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(54) **Arrangement in a paper machine.**

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EP-A- 0 337 973
GB-A- 2 169 381

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Description

The invention concerns an arrangement in a part of a paper machine in which the surface properties of a roll and/or rolls are affected by regulating the temperature of the roll face by means of an external heating device.

The invention further concerns the use of the arrangement in accordance with the invention.

A number of different requirements are imposed on the rolls and roll faces in different parts of a paper machine, such as, for example, properties of durability, adhesion, transfer, and detaching.

For example, in so-called closed press sections, which are used commonly in paper machines, in connection with the centre roll, one or, as a rule, several press nips are formed. An example of such a prior-art press section is the press section marketed by the applicant under the trade mark "Sym-Press II". The smooth-faced centre roll in the press section, which is a roll of a larger diameter as compared with the other rolls, is usually made of rock, as a rule of granite. Being an inhomogeneous natural material of low tensile strength, granite is quite problematic in machine construction. Should it be desired to heat a granite roll, its deformations dependent on temperature are non-linear and hard to predict.

As a press roll material, granite has relatively good properties of adhesion, transfer and detaching of the web, which is at least one of the reasons for its popularity. The properties of detaching would, however, require further improvement, in particular in the case of unbleached paper qualities.

As is known in prior art, the web is detached by pulling it freely, without support, off the face of said centre roll in the press. This free draw is quite critical in view of the operation of the paper machine. In said free draw, a difference in speed is used which extends the web, resulting in certain drawbacks. Moreover, said free draw forms a problematic point susceptible to breaks in the paper machine. Earlier, the detaching was always carried out mechanically by pulling, and the heating took place in the roll body, whereby the whole roll was hot. Thereby the roll is worn and the intervals between grindings become short.

The free draw of the web has become an ever more important problem point because of ever increasing running speeds of paper machines and because different paper qualities are often produced by a paper machine, with different adhesion to the face of the rock roll, which results in variations in the necessary tension required for detaching of the web.

EP-A-0 337 973 discloses a method and a device in a machine for the manufacture of paper or board for heating the outer face of such a cylinder or roll as is in direct contact with the web to be pressed against said roll face. The cylinder or roll face is heated from outside inductively by using a magnetic field, by means of which a heating effect based on eddy currents is produced in the outer layer of the roll. As the cylinder or roll face, a relatively thin outer layer of an electrically conductive ceramic material is used, in which the resistive heating effect is concentrated. The depth of penetration of the heating effect in the radial direction of the roll to be heated is restricted to a sufficiently low depth by means of the choice of the thickness of the ceramic outer layer and/or of the electric frequency of the induction heating. Besides on the basis of its electric properties, the ceramic material of the outer layer is chosen so that the cylinder or roll face is given the necessary properties of strength, also in view of the thermal shock of the heating effect.

GB-A-2 169 381 discloses a synthetic press roll to be used in a paper machine, the surface layer of the cylinder mantle of the press roll being composed of a mixture of a metal powder and a powder of an inorganic material. The metal component may be copper, bronze, stainless steel, nickel, chromium and/or a titanium alloy, and the inorganic powder consists of quartz, feldspar, Al_2O_3, ZrO_2, TiO_2, SiC, MgO, Si_3N_4, Cr_2O_3, WC, NbC, VC, Cr_7C_3, or of a corresponding ceramic material or of mixtures of same. The roll face is produced by thermal spraying, casting, by winding a sintered and/or rolled band around the cylinder, or by using a flexible mat in which the desired mix is bound by means of PTFE and in which the pre-coating is fixed by melting by means of induction or laser heating. The press roll provides means by which the detaching of the paper web from the roll face is controlled and the resistance of the roll to variations in temperature and to mechanical strains is improved.

In the applicant's FI Patent Application No. 870308 (EP-B-0 276 203) a system of regulation is described wherein the detaching of the paper web from the smooth face of the centre roll in a press can be controlled better. It is a particular objective of said invention to provide such a system of regulation of the detaching of the web therein the tension of detaching of the web can be set optimally irrespective of the dry solids content of the paper web, of the surface energy of the material, and of the running speed of the paper machine. The method in accordance with the application FI 870308 is characterized in that in the method the temperature of the face of said smooth-faced press roll is regulated and that, by means of said regulation, the adhesion between said roll face and the paper web to be detached is affected and, thereby, the detaching angle and/or the detaching tension of the paper web is/are set within an optimal range.

On the other hand, the device in accordance with the invention described in said application is mainly characterized in that in connection with said smooth-faced press roll heating devices are provided, by means of which the temperature of the smooth face of said press roll and thereby the detaching of the web from said roll face are affected.

The invention of the FI application 870308 (EP-B-0 276 203) is based on the observation that the temperature at the interface between the paper web and the smooth roll face from which the web is to be detached affects the dry solids content of the web, the surface energies of the materials in contact, and the viscosity of water, which parameters again affect the adhesion between the paper web and the water contained therein, on one hand, and the smooth roll face, on the other hand. By establishing the interdependence of said parameters, by controlling them, and by, on the basis of this information, regulating the temperature of the roll face by means of the regulating system of said invention, it is possible to set the detaching tension of the paper web to a suitable level even within highly varying operating conditions. Thus, in the invention, when running different paper qualities and with different running speeds of the paper machine, it is possible to adjust the temperature of the smooth face of the roll to a certain set value, which provides an optimal detaching of the web and an optimal running quality with the web quality and machine speed that are used at each particular time.

In the invention of FI-870308 (EP-B-0 276 203), the central roll of the press or any other corresponding smooth-faced roll from which the paper web is supposed to be detached is a substantially metal-mantle roll coated with a metal, with a ceramic material, or with mixtures of same, a cast-iron roll, or an uncoated metal roll, which are arranged to be heated by means of adjustable heating devices. The heating may take place from inside and/or from outside the roll at least partly by means of techniques known in prior art. The invention of FI 870308 is by no means restricted to be used for the detaching of the web from the central roll of closed press sections of paper machines alone, but the invention is suited and intended for controlling the detaching of the web from a smooth-faced roll in a press in general, i.e. also from a roll other than a central roll.

As prior art, the solution in accordance with the Finnish Patent Application No. 870309 (EP-B-0 276 202) is also cited, wherein, by means of a heating effect applied, among other things, to the roll mantle, the water present between the web and the roll face is heated, preferably vaporized, locally within the area of the detaching point so as to detach the web from said roll face. Since, in accordance with said invention, the work for the detaching of the web is carried out by vaporization, to detach the web it is not necessary to extend the web at all, which again permits a closed draw from the centre roll in the press to the drying section, e.g. onto the drying wire.

The object of the present invention is further development of the solutions in accordance with said FI applications 870308 (corresponding to EP-B-0 276 203) and 870309 (corresponding to EP-B-0 276 202) by coming even closer to the objectives of said applications, which were, among other things, better control of the detaching of the paper web from the smooth face of the centre roll in the press as well as to provide such a system for the regulation of the detaching of the web.

An object of the present invention is further expansion of the field of application of the invention so that in each application of use the detaching tension of the web can be set optimally irrespective of the dry solids content of the paper web, of the surface energy of the material, and of the running speed of the paper machine.

An object of the present invention is additionally to expand the field of application of the invention so that the invention can also be used for modification of other surface properties besides the properties of detaching.

It is a particular object of the present invention to provide suitable surface materials for applications of use wherein a heating device outside the roll is used.

In view of achieving these objects, the arrangement in accordance with the invention defined in the preamble of claim 1 has the features appearing in the characterizing clause of claim 1.

It is the idea of the combination of coating and heating in accordance with the invention that the dark surface of the surface material absorbs the light coming from the heating device efficiently and so that the roll face is heated but the paper not. Moreover, the coating material is chosen so that it acts as a thermal insulation, whereby the rest of the roll is not heated and heating power is not wasted.

Said external heating device is advantageously a short-wave infrared heater or a laser heater which is capable of heating the coating. It is an advantage of infrared heating that the face can also be heated through the paper. Only a thin surface layer of the roll has to be heated, while the rest of the roll remains at the temperature of the environment. Embodiments of heaters are described in the applicant's earlier patent applications FI-870308 (EP-B-0 276 203) and FI-870309 (EP-B-0 276 202).

The function of the coating would be to apply a thermal shock to the paper. The thermal shock can be utilized, e.g., for drying the paper or for detaching the paper from the roll. Properties of the coating include dark face, good capacity of thermal insulation, good resistance to heat, good resistance to thermal shock, low coefficient of thermal expansion, high heat capacity, good wear resistance, and/or good resistance to corrosion. One coating of this type is, e.g., chromia-silica composite, which has been prepared by means of thermal spraying. It is an advantage of this material that it is dark, corrosion-proof, and wear-resistant, for which reason one objective of the invention is to apply said material to various objects of use, such as, e.g., to a calender.

Thus, as said roll coating, a dark readily heatable material is used. The final coating material in detail is chosen in accordance with the above desired ultimate additional properties. The coating may be, e.g., a ceramic or a ceramic composite or a mixture of a ceramic and a metal.

If hardness and wear-resistance is desired for the material, advantageously materials based on alumina (Al_2O_3) or chromia (Cr_2O_3) are used. On the other hand, if heat resistance, impact strength and/or capacity of thermal insulation is/are desired for the material, advantageously materials based on zirconia (ZrO_2) are chosen. In surface finish applications of high requirements, advantageously materials based on titania (TiO_2) are used.

Coating materials can be used alone or in layers depending on the objects of use, e.g., so as to provide a suitable resistance to thermal shocks or a capacity of thermal insulation.

One object of use in accordance with the invention is in a calender roll, wherein the heating effect of the heating device penetrates through the paper, whereby the hot roll face modifies the surface properties of the paper. Suitable coating materials are, e.g., Cr_2O_3, Al_2O_3, TiO_2. If desired, zirconia or equivalent may be used as a thermal insulation underneath a thin ceramic mantle.

The invention may also be employed to detach the paper from the web by heating (by affecting the viscosity of the medium) or by vaporizing the interface, e.g. by vaporizing the water, in the case of a press roll, or the coating agent, in the case of a guide roll in a coating device. In other words, the arrangement can be used in a guide roll in a separate sizing cylinder to facilitate the scraping by means of a doctor, in which case the hot roll face vaporizes some of the size layer and detaches the paper from the roll. Coating materials suitable for this purpose include, e.g., Cr_2O_3.

An object of application may also be a pick-up roll wherein there is a felt between the paper and the roll.

The thickness of the coating may be, e.g., 10 μm to 10 mm, most appropriately about 50 μm to 150 μm.

In the invention, when it is desirable to obtain good adherence of the coating to the roll, increased toughness, and good wear-resistance of the coating at the same time, in the coating material it is possible to use a metal as an alloying agent, the ratio being, for example, 1 to 10...30 (metal to ceramic). One example of a coating might be a surface layer of WC 86 Co 20 Cr4 isolated from the roll body by a layer of Zr_2O_3.

To manufacture a roll coating, it is possible to employ prior-art processes, e.g. powder-metallurgic processes.

By means of the invention, a number of advantages are obtained over prior art. By its means it is possible to provide a wear-resistant face at the same time as the detaching and other properties of the face can be modified highly precisely in the desired way by means of the system of heating of the roll and by means of a suitable choice of materials.

Thus, the various objects of application of the invention are briefly detaching of paper from a roll by heating (by acting upon viscosity) or by vaporizing the interface, heating of the paper, and/or modifying the surface properties of the paper by heating.

For these applications, a short-wave radiation is suitable, the wavelength being, e.g., 1 μm when the radiation is supposed to penetrate through the web (infrared heater); when the roll face is heated directly, a radiation of longer wavelength is suitable (infrared heater 1...5 μm, CO_2-laser 10.6 μm). The requirement of power depends on the web length, web thickness, web moisture, and on the filler material. In the following, examples will be given on materials suitable for use in the invention.

Examples of surface material compositions based on different oxides.								
Constituents	Ex. 1 (White Alumina)	Ex. 2 (Gray Alumina)	Ex. 3 (Alumina Titania)	Ex. 4 (Zirconia)	Ex. 5 (Yttria-stabilizing Zirconia)	Ex. 6 (Alumina Zirconia)	Ex. 7 (Titania)	Ex. 8 (Chromia)
Al_2O_3	99.64	96.06	58.29	0.45		73.82	0.20	1.83
SiO_2	0.10	0.60	0.13	0.40	0.12	0.10	0.12	6.23
Na_2O	0.15		0.15			0.02		
Fe_2O_3	0.03	0.40	0.04	0.13	0.03	0.06	0.40	0.30
CaO	0.04	0.12	0.02	5.51			0.03	0.45
MgO	0.04	0.12	0.01	1.43				1.40
TiO_2		2.70	41.36	0.10	0.10	2.32	99.20	
ZrO_2				91.64	89.78	25.68		
Y_2O_3					9.97			
Cr_2O_3								89.50
Thermal expans. coeff. x 10^{-16}/°C (20...1500°C)	7.4	7.6	7.8	9.5			5.0	5.0
Thermal conductivity K Cal/m hr °C	2.36 (550...1100°C)			0.99 (550...1100°C)			2.98 (600°C)	

Claims

1. Arrangement in a part of a paper machine in which the surface properties of a roll or rolls are affected by regulating the temperature of the roll face by means of an external heating device, **characterised** in that in the arrangement such a combination of a heating device and a roll coating is used that the heating radiation penetrates through the paper manufactured in the machine or directly to the roll face but does not heat the roll itself at a greater depth, in that said heating device is an external shortwave infrared heater which is capable of heating the coating, and in that said roll coating is made of a dark, easily heatable material, that insulates heat so that the roll is not heated at a great depth, and in that the coating consists of a ceramic or of a ceramic composite or of a mixture of ceramic and metal.

2. Arrangement as claimed in claim 1, **characterised** in that the wavelength of the beam of the infrared heater is 1 μm ± 0.5 μm when heating takes place through the web, and 1...5 μm when the roll face is heated directly; in laser heating the wavelength is 10.6 μm when the roll face is heated directly.

3. Arrangement as claimed in claim 1 or 2, **characterised** in that the composition of the coating material is chosen finally in accordance with the desired additional properties, said properties being, for example, wear resistance, detaching properties, resistance to corrosion, capacity of thermal insulation, heat resistance, resistance to thermal shock, thermal expansion coefficient, and heat capacity.

4. Arrangement as claimed in claim 3, **characterised** in that materials based on alumina (Al_2O_3) or chromia (Cr_2O_3) are used to obtain hardness and wear resistance.

5. Arrangement as claimed in claim 3, **characterised** in that materials based on zirconia (ZrO_2) are used to obtain heat resistance, impact strength, and/or capacity of thermal insulation.

6. Arrangement as claimed in claim 3, **characterised** in that materials based on titania (TiO_2) are used in applications with high requirements of surface finish.

7. Arrangement as claimed in claim 1, **characterised** in that coating materials may be used alone or in layers, depending on the application of use.

8. Use of an arrangement as claimed in any of the claims 1 to 7 in a calender, **characterised** in that the heating effect of the heating device is allowed to penetrate through the paper, whereby the hot roll face modifies the surface properties of the paper.

9. Use as claimed in claim 8, **characterised** in that coating materials suitable for this purpose are, e.g., Cr_2O_3, Al_2O_3, TiO_2.

10. Use as claimed in claim 8, **characterised** in that zirconia or equivalent is used as a thermal insulation underneath a thin ceramic mantle.

11. Use of a system as claimed in any of the claims 1 to 7 for detaching a paper from a roll by heating (by affecting the viscosity) or by vaporizing the interface, e.g. of water in the case of a press roll, and of a coating agent in the case of a guide roll in a coating device, such as a sizing cylinder, so as to facilitate the scraping by means of a doctor, the hot roll face heating or vaporizing the size layer and detaching the paper from the roll.

12. Use as claimed in claim 11, **characterised** in that coating materials suitable for this purpose include, e.g., Cr_2O_3.

13. Use as claimed in claim 8, **characterised** in that the object of application is the centre roll in a press, a sizing press, or a release-coating guide roll.

Patentansprüche

1. Anordnung in einem Teil einer Papiermaschine, in dem mittels einer äußeren Heizvorrichtung auf die Oberflächeneigenschaften einer Walze oder Walzen durch Regeln der Temperatur der Walzenoberfläche eingewirkt wird, **dadurch gekennzeichnet, daß**
in der Anordnung eine Kombination einer Heizvorrichtung und einer Walzenbeschichtung verwendet wird derart, daß die Hitzestrahlung durch das in der Maschine hergestellte Papier hindurch, oder direkt auf die Walzenoberfläche vordringt, aber nicht die Walze selbst in einer größeren Tiefe erhitzt, daß die Heizvorrichtung ein äußerer Kurzwellen-Infrarotheizer ist, der in der Lage ist, die Beschichtung zu erhitzen, daß die Walzenbeschichtung aus einem dunklen leicht erhitzbaren Material besteht, das Wärme isoliert, so daß die Walze nicht in einer größeren Tiefe erhitzt wird, und daß die Beschichtung aus einer Keramik oder aus einer keramischen Mischung oder aus einer Mischung von Keramik und Metall besteht.

2. Anordnung gemäß Anspruch 1, **dadurch gekennzeichnet, daß** die Wellenlänge des Strahls des Infrarotheizers 1 µm ± 0,5 µm beträgt, wenn das Heizen durch die Bahn hindurch stattfindet, und 1...5 µm, wenn die Walzenoberfläche direkt erhitzt wird; und daß bei einem Erhitzen mit einem Laser die Wellenlänge 10,6 µm beträgt, wenn die Walzenoberfläche direkt erhitzt wird.

3. Anordnung gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, daß**
die Zusammensetzung des Beschichtungsmaterials schließlich gemäß den gewünschten zusätzlichen Eigenschaften gewählt wird, wobei die Eigenschaften beispielsweise Verschleißwiderstand, Ablöseeigenschaften, Korrosionsbeständigkeit, thermisches Isolationsvermögen, Hitzebeständigkeit, thermische Schockbeständigkeit, thermischer Ausdehnungeskoeffizient und Heizkapazität sind.

4. Anordnung gemäß Anspruch 3, **dadurch gekennzeichnet, daß**
Materialien verwendet werden, die auf Aluminiumoxid (Al_2O_3) oder Chromoxid (Chromia) (Cr_2O_3) basieren, um Härte und Verschleißbeständigkeit zu erhalten.

5. Anordnung gemäß Anspruch 3, **dadurch gekennzeichnet, daß**
Materialien verwendet werden, die auf Zirkonerde (ZrO_2) basieren, um Hitzebeständigkeit, Stoßfestigkeit und/oder thermisches Isolationsvermögen zu erhalten.

6. Anordnung gemäß Anspruch 3, **dadurch gekennzeichnet, daß**
in Anwendungen mit hohen Anforderungen an die Oberflächenglätte Materialien verwendet werden, die auf Titaniumoxid (TiO_2) basieren.

7. Anordnung gemäß Anspruch 1, **dadurch gekennzeichnet, daß**
in Abhängigkeit von der Anwendung Beschichtungsmaterialien alleine oder in Schichten verwendet werden können.

8. Verwendung einer Anordnung gemäß einem der Ansprüche 1 bis 7 in einem Kalander, **dadurch gekennzeichnet, daß**
es der Heizwirkung der Heizvorrichtung erlaubt ist, durch das Papier zu dringen, wodurch die heiße Walzenoberfläche die Oberflächeneigenschaften des Papiers ändert.

9. Verwendung gemäß Anspruch 8, **dadurch gekennzeichnet, daß**
zu diesem Zweck geeignete Beschichtungsmaterialien beispielsweise Cr_2O_3, Al_2O_3, TiO_2 sind.

10. Verwendung gemäß Anspruch 8, **dadurch gekennzeichnet, daß**
unterhalb eines dünnen Keramikmantels Zirkonerde oder gleichwertiges als thermische Isolation verwendet wird.

11. Verwendung eines Systems gemäß einem der Ansprüche 1 bis 7 zum Ablösen eines Papiers von einer Walze durch Erhitzen (durch Einwirken auf die Viskosität) oder durch Verdampfen der Grenzfläche, beispielsweise von Wasser im Falle einer Preßwalze, und eines Beschichtungswirkstoffs im Falle einer Führungswalze in einer Beschichtungsvorrichtung, so wie bei einem Leimungszylinder, um das Abziehen mittels eines Abstreichers, das Erhitzen oder das Verdampfen der Leimschicht und das Ablösen

des Papiers von der Walze durch die heiße Walzenoberfläche zu erleichtern.

12. Verwendung gemäß Anspruch 11, **dadurch gekennzeichnet, daß**
zu diesem Zweck geeignete Beschichtungsmaterialien beispielsweise Cr_2O_3 enthalten.

13. Verwendung gemäß Anspruch 8, **dadurch gekennzeichnet, daß**
der Anwendungsgegenstand die Zentralwalze in einer Presse, eine Leimpresse oder eine Ablöse-Beschichtungs-Führungswalze ist.

Revendications

1. Dispositif dans une partie de machine à papier dans laquelle les propriétés de surface d'un rouleau ou des rouleaux sont affectées par la régulation de la température de la face du rouleau au moyen d'un élément de chauffage extérieur, caractérisé en ce que dans le dispositif, cette combinaison d'élément de chauffage et de revêtement de rouleau est utilisé de telle sorte que la radiation de chaleur pénètre dans le papier fabriqué dans la machine ou encore directement dans la face du rouleau mais ne chauffe pas le rouleau lui-même à une plus grande profondeur, en ce que l'élément de chauffage est un élément infrarouge à onde courte extérieure qui est apte à chauffer le revêtement et en ce que le revêtement du rouleau est réalisé à partir d'un matériau facilement chauffable, de couleur sombre qui isole la chaleur de telle sorte que le rouleau n'est pas chauffé à une grande profondeur et en ce que le revêtement consiste en un composite céramique ou en une céramique ou un mélange de céramique et de métal.

2. Dispositif selon la revendication 1, caractérisé en ce que la longueur d'onde du faisceau de l'élément de chauffage à infrarouge est de 1 µm ± 0,5 µm lorsque le chauffage s'effectue à travers la bande de papier continue et de 1... 5 µm lorsque la face du rouleau est chauffée directement ; dans le chauffage au laser, la longueur d'onde est de 10,6 µm lorsque la face de rouleau est chauffée directement.

3. Dispositif selon la revendication 1 ou 2, caractérisé en ce que la composition du matériau de revêtement est choisie pour finir selon les propriétés supplémentaires souhaitées, ces propriétés étant par exemple la résistance à l'usure, des propriétés de décollage, la résistance à la corrosion, la capacité d'isolation thermique, la résistance à la chaleur, la résistance au choc thermique, le coefficient de dilatation thermique et la capacité calorifique.

4. Dispositif selon la revendication 3, caractérisé en ce que les matériaux à base d'alumine (Al_2O_3) ou d'oxyde de chrome (Cr_2O_3) sont utilisés pour obtenir une dureté et une résistance à l'usure.

5. Dispositif selon la revendication 3, caractérisé en ce que les matériaux à base d'oxyde de zircone (ZrO_2) sont utilisés pour obtenir une résistance à la chaleur, une résistance à l'impact et/ou une capacité d'isolation thermique.

6. Dispositif selon la revendication 3, caractérisé en ce que les matériaux à base d'oxyde de titane (TiO_2) sont utilisés dans les applications avec des exigences élevées en fini de surface.

7. Dispositif selon la revendication 1, caractérisé en ce que les matériaux de revêtement peuvent être utilisés seuls ou par couches en fonction de l'application finale.

8. Utilisation d'un dispositif selon l'une quelconque des revendications 1 à 7 dans un appareil de calandrage, caractérisée en ce que l'effet de chauffage de l'élément de chauffage peut pénétrer à travers le papier de sorte que la face du rouleau chaud modifie les propriétés de surface du papier.

9. Utilisation selon la revendication 8, caractérisée en ce que les matériaux de revêtement convenant à cette utilisation sont par exemple Cr_2O_3, Al_2O_3, TiO_2.

10. Utilisation selon la revendication 8, caractérisée en ce que l'on utilise de l'oxyde de zircone ou équivalent comme isolation thermique au-dessous d'une mince enveloppe de céramique.

11. Utilisation d'un système selon l'une quelconque des revendications 1 à 7 pour le décollage d'un papier d'un rouleau par chauffage (en affectant la viscosité) ou par vaporisation de l'interface, par exemple de l'eau dans le cas d'un rouleau de presse, ou d'un agent de revêtement dans le cas d'un rouleau de guidage dans un dispositif de revêtement tel qu'un cylindre encolleur de façon à faciliter le raclage au moyen d'une lame de raclage, la face du rouleau chaud chauffant ou vaporisant la couche de colle et décollant le papier du rouleau.

12. Utilisation selon la revendication 11, caractérisée en ce que les matériaux de revêtement convenant à cette utilisation comprennent par exemple le Cr_2O_3.

13. Utilisation selon la revendication 8, caractérisée en ce que l'objet de l'application est le rouleau central dans une presse, une presse encolleuse, ou un rouleau de guidage de revêtement-décollage.