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A Pusher Assembly and a Guide Rail for a Unit Production System

Field of Technology

The present invention relates to a pusher assembly for pushing a hanger movable along a support rail. More particularly but not limited to, the invention relates to a unit production hanger system in garment manufacturing.

Background

Traditional garment factories use a batched method called progressive bundle system. Parts of various components after being cut in the cutting room are tied up in bundles and distributed out to individual sewing operators in the sewing section. Typically, the bundles are transported to individual sewing operators by trolleys or moveable trays. A lot of material handling work has to be done and results in high work-in-progress and low production efficiency.

A unit production system (UPS) has been proposed to automate the distribution process. This is an advanced garment manufacturing system in which a single garment is progressed through a sequence of operations. A garment is automatically transported via a computer-controlled overhead hanging system, which has been ergonomically designed to reduce the amount of handling of the garment. The system includes an overhead conveyance system for transporting hangers along a support rail. All parts for a single garment are transported together by means of a hanger that travels along the overhead conveyor. The hangers are moved along the support rail to the workstations where an operation is to be performed. Different operations are performed at individual workstations.

A typical unit production system 100 as shown in Figure 1a includes a fixed structure 102 and a hanger transportation subsystem 104 having a support rail along which a plurality of hangers 106 are transported. Figure 1b shows an enlarged view of the

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hanger transportation subsystem. The hangers 106 are supported by a support rail 160, which is mounted to the fixed structure through a guide rail 120 and a spacer 162. Movement of the hanger 106 is driven by a pushing bar 146 of a pusher assembly 140 movable along the guide rail 120. A plurality of pusher assemblies 140 are driven by a chain conveyer.

One problem with the existing system is that the guide rail 120 and the rollers 142 wear out after a period of use. Replacement of the guide rail and pusher assembly or rollers is costly and time consuming, and thus resulting in a high maintenance cost. One may provide a guide rail and rollers of a more wear resistant material, however, this adds significant cost to the system.

When sections of the rail fail though excessive wear, the entire rail needs to be replaced as alignment and continuity problems prevent the practical replacement of rail sections. Amortisation of the capital cost of replacing the rail limits the economic viability of such systems.

Another problem is that the whole pusher assembly 140 including the rollers 142 and the chain conveyer are exposed to the operators. This may lead to safety problems and results in an untidy looking of the working environment of the factory. One common solution is to provide a covering shield to cover the rollers and the chain along the rail, which will be costly and will add further difficulty to replacement of guide rail and pusher assembly.

The present invention proposes a system alleviating at least one of the problems above.

Summary of Invention

In a first aspect, the invention provides a pusher assembly for pushing a hanger movable along a support rail, the pusher assembly comprising: a roller assembly for engaging and moving along a guide rail; a frame having a pushing bar, arranged to operate in a horizontal position, and a support to which the roller assembly is coupled; wherein the pushing bar and the roller assembly project from a first side of the support.

The roller assembly may comprise a pair of rollers, said pair of rollers defining a vertical axis, with a centre of gravity of the pusher assembly located along said vertical axis. The frame may be L shaped such that the support is a vertical portion and the pushing bar is a horizontal portion for pushing the hanger. The pair of rollers may be spaced for engaging opposed sides of the guide rail.

By having both the roller assembly and the pushing bar on the same side of the support, this immediately solves the safety and aesthetics issues by covering and protecting the chain drive. In one embodiment, this may also shift the centre of gravity of pusher assembly so as to lie adjacent to the roller assembly, and preferably locate along a vertical axis defined by the rollers of the roller assembly. In use, this allows the pusher assembly to be balanced, and thus minimizing lateral force between the sides of the guide rail and the rollers. This may reduce wear of, not only the rollers, but also the guide rail.

In a second aspect, the invention provides a guide rail for guiding a pusher assembly to push a hanger movable along a support rail, the guide rail comprising: a base portion for mounting the guide rail to a fixed structure; a side wall projecting from a first side of the base portion; and a rail bearing portion at the distal end of the side wall; wherein the distal end of the side wall extends inwardly toward a second side of the base portion.

The side wall may have an inwardly curved portion so as to define a cavity together with the base portion and the rail bearing portion. The rail bearing portion may have a first bearing side extending towards the base portion and an opposed second bearing side extending away from the base portion. The guide rail may further comprise, at the second side of the base portion, a connection interface for connecting to a spacing member which spaces the guide rail from a support rail for supporting a hanger.

The rail bearing portion may be adapted to selectively engage a protective cap. Alternatively, the guide rail may further comprise a replaceable protective cap covering at least a part of the rail bearing portion. The protective cap may be made of sheet material of higher abrasion resistance than the rail bearing portion. The protective cap may be made from any one or a combination of: stainless steel, carbon fiber composite material, and glass fiber reinforced plastic.

In one embodiment, the side wall may be inwardly curved, and consequently a cavity is formed with the base portion, the side wall and the rail bearing portion. The guide rail may allow at least a portion of the pusher assembly to be received within the cavity.

Having the guide rail in cooperation with the above pusher assembly, a significant part of the pusher assembly may be hidden inside the guide rail, particularly the support and the chain become not accessible to the operators, and thus resulting in safer and nicer looking working environment.

In a third aspect, the invention provides a protective cap for a guide rail, comprising a sheet material shaped to cover a roller engaging surface of the guide rail. Preferably, the protective cap further comprises means for engaging the sheet material to the guide rail. The engaging means may be any one or a combination of: a snap fit arrangement, a layer of adhesive material, and a bolt fastening. The sheet material may be made from any one or a combination of: stainless steel, carbon fiber composite material, and glass fiber reinforced plastic.

By having a protective cap covering the roller engaging surface of the guide rail, it protects the guide rail from wearing and/or can be replaced. Replacement of the

protective cap can be easily done and is less costly in comparison to replacement of the entire guide rail, or even if possible, a section of the guide rail.

In a fourth aspect, the invention provides a hanger transportation system for moving a hanger along a support rail comprising: a guide rail having a base portion for mounting the guide rail to a fixed structure; a side wall projecting from a first side of the base portion; and a rail bearing portion at the distal end of the side wall; wherein the distal end of the side wall extends inwardly toward a second side of the base portion; and a pusher assembly having a roller assembly for engaging and moving along a guide rail; a frame having a pushing bar, arranged to operate in a horizontal position, and a support to which the roller assembly is coupled; wherein the pushing bar and the roller assembly project from a first side of the support.

In a fifth aspect, the invention provides a rail for a pusher assembly comprising a roller engaging surface arranged to receive a roller of said pusher assembly; said roller engaging surface including an abrasion resistant layer. Preferably, the said layer may be a cap mounted to said rail.

Brief Description of Drawings

It will be convenient to further describe the present invention with respect to the accompanying drawings that illustrate possible arrangements of the invention. Other arrangements of the invention are possible, and consequently the particularity of the accompanying drawings is not to be understood as superseding the generality of the preceding description of the invention.

Figures 1a and 1b illustrate a known unit production system in garment manufacturing and an enlarged view of a hanger transportation subsystem.

Figure 2 shows a cross-sectional view of an improved hanger transportation system in an assembled form.

Figure 3 shows a cross-sectional view of a pusher assembly according to one embodiment of the invention.

Figure 4 shows a cross-sectional view of a guide rail according to another embodiment of the invention.

Detailed Description of Embodiments

Figure 2 shows a hanger transportation system for transporting the hangers 106 along the support rail 260. The system includes a guide rail 220 running parallel with the support rail and a pusher assembly 240 traveling along the guide rail. A plurality of pusher assemblies 240 may be arranged along the guide rail. The guide rail 220 is mounted to a fixed structure. The support rail 260 is mounted to the guide rail through a spacer 262. The spacer maintains the relative position of the support rail 260 and the guide rail 220. The plurality of pusher assemblies 240 are driven by a chain conveyer 248 to move along the guide rail 220. The movement of the pusher assembly pushes the hanger 106 to move along the support rail 260.

As shown in Figure 3, the pusher assembly 240 includes a roller assembly 242 and a frame. The roller assembly 242 includes a pair of rollers 242a and 242b. The frame includes a support 244 and a pushing bar 246.

The rollers 242a,b are mounted to a first side of the upper part of the support 244 and are arranged in a vertical plane spaced for engaging and moving along a guide rail. In one embodiment, each of the rollers is a U groove track roller bearing. The two rollers together define a space within which the guide rail is received. The rollers are spaced

for engaging opposed sides of the guide rail. Each roller is rotatable about a shaft mounted to the support.

The frame may be L shaped with the support 244 being a vertical portion and the pushing bar 246 being a horizontal portion for pushing the hanger. Further, the pushing bar 246 may also be an L shaped member having a vertical portion and a horizontal portion. The vertical portion pivots on the support and the horizontal portion projects from the first side of the support 244, the same side where the roller assembly is mounted to, at the lower end. With the arrangement having both the rollers 242a,b and the pushing bar 246 on the same side of the support, it at least partially solves the safety and aesthetic issues by covering and protecting the chain drive. Further, the centre of gravity of pusher assembly can be arranged to locate along a vertical axis defined by the two rollers 242a,b. In use, this allows the pusher assembly to be balanced, and thus minimizing the lateral shearing force between the sides of the guide rail and the rollers.

In contrast, the pusher assembly 140 of Figure 1b includes rollers 142 and pushing bar 146 at different sides of the support 144. The centre of gravity therefore locates at an offset point from the axis defined by the rollers. Due to imbalance of the pusher assembly, in use, the sides of the bearing groove of the rollers exerts a lateral force on the guide rail. This is one of the important attributions of wearing.

By re-designing the pusher assembly 240 with a more balanced arrangement, it minimizes the lateral force on the sides of the rollers and the guide rail, and preferably, there is only vertical force between the rollers and the guide rail. This will reduce wear

of, not only the rollers of the pusher assembly, but also the guide rail. Thus, it results in a system of prolonged life without change of materials.

In one embodiment, the vertical portion of the pushing bar 246 pivots on the support 244 about the shaft of one of the rollers. The pushing bar and the lower end of the support are configured such that the pushing bar is rotatable at only one side of the support. A torsion spring is provided urging the pushing bar against the lower end of the support. In use, the torsion spring exerts a force on the pushing bar in a direction opposite to the direction of the force received from the hangers. As compared to a fixed structure, this arrangement is to prevent jammed parts or heavy injuries. The support 244 has two holes between the shafts of the rollers allowing it to be bolted to a chain conveyer 248. The support and the pushing bar are preferably made of stainless steel. The rollers may be made in plastic, metal or any other suitable material.

Figure 4 shows a cross-sectional view of a guide rail 220 for guiding the pusher assembly to push a hanger movable along the support rail. The guide rail includes a base portion 222 for mounting the guide rail to a fixed structure, a side wall 224 projecting from a first side of the base portion, and a rail bearing portion 226 at the distal end of the side wall, wherein the distal end of the side wall 224 extends inwardly toward a second side of the base portion.

In one embodiment, the side wall 224 may have an inwardly curved portion so as to define a cavity together with the base portion 224 and the rail bearing portion 226.

The guide rail 220 is preferably an extrusion of aluminum alloy. The base portion 222, side wall 224 and rail bearing portion 226 define a cavity 228 for receiving at least a part of the pusher assembly, including one of the rollers.

The rail bearing portion 226 has two round profiled bearing sides: a first bearing side extending towards the base portion 222 and an opposed second bearing side extending away from the base portion. Each bearing side is U shaped and has a greater thickness than the connecting portion between the two sides. A plurality of protrusions 227 are provided at the internal side of the U shape. The protrusions 227 have a cross-section of a rectangle or square for inserting metal piece to align the guide rail.

The guide rail further includes, at the second side of the base portion 222, a connection interface 230 for connecting to a spacing member 262, which spaces the guide rail 22 from a support rail 260. The spacing member or spacer 262 is able to maintain a fixed relative position of the support rail 260 with respect to the guide rail 220.

The base portion includes one or more recesses or grooves for mounting the guide rail to a fixed structure. The base portion 220 and the connection interface 230 may have a double layered structure and the connection between the side wall 224 and the rail bearing portion 226 may be thickened for additional strength. Preferably, the side wall 224 extends perpendicularly from the base portion 222. An inclined support may be provided between the base portion 222 and the side wall 224, preferably at the corner of the base portion and the side wall at 45 degree to the side wall, to keep the side wall 224 perpendicular to the base portion 222.

As shown in Figure 2, this profile of the guide rail 220 allows at least a portion of the pusher assembly to be received within the cavity 228. A significant part of the pusher assembly and the chain conveyer are now hidden inside the guide rail. The support 244, the chain 248 and one of the rollers are not accessible to the operators, and thus resulting in safer and nicer looking working environment.

Preferably, the rail bearing portion 226 is adapted to selectively engage a protective cap (not shown) for further increased durability. Once worn out, the protective cap maybe replaced with a new protective cap without the need of re-installing the entire, or even a section of the, guide rail.

The protective cap may be an abrasion resistant layer covering the roller engaging surface of the first bearing side or the second bearing side. Alternatively, the protective cap may be shaped to cover the roller engaging surface of both the first bearing side and the second bearing side.

The protective cap maybe made of sheet material of higher abrasion resistance than the rail bearing portion. The protective cap maybe made from any suitable material, such as stainless steel, carbon fiber composite material, and glass fiber reinforced plastic.

In another embodiment, a rail for a pusher assembly is provided comprising a roller engaging surface arranged to receive a roller of said pusher assembly, said roller engaging surface including an abrasion resistant layer. The abrasion resistant layer may be a cap mounted to the rail, or alternatively an integral part of the rail. This layer is of higher resistant to abrasion than main body of the rail. In one example, the rail

body may be made of aluminum alloy and the abrasion resistant layer may be made of stainless steel.

In a yet further embodiment, a protective cap for a guide rail may be provided comprising a sheet material shaped to cover a roller engaging surface of the guide rail. The protective cap may further comprise means for engaging the sheet material to the guide rail. The engaging means maybe any one or a combination of: a snap fit arrangement, a layer of adhesive material, and a bolt fastening.

It should be appreciated that variations of the design of the pusher assembly and guide rail are possible within the scope of the concept of the present invention defined in the claims.

Claims

1. A pusher assembly for pushing a hanger movable along a support rail, the pusher assembly comprising:

a roller assembly for engaging and moving along a guide rail;

a frame having a pushing bar, arranged to operate in a horizontal position, and a support to which the roller assembly is coupled;

wherein the pushing bar and the roller assembly project from a first side of the support.

2. The pusher assembly according to claim 1 wherein the roller assembly comprises a pair of rollers, said pair of rollers defining a vertical axis, with a centre of gravity of the pusher assembly located along said vertical axis.

3. The pusher assembly of claim 2, wherein the frame is L shaped such that the support is a vertical portion and the pushing bar is a horizontal portion for pushing the hanger.

4. The pusher assembly of claim 1, wherein the pair of rollers are spaced for engaging opposed sides of the guide rail.

5. A guide rail for guiding a pusher assembly to push a hanger movable along a support rail, the guide rail comprising:

a base portion for mounting the guide rail to a fixed structure;

a side wall projecting from a first side of the base portion; and

a rail bearing portion at the distal end of the side wall;

wherein the distal end of the side wall extends inwardly toward a second side of the base portion.

6. The guide rail of claim 5, wherein the side wall has an inwardly curved portion so as to define a cavity together with the base portion and the rail bearing portion.

7. The guide rail of claim 5, wherein the rail bearing portion has a first bearing side extending towards the base portion and an opposed second bearing side extending away from the base portion.

8. The guide rail of claim 5, further comprising, at the second side of the base portion, a connection interface for connecting to a spacing member which spaces the guide rail from a support rail for supporting a hanger.

9. The guide rail of claim 5, wherein the rail bearing portion is adapted to selectively engage a protective cap.

10. The guide rail of claim 5, further comprising a replaceable protective cap covering at least a part of the rail bearing portion.

11. The guide rail of claim 10, wherein the protective cap is made of sheet material of higher abrasion resistance than the rail bearing portion.

12. The guide rail of claim 11, wherein the protective cap is made from any one or a combination of: stainless steel, carbon fiber composite material, and glass fiber reinforced plastic.

13. A hanger transportation system for moving a hanger along a support rail comprising:

a guide rail according to any one of claims 5 to 12; and

a pusher assembly according to any one of claims 1 to 4 movable along said guide rail.

14. A rail for a pusher assembly comprising

a roller engaging surface arranged to receive a roller of said pusher assembly;

said roller engaging surface including an abrasion resistant layer.

15. The rail according to claim 14, wherein said layer is a cap mounted to said rail.

16. A protective cap for a guide rail, comprising a sheet material shaped to cover a roller engaging surface of the guide rail.

17. The protective cap of claim 16, further comprising means for engaging the sheet material to the guide rail.

18. The protective cap of claim 17, wherein the engaging means is any one or a combination of: a snap fit arrangement, a layer of adhesive material, and a bolt fastening.

19. The protective cap of claim 16, wherein the sheet material is made from any one or a combination of: stainless steel, carbon fiber composite material, and glass fiber reinforced plastic.