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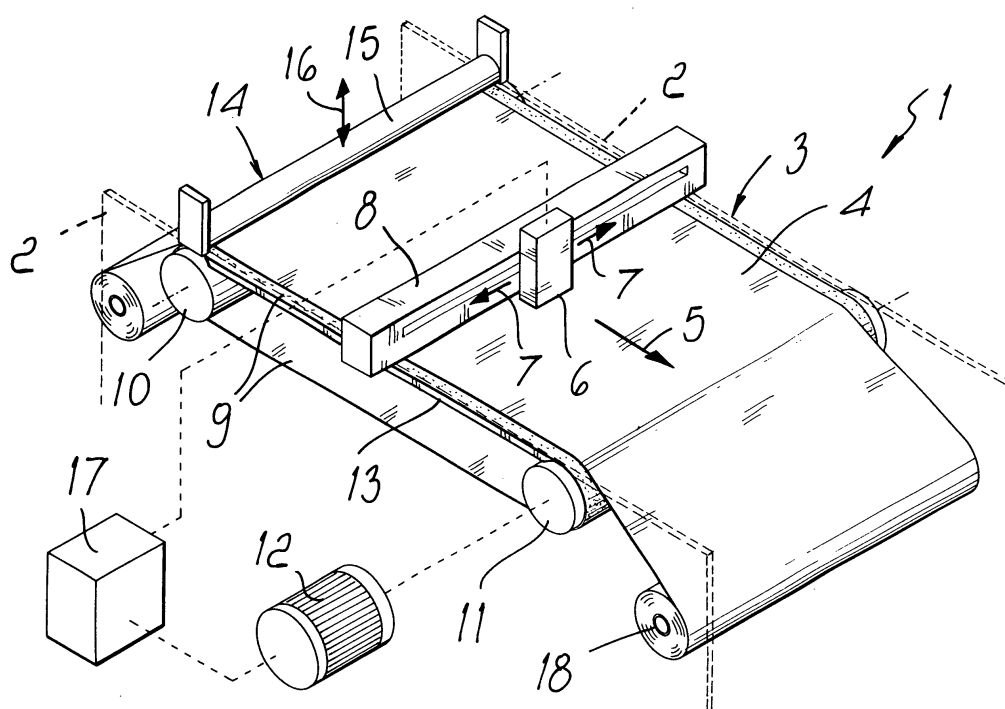
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AL LT LV MK RO SI(72) Inventor: **Perini, Piergiuseppe****22073 Fino Mornasco (Prov. of Como) (IT)**(74) Representative: **Modiano, Guido, Dr.-Ing. et al****Modiano & Associati SpA****Via Meravigli, 16****20123 Milano (IT)**(30) Priority: **19.12.2001 IT MI20012701**(71) Applicant: **T.M.S. S.r.l.****22070 Senna Comasco (Prov. of Como) (IT)**(54) **Printing machine with inkjet printer or the like, particularly for decorative printing of deformable sheet-like products**

(57) A printing machine with inkjet printer or the like, particularly for decorative printing of easily deformable sheet-like products such as fabrics, hides, synthetic films or other products, which comprises a main structure (2) that supports means (3) for supporting and moving the product (4) to be printed, which can be actuated in order to produce an advancement of the product along an advancement direction. The machine comprises at least one inkjet printing head (6), which can move

on command with a reciprocating motion along a printing direction (7) that is substantially perpendicular to the product advancement direction (5) in order to print a region of the product that faces the printing head (6). The support and movement means (3) comprise a belt-type conveyor element (9) that runs along a path in which one portion faces the work area of the printing head and forms, with one of its faces, at least along that portion, a supporting surface for the product.

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Description

[0001] The present invention relates to a printing machine with inkjet printer or the like, particularly for decorative printing of easily deformable sheet-like products such as fabrics, hides, synthetic films or other products.

[0002] Various methods are known for performing the decorative printing of fabrics, hides, synthetic films or other sheet-like products in general. These methods usually provide satisfactory print quality but have the drawback of being economically convenient only when a significant quantity of products with a same print subject is to be printed.

[0003] This is due to the fact that with conventional methods changing the print subject generally entails replacing some elements of the printing machine and/or adjustments and tunings of the printing machine that require substantial times and/or costs.

[0004] For this reason, the decorative printing of small quantities of products is, in proportion, very expensive.

[0005] The printing of fabric samples, which requires printing a large variety of subjects in a small number of copies, increasingly uses computer-controlled inkjet printers, which transfer onto the fabric ornamental patterns and designs created by means of graphics programs.

[0006] Unquestionably, this method has the advantage of requiring no intervention for replacement or adaptation, and further allowing to utilize the extreme versatility and speed that are typical of digital technology.

[0007] Up to now, however, this printing method has been limited to the production of samples and has not been used for mass-production, mainly because this method is not devoid of problems.

[0008] One of these problems is the quality of the inks, which until recently was unable to compete in qualitative terms with the inks usually used in conventional printing methods.

[0009] However, recently the constant research aimed at improving in qualitative terms the inks used by inkjet printers has yielded surprising results, which led to a reevaluation of the possibility to use this method also for mass-production.

[0010] Another problem is the behavior of the product being printed, i.e., the fabric. During printing, the fabric is in fact rested on a supporting surface and is made to advance gradually, in step with the actuation of the printing head, by means of a set of wheels that press on the fabric and move it by friction.

[0011] This advancement often causes a transient deformation of the fabric that inevitably penalizes printing precision. Moreover, during advancement the fabric may shift accidentally.

[0012] This problem, which is particularly felt in the field of decorative printing of fabrics, is also noted for the same reason in the printing of other kinds of product, such as for example hides, synthetic films or other materials that are deformable due to their structure and/or

composition.

[0013] The aim of the present invention is to solve the problems noted above by providing a printing machine that allows to print, with fully satisfactory results, easily deformable sheet-like products such as fabrics, hides, synthetic films or other products by using an inkjet printer or the like.

[0014] Within this aim, an object of the invention is to provide a printing machine that allows to use the advantages of printing with digital technology also for the printing of fabrics, hides, synthetic films or other deformable products.

[0015] Another object of the invention is to provide a printing machine that thanks to its high versatility allows economically convenient decorative printing of products even in small runs.

[0016] This aim and these and other objects that will become better apparent hereinafter are achieved by a printing machine with inkjet printer or the like, particularly for decorative printing of easily deformable sheet-like products such as fabrics, hides, synthetic films or other products, comprising a main structure that supports means for supporting and moving the product to be printed, which can be actuated in order to produce an advancement of said product along an advancement direction, and at least one inkjet printing head, which can move on command with a reciprocating motion along a printing direction that is substantially perpendicular to said advancement direction in order to print a region of the product that faces said printing head, characterized in that said support and movement means comprise a belt-type conveyor element that runs along a path in which one portion faces the work area of said printing head and forms, with one of its faces, at least along said portion, a supporting surface for said product.

[0017] Further characteristics and advantages will become better apparent from the description of a preferred but not exclusive embodiment of the machine according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein the only figure is a schematic perspective view of the machine according to the invention.

[0018] With reference to the figure, the machine according to the invention, generally designated by the reference numeral 1, comprises a main structure 2 that supports supporting and movement means 3 for supporting and moving the product 4 to be printed; said means can be actuated in order to cause the advancement of the product 4 along an advancement direction, indicated by the arrow 5.

[0019] The machine comprises at least one printing head 6 of the inkjet type or the like, which can move on command with a reciprocating motion along a printing direction 7, which is substantially perpendicular to the product advancement direction 5, in order to print the region of the product 4 that in each instance faces the printing head 6.

[0020] The printing head 6 can slide along a guiding

bar 8, which is fixed to the main structure 2 of the machine.

[0021] The printing head 6, with the corresponding elements required for its operation, such as for example a motor that is actuated to cause the reciprocating movement of the printing head 6 along the bar 8, is not described further for the sake of simplicity, since it is of a known type, for example of the type currently used to print fabric samples or more generally for computer-controlled printing of graphic output on a paper medium.

[0022] According to the invention, the support and movement means 3 comprise a belt-type conveyor element 9, constituted by a conveyor belt or ribbon, which runs along a path that faces, with one of its portions, the work area of the printing head 6.

[0023] The conveyor element 9 forms, with one of its faces, at least at the portion that faces the work area of the printing head 6, a supporting surface for the product 4.

[0024] If the friction between the product 4 and the face of the conveyor element 9, on which the product 4 is to be placed, is such as to avoid movements of the product 4 with respect to said conveyor element 9, the product 4 can be simply rested on the conveyor element 9. Owing to the fact that the product 4, differently from what occurs with known types of printing machine with inkjet printing head, is not subjected to traction during its advancement, deformation of the product 4 as a consequence of its feeding during printing is avoided with absolute certainty.

[0025] Preferably, the face of the conveyor element 9 that is meant to make contact with the product 4 in order to support it and feed it is adhesive-coated, so that the product 4 is firmly anchored to the conveyor element 9 during its advancement and during printing, thus avoiding any possibility of deformation of the product 4 or of random movements of said product 4 with respect to the conveyor element 9.

[0026] In greater detail, with particular reference to the illustrated embodiment, the conveyor element 9 has a closed shape and winds around at least two rollers 10 and 11 that have horizontal and mutually parallel axes and are orientated at right angles to the advancement direction 5.

[0027] At least one of the rollers 10, 11 is connected to a motor 12, which can be actuated in order to cause the advancement of the conveyor element 9.

[0028] The rollers 10 and 11 are preferably arranged so that their axes lie on a substantially horizontal plane and have mutually identical diameters, so that the upper portion of the conveyor element 9, meant to support the product 4, lies on a substantially horizontal plane and faces, with one of its portions, the underside of the guiding bar 8 along which the printing head 6 moves.

[0029] A plate-like supporting element 13 is conveniently arranged below the upper portion of the conveyor element 9 over at least one portion of its extension that also affects the work area of the printing head 6; said

supporting element is fixed to the main structure 2 and forms a supporting surface for the upper portion of the conveyor element 9.

[0030] Advantageously, upstream of the printing head 6 along the direction of the advancement of the product 4 along the direction 5, there are presser means 14, which are meant to make the product 4 adhere firmly to the adhesive layer of the conveyor element 9.

[0031] Said presser means 14 can be constituted by a presser roller 15, which is orientated so that its axis is parallel to the axes of the rollers 10 and 11 and is supported by the main structure 2. Said presser roller 15 faces the upper portion of the conveyor element 9 and optionally can be movable toward or away from the conveyor element 9 along the direction 16 in order to facilitate the deposition of the initial part of the product 4 on the conveyor element 9.

[0032] The presser roller 15 can be pushed toward the conveyor element 9 by means of springs, weights, fluid-driven cylinders or other means of a known type.

[0033] The presser roller 15 can be arranged above the roller 10 or above a region of the conveyor element 9 that is supported by the supporting element 13, so that its pressure on the conveyor element 9 is contrasted adequately in order to achieve the maximum effect in pushing the product 4 against the conveyor element 9.

[0034] The conveyor element 9 can be made, for example, of vulcanized rubber reinforced with a textile core, so as to have high dimensional stability and adequate mechanical strength.

[0035] The adhesive coating of the face of the conveyor element 9 that is meant to make contact with the product 4 can be achieved by spreading a layer of permanent adhesive of a known and easily commercially available kind.

[0036] The motor 12 and the motor that drives the printing head 6 along the direction 7 are functionally interconnected so that the actuation of the printing head 6 and of the conveyor element 9 are synchronized according to the printing requirements.

[0037] Preferably, the actuation of the entire machine can be managed by a control and monitoring element 17 of the programmable electronic type, such as for example a computer, which controls and monitors the actuation of the conveyor element 9 and of the printing head 6 according to preset programs.

[0038] For example, the movement of the printing head 6 and of the conveyor element 9 can be controlled by means of encoders connected to the control and monitoring element 17 and arranged on the shafts of the motors that actuate said elements.

[0039] If the product 4 to be printed is constituted by a rolled-up continuous element, such as for example a fabric, it is possible to provide, at the inlet of the machine, a roll holder for supporting the product in roll form to be printed, which is gradually unrolled, and it is possible to provide, at the output of the machine, a motorized takeup roll 18 on which the printed product is grad-

ually wound.

[0040] The operation of the machine according to the invention is as follows.

[0041] If the face of the conveyor element 9 designed to support the product 4 is not coated with adhesive, the product 4 to be printed, optionally deposited on a supporting element such as a plate or another element, is simply rested on the upper portion of the conveyor element 9.

[0042] If the face of the conveyor element 9 designed to support the product 4 is coated with adhesive, the product 4 to be printed or the supporting element on which it is placed is gradually made to adhere to the upper face of the upper portion of the conveyor element 9 by the presser roller 15.

[0043] The advancement of the upper portion of the conveyor element 9 along the advancement direction 5 places in each instance a portion of the product 4 under the work area of the printing head 6, which prints it, according to a program that is preset according to the ornamental pattern or design to be printed.

[0044] The printed product 4 exits from the machine and is optionally collected on the takeup roller 18.

[0045] The product 4 can separate from the conveyor element 9 after printing either spontaneously, as a consequence of the change of direction of the conveyor element 9 that winds onto the roller 11, or can be assisted, optionally by means of a separator bar or blade.

[0046] It should be noted that during advancement and printing, owing to the fact that the product 'is not subjected to traction, deformation of the product 4 or accidental movement thereof is avoided effectively. For this reason it is possible to achieve high printing precision.

[0047] Any adhesive coating of the face of the conveyor element 9, by reinforcing the adhesion of the product 4 to the conveyor element 9, further ensures the absence of deformations and/or movements of the product 4.

[0048] If it is necessary to change the ornamental pattern or design to be printed, it is sufficient to change the program that drives the computer that controls the machine, without performing any replacement of the components of the machine.

[0049] In practice it has been found that the machine according to the invention fully achieves the intended aim, since it allows to print with excellent precision easily deformable products such as fabrics, hides, synthetic films or other products by using an inkjet printer or the like, and therefore with the possibility to utilize all the advantages, in terms of speed and versatility, of the digital technology used to control these kinds of printer.

[0050] Although the machine according to the invention has been conceived particularly for printing deformable sheet-like products, such as fabrics, hides, synthetic films or other similar products, it can be used nonetheless also to print other kinds of product that do not have the problem of avoiding deformations induced by

traction, such as for example paper, but in which one wishes to avoid with absolute certainty accidental movements of the product during feeding and/or printing.

[0051] The machine thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims; thus, for example, multiple printing heads might be provided instead of a single printing head.

[0052] All the details may further be replaced with other technically equivalent elements.

[0053] In practice, the materials used, as well as the dimensions, may be any according to requirements and to the state of the art.

[0054] The disclosures in Italian Patent Application No. MI2001A002701 from which this application claims priority are incorporated herein by reference.

[0055] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A printing machine with inkjet printer or the like, particularly for decorative printing of easily deformable sheet-like products such as fabrics, hides, synthetic films or other products, comprising a main structure that supports means for supporting and moving the product to be printed, which can be actuated in order to produce an advancement of said product along an advancement direction, and at least one inkjet printing head, which can move on command with a reciprocating motion along a printing direction that is substantially perpendicular to said advancement direction in order to print a region of the product that faces said printing head, **characterized in that** said support and movement means comprise a belt-type conveyor element that runs along a path in which one portion faces the work area of said printing head and forms, with one of its faces, at least along said portion, a supporting surface for said product.
2. The machine according to claim 1, **characterized in that** the face of said conveyor element that is meant to make contact with said product is coated with adhesive.
3. The machine according to claim 1, **characterized in that** said conveyor element has a closed shape and winds around at least two rollers that have mutually parallel axes orientated substantially at right angles to said advancement direction, motor means being provided which are connected to at least one

of said rollers for its rotary actuation about its own axis for the advancement of said conveyor element.

4. The machine according to one or more of the preceding claims, **characterized in that** said rollers are arranged so that their axes lie on a substantially horizontal plane and **in that** said conveyor element faces the work area of said printing head with a region of its upper portion that lies on a substantially horizontal plane. 5
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5. The machine according to one or more of the preceding claims, **characterized in that** a supporting element is arranged below said upper portion of the conveyor element, along at least one portion of its extension that also comprises the region that faces the printing head, said supporting element forming a substantially horizontal supporting surface for said upper portion of the conveyor element. 15
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6. The machine according to one or more of the preceding claims, **characterized in that** it comprises, upstream of said printing head along the direction of the advancement imparted to said product by said support and movement means, presser means that act on said product for its adhesion to the adhesive-coated face of the conveyor element. 25
7. The machine according to one or more of the preceding claims, **characterized in that** said presser means comprise a presser roller that is orientated so that its axis is substantially perpendicular to said advancement direction and faces, in an upward region, the upper portion of the conveyor element, said presser roller being movable on command toward or away from the face of said conveyor element that is meant to make contact with said product. 30
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8. The machine according to one or more of the preceding claims, **characterized in that** said motor for the actuation of the conveyor element and the means for actuating said printing head along said printing direction are functionally connected to each other for synchronization of the actuation of said printing head with the movement of said product along said advancement direction. 40
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9. The machine according to one or more of the preceding claims, **characterized in that** it comprises a control and monitoring element of the programmable electronic type that is connected to said printing head and/or to said conveyor element and is suitable to actuate said printing head and/or said conveyor element according to preset printing programs. 50
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10. The machine according to one or more of the pre-

ceding claims, **characterized in that** it comprises means for sensing the movement of said conveyor element along said advancement direction and/or of said printing head along said printing direction, said means being connected to said control and monitoring element.

