Enhanced roller registration systems and associated structures provide improved registration for a transfer belt driven between rollers. Improved belt materials and construction techniques provide improved dimensional stability over prior transfer belts. In some embodiments of the enhanced roller registration systems, one or more sensors provide signals that sense one or more workpieces at one or more locations on the transfer belt. The signals are sent to a controller, which is configured to integrate the location information with one or more processes that are carried out with respect to the workpieces. While the enhanced roller registration system and structures may advantageously be used for a wide variety of conveyors, some current embodiments are adapted to printing systems, such as to deliver ink onto ceramic tiles.
ENHANCED ROLLER REGISTRATION SYSTEMS AND ASSOCIATED STRUCTURES

CROSS REFERENCE TO RELATED APPLICATIONS

This Application claims priority to U.S. Provisional Application No. 61/704,407, entitled *Printing System*, filed 21 September 2012, and to U.S. Provisional Application No. 61/704,406, entitled *Large Format Printer*, filed 21 September 2012, each of which is incorporated herein in its entirety by this reference thereto.

FIELD OF THE INVENTION

The invention relates to the field of conveyor systems. More particularly, the invention relates to improved transfer belts, roller registration systems, associated structures, and related equipment.

BACKGROUND OF THE INVENTION

Conveyor belt systems have long been used to transfer objects, such as materials, objects, substrates, and workpieces. In such environments, the transfer belt is suspended between a plurality of rollers, wherein one of the rollers, i.e. a drive roller, is typically connected to a drive mechanism, e.g. a motor, such that rotational movement of the drive mechanism results in rotational movement of the drive roller, which moves the belt with respect to the rollers, providing linear movement.

Printing systems often use conveyor belt systems to transfer workpieces, such as but not limited to flexible substrates, e.g. paper or film, or rigid substrates, e.g. ceramic tiles. In a prior tile printing system, ceramic tiles are arranged upon a conveyor belt, and are moved through a print zone, which typically includes a plurality of print bars, wherein each of the print bar assemblies comprise a plurality of print heads that are arranged to controllably deliver ink onto the tiles as they are moved through the print zone.
In many such systems, it is critical that the location of a workpiece in relation to each and every print zone is known, such that the jetted ink for each print bar, and for each print head in each print bar, is properly delivered to the workpiece.

The required resolution of delivered ink has increased over time, such that the demands for increased accuracy can extend beyond the accuracy with which workpieces can be located and moved, particularly within a manufacturing environment, where workpieces are often required to be accurately moved through one or more print zones during the delivery of ink to the workpieces.

It would be advantageous to provide a structure and/or system that provides more accurate registration for a conveyor belt, such as in conjunction with one or more workpieces that travel on the belt. The development of such a structure and/or system would constitute a significant technological advance.

Some efforts have previously been made to provide transfer belts having dimensionally stable belt materials. However, while some previously belt materials may initially provide adequate dimensional stability, such belt material is required to be formed into a continuous belt, wherein the belt is looped and joined at opposing ends to form a seam region between the start of the belt and the end of the belt. Seam regions have often been problematic, in that the dimensional stability of the material is lost through the seam area.

For example, some recent transfer belts have been manufactured with internal cables, such as comprising metal, e.g. stainless steel, which are required to be accurately welded. While such transfer belt materials may initially have favorable dimensional specifications, e.g. resistance to elongation, the dimensional stability of such belts is often lost during one or more joining processes, e.g. pressing, clamping and/or welding.

It would therefore be additionally advantageous to provide a transfer belt that provides improved dimensional stability over prior transfer belts. The development of such a structure would constitute a major technological breakthrough. It would also be
advantageous to provide a conveyor system that is configured to operate with such a transfer belt.

As well, it would be further advantageous to provide other enhancements that improve the setup and accuracy of transfer belt roller registration systems. Such enhancements would constitute significant technological advances.

**SUMMARY OF THE INVENTION**

Enhanced roller registration systems and associated structures provide improved registration for a transfer belt that is driven between rollers. Improved belt materials and construction techniques provide improved dimensional stability over prior transfer belts. In some embodiments of the enhanced roller registration system, one or more sensors provide signals that sense one or more workpieces at one or more locations on the transfer belt. The signals are sent to a controller, which is configured to integrate the detected location of the workpieces with one or more processes that are carried out with respect to the workpieces. While the enhanced roller registration system and structures may advantageously be used for a wide variety of conveyors, some current embodiments are adapted to printing systems, such as to deliver ink and/or glazing onto ceramic tiles.

**BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1 is a schematic diagram of an exemplary enhanced roller registration system;

Figure 2 is a side view of a printing system having an exemplary enhanced roller registration system associated therewith;

Figure 3 is a plan view of a printing system having an exemplary enhanced roller registration system associated therewith;

Figure 4 is a partial cutaway view of a first exemplary enhanced transfer belt;
Figure 5 is a partial cutaway view of a second exemplary enhanced transfer belt;

Figure 6 is a partial cutaway view of a third exemplary enhanced transfer belt;

Figure 7 is a partial cutaway view of a fourth exemplary enhanced transfer belt;

Figure 8 is a detailed partial perspective view of an exemplary conveyor assembly associated with an enhanced roller registration system; and

Figure 9 is a detailed view of a drive motor, transfer unit, and conveyor assembly for an exemplary ceramic printer conveyor system having an enhanced roller registration system associated therewith.

**DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS**

Figure 1 is a schematic diagram of an enhanced roller registration system 10. Figure 2 is a side view of an exemplary printing system 80 having an enhanced roller registration system 10 associated therewith. Figure 3 is a plan view of an exemplary printing system 80 having an enhanced roller registration system 10 associated therewith.

The exemplary conveyor assembly 14 seen in Figure 1 comprises a transfer belt 18 that extends between a plurality of rollers 16, *e.g.* 16a, 16b, which are rotatably mounted with respect to a frame structure 12. It should be understood that the exemplary roller registration system 10 seen in Figure 1 provides a simplified view of the system 10. For example, conveyor assembly 14 may further comprise one or more additional rollers, such as a tension roller 52 associated with a tension mechanism 90 (FIG. 2, FIG. 3), and/or the rollers 16 and transfer belt 18 may further comprise a plurality of teeth that intermesh. As well, the enhanced roller registration system 10 may preferably comprise additional structures and mechanisms to provide improved dimensional tolerances for any of setup, operation, or longevity.
The exemplary conveyor assembly 14 seen in Figure 1 is typically operated upon by a drive mechanism 26, which controllably rotates one of the rollers 16, e.g. 16a, thus producing movement 32 of the transfer belt 32, by which one or more work pieces 42, e.g. ceramic tiles 42, are controllably moved, such as to be operated upon at one or more locations with respect to the system 10.

The drive mechanism 26 typically comprises a drive motor 302 (FIG. 9) and a coupling mechanism, e.g. a transfer drive 304 (FIG. 9), wherein the drive motor 302 is controllably powered through a controller 20, e.g. a programmable logic controller (PLC). The drive motor 302 may preferably comprise one or more enhanced structures, to provide highly accurate and repeatable location and movement.

The roller registration system may preferably include an encoder 28, such as to provide accurate controlled movement 32 of the transfer belt 18 through the drive mechanism 26. The controller 20 typically comprises one or more processors 22, e.g. 22a-22e, and may also comprise storage 24, e.g. memory, such as for but not limited to storage of any of operating parameters, thresholds, operational history, and/or tracking. The controller is typically configured to control all of the movements and operations in the roller registration system and associated hardware in a printing system 80, such as but not limited to movement of the transfer belt through the drive mechanism 26, an coordinated operations of the printing bars 84, e.g. 84a-84f.

As also seen in Figure 1, a display 34 and user interface 36 are also typically connected to the controller 20, such as to provide input from a user USR, e.g. an operator, and/or to provide information to the user USR. As well, the system 10 may further comprise a communications link 46, through which the controller 20 may preferably be configured to transmit an output signal 48 or receive an input signal 50.

The enhanced roller registration system 10 seen in Figure 1 further comprises one or more workpiece sensors 40, e.g. lasers 40, by which the location of a workpiece 42, e.g. a ceramic tile 42, is sensed, whereby one or more operations may accurately be carried out upon the workpiece 42. For example in a printing system 80 that controllably
applies ink 230 (FIG. 8) to a ceramic tile 42 at one or more print bars 84, 84a-84f (FIG. 2, FIG. 3), it is often important to accurately deliver the ink 230, to produce a desired design 232 (FIG. 8) upon the ceramic tile 42, when each print bar 84 is configured to accurately deliver 224 a corresponding color of ink 230, and wherein different ink colors are accurately delivered 224 with respect to the other delivered colors.

Therefore, in operation, upon receiving one or more location signals 41 at the controller 20, the controller 20 may control and/or adjust the delivery 224 of ink 230 at one or more print bars 84. System embodiments 10 that comprise one or more workpiece sensors 40 thus provide improved design reproduction on workpieces 42, while reducing waste, and avoiding the delivery 224 of ink 230 to anywhere but the intended location upon a workpiece 42.

In some system embodiments 10, the conveyor assembly 14 may comprise one or more belt sensors 44, e.g. lasers 44, by which the location of one or more portions of the transfer belt are sensed, such as for any of setup or operation. For example the belt sensor 44 and controller 20 may preferably be configured to determine if there is a problem, e.g. setup, tension, or longevity, of the transfer belt 18, or if the performance of the transfer belt 18 is acceptable.

The exemplary printing system 80 seen in Figure 2 and Figure 3 is configured for printing on ceramic tiles 42, and may preferably comprise one or more workpiece guides 102, upstream of one or more of the print bars 84, such as at the entrance area 108 of the transfer belt 18. The workpiece guides 102 ensure that tiles 42 are in the proper location on the transfer belt 18, e.g. in the middle, and that the tiles 42 are acceptably straight, e.g. within an acceptable threshold. For example, the tiles 42 placed on the transfer belt may not initially be located with a great degree of accuracy, and/or may be twisted, i.e. rotated.

The use of multiple workpiece sensors 40 may preferably be used for determining not only the location of a workpiece 42, but also if there is any skew of a workpiece 42, which may also be corrected in real time, i.e. on the fly. For example, the system 10,80
may preferably controllably adjust the delivery 224 of ink 230 for a skewed ceramic tile 42. In other embodiments, the system 10,80 may be configured to notify the operator USR, such as through the display 34 or through other visual output or acoustic output, e.g. an alarm 38 (FIG. 1).

As well, the use of multiple workpiece sensors 40 may provide location data signals for more than one location within the system, e.g. 80, such that, at any desired moment, the controller 20 can accurately determine where a tile 42 is located, wherein the controller 20 can accurately provide a signal 96 (FIG. 2) to direct one or more of the printing bars 84 to fire 224 the ink 230.

Since the stepper/encoder 28 seen in Figure 1 encodes the motion of the transfer belt 18, upon receipt of a signal 41 from the workpiece sensor 40, the controller 20 is configured to register the location of the workpiece 42, e.g. the tile 42, in conjunction with the known location and motion of the transfer belt 18. Therefore, the enhanced registration system 10 may preferably be configured to link, i.e. join the electronic devices with mechanical devices.

When the location data signal 41 is sent from the workpiece sensor 40 to the controller 20, the controller 20 determines the location of the workpiece 42. The controller 20 also assures that the transfer belt 18 has not moved, i.e. in relation to the workpiece 42. Otherwise, relative movement between the workpiece 42 and the transfer belt 18 would result in a mistake, due to the resultant misregistration.

The exemplary roller registration system 10 and associated printing system 80 seen in Figure 2 and Figure 3 may preferably comprise an enhanced tension adjustment mechanism 90 for the transfer belt 18. For example, such as during any of initial setup, belt replacement, or other service, a threaded, i.e. guide screw mechanism 92 (FIG. 3) may be rotatably moved, such as to provide a fine adjustment of linear distance between the rollers 16, e.g. 16a, 16b, to obtain a desired tension in the transfer belt 18, such as recommended by the manufacturer of the transfer belt 18.
Similarly, for adjustment of parallelism between the rollers 16, the tension mechanism 90 typically comprises a pair of guide screws 92, e.g. 92a,92b, on opposing sides one of the rollers 16, e.g. 16a or 16b. One or both of the guide screws 92 may preferably be adjustable to achieve parallelism between the roller and transfer belt 18, i.e. to achieve 90 degrees between the axis of the roller 16 and the longitudinal axis of the transfer belt 18.

In some embodiments, a guide screw set 92 associated with a first roller 16, e.g. 16a, may be considered a main or primary guide 92, which may be adjustable for parallelism, when the corresponding roller 16 is free for adjustment of any of parallelism or tension, i.e. not locked down, such as when the position of the opposing roller 16, e.g. 16b, is maintained. Similarly, the opposite roller 16, e.g. 16b, may be adjustable for any of parallelism or tension, i.e. not locked down, such as when the position of the opposing roller 16, e.g. 16a, is maintained. The operator USR can then determine when the roller 16 is aligned with the guide 92, which assures that the transfer belt 18 is parallel to the opposing roller 16 and properly aligned with the transfer belt 18.

Once the transfer belt 18 is adjusted to be parallel, with adequate tension, the guide screw mechanism 92 is tightened, and the guide 102 is put back in place. Upon completion, the operator USR may start up the roller registration system 10 in a test mode, such as to confirm that the guide is not getting hot, e.g. from excessive friction. If not, the system 10,80 may be put into or returned to service. If the temperature of the guide increases excessively during testing, the operator or service personnel USR may repeat one or more of the procedures as necessary, and retest.

When the transfer belt 18 and rollers 16 are considered to be both parallel and properly tensioned, the operator USR may preferably mark 112 both the transfer belt 18 and the guide, and then rotabably move, i.e. advance, the transfer belt 18 from one part of the system to another part of the system, e.g. at opposite ends 108,110, at which time the location of the mark 112 may be determined and compared to the expected location, by which a difference is calculated, e.g. in millimeters. The calculated difference provides an indication as to whether there is any slip in the transfer belt 18, i.e. to confirm that
there is no problem with the set up during operation.

After setup, the owner or operator USR, does not typically need to reset the tolerance, as the rollers 16 and transfer belt 18 are dimensionally stable, such as for the expected lifetime of the transfer belt, e.g. which may have a useful lifetime in operation of up to or greater than about two years.

In alternate embodiments of the tension and alignment mechanism 90, the system 10 may preferably comprise a belt sensor 44 (FIG. 1). For example, a known location in the transfer belt 18 may further comprise a marker 114 e.g. such as but not limited to a piece of metal, a magnet, or a chip, such that the marked portion of the transfer belt 18 can be registered as it passes the belt sensor 94. In such a system, the tolerance may be automatically checked, e.g. based on any of periodically, continuously, or as desired. Such a configuration readily provides one or more readings, without the need to manually mark and check the belt tolerance.

As well, the automated configuration may preferably provide remote diagnostics, wherein the data may be sent 50 (FIG. 1) and displayed to a remote location, such as to remotely confirm that the registration system 10 has remained square and parallel, without going onsite. The communication link 46 may preferably be implemented though a wired or wireless port. For example, in a printing environment, a printing system 80 at a customer location may preferably be connected, such as through a DSL port, whereby the printing system may be remotely monitored, for any of assistance, service, or remote diagnostics. Therefore, through any of the local controller 20 or through a remote terminal, one or more data processing functions can be implemented, such as to operate the conveyor assembly 14, control the print heads 222 (FIG. 8) and corresponding ink jets. Through the local user interface, e.g. 34, 36, or through a remote terminal, the user or other personnel can establish, implement, and/or update the set up for the printing system 80, such as but not limited to voltages, the transfer belt 18, controlling movement of print bar covers, e.g. up or down, or any combination thereof.
An exemplary printing operation is also seen in the in Figure 2, wherein a print job 90, such as received from a remote terminal, e.g. an artist or designer, arrives at a main computer 92, which may be associated with the controller 20. In some system embodiments, the print job 90 comprises a tagged image file format (TIFF) print job 90.

The main computer 92 then typically produces, i.e. RIPs, a raster image file from the received print file 90, through which the main computer 92 makes the separations 94, which are assigned to one or more channels 96 as necessary to print the image. Each of the channels 96 are sent to a corresponding slave computer or processor 98, e.g. 98a-98f associated with each print bar 84, e.g. 84a-84f, for printing respective colors on the workpieces 42. The slave computers or processors 98 may be independent of or integrated with corresponding print bars 84. The different printing bars 84, e.g. 84a-84f, are commanded by the respective slave computers 98, whereby by each slave 98, e.g. 98a operates in conjunction with a respective for each print bar 84, 84a, i.e. one channel for each computer 98.

While the main computer 92 is making the RIP, the printing system 80 is typically configured to work with the graphics that are loading into the slaves 98. When each of the slave computers 98 has the information for their respective print bar 84, the slave computer connects, e.g. through an HPC card, to each of the print heads 222 (FIG. 9). In some system embodiments 80, each print head 222 has a dedicated HPC card, for local processing.

**Enhanced Transfer Belts for Roller Registration System.** Some embodiments of the enhanced conveyor system 10 may comprise conventional transfer belts 18, such as presently available. However, a number of enhancements may preferably be made to improve the transfer belt structures, such as related to any of materials or design, e.g. cross sectional structures and/or seamless construction.

For example, Figure 4 is a partial cutaway view 120 of a first exemplary enhanced transfer belt 18a. Figure 5 is a partial cutaway view 140 of a second exemplary enhanced transfer belt 18b. Figure 6 is a partial cutaway view 160 of a third exemplary
enhanced transfer belt 18c. Figure 7 is a partial cutaway view 180 of a fourth exemplary enhanced transfer belt 18d.

As seen in Figure 4, a plurality of cords or cables are located longitudinally within the belt substrate 122, which has an outer surface 124a, and an inner surface 124b opposite the outer surface 124a. The outer surface 124 of the transfer belt is considered to be a work surface, in that it is configured to receive workpieces 42, and faces the print heads 222 (FIG. 8) associated with the print bars 84, e.g. 84a-84f. The inner surface 124b of the transfer belt 18 is considered to be a driven surface, in that it contacts the rollers 16, e.g. 16a, 16b, wherein the inner surface 124b may preferably comprise a continuous plurality of teeth or ridges 130, which are configured to intermesh with corresponding teeth on one or more of the rollers 16.

The third exemplary enhanced conveyor belt 18c seen in Figure 6 may have a similar construction to that of the first exemplary enhanced conveyor belt 18a seen in Figure 4, except that the profile of the outer surface 124a has a series of outward facing ridges 162, such as corresponding to the series of cords 128a.

In the second exemplary enhanced conveyor belt 18b seen in Figure 5, each of the cables 128b comprises a plurality of cable elements 142, in contrast to the single cords 128a seen in Figure 4 and Figure 6.

The fourth exemplary enhanced conveyor belt 18d seen in Figure 7 may have a similar construction to that of the second exemplary enhanced conveyor belt 18b seen in Figure 5, except that the profile of the outer surface 124a has a series of outward facing ridges 162, such as corresponding to the series of embedded cables 128b. Some current embodiments of the enhanced conveyor belt 18, e.g. 18b, 18d comprise about three to five embedded cables 128b.

The structures, materials and seamless construction of the enhanced transfer belts 18, e.g. 18a-18d, may preferably be configured to improve the registration accuracy of the enhanced system 10, as compared to prior transfer belts, to provide accurate and
repeatable performance in production. For example, the single cords 128a or composite cables 128b may preferably comprise synthetic fiber, e.g. para-aramid synthetic fiber, such as Kevlar®, available through E. I. du Pont de Nemours and Company, of Wilmington, Delaware, United States. Enhanced transfer belts 18 that include para-aramid synthetic fiber cords 128a or composite cables 128b, such as with seamless construction, are highly resistant to changes in dimensions, and avoid problems associated with seamed construction, by preventing dimensional movement of the belt. Such enhanced transfer belts 18 maintain their form, i.e. they don’t lose their shape, thus providing a very stable and consistent material for accurately moving the workpieces 42, e.g. ceramic tiles 42. As well, the seamless construction of the enhanced transfer belts retains the resistance to elongation for the enhanced belt material.

Figure 8 is a detailed partial perspective view 220 of an exemplary conveyor assembly 14 associated with an enhanced roller registration system. Figure 9 is a detailed view 300 of a drive mechanism 26, end roller 16 and conveyor assembly 14 for an exemplary ceramic tile printing system 80 having an enhanced roller registration system 10 associated therewith. The partial cutaway view of the transfer belt 18 seen in Figure 8 reveals that the conveyor assembly 15 typically comprises a transfer belt support 240 located between the rollers 16, such as to support the weight workpieces 42, e.g. ceramic tiles 42.

In some embodiments of the enhanced roller registration system 10, such as associated with a printing system, the drive motor 302 is preferably chosen to reduce or eliminate electrical noise, e.g. radio frequency (RF) noise, which may otherwise interfere with the operation of the electronics associated with any of the enhanced roller registration system 10 or other components in the print system 80. For example, the drive motor may preferably comprise a brushless motor 302, to provide accurate continuous operation. As well, the encoder 28 (FIG. 1) may preferably be chosen to provide accurate continuous operation of the drive motor 302, while reducing or eliminating RF noise.
The drive motor 302 may preferably be specified for a wide variety of applications, such as to provide stepped, i.e. start and stop, motion, or continuous motion. For example, in the exemplary printing system 80 disclosed herein, such as for printing on ceramic tiles 42, the drive mechanism 26 is typically required to transport a large number of ceramic tiles 42, which are commonly large and heavy.

In a current system embodiment 80, the ceramic tile printing system 80 is configured to move the ceramic tiles 42 at a constant velocity, wherein the maximum speed of the transport belt 18 is about five meters per minute. As such, the drive mechanism 26, comprising the drive motor 302 and transfer drive 304, are rated to controllably bring the system up to speed, maintain a constant speed throughout it rated duty cycle, e.g. up to full 100 percent capacity, and bring the system to a stop.

In addition to the rated power for the drive motor 302 and transfer drive 304 to bring up a line to constant speed and maintain that speed, it should be understood that the system and combined mass of a large number of ceramic tiles 42, e.g. up to approximately 500 kilograms at a time, typically results in significant inertia, with which the drive mechanism 26, transfer belt 18, and other components associated with the conveyor assembly are configured to handle, such as for starting, constant operation, and stopping.

In addition to the performance requirements for the drive mechanism 26, the transfer belt 18 is also configured to be adequately strong under all operation conditions, while avoiding deformation or flexing. Similarly, all other hardware associated with the roller registration system 10 and printing system 80 are configured to meet all the operation requirements.

While the exemplary printing system 80 disclosed herein may preferably be configured to operate with a constant belt velocity, it should be understood the enhanced roller registration system 10 may suitably be configured for other types of operations, such as for systems that may require stepped operation, wherein the drive motor 302 may preferably be configured to be powered on an off. In such applications, the motor may
preferably be controlled with pulse width modulation (PWM).

Some embodiments of the enhance roller registration system and corresponding system, e.g. printing system 80, are powered through an uninterruptable power supply (UPS), wherein the system buffers the outside current, such as for any of the controller 20, sensors, print bar electronics, associated computers, memories, or other sensitive electronics. As the operation of the drive mechanism 26 is controlled through the controller 20, such as for any of start up, operation, and shutdown of the conveyor assembly 14.

The use of the uninterruptable power supply (UPS) helps to avoid variations in the peaks of tension, and maintains the power at a consistent level. The printing system 80 can therefore move at a constant rate, independent of incoming power fluctuations, wherein the system can match the electronics and print heads 222. As well, such as at a customer facility, upon loss of incoming power, the UPS may preferably be configured to provide sufficient time, such as to switch off the machine production, e.g. to avoid problems with the electronics, the computers, and heads.

In some system embodiments 80, some components may not be required to be powered by the uninterruptable power supply (UPS). For example, some temperature controls may not be powered by the uninterruptable power supply (UPS), as temperature parameters may not be required to be tracked when a production line associated with the system is stopped.

While the exemplary embodiment of the roller registration system is described herein with respect to an exemplary printing system, such as for but not limited to printing upon ceramic tiles, it should be understood that the structures and systems described herein may readily be implemented for a wide variety of conveyor systems.

Accordingly, although the invention has been described in detail with reference to a particular preferred embodiment, persons possessing ordinary skill in the art to which this invention pertains will appreciate that various modifications and enhancements may
be made without departing from the spirit and scope of the claims that follow.
CLAIMS

What is claimed is:

Claim 1. A roller registration structure, comprising:
   a frame structure;
   at least two cylindrical rollers, wherein at least one of the rollers is rotatably affixed to the frame structure;
   a transfer belt suspended between the at least two rollers;
   drive mechanism corresponding to at least one of the cylindrical rollers;
   a controller comprising at least one processor; and
   a sensor affixed in relation to the support frame, wherein the sensor is configured to determine the position of at least one portion of the belt, and send a signal to controller, wherein the signal corresponds to the determined position;
   wherein the at least one processor is programmed to receive the signal that corresponds to the determined position of the transfer belt, determine if the current position of the transfer belt is acceptable,
   wherein if the current position of the belt is not acceptable, the processor adjusts any of at least one of the rollers or the drive mechanism to change the registration of the transfer belt with respect to the system, and
   wherein if the determined current position of the belt is acceptable, the processor allows the current registration of the transfer belt with respect to the system to continue.

Claim 2. The structure of Claim 1, wherein the sensor is configured to determine the position in any of a periodic or continuous manner.

Claim 3. The structure of Claim 1, wherein if the determined position of the transfer belt exceeds a first threshold value, the processor is configured to provide any of an indicator or alarm.

Claim 4. The structure of Claim 1, wherein if the determined position of the transfer belt exceeds a first threshold value, the processor is configured to cease operation of the
transfer belt.

Claim 5. The structure of Clainn 1, wherein the system is associated with a printer.

Claim 6. The structure of Claim 5, wherein the printer comprises a ceramic printer.

Claim 7. The structure of Claim 1, wherein the adjustment of at least one parameter by the at least one processor compensates for a difference in length between the transfer belt and at least one location associated with the system.
Claim 8. A printing system, comprising:
   a frame structure;
   at least two cylindrical rollers, wherein at least one of the rollers is rotatably affixed to the frame structure;
   a transfer belt suspended between the at least two rollers;
   one or more print bars mounted to the frame structure, wherein the print bars each comprise one or more print heads configured to jetting ink onto a workpiece located on the transfer belt;
   a drive mechanism corresponding to at least one of the cylindrical rollers;
   a controller comprising at least one processor; and
   a sensor affixed in relation to the support frame, wherein the sensor is configured to determine the position of at least one portion of the transfer belt, and send a signal to controller, wherein the signal corresponds to the determined position;
   wherein the at least one processor is programmed to receive the signal that corresponds to the determined position of the transfer belt, determine if the current position of the transfer belt is acceptable,
   wherein if the current position of the belt is not acceptable, the processor adjusts any of at least one of the rollers or the drive mechanism to change the registration of the transfer belt with respect to the print bars, and
   wherein if the determined current position of the belt is acceptable, the processor allows the current registration of the transfer belt with respect to the print bars to continue.

Claim 9. The printing system of Claim 8, wherein the sensor is configured to determine the position in any of a periodic or continuous manner.

Claim 10. The printing system of Claim 8, wherein if the determined position of the transfer belt exceeds a first threshold value, the processor is configured to provide any of an indicator or alarm.

Claim 11. The printing system of Claim 8, wherein if the determined position of the transfer belt exceeds a first threshold value, the processor is configured to cease
operation of the transfer belt.

Claim 12. The printing system of Claim 8, wherein the system is associated with a printer.

Claim 13. The printing system of Claim 12, wherein the printer comprises a ceramic printer.

Claim 14. The printing system of Claim 8, wherein the adjustment of at least one parameter by the at least one processor compensates for a difference in length between the transfer belt and at least one location associated with the system.
Claim 15. A transfer belt, comprising:
   a seamless transfer belt substrate having a defined width and a longitudinal axis
   that is perpendicular to the width, wherein the seamless transfer belt substrate has an
   outer surface and an inner surface opposite the outer surface, wherein the outer surface
   is configured to receive and support one or more workpieces, and wherein the inner
   surface is configured to be suspended between the at least two generally cylindrical
   rollers; and
   a plurality of continuous cord or cable elements embedded longitudinally within
   the seamless transfer belt substrate, wherein the plurality of continuous cords comprise
   a synthetic fiber;
   wherein the seamless transfer belt substrate is configured to be dimensionally
   stable; and
   wherein the plurality of continuous cord or cable elements are configured to resist
   dimensional movement of the transfer belt.

Claim 16. The transfer belt of Claim 15, wherein the synthetic fiber comprises para-
aramid fiber.

Claim 17. The transfer belt of Claim 16, wherein the para-aramid fiber comprises
KEVLAR®.

Claim 18. The transfer belt of Claim 15, wherein each of the cord or cable elements
comprise a plurality of synthetic fibers.

Claim 19. The transfer belt of Claim 15, wherein the workpieces are ceramic tiles.

Claim 20. The transfer belt of Claim 15, wherein a plurality of teeth ridges or grooves or
teeth are defined on the inner surface, and are configured to intermesh with an interlock
mechanism defined on the generally cylindrical rollers.