# United States Patent [19]

**Shaffer**

[11] **3,762,589**

[45] **Oct. 2, 1973**


[54] **ULTRA-NARROW-AISLE LIFT TRUCK**


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[73] Assignee: **Townmotor Corporation,** Cleveland, Ohio



[22] Filed: **Dec. 16, 1971**

[21] Appl. No.: **208,576**

[52] **U.S. Cl.** ..... **214/730,** 104/127

[51] **Int. Cl.** ..... **B66f 9/14**

[58] **Field of Search** ..... 214/730, 16.4 A, 214/38 D; 104/48, 127, 131



[56] **References Cited**

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[57] **ABSTRACT**

An apparatus and method in the form of a vehicle for transporting, lifting, placing and retrieving loads in narrow-aisle load storage racks. Narrow-aisle operation is provided by vertically movable, extensible tracks which enter the load space and rest upon the racks thus permitting a track-mounted carriage having lift forks thereon to enter and leave a load space.


**7 Claims, 15 Drawing Figures**

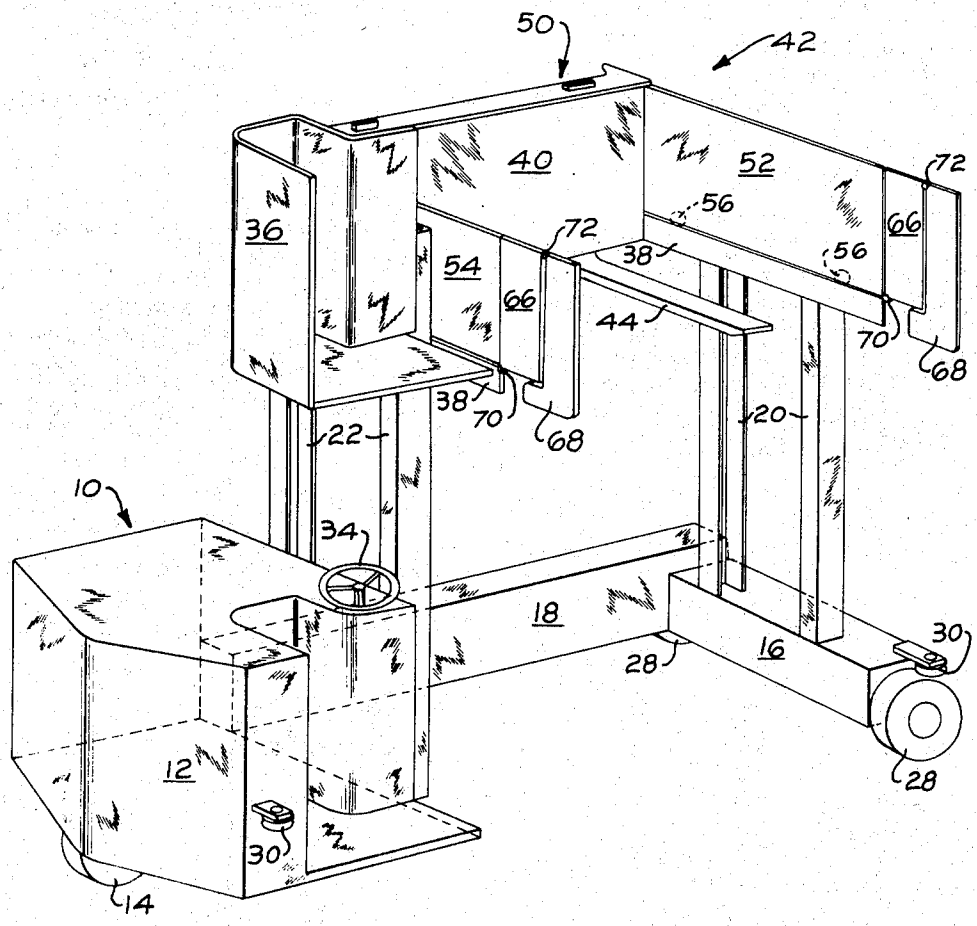
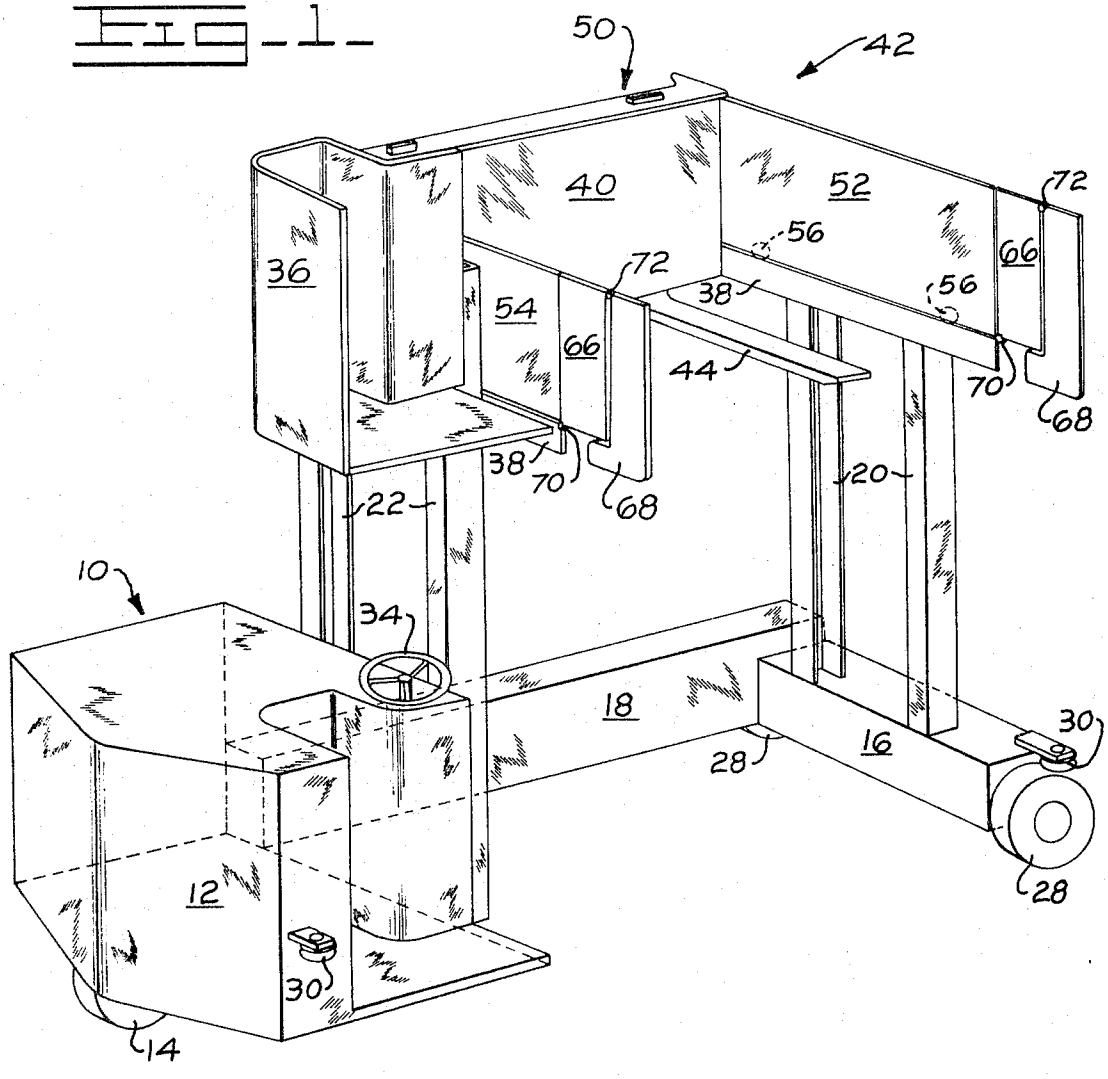


Fig. 1




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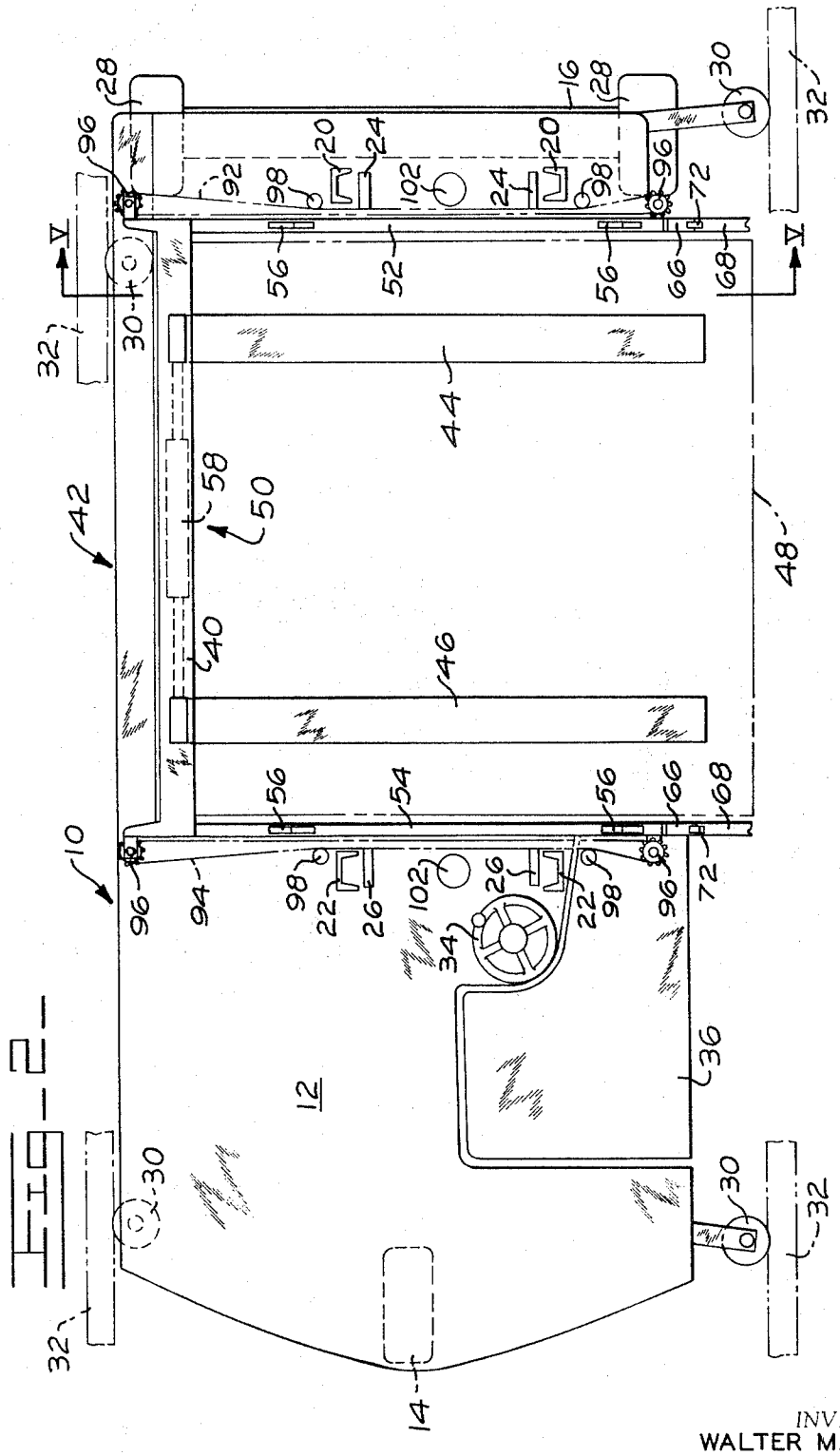



FIG. 2

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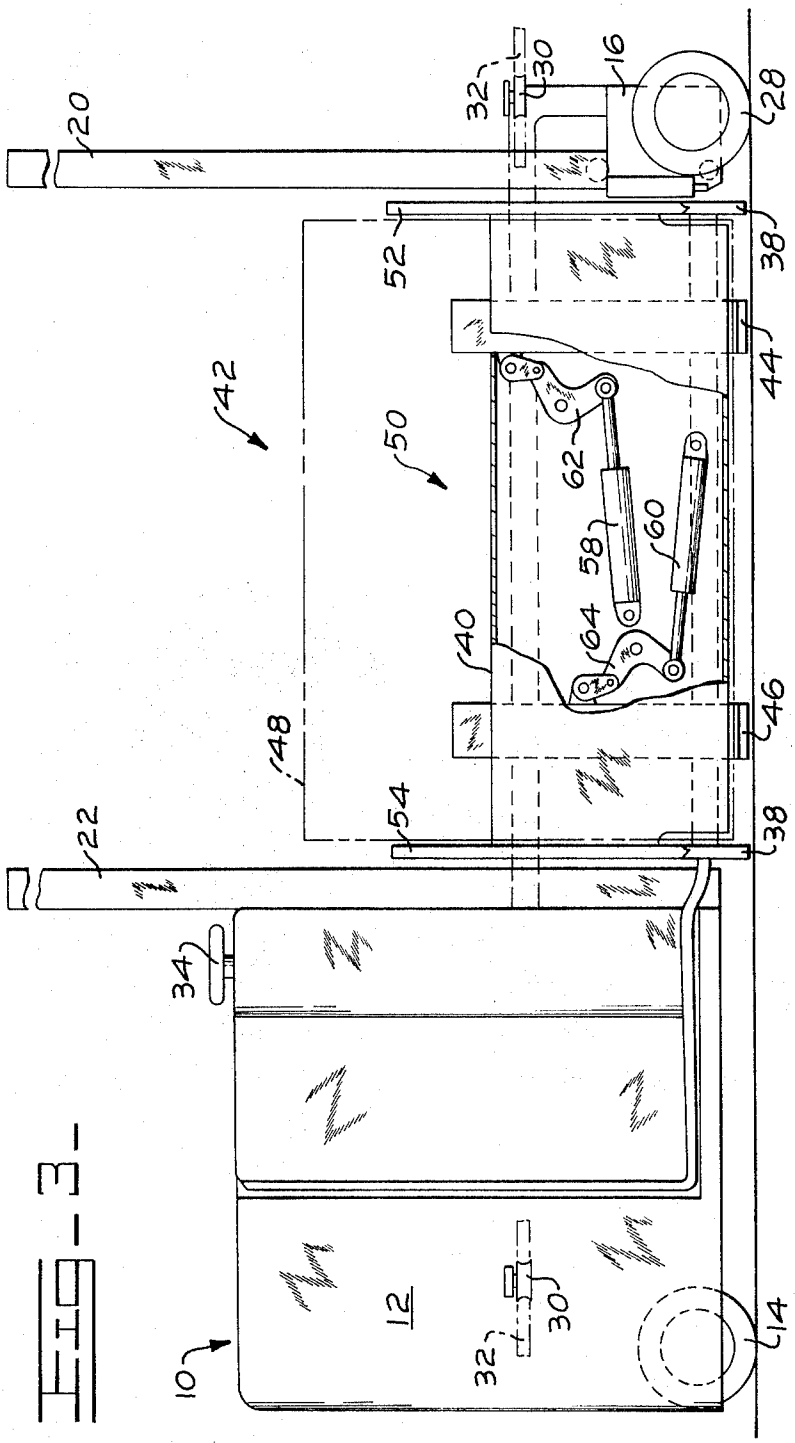



FIG - 3 -

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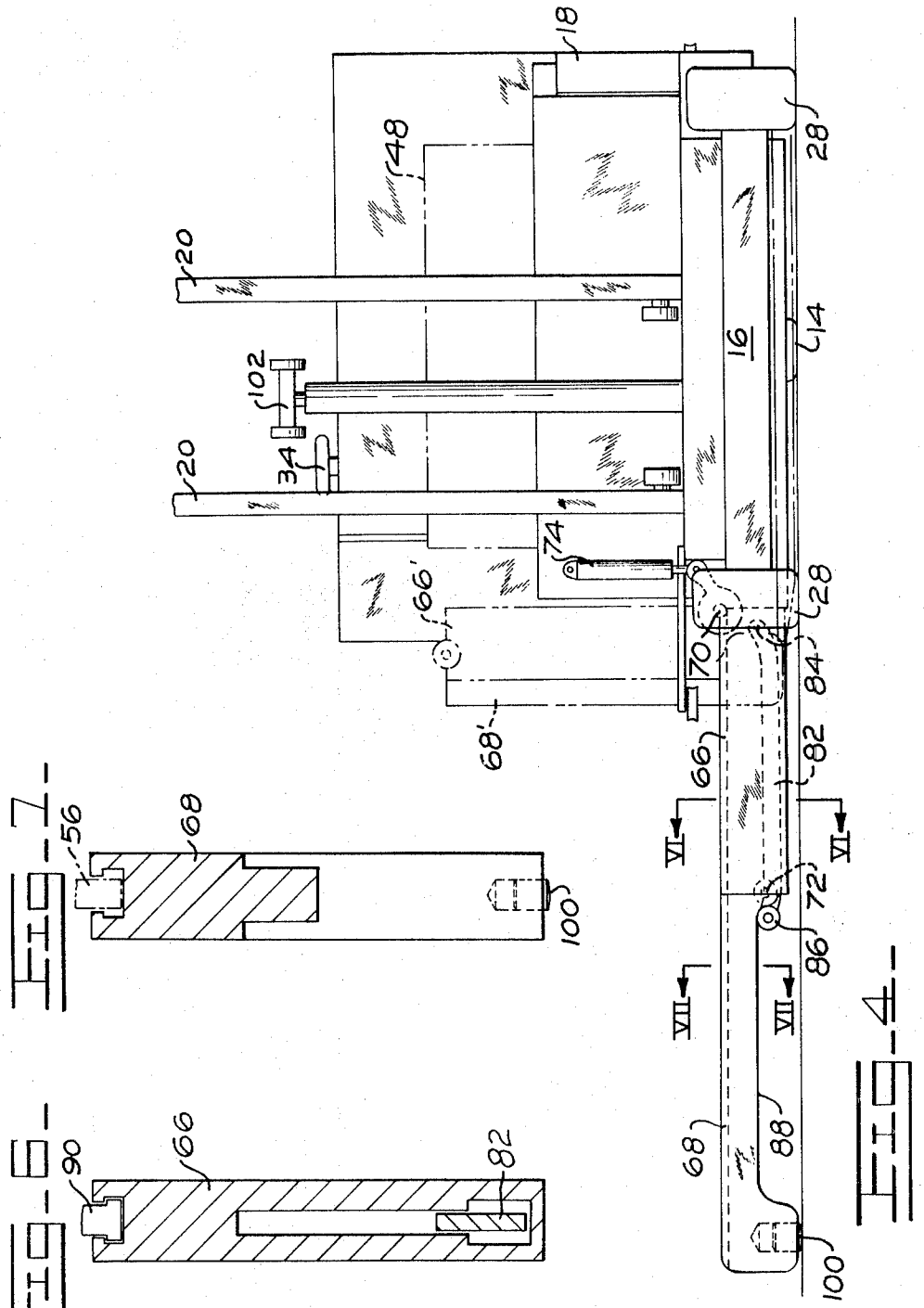



FIG-4-




FIG-7-

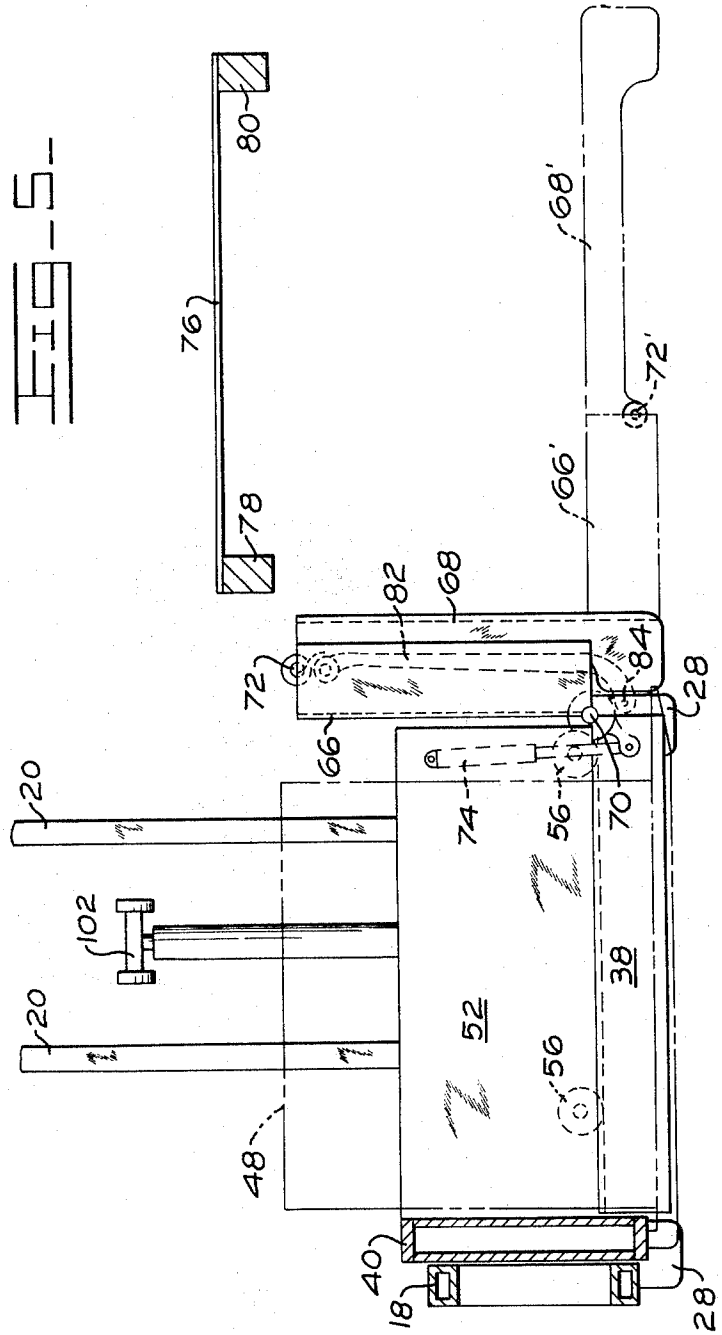



FIG-5-

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FIG-5-




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Fig. 8

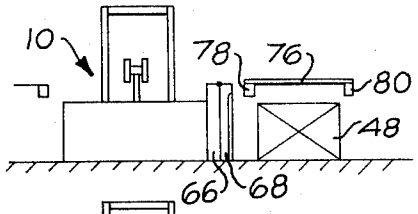



Fig. 9

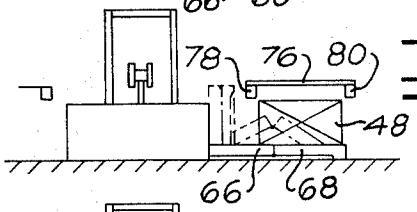



Fig. 10

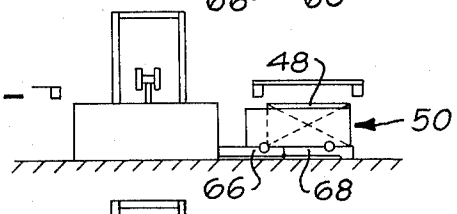



Fig. 11

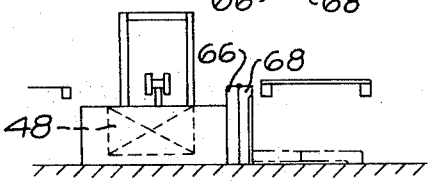



Fig. 12

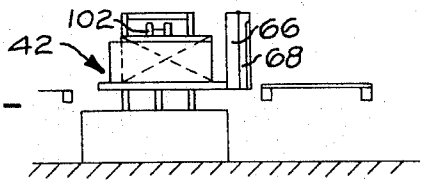



Fig. 13

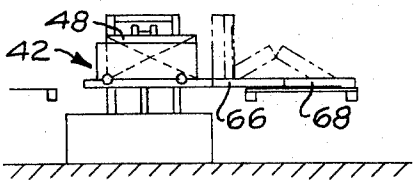



Fig. 14

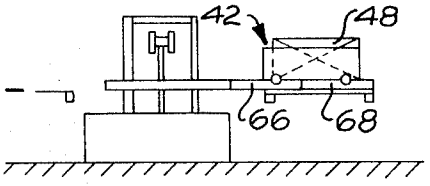
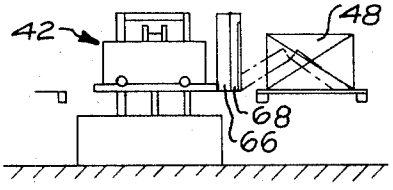



Fig. 15




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# ULTRA-NARROW-AISLE LIFT TRUCK

## BACKGROUND OF THE INVENTION

It has long been a problem in the storage and other industries to maximize the usage of available storage space without resorting to high-cost, limited-use equipment installations. Industry is presently attempting to solve this problem through several approaches.

One such approach has been to use lift trucks with a reach-type, pantograph carriage mechanism that is designed to extend into a second storage space, thus reducing the number and width of aisles from that required by a standard fork-lift truck. Another approach uses straddle trucks which have extending arms to straddle and support the load and which, like the standard truck, must make a 90° turn from the aisle and enter the load storage space to deposit or retrieve a load. Both the reach-type truck and the straddle truck require four- or five-foot wider aisles than the load being carried which is obviously wasteful of available storage space.

Another approach that is more of a single-purpose nature and consequently much more expensive is using a stacker crane, which normally works from an overhead rail. This requires that it be built into the warehouse design. The stacker crane requires a working aisle width two or three feet wider than the loads being handled.

A still further industry approach to the problem is the use of an automatic warehousing system, wherein a computer provides data storage and is interconnected with an automated storage-retrieval mechanism similar to the stacker crane. This later system is costly and is usually very difficult to adapt to an existing warehouse facility.

## SUMMARY OF THE INVENTION

The present invention overcomes the above-noted problems by providing an apparatus and method in the form of an extremely narrow-aisle lift truck that makes more efficient use of warehousing and storage space by requiring an aisle only slightly wider than the load itself. This is a major economic advantage since the aisle space saved can be put to productive use as load storage space. This subject lift truck's load moment is primarily within its wheel plan, and this fact coupled with the elevated load and mechanism being closely contained and partially supported by the warehouse racks, provides a lift truck which is highly resistant to tipping even when the load is in its highest extended position.

Another feature provides for the operator riding up with the load, thus providing him with excellent visibility for a more efficient and safe operation.

Added to its usefulness in narrow-aisle rack storage of unit loads, this invention will also be an effective order-picker. Furthermore, by not requiring a 90° turn from the aisle into the stack to store or retrieve the load, as is necessary with present narrow-aisle lift trucks, this invention is adaptable to varying degrees of automatic control.

Since a significant load moment is not applied to the load-handling mechanism other than within the traveling carriage, relatively small structural members are used, thus greatly reducing the cost of manufacturing and further increasing the vehicle's efficiency.



## OBJECTS OF THE INVENTION

Accordingly, it is a primary object of this invention to provide a lift truck that will operate in an aisle no more than one foot wider than the load being transported, thus making maximum use of expensive warehouse and storage yard space.

Another object of this invention is to accomplish the above by containing the major portion of the load moment within the wheel plan of the lift truck, thus making use of relatively small and inexpensive structural members, and further reducing vehicle cost as well as increasing vehicle efficiency through the reduction of unproductive vehicle weight.

Also, it is an object of this invention to provide a lift truck whose load moment is so placed as to allow extremely high lifts in a safe manner.

It is a further object of this invention to provide a lift truck having extensible tracks for supporting the load during deposit and retrieval and also having safety means precluding operation unless the tracks are fully supported.

It is a further object to provide a vehicle whereby the operator rides up with the load, thus assuring excellent visibility and a highly efficient and safe operation.

A further object of this invention is to provide a more versatile lift truck that will be adaptable to varying degrees of an automated-control warehousing system.

Additional advantages and features of the present invention are made apparent in the following description and the accompanying drawings, wherein:

FIG. **1** is a perspective view of the invention, from the operator platform side, showing the carriage assembly and operator platform in its highest, raised position;

FIG. **2** is a top plan view of the invention;

FIG. **3** is a side elevation view partially cut away to show the operating mechanism for providing small incremental movement of the forks relatve to the major carriage member;

FIG. **4** is a front elevation of the invention showing the tracks fully extended;

FIG. **5** is a cross-sectional view taken as shown in FIG. **2**;

FIG. **6** is a cross-sectional view of the carriage guide rail as shown in FIG. **4**;

FIG. **7** is a similar view of the carriage guide rail, as shown in FIG. **4**; and

FIGS. **8–15** are schematic drawings setting forth a sequence of load handling operations.

## DETAILED DESCRIPTION

Referring now in detail to FIGS. **1–3** of the drawings, the inventive lift truck generally at **10** comprises a body portion **12** containing power and control components (not shown). The power source may consist of battery-powered electric motor means, an internal combustion engine coupled through a mechanical or hydrostatic drive means to the single steerable drive wheel **14**, or such other motive power means or combination of means known to those well skilled in the art.

A transverse, forward frame member **16** is joined to the body portion **12** by means of a longitudinal side frame member **18**. Forward and aft mast assemblies **20** and **22** with their associated carriages **24** and **26**, respectively, are provided for vertical positioning of the load carriage means. Mast assembly **22** is mounted on body portion **12**, while mast assembly **20** is mounted on

the forward frame member **16.** The two forward non-steerable wheels **28** are also secured at each end of the forward frame member **16,** by conventional axle suspension means (not shown).

Four guide rollers **30** at the four corners of the vehicle are spaced at the correct width and height to properly mate with the warehouse longitudinal rack members **32,** thus providing additional guidance for the lift truck when it is traversing the storage aisles. Steering of the powered wheel **14** is accomplished by means of a manually operable steering wheel **34** with its column-mounting integral with the rigid body portion **12.**

The operator station **36** contains all other controls (not shown) and moves with the stationary transverse track sections **38** and the movable carriage assembly **40,** thus permitting the operator compartment **12** to move vertically with the load handling portion of the truck, shown generally at **42.** It is understood that alternatively the steering wheel could also move vertically with the operator station or compartment.

The carriage assembly **40** has mounted thereon a pair of forks **44** and **46** for supporting the load **48** to be transported, and forms a traversing unit **50** in combination with the side members **52** and **54.** Each side member contains a pair of rollers **56** mounted in recesses on its underside, for engaging the track section members **38.**

As shown in FIG. **3,** a pair of hydraulic jacks **58** and **60** in combination with bellcrank linkages **62, 64,** permit a limited amount of vertical movement for raising and lowering the load independently of the carriage lift mechanism, with such movement being necessary to raise or lower the load to the warehouse racks or floor without moving the guide tracks.

Stationary transverse track sections **38** serve to support both the load carriage and the two sections of folding transverse track members **66** and **68,** all having the same top contour. The folding track sections **66** are pivotally joined to carriage members **38** by a rotary hinge means **70,** and the folding track section **66** is pivotally joined to the track member **68** by rotary hinge means **72.**

Turning now to FIG. **5,** the track extension sequence, from traveling position to load/unload position, will be described. Operator activation of the hydraulic jack means **74,** causes the folding track member **66** to rotate clockwise and assume position **66'.** At the same time, folding track member **66** rotates clockwise, folding track member **68** rotates counterclockwise to assume its position **68'.**

Thus, the lower surfaces of the transverse folding track members **66** and **68** will have engaged the warehouse storage space floor as shown in FIG. **4,** or, if the carriage lift member **40** is in the upper position, as shown in FIGS. **12–15,** said track members will rest upon the warehouse rack assembly **76** supported by members **78** and **80.**

Returning to FIG. **5,** the mechanism for extending the track sections includes a link member **82** which is pivotally attached at one end at pivot means **84** on the track members **38** and is guided by the internal walls of of hollow track sections **66.** A support roller means **86** is attached to the other end of link **82.** As best seen in FIG. **4,** roller means **86** rolls against the surface **88** on the underside of folding track assembly **68** allowing it to move smoothly from its vertical traveling position **68'** to its horizontal load/unload position. The sequence of operation is reversed for folding the track back into its traveling position.

When the truck is in the load/unload condition and the track is horizontally extended into the warehouse storage space, a smooth, continuous load-support track is presented for the subsequent transverse movement of the traversing unit **50.**

Turning to FIGS. **5–7,** it may be seen that rollers **56** conform to the contoured upper surface of track members **38, 66** and **68.** The rollers **56** are mounted on the bottom of the carriage side members **52** and **54,** and have a fixed scraper member **90** in front and behind the rollers **56** to clear debris from the track top surface, thus always presenting a clean, smooth track surface to the rollers.

As best seen in FIG. **2,** the transverse movement of the carriage assembly or traversing unit **50** and load **48** is provided by chains **92** and **94** attached to side members **52, 54,** chain sprockets **96,** and chain guides **98** attached to transverse track sections **38** by conventional means (not shown). A very small rotary hydraulic motor means, or other such motor means readily known to one skilled in the art, is used to drive the chain sprocket mechanism thereby propelling the carriage and load onto the track sections **66** and **68.** The carriage forks vertical movement is then actuated through hydraulic jacks **58** and **60** and bellcranks **62** and **64** as best seen in FIG. **3** to deposit the load on the warehouse rack or floor.

As seen in FIG. **4,** a safety feature is also included whereby the chain drive sprocket motor means cannot be energized if the folding track members **66** and **68** are not in a safe, supported position on the warehouse floor or rack. This is accomplished by means of a plunger **100,** located in the lower surface of the outer track member **68,** which is depressed by either the warehouse floor or warehouse rack assembly **76** and thereby actuates a safety switch mechanism (not shown) connected to the chain sprocket motor means.

The method of operation of my invention will now be described with particular reference to FIGS. **8–15** of the drawings. The first step is shown in FIG. **8** wherein lift truck **10** is driven in a storage aisle to a point adjacent to a load **48,** which load is contained in a load storage space defined by top rack assembly **76** and members **78** and **80.** As shown in FIG. **9,** the next step is the extension of folding track sections **66, 68** into the load space, with one of each pair of track sections resting on the ground on either side of load **48.**

The next step, shown in FIG. **10,** is to propel the traversing unit or carriage into the load space on the track sections by chain means (not shown). It may be parenthetically noted that the load moment on the vehicle is minimized due to the ability of the track sections to transmit much of the weight of the load to the supporting ground at their point of contact therewith. Actuation of fork means (not shown) is then accomplished to lift the load from its supporting surface whereupon the chain means is reversed to retract the traversing unit and load into the vehicle to the position shown in FIG. **11.**

The track members are then retracted for subsequent movement of the vehicle.

If a higher load space is to be serviced, the load handling portion **42** of the truck including the operator station is raised by activating the lift mast means **102** as shown in FIG. **12.** The above steps are then repeated

as shown in FIGS. 13–15, however, reversing the steps to deposit the load.

One embodiment of my invention has been fully described, but it will be apparent to anyone skilled in the art that various other forms would be possible without departing from the spirit of the invention or the scope of the following claims.

What is claimed is:

1. A lift truck for use in narrow storage aisles comprising,

a body,

a pair of track members pivotally attached to the body by pivot means, said track members being extendible so as to enter an adjacent load space,

means for extending said track members,

carriage means including lift fork means thereon adapted for raising and lowering loads,

means for propelling said carriage means on said track members into an adjacent load space for retrieving or depositing loads,

safety means rendered operative by extending said track members into supporting contact with a support surface for preventing propelling of the carriage means when the track means is not fully supported.

2. The lift truck of claim 1 further including mast means for raising and lowering said track means whereby higher load spaces can be accommodated.

3. The lift truck of claim 1 wherein the means for propelling the carriage means comprises chains and sprockets mounted on the track means.

4. The lift truck of claim 1 wherein the lift fork means comprises hydraulic cylinder means operatively connected to a pair of lift forks by linkage means.

5. The lift truck of claim 1 wherein the means for extending said track members comprise hydraulic jacks operatively connected to said track members for movement thereof.

6. The lift truck of claim 1 further including an operator platform operatively connected to said track means for vertical movement therewith whereby enhanced operator visibility is provided.

7. The lift truck of claim 1 further including a plurality of guide wheels mounted on said body for facilitating negotiation of narrow aisles by the lift truck.

* * * * *

# UNITED STATES PATENT OFFICE
# CERTIFICATE OF CORRECTION

Patent No. 3,762,589 Dated October 2, 1973

Inventor(s) WALTER M. SHAFFER

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading:

"Townmotor" should read --Towmotor--.

Column 1, line 16 "dard truck" should read --dard fork lift truck--.

Signed and sealed this 30th day of April 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents



USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334