

RIGHT ANGLE TRANSFER DECK

This invention relates to conveyor systems generally, and more particularly, to right angle transfer decks.

A conveyor system, such as a land-side or fixed air cargo system, for example, requires means for rotating about a vertical axis the articles conveyed thereby, as well as means for transferring or shifting such articles, i.e., moving the articles at right angles or transverse to the former direction of movement, without rotation. The number of such rotate means, i.e., rotate decks, required in any system is usually far less than the number of such right angle transfer means, i.e., right angle transfer decks, because the conveyed article usually needs to be rotationally positioned only once while the conveyed article may be selectively transferred at right angles at each intersection of straight conveyors in the system, as well as at each place of discharge from the system. Usually a rotate deck can also function as a right angle transfer deck, but a right angle transfer deck cannot function as a rotate deck. Rotate decks require complex structures and/or several independently controllable power sources and hence are difficult and expensive to manufacture and maintain. A rotate deck of this type is disclosed in our United Kingdom Patent No. GB2174966. The need for an effective, reliable, and relatively inexpensive right angle deck is apparent.

The present invention provides a right angle transfer deck which reliably and consistently side-shifts conveyed articles upon demand and yet functions just as reliably and

consistently as a straight conveyor when desired, which is relatively simple and inexpensive to manufacture and maintain, and which preferably requires fewer components and, in particular, a minimum number of independently controllable power sources or motors.

According to the present invention, a deck for translating an article such as a pallet in a straight ahead direction or in either direction orthogonal to the straight ahead direction, comprises:

- a frame having a rectangular shape complementary to a rectangular shape of the pallet or article;

- first and second sets of shafts journaled to the frame substantially in parallel and in longitudinally spaced apart relationship to form an elongate substantially coplanar array, the shafts of the first set alternating with the shafts of the second set;

- a plurality of roller clusters mounted upon and rotatable with each shaft;

- the rollers of a given cluster all being angled in the same direction and the clusters on each shaft all having rollers angled in the same direction;

- the clusters of said first and second shaft sets having rollers angled in different directions; and,

- the shafts within each set being drivingly connected together and connected to a respective variable drive means,

- whereby the first and second shaft sets may be independently rotated as sets in opposite or similar directions with respect to each other for translating the pallet selectively in one of the orthogonal directions or for moving the pallet in the straight ahead direction.

Thus the present invention provides a relatively simple and inexpensive transfer deck particularly suited to the accurate translation of articles without rotation.

Other attributes of the present invention will be apparent from the Claims. A preferred embodiment of the invention is described below by way of example and with reference to the drawings, wherein:

Figure 1 is a top plan view of a right angle deck, with portions thereof eliminated or illustrated schematically for

clarity, according to the present invention; and

Figure 2 is a table showing the direction of rotation required of the shafts incorporated into the deck of Figure 1 in order to achieve various directions of movement for the conveyed article.

Referring now to Figure 1, there is shown a deck, indicated generally at 10, having a frame 12 which is formed by rigidly connecting a pair of shorter structural members 14 and 16 and a pair of longer structural members 18 and 20. These members form a generally rectangular outline in plan form, which preferably is proportional to and compatible with the dimensions of the largest pallet to be handled by the deck 10. Such pallets would be conveyed onto the deck 10 from the left or the right by the system with which the deck is associated with the long axis of the pallet transverse to the shorter members 14 and 16, and discharged from the top or bottom, i.e., in the direction of the up or down arrows with the long axis of the pallet remaining essentially perpendicular to the shorter members 14 and 16. Similarly, the pallets could be conveyed onto the deck 10 from either the UP or DOWN direction and discharged to either the LEFT or to the RIGHT with the long axis of the pallet oriented as explained before. The pallets, or any other flat-bottomed article, can be conveyed from left to right, or right to left, and from top to bottom and vice versa.

A plurality of shafts 22A - 22J extend across the frame 12 and are journaled at each end by conventional bearings in the longer beams 18 and 20. The plurality shafts are

preferably even in number and are arranged parallel to each other and spaced essentially an equal distance apart. Preferably, the shafts are rotatably supported by bearings carried by a support member 24 extending between and connected to the shorter members 14 and 16 intermediate their ends. This support member 24 permits smaller diameter shafts 22A - 22J without encountering excessive deflection from the bending loads imposed by the weight of the articles conveyed by the deck.

Each of the shafts 20A, 20C, 20E, 20G and 20I have a plurality of clusters 26 affixed thereto with a plurality of barrel-shaped rollers 28 freely rotatable thereon. The rollers 28 are preferably oriented with their axes at substantially a forty-five degree angle relative to the axis of the shaft to form a right hand cluster, although other angles are possible. Clusters 30 are affixed to the shafts 20B, 20D, 20F, 20H and 20J. Each cluster 30 has a plurality of barrel-shaped rollers 32 freely rotatably mounted thereon. The rollers 32 are preferably oriented with their axes at substantially a forty-five degree angle relative to the axis of the shaft and in mirror image to the angle of rollers 28, to form a left hand cluster. However, other angles are again possible. The clusters 26 and 30 may be similar to the clusters utilized in United Kingdom Patent Serial Number 2213908.

The rollers 28 and 30 contact and support the bottom of the containers or pallets. When the shafts on which the clusters are mounted are rotated, the rollers exert a force on

the bottom of the containers along the axis of the rotation for the rollers, as indicated by the arrows associated with the single roller 28 in the lower left corner of the deck 10. Rotation of the shafts 22A, 22C, 22E, 22G and 22I in a clockwise direction (the direction of rotation here, and as referred to hereinafter, is as viewed looking up from the lower side of the deck 10 in Figure 1.), the force exerted on the bottom of a container in contact with the rollers 28 will be along the axis of the rollers 28 in the direction of the arrow 34. Rotation of the aforementioned shafts in a counterclockwise direction will cause each roller 28 in contact with the container to exert a force in the direction of the arrow 36. Similarly, rotation of the shafts 22B, 22D, 22F, 22H and 22J in a clockwise and counterclockwise direction will result in the roller 32 carried by the clusters 30 exerting a force in the direction of arrows 38 and 40 respectively. When all shafts are rotated clockwise at the same speed, the component of the force indicated by arrow 34 in the UP direction is offset or cancelled by the DOWN component of the force indicated by the arrow 38 and the components thereof directed toward the right cause the container to be translated toward the RIGHT. Similarly, rotation of all shafts in a counterclockwise direction will translate a container to the LEFT. Translating a container purely in the UP direction is achieved by rotating shafts 22A, 22C, 22E, 22G and 22I clockwise, while simultaneously rotating shafts 22B, 22D, 22F, 22H and 22J in a counterclockwise direction at the same speed. Translation in a DOWN direction

is achieved by reversing the directions of rotation recited immediately above. Translation of the container in any given direction may be achieved by rotating shaft set 22A, 22C, 22E, 22G and 22I and shaft set 22B, 22D, 22F, 22H and 22J with various combinations of speed and direction respectively. Thus the expression "right angle transfer deck" used herein refers to a deck capable of imparting components of motion of various magnitudes and signs, simultaneously along two directions at right angles, including the special cases wherein the component of motion in either of those directions is zero.

A reversible rotary drive 44 has a pair of sprockets 46 and 48 secured to the output shaft 50 of the drive. A pair of sprockets 52 and 54 are secured to the shaft 22E. A chain 56 is trained over the sprockets 46 and 52 to drive the shaft 22E when the output shaft 50 of the drive 44 is rotated. A pair of sprockets are also attached to the shafts 22C and 22G with a chain 58 engaging the sprocket 48 to drive the shaft 22G and a chain 60 engaging the sprocket 54 to the drive shaft 22C. A chain 62 trained over the other sprocket on shaft 22C to drive a sprocket affixed to the shaft 22A. The shaft 22I is driven by a chain 64. Thus, the shafts 22A, 22C, 22E, 22G and 22I are all driven in the same direction by the drive 44. Similarly, the shafts 22B, 22D, 22F, 22H and 22J are driven by a reversible motor 66 through a comparable arrangement of sprockets and chains 68, 70, 72, 74 and 76. The table of Figure 2 illustrates the direction of rotation of each of the shafts 22A - 22J in order to achieve the direction listed in

the left column thereof. The direction of rotation is indicated by both an arrow and CW for clockwise and CCW for counterclockwise. The summation of the force components in the UP and DOWN directions is essentially zero when all shafts are rotated in the same direction at the same speed, and the summation of the force components in the LEFT and RIGHT directions is essentially zero when adjacent shafts are rotated in opposite directions at the same speed.

It will be apparent that it is possible to achieve resultant forces of any magnitude and in any direction by suitably varying the speeds and directions of rotation of the respective shaft sets, 22A, 22C, 22E, 22G, 22I and 22B, 22D, 22F, 22H, and 22J. It will also be apparent that the rollers in each set need not be oriented in mirror image to one another, or at 45° to their respective shafts, in order to achieve the desired resultant forces. Thus, while a preferred embodiment of the present invention has been illustrated and described herein, various changes may be made therein without departing from the scope of the invention as defined by the appended Claims.

CLAIMS

1. A deck for translating an article such as a pallet in a straight ahead direction or in either direction orthogonal to the straight ahead direction, comprising:

a frame having a rectangular shape complementary to a rectangular shape of the pallet or article;

first and second sets of shafts journally mounted to the frame substantially in parallel and in longitudinally spaced apart relationship to form an elongate substantially coplanar array, the shafts of the first set alternating with the shafts of the second set;

a plurality of roller clusters mounted upon and rotatable with each shaft;

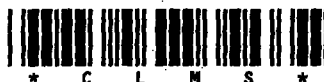
the rollers of a given cluster all being angled in the same direction and the clusters on each shaft all having rollers angled in the same direction;

the clusters of said first and second shaft sets having rollers angled in different directions; and,

the shafts within each set being drivingly connected together and connected to a respective variable drive means,

whereby the first and second shaft sets may be independently rotated as sets in opposite or similar directions with respect to each other for translating the pallet selectively in one of the orthogonal directions or for moving the pallet in the straight ahead direction.

2. A transfer deck according to claim 1 wherein the rollers of the first shaft set are angled in mirror image to the rollers of the second shaft set to form right hand and left hand clusters respectively.



3. A transfer deck according to claim 2 wherein said drive means comprises:

an independently controlled and reversible first drive transmission means connecting a first power means to rotate the shafts having right hand clusters; and

an independently controlled and reversible second drive transmission means connecting a second power means to rotate the shafts having left hand clusters.

4. A transfer deck according to Claim 1, 2 or 3, including:

a support member extending transversely to said shafts and secured to said frame; and

bearing means carried by said member to rotatably support said shafts intermediate their ends.

5. A right angle transfer deck substantially as described with reference to or as shown in the drawings.



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