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DESCRIPTION

Description

BACKGROUND

[0001] The invention relates generally to power-driven conveyors and in particular to ice-covered tray conveyors.

[0002] Current methods of processing meat, fish, or poultry require cutting bulk product by hand. For example, the bulk meat is conveyed to an operator who loads the meat onto a tray. The operator then cuts the meat into defined portions on the tray's cutting surface. The tools used to cut the meat can score and scratch the cutting surface. Trays marred by scratched surfaces are difficult to sanitize-especially if the trays are sanitized manually. Biofilms, which are especially difficult to remove, can form on and contaminate the trays.

SUMMARY

[0003] A tray conveyor embodying features of the invention comprises a track having an array of electromagnetic drive coils extending along the length of the track and a coil driver driving the drive coils to produce an electromagnetic flux wave that travels along the length of the track along a conveying path defined by the drive coils. A tray conveying products through a process includes a top and a bottom. A permanent magnet array between the top and the bottom produces a magnetic field that interacts with the traveling electromagnetic flux wave to produce a force that propels the tray along the track. An ice coating covers at least the top of the tray. Products sit atop the ice coating on the top when the products are undergoing the process. The tray conveyor furthermore comprises a freezer producing an ice cover and a cover applicator on the conveying path depositing the ice cover on the top of the tray to form the ice coating.

[0004] In another aspect, a method for conveying products through processing using a tray conveyor as previously described comprises: (a) advancing a magnetic tray along a track with a linear motor drive; (b) adding an ice coating to cover the top of the tray by freezing an ice cover and putting it on top of the tray; (c) loading a product onto the ice coating atop the tray; (d) processing the product; (e) removing the product from the tray during or after undergoing the process; (f) removing at least a top layer of ice from the ice coating covering the top of the tray; and (g) repeating steps (c) through (f).

[0005] WO 2010/092473 A1 discloses a conveyor system for conveying objects having at least one rail having a top wall and extending along a path; a number of electromagnets housed inside the rail; control means for sequentially operating the electromagnets; and at least one support for supporting the objects, and which is movable on the rail to transport the objects, has a bottom wall, and has at least one permanent magnet inside; the permanent magnet, in use, being designed to interact with the electromagnets in the rail to move the support on said rail; and the support is connected to the rail so that the bottom wall of the support rests on and, in use, slides on the top wall of the rail.

[0006] WO 2016/083394 A1 discloses an XY table for a linear transport system, having a carriage-guide rail which has a curved portion, designed so that, when a first and a second linear guide of the XY table are oriented parallel to the track plane of the carriage-guide rail, first guide elements of the first and second linear guides are connected to a carrying structure of the XY table and/or a second guide element of the first linear guide is connected to a first carriage, and a second guide element of the second linear guide is connected to a second carriage, such that rotation is possible in the track plane of the carriage-guide rail, or so that, when a first and a second linear guide are oriented in a plane of orientation perpendicular to the track plane of the carriage-guide rail 20, first guide elements of the first and second linear guides are connected to a carrying structure of the XY table and/or a second guide element of the first linear guide is connected to a first carriage, and a second guide element of the second linear guide is connected to a second carriage, such that tilting is possible in the plane of orientation.

[0007] US 2016/325938 A1 discloses the features of the preamble of claim 1 and in particular discloses a transport system powered by short block Linear Synchronous Motors (LSMs).

[0008] WO 2018/067567 A1 discloses a tray conveyor in which plastic trays with rows of embedded translators are driven by stators. Washing stations in cleaning zones are provided to automatically clean empty trays in the conveyor's return path.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

FIG. 1 is an isometric view of a portion of a tray conveyor embodying features of the invention.

FIG. 2 is a top plan view of the tray conveyor of FIG. 1.

FIG. 3 is an isometric view of a tray for the conveyor of FIG. 1.

FIG. 4 is an exploded view of the tray of FIG. 3.

FIG. 5 is an exploded view of a tray as in FIG. 3 with a pre-made ice cover.

FIG. 6 is an isometric view of a portion of the track rails for a tray conveyor as in FIG. 1 with parts of the rails cut away.

FIG. 7 is an enlarged isometric view of stator coils in the track rails of FIG. 6.

FIG. 8 is an isometric view of a right-angle corner section of the track coils for a tray conveyor as in FIG. 1 with the corner rails in phantom.

FIG. 9 is an isometric view of a rotating-blade ice refinisher removing a top layer of an ice coating from a tray as in FIG. 3.

FIG. 10 is an isometric view of a flame or hot-air ice refinisher removing a top layer of an ice coating from a tray as in FIG. 3.

FIG. 11 is an isometric view of an infrared ice refinisher removing a top layer of an ice coating from a tray as in FIG. 3.

FIG. 12 is an isometric view of an air- or water-jet ice refinisher removing a top layer of an ice coating from a tray as in FIG. 3.

FIG. 13 is an isometric view of a resistance-wire ice refinisher removing a top layer of an ice coating from a tray as in FIG. 3.

FIG. 14 is an isometric view of a vacuum system removing melted ice in conjunction with an ice refinisher as in FIG. 13.

FIGS. 15A-15D are isometric views showing the sequence of defrosting a tray as in FIG. 3 with inductive heating.

FIGS. 16A and 16B are isometric views of an infrared defroster and tilter removing an ice coating from a tray as in FIG. 3.

FIGS. 17A-17D are isometric views showing the sequence of inductively defrosting an upside-down tray as in FIG. 3.

FIGS. 18A-18C are isometric views showing the sequence of flipping a tray as in FIG. 5 to remove the ice cover.

FIG. 19 is a flowchart describing one example of a method for using ice-covered trays in a conveyor system as in FIG. 1.

FIG. 20 is a block diagram of a control system for the tray conveyor of FIG. 1.

DETAILED DESCRIPTION

[0010] FIGS. 1 and 2 show one version of a tray conveyor embodying features of the

invention. The tray conveyor 20 has a track 22 that defines a conveying path. In this example, the track 22 has a pair of parallel rails 24L, 24R supported by legs 26 along the length of the track. In right-angle corner sections 28 of the track 22, the track rails 24L, 24R cross each other at a 90° angle. The corners could alternatively be made of curved track sections without crossing track rails.

[0011] Magnetic trays 30 are independently propelled along the track 22 by linear stator coils in the track rails 24L, 24R. The trays 30, shown in more detail in FIGS. 3 and 4, have a top 32 and an opposite bottom 34 sandwiching a permanent magnet layout 36. An electrically conductive aluminum or copper plate 38 is optionally sandwiched between the top 32 and the permanent magnet array 36. The top 32 and the bottom 34 may be made of a rigid, nonmagnetic, corrosion-resistant material. For example, stainless steel top and bottom covers can form the tray's top and bottom. The permanent magnet layout 36 shown in FIG. 4 has four magnet arrays 40A-40D, each extending along a different side of the rectangular tray 30. The magnet arrays 40A-40D can be arranged as Halbach arrays to focus the magnetic field toward the tray bottom 34. The top 32 of the tray 30 in FIG. 5 may be covered with a pre-made ice cover 42 with a recess 44 in which the tray fits.

[0012] As shown in FIG. 6, the two track rails 24L, 24R each have linear stator coils 46 extending along the length of the track. The electromagnetic drive coils 46 shown enlarged in FIG. 7 are driven by a coil driver to produce an electromagnetic flux wave that travels along the length of the track rails 24L, 24R. The traveling flux wave interacts with the magnetic field of the permanent magnet arrays in the trays to produce a force propelling the trays along the track. Position sensors 48, such as Hall-effect sensors, are periodically spaced along the length of the linear stator coils 46 at predetermined sensor positions to detect the presence of a tray at the sensor positions. The position sensors 48 are used by the coil driver to drive the coils with a commutated current as a brushless de motor. As one alternative, the magnetic trays could be driven as a synchronous linear ac motor. The lateral spacing of the permanent magnet arrays along opposite sides of the trays matches the lateral spacing of the electromagnetic drive coils for effective magnetic coupling. If a single-rail track is used instead, the trays would need only a single permanent magnet array in line with the drive coils in the rail. The single rail can be a wide rail whose width is less than, equal to, or greater than the width of the tray and could have a single stator or a pair of stators.

[0013] FIG. 8 shows a corner section 28 of the conveyor in greater detail. The drive coils 46A in a first track segment 22A produce an electromagnetic flux wave traveling in a first conveying direction 50A. The drive coils 46B in a second track segment 22B perpendicular to and intersecting the first track segment 22A propagate an electromagnetic wave in a second direction 50B 90° from the first direction 50A. When a tray as in FIG. 4 is completely on the corner section, its two pairs of permanent magnet arrays are aligned under the pairs of intersecting rails on each track segment 22A, 22B. The drive coils 46A on the first track segment 22A are then de-energized, and the drive coils 46B on the second track segment 22B are energized to propel the tray in the new direction 50B.

[0014] As shown in FIGS. 1 and 2, trays 30' with ice coatings covering at least their tops advance along a first track segment 22A with products 52 sitting on the ice coatings. The ice-coated trays 30' proceed along the track segment 22A to a processing area where the products 52 are processed manually or robotically. Processed products 54 are transferred to a discharge conveyor 56. Residual contaminants from the products reside on the ice coatings, which isolate the trays themselves from contamination. The tracks themselves could be coated in ice and periodically defrosted for improved hygiene. An ice refinisher or a defroster 58 on the conveying path removes a top layer or the entirety of the ice coatings along with the contaminants they hold.

[0015] FIGS. 9-13 show various versions of ice refinishers acting on ice-coated trays 30'. All the refinishers are shown with cameras 60 associated with vision systems to control the thickness of the top layer of ice removed from the ice coating. But the refinishers could operate without cameras and a vision system and remove a fixed amount or all of the ice coating. The ice refinisher 62 of FIG. 9 includes a trimming wheel 64 with a peripheral blade 66. The wheel 64 is rotated by a motor 68 as the wheel moves side to side along the tray 30' as it is driven in the conveying direction 70 by the drive coils in the track rails. The rotating and side-to-side oscillating wheel 64 cuts into the ice coating 72 covering the top of the tray 30' to trim a top layer of ice.

[0016] The ice refinisher 74 of FIG. 10 is a heater that emits a flame or hot air at the top of the advancing tray 30' to melt a top layer of the ice coating 72. The ice refinisher 76 of FIG. 11 uses infrared lamps 78 directed at the ice coating 72 to melt a top layer. The ice refinisher 80 of FIG. 12 uses a fluid jet 82 of compressed air or water moving side to side across the tray 30' to remove a top layer of the ice coating 72. And the ice refinisher 84 of FIG. 13 heats up a resistance wire 86 extending across the width of the tray 30' and movable in depth to melt a top layer of the ice coating 72. FIG. 14 shows the ice refinisher 84 of FIG. 14 with a vacuum system 88 to remove melted ice and ice particles from the residual ice coating. The vacuum system 88 can be used with any of the ice refinishers. Once an ice refinisher has removed the contaminated top layer, the tray with the residual uncontaminated ice coating can be removed from the track and replaced back on the track upstream to convey another product through the process.

[0017] Instead of removing only a top layer of the ice coating as the ice refinisher can, a defroster can remove the entire ice coating. One example of a defroster is shown removing the ice coating in FIGS. 15A-15D. The defroster 90 includes a barrier 92 that extends across the conveying path and a linear-induction motor stator 94 above the rails 24L, 24R. A slot 96 in the barrier 92 extends upward from the rails a height slightly greater than the thickness of the magnetic tray 30. Brackets 98 are attached between the barrier 92 and the stator 94 to support it above the rails 24L, 24R. A camera 100 and its associated vision system images the tray 30 under the stator 94 as in FIG. 15B. The energized rails 24L, 24R push the tray 30 against the stop 92. The thickness of the ice coating 72 on the tray prevents the tray from passing through the slot 96. The linear-induction motor stator coils 94 are energized to produce an electromagnetic field that induces eddy currents in the electrically conductive copper or

aluminum plate (38, FIG. 4). The eddy currents heat the plate, and that heat is conducted to the top 32 and the bottom 34 tray covers 32, 34 as shown in FIG. 15C. The inductive heating melts the ice coating 72 from the inside out and defrosts the tray 30. When the ice coating 72 is melted, the tray 30 can pass through the slot 96 as shown in FIG. 15D. The camera 100 and the visioning system can be used to de-energize the defroster's stator 94 when they detect no tray 30 in position against the stop 92.

[0018] An infrared defroster 102 is shown in FIGS. 16A and 16B. When the ice-coated tray 30' reaches a tiltable track segment, a camera 106 and its associated vision system or another kind of position sensor detects the tray, and a tilt actuator (not shown) tilts the tray as indicated by the arrow 108 in FIG. 16B. When the tiltable track segment 104 is tilted, its stator coils are disconnected from the rail coil drivers and connected to direct-current coil drivers that generate an electromagnetic field to which the permanent magnet arrays in the tray 30 are attracted. The force of attraction prevents the tray 30 from sliding off the rails. Infrared lamps 112 direct their radiation at the ice coating 72 on the tilted tray 30. As the ice coating melts, the water is shed from the tilted tray 30 by gravity. The camera 100 and its vision system are used to determine when the tray 30 is completely defrosted so that the tilt actuator can pivot the tiltable track segment 104 back to its untilted position. Once the track segment is back in the untilted position, the defrosted tray 30 can resume its advance along the conveying path.

[0019] Another defroster is shown in FIGS. 17A-17D. The defroster 114 is similar to that of FIGS. 15A-15D. One difference is that the barrier 92 and the defrosting stator 94 are "upside down," i.e., rotated 180° about the conveying direction from their positions in FIGS. 15A-15D. A tray-flipping track segment 118, such as an extended-range tiltable track segment as in FIGS. 16A and 16B, flips the ice-coated tray 30' 180° while transferring it from a first track segment 120 to an adjacent laterally offset second track segment 122 as shown in FIG. 17B. The upside-down, ice-coated tray 30' is blocked by the barrier 92 as shown in FIG. 17C. The second track segment 122 has a pair of lower passive guide rails 124L, 124R without stators. The lower rails 124L, 124R prevent the upside-down tray 30' from falling. Upper guide rails 126L, 126R include the rail stators that push the tray 30' against the barrier 92. The defrosting stator 94 beneath the second track segment 122 inductively heats the electrically conductive plate in the tray 30' to melt the ice coating. The melted ice falls from the tray without contaminating the downward-facing tray top 32. As shown in FIG. 17D, once the ice coating is removed, the defrosted tray 30 passes through the slot 96 in the barrier 92, and the flipping track segment 118 is pivoted back to its position in line with the first track segment 120. A similar flipping track segment downstream of the defroster 114 rights the tray 30 with its top facing upward to continue along the conveying path.

[0020] If the tray 30 is covered with a conforming pre-made ice cover 42 as in FIG. 5, a defroster can be replaced by an ice-cover remover 130 as shown in FIGS. 18A-18C. A flipping track segment 118, like the one in FIGS. 17A-17D flips the tray 30 with its ice cover 42 upside down as shown in FIG. 18B. The ice cover 42 falls from the tray 30. Once the ice cover 42 has been removed, the flipping track segment 118 returns to its position in line with the main track 22, and the ice-free tray 30 advances along the track in the conveying direction.

[0021] Defrosted trays 30 exiting the defroster 58 in FIGS. 1 and 2 are diverted from the main track 22A to a tray sanitizer 134 in a side track 22B. The sanitizer 134 sanitizes the ice-free trays 30, which are then advanced along the side track 22B to a tray freezer 136, which installs an ice cover on top of the tray. The ice-coated tray 30' is driven back to the entrance end 132 of the main track 22A to receive product.

[0022] A flowchart of one way the tray conveyor can be operated is shown in FIG. 19. First, at step 140, an ice coating or an ice cover is added to the tray, which is then loaded with a bulk product, such as a slab of meat, at step 142. In step 144, the product is then processed, e.g., cut and removed from the tray, whose ice coating is now contaminated by the product. If enough ice remains atop the tray to be reused as determined by visioning the tray at step 146, the top layer of the ice coating is removed at step 148 and a further layer of ice is optionally added (step 150) before the tray is returned to receive bulk product. If it is determined that the ice coating is too contaminated or too thin to be reused, the tray is defrosted and the ice totally removed at step 152. The defrosted tray is sanitized at step 154 before returning to the freezer to have an ice coating added at step 140. As an option, the contaminated ice removed from the tray by the defroster or the ice refinisher can be reconditioned and reused as in steps 156 and 158.

[0023] A block diagram of an exemplary control system for the tray conveyor of FIGS. 1 and 2 is shown in FIG. 20. A controller 160, such as a programmable logic controller or a special or general purpose computer, which may be an individual system controller or may represent a number of distributed controllers throughout the tray conveyor, executes program instructions stored in program memory to control the operation of the tray conveyor. The controller 160 enables and disables the coil drivers 162 driving the drive coils 46 in the various track segments. The coil drivers 162 use feedback from the Hall-effect sensors 48 to electronically commutate the coil drive currents. The controller also controls the heating stator coils 94 in the defroster with a dedicated defroster coil driver 164. The controller 160 also represents the visioning system that takes the digital images from the cameras 60, 100 in the ice refinisher or defrosters 58 to control their rail actuators, direct-current coil drivers, and ice removal elements. The controller 160 also controls the operation of the sanitizer 134 and the freezer 136, as well as the discharge conveyor 56.

REFERENCES CITED IN THE DESCRIPTION

Cited references

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all

liability in this regard.

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- [WO2016083394A1 \[0006\]](#)
- [US2016325938A1 \[0007\]](#)
- [WO2018067567A1 \[0008\]](#)

PATENTKRAV

1. Bakketransportør (20), der omfatter:
 - et spor (22) med en gruppe af elektromagnetiske drivspoler (46), der strækker sig langs sporets (22) længde og definerer en transportbane;
 - en spoledriver (162), der driver drivspolerne (46) for at frembringe en elektromagnetisk fluxbølge, der bevæger sig langs sporets (22) længde;
 - en bakke (30; 30'), der transporterer produkter (52) gennem en proces, hvilken bakke (30) indbefatter:
 - en top (32);
 - en bund (34);
 - en permanentmagnetgruppe (36) mellem toppen (32) og bunden (34), som frembringer et magnetfelt, der interagerer med den bevægende elektromagnetiske fluxbølge for at frembringe en kraft, der frembringer bakken (30; 30') lang sporet (22);
 - kendetegnet ved, at bakketransportøren endvidere omfatter,
 - en isbelægning (72), der dækker mindst toppen (32) af bakken (30; 30'), hvor produkter (52) står på isbelægningen (72) på toppen (32), når produkterne (52) gennemgår processen; og
 - en fryser (136), der frembringer en isafdækning og en afdækningspplikator på transportbanen, som aflejrer isafdækningen på toppen (32) af bakken (30; 30') for at danne isbelægningen (72).
2. Bakketransportør (20) ifølge krav 1, hvor bakken (30) indbefatter en topafdækning af rustfrit stål, der danner toppen (32), og en bundafdækning af rustfrit stål, der danner bunden (34).
3. Bakketransportør (20) ifølge krav 1, hvor sporet (22) er belagt med en isbelægning (72), der er i kontakt med bakken (30).
4. Bakketransportør (20) ifølge krav 1, og som omfatter a) en is-refinisher (62; 74; 76; 80; 84) på transportbanen, hvor is-refinisheren (62; 74; 76; 80; 84) fjerner et øvre islag fra isbelægningen (72), der dækker toppen (32) af bakken (30'); eller b) en is-refinisher (62; 74; 76; 80; 84) på transportbanen, hvor is-refinisheren (62; 74; 76; 80; 84) fjerner et øvre islag fra isbelægningen (72), der dækker toppen (32) af bakken (30'), og hvor is-refinisheren (62; 74; 76; 80; 84) indbefatter et visningssystem, der frembringer billeder af isbelægningen (72), der dækker toppen (32) af bakken (30'), til at styre tykkelsen på det øvre islag fjernet fra isbelægningen (72); eller c) en is-refinisher (62) på transportbanen, hvor is-refinisheren

(62) fjerner et øvre islag fra isbelægningen (72), der dækker toppen (32) af bakken (30'), og hvor is-refinisheren (62) omfatter en roterende klinge (66), der trimmer det øvre islag fra isbelægningen (72); eller d) en is-refinisher (74) på transportbanen, hvor is-refinisheren (74) fjerner et øvre islag fra isbelægningen (72), der dækker toppen (32) af bakken (30'), og hvor is-refinisheren (74) omfatter en opvarmer, der anvender en flamme eller opvarmet luft til at smelte det øvre islag fra isbelægningen (72); eller e) en is-refinisher (76) på transportbanen, hvor is-refinisheren (76) fjerner et øvre islag fra isbelægningen (72), der dækker toppen (32) af bakken (30'), og hvor is-refinisheren (76) indbefatter en infrarød lampe (78) til at smelte det øvre islag fra isbelægningen (72); eller f) en is-refinisher (80) på transportbanen, hvor is-refinisheren (80) fjerner et øvre islag fra isbelægningen (72), der dækker toppen (32) af bakken (30'), og hvor is-refinisheren (80) indbefatter en fluidstråle (82) til at skære det øvre islag fra isbelægningen (72); eller g) en is-refinisher (84) på transportbanen, hvor is-refinisheren (84) fjerner et øvre islag fra isbelægningen (72), der dækker toppen (32) af bakken (30'), og hvor is-refinisheren (84) indbefatter en modstandswire (86) som et varmeelement, der strækker sig over transportbanen for at smelte det øvre islag fra isbelægningen (72); eller h) en is-refinisher (84) på transportbanen, hvor is-refinisheren (84) fjerner et øvre islag fra isbelægningen (72), der dækker toppen (32) af bakken (30'), og hvor is-refinisheren (84) smelter det øvre islag og indbefatter et vakuumssystem (88) til at fjerne vandet som følge af det smeltede øvre lag.

5. Bakketransportør (20) ifølge krav 1, og som omfatter a) en bakkedefroster (90) på transportbanen til at fjerne hele isbelægningen fra bakken (30), eller b) en bakkedefroster (90) på transportbanen til at fjerne hele isbelægningen fra bakken (30), og hvor bakken (30) indbefatter en elektrisk ledende kobber- eller aluminiumsplade (38), og hvor bakkedefrosteren (90) indbefatter:

et stop (92), der strækker sig over transportbanen og har en spalte (96) dimensioneret til at blokere en bakke (30) med isbelægningen (72) og til at gøre det muligt for en bakke (30) med isbelægningen (72) fjernet at passere igennem;

en lineær induktionsmotorstator (94) tæt på stoppet (92) og som frembringer en bevægende elektromagnetisk fluxbølge, der inducerer strømme i den elektrisk ledende kobber- eller aluminiumsplade (38), der opvarmer bakken (30) og smelter isbelægningen (72); eller c) en bakkedefroster (114) på transportbanen til at fjerne hele isbelægningen (72) fra bakken (30'), og hvor bakken (30') indbefatter en elektrisk ledende kobber- eller aluminiumsplade (38), og hvor bakkedefrosteren (114) indbefatter:

et stop (92), der strækker sig over transportbanen og har en spalte (96) dimensioneret til at blokere en bakke (30') med isbelægningen (72) og for at gøre det muligt for en bakke (30') med isbelægningen (72) fjernet at passere igennem;

en lineær induktionsmotorstator (94) tæt på stoppet (92) og som frembringer en bevægende elektromagnetisk fluxbølge, der inducerer strømme i den elektrisk ledende kobber- eller aluminiumsplade (38), der opvarmer bakken (30') og smelter isbelægningen, og hvor den lineære induktionsmotorstator (94) er under sporet, og hvor sporet indbefatter en roterbar del (118), der roterer bakken (30') 180° omkring transportbanen, således at bakkens top vender mod den lineære induktionsmotorstator (94) under sporet; d) en bakkedefroster (102) på transportbanen til at fjerne hele isbelægningen fra bakken (30), og hvor bakkedefrosteren (102) indbefatter:

en vippeaktuator til at vippe en vipbar del (104) af sporet og bakken; en jævnstrømsspoledriver forbundet med drivspolerne i den vipbare del af sporet til at frembringe et elektromagnetisk felt, der tiltrækker gruppen af permanentmagneter i bakken for at forhindre bakken i at falde af sporet; eller e) en bakkedefroster (102) på transportbanen til at fjerne hele isbelægningen fra bakken, og hvor bakkedefrosteren indbefatter:

en vippeaktuator til at vippe en vipbar del (104) af sporet og bakken;

en jævnstrømsspoledriver forbundet med drivspolerne i den vipbare del af sporet til at frembringe et elektromagnetisk felt, der tiltrækker gruppen af permanentmagneter i bakken for at forhindre bakken i at falde af sporet, og som omfatter en infrarød lampe (112), der dirigerer stråling til den vippede bakke for at optø den vippede bakke.

6. Backetransportør (20) ifølge krav 1, hvor spoledriveren (162) driver drivspolerne (46) til at frembringe et ikke-kommuteret elektromagnetisk jævnstrømsfelt til tiltrækning af gruppen af permanentmagneter (36) og fastholdelse af bakken (30) på sporet (22).

7. Backetransportør (20) ifølge krav 1, hvor sporet (22) omfatter et par parallelle skinner (24L, 24R), der hvert indbefatter en gruppe af de elektromagnetiske drivspoler (46), og hvor bakken (30) har et par grupper af parallelle permanentmagneter flugtende med grupperne af elektromagnetiske drivspoler i skinnerne.

8. Backetransportør (20) ifølge krav 1, hvor gruppen af elektromagnetiske drivspoler og gruppen af permanentmagneter danner en børsteløs jævnstrømsmotor.

9. Fremgangsmåde til transport af produkter gennem en proces ved hjælp af en backetransportør ifølge et hvilket som helst af de foregående krav, hvilken fremgangsmåde omfatter:

- (a) fremføring af en magnetisk bakke (30) langs et spor (22) med et lineært motordrev;
- (b) tilsætning af en isbelægning (72) på toppen (32) af bakken (30) ved frysning af en isafdækning og anbringelse heraf på bakken (30);
- (c) placering af et produkt (52) på isbelægningen (72) på bakken (30);
- (d) behandling af produktet (52);
- (e) fjernelse af produktet (52) fra bakken (30) under eller efter, det gennemgår processen;
- (f) fjernelse af mindst et øvre islag fra isbelægningen (72), der dækker toppen (32) af bakken (30);
- (g) gentagelse af trin (c) til og med (f).

10. Fremgangsmåde ifølge krav 9, og som omfatter fjernelse af hele isbelægningen (72) fra bakken (30) ved optøning og desinfektion af den optøede bakke (30).

11. Fremgangsmåde ifølge krav 9, og som omfatter vipning af bakken (30) for fjernelse af det øvre islag fjernet fra bakken (30).

12. Fremgangsmåde ifølge krav 9, og som omfatter tilsætning af et islag på bakken (30) for at erstatte det øvre lag af isbelægningen fjernet før gentagelse af trin (c) til og med (f).

DRAWINGS

Drawing

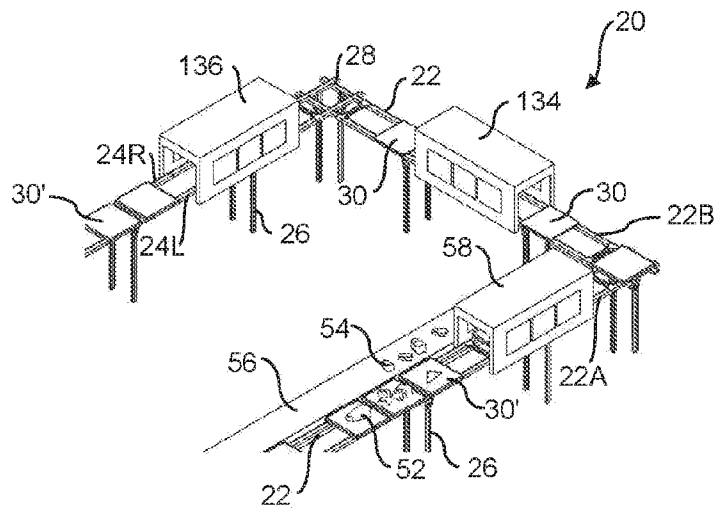


FIG. 1

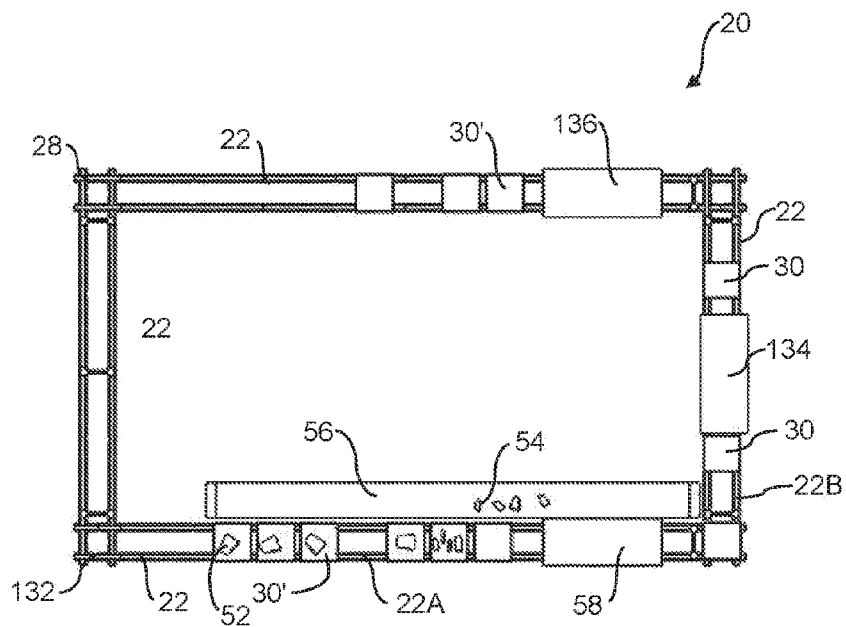


FIG. 2

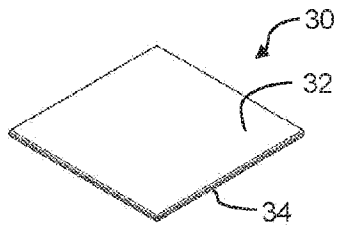


FIG. 3

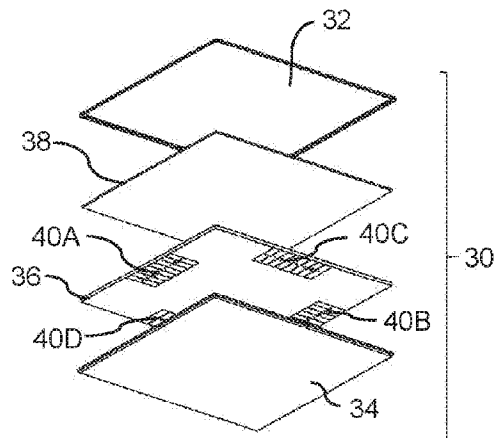


FIG. 4

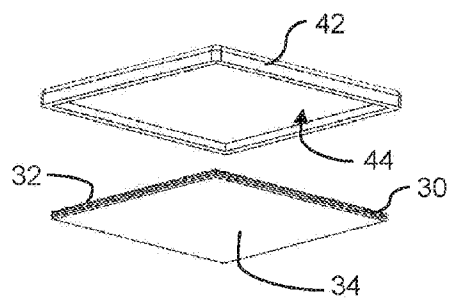


FIG. 5

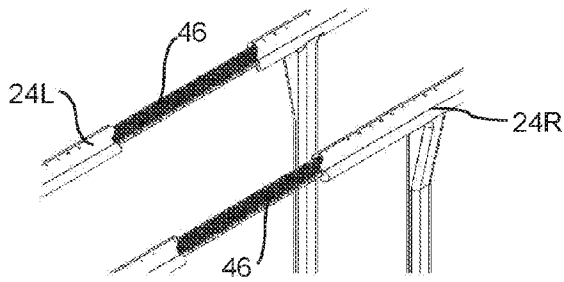


FIG. 6

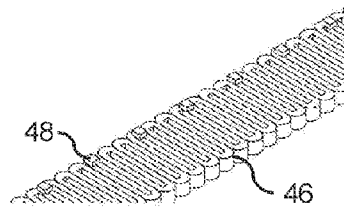


FIG. 7

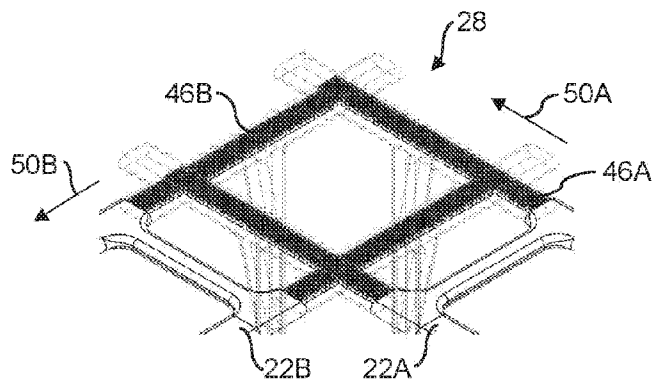


FIG. 8

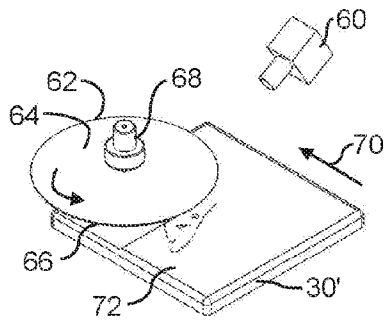


FIG. 9

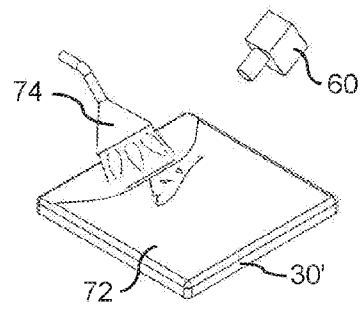


FIG. 10

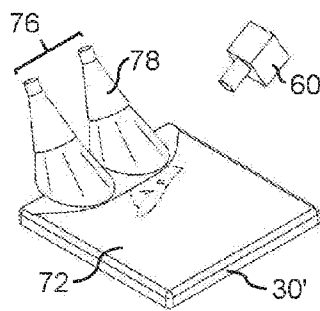


FIG. 11

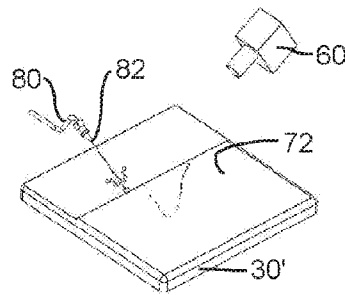


FIG. 12

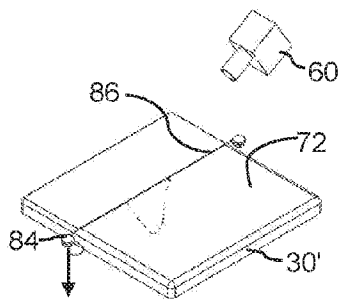


FIG. 13

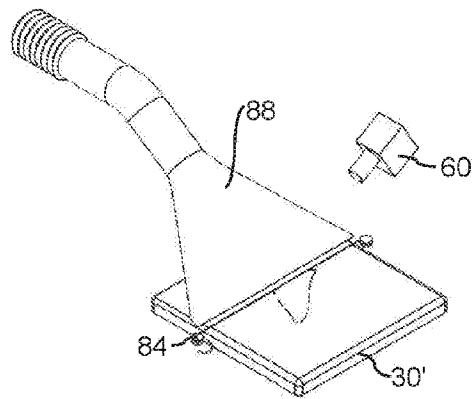


FIG. 14

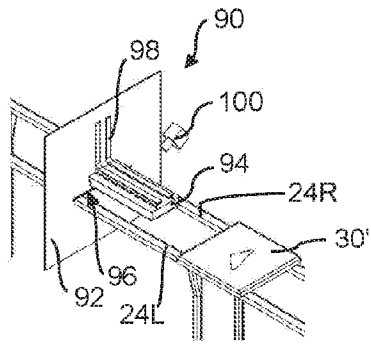


FIG. 15A

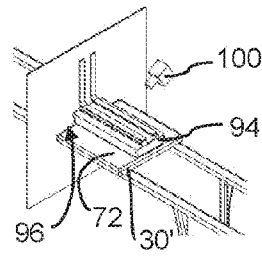


FIG. 15B

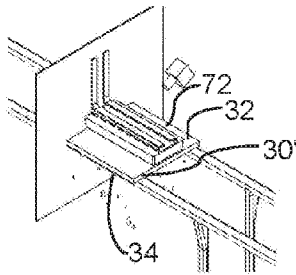


FIG. 15C

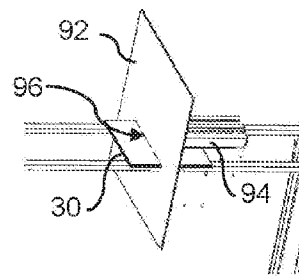


FIG. 15D

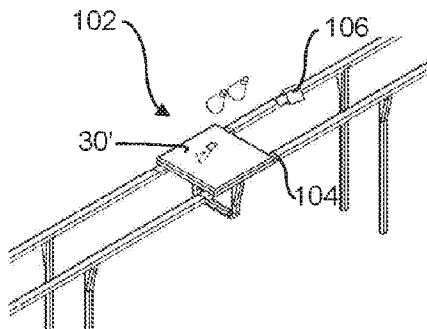


FIG. 16A

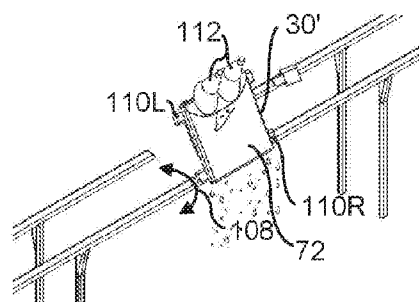


FIG. 16B

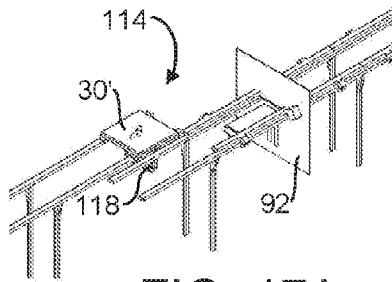


FIG. 17A

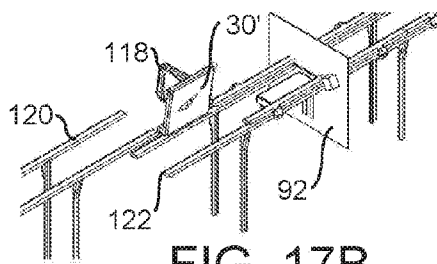


FIG. 17B

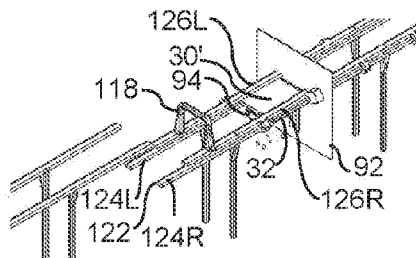


FIG. 17C

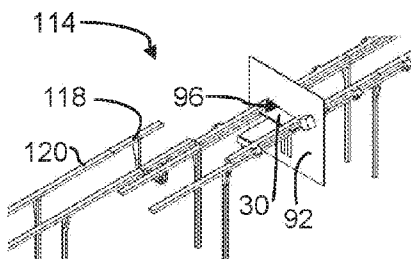


FIG. 17D

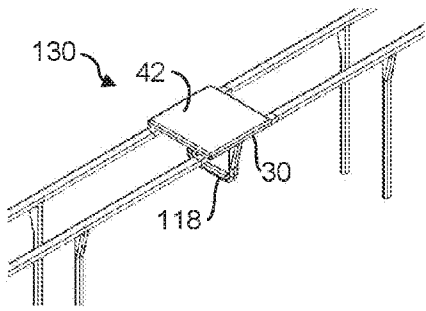


FIG. 18A

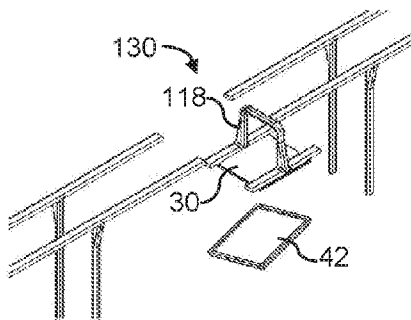


FIG. 18B

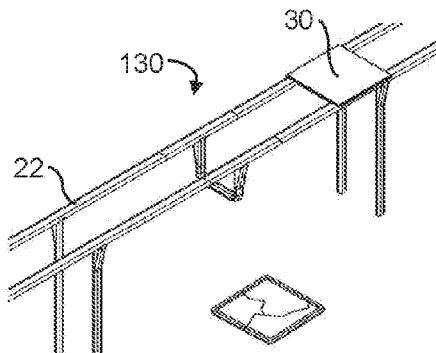


FIG. 18C

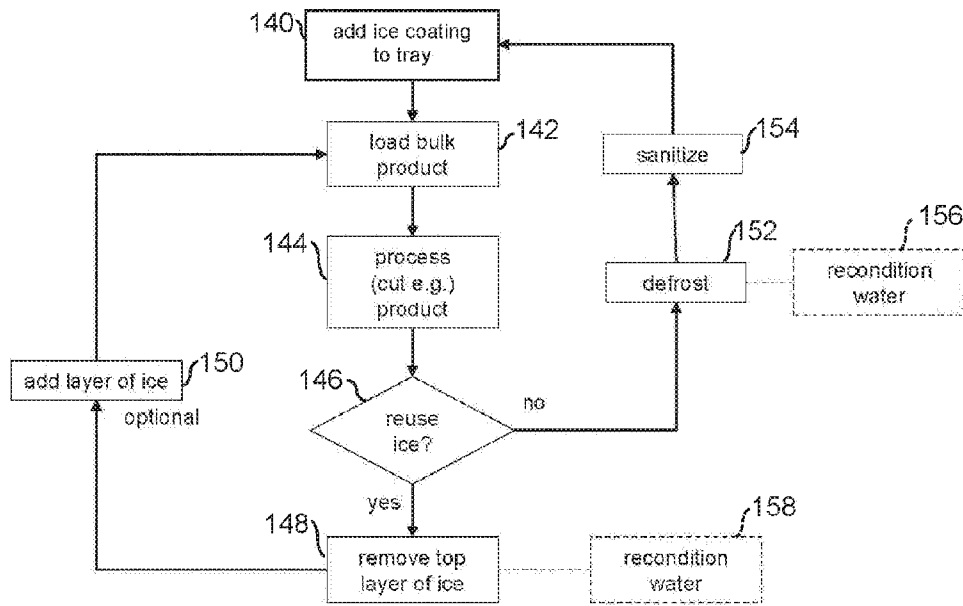


FIG. 19

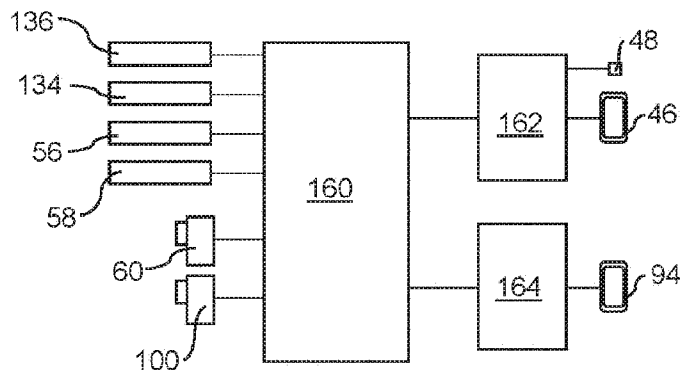


FIG. 20