Abstract: A trolley assembly for a conveyor system includes a pair of trolley arms having wheels for rolling engagement with a track or rail of the conveyor system. A trolley attachment is adjustably mounted to the trolley arms and adjusted relative to the trolley arms to adjust a position of the trolley attachment relative to the wheels. The trolley attachment is positionable at a selected one of a plurality of vertical positions relative to the trolley arms and the trolley attachment is retained at the selected one of the plurality of vertical positions by engagement of the trolley attachment with the trolley arms. The engaging elements of the trolley arms or attachment may comprise projections, and the engaging elements of the other of the trolley arms or attachment may comprise recesses, with the recesses receiving the projections when the trolley attachment is positioned between the inner surfaces of the trolley arms.
ADJUSTABLE HEIGHT TROLLEY ASSEMBLY
CROSS REFERENCE TO RELATED APPLICATIONS

The present application claims the benefit of U.S. provisional applications, Serial No. 61/119,161 filed December 2, 2008, and Serial No. 61/182,405, filed May 29, 2009, which are hereby incorporated herein by reference in their entireties.

FIELD OF THE INVENTION

The present invention relates generally to trolley assemblies for conveyors of material handling systems and, more particularly, to a trolley assembly with a wheel rotatably mounted to a trolley arm or bracket for travel along an I-beam or the like of the material handling system.

BACKGROUND OF THE INVENTION

Conveyor trolleys typically have trolley arms and wheels that are moved along a rail or track by a drive chain and that support or are attached to a load bar or trolley attachment or pusher dog or other item below the rail or track. Typically, the trolley attachment is fixedly mounted to the trolley arms such that the drive chain and the attachment are at fixed heights or separation distances relative to the rail or track.

SUMMARY OF THE INVENTION

The present invention provides a trolley assembly that has an adjustable connection or mounting structure for adjustably mounting a pusher dog or trolley attachment or the like to the trolley arms of the trolley assembly. The trolley assembly thus provides for adjustment of the height of the pusher dog or trolley attachment and/or drive chain relative to the trolley wheels and track or rail of the conveying system.

These and other objects, advantages, purposes and features of the present invention will become apparent upon review of the following specification in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an adjustable height trolley assembly in accordance with the present invention;

FIG. 2 is a front elevation of the trolley assembly of FIG. 1, with a pusher dog in a lowered position;

FIG. 2A is an enlarged view of the area designated A in FIG. 2;
FIG. 3 is a side elevation of the trolley assembly of FIG. 2;
FIG. 4 is a front elevation view of the trolley assembly of FIG. 1, with the pusher dog in a raised position;
FIG. 4A is an enlarged view of the area designated A in FIG. 4;
FIG. 5 is a side elevation of the trolley assembly of FIG. 4;
FIG. 6A is a front elevation and partial sectional view of another adjustable height trolley assembly in accordance with the present invention, shown with a pusher dog in a raised position;
FIG. 6B is a front elevation and partial sectional view of the adjustable height trolley assembly of FIG. 6A, shown with the pusher dog in a lowered position with a spacer element;
FIG. 6C is a front elevation and partial sectional view of the adjustable height trolley assembly of FIGS. 6A and 6B, shown with the pusher dog in a further lowered position with two spacer elements;
FIG. 7 is a side elevation of the trolley arm assembly of the trolley assembly of FIGS. 6A-C;
FIG. 8 is an end elevation and partial sectional view of the trolley arm assembly of FIG. 7;
FIG. 9 is a perspective view of the trolley arm of the trolley assembly of FIGS. 7 and 8;
FIG. 10 is a perspective view of a pusher dog of the trolley assembly of FIGS. 6A-C;
FIG. 11 is a side elevation of the pusher dog of FIG. 10;
FIG. 11A is an enlarged sectional view of the area A of FIG. 11;
FIG. 12 is an end elevation of the pusher dog of FIGS. 10 and 11;
FIG. 13 is a perspective view of a spacer element suitable for use with the trolley assembly of FIGS. 6A-C;
FIG. 14 is a plan view of the spacer element of FIG. 13;
FIG. 15 is a side elevation of the spacer element of FIGS. 13 and 14;
FIG. 16 is an exploded perspective view of another adjustable trolley assembly in accordance with the present invention;
FIG. 17 is an exploded end view of the adjustable trolley assembly of FIG. 16;
FIG. 18 is an exploded top plan view of the adjustable trolley assembly of FIG. 16;
FIG. 19 is an exploded sectional view of the adjustable trolley assembly of FIG. 16;
FIG. 20 is an exploded side elevation of the trolley arm and pusher dog of the adjustable trolley assembly of FIG. 16;

FIG. 21 is a side elevation of the trolley arm and pusher dog of FIG. 20, shown as assembled together and set at a nominal height;

FIG. 22 is a side elevation of the adjustable trolley assembly of FIG. 16, showing three different levels at which the pusher dog height may be set;

FIG. 22A is another side elevation of the adjustable trolley assembly of the present invention, showing five different levels at which the pusher dog height may be set, and showing position indicators that indicate the selected level of the pusher dog relative to the trolley arms;

FIG. 23 is an exploded perspective view of another adjustable trolley assembly in accordance with the present invention;

FIG. 24 is an exploded end view of the adjustable trolley assembly of FIG. 23;

FIG. 25 is an exploded top plan view of the adjustable trolley assembly of FIG. 23;

FIG. 26 is an exploded sectional view of the adjustable trolley assembly of FIG. 23;

FIG. 27 is an exploded side elevation of the trolley arm and pusher dog of the adjustable trolley assembly of FIG. 23;

FIG. 28 is a side elevation of the trolley arm and pusher dog of FIG. 27, shown as assembled together and set at a nominal height;

FIGS. 29A-C are side elevations of another adjustable trolley assembly showing three different levels at which a claw dog attachment of the trolley assembly may be set by adjustment of a lobed adjustment bolt;

FIG. 30 is a side elevation of a lobed adjustment bolt suitable for use with the adjustable trolley assembly of FIGS. 29A-C;

FIGS. 30A-E show different orientations of the lobed adjustment bolt for adjusting the height of the claw dog attachment;

FIG. 31 is a sectional view of the adjustable trolley assembly of FIGS. 29A-C, showing how the lobed bolt is received through the trolley assembly;

FIG. 32 is a side elevation of a locking bracket of the adjustable trolley assembly of FIGS. 29A-C;

FIG. 33 is a side elevation of a non-locking bracket of the adjustable trolley assembly of FIGS. 29A-C;
FIG. 33A is a sectional view taken along the line A-A in FIG. 33;
FIG. 34 is a side elevation of a claw dog attachment of the adjustable trolley assembly of FIGS. 29A-C;
FIG. 35 is an end elevation of the claw dog attachment of FIG. 34;
FIG. 36 is a perspective view of a two wheeled trolley assembly with a claw dog attachment attached to the trolley arms of the trolley assembly in accordance with the present invention;
FIG. 37 is an end elevation and partial sectional view of the trolley assembly of FIG. 36;
FIG. 38 is a side elevation of the claw dog attachment of the trolley assembly of FIGS. 36 and 37;
FIG. 39 is a perspective view of a four wheeled trolley assembly with a claw dog attachment attached to the trolley arms of the trolley assembly in accordance with the present invention;
FIG. 40 is an end elevation and partial sectional view of the trolley assembly of FIG. 39;
FIG. 41 is a side elevation of the claw dog attachment of the trolley assembly of FIGS. 39 and 40;
FIG. 42 is an end elevation of the claw dog attachment of FIG. 41;
FIG. 43 is a perspective view of a free trolley assembly with an engaging portion adjustably mounted to the trolley in accordance with the present invention;
FIG. 44 is a side elevation of the free trolley assembly of FIG. 43;
FIG. 44A is a sectional view taken along the line A-A in FIG. 44;
FIG. 45 is an end elevation of the free trolley assembly of FIG. 43;
FIG. 45A is a sectional view taken along the line A-A in FIG. 45; and
FIG. 45B is a sectional view taken along the line B-B in FIG. 45.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings and the illustrative embodiments depicted therein, a trolley assembly 10 includes wheels or wheel assemblies 12, a pair of trolley arms 14 and a trolley attachment or trolley engaging member 16, such as a pusher dog or the like (FIGS. 1-5). In the illustrated embodiment, the trolley assembly 10 is movable along an I-beam track or rail 18 (FIGS. 3 and 5), such as via movement of a drive chain or the like attached to or connected with the trolley arm 14 and/or pusher dog 16. The pusher dog 16 is adjustably mounted to or
attached to the trolley arms 14 and is adjustable to adjust the height of the pusher dog or location of the pusher dog relative to the trolley arms and the I-beam track or rail 18, as discussed below.

Trolley assembly 10 includes one or more wheels or wheel assemblies 12 mounted at the wheel mounting portion 14a of the trolley arm or arms 14. For example, each trolley arm may have a single wheel assembly mounted thereon (such that the trolley assembly has a total of two wheels, one on each side of the center web of the I-beam track or rail) or each trolley arm may have two wheels or wheel assemblies mounted thereon (such as shown in FIGS. 1, 3 and 5 and such that the trolley assembly has a total of four wheels, two on each side of the center web of the I-beam track or rail), or each trolley arm may have any other number of wheels mounted thereon, depending on the particular application of the trolley assembly.

Each wheel assembly 12 includes a wheel 20, which is rotatably mounted to an axle that extends along an axis of rotation of wheel 20. The axle is secured to a wheel mounting portion 14a of a respective trolley arm 14, whereby wheels 20 rotates about the axles as the trolley assembly 10 and trolley arms 14 travel along an I-beam track or rail 18 or the like of a trolley conveyor system of a material handling system. The wheels may be rotatably mounted to the respective axles via a bearing assembly or the like, such as a bearing device comprising bearings or bearing elements (not shown). Such bearings or bearing elements may comprise any suitable element, such as ball bearings or journal bearings or other known bearings, or such as journal bearings of the types described in U.S. Pat. No. 6,880,469, and/or U.S. patent application Serial No. 12/191,348, filed August 14, 2008 (Attorney Docket FRO01 P-395A), which are hereby incorporated herein by reference in their entireties, without affecting the scope of the present invention.

In the illustrated embodiment, each trolley arm 14 includes wheel mounting portion 14a, a curved arm element or portion 14b that extends downward from wheel mounting portion 14a, and a lower attachment portion 14c that extends downward from a lower end region of curved arm portion 14b and that is connectable to the trolley attachment or pusher dog 16. In the illustrated embodiment, attachment portion 14c includes a passageway or hole or slot 14d (FIGS. 3 and 5), and may include two slots 14d, for receiving a fastener therethrough for retaining the trolley arms 14 and pusher dog 16 together. Trolley arms 14 may be clamped or fastened together to entrap or lock an upper portion or web or mounting portion 16a of pusher dog 16 therebetween, such as by placing threaded fasteners (not shown) through slots or apertures 14d
and tightening threaded nuts thereon. As shown in FIGS. 2, 2A, 4 and 4A, attachment portion 14c includes engaging elements 22 (such as ribs or recesses, such as the ribs or protrusions shown in FIGS. 2, 2A, 4 and 4A) for adjustably securing the pusher dog 16 or the like to the trolley arms, as discussed below.

Optionally, the lower portion of the trolley arms may be formed to be attach to the drive chain, such as by being received through a chain link (such as a center link) of the drive chain to attach or connect the trolley assembly to the drive chain. Optionally, the attachment portion 14c (and/or the attached trolley attachment) may be configured to attach to a load bar or the like, such as is known in the art and such as by utilizing known aspects or by utilizing aspects of the trolley attachment described in U.S. Patent No. 7,334,527, which is hereby incorporated herein by reference in its entirety.

Trolley attachment or pusher dog 16 functions to transfer power from the power or drive chain to the trolley assembly. In the illustrated embodiment, pusher dog 16 includes upper mounting portion 16a, a drive chain connecting portion 16b, and a lower portion 16c. The drive chain connecting portion 16b is configured to be received in or through a chain link, such as a center chain link of the drive chain to connect the pusher dog and trolley assembly to the drive chain. As shown in FIGS. 2, 2A, 4 and 4A, mounting portion 16a includes engaging elements 24 (such as ribs or recesses, such as the recesses or grooves shown in FIGS. 2, 2A, 4 and 4A) for adjustably securing the pusher dog 16 or the like to the trolley arms 14, as discussed below. The mounting portion 16a also includes apertures or holes (not shown in FIGS. 1-5) for receiving the fasteners therethrough when securing the pusher dog to the trolley arms, as also discussed below. Pusher dog 16 thus facilitates connection of the trolley assembly to a drive chain or other drive system, or facilitates other means (such as manual) for moving the trolley assembly 10, and can be installed at a selected height relative to trolley arms 14.

Thus, mounting portion 14c of trolley arm or bracket 14 may include a plurality of vertically evenly-spaced apart elongate engaging members or projections or ribs 22 that engage a set of corresponding vertically evenly-spaced apart engaging members or elongate recesses or slots or grooves 24 on the mounting portion 16a of pusher dog 16. For example, multiple (such as, for example, three or four, or more or less) evenly-spaced ribs 22 may project from the lower attachment portion 14c of each of the two opposed trolley arms 14, while the mounting portion 16a of pusher dog 16 may include multiple (such as, for example, four or five, or more or less)
slots or recesses 24 on each of the opposite faces of mounting portion 16a of pusher dog 16. Thus, the mounting portion 16a may be positioned between the attachment portions 14c of trolley arms 14 and the projections or ribs 22 may be received in selected respective recesses or grooves 24 of the mounting portion 16a. When so positioned, the fasteners may be inserted through or received in the slots 14d of attachment portions 14c and the passageways or apertures of the mounting portion 16a to secure the trolley arms to the pusher dog by clamping the attachment portions 14c toward one another and into engagement with the mounting portion 16a.

By selectively engaging the ribs 22 of each trolley arm 14 with the uppermost slots 24 on each face of mounting portion 16a of pusher dog 16, the pusher dog 16 may be positioned at a raised or upper position relative to trolley arms 14 (FIGS. 4 and 5). Alternately, by selectively engaging the ribs 22 of each trolley arm with the lowermost slots 24 on each face of mounting portion 16a of pusher dog 16, pusher dog 16 is positioned at a lowered or bottom position relative to trolley arms 14 (FIGS. 2 and 3). Thus, pusher dog 16 may be positioned at varying heights relative to trolley arms 14 and track or rail 18, such as to accommodate various drive systems or space or packaging constraints (such as to provide the desired spacing between a centerline of the wheels and a centerline of the drive chain or the like).

Although shown as having four slots and three ribs (and thus the pusher dog is only adjustable between two positions, a raised position and a lowered position), clearly other configurations may be implemented, while remaining within the spirit and scope of the present invention. For example, one of the components may have a plurality of slots, such as four or five or more slots, while the other component may have one or two or more ribs, such that the ribs and slots may engage to retain the components in one of three or more positions relative to one another to enhance the adjustability of the height or level of the pusher dog. Optionally, other engaging elements, such as other protruding and receiving members, such as cylindrical projections and recesses, or non-cylindrical or regular polygonal projections and recesses or the like, or irregular shaped projections with corresponding or complimentary irregular shaped recesses, may be utilized at the trolley arm and trolley attachment or pusher dog for supporting trolley attachment or pusher dog at a selected height between the trolley arms, while remaining within the spirit and scope of the present invention. Optionally, different vertically oriented inserts or plates with projections and/or recesses may be selectively disposed at the interface between the trolley arms and the pusher dog to establish different heights of the pusher dog.
relative to the trolley arms (with the different inserts providing the recesses/projections at
different levels relative to the aperture through which the fastener is inserted).

Although shown and described as having engaging elements or ribs or protrusions, the
trolley arm and pusher dog may otherwise interface with or engage one another in a manner that
allows for adjustment of the pusher dog relative to the trolley arm, while remaining within the
spirit and scope of the present invention. Optionally, for example, it is envisioned that the
engagement between the trolley arms and the pusher dog may provide a frictional engagement to
resist movement when the fasteners are tightened, whereby the pusher dog may be finely
adjusted to a plurality of different heights relative to the trolley arms.

When the ribs and slots (or other projections and recesses or the like) are mated together
to set the desired or appropriate height of the trolley engaging member or pusher dog, the drive
chain connecting portions 14b and the pusher dog 16 may be secured together, such as via one or
more fasteners or bolts or the like inserted through the apertures or slots (that extend through the
mounting portion 16a of pusher dog 16 as well as through the drive chain connecting portions
14b of trolley arms 14) and secured or tightened to retain the pusher dog at the selected height
and between the trolley arms. If desired, the height of the pusher dog may be adjusted, such as
when there are changes made to the conveying systems layout or design, without having to
replace the trolley assembly and/or pusher dog. Although shown as a pusher dog with a wider
lower end, it is envisioned that the pusher dog may comprise any shape, such as a generally
rectangular shape or any other suitable shape for the pusher dog, without affecting the scope of
the present invention. Optionally, other attachment elements or members or structures may be
adjustably attached to the trolley in a similar manner as described above, while remaining within
the spirit and scope of the present invention.

FIGS. 6A-C, show an alternative embodiment trolley assembly 10' in which the essential
differences are the use of a different type of pusher dog, labeled 16' to distinguish it from pusher
dog 16 of trolley assembly 10, and the of a spacer 26'. The cross section of a link 19a of chain
19 is also shown in Figs 6A-C. The rest of the members of trolley assembly 10' have been given
the same numbers, but with an added prime (') indication, as the corresponding members in
trolley assembly 10. The trolley assembly 10' is movable along an I-beam track or rail 18', such
as via movement of a drive chain 19' or the like attached to or connected with the trolley arm 14'
and/or pusher dog 16'. As with pusher dog 16, pusher dog 16' is adjustably mounted to or
attached to the trolley arms 14' and is adjustable to adjust the height of the pusher dog or location of the pusher dog relative to the trolley arms and the I-beam track or rail 18', in a similar manner as described above.

The trolley assembly 10' includes one or more spacer elements 26' that are selectively disposed or positioned between the chain link 19a' at the pusher dog and the pusher dog 16' and/or trolley arms 14' to fill in any gaps that may occur between the pusher dog and/or trolley arms and the chain link when the height of the pusher dog is adjusted relative to the trolley arms, as discussed below.

In the illustrated embodiment, the attachment portions 14c' of trolley arms 14' include vertically spaced apart ribs or recesses 22' (such as four ribs shown in FIGS. 8 and 9) forged or otherwise established at the attachment portions for adjustably engaging corresponding vertically spaced apart recesses 24' (such as six recesses shown in FIGS. 10-12) of mounting portion 16a' of pusher dog 16' for securing the pusher dog 16' to the trolley arms 14'. Other engaging elements and receiving elements, such as described above, may be utilized at the trolley arm 14' and pusher dog 16' for supporting pusher dog 16' at a selected height between trolley arms 14', while remaining within the spirit and scope of the present invention. Trolley arms 14' may be similar to trolley arms 14, discussed above, such that a detailed discussion of the trolley arms need not be repeated herein. As can be seen in FIGS. 6A-C, 8 and 9, the trolley arms include curved arm portions 14b' and attachment portions 14c' that each have four protrusions or engaging elements 22' and a pair of slotted openings or apertures 14d' formed through attachment portion 14c'. In the illustrated embodiment, attachment portion 14c' includes a flange or flared portion 14e' at its lower end region that terminates above the chain link 19a' and assists in limiting vertical movement of the chain link and the chain relative to the trolley arm and pusher dog as the trolley assembly is moved or driven along the conveying path.

Pusher dog 16' facilitates connection of the trolley assembly 10' to the chain links of the drive chain 19' or other drive system, or facilitates other means for moving the trolley assembly 10', and can be installed at a selected height relative to trolley arms 14'. The chain link 19a' may comprise a center link that is pinned or connected to a pair of side links at each end of the center link, such as is known in the art.

In the illustrated embodiment, pusher dog 16' may have a narrowed web or neck region or mounting portion 16a' and chain engaging portion 16b' that extend upward from a flange or
base surface 16d' at an upper region of a base or pusher or engaging portion 16c'. The chain engaging portion 16b' may be received through a chain link 19a' of the drive chain 19' (and may include a narrowed wall 16e' and a pair of thicker or wider wall portions 16f at opposite ends of the narrowed wall for enhanced structural rigidity of the pusher dog).

The upper mounting portion 16a' of the narrowed region or web has the spaced apart grooves or recesses 24' established thereat. As can be seen in FIGS. 10-12, grooves or recesses 24' may be forged or otherwise established at opposite surfaces of mounting portion 16a' formed at an upper region of pusher dog 16'. In the illustrated embodiment, the mounting portion 16a' comprises generally circular pads formed at the upper corner regions of the pusher dog. The thickness of the mounting portion 16a' is generally the same as the thickness of the wider wall portions 16f so that, when the trolley arms are drawn into tight engagement with the pusher dog (such as via the tightening of one or more fasteners 21' (FIGS. 7 and 8) that extend through apertures or slots 14d' of attachment portions 14c' of trolley arms 14' and through apertures 16g' at mounting portion 16a' of pusher dog 16'), the wider portions 16f may engage a lower portion of the trolley arm and limit relative movement between the pusher dog and the trolley arm.

In the illustrated embodiment, one or more spacer elements 26' are provided for positioning between the chain link 19a' and the pusher dog 16' and/or trolley arms 14' to fill in any gaps that may occur between the pusher dog and the chain link and/or between the trolley arms and the chain link when the height of the pusher dog is adjusted relative to the trolley arms. For example, and with reference to FIGS. 6A-C, when the pusher dog 16' is set at its highest setting (such as shown in FIG. 6A), the chain link 19a' may be snugly disposed between the flange or flared portion 14e' at the lower end region of trolley arms 14' and the base surface 16d' at an upper region of the base or pusher or engaging portion of pusher dog 16'. When the pusher dog 16' is lowered to, for example, a middle setting (such as shown in FIG. 6B), a spacer element 26' may be disposed between the lower surface of chain link 19a' and the base surface 16d' of pusher dog 16' to take up the gap that may otherwise occur between the fixed chain height and the pusher dog base when the pusher dog is lowered to that setting. Likewise, when the pusher dog 16' is lowered to, for example, a lower setting (such as shown in FIG. 6C), two spacer elements 26' may be disposed between the lower surface of chain link 19a' and the base surface 16d' of pusher dog 16' to take up the larger gap that may otherwise occur between the fixed chain height and the pusher dog base when the pusher dog is lowered to that setting.
[0080] Thus, the spacer element or elements maintain the desired fit or engagement of the chain with the pusher dog and/or trolley arms for any setting that the pusher dog may be set to relative to the trolley arms. In the illustrated embodiment, and with reference to FIGS. 13-15, the spacer elements 26' comprise generally ring-shaped elements that have an aperture 26a' therethrough that is shaped to receive the mounting portion 16a' and chain engaging portion 16b' of pusher dog 16' therethrough. As can be seen in FIGS. 13 and 15, the lower surface 26b' of spacer element 26' may be curved or angled at the end regions of the spacer element to generally correspond with an upwardly curved base surface of the pusher dog, so that the spacer element may substantially fully engage the base surface of the pusher dog when disposed thereat to reduce rocking or uneven engagement between the spacer element and the pusher dog. The width or thickness of the spacer element 26' is selected to generally correspond with the spacing between adjacent gaps or protrusions on the mounting portion or attachment portions so that one spacer element is used for each degree of adjustment of the pusher dog relative to the trolley arms.

[0081] Thus, the four protrusions of the trolley arms can be selectively engaged with selected sets of four recesses of the six recesses of the pusher dog to provide vertical adjustment of the pusher dog relative to the trolley arms to achieve the three height positions. When the pusher dog is positioned at the desired or selected height relative to the trolley arms, the pusher dog is sandwiched between the trolley arms and bolted into place. If the pusher dog is lowered, one or more spacers are provided to maintain the chain centerline height (by not allowing the chain to drop or sag to the lower level of the pusher dog).

[0082] Optionally, it is envisioned that the spacer element or elements may be provided as removable or replaceable wear surfaces to prolong the life cycle of the pusher dog and/or trolley arms. For example, a spacer element may be disposed between the lower surface of the chain link and the base surface of the pusher dog even when the pusher dog is at its highest level, such that the spacer may be replaced as it wears during operation of the conveyor system. Such a replaceable wear surface allows for the spacer element to be replaced to maintain the desired level of the conveyor chain (as the spacer element may wear as it moves relative to the chain link and/or the pusher dog as the conveyor chain and trolley negotiate the conveying path of the conveyor system). Optionally, the pusher dog and trolley arms may be formed so as to accommodate a spacer element between the lower surface of the chain link and the base surface.
of the pusher dog and to accommodate a spacer element between the upper surface of the chain link and the flange or flared portion of the trolley arms, even when the pusher dog is at its highest setting. Thus, one or both spacer elements could be replaced as they wore down during operation of the conveyor system.

Optionally, and desirably, the conveyor system may include a wear measurement device or system that is operable to detect a degree of wear of one or more spacer elements at the chain-pusher dog interface and/or at the chain-trolley arm interface. For example, a wear measurement device or system may detect a threshold change (such as a drop) in chain height to determine that a lower spacer element or replaceable wear surface is worn a targeted amount, or a wear measurement device or system may detect a threshold gap between the spacer element and the lower end or flange of the trolley arms to determine that an upper spacer element or replaceable wear surface is worn a targeted amount. The wear measurement device or system (which may be any suitable wear measurement device or system and may utilize aspects of the systems described in U.S. Patent Nos. 6,862,939; 6,993,978; 7,325,669; and/or 7,540,374, which are hereby incorporated herein by reference in their entireties) may generate an alert or warning or signal in response to a detection of a threshold degree of wear of one or more of the spacer elements and the spacer element or elements may be replaced, thereby providing new wear surfaces and bringing the relative position of the trolley arms and chain link and pusher dog back to or toward their initial design parameters, without having to replace the costly trolley arms and/or pusher dog. Thus, the replaceable wear surfaces or spacer elements provide an enhanced life cycle for the pusher dog and/or the trolley arms because the wear that would otherwise occur to those elements during operation of the conveyor system is absorbed by the spacer element or elements, which can be readily replaced when they have worn a threshold level.

In yet another embodiment, trolley assembly 110 may include an adjustable configuration or assembly to allow for adjustment of a pusher dog relative to a pair of trolley arms, such as in a similar manner as discussed above, with a means to ease or enhance or control adjustment of the height of the pusher dog relative to the trolley arms that reduces disassembly of the trolley assembly during the adjustment process. (FIGS. 16-22.) Trolley assembly 110 includes wheels or wheel assemblies 112, a pair of trolley arms 114 and a trolley attachment or trolley engaging member 116, such as a pusher dog or the like. The pusher dog 116 is adjustably mounted to or
attached to the trolley arms 114 and is adjustable to adjust the height of the pusher dog or location of the pusher dog relative to the trolley arms and the I-beam track or rail.

In trolley assembly 110, multiple (such as, for example, four) evenly-spaced ribs 122 may project from the lower attachment portion 114c of each of the two opposed trolley arms 114, while the mounting portion 116a of pusher dog 116 may include multiple (such as, for example, eight as shown in FIGS. 16, 17, 20 and 21) recesses 124 on each of the opposite faces of mounting portion 116a of pusher dog 116. Thus, the mounting portion 116a may be positioned between the attachment portions 114c of trolley arms 114 and the projections or ribs 122 may be received in selected respective recesses or grooves 124 of the mounting portion 116a, such as described above. When so positioned, the fasteners 130 may be inserted through or received in the holes or apertures 114d of attachment portions 114c and the passageways or apertures or slots 116g of the mounting portion 116a to secure the trolley arms to the pusher dog by clamping the attachment portions 114c toward one another and into engagement with the mounting portion 116a. As shown in FIGS. 16 and 18-21, trolley arms 114 include planar or flattened regions 114f established between columns or sets of projections or ribs 122 (the flattened regions 114f are generally coplanar with the mating face of attachment portion 114c with the projections 122 protruding from the mating face in sets or columns of projections), while mounting portion 116a of pusher dog 116 includes slots or elongated recesses 116h formed or established between columns or sets of recesses 124 (with the depth of the elongated recesses generally corresponding to the depth of the recesses 124).

In the illustrated embodiment, the pusher dog includes two elongated recesses established along and between three columns of height adjusting recesses, while the trolley arms include three spaced-apart columns of projections 124 protruding from the mating face of the attachment portion 114c). However, clearly other arrangements or configurations may be provided or established at the trolley arms and/or pusher dog attachment while remaining within the spirit and scope of the present invention.

Thus, the height or level of pusher dog 116 may be adjusted relative to the trolley arms 114 (and thus relative to the track or rail along which the trolley travels) by removing the fasteners and sliding or moving the pusher dog forward or rearward relative to the trolley arms to align the elongated recesses 116h of pusher dog 116 with the projections 122 of trolley arms 114, whereby the pusher dog may be readily moved upward or downward to the desired level relative
to trolley arms 114. When the pusher dog 116 is moved to disengage the projections 122 from the recesses 124, two sets or columns of the projections 122 are received within a respective elongated recess 116h, while the third column of projections 122 would be disengaged or spaced from or adjacent to the mounting portion 116a of pusher dog 116, such that the pusher dog may be vertically adjusted without projections 122 engaging the steps or recesses 124. As can be seen in FIGS. 16 and 18-21, when the pusher dog 116 is at the desired or appropriate or selected level, the pusher dog 116 may be moved rearward of forward to again align and engage the recesses 124 of pusher dog 116 with the projections 122 of trolley arms 114. When so positioned or engaged, the fasteners or bolts 130 may be inserted through apertures 114d, 116g and secured (such as via a nut or female fastener 132 being tightened at a threaded end of bolt 130 to clamp the mounting portion 116a of pusher dog 116 between the trolley arms 114.

In the illustrated embodiment, the upper slot 116g of mounting portion 116a of pusher dog 116 encompasses an upper portion of the center column of recesses 124, whereby, when the pusher dog is in one of its lower positions, the upper projections 122 of the center column of projections of trolley arms 114 may not engage recesses 124. However, clearly other configurations or arrangements or locations of the slots or projections and/or recesses may be implemented.

In the illustrated embodiment, attachment portions 114c of trolley arms 114 include chain link receiving portions 114g for receiving a chain link therein to attach or connect the trolley assembly 110 to a chain or section of chain 119 (FIG. 22). For example, and as shown in FIG. 22, a center chain link 119a may receive attachment portions 114c of trolley arms 114 and mounting portion 116a of pusher dog 116 therein or therethrough, with the side portions of the center link 119a being received in recessed chain link receiving portions 114g at attachment portions 114c of trolley arms 114. Because the attachment portions 114c of trolley arms 114 include the chain link receiving portions 114g, the trolley assembly 110 does not include the spacers 26', discussed above, since the height or level of the drive chain 119 relative to the track or rail is not affected by any height adjustment of the pusher dog.

Thus, when it is desired to adjust the height of the pusher dog 116 relative to the trolley arms 114, an operator may loosen and remove the fasteners 130, 132, and may slide or move the pusher dog to disengage the slots 124 from the projections 122 and to align the recesses 116h with the projections 122, and then vertically move or adjust the pusher dog (with the projections
122 moving along the respective elongated recesses 116h), all while the chain link remains around the attachment portions 114c of the trolley arms 114. Thus, the operator need not disassemble the trolley assembly to make such an adjustment.

Optionally, it is envisioned that the apertures 114d of attachment portions 114c of trolley arms 114 may be horizontally slotted (so as to be oriented in a transverse orientation relative to vertical slots 116g) to allow for movement of the pusher dog in a forward or rearward direction without having to remove the fasteners or bolts 130. In such an application, the operator may loosen the fasteners 130, 132 and move the pusher dog forward or rearward (with the bolts 130 moving along the horizontal slots 114d) to disengage the recesses 124 from the projections 122, and then may move the pusher dog vertically to the desired height or level. When the pusher dog is at the desired or appropriate level, the operator may move the pusher dog rearward or forward to realign the projections and recesses, and then retighten the fasteners 130, 132 to secure the pusher dog at the desired or appropriate or selected height or level relative to the trolley arms and track or rail and drive chain.

By selectively engaging the ribs 122 of each trolley arm 114 with the uppermost slots 124 on each face of mounting portion 116a of pusher dog 116, the pusher dog 116 may be positioned at a raised or upper position relative to trolley arms 114 (such as shown at A in FIG. 22). Alternately, by selectively engaging the ribs 122 of each trolley arm with the lowermost slots 124 on each face of mounting portion 116a of pusher dog 116, pusher dog 116 is positioned at a lowered or bottom position relative to trolley arms 114 (such as shown at B in FIG. 22). In the illustrated embodiment, pusher dog 116 may be adjusted to any of five different heights or levels relative to trolley arms, including a middle height or level (such as shown at C in FIG. 22). Thus, pusher dog 116 may be positioned at varying heights relative to trolley arms 114 and the track or rail, such as to accommodate various drive systems or space or packaging constraints.

Optionally, and as shown in FIG. 22A, the pusher dog may be positioned at one of five positions relative to the trolley arms (but clearly could be positioned at more or less positions relative to the trolley arms depending on the particular application of the trolley assembly), including a first or highest position (such as shown at A’ in FIG. 22A), a lowered or bottom position relative to trolley arms (such as shown at B’ in FIG. 22A), a middle height or level (such as shown at C in FIG. 22A), and an intermediate raised position (such as shown at D’ in FIG. 22A) and an intermediate lowered position (such as shown at E’ in FIG. 22A). In the illustrated
embodiment, the pusher dog includes a plurality of position indicators 140 to indicate to an
operator the selected or set level or position of the pusher dog relative to the trolley arms. As can
be seen in FIG. 22A, when the pusher dog is in its raised position A', only one indicator may be
visible to a person viewing the trolley assembly (and optionally no indicator may be visible when
the pusher dog is in this position), and when the pusher dog is in its lowered position B', all of
the indicators (such as, for example, the five indicators shown in FIG. 22A) may be visible to a
person viewing the trolley assembly. The number of position indicators that are viewable (or the
visible portion of a single larger indicator) indicates the present set or selected height of the
pusher dog relative to the trolley arms.

The position indicators 140 may comprise any suitable indicators, such as, for example,
any suitable marks or numbers or characters or other indicia or indicators, such as forged indicia
(such as holes or depressions or protrusions formed at the surface of the pusher dog), laser etched
indicia, machined indicia, ink stamped indicia, and/or the like, while remaining within the spirit
and scope of the present invention. The position indicator or indicators thus provide a means for
readily determining the set or selected height of the pusher dog by viewing the trolley assembly,
whereby an operator may readily discern whether or not the pusher dog can be raised or lowered
from its current position or level and how far the pusher dog can be raised or lowered from its
current position, without having to disassemble or loosen the fasteners securing the pusher dog to
the trolley arms. For example, in the illustrated embodiment of FIG. 22A, each position is 0.125
inches above or below the next position, such that if, for example, two indicators are visible at
the pusher dog (such as shown at position D'), an operator would readily know that the pusher
dog may be raised 0.125 inches (to position A') or may be lowered downward a distance of up to
0.375 inches (to position B') from its current position relative to the trolley arms (clearly other
increments and/or total adjustment ranges are contemplated within the spirit and scope of the
present invention). The position indicators thus enhance the adjustment process by indicating the
current selected or set status or position of the pusher dog relative to the trolley arms.

Yet another embodiment trolley assembly 106 (FIGS. 23-28) is similar to trolley
assembly 110, but includes a trolley attachment which is a claw dog attachment 116' that is
adjustably attached to trolley arms 114', in the manner as described above. Claw dog 116b' is
pivotally mounted to claw dog attachment 116'. Trolley assembly 110' may otherwise be similar
in construction and adjustment to trolley assembly 110, discussed above, such that a detailed
discussion of the trolley assemblies and adjustment mechanism or feature need not be repeated herein. Parts in trolley assembly 110' bear the same numbers, with a prime (') indication, as similar parts in trolley assembly 110.

The mounting portion 116a' of claw dog attachment 116' includes multiple (such as, for example, eight) recesses 124' on each of the opposite faces of mounting portion 116a' of claw dog attachment 116' (with elongated recesses 116h' established between spaced apart columns or sets of recesses or steps 124'), which engage the spaced ribs 122' on the trolley arms 114', as described above. Height adjustment of assembly 110' is effected as described above for trolley assembly 110.

In other embodiments, height adjustment of a trolley attachment (such as a pusher dog attachment or a claw dog attachment or the like), may be made by other adjustment means. For example, a cammed or lobed bolt may engage the trolley arms and the mounting portion of the trolley attachment. The lobed bolt may be received through a non-circular aperture in the trolley arm and/or mounting portion of the trolley attachment, whereby the bolt may be rotated to adjust the height of the trolley attachment by moving a lobed portion of the bolt into engagement with different surfaces of the trolley arm and/or mounting portion of the trolley attachment.

For example, and with reference to FIGS. 29A-35, a trolley assembly 110" includes a pair of trolley arms 114", 115" (attached to wheel assemblies 112" for moving the trolley assembly along a track or rail) and a trolley attachment or claw dog attachment 116" that is adjustably attached to trolley arms 114", 115". In the illustrated embodiment, trolley assembly 110" includes a claw dog 116b", which is pivotally mounted to claw dog attachment 116".

In the illustrated embodiment, the claw dog attachment 116" is adjustably attached to trolley arms 114", 115" and is adjustable relative to the trolley arms 114", 115" by rotation of a cammed or lobed bolt or fastener 130". As shown in FIGS. 29A-C, rotation of the bolt 130" to one of three distinct positions or orientations (such as rotation of about one sixth of a rotation for a hexagonal headed fastener) adjusts the height or level of the claw dog attachment 116". For example, if the bolt is oriented with its lobe in an upward orientation, the claw dog attachment 116" may be in a raised position (FIG. 29A), while if the bolt is rotated, for example, one sixth of a rotation from the upward orientation, the claw dog attachment 116" may be in a middle orientation (FIG. 29B), and if the bolt is rotated to a downward orientation, the claw dog
attachment 116" may be in a lowered position (FIG. 29C) relative to the trolley arms 114", 115" and track or rail along which the trolley travels.

[00100] As shown in FIG. 30, lobed bolt 130" comprises a hexagonal head portion 130a" and a shaft portion 130b". Shaft portion 130b" includes a lobe or protrusion 130c" that extends radially outward along a side region of the shaft portion 130b". A threaded end 130d" of shaft portion 130b" is at the end of shaft portion 130b" opposite the head portion 130a" for threaded attachment to a female fastener or nut 132" to retain bolt 130" at trolley arms 114", 115" and claw dog attachment 116", as discussed below. Optionally, the head portion 130a" may include indicia 130e" thereon to indicate the orientation of the lobe 130c", such as an arrow or the like pointing in the direction of the lobe, in order to ease adjustment of the height or level of the claw dog attachment to a desired or appropriate or selected level relative to the trolley arms.

[00101] In the illustrated embodiment, trolley arm 114" comprises a locking bracket and includes a pair of apertures 114d" therethrough for receiving shaft portion 130b", and includes a head receiving recess or portion 114h" that is configured to non-rotatably receive head portion 130a" of lobed bolt 130". Trolley arm 115" comprises a non-locking bracket and also includes a pair of apertures 115d" therethrough for receiving shaft portion 130b".

[00102] Claw dog attachment 116" includes a mounting portion 116a" that is configured to be received between attachment portions 114c", 115c" of trolley arms 114", 115". Mounting portion 116a" includes a pair of non-circular apertures 116g" for receiving the lobed portion of shaft portion 130b" of bolt 130" therein when the claw dog attachment 116" is attached to trolley arms 114", 115". In the illustrated embodiment, and as best shown in FIG. 34, non-circular aperture 116g" comprises a generally flat or non-curved upper portion and a curved lower portion, whereby the height or level of the claw dog attachment 116" relative to the trolley arms 114", 115" is varied by engagement of the lobe 130c" of bolt 130" at different locations along the non-circular aperture 116g".

[00103] Thus, and as can be seen with reference to FIGS. 31-33A, mounting portion 116a" of claw dog attachment 116" is disposed between attachment portions 114c", 115c" of trolley arms 114", 115", and sandwiched and secured therebetween via lobed bolts 130" and nuts 132". As shown in FIG. 31, head portion 130a" is non-rotatably received in head receiving portion 114h", while lobe 130c" is received in non-circular aperture 116g" of mounting portion 116a" of claw dog attachment 116". When the bolt is inserted through the attachment portions 114c", 115c" of
trolley arms 114", 115" and mounting portion 116a" of claw dog attachment 116", the threaded end portion 130d" of bolt 130" protrudes through attachment portion 115c" of trolley arm 115", whereby nut 132" is tightened onto threaded end portion 130d" to secure bolt 130" to trolley arms 114", 115" and claw dog attachment 116".

When it is desired to adjust the height or level of the claw dog attachment 116" relative to the trolley arms 114", 115", the bolts 130" may be rotated to position the lobes 130c" at a different orientation and location along the non-circular apertures 116g" of claw dog attachment 116". For example, the nut 132" may be loosened and bolt 130" may be moved outward from the apertures a sufficient amount to remove head portion 130a" from the head receiving recess 114h", whereby the bolt may be rotated to a different orientation. The head receiving recess 114h" may comprise a hexagonal shape to allow for the bolt to be rotated by one sixth of a rotation each time it is adjusted (whereby the bolt may be rotated to the positions shown in FIGS. 30A, 30C and 30E to provide three distinct heights or levels of the claw dog attachment), or the head receiving recess may allow for other degrees of adjustment, such as one twelfth of a rotation increments (whereby the bolt may be rotated to the positions shown in FIGS. 30A-E to provide five distinct heights or levels of the claw dog attachment).

When the claw dog attachment is adjusted to the desired or appropriate or selected height or level, the nuts 132" are tightened onto threaded ends 130d" of bolts 130". As shown in FIGS. 31 and 33A, the attachment portions 114c", 115c" of the trolley arms 114", 115" may include a recess 114i", 115i" at their mating surfaces to provide clearance for rotation or movement of the lobe 130c" of bolt 130" during adjustment of the bolt 130". Thus, when the nuts 132" are tightened onto the bolts 130", the attachment portions 114c", 115c" of trolley arms 114", 115" are clamped against the mounting portion 116a" of claw dog attachment 116" and are not clamped against the lobes 130d" of bolts 130" due to the clearance provided by recesses 114i", 115i".

The aperture 114d" at head receiving recess 114h" may be shaped to allow for insertion of the lobed shaft portion therethrough to allow for insertion of the lobed shaft portion through the attachment portion 114c" of trolley arm 114" when the bolt is oriented in a particular orientation, whereby the bolt cannot be extracted through aperture 114d" when oriented in any other orientation relative to the trolley arm 114". The recess 114h" may have sufficient depth to allow for partial retraction of bolt 130" in any orientation to allow for clearance of head portion.
130a" from head receiving recess 114h" to allow for rotation of bolt 130" to a selected orientation that corresponds to the desired height or level of the claw dog attachment relative to the trolley arms.

Optionally, the trolley arms and/or claw dog attachment may include stabilizing features or elements that engage one another and maintain the trolley arms and claw dog attachment in the proper orientation during the adjustment process. For example, and as shown in FIGS. 33-35, trolley arm 115" may include a plurality of pins or protrusions 115j" that protrude from the mating surface of the attachment portion 115c" and that are received in corresponding recesses or apertures or slots 116j" established at mounting portion 116a" of claw dog attachment 116". The slots 116j" are vertically oriented slots to allow for vertical movement of claw dog attachment 116" relative to trolley arms 114", 115" during the adjustment process, while limiting other relative movement between the claw dog attachment and the trolley arms.

Referring now to FIGS. 36-38, another embodiment trolley assembly 210 includes a pair of trolley arms 214 and a trolley attachment 216 that is removably attached to trolley arms 214. In the illustrated embodiment, trolley attachment 216 comprises a claw dog attachment 216a and a claw dog 216b, which is pivotally mounted to claw dog attachment 216a. Trolley assembly 210 includes a wheel assembly 212 at a wheel mounting portion 214a of each trolley arm 214, such that there are two wheel assemblies 212 and wheels 220 for moving the trolley assembly along the track or rail or I-beam 218 or the like. The claw dog is configured to suspend from the driven trolley arms (as driven via a drive chain 219 connected to the trolley arms 214) for engaging a free trolley or the like to drive or push or pull the free trolley along a conveying path or rail or track, such as in a known manner.

In the illustrated embodiment, trolley arms 214 include curved arm portions 214b and drive chain engaging portions 214c that are configured to be received through a center chain link 219a, with claw dog attachment 216a sandwiched between the drive chain engaging portions 214c and secured therebetween via fasteners 221. Thus, the trolley attachment or claw dog is removably attached to the trolley arms and, optionally, the trolley attachment or claw dog may be adjustably attached to the trolley arms, such as via protrusions and recesses or grooves at the trolley attachment and trolley arms, such as in a similar manner as described above. In the illustrated embodiment, the claw dog is attached to a trolley that is driven or moved by an X-style or X-type chain, with the chain engaging portions 214c and claw dog attachment 216a
disposed through the center link 219a of the X-type chain. The claw dog may be adjustably mounted to the trolley and may be adjustable to adjust the height of the claw dog relative to the trolley and track or I-beam and chain.

Trolley assembly 210' (FIGS. 39-42) may include a pair of trolley arms 214' and a trolley attachment 216' that is removably attached to trolley arms 214' and includes a claw dog attachment 216a' and a claw dog 216b', which is pivotally mounted to claw dog attachment 216a'. Trolley assembly 210' includes a pair of wheel assemblies 212' at a wheel mounting portion 214a' of each trolley arm 214', such that there are four wheel assemblies 212' and wheels 220' for moving the trolley assembly along the track or rail or I-beam 218' or the like. The claw dog is configured to suspend from the driven trolley arms (as driven via a drive chain 219' connected to the trolley arms 214') for engaging a free trolley or the like to drive or push or pull the free trolley along a conveying path or rail or track, such as in a known manner.

In the illustrated embodiment, trolley arms 214' include attaching portions 214c', with claw dog attachment 216a' sandwiched between the attaching portions 214c' and secured therebetween via fasteners 221'. The claw dog attachment 216a' is configured to be received through a center chain link 219a', with a lower surface of chain link 219a' engaging an engaging surface 216c' of claw dog attachment 216a' and with an upper surface of chain link 219a' engaging a lower flange or surface 214d' of trolley arms 214', such as in a similar manner as described above with respect to pusher dog 116, chain link 119 and trolley arms 114. Thus, the trolley attachment or claw dog is removably attached to the trolley arms and, optionally, the trolley attachment or claw dog may be adjustably attached to the trolley arms, such as via protrusions and recesses or grooves at the trolley attachment and trolley arms, as described above. Optionally, one or more spacer elements may be provided to allow for lowering the claw dog without lowering the centerline of the chain, if desired, and such as by utilizing aspects of the spacer elements discussed above.

Referring now to FIGS. 43-45B, a free trolley 310 includes wheel assemblies 312 that movably support a trolley bracket or body 314 at and along a track or rail or I-beam or the like. The free trolley 310 includes an engaging member 316 that has an upper engaging portion 316a that engages a pusher dog or element of a driven trolley (such as a drive trolley of the types described above or any suitable driven trolley or device) so as to be moved along the track via the driven trolley or device. As best shown in FIG. 45A, the engaging member 316 is movably
mounted to trolley body 314 and is vertically movable to allow for engagement with and disengagement from the driven trolley or device. The engaging member 316 is pivotally connected to or attached to a pivotal element or member 318 at or near its lower end portion 316b. Pivotal element 318 may engage a trigger or actuating element as the free trolley moves along the track or rail, whereby the actuating element imparts a pivotal movement of pivotal element 318, which in turn imparts a generally vertical movement of engaging member 316, such as to cause the engaging member to disengage from the driven trolley or device, such as in a known manner.

As can be seen in FIGS. 44 and 45B, engaging member 316 is guided in its generally vertical movement via a guide pin or member 320 mounted to or inserted through trolley body 314 and received in a slot 316c of engaging member 316. The guide pin 320 functions to guide the generally vertical movement of engaging member 316 relative to trolley body 314 and to limit or stop the generally vertical movement at its upper limit and lower limit (via engagement of the pin 320 at the lower or upper end walls of the slot 316c). The engaging member is thus movably mounted to the trolley body and movable relative thereto between an engaging position, where the engaging member is configured to engage the driven trolley or device to move the free trolley assembly along the track or rail, and a disengaging position, where the engaging member is configured to disengage from the driven device, such as in response to the pivotal element contacting a triggering or actuating element along the track or rail. The range of travel of the engaging member between the engaging position and the disengaging position is limited by the guide pin 320 engaging the upper or lower end of the slotted aperture or slot 316c.

Trolley assembly 310 includes an adjustable height limiting feature 322 that adjusts the upper and/or lower range of the generally vertical travel of the engaging member so as to allow for an adjustable range of motion of the engaging member. In the illustrated embodiment, the adjustable height limiting features 322 comprises a non-circular or cammed bushing or shaft of the bolt or pin 320, whereby rotation of the pin and bushing or shaft about its axis adjusts the location of the upper and/or lower surface of the shaft or bushing to adjust the lower and/or upper travel stop or end stop of the engaging member 316. For example, when the pin is rotated so that a larger radius portion of the pin shaft or bushing is at the lower surface of the pin, the pin effectively limits or reduces the upward travel range of the engaging member. The orientation of the pin thus may be selectively adjusted to set a desired range of travel of the engaging member.
relative to the trolley body. The pin may be secured or substantially locked in any selected orientation so that the range of motion or end stop of the engaging member may be selected and substantially set for a given trolley assembly.

Thus, the adjustable height limiting feature 322 allows for adjustment of the vertical range of travel of the engaging member to adjust how much bite the trolley has when engaging the driven trolley or device. In the illustrated embodiment, the guide pin has a non-circular shaft portion at and within the slotted aperture of the engaging member, with the guide pin being selectively rotatable to generally align a desired surface of the non-circular shaft portion with an upper or lower end of the slotted aperture to set an end stop of the desired range of travel of the engaging member. The trolley assembly 310 thus is readily adjustable to allow for use of the trolley assembly on various tracks and facilities, without requiring a specific set range of motion for different tracks and facilities. The trolley assembly 310 thus provides a common trolley assembly for various applications, thereby providing reduced manufacturing costs for different applications.

Accordingly, the present invention provides a trolley assembly with adjustable features that allow for vertical adjustment of a trolley engaging member (such as a pusher dog or pusher dog engaging member or the like) to adapt the trolley assembly for different applications with different chain heights or levels relative to the trolley track or rail. The present invention provides an adjustment system that an operator can readily and accurately adjust to set the trolley assembly at an appropriate height and allows for adjustment of the height for other applications of the same or common trolley assembly. The present invention thus facilitates use of common trolley assemblies and components for various applications and for adjustments in plant layouts, and thus provides a reduction in different parts and thus a reduction in costs and provides ease of adaptation of the trolley components to new layouts or designs.

Changes and modifications in the specifically described embodiments may be carried out without departing from the principles of the present invention, which is intended to be limited only by the scope of the appended claims, as interpreted according to the principles of patent law.
CLAIMS:

1. A trolley assembly for a conveyor system, said trolley assembly comprising:
   a pair of spaced apart trolley arms having wheels rotatably mounted at said trolley arms
   for rolling engagement with a track or rail of said conveyor system;
   a trolley attachment adjustably mounted to said trolley arms and adjusted relative to said
   trolley arms to adjust a position of said trolley attachment relative to said wheels; and
   wherein said trolley attachment is positionable at a selected one of a plurality of vertical
   positions relative to said spaced apart trolley arms and wherein said trolley attachment is retained
   at said selected one of said plurality of vertical positions by engagement of said trolley
   attachment with said trolley arms.

2. The trolley assembly of claim 1, wherein said trolley arms comprise inner opposed
   surfaces having an engaging element, and wherein said trolley attachment comprises opposite
   outer surfaces having an engaging element, wherein said trolley attachment is positioned
   between said inner surfaces of said trolley arms such that said engaging element of said trolley
   arms engages said engaging element of said trolley attachment, whereby said trolley attachment
   is positionable at and retained at said one of said plurality of vertical heights relative to said
   spaced apart trolley arms by engagement of said engaging element of said trolley arms with said
   engaging element of said trolley attachment.

3. The trolley assembly of claim 2, wherein said engaging elements of said trolley arms
   comprise evenly-spaced elongated horizontal projections, and wherein said engaging elements of
   said trolley attachment comprise evenly-spaced elongate horizontal channels, said channels
   receiving said projections when said trolley attachment is positioned between said inner surfaces
   of said trolley arms.

4. The trolley assembly of claim 2, wherein a first one of said engaging elements comprises
   at least one projection and wherein a second one of said engaging elements comprises at least
   two recesses, and wherein said at least two recesses receive said at least one projection when said
   trolley attachment is positioned between said inner surfaces of said trolley arms.
5. The trolley assembly of claim 4, wherein said second engaging element comprises more horizontal channels than said first engaging element comprises horizontal projections, and wherein each of said horizontal projections is positionable in one of said horizontal channels and repositionable in an adjacent one of said horizontal channels to adjust the vertical height of said trolley attachment relative to said trolley arms.

6. The trolley assembly of claim 5, wherein said second engaging element comprises at least four horizontal channels at each of outer surfaces of said trolley attachment, and wherein said trolley arms comprise at least two horizontal projections at each an inner surface of each of said spaced apart trolley arms.

7. The trolley assembly of claim 5, wherein said trolley attachment comprises a generally vertical recess established along said channels to facilitate selective vertical movement of said horizontal projections to different channels when said projections are aligned with said recess.

8. The trolley assembly of claim 5 further comprising at least one spacer element that is selectively positioned between a portion of said trolley arms and a portion of said trolley attachment when said trolley attachment is moved to a lower position relative to said trolley arms.

9. The trolley assembly of claim 1, wherein said trolley attachment is positionable at the selected one of a plurality of vertical positions relative to said spaced apart trolley arms via rotational adjustment of a cammed fastener received through said trolley attachment and said trolley arms.

10. The trolley assembly of claim 1, wherein said trolley attachment is movable from a first position relative to said trolley arms to a second position relative to said trolley arms, said second position being lower than said first position.
11. The trolley assembly of claim 10 further comprising at least one spacer element that is selectively positioned between a portion of said trolley arms and a portion of said trolley attachment when said trolley attachment is moved from said first position to said second position.

12. The trolley assembly of claim 1 further comprising at least one position indicator that visually indicates a position of said trolley attachment relative to said trolley arms.

13. A free trolley assembly for a conveyor, said free trolley assembly comprising:
   a trolley body having wheels rotatably mounted thereat;
   an engaging member movably mounted to said trolley body and movable relative thereto between an engaging position, where said engaging member is configured to engage a driven device to move said free trolley assembly along a track, and a disengaging position, where said engaging member is configured to disengage from a driven device; and
   wherein a range of travel of said engaging member between said engaging position and said disengaging position is selectively adjusted to set a desired range of travel of said engaging member.

14. The free trolley assembly of claim 13, wherein said engaging member is guided between said engaging position and said disengaging position via a guide pin mounted to said trolley body and received through a slotted aperture in said engaging member.

15. The free trolley assembly of claim 14, wherein said guide pin has a non-circular shaft portion at and within said slotted aperture, said guide pin being selectively rotatable to generally align a desired surface of said non-circular shaft portion with an upper or lower end of said slotted aperture to set an end stop of the desired range of travel of said engaging member.

16. A method of adjusting a trolley assembly for a conveyor, said method comprising:
   providing a trolley assembly having a pair of spaced apart trolley arms having wheels rotatably mounted at said trolley arms;
   providing a trolley attachment;
positioning said trolley attachment at a selected one of a plurality of vertical heights relative to said spaced apart trolley arms and retaining said trolley attachment at said selected one of said plurality of vertical heights by engagement of said trolley attachment with said trolley arms; and

adjusting said trolley attachment relative to said trolley arms to generally vertically adjust a position of said trolley attachment relative to a position of said wheels.

17. The method of claim 16, wherein adjusting said trolley attachment comprises moving said trolley attachment from a first position relative to said trolley arms to a second position relative to said trolley arms, said second position being lower than said first position.

18. The method of claim 17 comprising providing at least one spacer element and selectively positioning said at least one spacer element between a portion of said trolley arms and a portion of said trolley attachment when said trolley attachment is moved from said first position to said second position.

19. The method of claim 16, wherein said trolley arms have an engaging element and said trolley attachment has an engaging element, wherein positioning said trolley attachment comprises positioning said trolley attachment relative to said spaced apart trolley arms by engaging said engaging element of said trolley arms with said engaging element of said trolley attachment, whereby said trolley attachment is positioned at said selected one of said plurality of vertical heights relative to said spaced apart trolley arms.

20. The method of claim 19, wherein a first one of said engaging elements comprises at least one projection and wherein a second one of said engaging elements comprises at least two recesses, and wherein positioning said trolley attachment relative to said spaced apart trolley arms comprises positioning said trolley attachment relative to said spaced apart trolley arms by receiving said first engaging element at least partially in said second engaging element.
1. A trolley assembly for a conveyor system, said trolley assembly comprising:

   a pair of spaced apart trolley arms having wheels rotatably mounted at said trolley arms for rolling engagement with a track or rail of said conveyor system;

   a trolley attachment pusher for engaging and moving a free trolley positioned below said trolley assembly, said pushing being adjustably mounted to said trolley arms and adjusted relative to said trolley arms to adjust a position of said trolley attachment pusher relative to said wheels; and

   wherein said trolley attachment pusher is positionable at a selected one of a plurality of vertical positions relative to said spaced apart trolley arms and wherein said trolley attachment pusher is retained at said selected one of said plurality of vertical positions by engagement of said trolley attachment pusher with said trolley arms.

2. The trolley assembly of claim 1, wherein said trolley arms comprise inner opposed surfaces having an engaging element, and wherein said trolley attachment pusher comprises opposite outer surfaces having an engaging element, wherein said trolley attachment pusher is positioned between said inner surfaces of said trolley arms such that said engaging element of said trolley arms engages said engaging element of said trolley attachment pusher, whereby said trolley attachment pusher is positionable at and retained at said one of said plurality of vertical heights relative to said spaced apart trolley arms by engagement of said engaging element of said trolley arms with said engaging element of said trolley attachment pusher.
3. The trolley assembly of claim 2, wherein said engaging elements of said trolley arms comprise evenly-spaced elongated horizontal projections, and wherein said engaging elements of said trolley attachment pusher comprise evenly-spaced elongate horizontal channels, said channels receiving said projections when said trolley attachment pusher is positioned between said inner surfaces of said trolley arms.

4. The trolley assembly of claim 2, wherein a first one of said engaging elements comprises at least one projection and wherein a second one of said engaging elements comprises at least two recesses, and wherein said at least two recesses receive said at least one projection when said trolley attachment pusher is positioned between said inner surfaces of said trolley arms.
5. The trolley assembly of claim 4, wherein said second engaging element comprises more horizontal channels than said first engaging element comprises horizontal projections, and wherein each of said horizontal projections is positionable in one of said horizontal channels and repositionable in an adjacent one of said horizontal channels to adjust the vertical height of said trolley attachment pusher relative to said trolley arms.

6. The trolley assembly of claim 5, wherein said second engaging element comprises at least four horizontal channels at each of outer surfaces of said trolley attachment pusher, and wherein said trolley arms comprise at least two horizontal projections at each an inner surface of each of said spaced apart trolley arms.

7. The trolley assembly of claim 5, wherein said trolley attachment pusher comprises a generally vertical recess established along said channels to facilitate selective vertical movement of said horizontal projections to different channels when said projections are aligned with said recess.

8. The trolley assembly of claim 5 further comprising at least one spacer element that is selectively positioned between a portion of said trolley arms and a portion of said trolley attachment pusher when said trolley attachment pusher is moved to a lower position relative to said trolley arms.

9. The trolley assembly of claim 1, wherein said trolley attachment pusher is positionable at the selected one of a plurality of vertical positions relative to said spaced apart trolley arms via rotational adjustment of a cammed fastener received through said trolley attachment pusher and said trolley arms.
10. The trolley assembly of claim 1, wherein said trolley attachment pusher is movable from a first position relative to said trolley arms to a second position relative to said trolley arms, said second position being lower than said first position.
11. The trolley assembly of claim 10 further comprising at least one spacer
element that is selectively positioned between a portion of said trolley arms and a portion of said
 trolley attachment pusher when said trolley attachment pusher is moved from said first position
to said second position.

12. The trolley assembly of claim 1 further comprising at least one position
indicator that visually indicates a position of said trolley attachment pusher relative to said trolley arms.

13. A free trolley assembly for a conveyor, said free trolley assembly
comprising:

   a trolley body having wheels rotatably mounted thereat;
   an engaging member movably mounted to said trolley body and movable relative
tereto between an engaging position, where said engaging member is configured to
engage a driven device to move said free trolley assembly along a track, and a
disengaging position, where said engaging member is configured to disengage from a
driven device; and

   wherein a range of travel of said engaging member between said engaging
position and said disengaging position is selectively adjusted to set a desired range of
travel of said engaging member.

14. The free trolley assembly of claim 13, wherein said engaging member is
guided between said engaging position and said disengaging position via a guide pin mounted to
said trolley body and received through a slotted aperture in said engaging member.

15. The free trolley assembly of claim 14, wherein said guide pin has a non-
circular shaft portion at and within said slotted aperture, said guide pin being selectively
rotatable to generally align a desired surface of said non-circular shaft portion with an upper or lower end of said slotted aperture to set an end stop of the desired range of travel of said engaging member.

16. A method of adjusting a trolley assembly for a conveyor, said method comprising:

providing a trolley assembly having a pair of spaced apart trolley arms having wheels rotatably mounted at said trolley arms;

providing a trolley attachment pusher;
positioning said trolley attachment pusher at a selected one of a plurality of vertical heights relative to said spaced apart trolley arms and retaining said trolley attachment pusher at said selected one of said plurality of vertical heights by engagement of said trolley attachment pusher with said trolley arms; and

adjusting said trolley attachment pusher relative to said trolley arms to generally vertically adjust a position of said trolley attachment pusher relative to a position of said wheels.

17. The method of claim 16, wherein adjusting said trolley attachment pusher comprises moving said trolley attachment pusher from a first position relative to said trolley arms to a second position relative to said trolley arms, said second position being lower than said first position.

18. The method of claim 17 comprising providing at least one spacer element and selectively positioning said at least one spacer element between a portion of said trolley arms and apportion of said trolley attachment pusher when said trolley attachment pusher is moved from said first position to said second position.

19. The method of claim 16, wherein said trolley arms have an engaging element and said trolley attachment pusher has an engaging element, wherein positioning said trolley attachment pusher comprises positioning said trolley attachment pusher relative to said spaced apart trolley arms by engaging said engaging element of said trolley arms with said engaging element of said trolley attachment, whereby said trolley attachment is positioned at said selected one of said plurality of vertical heights relative to said spaced apart trolley arms.

20. The method of claim 19, wherein a first one of said engaging elements comprises at least one projection and wherein a second one of said engaging elements comprises
at least two recesses, and wherein positioning said trolley attachment pusher relative to said spaced apart trolley arms comprises positioning said trolley attachment pusher relative to said spaced apart trolley arms by receiving said first engaging element at least partially in said second engaging element.
21. A conveyor system comprising a driven trolley mounted on and moveable on a first track, said driven trolley having a pusher attached to and depending from said driven trolley; a second track positioned below said driven trolley and said pusher, and a free trolley mounted on and moveable on said second track; said free trolley including an engaging member configured to be engaged by said pusher, whereby as said driven trolley and pusher move, said free trolley also moves on said second track; said pusher being positionable at a selected one of a plurality of vertical positions on said driven trolley whereby the depth of engagement between said pusher and said engaging member on said free trolley can be adjusted.

22. The conveyor system of claim 21 in which said engaging member is moveably mounted on said free trolley between an engaging position wherein it is engaged by said pusher, and a disengaging position where it is disengaged from said pusher; and wherein a range of travel of said engaging member between said engaging position and said disengaging position is selectively adjustable to set a desired range of travel of said engaging member, and thereby vary the depth of engagement between said pusher and said engaging member.

23. A conveyor system comprising a driven trolley mounted on and moveable on a first track, said driven trolley having a pusher attached to and depending from said driven trolley; a second track positioned below said driven trolley and said pusher, and a free trolley mounted on and moveable on said second track; said free trolley including an engaging member configured to be engaged by said pusher, whereby as said driven trolley and pusher move, said free trolley also moves on said second track; said engaging member being moveably mounted on said free trolley between an engaging position wherein it is engaged by said pusher, and a disengaging position where it is disengaged from said pusher; and wherein a range of travel of said engaging member between said engaging position and said disengaging position is
selectively adjustable to set a desired range of travel of said engaging member, and thereby vary the depth of engagement between said pusher and said engaging member.
A  CLASSIFICATION OF SUBJECT MATTER
IPC(8) - B65G 17/20 (2010 01)
USPC - 198/680

According to International Patent Classification (IPC) or to both national classification and IPC

B  FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - B65G 17/20 (2010 01)
USPC - 198/680

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
MicroPatent, Google Patents

C  DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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Further documents are listed in the continuation of Box C

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Authorized officer
Blame R Copenheaver

Date of the actual completion of the international search
18 January 2010

Date of mailing of the international search report

Form PCT/ISA/210 (second sheet) (July 2009)