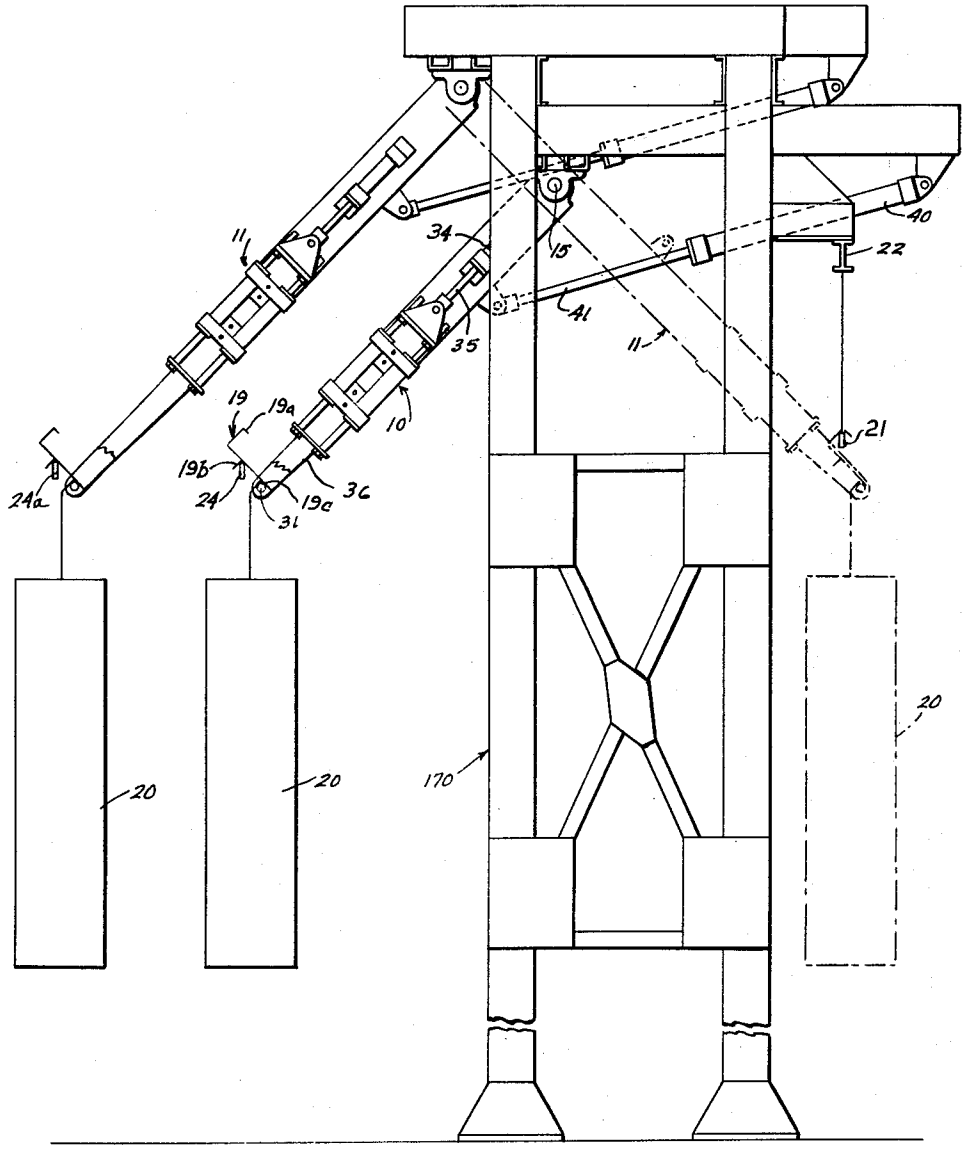
March 15, 1960 V. FINSTON 2,928,519

WORK TRANSFER APPARATUS

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Fig. 1



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WORK TRANSFER APPARATUS

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Fig. 2

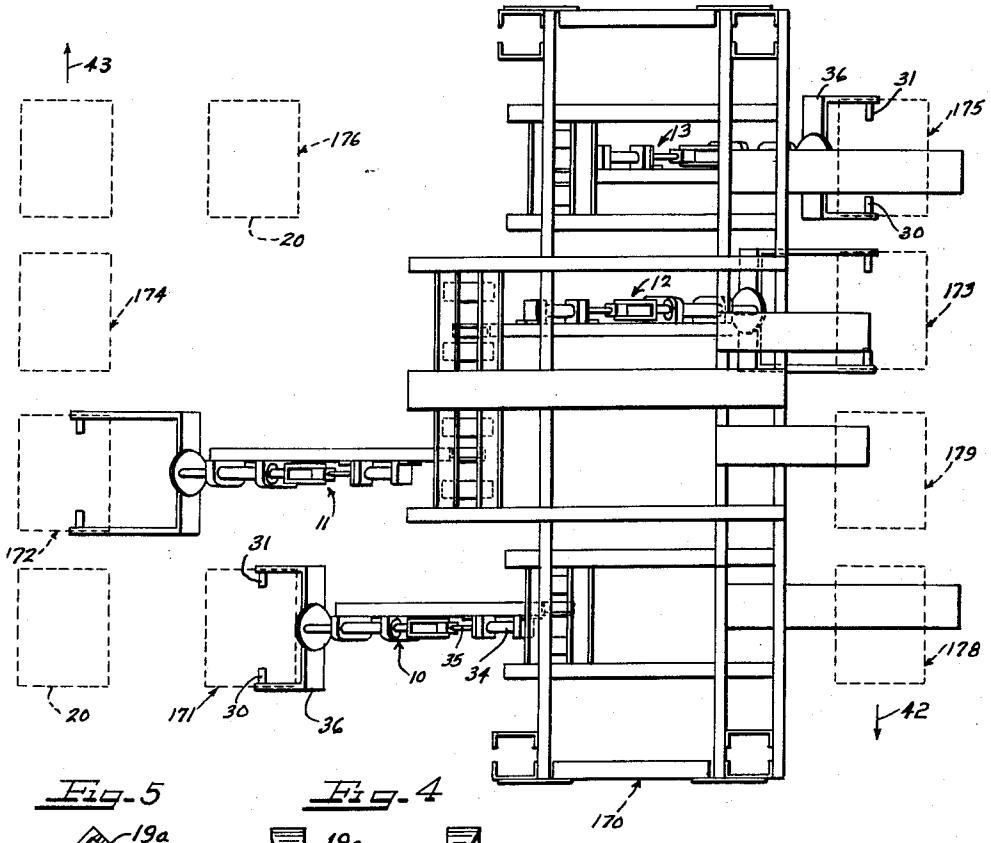


Fig. 5

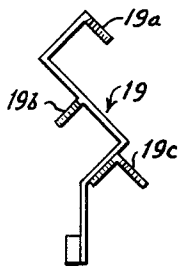
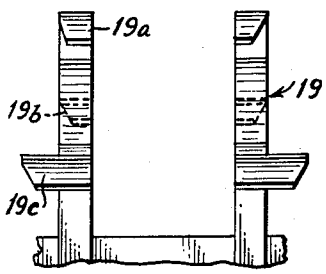


Fig. 4



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WORK TRANSFER APPARATUS

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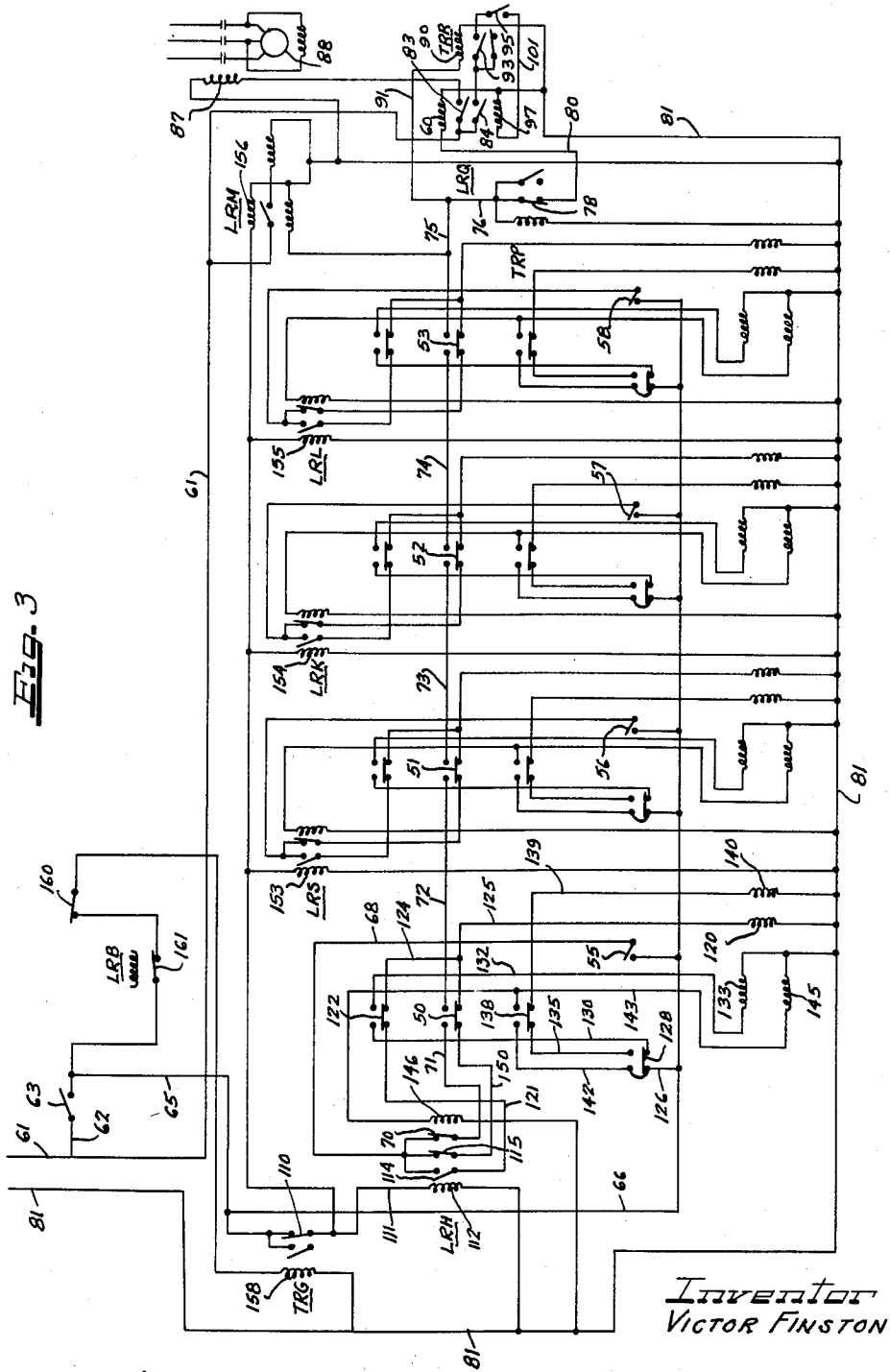


Fig. 3

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2,928,519

WORK TRANSFER APPARATUS

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Application September 21, 1956, Serial No. 611,151

4 Claims. (Cl. 198—27)

This invention relates to a processing machine and method, and particularly to a load and unload mechanism for such a machine.

It is an important object of the present invention to provide a novel and improved automatic load and unload mechanism for processing machines and the like.

It is a further object of the present invention to provide a novel load and unload apparatus which is operative to remove work units from a monorail conveyor and load the units on carriers associated with a processing machine or the like.

It is a further object of the present invention to provide an electric control circuit synchronized with the operation of a processing machine for controlling load and unload operations thereof.

Another object of the invention is to provide a novel hanger bar for work units and a novel load and unload mechanism for cooperation therewith.

Other and further objects, features and advantages of the invention will be apparent from the following detailed description, taken in connection with the accompanying drawings, in which:

Figure 1 is a somewhat diagrammatic side elevational view of the load and unload mechanism of the present invention;

Figure 2 is a top plan view of the mechanism of Figure 1;

Figure 3 is a diagrammatic illustration of an electric control circuit for controlling operation of the mechanism of Figure 1;

Figure 4 is a fragmentary elevational view on an enlarged scale showing the work hanger; and

Figure 5 is an end elevational view of the hanger of Figure 4.

As shown on the drawings:

The load and unload mechanism of the present invention is particularly adapted to be incorporated in a processing machine of the type disclosed in my copending application Serial No. 536,866 filed September 27, 1955, now Patent No. 2,869,560 and the disclosure of that copending application is incorporated herein by reference.

In the copending case, there is illustrated a processing machine for moving work units through a series of processing stations which involves moving certain of the work units horizontally between stations, raising other of the work units vertically, transferring work units horizontally in raised position between stations, and then lowering work units to the next succeeding stations. After the main elevator has reached its lower position, a timing relay is provided to provide a predetermined processing time before the machine is recycled. The load and unload mechanism of the present invention is adapted to operate during this dwell period in the operation of the machine and to return to a rest position before the machine is recycled.

Figures 1 and 2 illustrate a load and unload mechanism for use in the machine of said copending application. Said mechanism comprises short and long unload arms

10 and 11 and long and short load arms 12 and 13. Since the arms are substantially identical except as to length, only one arm need be described in detail. Each arm is pivotally carried on a shaft such as 15 for swinging movement between a position such as indicated in dotted outline in Figure 1 where it is engageable with a hanger 19 of a work unit 20 suspended by means of a bar 21 from a monorail 22 and a position such as indicated in solid outline in Figure 1 for delivering the work unit to a mounting bar such as 24 or 24*a* of a work carrier such as illustrated in my aforementioned copending application. It will be observed that the hanger bar 19 has an upper hook portion 19*a* for engagement with the bar 21, an intermediate hook portion 19*b* for support by the work carrier bar 24 and a lower hook portion 19*c* for engagement by lift pins 30 and 31 of each arm which are best seen in Figure 2.

In order to disengage the hook portion 19*a* or 19*b* of the hanger 19 from the monorail bar 21 or the work carrier bar 24 or 24*a*, a cylinder mechanism 34 is provided on each arm having a piston rod 35 connected to a longitudinally shiftable raising fork 36 on the arm which carries the lift pins 30 and 31. Thus in the solid outline position shown in Figure 1 with the lift pins 30 and 31 of arm 11 engaged under the hook portion 19*c* of the hanger 19, cylinder 34 is actuated to raise the hanger bar 19 and thereby disengage the hook portion 19*b* from the bar 24*a*. A cylinder such as indicated at 40 is then actuated to retract its piston rod 41 to swing the arm 11 into its dotted outline position after which the piston rod 35 is extended to cause the hook portion 19*a* to engage the monorail bar 21. The arm is now free to swing back to an intermediate rest position out of the path of the work units to accommodate cycling of the machine. In mid position, the arms may hang vertically from pivot shafts 15.

It will be understood that in loading work carriers, cylinder 34 of each load arm would be actuated to retract its piston 35 and disengage hook portion 19*a* from monorail bar 21, after which the arm would be swung to its unload position and piston rod 35 extended to place the hook portion 19*b* of the work hanger on a work carrier bar 24 or 24*a*.

Referring to Figure 2, it will be understood that the monorail conveyor would travel in the direction of arrow 42 from the load arms 12 and 13, where work would be taken from the monorail, to the unload arms 10 and 11 where work units would be transferred from the plating machine to the monorail for movement to any desired location remote from the plating machine. The work carriers would be traveling in the direction of arrow 43 from the unload arms 10 and 11, where treated work units would be transferred from the machine, to the load arms 12 and 13 where the work carriers would receive new work units to be treated.

Automatic load and unload electric circuit

The unload arms 10 and 11 and the load arms 12 and 13 of Figures 1 and 2 are returned to a mid position after each load and unload operation, and in this condition the respective mid position limit switch contacts 50, 51, 52 and 53 are in upper position. With the raising forks or shiftable members such as 36 in Figure 1 extended, limit switch contacts 55, 56, 57 and 58 will also be in their upper positions. To index the monorail conveyor, latch coil 60 of relay LRQ will now be energized through the following circuit:

Line 61, line 62, contact 63 of main elevator lower position limit switch (with the main elevator in lowered position), line 65, line 66, contact 55, line 68, normally closed contact 70, line 71, contact 50, line 72, contact 51, line 73, contact 52, line 74, contact 53, line 75, line

76, normally closed contact 78 of relay TRP, line 80, latch coil 60 and line 81.

Latching of relay LRQ closes contacts 83 and 84. Closure of contact 83 energizes relay coil 87 to thereby cause energization of the monorail motor 88.

Coil 90 of relay TRR is energized from line 75 to line 91, coil 90 and line 81 to close contact 93 after a suitable time delay. Relay TRP is energized from line 76 to open contact 78 after a suitable time delay. When the monorail limit switch contact 95 is actuated to indicate proper positioning of the monorail conveyor for load and unload operation, a circuit is completed for unlatch coil 97 of relay LRQ from line 61, through contact 84 of relay LRQ, contact 93, contact 95 of the monorail limit switch, line 101, unlatch coil 97 and line 81 to unlatch relay LRQ and deenergize and brake the monorail motor 88.

When the main elevator reaches its lowered position, relay LRH is latched through the following circuit:

Line 61, line 62, contact 63, line 65, normally closed contact 110 of relay TRG, line 111, latch coil 112 of relay LRH and line 81.

Latching of relay LRH closes contact 114 and opens contacts 115 and 70.

Forward coil 120 of number 1 unload cylinder 40 is now energized through the following circuit:

Line 65, line 66, contact 55, line 68, contact 114, line 121, contact 122 of number 1 unload forward position limit switch, line 124, line 125, forward coil 120 and line 81.

When the unload arm number 1 indicated at 10 in Figures 1 and 2 reaches its forward position shown in solid outline in Figure 1, limit switch contact 122 is actuated to cause retraction of shiftable member 36 through the following circuit:

Line 65, line 66, line 126, contact 128 of number 1 unload shiftable member upper (retracted) position limit switch, line 130, contact 122, line 132, reverse coil 133 for cylinder 34 and line 81.

When the shiftable member 36 is fully retracted, contact 128 shifts to complete a circuit from line 126 through contact 128, line 135, number 1 unload arm return position limit switch contact 138, line 139 and reverse coil 140 of cylinder 40 to begin moving the number 1 unload arm toward the monorail conveyor.

When the arm reaches the monorail conveyor, limit switch contact 138 completes a circuit from line 66 through line 126, line 142, contact 138, line 143, and forward coil 145 of number 1 retracting cylinder 34 to extend the shiftable member 36 and thereby place the outgoing work unit on the monorail bar 21 as shown in Figure 1 in dotted outline. Limit switch contact 138 also causes energization of unlatch coil 146 of relay LRH upon retraction of the arm to its rear position to unlatch relay LRH.

When the shifatble member 36 is fully extended, number 1 unload shiftable member lower (extended) position limit switch 55 closes, completing a circuit from line 66, through contact 55, line 68, contact 115, line 150, contact 50, line 125 and forward coil 120. This circuit is now interrupted by contact 50 when the number 1 unload arm reaches its mid position.

It will be understood that the relay TRG interrupts the energization of latch coil 112 of relay LRH after a short time interval.

It will be understood that latch coils 153, 154, 155 and 156 of relays LRJ, LRK, LRL and LRM respectively are energized along with latch coil 112 of relay LRH under the control of contact 110 of timing relay TRG. Coil 158 of timing relay TRG is energized when the main elevator reaches its lower position and the top and bottom shuttles start returning, contact 160 opening when the top shuttle reaches returned position and contact 161 opening when the processing machine timing relay times out and coil 161 of relay LRB is energized in preparation for a transfer cycle of the machine. When TRG times out, contact 110 is opened to deenergize the latch coils 112, 153, 154 and 155.

The circuits for the unload arm 11 and the load arms 12 and 13 operate in the manner described for the number 1 unload arm 10 except that the movement of the arms 12 and 13 is opposite to that of the unload arms as will be apparent from an inspection of the electric circuit.

Summary of operation

The load and unload mechanism shown in Figures 1 and 2 includes arms 10, 11, 12 and 13 which are normally in a mid position hanging vertically. The unload arms 10 and 11 first swing to the left as viewed in Figure 1 with fork members 36 extended to swing under hook portions 19*c* of the hanger bars. These members 36 are now retracted to lift the work off of the work carrier bars 24, after which the unload arms are swung to the right in Figure 1 to place the hook portions 19*a* of the hanger bars over the monorail bar 21. The members 36 are now extended to deposit the work on the monorail bar 21.

The load arms 12 and 13 also start from a mid vertical position but swing to the right with the members 36 extended to engage in the hook portions 19*c*. The members 36 are then retracted to lift the work units off the monorail bars 21, and the arms are swung to the left to move hook portions 19*b* into overlying relation to the work carrier bars 24, after which the members 36 are extended to disengage the work. The arms then return to mid position.

As will be understood from Figures 1 and 2, work carrier means such as bars 21 of the monorail conveyor travel along the path indicated by arrow 40 on one side of the framework 170 and are indexed two positions under the control of limit switch 95 during each cycle of the processing machine. Work carrier means such as bars 24 and 24*a* travel in two laterally adjacent paths in the direction of the arrow 41. A bar 24 and a bar 24*a* may be carried by each work carrier of the processing machine for suspending a pair of work units from each work carrier. In each cycle of the processing machine the short unload arm 10 in its unload position removes the nearer work unit at unload station 171 from the work carrier just leaving the last treatment station of the processing machine, while the long unloading arm 11 in its unloading position removes the farther work unit, at unload station 172 from a second work carrier. The long load arm 12 transfers an incoming work unit from an unload station 173 of the monorail conveyor to a load station 174 at the farther side of a third work carrier, and the short load arm 13 transfers a second incoming work unit from an unload station 175 to a load station 176 at the near side of a fourth work carrier. The work carriers are then advanced one step by the processing machine to deliver said fourth work carrier fully loaded to the first treatment station of the processing machine, while the monorail conveyor is indexed two positions to bring two new incoming work units into the unloading stations indicated at 173 and 175 and to move the previously unloaded monorail bars 21 from unloading stations 173 and 175 to loading stations 178 and 179 respectively.

It will be understood that many modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. In a work transfer apparatus for transferring work units between first and second supports, a work unit supporting hanger for supporting a work unit having a first hook means opening toward said first support for engagement with said first support, having a second hook means opening toward said second support for engagement with said second support and having a third hook means opening generally downwardly, a framework, arm means swingably mounted on said framework for movement between a first position in operative relation to said first

support and a second position in operative relation to said second support, shiftable lifting means carried by said arm means comprising a yoke having lift pins extending inwardly from opposite sides thereof and operative to engage said third hook means when said hanger is supported by said first support and said arm means is in said first position, means mounting said yoke for longitudinal reciprocation on said arm means, said lift pins being operative upon retraction of said yoke in first position of said arm means to lift said hanger to disengage said first hook means from said first support, said lift pins being operative in second position of said arm means upon extension of said yoke to lower said hanger to engage said second hook means with said second support, said lift pins being operative in extended position of said yoke means to swing clear of said third hook means leaving said hanger on said second support, means for actuating said lifting means to retract said yoke to disengage said first hook means from said first support in first position of said arm means and for extending said yoke to engage said second hook means with said second support in second position of said arm means, and means for swinging said arm means between said first and second positions synchronized with said actuating means to move a hanger from said first support to said second support.

2. In a work transfer apparatus for transferring work units between first and second supports, a framework, arm means swingably mounted on said framework for movement between a first position in operative relation to said first support and a second position in operative relation to said second support, shiftable lifting means carried by said arm means comprising a yoke for movement between an extended and a retracted position, said yoke having lifting pins extending inwardly from the extremities thereof and terminating in spaced opposed relation, means for shifting said yoke between said retracted and said extended position, means separate and independent of said shifting means for swinging said arm means between said first and said second position, and control means for actuating said swinging means to move said arm means to its first position with said yoke in extended position, for actuating said shifting means to move said yoke to retracted position to detach a work unit from the first support, for actuating said swinging means to move said arm to its second position, and for thereafter actuating said shifting means to move said yoke to its extended position to engage the work unit with the second support.

3. In a work transfer apparatus for transferring work units, first and second supports, a frame work, arm means swingably mounted on said framework between said first and second supports for swinging movement in a lateral direction directly between and in alignment with said first and second supports between a first position

in laterally spaced aligned relation to said first support and a second position in laterally spaced aligned relation to the second support, shiftable lifting means carried by said arm means for movement between an extended and a retracted position, means carried by said arm means for shifting said shiftable lifting means between said retracted and said extended position, means connected to said framework and to said arm means for swinging said arm means between said first and said second position, and control means for actuating said swinging means to move said arm means to its first position with said shiftable lifting means in extended position, for actuating said shifting means to move said shiftable lifting means to retracted position to lift a work unit off of said first support, for actuating said swinging means to move said arm means to its second position, and for thereafter actuating said shifting means to move said shiftable lifting means to its extended position to deposit the work unit on the second support.

4. In a work transfer apparatus for transferring work units between first and second supports, a work unit supporting hanger for supporting a work unit and having a first hook means opening toward said first support for engagement with said first support, having a second hook means opening toward said second support for engagement with said second support and having a third hook means opening generally downwardly, a framework, arm means movably mounted on said framework for movement between a first position in operative relation to said first support and a second position in operative relation to said second support, lifting means carried by said arm means and operative to engage said third hook means when said hanger is supported by said first support and said arm means is in said first position, means for retracting said lifting means in first position of the arm means to lift the hanger and disengage said first hook means from said first support, means for extending said lifting means in second position of said arm means to lower said hanger to engage said second hook means with said second support, said lifting means being operative in extended position to swing clear of said third hook means leaving said hanger on said second support, and means for controlling the actuation of said arm means and lifting means to transfer said hanger from said first support to said second support.

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