July 31, 1962 C. L. BELL ETAL 3,047,095

PALLET ELEVATOR

Filed May 6, 1960 3 Sheets-Sheet 1

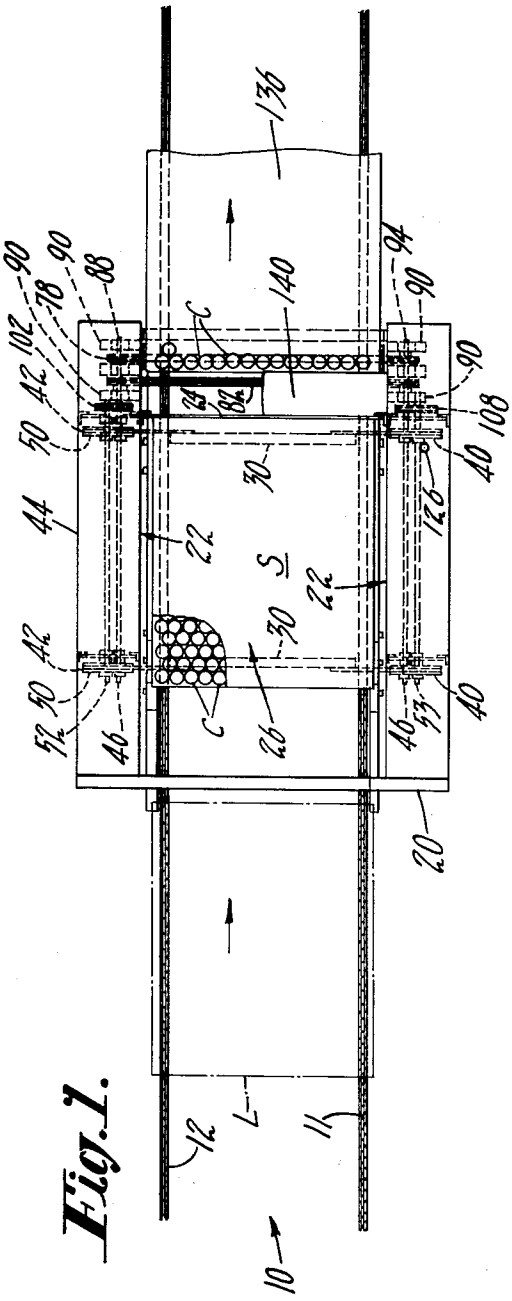


Fig. 1.

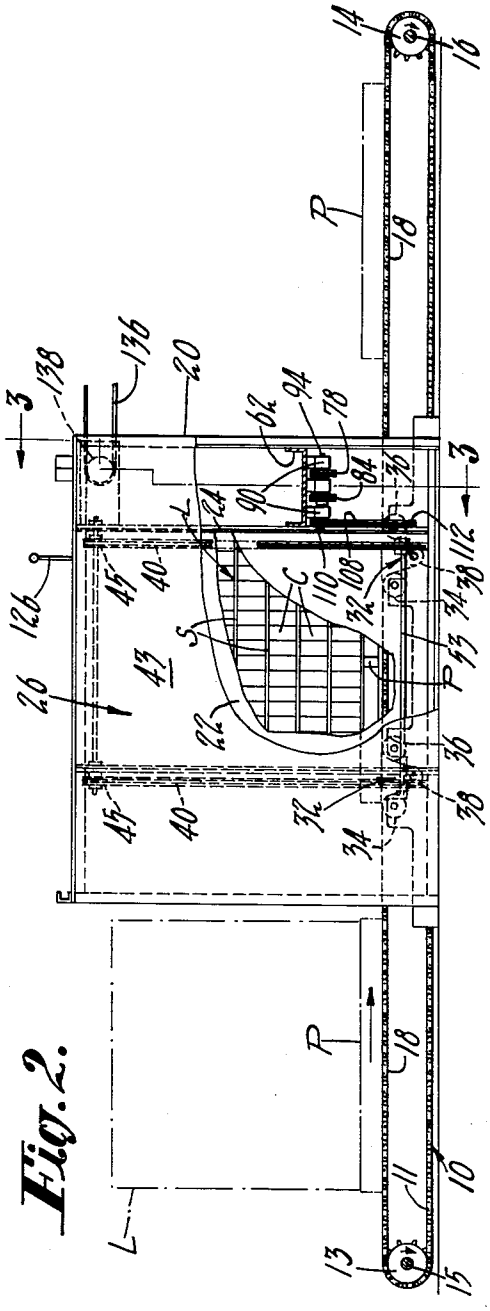


Fig. 2.

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Filed May 6, 1960 3 Sheets-Sheet 2

Fig. 3.

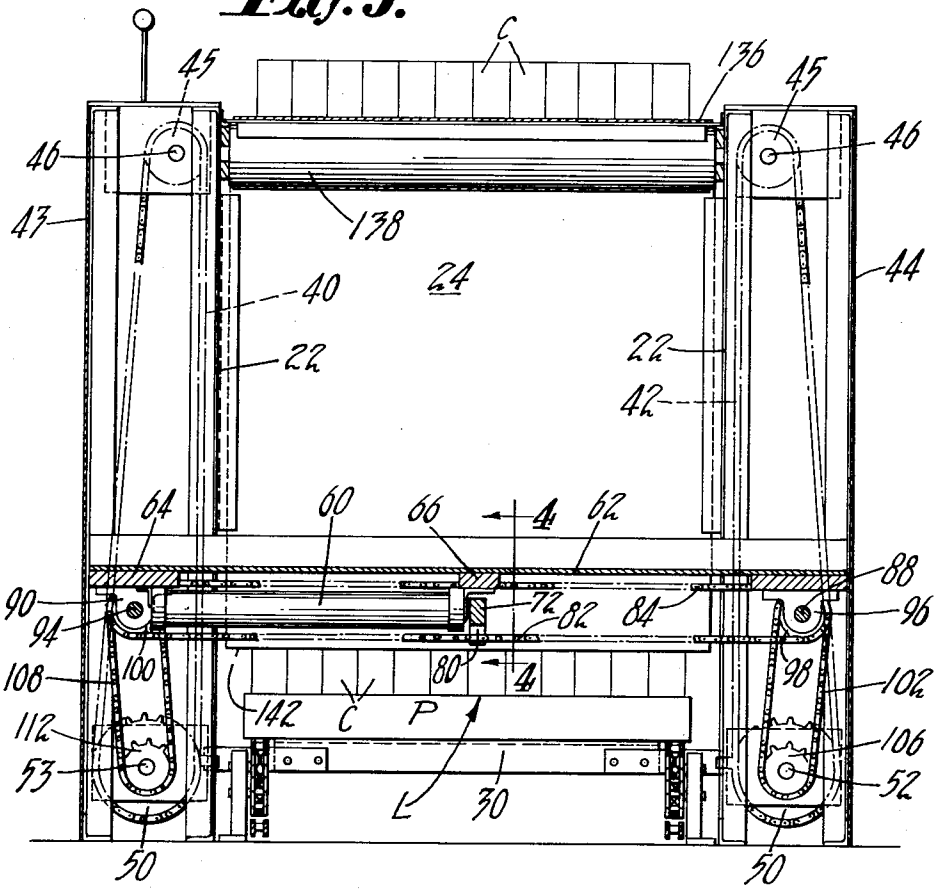
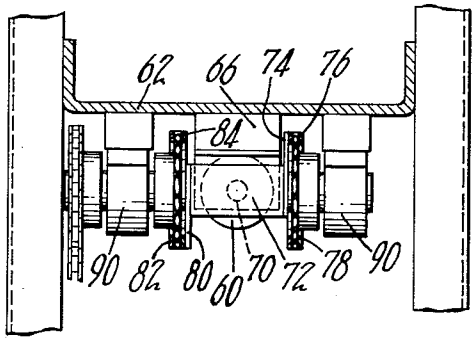


Fig. 4.



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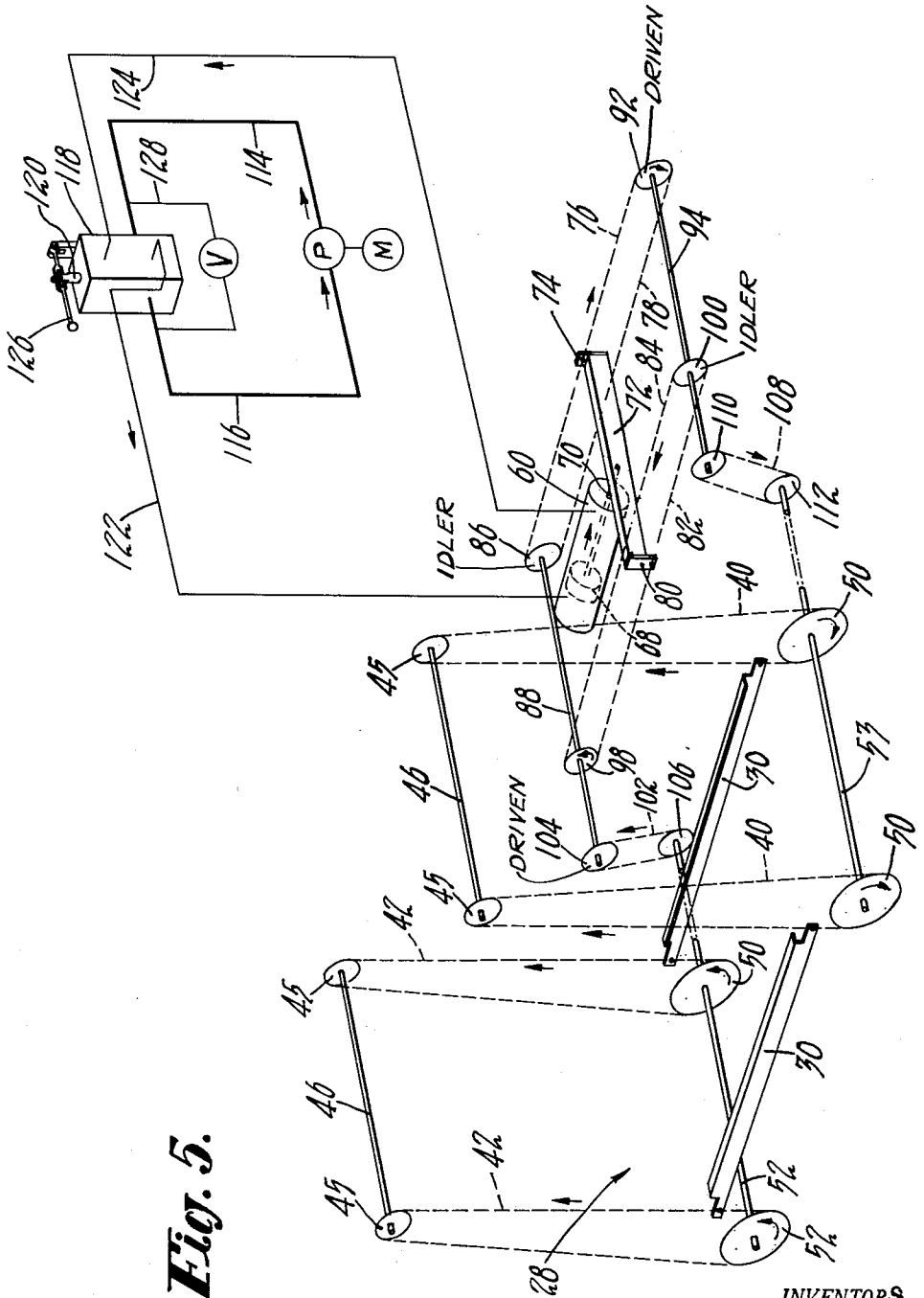


Fig. 5.

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PALLET ELEVATOR

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5 Claims. (Cl. 187—3)

The present invention relates to palletizing and depalletizing machines and has particular reference to a hydraulically operated chain lift pallet elevator.

The use of palletized can loads in the can making and canning industries for the handling and storing of cans has greatly increased in recent years because such loads make possible the greater use of fully or semi-automatic can-handling equipment with resultant economic benefits.

However, these benefits can only be obtained where the capital expenditures necessary for the purchase of such equipment are not beyond the economic capabilities of the individual company or plant desiring to adopt this method of handling cans. This is particularly true of small canning companies having limited financial assets.

Consequently, there is a great need for simple and inexpensive equipment which can be used to handle palletized loads of cans. The present invention provides a hydraulically driven pallet elevator construction which is suitable for incorporation in such equipment.

Accordingly, an object of the instant invention is the provision of a simple, inexpensive, and reliable pallet elevator wherein a single hydraulic cylinder is utilized to drive paired elevator lift chains in opposite directions so that their inner, opposing, elevator supporting flights all move in the same direction.

Another object of the invention is the provision of such an elevator where a single hydraulic cylinder is utilized to drive the elevator lift chains through a lift stroke which is much longer than the stroke of the hydraulic cylinder.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings:

FIGURE 1 is a plan view of a can depalletizing machine incorporating a pallet elevator which embodies the principles of the instant invention;

FIG. 2 is a side elevation of the machine of FIG. 1;

FIG. 3 is a vertical section on an enlarged scale taken substantially along the line 3—3 in FIG. 2;

FIG. 4 is a vertical section, on an enlarged scale, taken substantially along the line 4—4 in FIG. 3; and

FIG. 5 is a schematic view illustrating the various components of the elevator drive mechanism of the instant invention.

As a preferred and exemplary embodiment of the instant invention, the drawings disclose a depalletizing machine wherein palletized loads L of individual articles such as cans C are received on the inlet end of a conveyor **10** which comprises a pair of spaced and parallel endless feed chains **11**, **12** which at their opposite ends operate around pairs of drive sprockets **13**, **14** mounted respectively on cross-shafts **15**, **16**. The cross-shaft **16** is preferably driven by a suitable motor drive (not shown). The horizontal, upper flights **18** of the chains **11**, **12** ride in support channels (not shown) which prevent them from sagging beneath the weight of the load L.

Each palletized load L comprises a conventional support pallet P which is usually made of wood and which carries on it a plurality of horizontal layers of individual, upright cans C, each layer carrying on its upper surface

a chipboard separator sheet S which forms a stable base for the superposed layer.

The depalletizing machine includes a frame **20** through which the feed chains **11**, **12** operate. The frame **20** is preferably built up of suitable angle irons and channel bars, and forms a support for a pair of side walls **22** and a rear end wall **24**, these three walls in effect creating an unloading compartment **26** which receives a palletized load L as it is fed horizontally by the feed chains **11**, **12**. The front end of the compartment **26** is open to permit entry of the load L.

When the load L is fully within the unloading compartment **26**, the conveyor **10** is stopped, preferably by a suitably located stop switch which is tripped by the pallet P when it reaches the desired position. Since this stop switch forms no part of the instant invention, it is not shown in the drawings. After the conveyor **10** stops, the load L is moved upwardly off the chains **11**, **12** by an elevator, generally designated by the numeral **28** (see FIG. 5), which comprises a pallet support which in the instant embodiment is formed of a pair of transverse support bars **30** which engage the bottom surface of the pallet P. The support bars **30** are, while the load L is being fed into the unloading compartment **26**, positioned beneath the level of the pallet P in depressions **32** which are formed in the upper flights **18** of the chains **11**, **12**. There are two such depressions **32** formed in each chain **11**, **12**, the depressions **32** in chain **11** being disposed in transverse alignment with those in chain **12**. Each depression **32** is created by having the upper chain flights **18** operate around and over a pair of longitudinally spaced small sprockets **34**, **36** and beneath a third small sprocket **38** which is mounted intermediate and at a lower level than the sprockets **34**, **36** (see FIG. 2).

Each support bar **30** is secured at its opposite ends to a pair of opposed vertically mounted endless lift chains **40**, **42** which are mounted in opposition to each other on opposite sides of the frame **20** and operate in vertical planes which are disposed at right angles to the conveyor **10**. A second pair of side walls **43**, **44** are preferably disposed outwardly of the chains **40**, **42** to provide a protective covering.

At their upper ends, the chains **40**, **42** operate around small sprockets **45** which are mounted on a pair of longitudinal shafts **46** which are journalled in bearings (not shown) secured to the machine frame **20**. At their lower ends, the chains **40**, **42** operate around large sprockets **50** which are keyed to a pair of longitudinal shafts **52**, **53** which are journalled in bearings (not shown) which are also secured to the frame **20**. Since the lower sprockets **50** are larger than the upper sprockets **45**, the lower shafts **52**, **53** are offset outwardly with respect to the upper shafts **46** so that the inner flights of all of the lift chains **40**, **42** are vertically disposed to maintain a uniform spacing therebetween. The inner side walls **22** are suitably slotted inwardly of the chains **40**, **42** to permit the support bars **30** to be raised by the chains **40**, **42** for substantially the full height of the unloading compartment **26**.

The elevator **28** is actuated by a drive mechanism which includes a single hydraulic cylinder **60** which extends transversely across the conveyor **10** and is supported by a channel plate **62** which is secured in the machine frame **20**, the rear end of the hydraulic cylinder **60** being secured to a block **64** which is fastened to the underside of the channel plate **62** and the front end of the cylinder being secured to a block **66** which is also fastened to the channel **62**.

The hydraulic cylinder **60** contains a conventional reciprocating piston **68** to which is secured a piston rod **70** which projects from the cylinder and carries a short cross-bar **72**. One end of the cross-bar **72** has secured to it

an upwardly extending plate 74, which at its upper end is fastened to the upper flight 76 of a first endless drive chain 78, while the opposite end of the cross-bar 72 has secured to it a downwardly extending plate 80 which at its bottom end is fastened to the lower flight 82 of a second endless drive chain 84 (see FIGS. 3, 4 and 5).

The endless chains 78, 84 are mounted in parallelism in vertical planes which extend transversely of the conveyor 10 on either side of the hydraulic cylinder 60.

The chain 78 operates around an idler sprocket 86 which is freely mounted on a short longitudinal drive shaft 88 which is journalled in a pair of bearings 90 which are mounted on the underside of the channel plate 62 (see FIGS. 3 and 4). The chain 78 also operates around a sprocket 92 which is keyed to and drives a second short longitudinal drive shaft 94 which is mounted in a pair of bearings 96 which are also secured to the underside of the channel plate 62 on the opposite side of the machine (see FIG. 3.)

The chain 84 operates around a sprocket 98 which is keyed to and drives the drive shaft 88, and around an idler sprocket 100 which is freely carried on the shaft 94.

The adjacent ends of the shafts 52 and 88 are operatively connected by a short endless chain 102 which operates around a pair of sprockets 104, 106 which are keyed to the ends of the shafts 88 and 52 respectively, so that both of these shafts rotate in the same direction. In a similar manner, the adjacent ends of the shafts 53 and 94 are operatively connected by a short endless chain 108 which operates around a pair of sprockets 110, 112 which are keyed respectively to the shafts 94 and 53, so that these shafts also turn in the same direction.

The hydraulic cylinder 60 is connected into a closed hydraulic system which includes a circulating pump P which is driven uni-directionally by an electric motor M so that the fluid in the system flows from the pump P through a supply pipe 114 and enters it through a return pipe 116. A suitable control valve 118 is interposed bebtween the pipes 114, 116 and is provided with a movable internal valve slide 120 which is provided with suitable ports (not shown) which bring the supply pipe 114 selectively into communication with one or the other of a pair of pipes 122, 124 which are connected into the opposite ends of the hydraulic cylinder 60. The valve slide 120 also is provided with ports (not shown) which bring the return pipe 116 into communication with that pipe 122, 124 which at such time is out of communication with the supply pipe 114. The valve slide 120 also has a neutral position wherein both outlet pipes 122, 124 are shut off from both the supply pipe 114 and the return pipe 116.

The valve slide 120 is connected to a pivotally mounted handle 126 so that it can be manually moved to any of its control positions at the will of the operator. The actual interior construction of the control valve 118 and the valve slide 120 are not disclosed, since they are completely conventional. The usual by-pass line 128 and by-pass valve V are provided to maintain a uniform pressure within the system.

From the foregoing, it will be seen that when the fluid is introduced into the pipe 124, a pressure is exerted against one side of the piston 68, with the result that it is moved to the fully retracted position which is disclosed in FIGS. 3 and 5. In such position, the cross-bar 72 is positioned substantially midway of the conveyor 10 and the support bars 30 are disposed at the bottom of their stroke and are positioned within the recesses 32.

As soon as the palletized load L is fed into position within the unloading compartment 26, the conveyor 10 is stopped. The handle 126 is then manipulated by the operator of the machine to move the valve slide 120 to a position where it brings the pipe 122 into communication with the supply pipe 114, and at the same time connects the pipe 124 with the return pipe 116. As a result, the piston 68 is moved within the cylinder 60 away from its fully retracted position, and the chains 78, 84 are moved in opposite directions because of the fact that the cross-bar 72 is secured to the upper flight 76 of the chain 78 and to the lower flight 82 of the chain 84.

Since the chain 78 drives the drive shaft 94 and the oppositely moving chain 84 drives the other drive shaft 88, these shafts also rotate in opposite directions and in turn rotate the shafts 52 and 53 in opposite directions. As a result, the elevator lift chains 40, which are driven by the shaft 53, are driven in a direction opposite to the direction in which the lift chains 42, which are driven by the shaft 52, are driven. Consequently, the inner flights of all of the lift chains 40, 42 are moved in the same direction, i.e. upwardly, thus moving the support bars 30 upwardly. The directions of movement of all of the various elements of the instant mechanism which effect this upward movement of the support bars 30 are indicated by arrows in FIG. 5.

As best seen in FIGS. 3 and 5 the sprockets 50 are considerably larger in diameter than the sprockets 86, 92, 98, 100, 104, 106, 110 or 112, these latter preferably being of a uniform diameter. Since the shafts 52, 53 rotate at a one to one ratio with the drive shafts 88, 94, the result is that the lift chains 40, 42 are moved by the cylinder 60 through a distance which is greater than the distance of movement of the piston 68, the ratio of these distances being the same as the ratio of the diameter of the sprockets 50 to the diameter of the smaller sprockets 106, 112. This is very advantageous in that it makes possible the use in the machine of a hydraulic cylinder having a short operating stroke.

The upward movement of the lift chains 40, 42 initially brings the support bars 30 into contact with the pallet P and thereafter continues until the palletized load L is raised to a level wherein the uppermost horizontal layer of cans C in it is brought into horizontal alignment with a wide endless take-away belt 136, at which time the handle 126 is moved to its neutral position to stop the ascent of the elevator.

One end of the belt 136 operates around a drum 138 which is journalled in the machine frame 20. At its other end, the take-away belt 136 operates around a second drum (not shown), which is suitably driven so that the upper flight of the belt 136 moves in a direction away from the unloading compartment 26. To unload the cans from the palletized load L, the machine operator need merely use a wide pusher bar to manually push the cans across a support plate 140 and onto the belt 136 for delivery to the desired place of deposit. Suitable side guides (not shown) are provided to maintain the cans against undesired lateral movement during this transfer. If desired, the uppermost layerd of cans may be swept onto the belt 136 by a mechanical pusher arm (not shown).

After the uppermost layer of cans C has thus been removed from the load L, the handle 126 is again manipulated to reconnect the pipe 122 with the supply pipe 114 to move the piston 68 further to the right, as viewed in FIGS. 3 and 5, to thereby cause the support bars 30 to again move upwardly to bring the next layer of cans C in the palletized load L to the level of the take-away belt 136. The chipboard separator sheet S having been removed, the cans C in the next layer are pushed onto the take-away belt 136 and delivered to the place of deposit. This unloading operation is continued until such time as all of the layers are removed from the pallet P.

When this occurs, the handle 126 is moved into position to connect the pipe 124 with the supply pipe 114, and to simultaneously connect the pipe 122 with the return pipe 116, thereby causing the piston 68 to reverse itself and move in the opposite direction (to the left as seen in FIGS. 3 and 5) and to assume the retracted position of FIG. 3, thus causing the support bars 30 to move downwardly and enter the recesses 32. During the latter portion of this downward movement of the support bars

30, the now empty pallet P is deposited on the chains 11, 12.

The conveyor 10 is once again started up, in the same direction as before, to remove the empty pallet P from the unloading compartment 26. This movement is not obstructed by the end wall 24 of the loading compartment 26, since the bottom edge 142 of this wall 24 is disposed above the upper surface of empty pallet P, as seen in FIG. 3. Assuming that a new palletized load L has been previously positioned on the inlet end of the conveyor 10, this same movement of the conveyor 10 moves the new load L into unloading position within the unloading compartment 26 of the machine. When the new load L has thus been positioned, the conveyor 10 is stopped and the can unloading operation just described is again repeated.

It is clear that the machine which has been described is equally well adapted for use as a can palletizing machine. In such a machine, the belt 136 would be reversed and used as a can infeed belt, and the pallet P would initially be raised to its uppermost position and gradually lowered as the layers of cans are built up on it.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

We claim:

1. A hydraulically operated elevator for raising and lowering a pallet and the like, comprising a support engageable beneath said pallet, a pair of parallel shafts disposed on opposite sides of said support, a pair of endless lift chains operating around and driven by each of said shafts, the opposed inner flights of said lift chains extending vertically and secured to said pallet support, a pair of endless drive chains disposed in spaced parallel relation in vertical planes extending transversely of said shafts, said chains each including spaced parallel flights, means operatively connecting said drive chains to said shafts respectively, and means extending between said drive chains and secured at opposite ends to different spaced flights thereof for simultaneously driving the chains in opposite directions, whereby to rotate said shafts in opposite directions while moving said inner lift chain flights in the same vertical direction.

2. The mechanism of claim 1 wherein said drive chains are formed with upper and lower horizontally extending flights, and wherein the means for driving said drive chains in opposite directions comprises a fluid actuated cylinder having a reciprocable piston connected to the upper flight of one of said drive chains and to the lower flight of the other drive chain.

3. A hydraulically operated elevator for raising and lowering a pallet or the like, comprising in combination a pallet support engageable beneath said pallet, a pair of shafts mounted in parallelism on opposite sides of said support, a pair of sprockets keyed to each of said shafts, a pair of endless lift chains operating around and driven by said sprockets respectively, the inner flights of said lift chains extending vertically and being secured to said pallet support, a pair of rotatable drive shafts mounted in parallelism with said first named shafts, means for transmitting the rotation of said drive shafts to said first named shafts, a pair of sprockets carried on each of said drive shafts, the sprockets on one of said drive shafts being transversely aligned with those on the other drive shaft, a pair of spaced parallel endless drive chains each including spaced parallel upper and lower flights mounted for operation around said aligned sprockets respectively, a fluid actuated cylinder mounted in parallelism with said drive chains, a reciprocable piston disposed within said cylinder, and means securing one end of said piston to different flights of said drive chains respectively whereby rectilinear movement of said piston in one direction is utilized to actuate said lift chains in unison to move said pallet support in a vertical direction.

4. The mechanism of claim 3 wherein the sprockets on said first named shafts are of larger diameter than the sprockets on said drive shafts to thereby increase the vertical distance traversed by said lift chains relative to the length of the piston movement.

5. A hydraulically operated elevator for raising and lowering a pallet or the like, comprising in combination a pallet support engageable beneath said pallet, a pair of shafts mounted in parallelism on opposite sides of said pallet support, a pair of sprockets keyed to each of said shafts, an endless lift chain operating around and driven by each of said sprockets, said lift chains being disposed in vertical planes which extend transversely of said shafts, the inner flights of each of said lift chains extending vertically and being secured to said pallet support, a rotatable drive shaft disposed in parallelism to each of said first named shafts, means for transmitting the rotation of each of said drive shafts to its associated first named shaft so that the latter rotate in the same direction as the former, a pair of sprockets disposed in spaced relation along each of said drive shafts, the sprockets on one of said drive shafts being transversely aligned with the sprockets on the other of said drive shafts to form two pairs of transversely aligned sprockets, one of the sprockets of one of said transversely aligned pairs thereof being keyed to one of said drive shafts and one of the sprockets of the other of said transversely aligned pairs thereof being keyed to the other of said drive shafts, the remaining two sprockets being idler sprockets, a pair of spaced and parallel endless drive chains operating around said transversely aligned pairs of sprockets and extending in a substantially horizontal direction between said drive shafts, a fluid operated cylinder disposed between said drive chains, a reciprocable piston disposed in said cylinder, and means connecting said piston to the upper flight of one of said drive chains and to the lower flight of the other of said drive chains whereby said piston moves said drive chains in opposite directions and the motion of said drive chains is transmitted to said lift chains to move their inner flights in the same direction.

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