

(12)

EUROPEAN PATENT APPLICATION

(21) Application number: **87105831.9**

(51) Int. Cl.³: **B 41 F 15/24**
B 41 F 15/10

(22) Date of filing: **21.04.87**

(30) Priority: **23.04.86 IT 2018686**
05.02.87 IT 1927487

(43) Date of publication of application:
28.10.87 Bulletin 87/44

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR LI LU NL SE

(71) Applicant: **MS MACCHINE E SISTEMI S.r.l.**
Via Matteotti 11
I-20021 Bollate(IT)

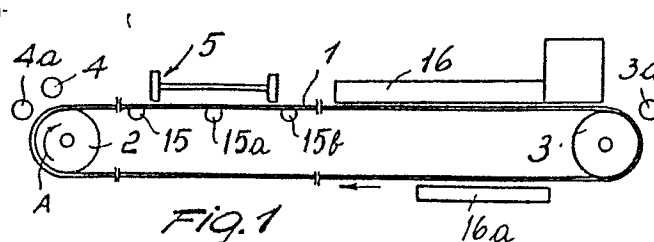
(72) Inventor: **Frigeni, Franco**
Via Roma 161
I-21047 Saronno (Varese)(IT)

(72) Inventor: **Pasello, Maurizio**
Via Salgari 1
I-21052 Busto Arsizio (Varese)(IT)

(74) Representative: **Modiano, Guido et al,**
MODIANO, JOSIF, PISANTY & STAUB Modiano &
Associati Via Meravigli, 16
I-20123 Milan(IT)

(54) **Machine for the plane frame printing of textile products and the like.**

(57) The machine comprises an endless belt (1) stretched between two end rollers (2,3). One roller (2) is driven by a motor for causing translatory motion of the belt (1) and the other roller (3) acts as a transmission element. At least one printing station (5) is arranged above the belt (1) and a device (15-15b) for detecting and measuring the translatory speed of the belt (1) is arranged proximate to the printing station (5). The device comprises a detector for the movement and alignment of the belt (1), comprising a plurality of indicia associated with the belt (1), toothed wheels (15,15a,15b) adapted for co-operation with the indicia, and an encoder associated with the detector, for providing output electric signals matching the speed of rotation of the detector, for conversion, by control members operatively associated with said encoder and with said belt driving motor, into electric signals for the control of the motor.



MACHINE FOR THE PLANE FRAME PRINTING OF TEXTILE PRODUCTS,
AND THE LIKE

The present invention relates to a machine for the plane frame printing of textile products and the like, operatively controlled by an electronic apparatus for the control and adjustment of the speed of the belt and of the
5 alignment thereof, both longitudinal and transverse, capable of ensuring a print with high precision and assured repeatability.

As is known, various type of printing devices are used for printing, in one or more colors, textile products, and
10 are differentiated in the methodology and in the devices used according to the quantity and the quality of the finished product.

In particular, very long fixed-table printing systems are known on which the fabric is laid and on which a frame-
15 bearing carriage slides and moves across the table in a variable manner according to the type of design, using sliding guides equal in length to said table. This system is used for relatively low amounts of good-quality product, since the operator follows the printing process color by
20 color and has the possibility of correcting at each stroke, but the dimensions of the tables and the bending which can occur on guides of such length make work very difficult and require large spaces for installation.

Other known printing systems relate to rotary machines, that is, machines which use the rotation of the belt and
25 keep the printing stations fixed for the simultaneous printing of a plurality of colors.

Said machines which, due to the plurality of the

stations, allow elevated production, do not however ensure the perfect execution of the product, also due to the systems used, which are composed of mechanical or hydraulic grippers which grasp the belt on the sides and move it into
5 alignment with reference to external stroke limiters. These systems can give rise to remarkable disadvantages, since these grippers do not ensure a perfect grasp due to slippage and most of all, even with very small errors, cannot ensure correct positioning of the belt after a high number of
10 rotations.

The main aim of the present invention is to provide a rotating-belt printing machine structured so as to ensure a high quality and repeatable printing action and capable of ensuring a constant translatory speed of the belt,
15 monitoring, at the same time, its perfect alignment, both longitudinally and transversely, during the passage under the printing station.

Another object of the invention is to provide a printing machine with plane frames and with a rotating belt,
20 capable of allowing high productivity, by virtue of the possibility of increasing the translatory speed of the belt and rendering automatic, most of those services which usually reduce, in known systems, the printing operations, these possibilities being allowed by the fact that the
25 printing station (or stations) are kept in a fixed position.

A further object of the invention is to provide a machine of the type described above, structured so that, by virtue of the use of a particular reading system, rigidly coupled to the belt, combined with a system for detecting

the fixed pitch at the printing station, it allows to calculate, by means of a calculator, the perfect takeup of a pitch even if the latter is not a submultiple of the extension of the belt.

5 Still another object of the invention is to provide a printing machine with very small overall dimensions, in practice equal to half, with respect to the conventional fixed table, and such as to save the operator the need to move along the table as required in the case of a fixed and
10 very long table.

 Not least object is to provide means for laying the fabric on the belt such as to avoid any danger of uncoupling from the belt, during the rotations thereof around the rollers.

15 This aim, and these and other objects which will become apparent hereinafter, are achieved by a machine for printing textile products of the plane frame type, according to the present invention, which is characterized in that it comprises:

20 - a band-like belt closed in a loop, extending between two end rollers, one of which is driven by a motor for the translatory motion of the belt intended to support the product to be worked, and the other acting as a transmission,

25 - at least one printing station, positioned above said belt and being supported by means associated with the structure of the machine,

 - a device for the continuous detection and measurement of the translatory speed of the belt, positioned proximate to
30 said printing station and comprising a device for detecting

the shift and the alignment of the belt comprising a plurality of indicia associated with the peripheral border of said belt, and a rotary transducer of a known kind, substantially an encoder of the incremental type associated
5 with said detector, adapted for providing electric output signals corresponding to the speed of rotation of said detector so as to be converted, by control means, operatively associated with said encoder and with said belt driving motor, into electric signals for the control of said
10 motor.

More in particular, according to the invention, said detector of the motion and alignment of the belt is advantageously composed of idle toothed wheels, arranged with a horizontal axis and engaged with mutually equally
15 spaced holes provided in the belt, of which wheels at least one is positioned before and at least another one after the printing station, in order to ensure, besides the detection of the shift of the belt, also a perfect alignment, both longitudinally and transversely, of the belt itself at least
20 in the portion of belt affected by the printing operation.

The invention will now be described in greater detail according to a preferred, but not exclusive, practical embodiment thereof, with reference to the accompanying illustrative, non-limitative drawings, wherein:

25 Fig. 1 is a schematic lateral view of a printing machine according to the invention, without the encoder of the incremental type and the means for transmitting control signals to the motor, since they are of a known kind;

Fig. 2 is an enlarged scale view of a portion of the

belt of Fig. 1 with a reading toothed wheel wherewith said encoder is associated;

Fig. 3 is a plan view of a portion of belt with a blade having equally mutually spaced holes, intended to stably
5 accommodate the teeth of said reading toothed wheel and the alignment teeth;

Fig. 4 is a schematic lateral view of a printing station used in the machine of Fig. 1;

Fig. 5 is a top plan view of the printing station of
10 Fig. 4; and

Fig. 6 is a view of the arrangement of the means for laying the fabric on the belt, adapted to avoid the uncoupling of the fabric during the rotations of the belt.

With reference to the above figures, and in particular
15 to Figs. 1 to 3, the machine according to the invention comprises a conveyor belt 1, arranged in a closed loop formation around two end rollers 2 and 3: the roller 2 is provided as a traction roller for the belt 1 along the arrow A and for this purpose a direct-current or similar motor
20 (not illustrated) is associated with its axis, while the roller 3 constitutes a transmission and tensioning roller for the belt using known and not illustrated means. The function of the driving roller 2 is only to cause rotation of the endless belt in order to transfer the textile product
25 to be printed, fed on the belt in a known manner by means of end rollers 4, below the printing station 5, and then to transfer the same to the end of the upper portion of said belt, where it can be extracted by means of rollers 3a, or to return it to the feed area, following the lower portion

of the belt, where it can be extracted by means of the rollers 4a, or even perform a plurality of rotations for printing in multiple colors.

A printing station 5 is positioned fixed above the belt 1, and is composed of two parallel shoulders 6-6a (Figs. 4 and 5), supported by two opposite crosspieces 7-7a rigidly coupled to the sides of the machine; within these shoulders 6,6a, a support 8 for the doctor blade or spatula 9 is advantageously slideably mounted by means of a kinematic transmission and a motor 10. The doctor blade 9 is magnetically coupled to the supporting bar 8 and is subjected to a constant pressure on the part of suitably spaced pneumatic pistons 11. The extent of the translatory motion of the support 8 along the shoulders 6-6a is variable and depends on the dimensions of the printing frame, and the setting of the extent of the translatory motion is expediently performed by electronically memorizing the actual position of the doctor blade, moving it both by means of buttons for actuating the motor 10, or manually or even by detecting the dimensions of the print frame by means of sensors arranged on the doctor blade-bearing bar 9.

In order to allow, as already mentioned, high printing quality, remarkable precision and repeatability, the present invention provides, in association with the belt 1, a device for the continuous measurement of the motion of the belt, based on a known detection system, precisely described in the Italian patent application no. 23830 A/83 filed on 22nd November 1983, which is rigidly coupled to said belt so as to ensure the perfect registering of the textile product below the printing station and, simultaneously ensure the

perfect alignment of the belt both longitudinally and transversely.

Said device for detecting and adjusting the traction speed of the belt on the part of said driving roller 2 is substantially composed, according to the present invention, of at least one band 12 (Fig. 2-3), advantageously constituted by a continuous steel band, rigidly coupled to the peripheral edge of the belt 1, for example by rivets 13, and extending in length so as to affect the entire length of the belt 1. On said band 12, and precisely on the part protruding beyond the edge of the belt 1, a series of holes 14 are provided, which holes are advantageously substantially rectangular in shape, substantially equally spaced apart from each other, and arranged in one or more rows. The holes 14 are intended to remain in constant engagement with the teeth of underlying toothed wheels, preferably idly mounted on their axes and indicated by the reference numerals 15-15a-15b in Figs. 1 and 4; said toothed wheels are arranged below the printing station 5 so as to keep the belt constantly in tension and aligned in the print area, regardless of the eventual oscillations and/or fluctuations of the remaining part of said belt.

On the axis of one of said toothed wheels, for example the wheel 15, a rotary transducer is rotatively coupled, substantially an encoder of the incremental type which is of a known type and thus not illustrated, (as already mentioned), the purpose of which is to supply electric output signals corresponding to the rotation of said gearwheel 15 rigidly coupled to the band 12, which signals, by means of control elements operatively associated with

said encoder and with said motor for operating said roller 2, are capable of providing electric output control signals adapted for driving said motor which operates the traction roller 2 of the belt 1.

5 Said control elements, operatively associated with said encoder and with said motor associated with the roller 2 have been described exhaustively in the abovementioned published Italian patent application no. 23830 A/83, and reference is made thereto for the complete description
10 thereof.

Thus, in practice, since the reading and measurement system, rigidly coupled to the belt, never uncouples from the system for detecting the already preset fixed pitch for the print station, it is possible to calculate with ease, by
15 means of a calculator, the perfect resumption of a printing pitch both in the case in which the pitch is a perfect submultiple of the extension of the belt and also in the case of a pitch equal to any submultiple of the extension of said belt; in other words, the resumption of the pitch can
20 be performed regardless of the dimension (extension) of said pitch.

With suitable presetting of the calculator, it is possible to also achieve an alternate print, that is the print of one pitch alternated with that of a not immediately
25 subsequent pitch.

It is furthermore possible to increase the potentiality of the machine by virtue of the fact that it is possible to increase the translatory speed of the belt, and to render automatic all the services which normally slow down the
30 printing operations; this is made possible by the fact that

the printing station is kept in a fixed position.

The above described machine is furthermore completed by the known heating systems 16 for drying the fabric, which is carried out by conveying warm air on the upper part of the belt, by belt washing devices 17, arranged below the return portion of said belt and by usual devices for the laying and removal of the textile product by means of the above mentioned rollers 4a and, respectively, 3a.

In practice, the computerized machine according to the invention is adapted for printing by means of a printing station with automatic operation as briefly described above, but can be advantageously used also with printing stations of the conventional type.

Furthermore, according to the invention, in the particular case of multiple rotations of the belt and therefore of the fabric, the laying of the fabric gives rise to particular problems due to the fact that the fabric, during the motion of the belt around the end rollers 2 and 3, tends to uncouple from said belt, thus compromising the printing precision in the subsequent phases.

Indeed, during the rotation of the belt around the rollers, the fabric is subject to a tension which causes the uncoupling thereof from the layer of adhesive, since the deformation by stretching of the upper portion of the belt with respect to its original length and the consequent elongation of the upper part of adhesive causes the fabric, already pre-stretched, to tend to exceed its remaining percentage of elongation and therefore, by becoming rigid, that is without elasticity, to cause its uncoupling from said adhesive.

In order to overcome this severe disadvantage, the present invention provides, as schematically illustrated in Fig. 6, a different initial positioning of the fabric on the belt, already provided with adhesive.

5 More precisely, the fabric 17, which unrolls from a free roll 18 (Fig. 6) is guided on a motorized unwinding cylinder 19 and then, passing through deviation rollers, around a speed adjustment roll or roller 20 to which a potentiometer (not illustrated) is applied for the
10 adjustment of the speed of said roller 20; during unwinding, the fabric is subjected to pretensioning, adjusted according to the type of fabric, and is then caused to adhere to the belt 1 by means of a usual presser roller 21.

15 In order to prevent the fabric from uncoupling from the belt during the rotations around the cylinders 2 and 3, the line of contact between the fabric and the belt, already provided with conventional adhesive, is selected, according to the present invention, in a rearward position with
20 respect to the start of the plane region of the belt 1 and precisely in a position which is angularly rearwardly offset by an angle "i" with respect to the start line of the upper plane portion of the belt (see figure 6). The shift of the initial laying position in the curved region of the belt,
25 while allowing application of the fabric with the provided tension in order to ensure its planarity on the belt, allows the performance of the glueing of the fabric to a part of adhesive already subject to elongation since it is already arranged on the curved part of the belt; accordingly, the
30 fabric, already tensioned on the curved region of the belt,

is subjected to a compression of its fibers when it reaches the plane part of the belt, which compression is allowed by the residual degree of elasticity remaining after the initial tensioning; accordingly, the fabric, when it reaches
5 the curved part of the cylinders 2 and 3, is again in its elastic range without being subjected to stiffenings such as to cause its uncoupling from the adhesive.

This method of laying on the curved part of the motor cylinder 2 is thus capable of preventing the uncoupling and
10 the shifting of the fabric from the conveyor belt, even after many rotations of said belt.

Naturally, in the practical embodiment, the invention as described above is susceptible to structurally and functionally equivalent modifications and variations without
15 thereby abandoning the scope of the protection of said invention.

CLAIMS

1 1. Machine for the plane frame printing of textile
2 products and the like, characterized in that it comprises
3 a band-like belt (1) closed in a loop, extending between two
4 end rollers (2,3), one of which is driven by a motor for the
5 translatory motion of the belt intended to support the
6 product to be worked, and the other acting as a
7 transmission, at least one printing station (5), positioned
8 above said belt and being supported by means (6,6a)
9 associated with the structure (7,7a) of the machine, a
10 device for the continuous detection and measurement of the
11 translatory speed of the belt, positioned proximate to said
12 printing station and comprising a means for detecting the
13 motion and the alignment of the belt by means of indicia
14 (14) associated with the peripheral border (12) of said
15 belt, and a rotary transducer of a known kind,
16 substantially an encoder of the incremental type associated
17 with said detector, adapted for providing electric output
18 signals corresponding to the speed of rotation of said
19 detector so as to be converted, by control means operatively
20 associated with said encoder and with said belt driving
21 motor, into electric signals for the control of said motor.

1 2. Machine according to claim 1, characterized in that
2 said means for detecting the motion of the belt comprises
3 toothed wheels (15,15a,15b), arranged on a substantially
4 horizontal plane and engaged with holes (14) provided in a
5 band (12) associated with the belt and freely rotating on
6 their axis, at least one of said toothed wheels being
7 positioned downstream and at least another of said toothed
8 wheels being positioned upstream of said printing station

9 (5), in order to ensure, besides the continuous detection of
10 the translatory motion of the belt, also perfect alignment,
11 longitudinally and transversely, of said belt at least in
12 the portion affected by the printing operation.

1 3. Machine according to claim 1, characterized in that
2 said printing station (5), is positioned fixed with respect
3 to the belt, and provided with all the functions related to
4 the operation performed automatically by the doctoring blade
5 by means of commands issued by an electronically controlled
6 actuation system.

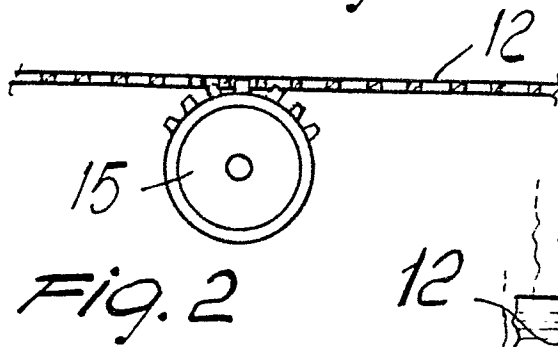
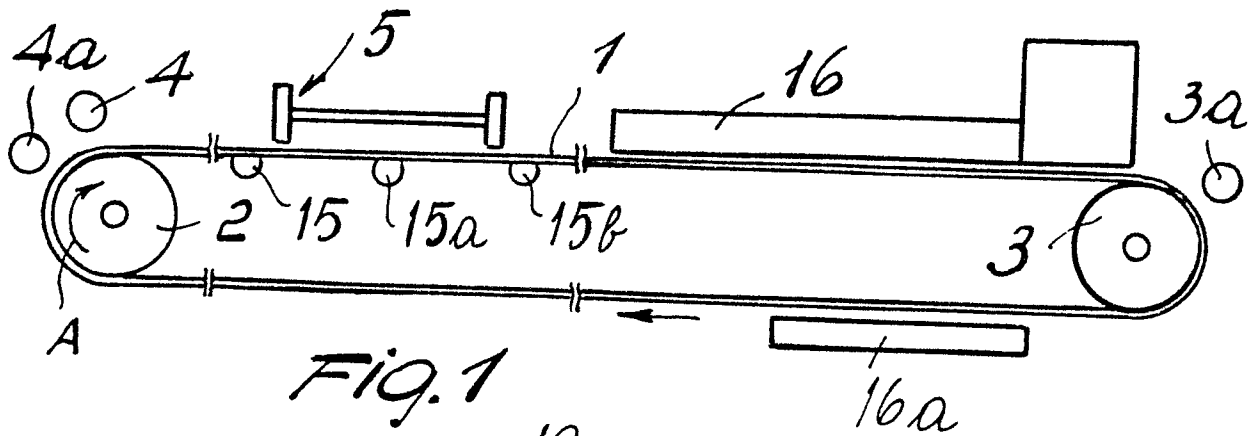
1 4. Machine according to claims 1 to 3, characterized in
2 that said device for detecting the fixed pitch at the
3 printing station (5) is adapted for calculating, by means of
4 a calculator, the perfect resumption of a pitch, even when
5 the latter is not an exact submultiple of the extension of
6 said belt.

1 5. Machine according to the preceding claims,
2 characterized in that it comprises means for the extraction
3 of the printed products both at the end of the upper portion
4 of the belt and at the end of the lower portion of said
5 belt, substantially at the driving roller (2).

1 6. Machine according to the preceding claims,
2 characterized in that it provides the laying of the fabric
3 (17) on the belt, already provided with adhesive, in a
4 region which is rearwardly offset with respect to the
5 beginning of the plane of said belt (1) and precisely in the
6 curved region of the belt which encircles the belt-bearing
7 cylinder (2).

1 7. Machine according to one or more of the preceding
2 claims, characterized in that it provides warm air drying

•

*Fig. 3*