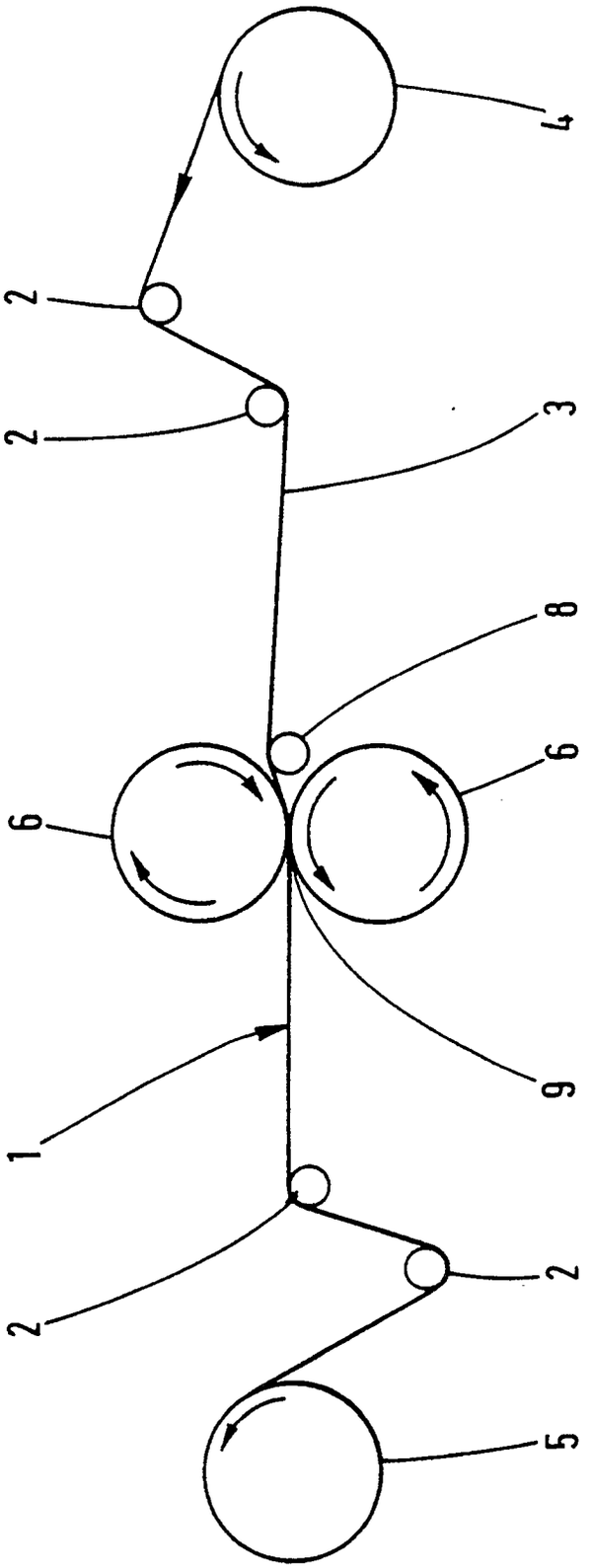
Revendications

1. Procédé pour l'apprêtage de papier révélateur couleur destiné à l'utilisation dans un système de reproduction sensible à la pression, comprenant l'étape dans laquelle on fait passer une bande de papier portant un revêtement en un matériau minéral co-réactant révélateur de couleur à travers une ligne de serrage entre deux cylindres de calandrage, caractérisé en ce que les cylindres de calandrage sont chauffés tous les deux autrement que par seul contact avec la bande de telle sorte que leurs surfaces sont à une température d'au moins 105°C.

2. Procédé selon la revendication 1, dans lequel le matériau co-réactant révélateur de couleur est une argile acide.

3. Procédé selon l'une quelconque des revendications précédentes, dans lequel le matériau co-réactant révélateur de couleur est une argile montmorillonite dioctaédrique lavée à l'acide.

4. Système de reproduction sensible à la pression utilisant un papier révélateur de couleur apprêté par le procédé selon la revendication 1.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