

5 DIGITAL PRINTED HEAT TRANSFER GRAPHICS FOR SOFT GOODS

CROSS-REFERENCE TO RELATED APPLICATION(S)

The present application derives priority from U.S. application no. 16/166,457 filed October 22, 2018.

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BACKGROUND OF THE INVENTION

1. Field of the invention

The present invention relates to heat activated transfers and, particularly, to a fully digital inkjet or laser printed heat-transfer comprised of numbers, letters, logos, graphics, and other
15 indicia.

2. Description of the Background

Ink-printed heat transfers are well-known and commonly used to transfer a graphic, such as text or a figure, onto an item, such as apparel or merchandise. A transfer sheet or release sheet is usually pre-printed with a graphic, and then the graphic is transferred from the
20 transfer sheet or release sheet to the item using a heated platen, iron or the like.

It is typical to apply a release layer to the transfer sheet before the graphic is printed, then print the ink graphic atop the release layer, and then coat the adhesive over the top surface of the graphic. When a user then applies the graphic to the item, the graphic transfer is turned adhesive-side down onto the item and heat is applied to the release sheet to transfer
25 the graphic to the item from the release layer of the release sheet.

Inks and toners can be digitally printed by a variety of methods including static discharge or ink jet printing. Thus, printing techniques such as gravure printing, offset printing, flexographic printing, screen printing and digital printing all can be used to create a heat transfer. The adhesive must be capable of being thermally activated and heat sealable in
30 order for the user to transfer the graphic from the transfer substrate to the item. The adhesive

5 application is usually not a continuous layer. Rather, when creating a diverse selection of products the shape and distribution of the adhesive layer is usually specific to each product type. Consequently, the adhesive is usually applied to the ink post-printing, using a separate screening process, e.g., a stencil method of application in which blank areas are “screened” such that glue is only transferred onto the inked areas.

10 Therefore a template is required to expose an area specific to each product. This requires an offline manufacturing process to create a screen for selectively applying the adhesive. See US 6,423,406, Bilodeau et al issued July 23 2002. Moreover, the adhesive application adds a time-consuming, non-digital step separate from the printing step. The interruption of the digital process significantly contributes to the fixed cost of downtime and
15 changeovers between graphic changes, e.g., any change in shape between designs and lowering the productivity of the operation by increasing change-over time. However, the apparel industry increasingly demands quick-change low-inventory production custom articles in small batches with low turnaround time while keeping inventory at a minimum. Additionally the offline screen manufacturing process is highly reliant on environmentally
20 damaging chemicals. Increasingly, customers and brands are seeing value in reducing the environmental impact of their products.

What is needed is a more efficient method than screen-applying adhesive. Until now heat transfer manufacturers have been unable to provide a fully digital heat transfer, and therefore they impose large minimum-order requirements and/or request a set up charge for
25 small order quantities, both of which are undesirable for the customer.

Efforts to date to improve the process offer only partial solutions. For example, one alternative method of producing digitally printed heat transfers by inkjet or laser printing onto white or clear vinyl film that already has an adhesive coating applied. The film is then knife-

5 cut to remove unwanted portions of the vinyl media. Generally, products that are produced in this way are stiff and heavy and have relatively slow production speeds when compared with high speed laser or inkjet printing. In addition, such products use environmentally damaging materials in their manufacturing processes such as PVC and solvents.

Yet another method of producing digitally printed heat transfers entails laser-printing
10 a toner printable sheet, pressing an adhesive coated paper to the print such that the adhesive only sticks in the digitally printed areas, and then use those layers in conjunction with an opaque layer as the final transfer decoration. This approach is described in US Patent No. 8,236,122 to Kronzer issued 7 August 2012. Unfortunately, the laminating conditions used in this process have very small tolerances that are difficult to achieve on a regular basis.
15 Additionally, the processing time to adhere the adhesive to the print is substantial, on the order of 30 seconds per sheet, which cannot compare to the speed of production of a high speed laser or inkjet printing.

What is needed is a method for applying adhesive in a fully-digital printing process.

SUMMARY OF THE INVENTION

20 It is, therefore, an object of the present invention to provide a fully-digital-printed heat transfer graphic and method of manufacture, to meet the needs of the market for smaller order quantities and even customized heat transfers produced in a more environmentally friendly way.

According to the present invention, the above-described and other objects are
25 accomplished by providing a more efficient process for producing a fully-digitally printed heat transfer capable of little to no process changeover between different graphics. Specifically, the method comprises printing a digital image onto an adhesive substrate, applying the image side to a carrier substrate, then digitally cutting and removing substrate

5 not containing graphic elements to produce a high stretch, multi-color photographic quality
print transfer for the apparel and soft goods industry. More particularly, the method entails
laser printing or inkjet printing onto the adhesive, laser cutting the adhesive/substrate in
register with the print and “weeding” the unprinted adhesive areas and or cutting through
internal unprinted areas. Weeding involves removing the adhesive from the non-printed
10 areas.

A variation of this method would be to print using a laser printer onto a transfer paper,
transfer the graphic from the paper directly to an adhesive film, laser cutting the adhesive in
register with the print and weeding the unprinted adhesive areas or cutting through internal
unprinted areas. Also claimed are some forms of a heat transfer product generated through
15 either of these methods.

The method replaces the conventional multi-step process, using a sheet or roll-fed
process.

BRIEF DESCRIPTION OF THE DRAWINGS

20 Other objects, features, and advantages of the present invention will become more
apparent from the following detailed description of the preferred embodiment and certain
modifications thereof, in which:

FIG. 1 is a cross sectional showing a completed digitally printed heat transfer 100.

FIG. 2 is a block diagram of the sequential method of manufacturing the digitally
25 printed heat transfer of FIG. 1.

FIG. 3 is a cross sectional view of the digitally printed graphic images 130 to yield an
intermediate transfer.

5 FIG. 4 is a cross-section showing the carrier paper 150 applied over the digitally printed graphic images 130 to yield an uncut transfer.

 FIG. 5 is a cross-section showing the cut differential of step 250.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

10 Generally, a more efficient full-digitally-printed heat transfer graphic and method of manufacture is disclosed that results in graphical sophistication and resolution with little or no process changeover between different graphics. The method disclosed herein replaces the conventional multistep process. Specifically, the present method comprises printing a digital image onto a sheet or roll-fed treated adhesive substrate. After printing, the process entails
15 digitally cutting and removing substrate not containing graphic elements to produce a stretch, multi-color photographic quality print transfer for the apparel and soft goods industry. Referring initially to the drawings, FIG. 1 illustrates a digitally printed heat transfer 100. The heat transfer 100 generally is formed on a thermo-plastic adhesive layer 110, the adhesive layer 110 being coated with an ink receptive layer 120, and imprinted with one or more
20 digitally-printed images 130 configured to define one or more graphics and/or text. In addition, a protective layer 140 comprising a polymeric coating overlies the printed images 130, and a carrier paper 150 is adhered to the protective layer 140 for handling and transportation purposes. Alternatively, the carrier paper 150 and protective layer 140 may be heat applied to the ink layer 130 simultaneously, for example, Coveme's KTR Digital Matte
25 or Arjowiggins D110 and Digipeel products.

 Adhesive layer 110 is a suitable polymeric thermo-plastic film upon which the remaining layers of the heat transfer 100 are supported and transferred and adhered to the soft goods. One skilled in the art will understand that there are different types of adhesive films

5 which can be applied to fabrics, and suitable polyester, polyamide and polyolefin films are known in the art. However, most adhesives commonly used in the industry are not suitable for the methods described herein because the process requires that the adhesive layer 110 remain solid at temperatures exceeding 90C that are typical for digital printing. Thus, the adhesive layer 110 of the present invention preferably has a melt point greater than 110C and
10 most preferably greater than 120C. The adhesive may contain fillers to increase opacity of the transfer. This is especially important when applying to patterned garments. The opacity of the adhesive may be improved by incorporating fillers such as TiO₂, for improved whiteness, or carbon black for improved blocking of the garment pattern. In an alternate embodiment the adhesive layer 110 is multi-layered so that the adhesive layer being printed melts at a
15 higher temperature than a secondary layer of adhesive. In this embodiment both layers can contribute to adhesion, but successful adhesion can be achieved with a lower heat seal temperature. The thermoplastic adhesive layer 110 may also require a support with release layer, to successfully navigate the printing process. This support with release layer will be removed after the carrier layer 150 is applied.

20 In use the heat transfer 100 is applied to the front side or the back side of a clothing article, or even on a tag of the clothing article depending on the wants and/or needs of the manufacturer or user and the adhesive layer 110 creates a permanent bond herewith. Ink receptive treatment 120 is a suitable adhesion promotor. For example, chlorinated polyolefins (CPOs) are widely used as adhesion promoters for coatings and inks on
25 polyolefin plastic, and Eastman Kodak® produces a line of suitable products. Additionally, Michelman Inc. produces a primer coating consisting of a combination of a copolymer of ethylene and acrylic or methacrylic acid and a compatible adhesion promoter including an aliphatic polyurethane dispersion, a hydrogenated hydrocarbon rosin or rosin ester dispersion,

5 and an amorphous acrylic polymer dispersion (detailed in US Patent application 20050245651). With regards to liquid toner printing it is especially important that the ink receptive treatment 120 enables durable adhesion between the substrate and the ink. Furthermore, the substrate can be designed to be ink receptive without additional coating. Ink layer 130 may be any suitable ink deposited by any suitable digital print head. A variety
10 of suitable inks can be used for digitally printing the graphic image 130 as is known in the art, as long as the inks provide visually recognizable information and durability against adverse conditions. In an embodiment, the ink layer is printed with a digital laser printer, such as a Xeikon™ laser printer, or digital offset press such as Indigo® available from HP of Palo Alto, Calif. Digital images can also be produced using conventional flexographic or
15 gravure printing equipment.

Protective layer 140 is an outermost polymeric layer for the heat transfer 100 on the clothing article or apparel that serves to protect the printed images 130 from damage. The combined protective layer 140 and/or printed image 130 should be capable of achieving a desired degree of flexibility and extensibility for the particular decorating (i.e., labeling)
20 application. More particularly, at least a portion of the protective layer 140 and/or printed image 130 ideally elastically stretches (i.e., extends or elongates) at least about 5%, and more preferably from about 5% to about 75% in at least one direction, without substantially cracking, speckling, distorting, or forming any other substantial defect in the heat transfer graphic 100 when the graphic is applied to the clothing article or soft good.

25 If desired, the protective layer 140 and/or printed image 130 may be formed from a curable composition or system, for example, an energy curable composition or system, such as printing the image with toner based inks to provide a transfer graphic 100 that includes

- 5 optically readable information, has excellent durability against wind, rain, and light, and can be produced more simply and at low cost.

Carrier paper 150 may be any suitable release-coated paper or film to protect and maintain the adhesive properties of the transfer 100 prior to application to the target product. The carrier paper 150 is simply peeled away and discarded after application of the transfer to
10 the target product.

FIG. 2 is a block diagram illustrating a method of manufacturing the digitally printed heat transfer label 100.

At step 200 the thermo-plastic adhesive layer 110 is obtained in roll form.

- At step 210 the adhesive layer 110 is processed with the ink receptive pre-treatment
15 120. For example, see WO2016196267A1 which is polyurethane base with self-crosslinking acrylic emulsion.

At step 220 the ink receptive treatment 120 is digitally printed one or more digitally-printed images 130 configured to define one or more graphics and/or text.

- At step 230 polymeric protective layer 140 is applied over the digitally printed
20 graphic images 130 to yield an intermediate transfer, as seen in FIG.3.

Next at step 240, the carrier paper or film 150 is applied over the polymeric protective layer 140 and the digitally printed graphic images 130 to yield an uncut transfer, as shown in FIG. 4. Alternatively, the carrier paper 150 and protective layer 140 may be heat applied to the ink layer 130 simultaneously.

- 25 Next at step 250 the uncut transfer of Step 240 is cut to one of two levels, level 1 being a kiss cut 2(a) and level 2 being a through-cut 2(b). Undesired elements of the composite which are separable by virtue of the combination of kiss cuts 2(a) and through-cuts 2(b) are weeded away. The cut differential of step 250 is illustrated in FIG. 5. Interior

5 unprinted areas that are not desired are through-cut 2(b) so they are unattached and simply fall away. On the other hand, complex perimeter shapes are kiss-cut 2(a) and weeded out. Finally, at Step 260 a protective release liner may be added to protect product in transit or in storage (this step does not contribute to the functional aspects of the transfer 100).
Given the completed heat transfer product described above, subsequent application may
10 occur in a separate process where the described product manufactured by the describe method has the protective release sheet removed and the digitally printed heat transfer graphic is applied to a clothing article or apparel, which falls in the category of soft goods such as products made from fabric or other pliable or bendable material. Examples include clothing of any type such as shirts, jerseys, and sweatshirts, as well as other products such as banners,
15 flags, covers, bedding, throws and other soft goods. Transfers can be according to cut singles or roll-to-roll formats. Application equipment suitable for this stage or phase can include heat transfer press machines, for example a Stahl Hotronix® STX16 heat-press or a Geo Knight Swing Away® Press.

Thus, the present invention discloses a digitally printed heat transfer graphic and
20 method of making the digitally printed heat transfer graphics that simplifies the prior art complex processes by creating a completely digital process which can achieve improved aesthetics and allow for graphical sophistication and resolution of graphical images. The method replaces the conventional multistep process, using a sheet or roll-fed process. Specifically, the method for fabricating a heat-transferrable decoration for soft goods made
25 by laser printing or inkjet printing onto an adhesive, laser cutting the adhesive in register with the print and weeding the unprinted adhesive areas or cutting through internal unprinted areas.

5 Having now fully set forth the preferred embodiments and certain modifications of the
concept underlying the present invention, various other embodiments as well as certain
variations and modifications of the embodiments herein shown and described will obviously
occur to those skilled in the art upon becoming familiar with said underlying concept. It is to
be understood, therefore, that the invention may be practiced otherwise than as specifically
10 set forth in the appended claims.

5 STATEMENT OF INDUSTRIAL APPLICABILITY

 There is a significant commercial need to provide a fully-digital-printed heat transfer graphic and method of manufacture, to meet the needs of the market for smaller order quantities and even customized heat transfers produced in a more environmentally friendly way. The present invention provides that with a thermal transfer and process for producing it

10 that provides a fully-digital printed heat transfer capable of little to no process changeover between different graphics. The invention is especially well-suited for the apparel and soft goods industry.