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(54) Ink-jet film image stabilization and storage system.

(57) Printed transparencies (**10**), or imaged films, printed upon by ink-jet printing to form an image (**10i**), are provided with means to allow proper drying while preventing long term image quality degradation of the printed transparency. A vapor permeable sheet (**12**) is first placed in contact with the imaged (inked side) ink-jet film to form an assembly (**14**). The assembly comprising the vapor permeable sheet and the imaged ink-jet film are then inserted into a non-vapor permeable sleeve protector (**16**). The present invention allows for immediate use of the imaged film in a non-vapor permeable sheet protector, such as polyvinyl chloride (PVC), polypropylene, and polyester (polyethylene terephthalate - PET). As a consequence, the imaged film may be archived indefinitely without significant degradation of the image quality. Further, the imaged film is protected against image degradation caused by excessive moisture, including atmospheric moisture (high humidity) and direct water contact. The present invention promotes image development at dry atmospheric conditions (low humidity) and allows non-vapor permeable sheet protector independence. The present invention induces minimal haze and opacity to the projected image of the transparency and allows the imaged film to dry properly.

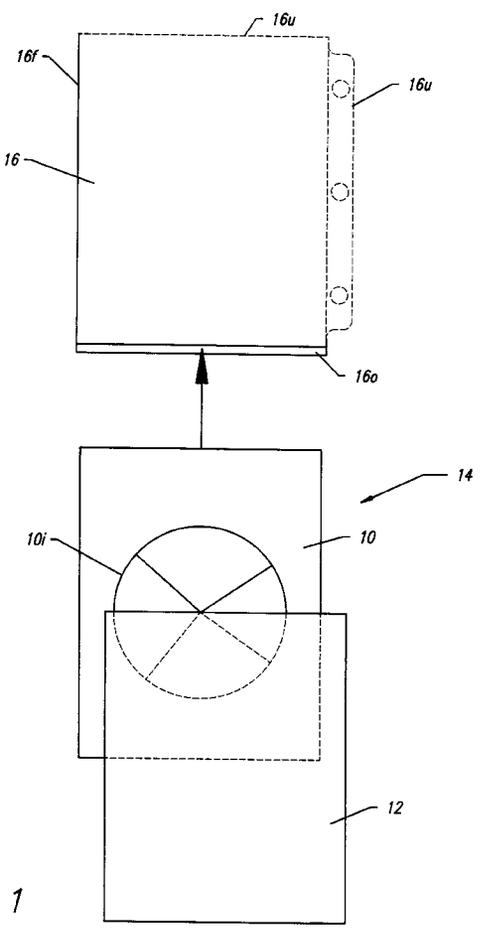

FIG. 1

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TECHNICAL FIELD

The present invention relates to the protection of printed media, and, more particularly, to transparent, printed-sheet protection sleeves for printed transparencies.

BACKGROUND ART

The use of ink-jet printers to form images such as alphanumeric characters and graphics on absorbent substrates, such as paper, is well-known.

However, the use of the same inks on non-ink receptive substrates, such as polyester films, commonly known as Mylar, has not produced the same high density of print, which results in intense colors, obtained with inherently absorbent substrates. Such non-ink receptive substrates do not readily absorb the aqueous-based inks commonly employed in ink-jet printing, with the result that dots of ink are slow to dry and do not spread laterally on the non-ink receptive substrate. For the purposes of this disclosure, the term "non-ink receptive substrates" is used to describe those substrates comprising materials which drops of ink deposited thereon do not readily penetrate.

Various solutions have been developed to overcome this problem. For example, U.S. Patent 4,810,544, assigned to the same assignee as the present application, discloses a novel printing media sleeve that overcomes weaknesses associated with prior art protector sleeves and preferably employs diacetate films. U.S. Patent 4,914,451, also assigned to the same assignee as the present application, discloses a non-ink receptive substrate provided with an ink-receptive coating. This patent further discloses use of vapor permeable and water absorbent sleeve protectors, such as acetate, for allowing drying of the transparency during storage in the sleeve protector.

The vapor permeable sleeve protectors described in the foregoing two patents allow the image to dry properly, but do not prevent long term image degradation from excessive moisture, specifically, atmospheric moisture (high humidity). On the other hand, while non-vapor permeable sleeve protectors, such as polyvinyl chloride (PVC), polypropylene, and polyester (polyethylene terephthalate PET), prevent image degradation from excessive moisture, including atmospheric moisture (high humidity), they cause image degradation by not allowing the image to dry properly.

Thus, what is needed is a means for storing printed transparencies, provided with an ink-receptive layer, that allows for immediate use of the imaged film in a non-vapor permeable sleeve protector while permitting the film to dry properly without excessive lateral movement of the image within the ink-receptive layer.

DISCLOSURE OF INVENTION

In accordance with the invention, printed transparencies, or imaged films, provided with an ink-receptive coating and printed upon by ink-jet printing, are provided with means to allow proper drying of the print while preventing long term image quality degradation of the printed transparency. A vapor permeable sheet is first placed in contact with the imaged (inked side) ink-jet film. The vapor permeable sheet and the imaged ink-jet film are then inserted into a non-vapor permeable sleeve protector.

The present invention allows for immediate use of the imaged film in a non-vapor permeable sheet protector, such as polyvinyl chloride (PVC), polypropylene, and polyester (polyethylene terephthalate - PET). As a consequence, the imaged film may be archived substantially indefinitely without significant degradation of the image quality. Further, the imaged film is protected against image degradation caused by excessive moisture, including atmospheric moisture (high humidity). The present invention promotes image development at dry atmospheric conditions (low humidity) and allows non-vapor permeable sleeve protector independence. The present invention adds no significant haze (less than about 1%) or opacity to the projected image and allows the imaged film to dry properly.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view, depicting the method of the invention for protecting printed transparencies; and

FIG. 2, on coordinates of micrometers and time, shows plots of bleed of ink (undesired color mixing) printed on transparencies that are then stored in various protective media.

BEST MODES FOR CARRYING OUT THE INVENTION

In accordance with the teachings of this invention, the vapor permeable material described in U.S. Patent Number 4,914,451 is combined with any non-vapor permeable sleeve protector, whether sealed or unsealed on any or all of its sides. The vapor permeable material allows the image to dry properly while the non-vapor permeable sleeve protector prevents image degradation from excessive moisture, including atmospheric moisture (high humidity).

In the practice of the present invention, the transparency preferably employed is that disclosed in U.S. Patent 4,914,451, because of the advantages that the ink-receptive coating provides. Any of the known vapor permeable materials may be used in the practice of the invention, including those disclosed in U.S. Patents 4,810,544 and 4,914,451, such as a cellulose

acetate, e.g., cellulose diacetate and cellulose triacetate. Any of the known non-vapor permeable sleeve protectors may also be utilized in the practice of the invention, including polyvinyl chloride (PVC), polypropylene, and polyester (polyethylene terephthalate - PET).

The vapor permeable sheet is placed in contact with the imaged (inked side) ink-jet film. The vapor permeable sheet and the imaged ink-jet film are then inserted into the non-vapor permeable sleeve protector. FIG. 1 depicts the imaged ink-jet film **10**, having an image **10i** thereon, contacted by the vapor permeable sheet **12**. The assembly **14** is then inserted into the non-vapor permeable sleeve protector **16**.

The non-vapor permeable sleeve protector **16** is provided with two unsealed edges **16u**, a folded edge **16f**, and an open edge **16o**. Alternatively, one or both of the unsealed edges **16u** may be sealed. The assembly **14** is inserted into the open edge **16o**. While the non-vapor permeable sleeve protector **16** is shown with three holes along the edge denoted **16u**, it will be appreciated that the invention is not limited to the particular construction of the sleeve protector.

A variety of combinations of imaged film with (a) polypropylene sleeve protector (non-vapor permeable); (b) acetate sleeve protector (vapor permeable); (c) no sleeve; and (d) acetate sheet and polypropylene sleeve combination, as described above. FIG. 2 provides plots of bleed between adjacent colors as a function of time for each of the foregoing combinations. In FIG. 2, combination (a) is represented by Point **18**, combination (b) is represented by Curve **20**, combination (c) is represented by Curve **22**, and combination (d) is represented by Curve **24**.

The imaged films were imaged at 23°C/50% relative humidity and then stored in the above-indicated manner at 30°C/80% relative humidity.

Bleed in each instance was measured by printing a preselected number of dot rows of blue ink (cyan + magenta) between a pre-selected number of dot rows of red ink (magenta + yellow), with the borders of the blue and red colors just touching. The blue ink swath had an initial width W_1. Bleed was measured by the invasion of blue ink into the red ink, resulting in a swath of width W_2. If $W_1 = W_2$, then there was no bleed. Where $W_1 \neq W_2$, then the difference in linewidth, in μm, was recorded as bleed.

FIG. 2 indicates that the maximum bleed allowed for crisp, clear transparencies is 200 μm (Curve **26**). Combinations (a), (b), and (c) each exceed this value. In direct contrast, combination (d), which is the combination of imaged film contacted by the vapor permeable sheet and inserted in the non-vapor permeable sleeve protector evidences bleed of less than 200 μm after accelerated exposure of 5 days at 30°C/80% RH.

The combination of the vapor permeable sheet material with the non-vapor permeable sleeve protector in accordance with the present invention takes advantage of the drying characteristics of the vapor permeable material and the sealing characteristics of the non-vapor permeable sleeve protector. This prevents significant long term image quality degradation of the imaged film.

The foregoing description has been given in terms of a vapor permeable sheet in conjunction with a non-vapor permeable sleeve protector for storing printed transparencies. However, it will be readily appreciated by those skilled in this art that the non-vapor permeable sleeve protector could alternatively be provided with one or both of its inner surfaces coated with a vapor permeable coating. For example, it may be possible to co-extrude polypropylene and diacetate to provide such inner coated sleeves.

INDUSTRIAL APPLICABILITY

The image stabilization system of the present invention is expected to find commercial use in protecting transparencies printed by ink-jet printing.

Thus, there has been disclosed an ink-jet film image stabilization and storage system. It will be readily apparent to those skilled in this art that various changes and modifications of an obvious nature may be made, and all such changes and modifications are considered to-fall within the scope of the invention, as defined by the appended claims.

Claims

1. A method of storing a printed transparency film **10**, printed on at least one side thereof by an ink-jet printer to form at least one image **10i**, comprising:
   (a) contacting said at least one printed side with a vapor permeable sheet material **12** to form an assembly **14**; and
   (b) inserting said assembly **14** into a non-vapor permeable sleeve protector **16**.

2. The method of Claim 1 wherein said printed transparency film **10** comprises a non-ink receptive, transparent substrate provided with an ink-receptive, transparent coating thereon.

3. The method of Claim 1 wherein said vapor permeable sheet material **12** comprises a cellulose acetate.

4. The method of Claim 1 wherein said non-vapor permeable sleeve material **16** comprises polyvinyl chloride, polypropylene, or polyester.

5. The combination of Claim 1, comprising said printed transparency film **10**, printed on at least

one side thereof by an ink-jet printer to form said at least one image **10i**, contacted on said at least one printed side with said vapor permeable sheet material **14** to form said assembly **14**, said assembly **14** stored in said non-vapor permeable sleeve protector **16**.

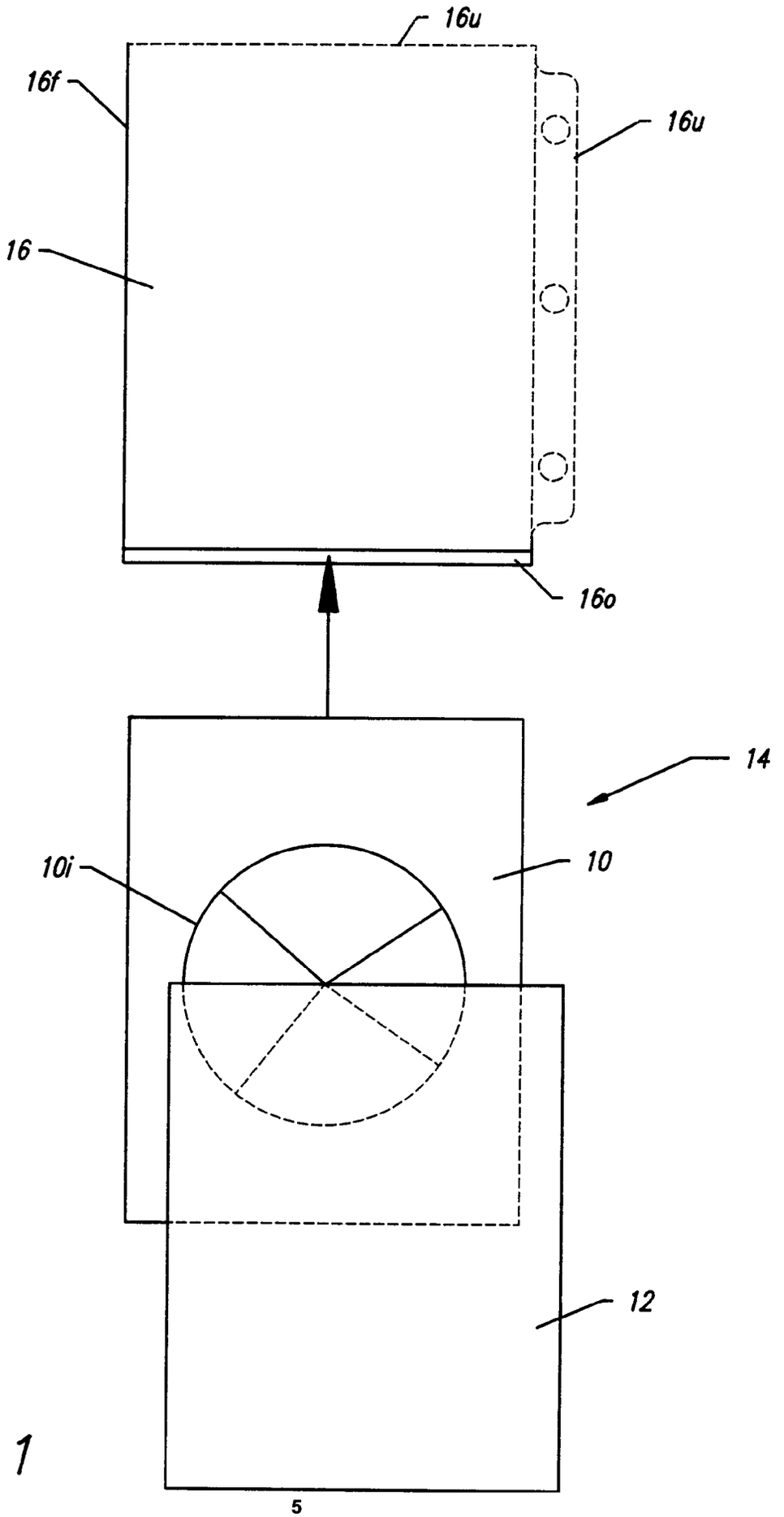

FIG. 1

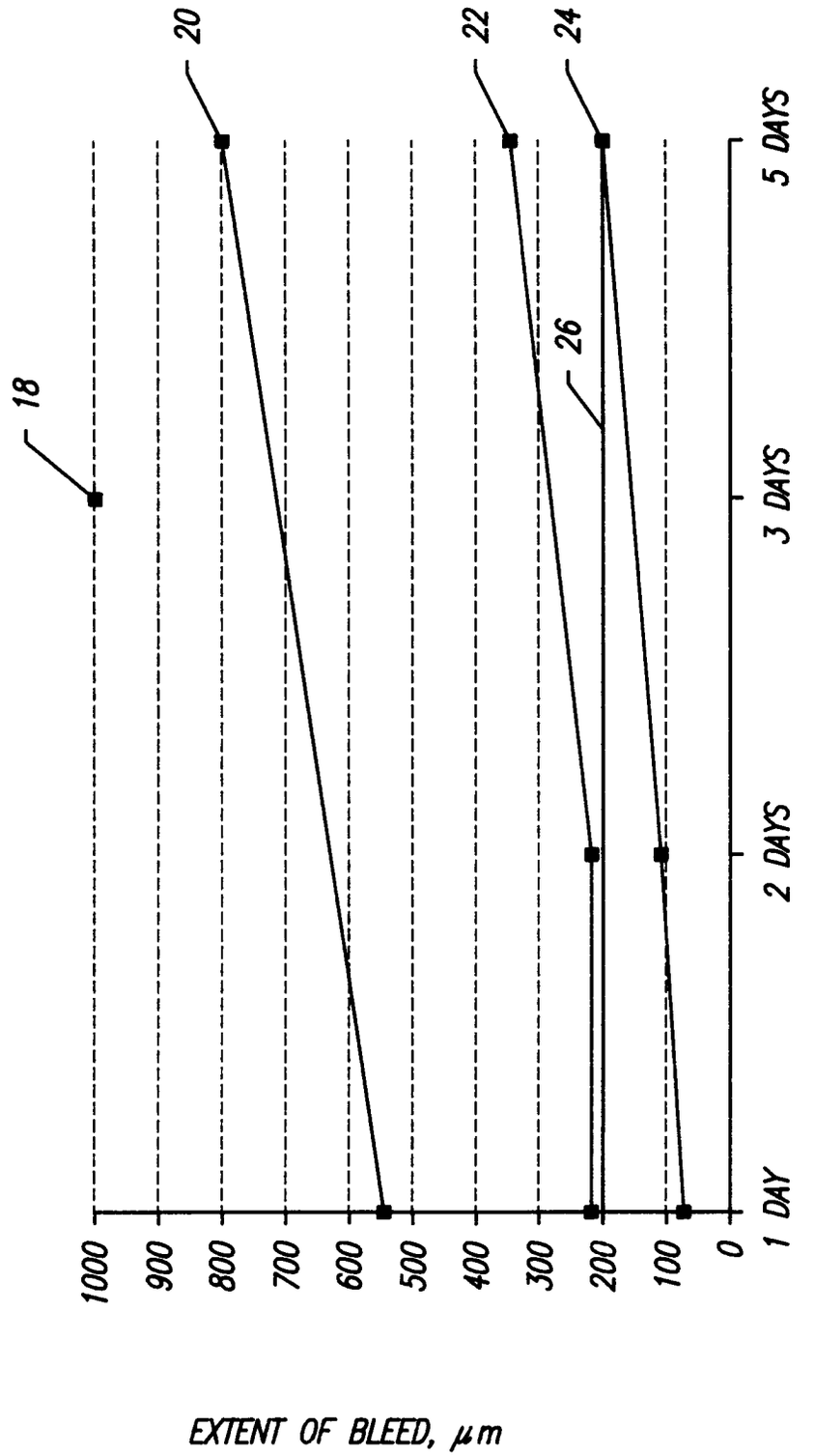
18
20
22
24
26
1000
900
800
700
600
500
400
300
200
100
0
1 DAY
2 DAYS
3 DAYS
5 DAYS
TIME
EXTENT OF BLEED, μm

FIG. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 30 8284

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.5)
D,Y	US-A-4 914 451 (MORRIS ET AL.) * the whole document *	1-5	B42F7/02
Y	WO-A-81 02639 (MINNESOTA MINING AND MANUFACTURING COMPANY) * page 5, line 5 - line 27 *	1-5	
A	US-A-4 417 659 (HATCHELL) * the whole document *	1,4,5	
A	US-A-5 140 764 (O'CONNOR) * the whole document *	1,4,5	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

B42F
G03B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	20 January 1994	Meulemans, J-P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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