June 20, 1961 F. T. HANSEN 2,989,201

FLOATATIVELY MOUNTED LIFT FORK

Filed July 9. 1956 4 Sheets-Sheet 1

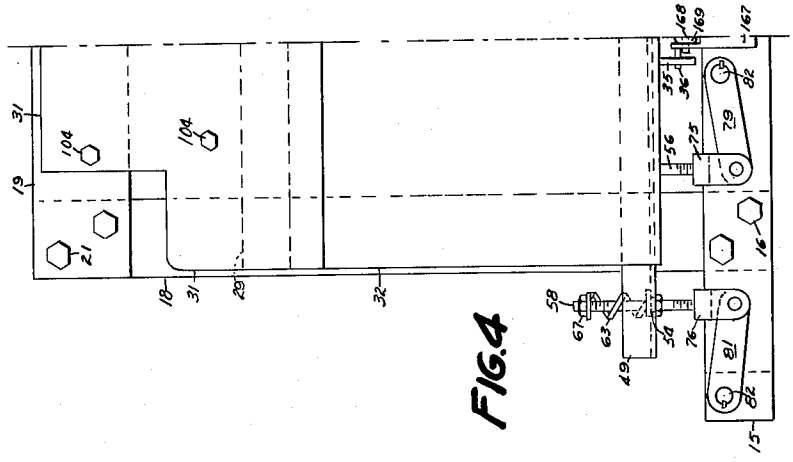

FIG. 4

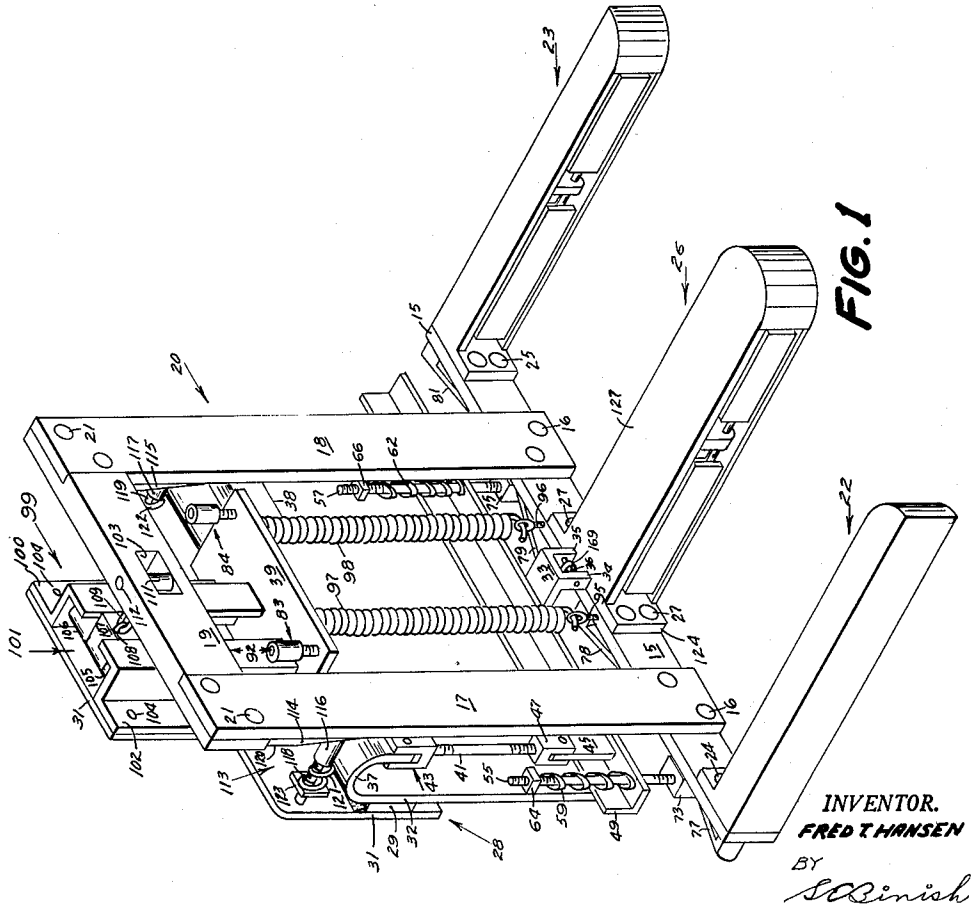

FIG. 1

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FLOATATIVELY MOUNTED LIFT FORK

Filed July 9. 1956 4 Sheets-Sheet 2

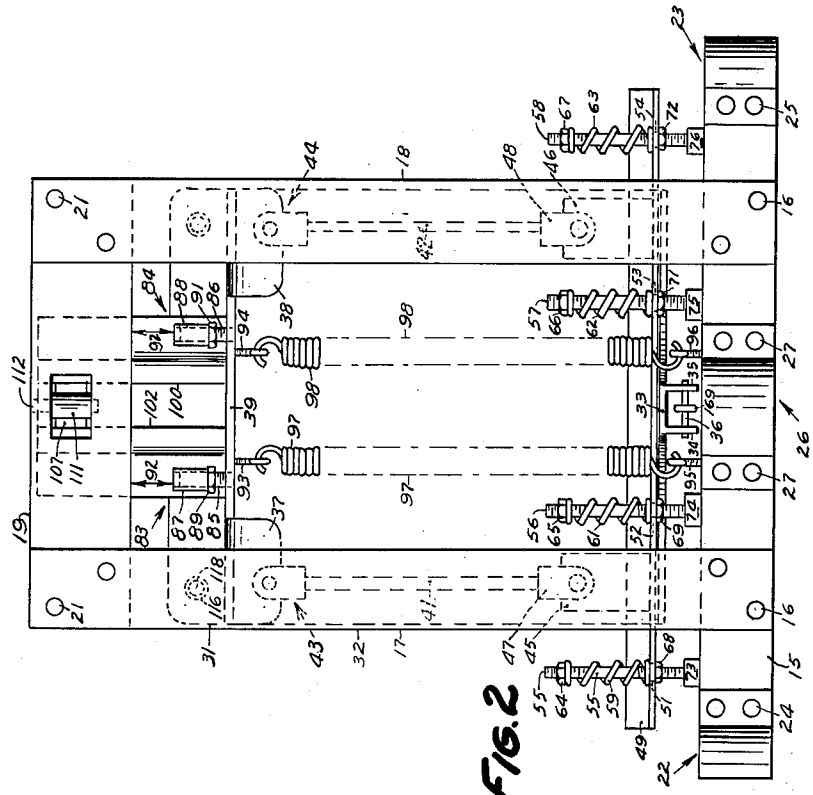

FIG. 2

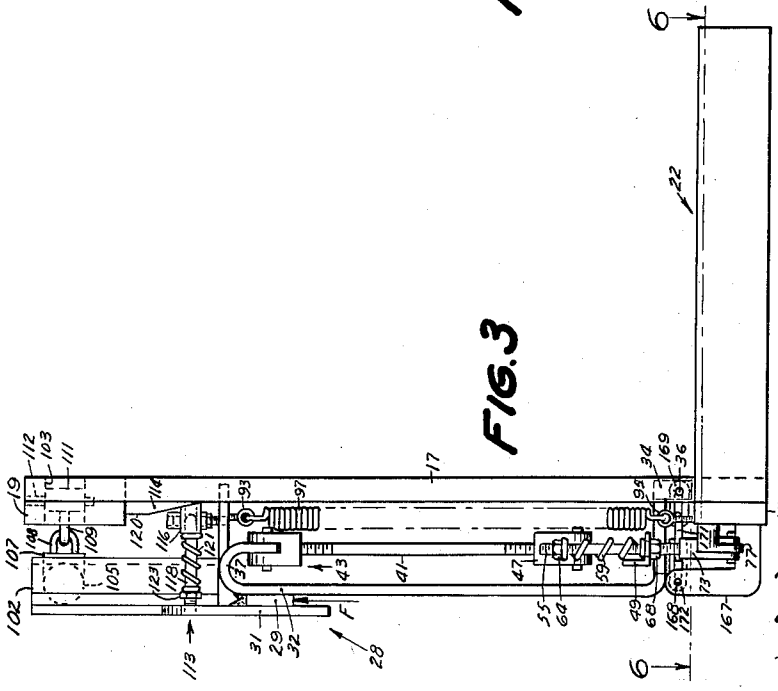

FIG. 3

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FLOATATIVELY MOUNTED LIFT FORK

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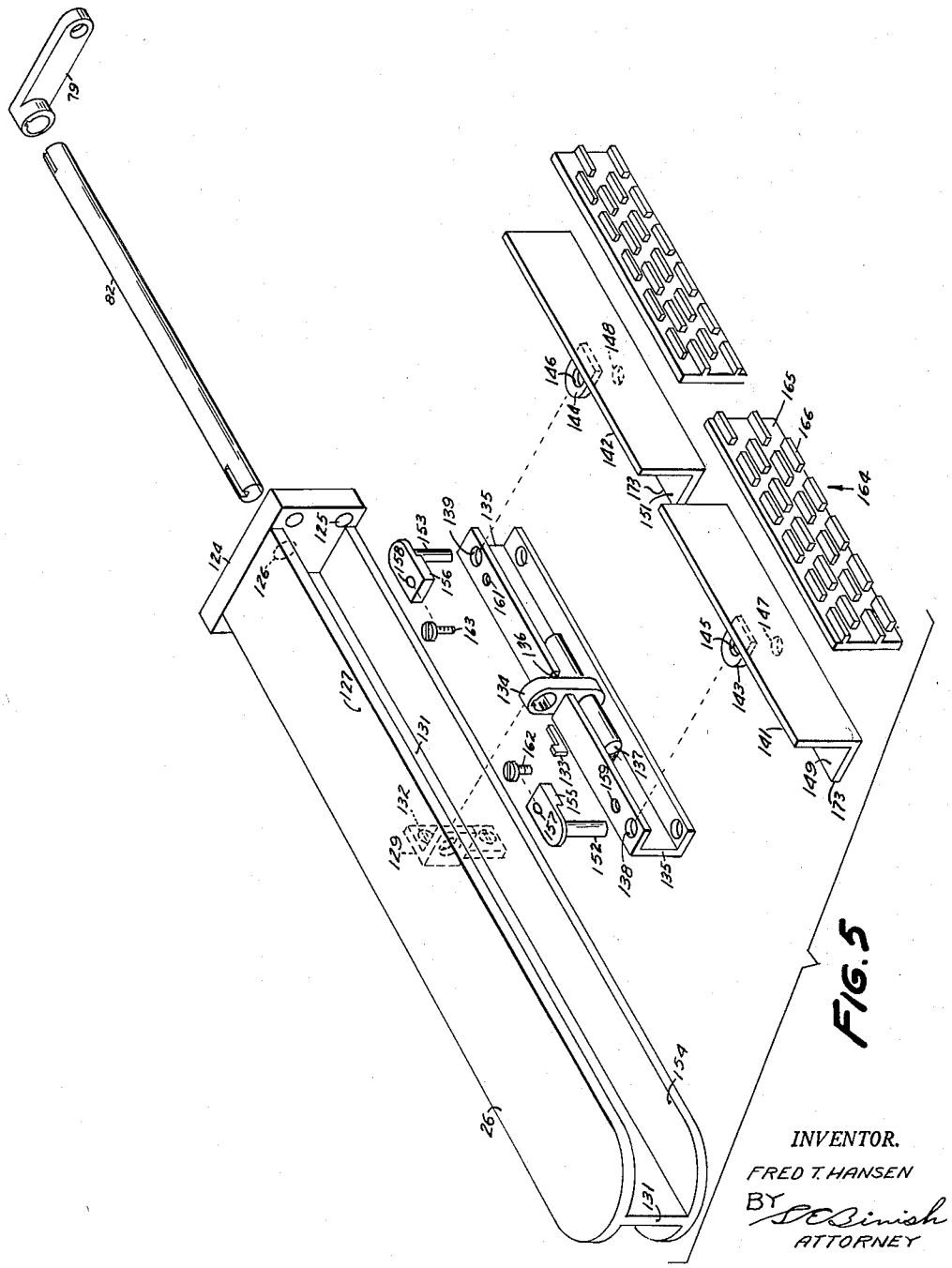

FIG. 5

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FLOATATIVELY MOUNTED LIFT FORK

Filed July 9. 1956 4 Sheets-Sheet 4

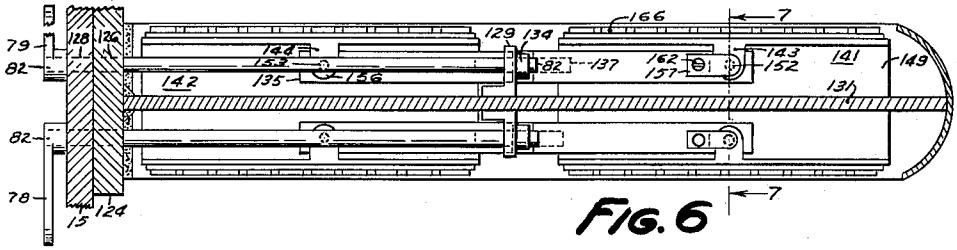

FIG. 6

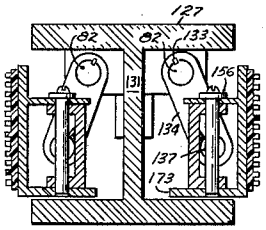

FIG. 8

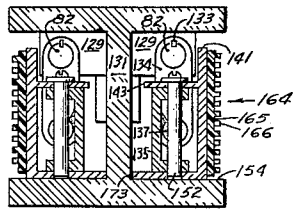

FIG. 7

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United States Patent Office 2,989,201 Patented June 20, 1961

2,989,201

FLOATATIVELY MOUNTED LIFT FORK

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Filed July 9, 1956, Ser. No. 596,618
11 Claims. (Cl. 214—652)

This invention relates to improvements in lift forks, and more particularly to improvements in lift forks of a "floating" suspension type adapted to handle cartons of canned goods stacked in conformity with a pre-arranged plan whereby there are provided uniform spaces between the base courses thereof into which the fork tines, embodying clamping devices automatically actuable by the weight of the load, may be projected into said spaces to pick-up and carry along said base courses by means of horizontal clamping action, to the end that the stack may be picked up, transported, and lowered bodily, and the tines withdrawn from the spaces, without the need of pallets.

The handling of soft goods, such as canned goods, by means of a stack handling fork, presents a materially different problem than the similar handling of hard goods, such as bricks or concrete blocks. Hard goods can absorb rough and careless handling without significant damage; whereas soft goods are easily damaged if handled roughly. For instance, some misalignment of the fork tines in relation to base courses of a stack of hard goods to be handled can be tolerated because hard goods resists damage; however the same misalignment in relation to cartons of canned goods, often results in badly dented cans and torn cartons.

To compensate for the operator's carelessness and ordinary misalignment, a floating fork mounting is provided to allow the fork to adjust and align itself relative to the base courses, within predetermined limits. To provide this characteristic, the fork is mounted somewhat "loosely" so as to drift or pendulate sidewise, as necessary, and to pivot on a vertical axis, to accommodate itself to the alignment of the base courses.

An object of this invention is the provision of a floating fork mounting to allow the fork to accommodate and align itself to a stack of soft goods.

Another object is to provide a pendulously mounted lifting fork.

Still another object of this invention is the provision of a laterally pendulent lifting fork.

Yet another object is to provide a lifting fork, oscillatable about its vertical axis, when non-loaded.

A further object of this invention is the provision of means for stabilizing the fork against oscillation about its vertical axis, when the fork is loaded.

Still a further object is the provision of a gripper mechanism actuable through means of a torque shaft mounted in a fork tine.

Yet a further object of this invention is the provision of a gripper mechanism provided with a shoe carrying beam oscillatable about a horizontal axis.

Another object is to provide a gripper shoe mounted for oscillation on a vertical axis.

Still another object of this invention is the provision of a gripper mechanism that properly aligns itself within the tine when in full retracted position.

Other specific objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings in which like reference numerals designate like parts throughout the figures thereof and wherein:

FIG. 1 is an isometric view of the invention;

FIG. 2 is a front elevation of the apparatus shown in FIG. 1;

FIG. 3 is a side elevation of the apparatus;

FIG. 4 is a rear elevation of one half of the apparatus, symmetrical about its centerline;

FIG. 5 is an exploded isometric view of the center tine, showing the extendable and retractable gripper mechanism elements in detail;

FIG. 6 is an enlarged plan view of the center tine taken along broken line 6—6 of FIG. 3, showing the top flange of the tine H-beam removed, and showing the gripping mechanism in normal retracted position;

FIG. 7 is an enlarged cross sectional view taken along line 7—7 of FIG. 6; and

FIG. 8 is cross sectional view similar to FIG. 7, showing the gripper mechanism in extended position.

Referring now to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, there is shown an elongated horizontal base bar **15**, disposed on edge, to which is secured, as by bolts **16**, a pair of symmetrically spaced companion upright bars **17** and **18**. A horizontally disposed header beam **19** is secured across the upper ends of the upright bars by means of bolts **21**, thereby forming an upstanding frame generally indicated at **20**.

Outer tines, generally indicated at **22** and **23**, and projecting forwardly at right angles to the base bar **15**, are secured to said base bar by means of bolts **24** and **25**, respectively.

A center tine, centrally located between upright bars **17** and **18**, and generally indicated at **26**, likewise projects forwardly at right angles to base bar **15**, and is secured thereto by means of bolts such as indicated at **27**. Said tines are all disposed in a horizontal plane.

Said frame and tine members define a simple fork structure.

Associated saddle means, generally indicated at **28**, comprise a saddle bar **29** and plates **31** and **32** welded on each side thereof operative to guide the lift plate of a lift truck (not shown) into engagement with said saddle bar. Said lift plate is indicated as acting at the arrow F.

The plate **32** is extended downwardly to provide a broad plate area and terminates in a forwardly projecting bracket **33** provided with spaced leg elements **34** and **35** across which is journalled a pin **36** for a purpose hereinafter described. The ends of the leg members are normally spaced slightly from the top edge of the base bar at all times to allow floating suspension. The adjustment for this is accomplished by pull rods **41** and **42**.

The plate **32** is also extended upwardly and the side portions thereof are curved upwardly and thence downwardly to provide arcuate brackets **37** and **38**. The middle portion of said extension is bent forwardly to provide a horizontal bracket **39**.

A pair of pull rods **41** and **42** pending from said arcuate brackets **37** and **38**, are connected to said brackets through means of knuckle joints generally indicated at **43** and **44**, respectively. Said knuckle joint arrangement allows the rods to pendulate side-wise, that is in a plane parallel to the plane of the upright frame or transversely of the tines, on forwardly disposed pivots.

The lower ends of the pull rods are connected to ear plates **45** and **46** through means of knuckle joints **47** and **48**, said ear plates being welded to horizontally disposed manifold lift bar **49**. The pivotal axes of said knuckle joints **47** and **48** are disposed parallel to the axes of knuckle joints **43** and **44**.

Said manifold lift bar **49** is provided with a series of spaced apertures **51**, **52**, **53** and **54** to loosely receive upright studs **55**, **56**, **57** and **58** therein.

The lifting force on the bar **49** is transmitted to a series of compression springs **59**, **61**, **62** and **63** surrounding studs **55**, **56**, **57** and **58**, respectively. Said springs rest on the lifting bar **49** and shoulder against nuts **64**, **65**, **66** and **67**, respectively. Nuts **68**, **69**, **71**

and 72, on said studs, respectively, are disposed against the underside of lift bar 49, and are operative as an abutment against which the lift bar drives during its downward travel to aid in positively retracting the gripper mechanism in the tines as hereinafter described.

The lower ends of said studs are knuckle joint connected as at 73, 74, 75 and 76 with crank arms 77, 78, 79 and 81, respectively, which are mounted rotatively-rigid on tine torque shafts such as indicated at 82. One of said tine torque shafts is provided for each gripper mechanism as hereinafter described.

The pivotal axes of said stud knuckle joints 73, 74, 75 and 76 are disposed parallel to the associated pull rod knuckle joints 41 and 42, and 47 and 48, thereby allowing the pull rods and pending attachments to pendulate sidewise.

Reverting now to the saddle bar 29 and guide plate 32, the middle portion of the upward extension thereof is bent forwardly to provide a horizontal bracket 39.

Mounted on said bracket 39 are a pair of spaced adjustable overload stop lugs, generally indicated at 83 and 84, comprising studs 85 and 86 mounted upright on said bracket and disposed below header beam 19, sleeves 87 and 88 threadedly engaged on said studs, and lock nuts 89 and 91 for said sleeves, respectively.

The spaced relation 92 between the overload stop lugs and the header beam 19 defines an initial take-up distance to permit shifting of the saddle means relative to the fork during which interval the gripper mechanism is actuated and the gripper shoes thereof are thrust against the cartons to be gripped, and after contact therewith, a predetermined pressure of the shoes against the cartons is slowly generated and subsequently halted upon the contact of the overload stop lugs with the underside of the header beam 19. When the overload stop lugs contact the header beam, the gripper shoe pressure ceases to increase, remains constant, and the fork, the load thereon, the base courses clamped between the tines, and the saddle means are bodily lifted by the lift plate of a lift truck (not shown) but indicated as acting at the arrow F.

Downwardly projecting eye bolts 93 and 94 mounted on the underside of saddle bracket 39, and vertically corresponding eye bolts 95 and 96 mounted on fork base bar 15, are connected by tension balance springs 97 and 98, respectively. The balance springs are initially tensioned to overbalance the weight of the fork, thereby urging or drawing-up the fork relative to the saddle means, resulting in the gripper mechanism, hereinafter described, being positively and fully retracted into the tines. The upward movement of the fork relative to the saddle means, due to the balance spring action, is stopped when the gripper mechanism is fully retracted and abutted against the tine webs to be hereinafter described. In this spring biased relationship the lift fork is in its normally retracted and normally positioned, unloaded state, and is yieldably carried by the saddle means.

Back plate 31 is extended upwardly forming a support for guide means generally indicated at 99, including roller means generally indicated at 101. See FIG. 1.

Said track means comprise a pair of confronting and spaced Z-bars 102 and 100, disposed opposite an aperture 103 centrally located in the header beam 19. Said Z-bars are secured to the back plate 31 by any suitable means, such as indicated by bolts 104.

The roller means 101 comprises a pair of axially aligned rollers 105 and 106 journalled on a block 107, therebetween. The block is of a width to slidingly engage the confronting edges of the Z-bars; and the rollers are suitably received in the track defined by the outlying flanges of the Z-bars and the back plate 31. Said rollers are adapted to rollingly engage the inner surfaces of said outlying flanges, respectively.

An eye element 108 on the front face of block 107 links with an eye element 109 on pivotal block 111 pivotly mounted in aperture 103 through means of vertically disposed pin 112. This eye or chain linkage construction provides, in effect, a universal joint permitting swivelling or turning at any angle within defined limits.

Said track means 99, roller means 101, and pivotal block 111 flexibly connects the upper portion of the fork frame to the upper portion of the saddle means, whereby to operatively engage the frame and saddle means and yet allow several degrees of freedom of movement, relative to each other. The linked eye and pivotal block 111 construction provides means for allowing the fork to move sidewise relative to the saddle means; and also to allow the fork to oscillate substantially about the vertical axis of pin 112. These constructions plus the previously pendulated arrangement of the pull rods 41 and 42 and associated elements, provide a "floating" suspension of the fork on the saddle means, operative to allow the fork to accommodate or adjust itself to the alignment of the base courses of a stack of cartons.

The track and roller means provides a rollable engagement operative to guide the fork and saddle means in vertical movement, one relative to the other, as when the lifting operation is commenced as hereinafter described.

To control the oscillation of the fork about the vertical axis of pin 112, there is provided cam or wedge stabilizing means generally indicated at 113. See FIGS. 1 and 3.

Said stabilizing means comprises a pair of wedge elements 114 and 115 mounted by any suitable means such as welding on upright bars 17 and 18, respectively. Slidably engageable on the inclined surfaces of said wedges are reciprocable sleeves 116 and 117 slidably mounted on rods 118 and 119 and urged against said wedges by initially tensioned compression springs 121 and 122, respectively. Said rods 118 and 119 are of equal length and are disposed normal to back plate 31 and mounted thereon as by threaded engagement. Adjusting nuts on said rods, such as indicated at 123, control the tension in the compression springs.

In the normal unloaded fork position, the spring urged reciprocable sleeves 116 and 117 project equally beyond the ends of rods 118 and 119, respectively, and engage their respective wedges at the thin edge portions. The equally tensioned springs 118 and 119 stabilize the suspended fork against the usual rocking, shaking and jostling forces when the unloaded fork is being carried by the lift truck; however, the springs are adapted to yield when the tines are adjusting or accommodating themselves to the alignment of the base courses of cartons, as when the tines are being inserted between said courses preparatory to a load lifting operation.

When a load is lifted, the sleeves travel up their associated wedges and rearwardly on the stabilizer rods 118 and 119, respectively, until the rod ends solidly, or substantially so, contact the flat portion 120 of the wedge elements and thus stabilize and hold the loaded fork firmly against unnecessary shaking. The level portion 120 is reached by the rods about the time the stop lugs 83 and 84 engage the header beam 19.

Obviously, under some conditions, solid contact of the rod end with the flat portion 120 of the wedge may not be necessary. Under these conditions, a shorter rod may be used, and the increased spring tension may be sufficient to stabilize the loaded fork.

The gripper mechanism is an extendable and retractable mechanism mounted in the recess of a beam. Said beam, serving as a tine of the fork, is either a wide channel beam such as outer tine channels 22 and 23, or an H-beam such as center tine 26. The center tine 26 is provided with a gripper mechanism in each of its two side recesses. The outer tines, disposed so that their recesses confront the adjacent recesses in the center tine, are likewise provided with a gripper mechanism each,

for clamping coaction with said companion gripper mechanism in the center tine. As the gripper mechanisms are all constructed alike, a description of one such mechanism will suffice and apply to all.

Center tine **26** is provided with a mounting plate **124** welded across the rear end thereof. See FIGS. 5 and 6. Said mounting plate is provided with apertures **125** to receive securing bolts **27** for securement to base bar **15**.

A second aperture **126** is provided in mounting plate **124**, adjacent top flange **127**, to receive torque shaft **82**. Said aperture **126** is aligned with aperture **128** in base bar **15** which likewise receives torque shaft **82** which extends therethrough, and on which is secured crank arm **79**.

Intermediate the ends of tine **26**, a bracket **129** is secured to the web **131** of said tine by means of screws **132** to receive torque shaft **82** journalled in said bracket.

To the torque shaft end extending beyond said bracket, is keyed, by means of key **133**, a link arm **134** disposed normally vertically in retracted position.

A shoe beam **135**, vertically slotted **136** intermediate its ends to receive said link arm **134**, is loosely pivotally connected to said link arm through means of a shaft **137** welded across said slot. See FIG. 5. This loose pivotal connection allows the shoe beam to pivot on a horizontal axis, and to wobble about a vertical axis to allow beam adjustment for cartons of slightly varying widths. The ends of said beam are vertically apertured at **138** and **139**, to receive pins hereinafter described.

A pair of angle iron shoes **141** and **142** are pivotally mounted on the ends of said shoe beam for pivoting on vertical axes, respectively. Rearwardly extending lugs **143** and **144** are provided on said shoes and apertured at **145** and **146** to vertically align with apertures **147** and **148** in the horizontal legs **149** and **151**, respectively. Said lugs are superimposed over the apertures **138** and **139** in the shoe beam, and aligned therewith to receive pins **152** and **153**, respectively, therethrough. It is to be noted that the pins do not project beyond the bottom surfaces of the horizontal legs **149** and **151** of the angle iron shoe elements, but terminate short thereof to avoid obstructionable projection therebeyond. See FIGS. 7 and 8.

The horizontal legs **149** and **151** of the angle iron shoes are disposed under the shoe beam **135** and are slidably engageable with the upper surface of the bottom flange **154** of the tine beam. Said legs are of sufficient rearward width to abut the tine web **131**, along their whole length, when the gripper mechanism is fully and normally retracted. This abutment arrangement functions to pivotally align the shoes within the tine at their full retraction thereby preventing the ends of the shoes from catching on the corner edges of the cartons during insertion or withdrawal movements of the tines, and provides a stop for the retractive movement of the gripper mechanism.

Furthermore, said horizontal leg width amply overlaps the bottom tine flange when the gripper mechanism is fully extended. This overlapping arrangement prevents the horizontally pivotal shoes from catching on the edge of the bottom tine flange, when retracting, and thereby assures unfailing retraction in this respect. This catching could occur should the shoe tilt about the shoe beam axis.

The pins **152** and **153** are provided with integral tab heads **155** and **156**, apertured at **157** and **158** to register with threaded apertures **159** and **161**, in shoe beam **135**, respectively.

Screws **162** and **163**, threadedly engaged in threaded apertures **159** and **161**, secure the pins against displacement, respectively.

The faces of the shoes are provided with a shoe facing generally indicated at **164** comprising a rubberized duck base **165** having molded thereon staggered rows of deep, resilient rubber cleats **166**. Said shoe facing is secured

to the shoe face by any means such as cementing or bonding, or with screws, not shown.

Cleats ⅛ in. long, ½ in. wide and 5/32 in. high have served very well in the handling of soft goods; however these dimensions are not to be considered as limiting the design thereof.

The above shoe facing design results in positive, non-slip characteristics. The individual deep rubber cleats and the multiplicity of gripping edges provides a maximum of grip-ability with a minimum of lateral force against the soft goods.

The saddle plate **32** terminates at its lower end in a bracket **33** mounting a pin **36**. Rearwardly of said pin and mounted on the base bar **15** there is provided a bifurcated bracket **167** mounting a pin **168** thereacross. Three chain links **169**, **171** and **172** link pin **36** with pin **168**. This chain link means provides, in effect, a universal joint permitting swivelling or turning at any angle within defined limits.

The chain linkage **108** and **109** on the top portion of the lift fork, and the chain linkage **169**, **171** and **172** on the bottom of the lift fork, are primary improvements contributing to the needed and necessary flexibilty of mounting.

Operation.—When the fork is normally at rest, on a floor, the initially tensioned balance springs **97** and **98** draw-up the fork until the gripper mechanism is fully retracted within the tine and the included shoe edges **173** are abutted and stopped against the web **131** of the tine. This spring tension yieldably combines the fork to the saddle means through the gripper mechanism, and unitizes the construction into a lift fork structure.

When the lift fork is to be used, a lift truck having a lift plate thereon (not shown) approaches the lift fork from the rear, and the operator engages the lift plate of the lift truck with the saddle bar **29** of the lift fork.

As the operator elevates the lift plate, the unitized lift fork assembly is bodily raised from the floor, and carried as a unit to a stack of canned carton goods which is to be transported.

The stack of canned goods to be raised and transported is supported on spaced base courses or rows of such canned carton goods. Each of said base courses consists of tandem arranged cartons, and between said courses are provided the working spaces to be occupied by the fork tines.

As the operator approaches the pre-arranged stack he attempts to align the fork tines with the passageway spaces between the base courses, and when satisfied with the alignment he directs the tines into said spaces by a forward movement of the lift truck and proceeds to operate the truck for a lifting operation.

As the lift truck, through its lift plate, commences to apply a raising force to the bottom of the carton stack, the load on top of the fork tines resists such lifting action; however, springs **97** and **98** yield, and the saddle means is slowly moved upwardly by the lift plate, relative to the fork, within the limits of the take-up distance between the initial resting position of the saddle stop lugs **83** and **84** and the underside of the header bar **19**.

Consequently the pull rods **41** and **42**, attached to the saddle bar **29**, actuate the torque shafts **82** through means of the intervening linked members.

The actuation of the torque shaft results in the gripping mechanism being extended and thrust laterally against the rows of cartons, as shown in FIG. 8.

Thereafter, as the load of cartons on top of the tines continues to resist displacement of the fork, the continued movement of the saddle means results in gripper shoe pressure being generated against the rows of cartons until a predetermined pressure is reached, at which time the overload stop lugs **83** and **84** solidly contact the underside of header bar **19**, and upon further application of lifting forces, the lift fork structure with its carton stack on top of the tines as well as the base rows of

cartons clamped between the tines, are raised bodily for transportation.

During the take-up movement, the springs **97** and **98** are stretched and biased from their initial tension to a position and tension determined by the take-up distance **92**. This stretched spring condition gives the springs added potential energy necessary to draw the saddle means and fork together, and thereby retract the gripper mechanism, when the lift fork is relieved of its load.

The gripper mechanism actuating forces are transmitted through means of the pull bars **41** and **42**, knuckle joints **47** and **48**, ear plates **45** and **46**, lift bar **49**, spring **62**, nut **66**, stud **57**, knuckle joint **75**, and arm **79**. Crank arm **79** imparts a rotational movement to torque shaft **82**.

This rotational movement of the torque shaft is communicated to the pivoted shoe beam **135** through means of link arm **134**, thereby thrusting the pivoted shoes **149** and **151** laterally against the rows of base cartons.

Similar gripper mechanism on an adjacent tine coacts with the above gripper mechanism to clamp the base course of cartons securely therebetween. The gripper mechanism generates a predetermined lateral clamping force which increases as stop lugs **83** and **84** negotiate the take-up space **92** and approach the header bar for solid abutment therewith.

When the load is about to be deposited at its destination, the lift plate and the complete lift fork structure is slowly lowered until the base course of cartons contact the floor or other resting place.

At this point the lift fork is relieved of the greater portion of the stack load, however, the saddle means is still at the upper limit of the take-up distance, and the lifting force necessary to generate the required lateral pressure on the base rows of cartons is still being applied by the lifting plate and resisted by the load.

To complete the act of deposition, the lift plate is further lowered, and the associated saddle means lowers with it, while the fork per se remains relatively immobile being urged against the bottom of the carton stack by forces resulting from tension in springs **97** and **98**. As the saddle retracts from the upper limit of take-up distance, there results a diminishing lateral clamping pressure against the base rows of cartons until the pressure is reduced to zero, and the gripper mechanism shoes are retracted from the cartons. Continued lowering of the lift plate and associated saddle means further relieves the tension in springs **97** and **98**, and the gripper mechanism including the shoes are retracted thereby into the fork tine.

When the gripper mechanism is fully retracted, the rear edges **173** of shoes **141** and **142** abut against tine web **131**, stopping further retraction, and properly aligning the pivoted shoes in the tine. The lift fork assembly now become unitized, and further lowering of the lift plate allows the complete lift fork assembly, including the heretofore immobilized fork, to be disengaged and retracted from the bottom of the carton stack. The tines can now be withdrawn from between the base rows of cartons by a rearward movement of the lift truck. This completes a cycle of operation.

Reverting now to the operator's attempt to initially align the fork tines with the narrow passageways between the base rows of cartons. More often than not, and despite the use of a side shifter mechanism and truck maneuvering, some significant misalignment remains. To insert the fork tines into the narrow passage under said misaligned conditions, often results in damage to soft goods such as canned goods packed in cartons. The cans become dented and the cartons ripped.

The floating suspension mounting of this improved lift fork assembly allows the fork thereon to pendulate laterally on balance springs **97** and **98**, and on pull rods **41** and **42**, oscillate substantially about vertically disposed pin **112**, and to bodily move laterally through means of upper linkage **108—109** and lower linkage **169—171—172** connections, thereby providing a lift fork construction that is adapted to adjust and accommodate itself to misaligned base rows.

The cam or wedge stabilizer feature **113** provides a fork with spring stabilization against rotative oscillations when empty, yet yieldably allowing the fork freedom of adjustability when accommodating itself to misalignment; and provides solid stabilization or substantially solid stabilization when loaded.

The gripper mechanism features: torque actuation in the tine; a gripper shoe pivotally mounted for two degrees of rotative freedom; a pivotal shoe arrangement providing proper shoe alignment in the tine when the shoes are fully retracted; and a shoe facing especially well adapted for the handling of soft goods whereby to provide a maximum of grip-ability with a minimum of lateral force.

The characteristic features of this invention are the general floating suspension arrangement; the upper and lower link connections between the saddle means and fork; the wedge stabilization means; the torsionally actuated gripper mechanism in the tine; the pivotally mounted shoes with two degrees of rotative freedom; and a gripper shoe having a facing consisting of staggered rows of deep resilient cleats.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood, that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed and desired to be protected by Letters Patent of the United States is:

1. In a lift fork, spaced parallel and horizontal tines disposed in side by side relation, a torsion shaft disposed along the confronting faces of each of said tines, each torsion shaft being parallel to the axis of its associated tine, bearing means on said tines rotatably supporting said torsion shafts, a laterally extending arm fixed on each of said torsion shafts for oscillation laterally of said tines, a horizontal beam for each of said arms disposed opposite the ends of said arms, first pivot means pivotally supporting said beams on said arms, intermediate the ends of said beams, the pivotal axes of said first pivot means being horizontal, shoe means disposed outwardly of each end portion of each beam, and second pivot means pivotally supporting said shoe means on said beams, intermediate the ends of said shoe means, the pivotal axes of said second pivot means being operatively disposed substantially vertically.

2. In a lift fork, spaced parallel and horizontal tines disposed in side by side relation, a torsion shaft disposed along the confronting faces of each of said tines, each torsion shaft being parallel to the axis of its associated tine, bearing means on said tines rotatably supporting said torsion shafts, a laterally extending arm fixed on each of said torsion shafts for oscillation laterally of said tines, a horizontal beam for each of said arms disposed opposite the ends of said arms, first pivot means pivotally supporting said beams on said arms, intermediate the ends of said beams, the pivotal axes of said first pivot means being horizontal, shoe means disposed outwardly of each end portion of each beam, and second pivot means pivotally supporting said shoe means on said beams, intermediate the ends of said shoe means, the pivotal axes of said second pivot means being operatively disposed substantially vertically, said shoe means having rearwardly extending portions abuttable with their associated tines for aligning said shoe means parallel to their associated tines when said shoe means are in fully retracted position.

3. In a lift fork, spaced parallel and horizontal tines disposed in side by side relation, a torsion shaft disposed along the confronting faces of each of said tines, each torsion shaft being parallel to the axis of its associated tine, bearing means on said tines rotatably supporting said torsion shaft, a laterally extending arm fixed on each of said torsion shafts for oscillation laterally of said

tines, a horizontal beam for each of said arms disposed opposite the ends of said arms, first pivot means loosely pivotally supporting said beams on said arms, intermediate the ends of said beams, the pivotal axes of said first pivot means being horizontal, shoe means disposed outwardly of each end portion of each beam, and second pivot means pivotally supporting said shoe means on said beams, intermediate the ends of said shoe means, the pivotal axes of said second pivot means being operatively disposed substantially vertically, said shoe means having rearwardly extending portion abuttable with their associated tines for aligning said shoe means parallel to their associated tines when said shoe means are in fully retracted position.

4. An improved lift fork, comprising: support means adapted for liftable engagement by fork lift truck means; fork means including a substantially vertical frame and spaced parallel tines projecting horizontally from said frame, said tines being disposed in side by side relation, and said frame being operatively disposed opposite said support means; spring balance means pendulously supporting said fork means on said support means; first chain linkage means connecting said support means and said fork means for maintaining said fork means operatively disposed relative to said support means and for guiding said fork means in up-and-down movement relative to said support means and for permitting lateral movement of said fork means relative to said support means; laterally extendable means on the confronting faces of adjacent tines for coactively clamping objects disposed between said tines; means pendulously connecting said support means and said extendable means, operative to actuate said extendable means outwardly, responsive to an upward movement of said support means relative to said fork means, and to permit lateral movement of said fork means relative to said support means; and stop means on said support means engageable with the frame of said fork means, for limiting the upward movement of said support means relative to said fork means.

5. An improved lift fork, comprising: support means adapted for liftable engagement by fork lift truck means; fork means including a substantially vertical frame and spaced parallel tines projecting horizontally from said frame in side by side relation, and said frame being operatively disposed opposite said support means; spring balance means supporting said fork means on said support means; first flexible linkage means connecting said support means to said fork means for operatively disposing and guiding said fork means in up and down movement relative to said support means, said flexible linkage means permitting lateral movement of said fork means relative to said support means; laterally extendable means on the confronting faces of adjacent tines for coactively clamping objects disposed between said tines; means pendulously connecting said support means and said extendable means, operative to actuate said extendable means outwardly and retractively responsive to upward and downward movement, respectively, of said support means relative to said fork means, and further operative to permit lateral movement of said fork means relative to said support means; and stop means on said support means engageable with the frame of said fork means, for limiting the upward movement of said support means relative to said fork means.

6. The apparatus of claim 5 wherein said first flexible linkage means comprises upper flexible linkage means connected across the upper central portions of said support means and said fork means and lower flexible linkage means connected across the lower central portions of said support means and said fork means.

7. The apparatus of claim 5 and damper means separate from said first flexible means, on said support means engageable with said fork means, operative to damp oscillatory movement of said fork means relative to said support means, said damper means including movable shoe means and spring means normally urging said shoe means into engagement with the sides of the vertical frame of said fork means.

8. The apparatus of claim 5 and stabilizer means, separate from said stop means, on said support means engageable with said fork means operative to stabilize said fork means relative to said support means during loaded condition of said fork means, said stabilizer means including a rigid extension of said support means engageable with the sides of the vertical frame of said fork means when said support means is disposed at its substantially maximum upward displacement relative to said fork means.

9. In a lift fork, support means adapted for engagement by lift means; fork means; spring means having its upper end attached to said support means and its lower end attached to a lower portion of said fork means, to pendently suspend and balance said fork means on said support means; vertically extending guide means on said support means; a movable member disposed in guiding relation on said guide means, said movable member being vertically guided by said guide means; and chain linkage means connecting said movable member and the central portion of the upper portion of said fork means, for operatively disposing said fork means relative to said support means, for permitting vertical movement of said support means relative to said fork means, and for otherwise permitting substantially universal movement of said fork means relative to said support means; and stop means on said support means engageable with the vertical frame of said fork means, for limiting the upward movement of said support means relative to said fork means.

10. In a lift fork, support means adapted for engagement by lift means; fork means; spring balance means pendulously supporting said fork means on said support means; and chain linkage means connecting said support means and said fork means for maintaining said fork means operatively disposed relative to said support means, for permitting vertical movement of said support means relative to said fork means, and for otherwise permitting substantially universal movement of said fork means relative to said support means.

11. In a lift fork, support means adapted for engagement by lift means; fork means; spring means for balancing said fork means on said support means; and flexible link means operatively connecting said fork means to said support means for guiding said fork means in substantially vertical and lateral movement relative to said support means, and for otherwise permitting substantially universal movement of said fork means relative to said support means.

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