United States Patent

Tollefsrud et al.

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[45] **July 18, 1972**

[54] WORK TRANSFER APPARATUS

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[52] **U.S. Cl.** .....**214/18 R,** 104/172 B, 214/83.3, 214/83.14, 214/16 B

[51] **Int. Cl.**.....**B65g 1/00**

[58] **Field of Search**.....214/16 B, 18 R, 23, 16.1 DB, 214/16.1 CE, 16.1 DC, 516, 83.3, 83.34, 83.14; 104/172 B

[56] **References Cited**

UNITED STATES PATENTS

2,940,619	6/1960	Schramm et al.	214/18 R
3,337,070	8/1967	Guilbert, Jr.	214/16 B

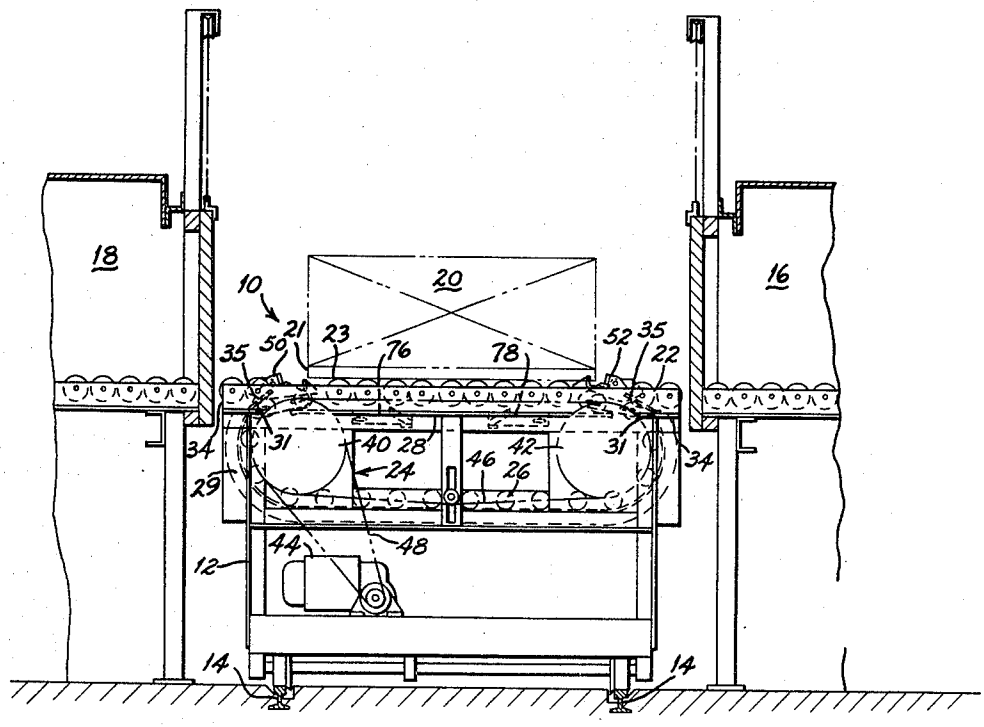
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[57] **ABSTRACT**

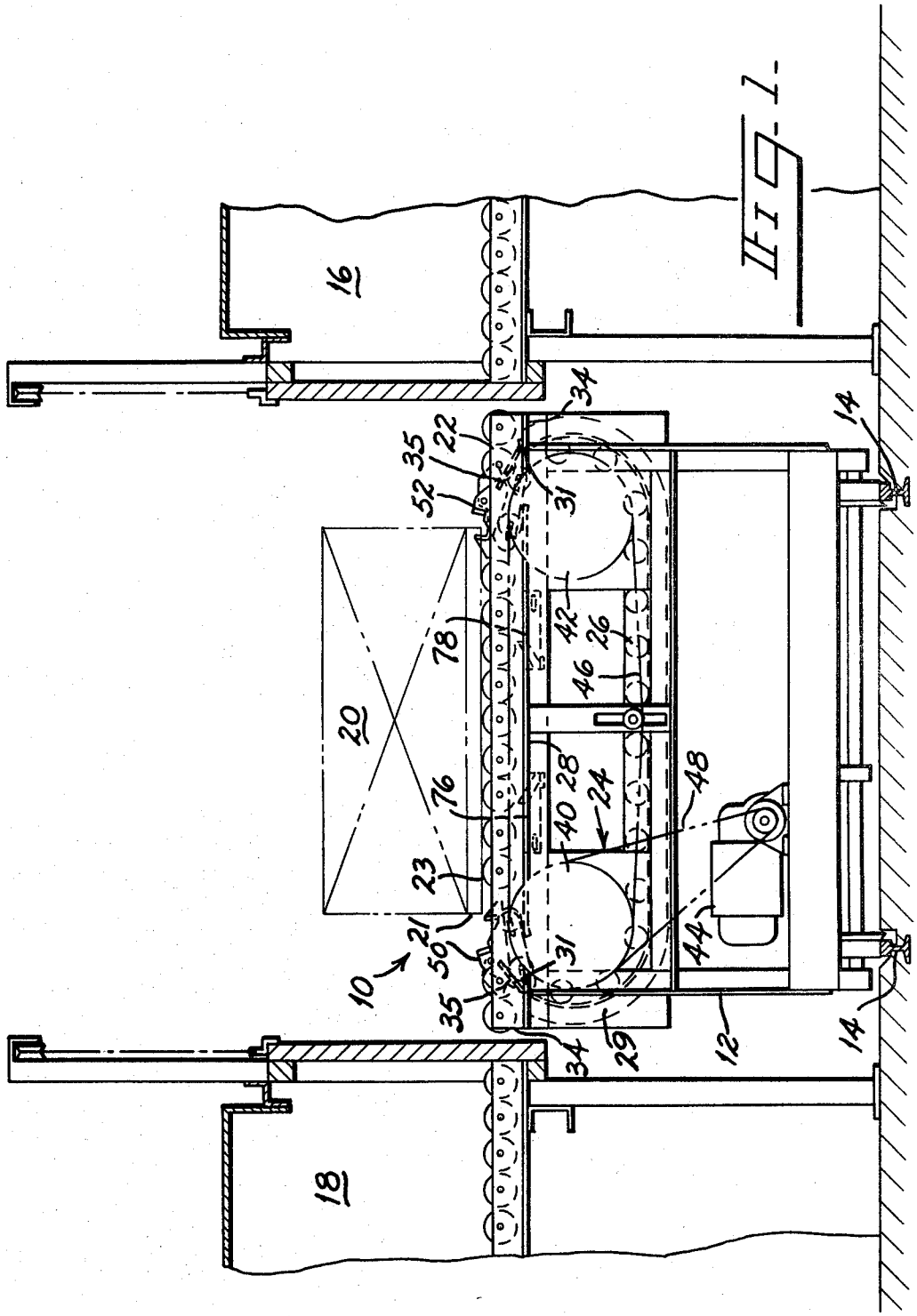
A car apparatus for transporting a workpiece carrier tray between separate work processing units and transferring the tray into and out of the units laterally with respect to the direction of car travel. The apparatus includes a push-pull means having a head assembly for engaging the tray. The head assembly comprises a frame slidable mounted upon a four wheeled carriage for relative movement between forward and rearward positions on the carriage. A hook member pivotally mounted on the frame is moved from a tray depositing mode to a tray withdrawing mode by shifting the frame into these alternate positions. The frame is shifted to the rearward position during a push stroke by the forward movement of the head assembly in combination with the resistance to this movement encountered when a bumper on the slidable frame engages a heavily laden tray to be charged into a processing unit. The frame is reset to its forward position during a pull stroke when a depending lug on the frame is pushed against a resiliently mounted abutment located on the car.

3 Claims, 5 Drawing Figures



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FIG. 1



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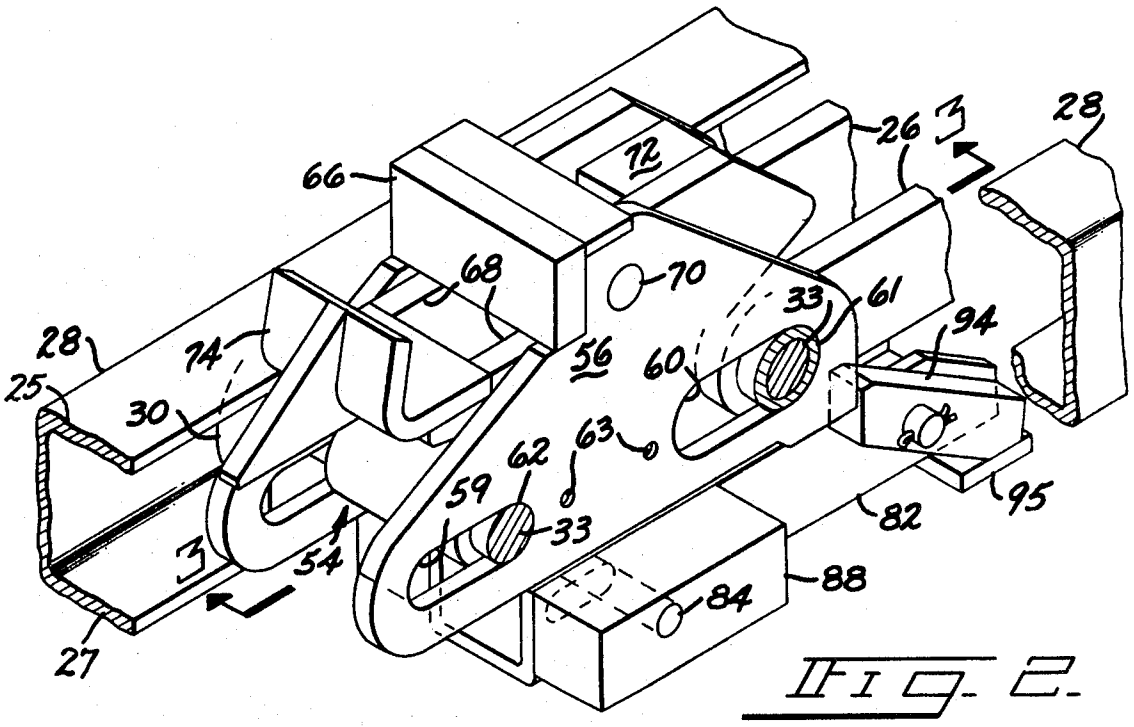


FIG. 2.

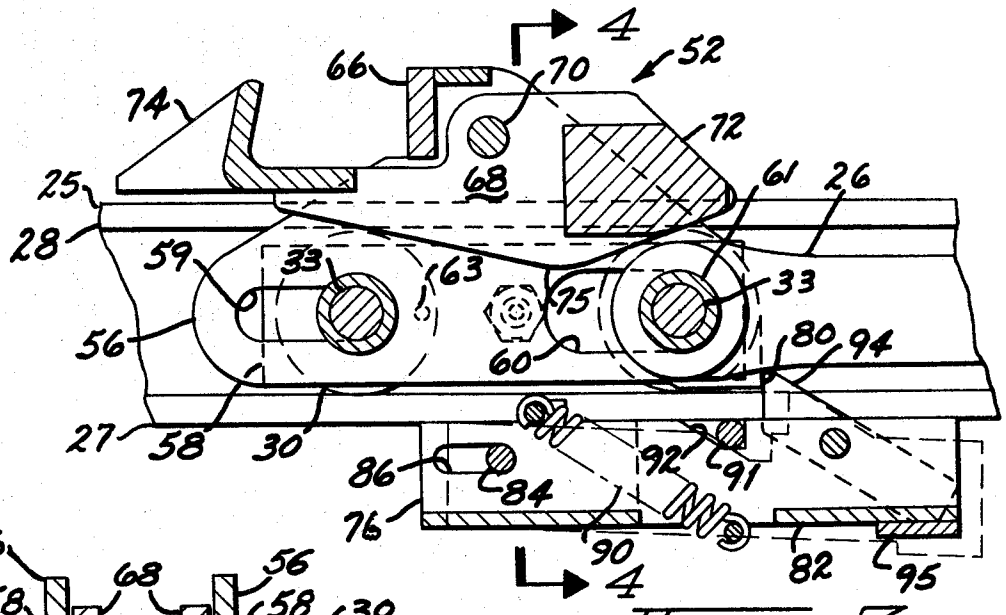


FIG. 3.

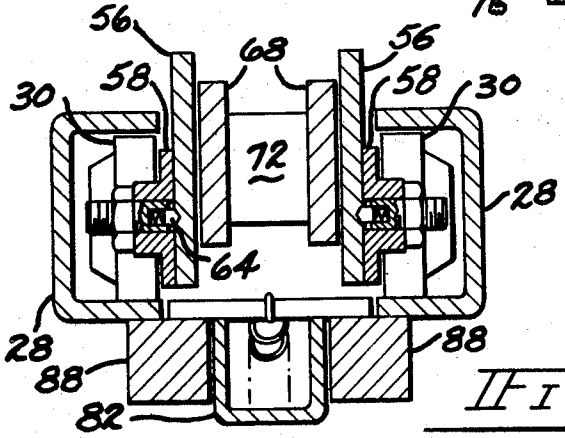


FIG. 4.

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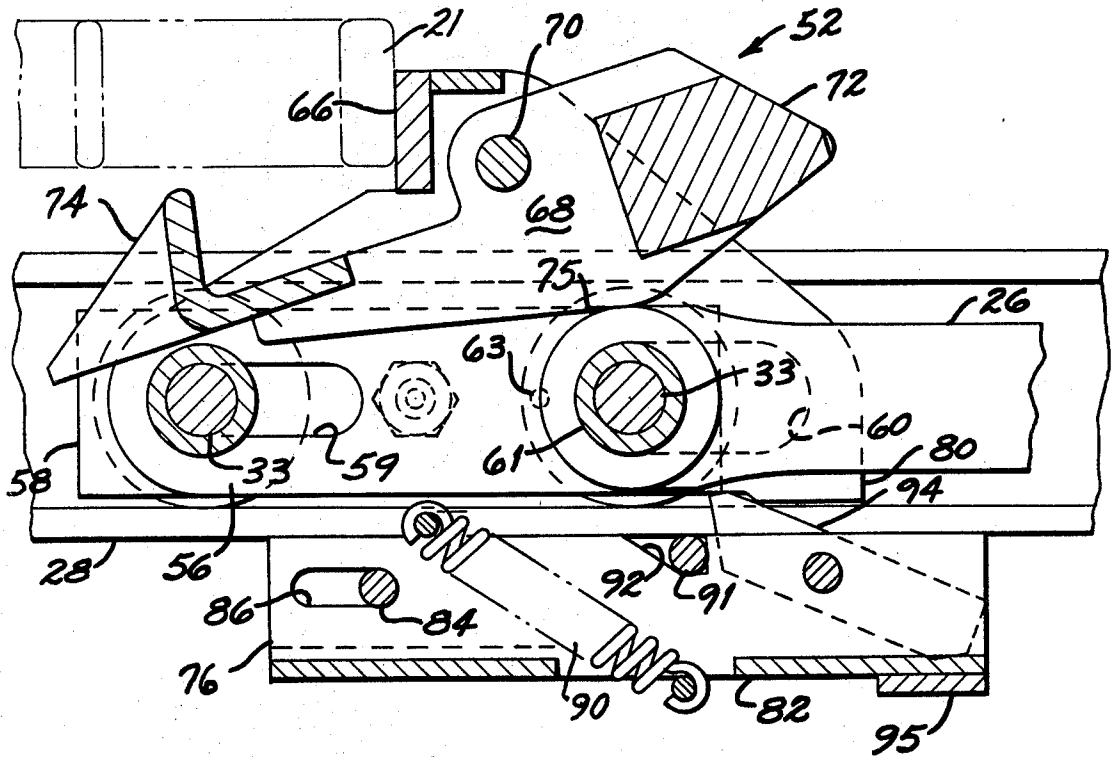


FIG. 5.

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WORK TRANSFER APPARATUS

BACKGROUND OF THE INVENTION

Equipment of this type is commonly used in heat treating shops in which a number of work processing units are located along opposite sides of a set of car tracks. An example of such equipment is found in U.S. Pat. No. 2,940,619 assigned to the applicants' assignee. In such equipment a workpiece carrier tray was transported on the car along the tracks until it was aligned with the desired processing unit. Then the tray was mechanically pushed into the processing unit and subsequently withdrawn after the processing step had been completed. Most of the problems with the prior art equipment involved the tray engaging head of the push-pull means. More particularly, it involved the manipulation of a pivotally mounted extractor dog between a raised position for contacting the tray and a lowered position for bypassing the tray. In most, if not all, of the prior art devices a cam means for tripping or resetting the dog was located in the work processing unit rather than on the car. In addition to the cost involved in supplying each processing unit with a tripping or resetting member for the coupler, other problems existed including constant exposure to the severe environment normally encountered within the processing units. Inaccessibility also created maintenance problems. Also the person operating the work transfer device could not determine if a coupling or discoupling malfunction had occurred until it was too late.

SUMMARY OF INVENTION

Generally speaking, the work transfer apparatus of this invention comprises a transporting car for traveling on a set of tracks running in front of one row or between two rows of processing equipment. The car has a push-pull means for moving a workpiece carrier tray laterally with respect to the direction of car travel into and out of the processing units. One or two coupling heads are attached to the push-pull means, depending upon the number of rows that the transfer device is to service. Each coupling head comprises a carriage with a frame member slidably mounted thereon for movement between forward and rearward positions. A bumper and a pivotal hook member are provided on the frame member for respectively pushing the tray into and withdrawing it from a processing unit. The hook member is weighed at one end so as to be in a raised position for engaging the tray when the hook is free to pivot. It is urged into a lowered or bypassing position by a cam means associated with the carriage. This is done in response to the bumper on the frame member engaging the tray on a push stroke and causing the frame to slide to its rearward position on the carriage. The frame member is reset to its forward position during a pull stroke by engaging a resiliently mounted abutment means located on the car. When the frame is in its forward position, the hook is free to rotate, and upon being placed under the edge of the tray engages the inside edge of the tray enabling it to be withdrawn from a processing unit. Means are provided to releasably hold the frame in the forward and rearward positions to prevent relative movement other than by forcible contact with the tray or the resetting abutment.

It is a general object of this invention to produce a simple, compact, rugged, and reliable work transfer apparatus capable of operating an an adverse environment with only a minimum of maintenance.

It is a more specific object of this invention to produce such a work transfer device having a hook member for withdrawing the workpiece carrier tray which may be reset or tripped by a means that is external of the processing units and within observation of the operator.

It is another object of this invention to provide such a work transfer device with a tray engaging head assembly that can be attached to a link belt and travel around sprocket.

The above mentioned objects and other objects and advantages and the manner of attaining them will be apparent from the following detailed description of a preferred embodiment of the invention made with reference to accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view showing the work transfer car and its means for conveying a workpiece carrier tray into and out of processing units located in rows adjacent the sides of the car.

FIG. 2 is an enlarged perspective view with parts broken away of a portion of the conveyor showing one of the coupling head assemblies with its frame in a forward position with respect to its carriage.

FIG. 3 is an elevational sectional view taken along line 3—3 of FIG. 2.

FIG. 4 is an elevational sectional view taken along lines 4—4 of FIG. 3.

FIG. 5 is a view similar to FIG. 3, but with the frame in a rearward position with respect to its carriage and with the hook cammed into its retracted position.

DESCRIPTION OF A PREFERRED EMBODIMENT

FIG. 1 shows a work transfer apparatus 10 comprising a transporting car 12 on a set of rails 14 running between rows of workpiece processing units 16 and 18 located closely adjacent its sides. The car 12 may be driven or otherwise moved along rails 14 to any number of preceeding or succeeding processing units 16, 18 having a depending edge 21 on each side thereof. A workpiece carrier tray 20 is disposed on a roller conveyor 22 having two rows of rollers 23 extending across the top of the car 12. The tray 20 may be conveyed from either side of the car 12 into and out of the processing units 16, 18 by a push-pull means 24 that runs across the car 12 parallel to and between the two rows of rollers 23 of the roller conveyor 22. Preferably the push-pull means 24 comprises a link type discontinuous chain 26 supported in a guide means 28 comprised of a pair of spaced apart channels formed to provide an oblong course with horizontal top 25 and bottom 27 runs connected at their ends by semicircular sections 29. The chain 26 is supported in the guide means 28 by rollers 30 mounted on opposite sides of each joint of the chain 26 by a common axle shaft 33 (see FIGS. 2 and 3). Horizontal guide extensions 34 are aligned with the top run 25 of the guide means 28 so that the free ends of the chain 26 may be projected into these extensions and beyond the sides of the car 12 into adjacent processing units. An opening 31 is provided in that portion of the lower flange of each guide extension 34 which would interfere with chain 26 travel between the horizontal top run 25 and the semicircular end sections 29. Pivotal bridge members 35 normally span these openings 31 subject to being swung into an open position by the upward advancement of one of the chain 26 ends after the other end of the chain has been withdrawn from the corresponding extension. The chain 26 is reciprocably driven by a pair of axially spaced apart sprockets 40 and 42 connected to each other and to a reversible motor means 44 by a drive chain 46 and drive belt 48.

Coupling head assemblies 50 and 52 are provided on the free ends of the chain 26 for pushing the tray 20 in either of two directions into the processing units 16, 18 and pulling the tray from the processing units back onto the car 12 or for transferring of the tray from one location to another within a processing unit. The coupling heads 50, 52 are identical so only the details of the coupling head 52 shown on the right side of FIG. 1 will be described and are shown in FIGS. 2 to 5. Basically, the coupling head assembly 52 comprises a dolly or carriage member 54 which carries a frame member 56 that may be slidably shifted back and forth on the carriage member 54. The carriage member 54 is pivotally attached to the end link of the chain 26. It has a pair of rollers 30 mounted on an axle shaft 33 at its front end and another pair of similarly mounted rollers 30 at its rear end. Linking the front and back pairs of rollers 30 together to form the carriage 54 is a set of

side plates 58. The frame member 56 is slidably mounted between the side plates of the carriage 54. For this purpose, oblong slots 59 and 60 are provided in the front and rear portions respectively of the frame member 56. Slots 59 slidably contain an axle shaft 33 for the front pair of rollers 30, while slots 60 slidably contain bushings 61 of the end link of chain 26 which in turn hold an axle shaft 33 for the rear pair of rollers 30. Slots 60 are wider than slot 59. A pair of detents 63 in the side of the frame member 56 adjacent the carriage member 54 are positioned so as to engage a spring loaded plunger 64 on the carriage side plates 58 to alternatively hold the frame in either the forward or rearward position with respect to the carriage. The frame member 56 has a protrusion which extends above the normal height of the chain and operates as a bumper 66 for engaging the outside lower edge of the tray 20 on a charging push stroke. A hook member 68 is provided for engaging a depending edge 21 of the tray 20 on a pull stroke to withdraw a tray from a processing unit 18 The hook member 68 is pivotally mounted on a shaft 70 which is attached to the frame member 56. The axis of the shaft 70 is disposed parallel to shafts 33 and located between the bumper 66 and the rear end of the frame member 56. The shank end 72 of the hook member 68 is adjacent the rear end of the frame member 56 and is weighted in order to maintain the opposite or hook end 74, adjacent the front end of the frame, in a normally raised or tray engaging position when the hook member is free to rotate upwardly, i.e., when the frame member is in its reset or forward position with respect to the carriage member 54. The upper forepart of the hook end 74 is inclined so that upon contact with the underside of the tray 20 on a push stroke it will be urged downwardly under the edge of the tray without itself causing the frame to shift to a rearward position on the carriage. After the forepart of the hook end 74 passes beyond the depending edge of the tray, it is free to rotate upwardly so that it will engage the inside edge of the tray on a pull stroke. The shank end 72 of the hook member has a cam engaging surface on its underside which cooperates with the upper frontal profile 75 of the first chain link 26, providing camming surfaces so that when the frame member 56 is in its rearward position, the shank end of the hook 72 is urged into its uppermost position. This position provides a carrier tray depositing or tray disengaging position of the coupling head 52. Thus, the coupling head 52 is now in position to be withdrawn from the processing equipment with the tray 20 remaining in an internal foremost position of the process equipment.

Reset mechanisms 76 and 78 are located on the car 12 in the path of the head assemblies 50 and 52 for shifting the frame member 56 of each head assembly 50 or 52 into its forward position. The reset mechanisms 76, 78 are in the form of resiliently mounted abutments located in the path of a lug means 80 depending from the rear end of the head assembly frame member 56. Each reset mechanism comprises a bracket 82 which is reciprocably mounted directly beneath the top run 25 of chain guide 28 by a pin 84 and slot means 86 located at one end of the bracket denoted the front end for the purpose of description. The pin 84 is anchored in supporting blocks 88 affixed to the underside of the chain guide 28. A spring 90 is attached to the bracket 82 so as to hold the rear end of the bracket in its upper-forward position. A rod 91 affixed across the underside of the chain guide 28 cooperates with an inclined surface of a notch 92 in the top of the bracket 82 to urge the rear end of the bracket downwardly when the bracket is moved rearwardly. A pair of pivoted dogs 94 are mounted at the rear end of the bracket 82. The dogs 94 are weighted at their rear ends which are carried upon a plate 95 affixed to the underside of the bracket 82 so that the dogs are held normally in an inclined position with their forward ends extending upwardly into the path of lugs 80. With this structure a coupling head assembly 52 may pass freely over the dogs 94 of both reset mechanisms 76 and 98 without shifting the frame member 56 with respect to the carriage when the head assembly is being pushed in a forward direction (see FIG. 5). In operation, the operator selects process equipment 18 to be serviced and energizes reversible motor 44 which drives the sprocket 40 via the belt 48. The sprocket 40 in turn drives the chain 26, which is contained within guide means 28. The coupling head 52, which is attached to the end of the contained chain 26 and travels in guides 28, travels horizontally until its bumper 66 contacts the tray 20. Upon contact, the frame 56 stops horizontal movement, but the carriage 54 continues its horizontal movement. This action causes the frame 56 to be shifted from the forwardly tray engaging position (FIG. 3) to the rearwardly tray disengaging position (FIG. 5). During this position change, hook 74 becomes cammed to its downward position by the action of the shank end of the hook 72 and the upper leading surface 76 of the end link of the chain 26. At this point, the frame member 56 stops its rearwardly motion with reference to the carriage 54 due to limitations of slots 59 and 60 and proceeds to transfer the tray 20 into the process equipment 18.

When the tray 20 is at its desired rearward location in the process equipment, the motion of the coupling head 52 is reversed, depositing the tray for processing, and returning the coupling head to the transport car 12.

As the coupling head 52 passes the reset mechanism 76 on its rearwardly return to its transporting position, its frame 56 is shifted from its rearward tray disengaging position (FIG. 5) to its forward tray engaging position (FIG. 3) by the action of reset dog 94 engaging the frame lug 80. On a pull stroke the frame member lugs 80 of the head assembly 52 will positively engage the dogs 94 of only reset mechanism 76 (see FIGS. 2 and 3). This engagement causes the frame member 56 to shift to its forward position on the carriage, whereupon the bracket 82 is moved rearwardly by the continued rearward progress of the head assembly. The rearward movement of the bracket 82 causes the rear end of the reset mechanism 76 to be urged downwardly out of the way due to the camming action of the inclined surface of the notch 92 riding against rod 91. After the head assembly has passed, the bracket 82 is returned by means of its spring 90 to its normal upper-forward position. Thus the coupling head assemblies are reset to a tray engaging position upon their return to the transport car without manual manipulation by the operator.

The tray 20 may be transferred from one location within the process equipment 16 to another. The coupling head 52 in its tray engaging position (FIG. 3) is moved to the rearward position of the process equipment 16 to engage the tray 20. The forepart of the hook end 74 is urged downwardly and passes beneath and beyond the depending edge 21 of the tray. After the hook member 68 passes beyond the depending edge 21 of the tray 20, the hook 68 rotates upwardly into its tray engaging position due to its counterweighted shank end 72. At this time, the rearward motion of the coupling head 52 is reversed, causing the tray 20 to be transferred to a forward position in the process equipment 18.

When the desired forward position of the tray 20 is reached in the process equipment 16, the motion of the coupling head 52 is reversed to a rearward direction. Upon contact of frame bumper 66 with the tray 20, the frame 56 stops motion, while carriage 54 and link 26 continue toward the rearward position of the process equipment 16 for a distance sufficient to shift the frame to its rearward disengaging position (FIG. 5). When the frame 56 is completely shifted to its disengaging position, the hook end 74 drops. The coupling head 52 direction is immediately reversed, leaving the tray 20 in the forwardly position and returns to the transport car 12 to be reset to its tray engaging position.

The final operation is to withdraw the tray 20 from a forward position in the process equipment after final processing. The coupling head 52 in its tray 20 engaging position (FIG. 3) is moved into the forward position of the process equipment 18 to engage the tray 20. The forepart of the hook end 74 is urged downwardly upon contact with the tray 20 and passes beneath and beyond the depending edge 21. At this point, the hook member 68 rotates upwardly, engaging the tray 20. The

direction of the coupling head **52** is now reversed, transferring the tray **20** from the forward position in the process equipment **16** to the transport position on the transport car **12**.

While the above description was made with reference to the presently preferred embodiment shown in the accompanying drawings, it is to be understood that the scope of the invention is not necessarily limited to the details shown in these drawings, but rather is limited only by the attached claims.

We claim:

1. A work transfer apparatus comprising: a car for transporting a workpiece carrier tray between separate processing units, a push-pull means on said car for moving said tray in directions lateral to the direction of car travel, a coupling head assembly secured to said push-pull means, said head assembly having a frame member slidably mounted upon a carriage for relative movement between forward and rearward positions on said carriage, a bumper for engaging said tray on a push stroke, a hook member pivotally mounted on said frame member for engaging said tray on a pull stroke, said hook member having its shank end weighted so as to maintain the hook end in a raised position when said hook member is free to rotate, a cam member associated with said carriage for engaging the shank end of said hook member and causing the hook end to be pivoted into its retracted lower position when the frame member is moved to its rearward position with respect to said carriage, and an abutment means on said car for resetting said frame members into a forward position with respect to said carriage.

2. A work transfer apparatus according to claim **1** wherein said abutment means includes a dog member pivotally mounted on an oscillatable bracket having a cam means for urging said abutment means out of confronting relationship with said frame upon limited movement of the bracket by said frame member, and spring means for returning said abutment means into its normal position in the path of said carriage.

3. A work transfer apparatus according to claim **1** wherein the pivotal axis of the hook member is located between said bumper and the front end of said carriage.

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