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(54) **A transfer printing process by vibrations at ultrasonic frequencies.**

(57) A transfer printing or decalcomania process by which a drawing and/or wordings suitably painted or printed in usual manner on a base sheet or support are transferred onto a more or less porous surface by vibrations at ultrasonic frequencies, in order to be shown evenly and well defined. The process differs clearly from those of prior art as the transfer printing does not require a heating source but only ultrasonic vibrations the frequency of which agitates the molecules of the adhesive material or the thermoplastic ink being used to form the original drawing and/or wordings and fluidifies same so that they may penetrate the pores and accomplish the transfer onto that porous surface, the return to its original state being possible in a very short cooling time.

The new process is intended to remedy the drawbacks of a possible uneven transfer printing when carried out according to the prior art, and is particularly intended to extend the application onto surfaces sensitive to heat, as well as to provide a much more economical production because of the remarkably shorter time required to carry out each operation while the results are more satisfactory.

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The invention relates to a transfer printing or decalcomania process and more particularly to a process by which a drawing and/or wordings suitably painted or printed in the usual manner on a base sheet or support are transferred onto a more or less porous surface by vibrations at ultrasonic frequencies, in order to be shown evenly and well defined on such surface. The process differs clearly from those of prior art as the transfer printing does not require a heating source but only ultrasonic vibrations the frequency of which agitates the molecules of the adhesive material or the thermoplastic ink used to form the original drawing and/or wordings and fluidifies same so that they may penetrate the pores and accomplish the transfer onto that porous surface, the return to its original state being possible in a very short cooling time.

While the new process may concern a wide range of products having a more or less porous surface onto which the drawing and/or wordings are to be transferred, anyone skilled in the art may easily understand that at present a particular importance is to be attached to transfer printings onto textiles, as for example weaves and knitted goods of sporting type, because of the very large diffusion that some of these goods have reached in the last years.

The advertising transfer printing has often had the upper hand of that relating to the protection of a manufacturer trade mark, and some problems have arisen from such diffusion which relate not only to transfer processes the products of which are presented satisfactorily, but also transfer processes to be carried out more economically.

While the methods usually suggested and/or applied to prepare

drawings and/or wordings to be transferred onto a more or less porous surface do not form a part of the scopes of the invention, it may be of some interest to recall a few of them as follows:

1. Thermoplastic transfer printings - The drawing and/or wordings to be transferred are painted or printed on silicone paper, or on a paper so treated that it cannot absorb the ink. In its turn, the ink used for the drawing and/or wordings to be transferred is composed of a synthetic resin having thermoplastic features so that it may be fluidified during the trasfer phase, i.e. when through a suitable device operating with heat and pressure suitable to the finality, such fluidified ink is transferred onto the porous surface and then returns to its original state after a suitable cooling time.

2. Polyurethan transfer printings - These transfer printings may be considered like those recalled at item 1., as the difference relates substantially to the use of polyurethan ink, some time suggested for particular applications.

3. Transfer of a drawing prepared on a flocked support - A flocked support has generally a base of paper or thin web treated with an adhesive material and then dusted with fine shreds of textile fibers which are applied electrostatically. On the free surface of the so flocked support a thermoadhesive material representing the drawing and/or wordings to be transferred is then printed by a silk-screen process, the adhesive force of which is however greater than that provided between the base and the dusted fine shreds of textile fibers.

Also in this case the transferring phase of the drawing and/or

wordings onto a porous surface is carried out by suitable heat and pressure. Because of the different adhesive force cited above it is possible to remove such part of the base sheet which does not include the drawing, while the flocked part which has been treated with the adhesive representing the drawing and/or wordings is transferred onto the selected porous surface, as desired and remains solidly attached thereon after a suitable cooling time.

This short recall evidences that by transferring operations according to the prior art a heating and compressing action is provided. Furthermore, it is to point out that a cooling action is necessary at the end of each transfer operation, the time of which must be sufficient to be sure that the transferred drawing and/or wordings are solidly attached onto such porous surface.

As it is surely known to a person skilled in the art, a first not-indifferent drawback resulting from the application of heat is due to the fact that the heating treatment is not supported by all the materials. The very large diffusion of transfer printings on webs or knitted goods, particularly of the sporting type, has not been extended, for example, in the field of silk and/or synthetic fiber goods. When a transfer printing is carried out on webs or knitted goods it is possible to remark transfer unevenness and also perimetrical halos, the appearance of which is obviously not pleasant by observing a transferred drawing. It is also possible to remark a perimetrical sign corresponding to the edge of the removed support of the transferred drawing, particularly when such support is not very thin. Further drawbacks may be remarked when the

transfer operation is carried out on finished goods wherein seams and buttonholes are usually provided, as in this case it is more difficult or also impossibile to have an even pressing action of the heating plates.

The drawbacks cited above are obviously concerned with the technical side of a transfer printing. A further, very important drawback relates however to the time required to heat the adhesive material or the thermoplastic ink during a transfer operation and then to cool the transferred drawing and/or wordings, after which the base sheet or support may be removed without any disadvantage to the transferred printing. It is important to point out that a time of at least 30 to 40 seconds is generally necessary for such heating and cooling phases of a transfer printing. This time is only seemingly modest but is really very great particularly by a mass-production, because of its considerable incidence on the prime cost.

The invention as claimed is intended to remedy these drawbacks. It solves the problem of how to provide a transfer printing economically more favourable than the prior art, by which the transferred drawing and/or wordings are shown in a well defined manner also in the case where the porous surface onto which such drawing and/or wordings are transferred relates to a product sensitive to heat.

The advantages offered by the invention are due to the use of ultrasounds, by which a drawing and/or wordings suitably painted or printed in the usual manner on a base sheet or support are transferred onto a more or less porous surface, such a base sheet or support being removable at the end of the transfer operation. The transfer printing process according to the in-

vention does not include the use of a heating source, but only ultrasonic vibrations the frequency of which agitates the molecules of the adhesive material or thermoplastic ink forming the original drawing and/or wordings and fluidifies same to penetrate the pores of the porous surface and accomplish the transfer onto this latter when the fluidified adhesive material or thermoplastic ink returns to its original state after a suitable very short cooling time.

The advantages depend not only on the fact that no heating source is necessary, but also on the fact that only the molecules of the adhesive material or thermoplastic ink forming the drawing and/or wordings to be transferred are agitated, and the transfer operation is carried out in a very short time, namely one/two seconds, as no heat is provided in the surrounding area of the drawing and/or wordings. The molecule motion in this area is in effect slowed down very rapidly, so that the removal of the base sheet or support at the end of a transfer operation is made easier and quicker.

It will also be understood to anyone skilled in the art that a further advantage depends on the fact that, different from the prior art, for a satisfactory transfer printing by ultrasonic vibrations, an essential adherence only is necessary, and not a remarkable compression, between the transfer printing support and the porous surface to be painted, as such essential adherence is sufficient to assure the penetration of the fluidified adhesive material or thermoplastic ink within the pores of the porous surface to be painted.

As it is well known, ultrasounds are used in many mechanical and chemical applications as well as for particular research,

because of the favourable interactions between the electrical and mechanical stress-strain variables of piezoelectric crystals, the frequency of which depends particularly on the crystal cut and electrical supply.

In the case of transfer printings by ultrasonic vibrations it is then obvious the possibility of extending the range of application to more or less porous surfaces of different types, also of pottery articles.

Claims:

1. A transfer printing process by vibrations at ultrasonic frequencies to transfer onto a more or less porous surface a drawing and/or wordings suitably painted or printed on a base sheet or support in the usual manner and defined by an adhesive material or a thermoplastic ink in order to be shown on said porous surface in a very clear and even state, c h a r a c t e r i z e d in that it comprises repeated interactions between the electrical and mechanical stress-strain variables of piezoelectric crystals used as ultrasonic sources, the molecules of said adhesive material or thermoplastic ink forming said drawing and/or wordings being agitated by the vibrations at ultrasonic frequency to turn into a fluid state and penetrate the pores of said porous surface, and then return into the original state after a very rapid cooling of the transferred drawing and/or wordings at the end of a transfer operation, so that said base sheet or support may be removed more easily and more quickly from said painted porous surface.

2. A transfer printing process as claimed in Claim 1 , c h a r a c t e r i z e d in that the ultrasonic frequency of vibrations is desirable in the range of about 40 kilocycles to about 60 kilocycles.

3. A transfer printing process as claimed in Claim 1, c h a r a c t e r i z e d in that the time required to accomplish each transfer operation is about 1 to 2 seconds.

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EUROPEAN SEARCH REPORT

Application number

EP 84 83 0239

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.4)
X	DE-A-2 851 583 (LANG, ALBERT) * The whole document *	1-3	B 41 M 5/025 B 44 C 1/17 D 06 B 11/00 D 06 B 13/00
X	FR-A-2 256 838 (SARL HAGAMEX) * Claims 1 and 4 *	1-3	
X	US-A-4 060 438 (C.A.JOHNSON) * Claims *	1	
X	US-A-3 653 758 (D.S.TRIMMER) * Claim 1; figures *	1	
X	GB-A-1 068 557 (KODAK) * Claims 1,4 *	1	
A	GB-A-1 372 737 (MATSUSHITA) * The whole document *	1	TECHNICAL FIELDS SEARCHED (Int. Cl.4)
A	TEXTIL PRAXIS, October 1965, pages 840-848; K.RAMASZEDER: "Die Anwendungsmöglichkeiten des Ultraschalls in der Textilindustrie" * The whole document *	1	B 41 M 5/025 B 44 C 1/17 D 06 B 11/00 D 06 B 13/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29-03-1985	RASSCHAERT A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
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