TOP PICKUP TRANSFER GUIDE FOR ENDLESS
CHAIN DRIVE
7 Claims, 6 Drawing Figs.

ABSTRACT: A series of work arms are pivotally mounted on
a chain drive and each has a pair of vertically spaced flanged
wheels which roll against vertical track elements to hold
the work arm erect as it lifts or lowers a load carried by a support-
ing cradle offset relative to the center of the work arm. Upper
transverse track elements guide the upper wheel as it passes
from one side of the chain drive to the other. To prevent the
upper wheel, for example, from slipping back the wrong way
during the crossover, a stop is located on each side of the
center in positions where they will engage respective cradles
so that, should the work arm tend to tilt too far from a vertical
orientation, it will be prevented from doing so by engagement
of one or the other cradle with its respective stop.
TOP PICKUP TRANSFER GUIDE FOR ENDLESS CHAIN DRIVE

This is a continuation-in-part of Ser. No. 47,764, filed June 19, 1970.

The invention relates to a vertical automated storage system in which platforms travel about on an endless link drive and wherein an endless chain drive having work arms are adapted to pick up platforms at one location in their path of travel and move them from one position to the next. The general arrangement is disclosed in U.S. Pat. Nos. 3,278,052, 3,424,321, and patent applications Ser. No. 737,647, filed June 17, 1968, Ser. No. 873,358, filed Nov. 3, 1969, and Ser. No. 47,764 filed June 19, 1970.

Although in the general arrangement of chain drive for devices of the kind herein made reference to structure has been included for holding the work arm in a desired position as it passes over the top of its path of travel from one side of the device to the other, such means heretofore made use of has been somewhat complicated and expensive, difficult to maintain and service, and, under some circumstances, not as dependable for long periods of use as might be desired.

It is therefore among the objects of the invention to provide a new and improved top pickup transfer for an endless chain drive which is very positive in its construction and operation, sufficiently so that it is fail-safe.

Another object of the invention is to provide a new and improved top pickup transfer guide for an endless chain drive which is very simple in its operation and which is such that it makes double use of elements already present for another purpose by utilizing their character and location to prevent the work arm from shifting to an unwanted orientation.

Still another object of the invention is to provide a new and improved pickup transfer guide for an endless chain drive in which stops are so positioned that they engage recesses on the work arm in a relationship such that either one or both stops are compelled to be in engagement with the recesses at all positions of travel, thereby to make certain that the work arm cannot inadvertently shift to an unwanted orientation.

With these and other objects in view, the invention consists in the construction, arrangement, and combination of the various parts of the device, whereby the objects contemplated are attained, as hereinafter set forth, pointed out in the appended claims and illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is a side elevational view of the chain drive with portions shown in section, showing five work arms in various different positions.

FIG. 2 is a fragmentary longitudinal sectional view on the line 2--2 of FIG. 1.

FIG. 3 is a fragmentary vertical sectional view of the uppermost end of the chain drive with the work arm in one position during passover.

FIG. 4 is a fragmentary vertical sectional view similar to FIG. 3 showing the work arm in a position successive to the position of FIG. 3.

FIG. 5 is an enlarged fragmentary side elevational view showing details of one of the stops.

FIG. 6 is a fragmentary vertical sectional view on the line 6--6 of FIG. 5.

In an embodiment of the invention chosen for the purpose of illustration, there is shown a frame indicated generally by the reference character 19 having vertical side members 11 and 12, a lower cross member 13 and transverse webs 14 and 15 having respective top portions 14' and 15'. Transverse channel sections 16 and 17 serve as means for anchoring the transverse webs in position, as shown in FIG. 2. Plates 18 and 19, constituting additional supporting structure associated with the horizontal arms shown in FIG. 2.

An endless drive chain 20 is shown extending over an upper sprocket 21 and a lower sprocket 22, the sprockets being rotatably mounted on the frame by respective shafts 23 and 24. A suitable source of power (not shown) is acting through a drive shaft 25, a sprocket 26, a drive belt 27 engaging with a sprocket 28 on an idler shaft 29, passing the drive to a sprocket 30, a drive belt 31 and a driven sprocket 32, the driven sprocket 32 being keyed to the same shaft 24 as is the lower sprocket 22 which accommodates the drive chain 20.

On the drive chain 20 is a series of work arms 35, 36, 37, 38, and 39, each work arm being identical such that a description of the work arm 36, for example, will suffice for the others.

The work arm is attached at its lower end by means of a pivot pin 40 to a junction of adjacent link drive chains 20. In the chosen embodiment there are in fact two of the chains 20 between which is mounted the arm 36 and the other arms identified heretofore. Bushings 41 and 42 assist in pivotally mounting the arm 36 on the pivot pin 40, as shown in FIG. 2.

At the lower end of the work arm 36 is a flathold slot 43 which, by engagement with a pin 44 in a section of the frame 10, when the work arm is in an inverted position serves to swing the arm from a position of tilt like that of the arm 38 in FIG. 1 to that of the arm 39 in FIG. 1 on the opposite side, assuming the travel of the chain 20 to be in a counterclockwise direction. For travel in an opposite direction the tilt would be in a reverse direction.

The work arm 36 in common with all of the other work arms is provided with two cradles 50 and 51 which are upwardly facing recesses on opposite sides of a vertical center line. The cradles 50 are shown in engagement or potential engagement with rods 52 and 53 on the right side of the device as viewed in FIG. 1. Similar rods 54 and 55 on the left side are shown in engagement or potential engagement with the cradles 51.

The work actually performed by the work arm is accomplished by the work arm being moved into engagement with one or another of the rods which support an appropriate load (not shown) so that the load may be moved up or down, as the case may be, depending upon the direction of travel of the respectively engaged work arm.

For maintaining each work arm in a vertical position during its upward or downward travel, as viewed in FIG. 1, an inside face 56 of the side member 11 of the frame serves as a vertical track element. Similarly, an inside face 57 of the side member 12 serves as a track element on the opposite side. To utilize the track elements 56 and 57 flanged wheels 58 and 59 are rotatably mounted upon a shaft 60 at the upper end of the work arm 36, for example. The wheels are adapted to roll on either the track element 56 or 57 depending upon where the work arm chances to be. For guiding the lower end of the work arm use is made of rollers 61 and 62 which are concentric with the bushings 41 and 42 and the pivot pin 40. The rollers 61 and 62 likewise are adapted to roll upon the track elements 56 and 57, and when in such position, as shown by the work arms 35 and 37 in FIG. 1, the work arm at that stage of travel is held in a vertical position so that the rod 53 is firmly supported by the work arm 35 as is the rod 54 supported by the work arm 37.

As the work arm approaches the top of its lifting path the work arm next below is brought into engagement with its respective rod and the upper work arm can be released. This is accomplished by movement of the chain 20 at the point where it is in engagement with the pivot pin 40 away from vertical alignment causing the work arm to tilt in a direction moving the cradle 50 out from under the rod in which it is engaged.

It is important, however, that this tilt be limited in that the work arm must be carried from one side of the structure to the other at the upper end of its path of travel. For guiding the upper end of the work arm from one side of the device to the other, there are provided track elements 63, 63' formed on the upper portions 14' and 15' of the respective webs 14 and 15, the track element 63 being transverse and sloping upwardly toward junctions 64, 64' with oppositely sloping track elements 65, 65'.

Lower members 66, 66' of the track elements 63, 63' serve to confine the flanged wheels in position. Similarly, on the opposite side are lower members 67, 67' which serve a comparable purpose.
3,627,110

3. To accommodate the space occupied by the wheels 58 and 59 in their path of travel from one side of the frame to the other, struts 70 are provided on front and back sides of the frame at the right of the structure, as viewed in FIG. 1, and similar struts 71, 71' are provided on the left-hand side. A recess 72 in the strut 71 and a similar recess 73 in the strut 71 demonstrates how the way is cleared for the passage of the wheels from one side to the other. Center struts 74 are similarly formed.

To make certain that the webs hold their upright orientation as they pass over the top of their path of travel, there are provided stops 75 and 76, fastened to one of the webs such for example as the web part 14', by means of bolts 77, as shown in FIGS. 5 and 6, the stop member being positioned by means of spacers 78 and 79. To provide a cushioning effect, there is employed an additional stop 80 which may be made of some durable plastic material, and which projects out slightly further than the stops 75, 76 so as to absorb initial impact, thereby to cushion the operation. The stop 80 is adapted to abut against a flange 81 effectively welded to the adjacent web. The arrangement of parts associated with the stop 76 is the same as that for the stop 75 except for one being oriented in a direction reverse with respect to the other.

In operation as the work arm 36, for example, moves toward the top of its path of travel it is tilted slightly clockwise by reason of the fact that the pivot pin 40 is moved toward the center slightly in advance of travel of the wheels 58 and 59 as they move along and are guided by the track elements 63, 63'. Some short distance before the wheels enter the junctions 64, 64', which are in effect recesses, the cradle 50 engages the stop 75 in the position shown in FIG. 3. As the chain 20 continues to move, the pivot pin 40 continues to be moved and, because the flanged wheels are temporarily detained at the junctions 64, 64', the work arm 36 will commence being tilted from the position of FIG. 3 to the position of FIG. 4. Intermediate these two positions, however, the cradles 50 and 51 will have the relative positions shown at the top of FIG. 1 wherein both are in potential engagement with the respective stops 75 and 76. In this position the work arm is held in and cannot depart from the vertical position there shown.

As the chain 20 continues to move, the work arm 36 will be tilted to the position of FIG. 4 wherein the cradle 50 becomes disengaged from the stop 75 and the cradle 51 becomes engaged with the stop 76. Clearly, in this position the upper end of the work arm cannot move in a contrary direction, namely a direction from left to right as viewed in FIG. 4, because of being prohibited by the stop 76. As the chain continues to move counterclockwise, although the work arm is then moved downwardly sufficient to disengage the cradle 51 from the stop 76, by this time the wheels are traveling down the track elements 65, 65' to a point where they overlie the lower members 67, 67' and the top of the work arm is still prevented from inadvertently tilting in the wrong direction.

Ultimately, the chain 20 moves the work arm 36 far enough down so that the wheels 58, 59 engage the track element 57 as do also the rollers 61, 62. This position is shown by the work arm 37 in FIG. 1. Hence, when for example one of the rods 54 may be in engagement with the cradle 51 at this point, the engagement will be maintained as the work arm moves downwardly, to follow through on the example previously undertaken, or should it be moved in an upward direction. As the work arm continues downwardly to the position shown by the work arm 38 in FIG. 1, the direction of travel of the chain 20 is such in that it will pull the work arm into the tilted position shown, thereby to release the cradle 51 from engagement with the adjacent rod, until finally the work arm is moved clear because of being drawn inwardly by the direction of chain travel until the fishtail slot 43 engages with the pin 44 to flop the work arm over to the position of the work arm 39 in FIG.

1. From this point the operation is substantially as heretofore described.

Travel of the chain 20 in an opposite or clockwise direction merely causes all parts of the apparatus to operate in reverse, but in substantially the same basic fashion.

The unit comprising in the main, the side members 11 and 12, the interconnecting webs 14 and 15 and corresponding transverse lower elements is designed to be slidably mounted in the overall structure (not shown) to allow it to move up or down about ¼-inch. This is done to prevent any error or wear in the bearings from causing undue forces on the guide.

While the invention has herein been shown and described in what is conceived to be a practical and effective embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to comprehend all equivalent devices.

Having described the invention, what is claimed as new in support of Letters Patent is:

1. A top pickup guide for an endless chain driven actuator, said guide comprising

a frame,

upper and lower vertically spaced sprockets on said frame,
a vertically mounted power-operated endless drive chain extending over said sprockets,
a plurality of work arms each pivotally mounted adjacent its lower end on said chain at spaced intervals relative to the others,
vertically disposed traveled means on said work arm and a cradle on each work arm on each side of said traveled means,

horizontally spaced parallel vertically extending track elements on said frame and transverse track elements extending from the vertically extending track elements to a centrally located junction,
said track elements and said traveled means being in traveling engagement,

and a pair of stops on the frame on respective opposite sides of said junction for preventing displacement of said work arm from a substantially vertical relationship, said stops being at substantially the same elevation and spaced one from the other a distance substantially equal to the distance between said cradles, whereby upon engagement of one cradle with one of said stops unwanted displacement of the lower portion of said work arm is inhibited by engagement of the other cradle with the other stop.

2. A top pickup guide as in claim 1 wherein the traveler means comprises vertically spaced independent rollers in rolling engagement with said track elements.

3. A top pickup guide as in claim 1 wherein said cradles are recessed depressions and each said stop includes a shoulder which enters the respective depression.

4. A top pickup guide as in claim 1 wherein there is a cushion on each stop engageable by a portion of said cradle to diminish noise and vibration.

5. A top pickup guide as in claim 2 wherein said transverse track elements comprise upper and lower members forming a channel therebetween for confinement of the upper of said rollers.

6. A top pickup guide as in claim 2 wherein said junction is an upwardly recessed junction substantially midway between opposite sides and the upper of said rollers is adapted to be temporarily detained in said recessed junction while the lower of said rollers passes from one side of a vertical centerline to the other.

7. A top pickup guide as in claim 1 wherein the cradles on one side of the work arm extend outwardly beyond the frame and the cradles on the opposite side of the work arms extend beyond the frame on the opposite side.

* * * * *