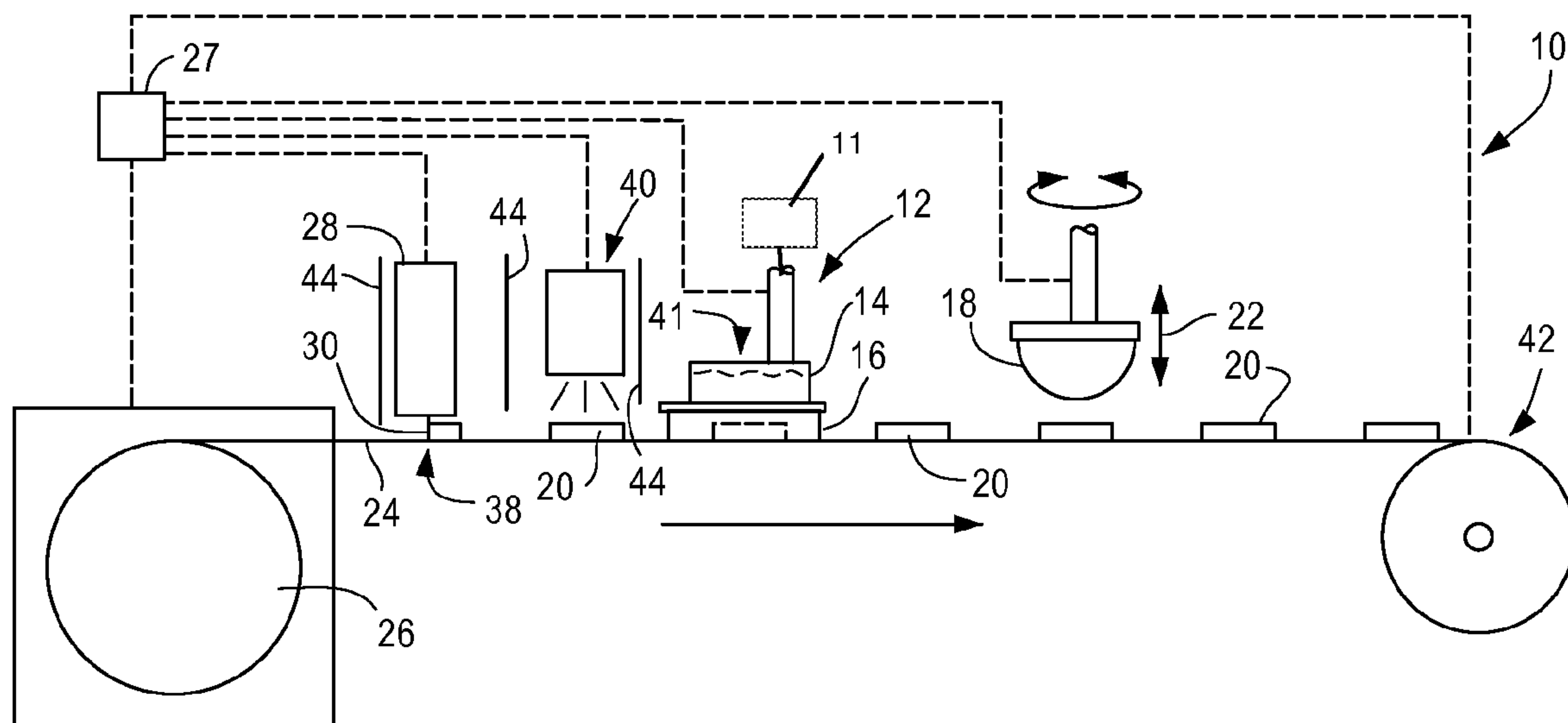




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(54) Titre : SYSTÈME ET PROCÉDE D'IMPRESSION NUMÉRIQUE DE TAMPONS A CLICHE  
(54) Title: DIGITAL CLICHE PAD PRINTING SYSTEM AND METHOD



(57) **Abrégé/Abstract:**

A digital cliché pad printing system includes a conveyor for conveying a substantially non-elastic support medium, a material deposition jetting device for depositing a curable material onto the support in a desired pattern, the desired pattern having at least one void space, means for curing the material in the desired pattern, the cured material defining a cliché having a top surface, an ink delivery system for depositing ink in the at least one void space and for wiping ink from the top surface and a pad configured to contact the cliché to transfer ink from the void space to the pad the pad also configured to move into contact with an object to which the ink is transferred. A digital cliché media and method are also disclosed.

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A schematic diagram of a multi-station processing system 10. The system is enclosed in a dashed rectangular frame. It features a main horizontal base 20 with two large circular end components 26 and 42. A series of processing stations are arranged along the base. From left to right, these include: a station with a vertical assembly 28 and 30; a station with a vertical assembly 44 and 40; a station with a vertical assembly 11 and 12; a station with a vertical assembly 14 and 16; a station with a vertical assembly 18 and 22; and a station with a vertical assembly 20. A control unit 27 is connected to the stations via a network of lines. A large arrow 38 points to the right, indicating the direction of material flow or processing sequence.

**(57) Abstract:** A digital cliché pad printing system includes a conveyor for conveying a substantially non-elastic support medium, a material deposition jetting device for depositing a curable material onto the support in a desired pattern, the desired pattern having at least one void space, means for curing the material in the desired pattern, the cured material defining a cliché having a top surface, an ink delivery system for depositing ink in the at least one void space and for wiping ink from the top surface and a pad configured to contact the cliché to transfer ink from the void space to the pad the pad also configured to move into contact with an object to which the ink is transferred. A digital cliché media and method are also disclosed.

## DIGITAL CLICHÉ PAD PRINTING SYSTEM AND METHOD

### BACKGROUND OF THE INVENTION

[0002] The present invention relates to pad printers. More particularly, the present invention relates to a digital cliché pad printing system and method.

[0003] Pad printing systems are used to apply high quality e.g., indicia. Pad printing systems use a deformable pad which receives ink, transferred as an image, from a cliché plate. The plate has an etching or engraving of the indicia formed therein. The image is transferred from the pad to the item onto which the indicia is applied.

[0004] These systems work well to produce high quality image transfer and for transferring images onto flat, as well as textured and non-planar surfaces. One drawback to the pad printing method is that cliché plates are expensive to fabricate, e.g., prepare, etch, and mount. As such, short run or single run printing is cost prohibitive using a pad printing method.

[0005] Digital systems (e.g., laser or ink jet printing) are often used for short run or single run printing due to the flexibility of these systems. These methods lend themselves well to short run and single run printing because printing commands such as image shapes are purely machine controlled. Accordingly, much lower costs are incurred in changing over the image to be printed or transferred.

[0006] It has been found that digital printing is however, limited in practical application to symmetrical shapes (e.g., spheres, cones, cylinders) or to flat or near-flat applications that allow the print head to remain within a narrow stand-off distance from the surface of the object (typically within a distance of about 0.5 to about 2.5mm).

[0007] Other solutions to enable the flexibility of digital printing in a pad system include directly jetting ink onto the printing pads which is then transferred onto the object surface.



It has however been found that inks that "jet" are not well suited for pad transfer, and often smudge or smear resulting in unacceptable image transfer.

[0008] Accordingly, there is a need for a digital cliché pad printing system and method. Desirably, such a system and method permit the use of a cliché in single run and short run printing applications. More desirably, such a system and method provide high quality image transfer without the costs associated with conventional cliché preparation.

## SUMMARY OF THE INVENTION

[0009] A digital cliché pad printing system includes a conveyor for conveying a substantially non-elastic support member, a fluid jetting device for jetting a curable fluid onto the support in a desired pattern and means for curing the fluid in the desired pattern. The pattern has at least one void space and the cured fluid defines a cliché having a top surface.

[0010] An ink delivery system deposits ink in the at least one void space and wipes ink from the top surface of the cliché. A printing pad is configured to contact the cliché and transfer ink from the void space to the pad. The pad is further configured to move into contact with an object to which the ink is transferred. In a present embodiment, a controller controls the fluid jetting device.

[0011] A contemplated cliché forming fluid is UV curable and the means for curing the fluid is a UV energy source.

[0012] In one embodiment, the support member is an elongate flexible element. The system can include a dispenser for dispensing the support member and a take up for taking up the support member following printing.

[0013] The ink delivery system can include an ink cup and a doctor blade for delivering ink to the cliché and depositing ink in the at least one void space, and for wiping excess ink from the cliché.

[0014] A digital cliché media and a method for pad printing are also disclosed.

[0014A] In a broad aspect, the invention pertains to a digital cliché pad printing system comprising a conveyor for conveying a substantially non-elastic, elongate and flexible support member, wherein the support member is a paper tape, foil or polymeric material, and a deposition device for depositing a curable material onto the support in a desired pattern, the desired pattern having at least one void space. Means are provided for curing the curable material in the desired pattern, the cured material defining a cliché having a top surface. An ink delivery system deposits

ink in the at least one void space and wipes ink from the top surface, and a pad is configured to contact the cliché and transfer ink from the void space to the pad, the pad further configured to move into contact with an object to which the ink is transferred.

[0014B] In a further aspect, the invention comprehends a method for pad printing comprising the steps of depositing a curable fluid onto a substantially non-elastic, elongate and flexible support member, wherein the support member is a paper tape, foil or polymeric material, the material deposited in a desired pattern defining at least one void space, curing the material to define a cliché having a top surface, filling the at least one void space with an ink, contacting a printing pad with the cliché to transfer the ink from the void space to the printing pad, and contacting the printing pad with an object to transfer the ink from the printing pad to the object.

[0015] These and other features and advantages of the present invention will be readily apparent from the following detailed description, in conjunction with the claims.



## BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The benefits and advantages of the present invention will become more readily apparent to those of ordinary skill in the relevant art after reviewing the following detailed description and accompanying drawings, wherein:

[0017] FIG. 1 is a schematic illustration of an embodiment of a digital cliché pad printing system embodying the principles of the present invention, the cliché being illustrated in partial cross-section to show the void spaces therein; and

[0018] FIG. 2 is an exemplary letter "O" formed in accordance with the principles of the present invention and provided for explanatory purposes.

## DETAILED DESCRIPTION OF THE INVENTION

[0019] While the present invention is susceptible of embodiment in various forms, there is shown in the drawings and will hereinafter be described a presently preferred embodiment with the understanding that the present disclosure is to be considered an exemplification of the invention and is not intended to limit the invention to the specific embodiment illustrated.

[0020] It should be understood that the title of this section of this specification, namely, "Detailed Description Of The Invention", relates to an aspect of the preferred format of the application, and does not imply, nor should be inferred to limit the subject matter disclosed herein.

[0021] Referring now to FIG. 1 there is shown a schematic illustration of a digital cliché pad printing system 10. The illustrated system 10 include various components of a conventional pad printing system, including a supply 11 of ink 12, an ink cup 14 with a doctor blade 16 and a printing pad 18. The pad 18 is a resilient member that moves into contact with an inked image-containing member (typically a cliché 20 and referred to herein as a cliché or an image-containing member) and picks up the image from the cliché 20. The pad 18 is resilient so that it can transfer the image, in total, onto a non-planar surface.

[0022] In a typical arrangement, the pad 18 reciprocates (as indicated at 22) to move into contact with the image-containing member 20 and away from the image-containing member/cliché 20. Various configurations can be used to then move the pad 18 into contact with an object onto which the image is to be transferred. One arrangement is illustrated in Hessert et al., U.S. Patent No. 7,210,405, commonly assigned with the present application and which may be referred to for further details.

[0023] Unlike known pad printing systems, the present system 10 uses a digitally-created cliché 20. It enables the decoration of complex contoured shapes, symmetric shapes, near flat shapes and flat shapes, and any other shape that can be decorated using a conventional pad printing process.

[0024] In a present embodiment, the cliché 20 is created on a supporting medium/media 24, preferably a flexible, transportable supporting media, such as a paper tape, foil, polymeric material or the like. The supporting media 24 is dispensed from a supply 26, such as a roll.

[0025] As with other digital systems that use a controller 27, such as a machine (computer) controller, the supporting media 24 is presented to a fluid jetting device 28 or the like, such as, or similar to, an ink jetting device. A cliché-forming material 30, such as a fluid and/or ceramic-based material, is expressed from the jetting device 28 onto the supporting media 24. Unlike conventional printing systems, in the present digital cliché system 10, the cliché-forming material 30 is jetted in the image of the negative space 36 (see FIG. 2), and is jetted so as to build up those regions that define the negative space 36. For example, referring to FIG. 2, for creating the letter "O" in the cliché 20, the cliché-forming material 30 would be jetted to create the central solid circular portion (shown cross-hatched as indicated at 32) and the outer periphery of the letter (shown cross-hatched as indicated at 34). This would define the open area (negative space, as indicated at 36) between the central solid circular portion and the outer periphery as the letter O.

[0026] Once the negative space 36 of the cliché 20 is created, conventional printing methods, e.g., pad printing methods, are used. That is, using an ink cup 14 or other ink delivery system, the negative space 36 is flooded with ink 12 and the cliché 20 is scraped clean such as by a doctor blade 16 on the ink cup 14. The pad 18 is then brought into contact with the cliché 20 and the ink 12 in the negative spaces 36 is transferred onto the pad 18. The pad 18 is then moved into contact with the object onto which the image is to be transferred.

[0027] Unlike known methods for creating clichés (which are subtractive processes – that is, material is removed from a plate), as set forth above, the present digitally created cliché 20 is formed by an additive process, or by depositing a cliché-forming material 30, such as a curable fluid, onto the support media 24. In a presently



contemplated embodiment, the support media 24 and cliché-forming material 30 are co-engineered (custom engineered) to create a non-elastic member having high adhesion (between the cliché-forming material 30 and the media 24), and a smooth finish of the cliché-forming material 30. Preferably, the fluid or cliché-forming material 30, which is applied in a drop-on-demand type system (such as a piezo ink jet, thermal ink jet or the like), dries into a relative hard, non-absorbing state.

[0028] In a contemplated digitally created cliché 20, the cliché-forming material 30 is an energy (e.g., ultraviolet -UV) curable material. Such a material 30 can be formulated to reduce or eliminate the use of solvents necessary to carry the material, and to enable immediate or almost immediate use as a cliché surface. Other materials, such as epoxies and the like (preferably immediate or almost immediate curing) are also contemplated.

[0029] As seen in FIG. 1, in one anticipated system and method, the support medium 24 is supplied from a roll 26 and is conveyed through a jetting station 38, at which a fluid jet device 28 jets fluid/cliché-forming material 30 onto the support medium 28 in a negative of the desired image.

[0030] The support medium 24 with the deposited cliché-forming material 30 is then conveyed through a UV curing station 40 to cure the cliché-forming material 30, such as fluid, on the support medium 24. The hardened cliché-forming material 30, which is built up (additive), creates the conventional cliché 20, in that the negative spaces 36 (FIG. 2) are void spaces for receiving ink.

[0031] The cliché 20 on the support medium 24 is then transported to an ink transfer station 41 at which an ink cup 14 is moved over the cliché 20 to deposit ink 12 in the void spaces 36 and a doctor blade 16 removes or scrapes excess ink 12 from the surface of the cliché 20. Alternately, the ink cup 14 can be stationary and the cliché 20 (web) moved relative to the ink cup 16. The pad 18 is then moved into contact with the cliché 20 to transfer ink 12 onto the pad 18, which is then moved into contact with the object onto which the image is to be transferred.

[0032] Alternately, the support medium 24 can be a porous material to enable ink 12 to permeate the image area and be presented to the printing pad 18 without the surface flooding and doctoring steps.

[0033] The support media 24 can be wound onto a waste roll 42 and discarded or reused/recycled. The cliché-forming materials 30 can also be of the type to be discarded or perhaps recycled. As set forth above, the cliché 20 itself can be



used for short run or single application printing runs. Due to the relatively inexpensive nature of the support media 24 and the cliché-forming material(s) 30 used, and the reduced time (labor) needed to create a cliché 20, such limited production runs can now be accomplished with the same high quality results as conventional pad printing processes.

[0034] Alternately the cliché support medium 24 can be a rigid support material, such as metal, ceramic or glass, upon which the additive process is applied to create the negative image cliché surface. In such an embodiment, the support medium 24 can be moved in a rotary fashion past the additive process, any curing process, inking/doctoring process and pad printing process. A final station can be configured to remove the additive or cliché-forming material 30 and prepare the surface for a new application of or cliché-forming material 30 to define a new image.

[0035] By the present method, the additive cliché manufacturing process 10 can be used to create a unique image for each cycle of the printing system. Of course, each image can be used to decorate several items in succession before presenting a new image for printing.

[0036] It will be appreciated that one or more fluid jetting devices 28 can be used to apply the cliché-forming material 30 to the support media 24 to effect an efficient process. It will also be understood from the description above that the various components, e.g., the fluid jetting device(s) 28, fluid jetting station 38, the curing station 40, the ink transfer station 41, and the like, can be separate from one another by space, by shrouds 44, or by other separating means as required. Given that space is often at a premium and most machines are designed with the smallest practical footprint, it is envisioned that partitions and/or shrouds 44 will be used to separate the stations 38, 40, 41 as necessary.

[0037] It will also be appreciated that any additive type of additive process can be used to create the cliché 20. For example, currently known (and to be developed) 3-D printing technologies, rapid prototyping technologies, other additive manufacturing processes can be used to create the cliché surface. To this end, the material can be jetted or, if solid or powdered, deposited onto the support media and allowed to harden (generally cure), for use. It is preferred that curing occurs immediately or almost immediately so as to provide an efficient printing process.

[0038] In the disclosure, the words "a" or "an" are to be taken to include both the singular and the plural. Conversely, any reference to plural items shall, where appropriate, include the singular.

[0039] The scope of the claims should not be limited by the preferred embodiments set forth in the description, but should be given the broadest interpretation consistent with the description as a whole.



**WHAT IS CLAIMED IS:**

1. A digital cliché pad printing system (10) comprising:
  - a conveyor for conveying a substantially non-elastic, elongate and flexible support member (24), wherein the support member is a paper tape, foil or polymeric material;
  - a deposition device (28) for depositing a curable material (30) onto the support (24) in a desired pattern, the desired pattern having at least one void space;
  - means for curing the curable material (30) in the desired pattern, the cured material defining a cliché (20) having a top surface;
  - an ink delivery system (14) for depositing ink in the at least one void space and for wiping ink from the top surface; and
  - a pad (18) configured to contact the cliché (20) and transfer ink from the void space to the pad (18), the pad (18) further configured to move into contact with an object to which the ink is transferred.
2. The digital cliché pad printing system (10) in accordance with claim 1 wherein the curable material (30) is a fluid and wherein the deposition device (28) is a fluid jetting device for jetting the curable fluid onto the support.
3. The digital cliché pad printing system (10) in accordance with claim 2 wherein the means for curing the fluid is a UV energy source.
4. The digital cliché pad printing system (10) according to claim 1, wherein the means for curing the curable material is arranged to cure the curable material by drying.
5. The digital cliché pad printing system (10) in accordance with claim 1 including a controller (27) for controlling the deposition device.

6. The digital cliché pad printing system (10) in accordance with claim 1 including a dispenser (26, 42) for dispensing the support member and a take up for taking up the support member following printing.
7. The digital cliché pad printing system (10) in accordance with claim 1, wherein the ink delivery system (14) includes an ink cup (14) and a doctor blade (16) for delivering ink to the cliché (20) and depositing ink in the at least one void space, and for wiping excess ink from the cliché (20).
8. A method for pad printing comprising the steps of:
  - depositing a curable fluid (30) onto a substantially non-elastic, elongate and flexible support member (24), wherein the support member is a paper tape, foil or polymeric material, the material deposited in a desired pattern defining at least one void space;
  - curing the material (30) to define a cliché (20) having a top surface;
  - filling the at least one void space with an ink;
  - contacting a printing pad (18) with the cliché (20) to transfer the ink from the void space to the printing pad (18); and
  - contacting the printing pad (18) with an object to transfer the ink from the printing pad (18) to the object.
9. The method for pad printing in accordance with claim 8, wherein the material (30) is a curable fluid and wherein the fluid is deposited by jetting the fluid onto the support member (24).
10. A digital cliché pad printing system comprising:
  - a conveyor for conveying a substantially non-elastic, elongate, flexible support member, the support member formed from a paper tape, foil or polymeric material;
  - a fluid jetting device for depositing a UV curable fluid onto the support in a desired pattern, the desired pattern having at least one void space;



a UV source for curing the fluid in the desired pattern, the cured fluid defining a cliché having a top surface;

an ink delivery system for depositing ink in the at least one void space and for wiping ink from the top surface; and

a pad configured to contact the cliché and transfer ink from the void space to the pad, the pad further configured to move into contact with an object to which the ink is transferred.

11. The digital cliché pad printing system in accordance with claim 10 including a controller for controlling the deposition device.

12. The digital cliché pad printing system in accordance with claim 10 including a dispenser for dispensing the support member and a take up for taking up the support member following printing.

13. The digital cliché pad printing system in accordance with claim 10, wherein the ink delivery system includes an ink cup and a doctor blade for delivering ink to the cliché and depositing ink in the at least one void space, and for wiping excess ink from the cliché.

14. A method for pad printing comprising the steps of:

depositing a UV curable fluid onto a substantially non-elastic, elongate, flexible support member, the support member formed from a paper tape, foil or polymeric material, the material deposited in a desired pattern defining at least one void space;

subjecting the UV curable fluid to UV energy to cure the material to define a cliché having a top surface;

filling the at least one void space with an ink;

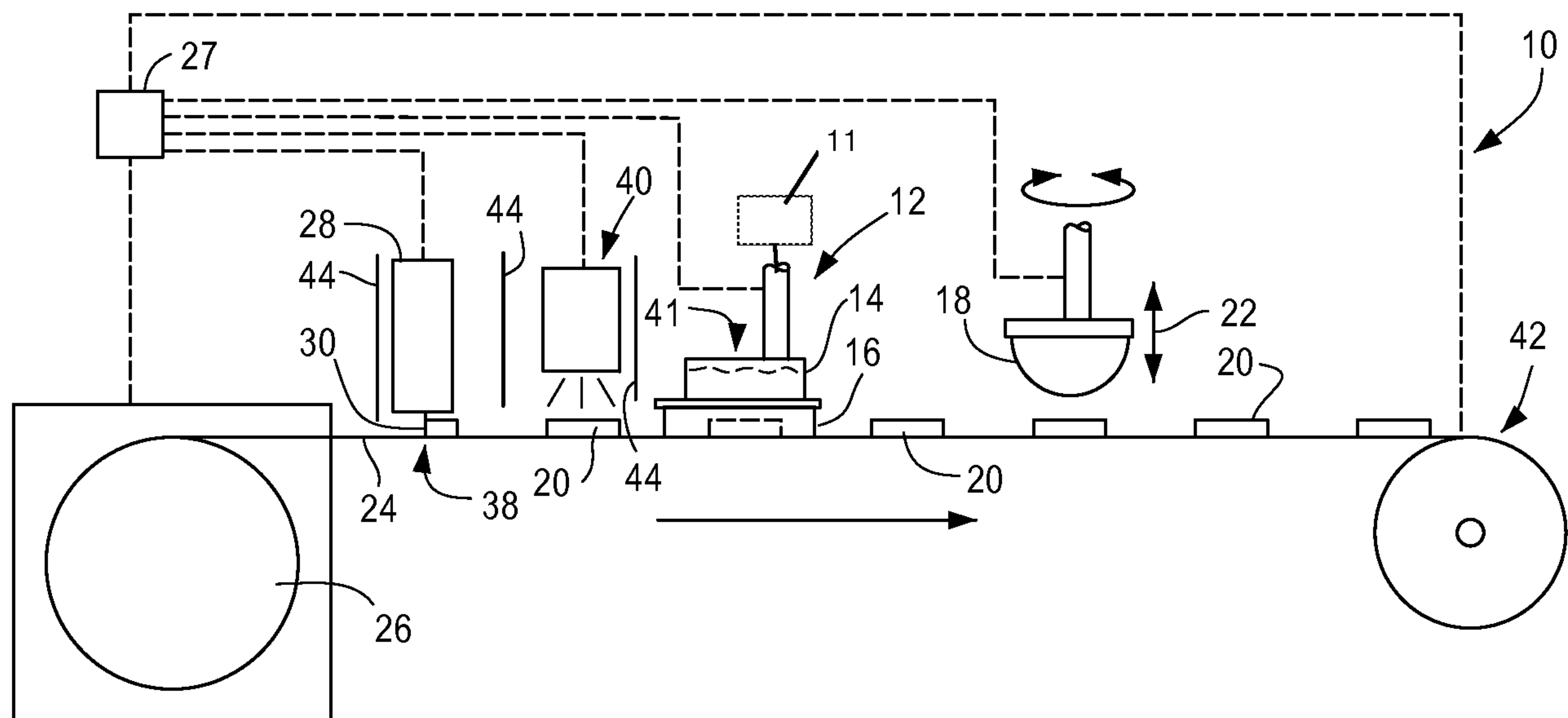
contacting a printing pad with the cliché to transfer the ink from the void space to the printing pad; and

contacting the printing pad with an object to transfer the ink from the printing pad to the object.

15. The method for pad printing in accordance with claim 14, wherein the UV curable fluid is deposited by jetting the fluid onto the support member.

16. The method for pad printing in accordance with claim 14 including the step of winding the support element following the step of contacting the printing pad with the cliché to transfer the ink from the void space to the printing pad.



**Fig. 1****Fig. 2**