

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 1 382 744 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

21.01.2004 Bulletin 2004/04

(51) Int Cl.7: **D21H 27/00**, B65D 57/00,
B41C 1/10, G03F 7/00

(21) Application number: **02077577.1**

(22) Date of filing: **28.06.2002**

(84) Designated Contracting States:
DE FR GB NL

(71) Applicant: **Fuji Photo Film B.V.**
5047 TK Tilburg (NL)

(72) Inventors:
• **Imaizumi, Mitsuhiro**
5045 JG Tilburg (NL)

• **Mangré, Randhiersing**
5165 EH Waspik (NL)
• **Sekiya, Toshiyuki**
5045 JW Tilburg (NL)

(74) Representative: **Prins, Adrianus Willem et al**
Vereenigde,
Nieuwe Parklaan 97
2587 BN Den Haag (NL)

(54) **Interleaf paper for printing plates**

(57) An interleaf paper for photosensitive printing plate wherein the Bekk smoothness of the interleaf paper at the side facing the photosensitive layer is less than 40 seconds, and Bekk air permeability is more than 40 seconds.

EP 1 382 744 A1

Description**Field of the invention**

5 **[0001]** This invention relates to a photosensitive lithographic printing plate, particularly to the interleaf paper for the printing plate. When photosensitive lithographic printing plate is manufactured, a thin paper cover is applied on top of the photosensitive layer with a static electricity charge to prevent scratches and keep the photosensitive layer stable from environmental change. This paper cover is called interleaf paper which this invention relates to.

Background of the invention

10 **[0002]** Recently in photosensitive lithographic printing plate market, the usage of thermal type computer to plate system is increasing. Advantage of the system is as follows. The plate can be exposed in infra-red wavelength directly from image data without using film. Similar or same processor and chemistry as the conventional system can be used.
15 No change of the lighting conditions at the working room to handle the printing plate is necessary as the one used within the current conventional system, or even can be changed back to normal white light environment. Further more, all major plate setter vendors who have developed the exposure machines for this thermal type computer to plate system, have also developed autoloaders to load the printing plates automatically to their infra-red wavelength exposure system. This reduced the necessary manpower for handling printing plates. These advantages contribute in a positive way to increase the thermal type computer to plate system.

20 **[0003]** When the autoloaders load the printing plate into its exposure unit, it separates the printing plate and the interleaf paper. Some loaders which need manual operation to separate the interleaf paper from the printing plate are called semi-automatic loaders. In all autoloaders, first a bundle of printing plates is set, wherein in most cases the photosensitive layer side of the printing plate (= top side of the printing plate) is placed downwards to the ground. In this type of autoloader, the printing plate is picked up from the back side of the printing plate where there is no photo-sensitive layer. When the printing plate is picked up, it is important that the interleaf paper on the top side of the printing plate (facing downward) separates well from the picked up printing plate. After the printing plate is loaded, picking up of the remaining interleaf paper from the back side of the next printing plate is not so critical since there is no electrostatic charge applied in between the interleaf paper and the backside of the next printing plate.

25 **[0004]** In other types of autoloaders, a bundle of printing plates is set first with the photosensitive layer of the printing plate (= top side of the printing plate) is placed upwards into the sky. In this type of autoloader, the printing plate is picked up from the top side of the printing plate. When the printing plate is picked up, it is important that the interleaf paper on the backside (facing downward) of the printing plate separates well from the printing plate. This separation is not as critical as the former case between the top side of the printing plate and the interleaf paper because at the production facility the topside of the printing plate is adhered together with the interleaf paper by electro statically charging means and not to the back side of the next printing plate. After the printing plate is loaded, the interleaf paper is picked up from the topside of the printing plate and the next printing plate will be loaded again etc.

30 **[0005]** However in the case when the back side of the printing plate is picked up by the autoloader, another problem is experienced sometimes as the interleaf paper sticks to the topside of the printing plate. This happens to a smaller extent also when the top side of the printing plate is picked up, but the picking up of the printing plate from the backside is more critical. When this interleaf paper does not fall down, the interleaf paper will be loaded together with the printing plate into the exposure unit which causes an incorrect exposure or a machine stop. As worst case a printing plate underneath can also be picked up at the same time, which causes a double loading. These machine failures consume extra manpower to recover the condition, and much operational time for solving this problem is also lost.

35 **[0006]** Another problem can happen when the autoloader is picking up the interleaf paper by suction cups. Problems are experienced when the suction cups pick up the interleaf paper together with the printing plate underneath. This causes a jam in the waste paper container, which requires again extra manpower and waste of operational time.

40 **[0007]** Further more, another problem can happen when the interleaf paper is picked up by the suction cups at the autoloader, when the autoloader interprets wrongly that the paper is not picked up. This happens more when some of the suction cups are not in use due to the size of the printing plate or by any malfunctioning of the suction cups. In such a case, the vacuum alarm setting of the suction cups system has to be tuned, again with extra manpower consumption and operational time loss as well as high risk of not picking up of the interleaf paper correctly.

45 **[0008]** Another problem in the market is that when the interleaf paper is sent to the waste paper container of the autoloader, sometimes less paper can be put in since the alarm for the waste container is activated. This will not be recovered until the waste interleaf paper is removed from the waste paper container. This also causes extra manpower consumption and operational time loss.

50 **[0009]** Even further, there is a problem that at certain sizes of printing plates, the distance between the active suction cups at the edge and the edge of the plate is too big and the paper starts to bend down. When this happens in front

of the guide roller, the paper is no longer guided through the guide roller but gives a paper jam at this roller. Again, this causes extra manpower consumption and operational time loss.

Summary of the invention / itemized

[0010] With the information above, an object of the present invention is to provide selection criteria of the interleaf paper suitable for these autoloader. Main aspect is to prevent any stop of the autoloader such that no loss of manpower and operational time happen.

[0011] First aspect is to prevent sticking of the interleaf paper to the picked up printing plate. According to the present invention this can be solved by keeping the paper surface rough enough such that the air can intervene between the interleaf paper and the printing plate. When enough air can intervene, the interleaf paper can easily be separated from the printing plate.

[0012] Second aspect is to prevent picking up the printing plate when the interleaf paper is picked up by the suction cups. According to the present invention this problem can be solved by keeping the air permeability high enough such that less air goes through the paper. When the air does not go through, no vacuum will be formed between the interleaf paper and the printing plate.

[0013] Third aspect is to prevent that the waste interleaf paper will fill the waste paper container very quickly. According to the present invention this problem can be solved by keeping the bending stiffness of the paper low enough such that the waste paper can be wrinkled easily into a smaller volume, which allows more paper to be put into the waste paper container.

[0014] Fourth aspect is to prevent that the corner of the interleaf paper bends in front of the paper guide roller. According to the present invention this problem can be solved by keeping the bending stiffness of the paper high enough such that corner bending does not occur.

[0015] Fifth aspect is to use paper without synthetic polymer to allow paper recycling.

[0016] For a better understanding of the present invention examples of an interleaf paper, stack of printing plates with such interleaf papers in between and a method for loading such printing plates are described by way of example only. In general in a method according to the present invention interleaf paper is chosen such that it separates easily from a printing plate. Preferably they separate under gravity within approximately a second or less after picking up.

Examples

Preparation of photosensitive printing plate

[0017] In the examples as photosensitive printing plate the thermal positive printing plate LH-PIE manufactured by Fuji Photo Film BV was applied. Here below examples are shown of interleaf papers according to the prior art in comparison to interleaf papers according to the present invention. The interleaf papers according to the present invention include the papers referred to as samples. Examples of possible substrate treatments are e.g. shown in JP10282645, JP10301262. Suitable coating materials are shown in JP2000241962, JP2000241961, JP2000112136, JP2000112132, JP2000112135, EP1182033, EP1182032, EP1170123, EP1096315, EP1155820, EP1129845.

[0018] For the interleaf paper various commercial papers of less than 100g/m² gram mage (determined by ISO 536 standard procedure) are used. The properties of the papers used are shown in Table 1.

The thickness of the paper is measured by a micrometer according to ISO 534. Bekk smoothness is measured by a smoothness meter according to the ISO 8791-1 standard procedure. The Bekk air permeability of the paper is measured by an air permeability meter according to ISO 5636-1 standard procedure. Bending stiffness of the paper is measured by a stiffness meter according to the ISO 5628 standard procedure. Tensile strength is measured by tensile strength tester according to ISO 1924-2.

The term "machine" direction is referring to an orientation in the direction of a paper web which is adhered in the manufacturing process of the printing plate; the term "cross" direction is referring to an orientation in the plane of the paper web and perpendicular to the "machine" direction. The limits given in the description should be assessed within the gist of the invention.

Table 1.

Properties of papers used for interleaf							
	Syntheti Polyme	Pape Appearan	Thicknes micron	Smoothne Bekk	Air permeability Bekk	Bending Stiffness	
						MD	CD
Sample	Not	Both sides	60	20	85	28	11
Sample	Not	Roth sides	55	25	50	36	11
Refernce	Not	Both sides	47	25	30	7	4
Refernce	Not	Both sides	72	30	3	48	20
Refernce	Not	Both sides	47	35	30	10	3
Refernce	Not	One side	62	50	10	21	7
Refernce	Not	One side	45	65	2	14	6
Refernce	Not	One side	79	100	2	30	16
Refernce	Not	One side	57	150	1	11	3
Refernce	Not	One side	54	290	14	11	3
Refernce	Not	One side	44	300	15	7	< 1
Refernce	Use	One side	38	600	2000	< 1	< 1
MD = machine direction CD = cross							

Sticking Test

[0019] For each interleaf paper type bundles of 30 printing plate sheets were cut into 400mm x 500mm. 3 bundles of each interleaf paper type was set on a table with the photosensitive layer facing downwards to the ground. The printing plate was picked up from the back side of the printing plate by an arm with 4 suction cups. When the plate is picked up, sometime later the interleaf paper underneath the picked up plate falls down and separates from the plate. The necessary time for the interleaf paper to fall was measured in seconds. After removing the interleaf paper manually, the next plate was picked up by the same procedure. In worst cases, a plate underneath the interleaf was also picked up. After 90 sheets are picked up, another 3 bundles were set on a table with the photosensitive layer facing upwards to the sky. The same picking up test was done again. The percentage of sheets consuming more than 2 seconds to separate the interleaf paper from the plate was calculated and defined as interleaf sticking paper percentage. The data is shown in Table 2.

Table 2.

Result of sticking test					
	Synthetic Polymer	Paper Appearance	Thickness microns	Smoothness Bekk sec	Sticking %
Sample 1	Not used	Both sides rough	60	20 sec	0
Sample 2	Not used	Both sides rough	55	25 sec	0
Refernce 1	Not used	Both sides rough	47	25 sec	0
Refernce 2	Not used	Both sides rough	72	30 sec	0
Refernce 3	Not used	Both sides rough	47	35 sec	0
Refernce 4	Not used	One side smooth	62	50 sec	10
Refernce 5	Not used	One side smooth	45	65 sec	30
Refernce 6	Not used	One side smooth	79	100 sec	30

Table 2. (continued)

Result of sticking test					
	Synthetic Polymer	Paper Appearance	Thickness microns	Smoothness Bekk sec	Sticking %
Refernce 7	Not used	One side smooth	57	150 sec	60
Refernce 10	Not used	One side smooth	54	290 sec	100
Refernce 8	Not used	One side smooth	44	300 sec	100
Refernce 9	Used	One side coated	38	600 sec	100

[0020] As shown in Table 2, the smoothness measurement must be lower than approximately 40 Bekk seconds to achieve a sticking percentage of 0%. Due to a low Bekk sec Smoothness it is surprisingly shown that air can relatively easily enter between the plate surface and the interleaf paper, thus preventing under pressure in between. The result shows clearly how important it is for the air to leak in between the picked up printing plate and the interleaf paper underneath to let paper fall easily. By providing sufficiently low smoothness air will be allowed to escape between the PS plate and the interleaf paper.

Plate pick up through paper test

[0021] For each interleaf paper type bundles of 30 printing plate sheets were cut into 400mm x 500mm. 3 bundles of printing plate with each interleaf paper type respectively was set on a table with the photosensitive layer facing downwards to the ground. After taking of the top printing plate, interleaf paper was picked up from the back side of the printing plate by an arm with 4 suction cups. When the interleaf paper was picked up, sometimes later the printing plate underneath the picked up interleaf paper falls down and separates from the interleaf paper. The necessary time for the plate to fall was measured in seconds. After removing the printing plate manually, the next interleaf paper was picked up by the same procedure. After 90 sheets of interleaf paper were picked up, another 3 bundles were set on a table with the photosensitive layer facing upwards to the sky. Same picking up test was done again. The percentages of sheets consuming more than 1, 2 or 3 seconds to separate the interleaf paper from the printing plate were calculated and defined as plate pickup percentage through paper. The result is shown in Table 3. As clearly shown in Table 3, the Bekk air permeability must be higher than approximately 40 seconds to prevent plate pickup through interleaf paper, even in the one sec. test.

Table 3.

Results of plate pickup through paper test and vacuum alarm test								
	Synthetic Polymer	Paper Appearance	Thickness microns	Air permeability Bekk sec	Plate pickup through paper (%)			Vacuum alarm (%)
					> 1 sec	> 2 sec	> 3 sec	
Sample 1	Not used	Both sides rough	60	85 sec	0	0	0	0
Sample 2	Not used	Both sides rough	55	50 sec	0	0	0	0
Refernce 9	Used	One side coated	38	2000 sec	0	0	0	0
Refernce 1	Not used	Both sides rough	47	30 sec	10	5	0	0
Refernce 3	Not used	Both sides rough	47	30 sec	10	5	0	0
Refernce 8	Not used	One side smooth	44	15 sec	10	5	0	0

Table 3. (continued)

Results of plate pickup through paper test and vacuum alarm test								
	Synthetic Polymer	Paper Appearance	Thickness microns	Air permeability Bekk sec	Plate pickup through paper (%)			Vacuum alarm (%)
					> 1 sec	> 2 sec	> 3 sec	
Reference 10	Not used	One side smooth	54	14 sec	10	5	0	0
Reference 4	Not used	One side smooth	62	10 sec	10	5	0	0
Reference 2	Not used	Both sides rough	72	3 sec	20	5	0	0
Reference 5	Not used	One side smooth	45	2 sec	40	30	5	5
Reference 6	Not used	One side smooth	79	2 sec	40	30	5	5
Reference 7	Not used	One side smooth	57	1 sec	90	50	30	30

Vacuum alarm test

[0022] For each interleaf paper type bundles of 30 printing plate sheets were cut into 1030mm x 790mm. 3 bundles of printing plates, with each interleaf paper type respectively were set into a Fujifilm SAL-9000 autoloader. In a cassette, plates were set with the photosensitive layer facing downwards to the ground. After taking out the top printing plate, interleaf paper was picked up from the back side of the printing plate by the autoloader arm. A pressure gauge of the suction cup vacuum system was checked, and the percentage that the vacuum level of holding the interleaf paper goes below 60% of that when the printing plate was held up was calculated as vacuum alarm. The lowest moment was when the interleaf paper was picked up and was separated from the printing plate underneath. The alarm is normally set to about 50%. It is clear to see from Table 3 that especially very low Bekk air permeability results in a vacuum alarm.

Stiffness related tests

[0023] For each interleaf paper type, bundles of 30 printing plate sheets were cut into 1030mm x 790mm. 3 bundles of printing plates with each interleaf paper type respectively were set into a Fujifilm SAL-9000 autoloader. In a cassette, plates were set with the photosensitive layer facing downwards to the ground. Loading tests were done for these 90 sheets of each type of interleaf paper, and the waste paper container after the machine was observed closely. The same test was done with a CreoScitex Lotem 800 autoloader and a CreoScitex Trendsetter 5880 AL without compressing unit. The filling efficiency of the waste paper container was tested to see if 30 sheets of interleaf paper can be sent easily into the waste container or not. As shown in Table 4, the bending stiffness of the interleaf paper in the machine direction must be lower than approximately 42mN to have good efficiency usage of the waste paper container. To test the corner bend behaviour for each interleaf paper type, bundles of 30 printing plate sheets were cut into 400mm machine direction x 500mm cross direction. 3 bundles with each interleaf paper type respectively were set on a table with the photosensitive layer facing downwards to the ground. After taking of the top printing plate, interleaf paper was picked up from the back side of the printing plate by an arm with 4 suction cups. Suction cups were positioned 150 mm away from the 400mm length edge. When the interleaf paper was picked up at the height of 100mm, corner bending of the interleaf paper was observed visually for various reference papers. As shown in Table 4, the bending stiffness of the interleaf paper in the cross direction must be higher than approximately 8mN in order to have good corner bending.

[0024] The thickness of the interleaf sheets is preferably less than approximately 70 microns since then a desired number of plates can be attached and packed in a box commonly used. The sheets may be thicker than 45 micron in order to be handled more easily.

Table 4.

Results of waste bin efficiency test and corner bending test							
	Synthetic Polymer	Paper Appearance	Thickness microns	Bending Stiffness (mN)		Waste bin efficiency	Corner bending
				MD	CD		
Sample 1	Not used	Both sides rough	60	28	11	good	good
Sample 2	Not used	Both sides rough	55	36	11	good	good
Reference 2	Not used	Both sides rough	72	48	20	bad	good
Reference 6	Not used	One side smooth	79	30	16	good	good
Reference 4	Not used	One side smooth	62	21	7	good	not good
Reference 5	Not used	One side smooth	45	14	6	good	not good
Reference 7	Not used	One side smooth	57	11	3	good	not good
Reference 10	Not used	One side smooth	54	11	3	good	not good
Reference 3	Not used	Both sides rough	47	10	3	good	bad
Reference 1	Not used	Both sides rough	47	7	4	good	not good
Reference 8	Not used	One side smooth	44	7	< 1	good	bad
Reference 9	Used	One side coated	38	< 1	< 1	good	bad
MD = machine direction CD = cross direction							

[0025] The present invention is by no means limited to the examples shown. Many variations are possible within the scope of the invention as defined by the claims. Any combination of material properties according to the present invention especially as discussed in the examples is considered to be included in this description as falling within said scope.

Claims

1. An interleaf paper for photosensitive printing plate wherein the Bekk smoothness of the interleaf paper at the side facing the photosensitive layer is less than 40 seconds, and Bekk air permeability is more than 40 seconds.
2. An interleaf paper preferably according to claim 1 for photosensitive printing plate which is sensitive to infra-red wavelength exposure.
3. An interleaf paper according to claim 1 or 2 wherein bending stiffness of the interleaf paper at the cross direction of the paper is higher than 8mN and at the machine direction of the paper lower than 42 mN.
4. An interleaf paper according to anyone of claims 1 - 3 wherein the thickness of the paper is less than approximately 70 microns.

EP 1 382 744 A1

5. An interleaf paper according to anyone of claims 1 - 4 wherein the density of the paper is more than approximately 0.5 g/cm³.
6. An interleaf paper according to anyone of claims 1 - 5 wherein the tensile strength of the paper is higher than 1.5kN/m.
7. An interleaf paper according to anyone of claims 1 - 6 wherein the paper can be recycled, and is preferably made without plastic material, especially without a synthetic polymer.
8. Stack of printing plates, comprising interleaf papers according to anyone of claims 1- 7 in between said printing plates.
9. Stack of printing plates according to claim 8, wherein the Bekk smoothness of the or each interleaf paper is less than 40 seconds and facing the printing plate opposite the side facing up while the Bekk air permeability is more than 40 seconds.
10. Stack of printing plates according to claim 8 or 9, wherein the Bekk smoothness of the or each interleaf paper is less than 40 seconds and facing the printing plate on the side facing up, while the Bekk air permeability is more than 40 seconds.
11. Method for loading printing plates from a stack according to anyone of claims 8 - 10, wherein the interleaf paper is chosen such that air is allowed to enter in between the paper and an adjacent printing plate such that the interleaf paper and the printing plate, when picked up, separate within less than 1 second after picking up.



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 07 7577

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 2002/042021 A1 (OKANO HIROSHI ET AL) 11 April 2002 (2002-04-11) * paragraph [0026] - paragraph [0028]; table 1 *	1-11	D21H27/00 B65D57/00 B41C1/10 G03F7/00
A	--- DATABASE WPI Section Ch, Week 200240 Derwent Publications Ltd., London, GB; Class F09, AN 2002-367457 XP002220048 & JP 2002 054090 A (YUKO SHIKO KK), 19 February 2002 (2002-02-19) * abstract *	1-11	
A	--- EP 1 190 850 A (FUJI PHOTO FILM CO LTD) 27 March 2002 (2002-03-27) * page 11, paragraph 78 - paragraph 79 *	1-11	
A	--- PATENT ABSTRACTS OF JAPAN vol. 2000, no. 25, 12 April 2001 (2001-04-12) & JP 2001 233385 A (FUJI PHOTO FILM CO LTD), 28 August 2001 (2001-08-28) * abstract *	1-11	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			D21H B65D B41C G03F
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 8 November 2002	Examiner Spyropoulou, E
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 02 07 7577

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

08-11-2002

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2002042021 A1	11-04-2002	JP 2002059669 A	26-02-2002
JP 2002054090 A	19-02-2002	NONE	
EP 1190850 A	27-03-2002	JP 2002086951 A	26-03-2002
		CN 1344923 A	17-04-2002
		EP 1190850 A2	27-03-2002
		US 2002060815 A1	23-05-2002
JP 2001233385 A	28-08-2001	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82