

CONVEYOR SYSTEM WITH INCORPORATED TEMPERATURE CONTROL

FIELD OF INVENTION

5 This invention relates to a conveyor system with incorporated temperature control for heating or chilling products. The conveyor system is intended for use in a production, processing or delivery line where maintaining of temperature of a product is required. This may be in restaurants, cafes, bistros, and other food outlets as well as factories. The use of the system of the present invention is particularly relevant, though not exclusively so, for the transportation and the temperature control of food items in restaurants that use a conveyor system for the display and serving of food.

BACKGROUND TO THE INVENTION

15 In most cities and countries, one may find food outlets serving Chinese cuisine. Among the more popular types of Chinese cuisine is "dim sum". "Dim sum" is traditional Chinese food cooked in a vertically arranged column of bamboo containers, each containing different food items that allow steam and heat to pass through them.

The traditional way of serving "dim sum" involves serving staff pushing a cart around a restaurant. Diners at their tables make their selection from several columns of bamboo containers stacked vertically on the cart. The carts usually do not have any heating to keep the food warm. This can result in lukewarm food, and non-crispy fried food, by the time the food reaches a table of diners.

There are currently several conveyor systems used in restaurants to deliver food around the restaurant. However, their main objective lies in the transportation of food, not the maintenance of the freshness and taste of the food, and the food used is generally served cool (Japanese sashimi), or at room temperature (Japanese sushi).

There have been attempts to maintain the temperature of food items on such conveyor belt systems. However, only bowls of pre-boiled water are used as a source of heating. That will not maintain the temperature of the food for the allowable duration of two hours. Air curtains have also been used for keeping food
5 cold in supermarket display cabinets. But the food items are static, and do not move about on a conveyor. Thus, the air flow from the air curtain blows continuously onto a fixed position.

Another traditional style of Chinese cuisine is the melting pot or steamboat. This
10 involves the placement of raw food into a boiling pot of soup in order to cook the food. The soup that remains after all the food items are cooked is flavoured with the taste of the food items that were cooked in the soup. Food used includes meats, seafood and vegetables, among others.

15 Currently, in such steamboat restaurants, the raw food is usually served on plates to the diner, or the diner may need to leave the seat to select the food from a buffet-style selection. There is no system which allows for the raw food to be delivered to the customer for selection and where the food is maintained at a correct temperature until needed by the diner.

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SUMMARY OF INVENTION

In a first embodiment of the present invention, there is provided a conveyor system, for the transport of items requiring temperature control, the conveyor system
25 including: a conveyor, a channel guide mounted within the conveyor, at least one temperature control device forming part of the conveyor and being for the control of temperature. The electrical circuit includes: an electrical circuit box connected to at least one temperature control device, a plurality of electrical connectors mounted on the electric circuit box, at least one electrical contact strip mounted within the
30 channel guide and extending longitudinally along the channel guide; and an electrical connection for connecting the plurality of electrical connectors to at least one temperature control device.

Preferably, the conveyor includes a chain having a plurality of links, each link of the chain including a pivot pin having a hollow interior for the passage therethrough of wires being attached to a conveyor segment. The segments may be heat and fire resistant.

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Advantageously, the temperature control device is activated when each of the plurality of preferably outwardly biased electrical contacts mounted on the circuit box is in contact with the contact strips in the channel guide.

10 It is preferable that the electrical circuit box has attached thereto, guide rollers for movement along tracks in the channel guide.

It is preferred that the number of electrical connectors is identical to the number of contact strips. Alternatively, the number of electrical connectors is the same as the
15 number of phases of an electricity supply plus one more connector for the neutral contact strip. Otherwise, the number of electrical connectors is preferably twice the number of phases of an electricity supply plus two more connectors for the neutral contact strips.

20 It is advantageous that the temperature control devices each has an electrical circuit and an associated connecting structure.

Preferably, the electrical circuit for the conveyor system includes at least one temperature control device. The electrical circuit may include: the channel guide
25 having a plurality of contact strips extending longitudinally along said guide, the plurality of contact strips being connectable to a source of electricity, a plurality of electrical connectors mounted on a circuit box, the circuit box being adapted to pass along said channel guide with each of the plurality of electrical connectors in electrical contact with one of a plurality of contact strips, and an electrical
30 connection for connecting the plurality of electrical connectors to at least one temperature control device.

In another embodiment of the present invention, there is provides a conveyor system, for the transport of items that require temperature control. The conveyor system includes: a plurality of segments, a conveyor chain, a switching means for operating the conveyor belt system, a plurality of heating/cooling means mounted
5 above the items, a tank for the containment of fluid and a plurality of heating/cooling means to maintain the temperature of the fluid in the container means.

Advantageously, the segment is a container and a plurality of heating/cooling means is mounted above the items to provide a curtain of hot/cool air directly onto
10 the segment. It is also advantageous that the container means is accessible only through a door means. The segment is preferably made from a heat conducting material.

Advantageously, the segment used in the conveyor system includes: a convex front
15 surface of a first radius and a concave rear surface of a second radius. The first and second radii is preferably substantially the same to enable a front surface of a first container to mate with a rear surface of an adjacent second container. The inner wall of a first height and outer wall of a second height may preferably be such that the first height is greater than the second height. The segment may also have a
20 base and an open top.

Preferably, the heating/cooling means in the tank is a heating/cooling coil. The fluid in the tank may be brine, water or air

25 **DESCRIPTION OF DRAWINGS**

In order that the invention may be better understood and readily put into practical effect, there shall now be described by way of non-limitative example only preferred embodiments of the present invention, the description being in reference to the
30 accompanying drawings in which:

Figure 1 is a side view of the conveyor system;

Figure 2 is a front view of the conveyor system;

Figure 3 is a side view of the individual electrical circuit mounted on the frame including the heater;
Figure 4 is a side view of the individual electrical circuit;
Figure 5 is a front view of an alternative embodiment of the conveyor system;
5 Figure 6 is a side view of an alternative embodiment of the conveyor system;
Figure 7 is a top view of the container segment;
Figure 8 is a side view of the container segment;
Figure 9 is a top view of the conveyor system;
Figure 10 is a side view of the individual container segment used in the alternative
10 embodiment of the conveyor system;
Figure 11 is a bottom view of the sprocket engaged with the conveyor chain;
Figure 12 is a perspective view of an embodiment of the conveyor system;
Figure 13 is a perspective view of the flared funnel of the channel guide;
Figure 14 is a side view of the heater with a bamboo container in position;
15 Figure 15 is a side view of the heater with a bowl in position;
Figure 16 is a side view of the heater with a hot plate in position;
Figure 17 is a side view of the refrigeration unit with a tray in position;
Figure 18 is a side view of the conveyor chain; and
Figure 19 is a top view of the conveyor chain.

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DESCRIPTION OF PREFERRED EMBODIMENTS

To first refer to Figures 1 to 4, 13 and 18 – 19, there is illustrated one embodiment of the present invention. There is provided a conveyor system 20 powered by an
25 alternating current power supply. The power supply is stepped down by a transformer 24 and rectified before passing to the conveyor system 20. The power supply is then passed to a motor 22. However, direct current may be used if desired or necessitated.

30 The motor 22 drives a shaft 28 on which a sprocket 58 is mounted. Sprocket 58 has teeth 74 that engage links 60 of a conveyor chain 34. Each link 60 of the conveyor chain 34 is attached to the underneath of a heat and/or fire-resistant planar segment 44. The planar segment 44 may be integral with the upper arm of link 60 to

form a single component. Alternatively, it may be a separate component. A plurality of the planar segments 44 are thus attached to the conveyor chain 34 to form a continuous belt 76 of segments 44. A plurality of sprockets 58 and conveyor chains 34 connected to only a motor 22 may be employed.

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A switch 26 is incorporated into the conveyor system 20 to turn the motor 22 on and off. When the motor 22 is running, the teeth 74 of the sprocket 58 will engage links 60 of the conveyor chain 34 and cause the conveyor chain 34 to move. As the planar segments 44 are connected to the conveyor chain 34, the continuous belt 76
10 also moves with the conveyor chain 34.

At least some of the planar segments 44 have a heater 38. The heater 38 may be attached to the planar segments 44 through a hole in the planar segments 44, integrated into the planar segments 44, or mounted on the planar segments 44. As
15 shown in Figure 12, the heater 38 protrudes from the surface of the segments 44. However, the heater 38 may be a pad built into the planar segments 44. The heater 38 may be a coil of high resistance within a casing 62. The casing 62 may be cylindrical as shown or relatively flat in the manner of a pad. Planar segments 44 having the heater 38 are positioned intermittently along the belt 76. This allows for
20 the placement of food items onto the belt 76 that do not require constant heating. Such items may include, for example, condiments, sauces, and the like. The heater 38 forms a part of an electrical circuit 52 that includes an electrical supply. The electrical circuit 52 comprises components that form a complete electrical circuit to power the heater 38.

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Alternatively, at least some of the planar segments 44 may have a refrigeration unit 39. The refrigeration units 39 may be attached to the planar segments 44 through a hole in the planar segments 44, integrated into the planar segments 44, or mounted on the planar segments 44. As shown in Figure 12, the refrigeration unit 39
30 protrudes from the surface of the planar segments 44. However, the refrigeration unit 39 may be a pad built into the planar segments 44. The refrigeration unit 39 may be a cooling coil within a casing 62. The casing 62 may be cylindrical as shown or relatively flat in the manner of a pad. Planar segments 44 having the refrigeration

unit 39 are positioned intermittently along the belt 76. This allows for the placement of food items onto the belt 76 that do not require constant chilling. Such items may include, for example, condiments, sauces, and the like. The refrigeration unit 39 forms a part of an electrical circuit 52 that includes an electrical supply. The electrical circuit 52 comprises components that form a complete electrical circuit to power the refrigeration unit 39. A cover 57 is usually employed to retain the cold generated by the refrigeration unit 39.

There is a frame 19 with legs 18 that form a structure that supports the motor 22, the transformer 24, the switch 26, the axle 28, the sprockets 58 and the conveyor system 20. The frame 19 has a bench 25 with a slot which allows a connecting structure to pass through from under a top surface 29 of the bench 25. A channel guide 40 is also mounted to the frame 19 below the bench 25. The channel guide 40 may have at least one slot 65 for guiding an electrical circuit box 53 along the guide 40. The channel guide 40 may also have a flared funnel 17 (Figure 13) at the entrance end to guide the circuit box 53 into channel guide 40. The flared funnel 17, and the slot 65 may both guide the circuit box 53, especially in the positioning of a plurality of electrical contacts 32 into contact with a plurality of electrical contact strips 66. There may be a plurality of tracks 64 within and extending along channel guide 40. They preferably extend from funnel 17 along the full length of channel guide 40.

Extending downwardly from each planar segment 44 having a heater 38/refrigeration unit 39 is a connecting structure 47. The connecting structure 47 includes a transmission line 36 that forms part of the electrical circuit 52. The connecting structure passes through slot 65. The transmission line 36 passes through a pivot pin 61. Pivot pin 61 passes through and joins link 60 of the conveyor chain 34. The transmission line 36 passes through a cylindrical opening 63 in pin 61 before being guided by the connecting structure 47 to the circuit box 53. The pin 61 may prevent the transmission line 36 from being twisted or damaged when the conveyor system 20 is in operation. The cylindrical opening 63 extend axially along the full length of pin 61 and are co-axial with pin 61. As pin 61 passes through

planar segment 44, the transmission line 36 is connected directly to heater 38/refrigeration unit 39 and thus all electrical connections are hidden.

5 A plurality of guide rollers 30 are rotatably attached to the connecting structure 47 or electrical circuit box 53 to aid the movement of the electrical circuit box 53 along the channel guide 40. The guide rollers 30 roll on the tracks 64 in the channel guide 40. A structural guide 51 rests against a surface 49 of the channel guide 40 to guide the electrical circuit box 53, primarily the electrical contacts 32, along a plurality of electrical contact strips 66. The flared funnel 17 at the entrance end of the guide
10 channel guide 40 guides the connecting structure 47 of the circuit box 53 into slot 65. This aligns the electrical contacts 32 with the electrical contact strips 66 so as to allow for contact between them to occur. There may be two electrical contacts 32 that come into contact with two electrical contact strips 66, one contact 32 per contact strip 66. One electrical contact strip 66 may be connected to a "live" wire,
15 while the other electrical contact strip 66 may be connected to a "neutral" wire. Alternatively, either two-phase or, three-phase or, direct current may be used. There should be at least one electrical contact strip 66 for each phase, plus at least one strip 66 for neutral. Preferably, there are two strips 66 for each phase and two strips 66 for neutral. Each strip 66 may preferably extend for the full length of
20 channel guide 40. This may include funnel 17. Alternatively, strips 66 may commence only at the inner end of funnel 17.

Each electrical contact 32 is biased outwardly from the circuit box 53, preferably by the use of a compression spring. This provides contact between each electrical
25 contact 32 and its electrical contact strip 66. This allows conduction of current between the electrical contact 32 and the electrical contact strip 66. The electrical contact 32 may have a tapered first end that aids in the compression of the electrical contact 32 when it meets the vertical side of the channel guide 40. Consequently, the electrical contact 32 compresses against the electrical contact
30 strip 66 as the circuit box 53 is in motion.

When the electrical contact 32 within the electrical circuit box 53 comes into contact with the electrical contact strip 66, the electrical circuit 52 is closed. The contact

strips 66 are connected to the power supply. The contact strips 66 form a part of the electrical circuit 52. The contact strips 66 may be positioned continuously or intermittently along the channel guide 40. The channel guide 40 may have an "L-shaped" cross-section by rearranging the positions of the contacts 32 and the contact strips 66 to allow for quick access to the electrical circuit 52 for maintenance.

When the electrical circuit 52 is closed, current will then flow in electrical circuit 52, through a transmission line 36 and the heater 38/refrigeration unit 39. A light emitting diode (LED) may be incorporated into the electrical circuit 52 with its illumination denoting the activation of the heater 38/refrigeration unit 39.

There may be a guide roller 30 employed, albeit thicker in width to fit a broader track 64. The guide rollers 30 may be self lubricating.

For safety reasons, the channel guide 40 may be made of or coated with an electrically insulating material. The electrical contact strip 66 is preferably insulated from the channel guide 40.

The guide 40 preferably extends for the length of any straight paths of motion of conveyor chain 34, although it may also extend around curves of relatively large radii as long as the circuit box 53 does not become trapped or jammed while moving in the guide 40. The electrical contacts 32 and the electrical contact strip 66 should remain in continuous contact when within the channel guide 40. As such, curved paths of relatively small radii may not be suitable. The conveyor system moves at a speed such that the duration of time when the electrical contact 32 engages the electrical contact strip 66 is sufficient to operate the heater 38/refrigeration unit 39. This is intended to allow heater 38/refrigeration unit 39 to maintain the correct temperature. Alternatively, by having the contact strip 66 extended in length, adequate temperature control can also be provided. When the contact 32 disengages from the electrical contact strip 66, the heater 38/refrigeration unit 39 will not function. Such periods should be limited to areas where the belt 76 traverses sharp corners, the minimum radius of curvature of guide 40 below which

electrical conduction cannot continue, is determined by the relative dimensions of guide 40, links 60 and circuit box 53, and/or where the belt 76 forms a curve of unsuitably small radii. Thus, it will be advantageous if, for example, the material of the heating coil in the heater 38 and the casing 62 has a high specific heat capacity.
5 For example, a material like ceramic allows the coil to retain heat.

A trimming 23 is attached to the edge of the bench 25, alongside the slot 67 which allows the connecting structure 47 to pass through from under the top surface 29 of the bench 25. The clip 23 acts as a barrier to reduce the ingress of liquid below the
10 top surface 29 of the bench 25. This is a preventive measure to reduce the likelihood of a short-circuiting of electrical circuit 52 stemming from contact by liquids. Planar segments 44 may contact trimming 23 to further enhance the liquid sealing mechanism.

15 In Figure 14, a steamer 42 may be a cylinder with a dish for containing water with a hollowed-out base 68 such that the heater 38 fits within the base 68 of the steamer 42, effectively concealing the heater 38. The steamer 42 may be positioned at the heater 38 such that the water in the dish of the steamer 42 is boiled. A wooden container with a perforated base 46 is positioned on the steamer 42 such that
20 steam passes through its base. Food items in the wooden container 46 is then heated and maintained at the temperature of steam, 100°C. This embodiment employs wet heat to maintain the temperature of the food.

In Figures 15 – 18, a container holder 48 may be a cylindrical object with a cavity
25 that passes through the length of the container holder 48. A base 70 of the container holder 48 may be able to conceal the heater 38 and the top portion 72 of the container holder 48 may have a configured surface for the mounting of containers like a bowl 50, a hot plate 54 and the like. The container holder 48 may be made of a heat insulating material to ensure that the container holder 48 does
30 not burn any user that attempts to move it.

In another embodiment, the container holder 48 is positioned atop the heater 38 to keep the bowl 50 in place to enable the contents in the bowl 50 to be heated. The

contents could be any liquid such as, for example, porridge, stock, congee, soup, dishes with gravy, and the like.

In Figures 16 – 17, there is shown another embodiment, a finned radiator 56 is positioned on top of and in contact with the heater 38. The container holder 48 is placed on top of and in contact with the finned radiator 56. The container may be designed to hide both the heater 38 and the finned radiator 56 within the hollow base 70 of the container holder 48. A hot plate 54 is placed in the container holder 48. Food in the hot plate 54 may be constantly simmering. This embodiment employs dry heat to be used for the maintenance of fried food items, like for example, the crispiness of fried chicken, the crispiness of savoury pastries and the like.

Figure 17 shows another embodiment where the finned radiator 56 is positioned on top of and in contact with the refrigeration unit 39 with the container holder 48 being placed on top of and in contact with the finned radiator 56, hiding both the refrigeration unit 39 and the finned radiator 56 within the hollow base 70 of the container holder 48. A tray 55 with food needing to be kept cold such as, for example, raw foods, cooked meats, cooked seafood, desserts like ice-cream, is placed in the container holder 48. The tray 55 aids in the provision of the correct temperature for the food items placed on it. The cover 57 also controls the heat conducted to the food item.

In Figures 5 – 10, there is shown a further embodiment of the present invention. There is provided a conveyor system 90 powered by an alternating current power supply. The motor 92 drives a shaft 94 on which a sprocket 96 is mounted with teeth that latch onto individual links of a conveyor chain 98. Each link of the conveyor chain 98 is attached to the underneath of a container 100. Each individual container 100 may be colour-coded to denote the pricing of the contents placed in the container 100.

The container 100 has a front curved surface 102 and a rear curved surface 104 that facilitates the movement of the segment 100. The top edge 106 of the container

100 is sloped at an incline to the horizontal so that inner side 103 is higher than outer side 105. The open top 107 facilitates ease of placement of content into container 100, and removal of content from container 100. A plurality of the container 100 are attached to the conveyor chain 98 to form a continuous belt 106 of segments 100.

For consecutive containers 100 in the belt 106 (Figure 9), a rear curved surface 104 of a first container 108 is separated by a small gap 109 from a front curved surface 102 of a second container 110. The arrangement allows for the turning and maneuvering of the container 100 around a tank 116. The container 100 is preferably made from a heat conducting material such as, for example, food grade stainless steel. The radius of curvature of front curved surface 102 and the radius of curvature of a rear curved surface 104 are the same. Surface 102 is convex and surface 104 is concave to allow a matching fit.

The tank 116 acts as the bench top for this particular embodiment of the invention. The tank 116 has raised peripheral walls 120 that aid in the containment of liquids. The tank 116 has a slot 112 in its base which allows for a connecting structure 138 to pass through. The tank 116 has a plurality of coils 118 for cooling positioned around the tank 116. The peripheral wall 120 allows the container to be filled with water or brine 122.

Brine 122 is preferable due to its lower freezing point and the resulting reduction in bacterial growth. As stipulated by hygiene and health laws on the storage and handling of raw food, raw food items that are placed in segment 100 will be maintained at $3^{\circ}\text{C} - 8^{\circ}\text{C}$ (a range of temperature that does not promote the growth and proliferation of bacteria) when the plurality of coils 118 for cooling is turned on as the brine 122 is cooled. The brine 122 cools the contents of the segment 100 to the desired temperature.

By their shape, container 100 can move through brine 122 with minimal disturbance. The close fit of surfaces 102, 104 provides a relatively smooth flow

path, yet gap 109 ensures that all surfaces 102, 104 and bases 111 in the belt 106 are contacted by brine 122 for maintenance of temperatures.

5 In an alternative or additional embodiment, there may be an air circulation hood 124 positioned over the tank 116. The air circulation hood 124 may be a component of the conveyor system 90 or, it may be a separate component attachable to the conveyor system 90. The air circulation hood 124 may have a plurality of cooling coils 126 to cool the air. Convection currents of air ensure that hot air rises while cool air sinks, ensuring a continuous circulation of air in the region directly above
10 the tank 116. However, one or more fans may be provided to assist air flow. The air circulation hood 124 may have heater lamps installed such that when the cooling coils 126 are not utilised, the lamps can be used to heat the contents placed in container 100. The coils 118 may also be used for heating the contents of the tank 116, and subsequently, the contents of the container 100.

15 The tank 116 may be surrounded by a plurality of doors 128 with a base 130 mounted on the peripheral wall 120 and a top 132 mounted on the air circulation hood 124. The plurality of doors 128 aid in the maintenance of freshness of the contents placed in container 100 by preventing flying insects from coming into
20 contact with the food.

In conveyor system 90, trimming 134 is attached to the edge of the tank 116, alongside the slot 112 which allows the connecting structure 138 to pass through from under a top surface 140 of the tank 116. The trimming 134 acts as a barrier to
25 prevent the ingress of water from the top surface 140.

Whilst there has been described in the foregoing description preferred embodiments of the present invention, it will be understood by those skilled in the technology concerned that many variations or modifications may be made to details
30 of design or construction without departing from the present invention.

The present invention extends to all features disclosed either individually, or in all possible permutations and combinations.

CLAIMS

1. A conveyor system, for the transport of items that require temperature control, the conveyor system including:
 - 5 a plurality of segments;
 - a conveyor chain;
 - a switching means for operating the conveyor system;
 - a plurality of heating/cooling means mounted above said items;
 - a tank for the containment of the plurality of segments and a fluid; and
 - 10 a plurality of heating/cooling means to maintain the temperature of said fluid in said tank.
2. A conveyor system as claimed in claim 1, wherein said segment is a container.
- 15 3. A conveyor system as claimed in claim 1, wherein said plurality of heating/cooling means mounted above said items provide a curtain of hot/cool air directly onto said segment.
4. A conveyor system as claimed in claim 1, wherein said container means is accessible only through a door means.
- 20 5. A conveyor system as claimed in claim 1, wherein said fluid in said tank is brine.
6. A conveyor system as claimed in claim 1, wherein said fluid in said tank is water.
- 25 7. A conveyor system as claimed in claim 1, wherein said fluid in said tank is air.
8. A conveyor system as claimed in claim 1, wherein said segment is made from a heat conducting material.
- 30 9. A conveyor system as claimed in any of claims 1 - 8, wherein said heating/cooling means in said tank is a heating/cooling coil.
10. A segment for use in a conveyor system as claimed in any of claims 1 - 9, wherein said segment includes:
 - 35 a convex front surface of a first radius;
 - a concave rear surface of a second radius;
 - said first and second radii being substantially the same to enable a front surface of a first container to mate with a rear surface of an adjacent second container;

an inner wall of a first height;
an outer wall of a second height;
the first height being greater than the second height;
a base; and
an open top.

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