June 11, 1946. D. M. KING 2,402,056

HYDRAULIC CONVEYER DRIVING MECHANISM

Filed Feb. 29, 1944 4 Sheets-Sheet 1

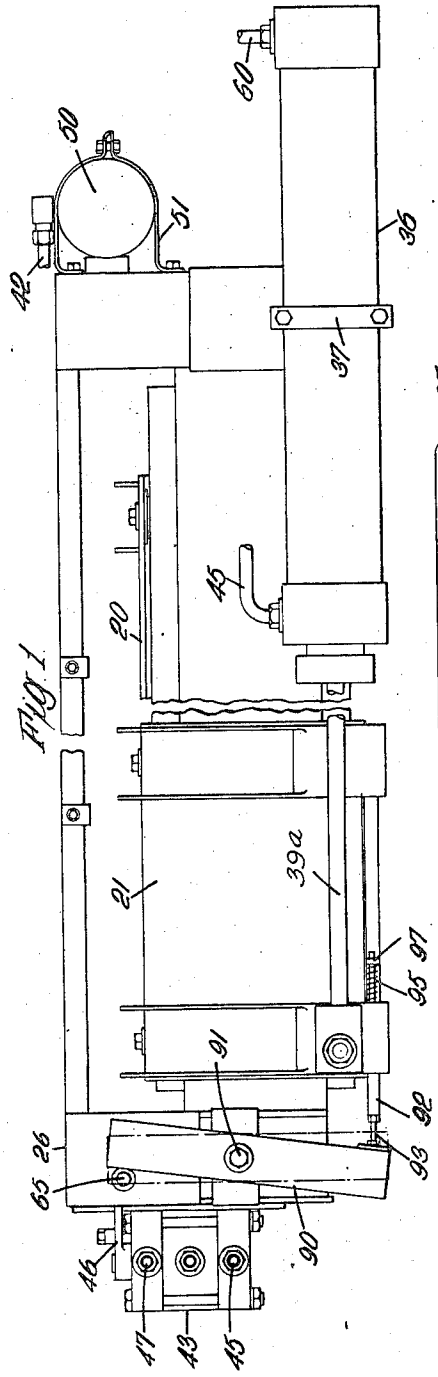


Fig. 1

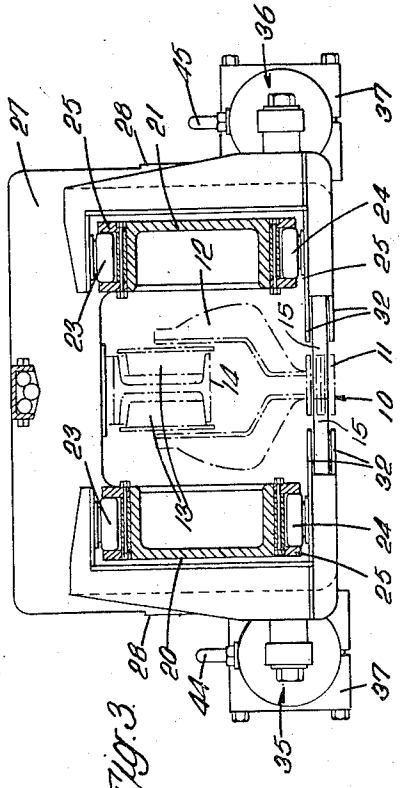


Fig. 3

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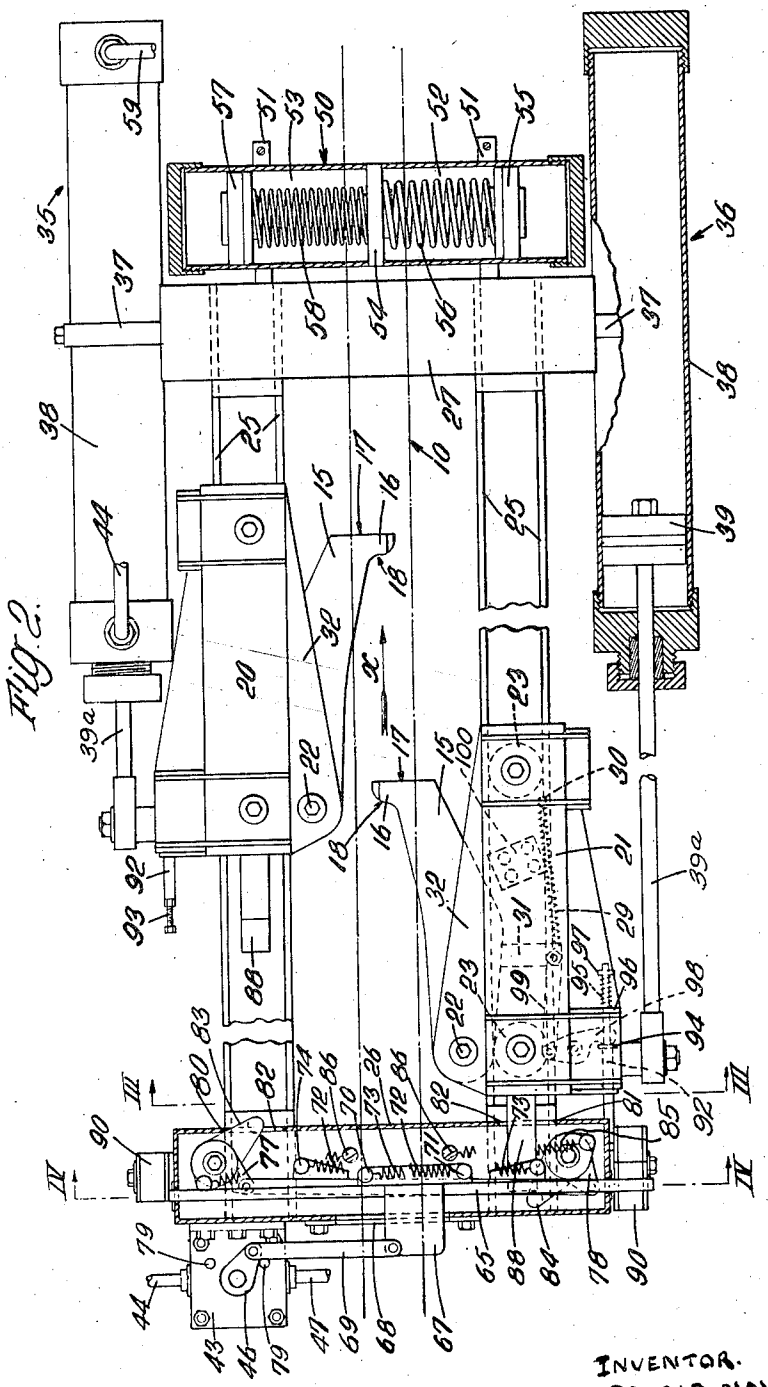


Fig. 2.

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HYDRAULIC CONVEYER DRIVING MECHANISM

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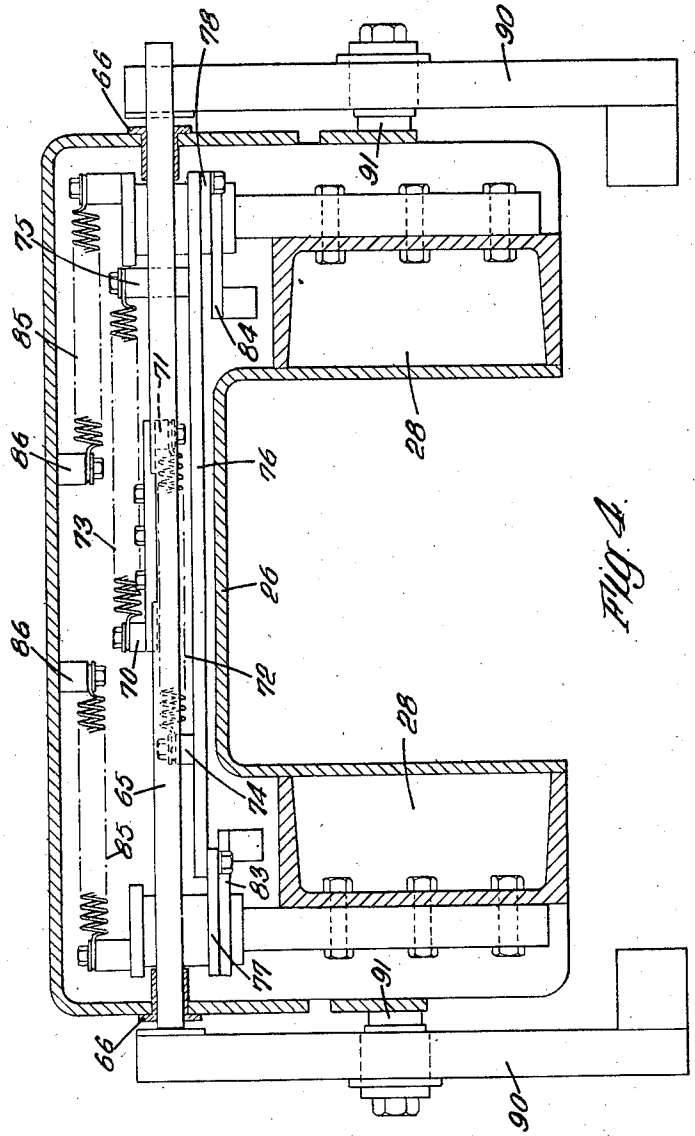


Fig. 4.

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HYDRAULIC CONVEYER DRIVING MECHANISM

Filed Feb. 29, 1944 4 Sheets-Sheet 4

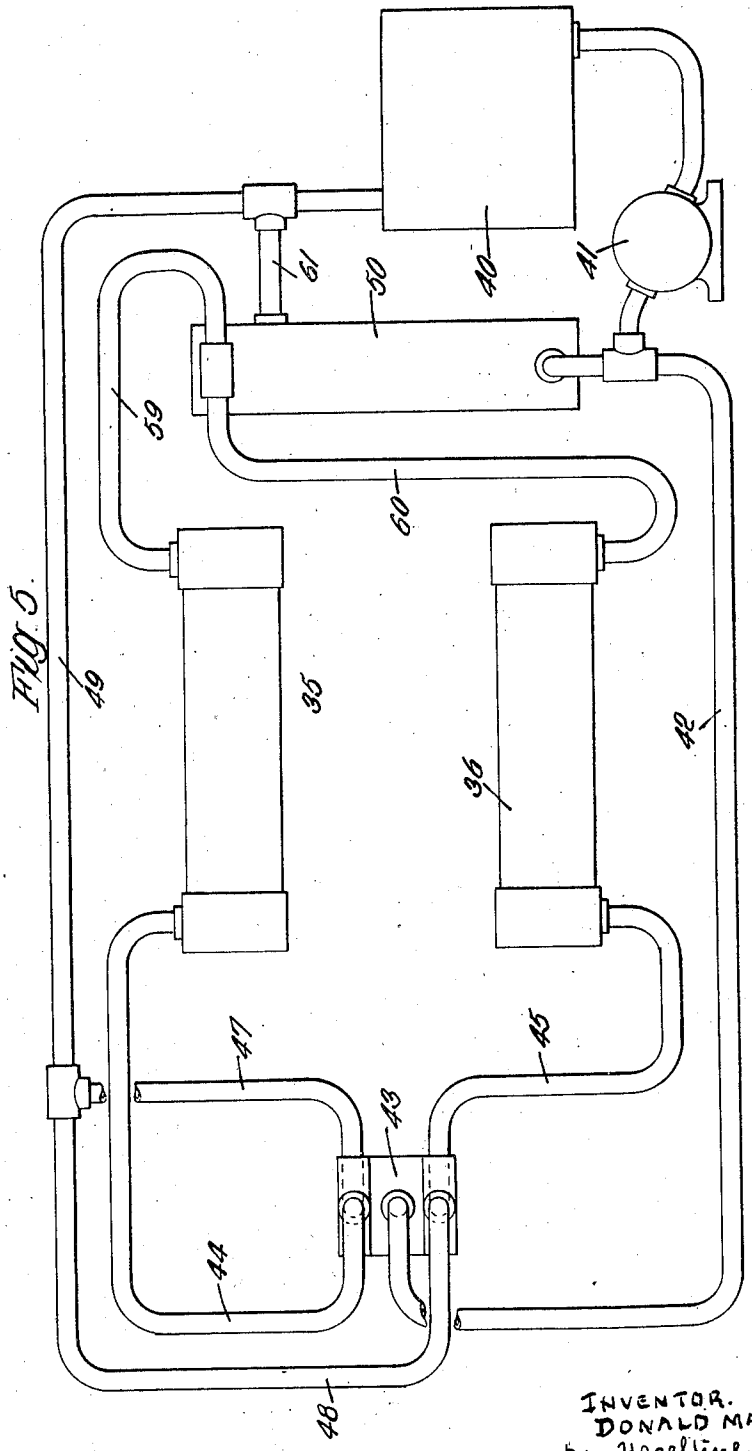


Fig. 5.

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2,402,056

UNITED STATES PATENT OFFICE

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HYDRAULIC CONVEYER DRIVING MECHANISM

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Application February 29, 1944, Serial No. 524,426
In Great Britain March 26, 1943

3 Claims. (Cl. 198—203)

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This invention relates to apparatus for driving conveyers, chains and the like and more especially to novel or improved hydraulically operated driving apparatus for such purpose.

It is an object of the present invention to provide a high speed hydraulic conveyer driving apparatus by which the conveyer is continuously driven at a constant speed.

It is a further object of the invention to provide a hydraulic conveyer driving apparatus comprising a plurality of reciprocating means which are returned to their rearmost or initial position at a speed greater than that of their forward or driving movement so that each of said means is positioned to carry out a further forward movement before the other of said means reaches the end of its forward stroke.

According to the invention the apparatus comprises a pair of reciprocating means including a driving member which in one direction of movement of said means is engageable with the conveyer and in the other direction of movement is disengaged from the conveyer. A high pressure fluid system is provided for actuating the reciprocating means and said high pressure fluid system is so controlled that the reciprocating means operate alternately, the arrangement being such that during the power stroke of one of said means the other is performing an idle or return stroke. The return stroke of each reciprocating means is accelerated in relation to the power stroke so that each of said means regains its rear position slightly before the other means completes its power stroke, thereby ensuring that the drive is continuous.

Each of the reciprocating driving means may comprise a pivoted driving lever engageable with the conveyer, chain or the like, a slide supporting said lever and a hydraulic jack for imparting movement to the slide. Each jack may comprise a cylinder and piston having opposed high and low pressure chambers, fluid being supplied from, for example, a pump alternately to the high pressure side of each jack through a valve. An accumulator may be provided in the high pressure line to the valve to maintain a steady fluid pressure therein. Return movement of the slides may be effected by the transfer of fluid from the low pressure side of the driving jack to the low pressure side of the other jack due to the effect of the high pressure fluid supplied to the driving jack and the accelerated return of said other jack may be effected by an accumulator in the connecting line. Return movement of each slide may, furthermore, be arranged to actuate the valve to reverse the flow of high pressure fluid to the jacks.

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In order that the invention may be clearly understood and readily carried into effect, an embodiment thereof as applied to an overhead workshop conveyer system will now be described, reference being made to the accompanying drawings in which:

Fig. 1 is a side elevation of the driving apparatus;

Fig. 2 is a plan view, partly in section and with parts broken away for clarity of illustration;

Fig. 3 is a vertical cross-section on line III—III of Fig. 2;

Fig. 4 is a vertical cross-section on line IV—IV of Fig. 2 but to a larger scale; and

Fig. 5 is a diagram showing the high and low pressure fluid systems.

Like reference numerals denote like parts in the several figures.

Referring now to the drawings and more especially to Figs. 1 to 3 thereof, an overhead workshop conveyer system is shown as including a chain 10 which may be of the endless kind, passing around guide sprockets (not shown) or being otherwise suitably guided at opposite ends of its run. The chain, which is shown as comprising a plurality of interconnected flat links 11 and may, for example, be of the kind described in British patent specification No. 417,134 or No. 438,975, is supported at intervals along its length as by means of trolleys 12, one being shown in Fig. 3, having wheels 13 running in an I-section joist 14.

For the purpose of imparting movement to the chain there are provided a pair of reciprocating driving arms or dogs 15 which are alternately actuated, in a manner which will be later described, to drive the chain in a forward direction, indicated by the arrow x in Fig. 2, at a substantially constant speed, each arm in turn being returned to its rearmost position as the other arm is carrying out a foward driving or power stroke. The driving arms which, as shown, are preferably arranged one at either side of the chain, are formed with inwardly directed noses or projections 16 of such dimensions as to engage within spaces formed in the chain between the links thereof. The forward edges 17 of the projections 16 are straight and are transverse to the direction of travel of the chain while the rear edges 18 are reversely curved or chamfered to facilitate rearward movement of the arms, the projections then passing freely along and in engagement with the

forwardly moving links without, however, tending to restrict the movement of the chain.

Each of the arms 15 is carried by one of a pair of slides 20, 21 and is pivotally attached thereto as at 22. The slides, which are shown as being of channelled cross-section, are each provided with upper and lower pairs of rollers 23, 24 which run within guide rails 25 secured at their ends to rear and front transverse frame members 26, 27 which, as shown in Fig. 3, are of inverted U-shape, the downwardly extending arms 28 of the frame members embracing the chain and trolleys as they are moved forwardly. Each driving arm is normally urged in a direction about its pivot 22 to engage the nose thereof with the chain by means of a spring 29 tensioned between an anchorage 30 on the corresponding slide 20 and a laterally projecting arm 31 fixed to the arm 15. Plates 32, secured to the underfaces of the slides, support the driving arms during their oscillatory movement about the axes 22.

Movement is imparted to the slides by a pair of hydraulic jacks 35, 36 which are supported by brackets 37 secured to the forward frame member 27. Each of the jacks comprises a closed cylindrical casing 38 within which is arranged a movable piston 39 coupled to the corresponding slide by a connecting rod 39a and as will be clear from the following description, high pressure fluid is admitted alternately to the jacks to actuate the slides 20 in succession. The fluid system also includes means by which rearward movement of the idle jack is accelerated so that the corresponding driving arm is in position to commence a further feed stroke before the feed stroke of the other jack has been completed.

The jacks are arranged to be actuated by high pressure fluid supplied from a storage tank 40 and a pump 41, the latter being diagrammatically illustrated in Fig. 5, and being of any suitable kind. The pump is connected by a conduit 42 to the admission port of a two-way valve 43, which also may be of any suitable kind and from which fluid may be delivered, in accordance with the setting of the valve, to the high pressure end of each of the jacks alternately through pipes 44 and 45. The valve is shown as having an arm 46 which is automatically operable, as will hereinafter be described, to control the flow of fluid to the jacks in accordance with the positions of the slides. Discharge of high pressure fluid from the jacks is preferably also valve controlled, the discharged fluid being returned through the control valve, which is operated concurrently with the fluid supply valve, to the tank 40. As here illustrated, the valve by which discharge of high pressure fluid from the jacks is controlled is assembled with the valve 43, such discharge taking place through the pipe 44 or 45 to the control valve and thence through a pipe 47 or 48 and a conduit 49 to the tank 40.

An accumulator generally designated by the numeral 50 and supported on the front frame member 27 as by brackets 51 is associated with the fluid system. The accumulator comprises a high pressure chamber 52 and a low pressure chamber 53, these chambers being coaxially arranged and separated from one another by a wall 54. The high pressure chamber contains a piston 55 and fluid admitted to said chamber from the pump 41 moves the piston inwardly against the pressure of a relatively heavy reaction spring 56 seated on the wall 54, the pressure of fluid passing from the pump to the jacks thereby being maintained at a substantially constant level.

The low pressure chamber 53 contains a piston 57 which is urged outwardly as by a relatively light spring 58 also seated in the wall 54. The outer end of the chamber 53 communicates through conduits 59 and 60 with the low pressure ends of the jacks and, at a point intermediate its ends, said chamber is in communication with the return conduit 49 through a conduit 61. Fluid in the low pressure chamber and the conduits 59 and 60 thus maintain a limited pressure on the back of each of the jack pistons, this pressure being sufficient, however, during the return movement of each of said pistons, to cause each piston to reach its rearmost position before the feed movement of the other has been completed.

As hereinbefore stated, the valve 43 is automatically actuated to supply fluid to the high pressure end of each jack alternately and for this purpose it is shown as being mechanically controlled in accordance with the positions of the slides. As shown, the valve arm 46 is coupled to an axially movable control rod 65 supported laterally of the direction of travel of the chain in bearing bushes 66 within the rear frame member 26, this coupling consisting of a bracket 67, which is rigidly secured to the rod and extends outwardly from said frame member through an elongated slot 68 in the wall thereof, and a link 69 connected between the bracket and the valve lever. Attached to the rod 65 as at 70 and 71 respectively are two oppositely extending springs 72 and 73 which at their other ends are attached as at 74 and 75 to a link 76 connected at its ends to a pair of arms 77 and 78 rotatably mounted in the frame member 26. In either extreme position of the control rod 65 one or other of the springs 72, 73 is tensioned and the other is relaxed, this condition being achieved by providing for greater movement of the link 76 than for the rod 65. Movement of the rod is limited in the embodiment shown by a pair of spaced stops 79 with one or other of which the valve arm 46 is adapted to engage in its extreme positions, while movement of the link 76 is limited by the ends 80 and 81 of a pair of slots 82 formed in the wall of the frame member 26 and with which engage a pair of arms 83 and 84 rigid with the arms 77 and 78 respectively. A pair of springs 85 each tensioned between an oppositely extending portion of the arm 83 or 84 and an anchorage 86 on the frame member 26 are provided to retain said arms in one or other of their extreme positions thereby also maintaining the link 76 in either of its extreme positions. The arms 83 and 84 are adapted to be actuated by extensions 88 on the rear ends of the slides and, being interconnected by the link 76, each of said arms is automatically pre-set upon actuation of the other arm by the corresponding extension 88.

Means are provided whereby actuation of the valve 43 to control the supply of high pressure fluid to the jacks is effected as the returning slide reaches its rearmost position. Such means are shown as comprising a pair of arms or levers 90 by which axial movement of the control rod 65, and thereby actuation of the valve, is prevented until the aforesaid condition is reached. The levers 90 are pivotally mounted at 91 intermediate their ends on the opposite side portions of the frame member 26 and in the operative condition each of said levers is substantially vertical, being biased to such position by gravity. The upper end of each lever, as shown in broken lines in Fig. 1, is then positioned in the path of movement of the rod 65 so that movement of said rod

is arrested until the lever 90 is rocked clear, this latter position of the lever being shown in Fig. 1 in full lines.

Provided on each of the slides 20 and 21 is a rearwardly extending pin 92 which carries at its end an adjustable screw 93 adapted when the slides approach the rearmost positions, to engage the lower ends of the corresponding levers 90 and rock said levers about their pivots 91. Each of the pins 92 carries a collar 94 which is maintained, by a spring 95 coiled about the pin and compressed between a projetion 96 on the slide and a nut 97 on the pin, in engagement with the bifurcated end of a rockable lever 98 the other end of which is connected to the bracket 31 by a link 99. This enables the driving arm 15 of the rearwardly moving slide, as the latter approaches its rearmost position, to be rocked about its pivot and thereby withdraw the nose 16 from the path of the chain until the slide commences its forward movement. This rocking movement of the arm 15 away from the chain is limited as by means of a stop 100, thereby also limiting movement of the rod 92 relatively to the slide and ensuring that the rod produces rocking movement of the lever 90 during the last stage of the rearward movement of the slide.

In operation and assuming the silde 21, as shown in Figs. 1 and 2, to have reached a position in which the head of the screw 93 has rocked the corresponding lever 90 out of the path of the valve control rod 65, the latter is moved axially to the position shown in Fig. 2 to cut off the supply of high pressure fluid to the jack 35 and instead to direct the fluid to the jack 36, the lever 90 associated with the slide 20 taking up a vertical position opposite the other end of the rod. This causes the slide 21 to move forwardly, the dog 15 being immediately rocked about its pivot to engage the nose 16 thereof with the chain. At the same time the high pressure end of the jack 35 is opened to exhaust fluid therefrom back to the tank. This exhaust of fluid from the jack is effected by the transfer of fluid from the low pressure end of the jack 35 during the feed stroke thereof to the low pressure end of the jack 36 through the conduits 60 and 59 and as there is no fluid resistance to the rearward movement of the slide 20, this transfer of the low pressure fluid boosted by the pressure built up in the low pressure accumulator during the feed movement of the slide 20, returns said slide to its rearmost position slightly in advance of the slide 21 reaching its forward position. During the last portion of the feed stroke of the slide 21, pressure is again built up in the low pressure chamber 53 of the accumulator. The supply of high pressure fluid is then again reversed to drive the slide 20 forwardly and return the slide 21, the sequence of operations described above being repeated.

While in the foregoing an embodiment of the invention has been described in its application to a moving chain conveyer, it is to be understood that it may equally well be applied to drive other forms of conveyer and that the form of the driving arms may, if necessary, be modified to meet the requirements of such other applications. Further, the invention in its broadest aspects is not restricted to the specific construction shown and described, being capable of substantial modification without departing from the scope of the appended claims.

What I claim and desire to secure by Letters Patent of the United States is:

1. Hydraulic conveyer driving apparatus comprising a pair of reciprocating means each having a member thereon engageable with the conveyer to drive the latter continuously in one direction, a source of fluid under pressure, means for alternately operating said reciprocating means including a valve operable by said reciprocating means for automatically supplying high pressure fluid alternately to said reciprocating means, an axially movable control rod connected to said valve, a spring loaded link system for actuating said control rod, a gravitationally biassed rocking member associated with each reciprocating means and normally positioned in the path of movement of said control rod, and means on each of said reciprocating means engageable with the corresponding rocking member to move said rocking member out of the path of movement of the rod upon return movement of said reciprocating member.

2. Hydraulic conveyer driving apparatus comprising a pair of reciprocating means each having a member thereon engageable with the conveyer to drive the latter continuously in one direction, a source of fluid under pressure, means for alternately operating said reciprocating means including a valve operable by said reciprocating means for automatically supplying high pressure fluid alternately to said reciprocating means, an axially movable control rod connected to said valve, a spring loaded link system for actuating said control rod, a gravitationally biassed rocking member associated with each reciprocating means and normally positioned in the path of movement of said control rod, lower pressure fluid means for returning each reciprocating means to rear position at higher speed during forward movement of the other reciprocating means, and means on each of said reciprocating means engageable with the corresponding rocking member to move said rocking member out of the path of movement of the rod upon return movement of said reciprocating member.

3. Hydraulic conveyer driving apparatus comprising a pair of reciprocating means each having a member thereon engageable with the conveyer to drive the latter continuously in one direction, a source of fluid under pressure, means for alternately operating said reciprocating means including a valve operable by said reciprocating means for automatically supplying high pressure fluid alternately to said reciprocating means, a high pressure accumulator chamber in the fluid supply line to said valve to maintain the fluid at constant pressure, an axially movable control rod connected to said valve, a spring loaded link system for actuating said control rod, a gravitationally biassed rocking member associated with each reciprocating means and normally positioned in the path of movement of said control rod, lower pressure fluid means for returning each reciprocating means to rear position at higher speed during forward movement of the other reciprocating means, and means on each of said reciprocating means engageable with the corresponding rocking member to move said rocking member out of the path of movement of the rod upon return movement of said reciprocating member.

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