

[54] MATERIALS HANDLING VEHICLE

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[51] Int. Cl. B60p 1/02

[58] Field of Search 214/16.4 A, 730,
214/16.1 CB, 75 G, 75 R, 512

[56] References Cited

UNITED STATES PATENTS

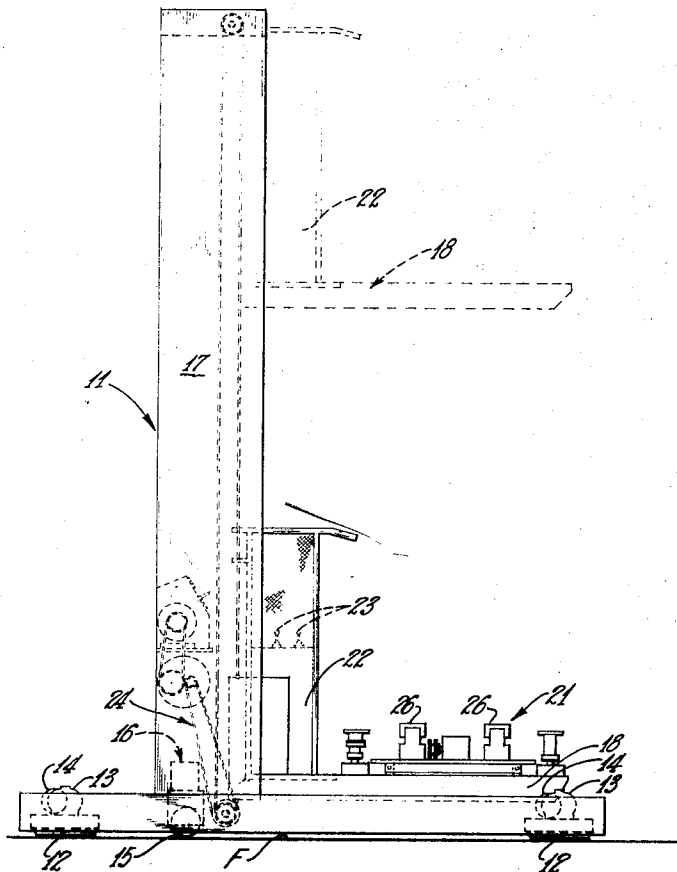
2,691,448 10/1954 Lontz 214/16.1 C
3,416,685 12/1968 Alimanestianu 214/16.1 CB

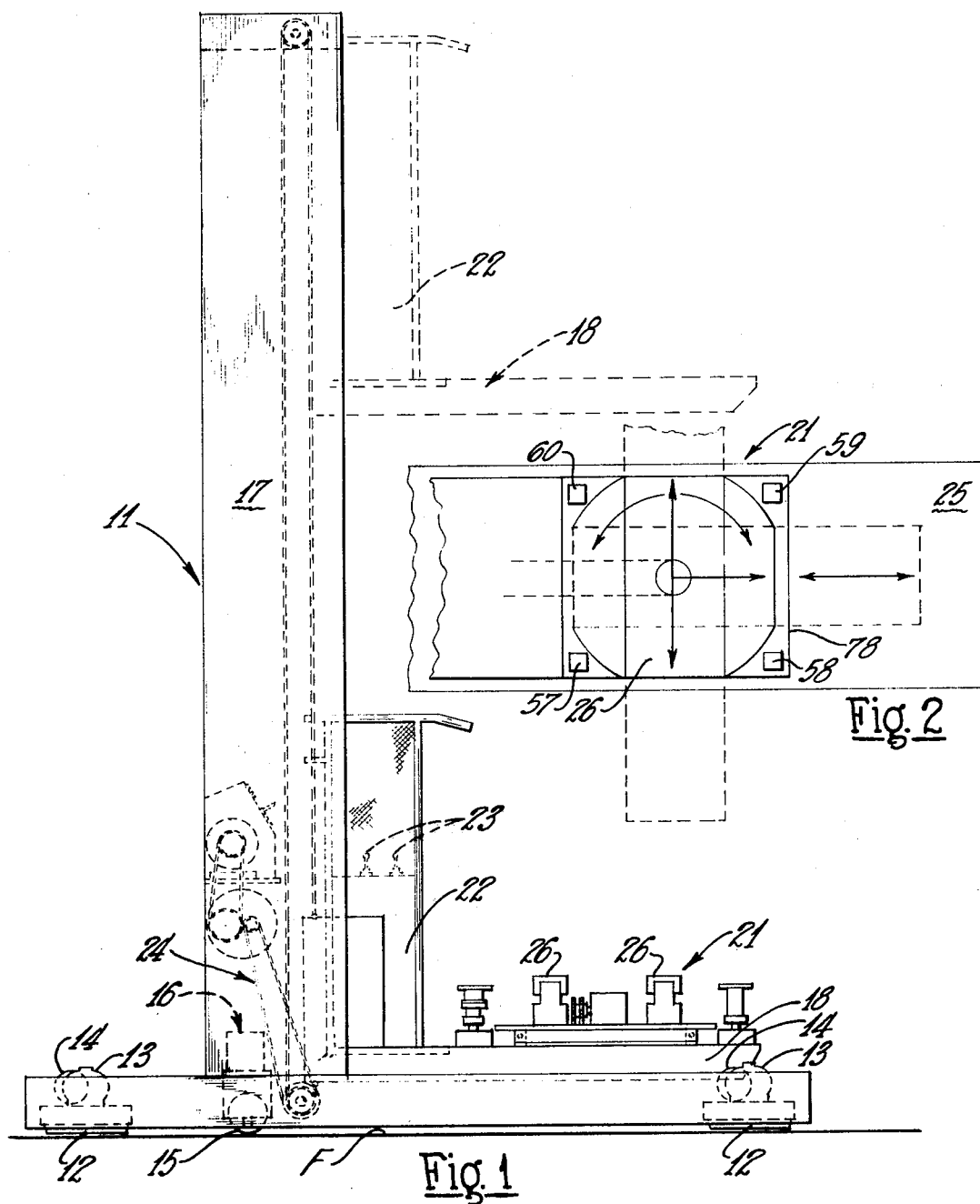
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[57] ABSTRACT

A load lifting vehicle including a shuttle which can be rotated free of the load to provide end loading and unloading. The shuttle assembly is mounted on a rotatable platform such that the shuttle table can be extended to either side of the vehicle transversely to the path of travel, or toward one end thereof parallel to the path of travel. Load-receiving pads capable of supporting the load are provided so that relative vertical movement of the shuttle table and the pads will free the shuttle of the load. The shuttle assembly can then be rotated 90° to provide end loading.

14 Claims, 6 Drawing Figures





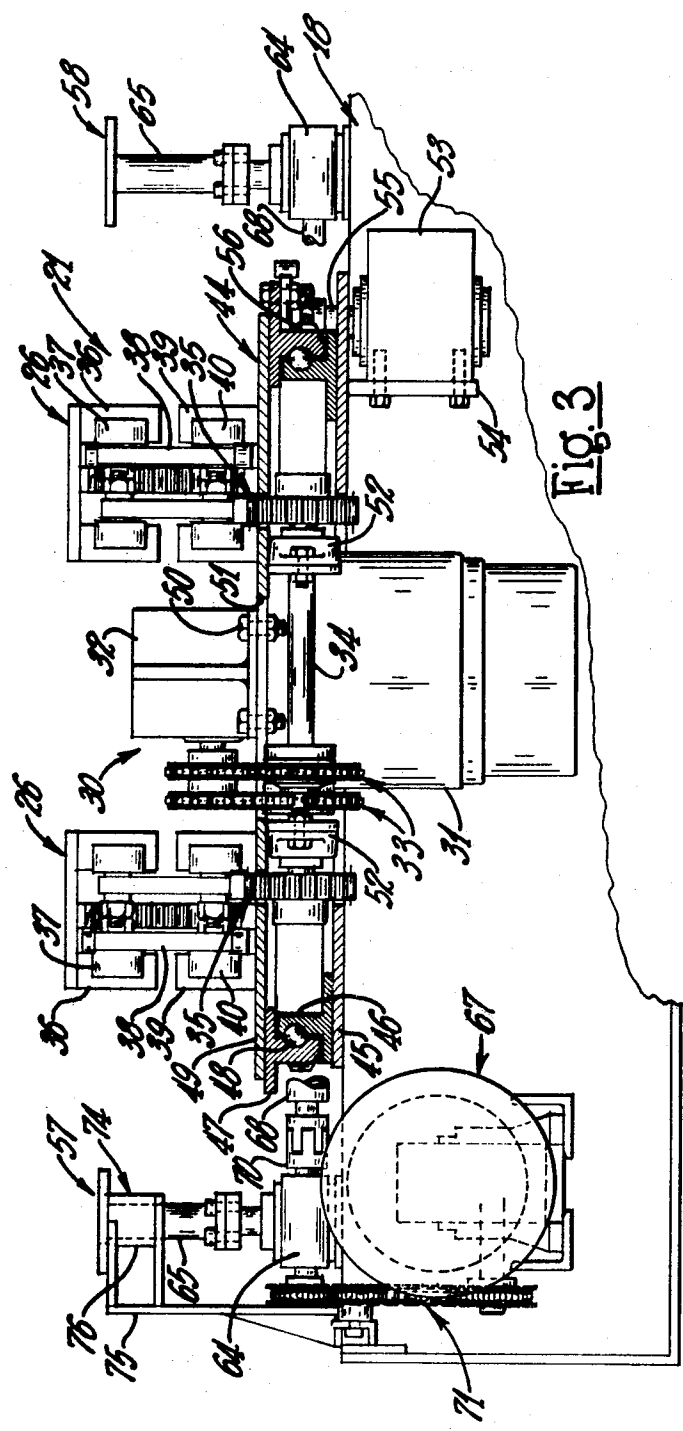


Fig. 3

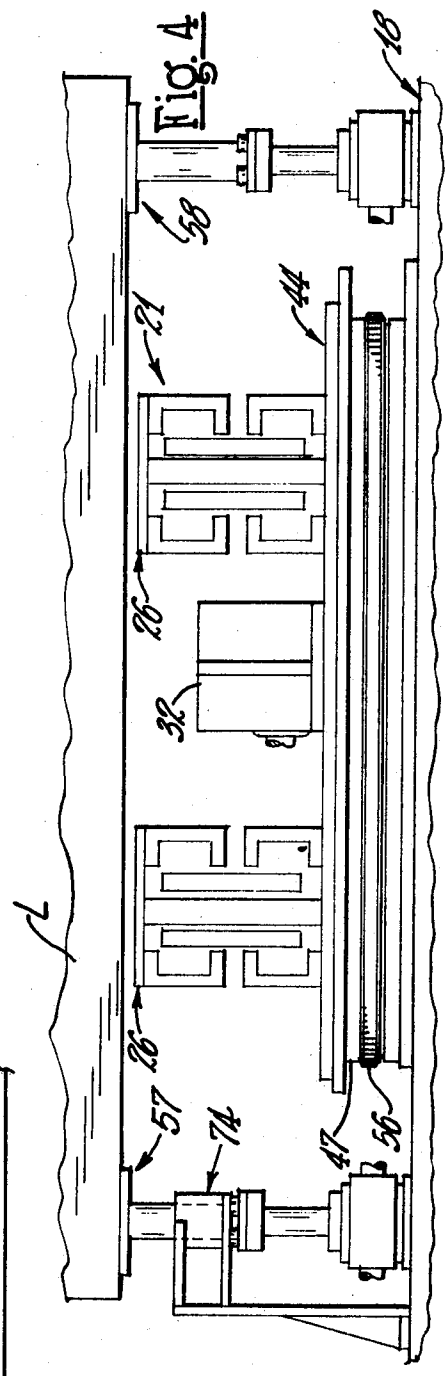
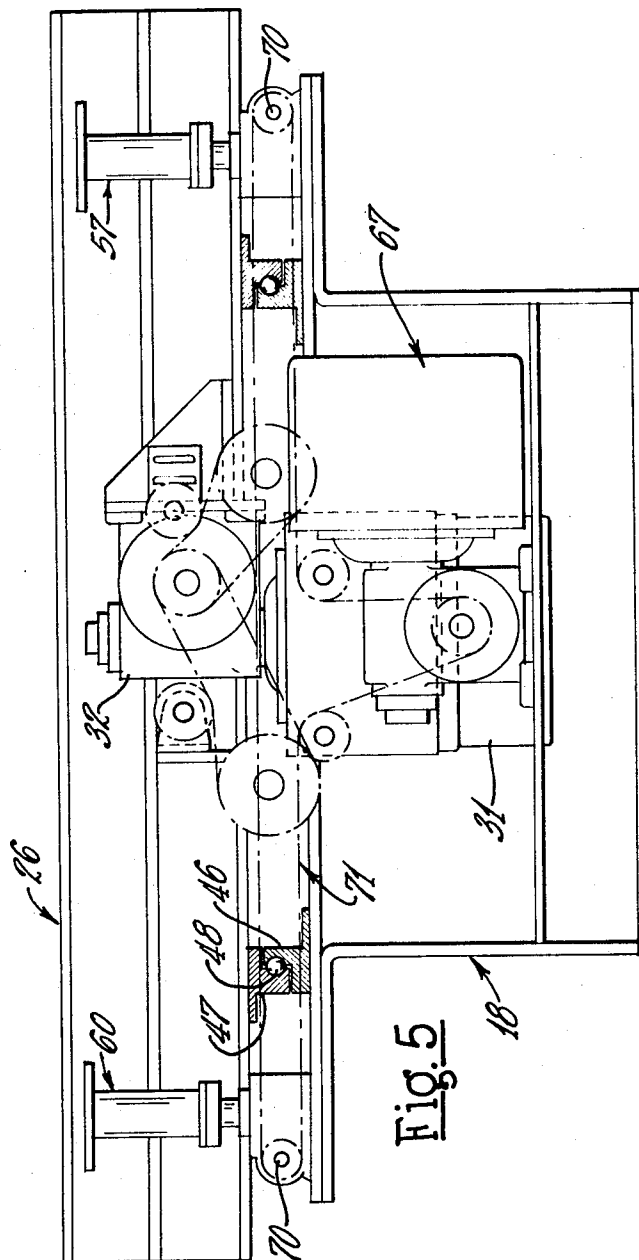


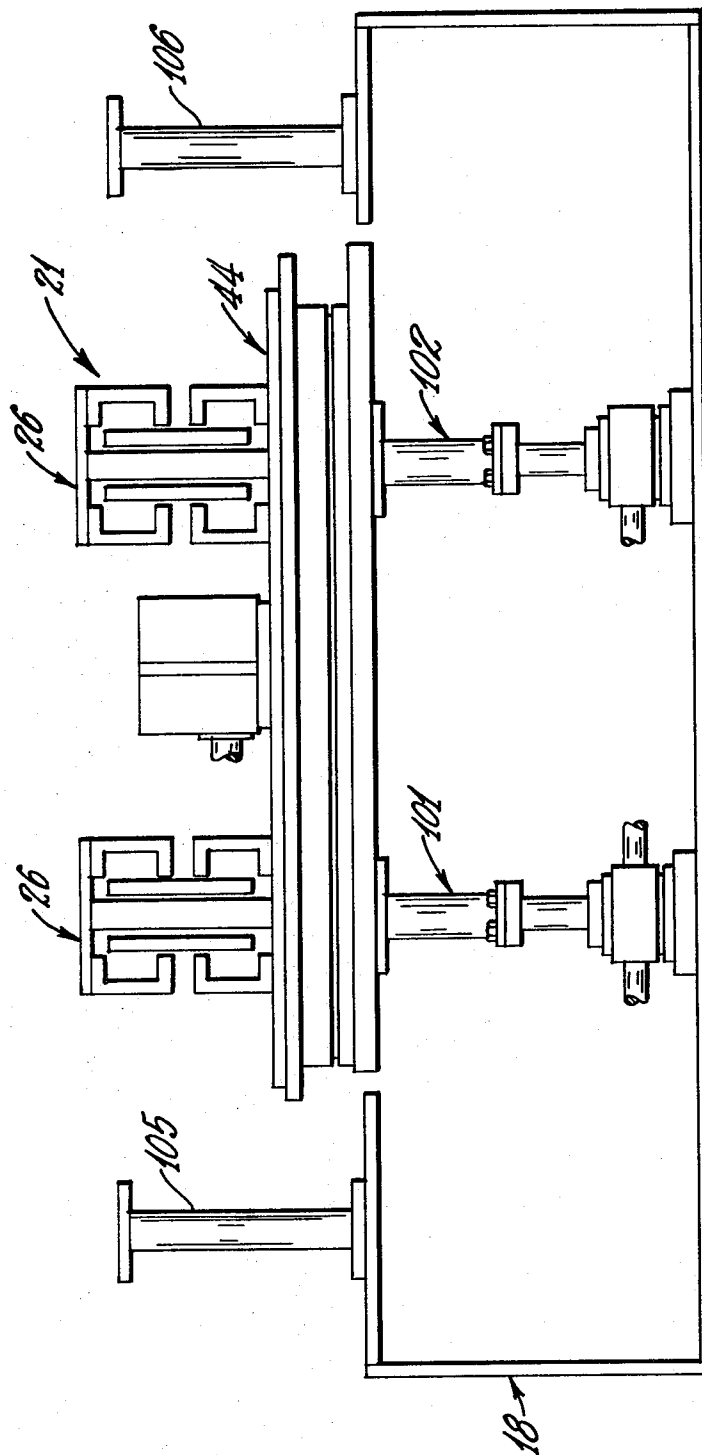
Fig. 4

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MATERIALS HANDLING VEHICLE

This invention relates to a material handling vehicle having an improved shuttle assembly for moving loads in a warehouse.

Modern warehouses, in an effort to conserve floor space, are often built extremely high and with a minimum of aisle space. For example, warehouses 40 to 60 feet in height are not uncommon. Access to the bins or storage racks of the warehouse is provided by masted stacker/retriever vehicles running between the rows of bins. Loading and unloading of the bins is accomplished by a load carriage movable up and down along the mast and including a shuttle assembly extendible to either side of the vehicle to either place a load in a selected bin or remove it therefrom.

To improve space utilization, the aisles between the bins are made as narrow as possible and every effort is made to minimize dead space at the ends of the aisles. One problem which is particularly vexing, however, is that of providing means to load or unload a stacker/retriever at the end of the aisles. If a belt conveyor running transversely to the aisles is provided, it can be appreciated that some means must be provided to transfer the load from the shuttle to the conveyor. This can be done quite easily with some form of transfer conveyor; however, this generally can be accomplished only at the cost of additional equipment and additional dead space, that is, space which could be more profitably devoted to bin space.

One solution is to provide means to rotate the shuttle assembly at the end of an aisle so that it can be extended toward a supply or exit conveyor as well as toward the bins. Past attempts at this have not been entirely satisfactory; however, in that the aisle is often too narrow to permit rotation of a load which makes maximum use of the aisle and bin space, and the equipment required to rotate the heavy loads often encountered is cumbersome and complex.

Accordingly, it is an object of the present invention to provide a material handling vehicle having end loading capability.

Another object of the invention is to provide a stacker/retriever capable of endloading without requiring increased aisle space to accommodate such end loading.

Another object of the invention is to provide such a stacker/retriever incorporating a rotatable shuttle assembly capable of extending to either side of the vehicle for operation within an aisle and of extending outward from one end of the vehicle for operation in association with a supply or exit conveyor.

Another object of the invention is to provide a stacker/retriever in which means are provided to permit the shuttle assembly to rotate free of a load in changing to or from operation within an aisle to or from an end loading mode of operation.

To accomplish the above objectives, the present invention provides a stacker/retriever vehicle incorporating a rotatable shuttle assembly and means to temporarily remove the load from the shuttle while the shuttle is rotated. More specifically, the invention provides load carrying pads flanking the shuttle assembly, and capable of being lifted in unison to raise a load off the shuttle while the shuttle is being rotated. According to an alternative embodiment of the invention the load carrying pads are fixed and the shuttle is dropped from

beneath the load. Since the load itself is not rotated, end loading capability is provided without necessitating increased aisle space.

Other objects and advantages of the invention will be apparent from the specification when taken in connection with the accompanying drawings, wherein:

FIG. 1 is a side elevation view of a stacker/retriever vehicle incorporating the invention;

FIG. 2 is a schematic plan view of the shuttle assembly of the invention;

FIG. 3 is an enlarged side elevation view of the shuttle assembly shown partly in section and with parts cut away;

FIG. 4 is a fragmentary elevation view similar to FIG. 3, but depicting a load supported on the lift pads of the invention;

FIG. 5 is a rear elevation view of the shuttle assembly schematically illustrating lift pad drive train means; and

FIG. 6 is a side elevation view of an alternative embodiment of the invention.

Referring to FIG. 1, the vehicle in which the invention is incorporated for purposes of illustration, is of a type that is adapted to ride on a series of air cushion elements. Thus, the vehicle, designated generally by the numeral 11, is supported by four air pads 12 (two shown), which receive measured amounts of air from fans 13 driven by motors 14. steering and driving is provided by a wheel 15 in contact with the warehouse floor F. The wheel 15 is part of a steering and driving assembly 16 mounted for traction movement against the floor F and for steering about a vertical axis. A more complete description of this type of vehicle may be found in application Ser. No. 886,884, filed Dec. 22, 1969, and assigned to the assignee of this application.

The vehicle 11 includes a mast 17 that is integral with the main frame of the vehicle and extends upwardly toward the ceiling of the warehouse. Suitably mounted on the mast 17 is a load elevating carriage 18 having a load carrying shuttle assembly 21, an operator's platform 22, and suitable controls 23 mounted thereon. Elevation of the carriage 18 is by a conventional sprocket and chain assembly, generally designated by the numeral 24, capable of moving the carriage between the full line and broken line positions of FIG. 1.

Referring particularly to FIGS. 2 and 3, the shuttle assembly 21 is adapted primarily to move a load supported thereon between a centered position on the vehicle 11 to either side of the vehicle for the transfer of a load between the vehicle and bins located on either side of an aisle 25 (see FIG. 2) in which the vehicle operates. The shuttle table, or load carrying member 26 can be in the form of pairs of fork-like table elements as shown in FIGS. 1 and 3, or can be a solid table as represented in the schematic drawing, FIG. 2.

The mechanism for extending and retracting the shuttle, designated generally by the numeral 30, does not form part of the present invention and will not be described in great detail. A mechanism such as that disclosed in U.S. Pat. No. 3,596,789, and assigned to the assignee of this application, is particularly adapted for use in conjunction with the present invention.

Referring primarily to FIG. 3, the shuttle drive mechanism 30 comprises a drive motor 31 and integral gear reducer 32, a chain and sprocket drive connection 33 between the gear reducer and a common shuttle drive shaft 34, and a compound rack and pinion drive system 35 operatively connected to the shuttle drive shaft. The

shuttle table, or forks 26, move(s) into or out of paper as viewed in FIG. 3 to extend fully into a selected bin for receiving or depositing a load therein. In the illustrative embodiment each shuttle fork 26 comprises an upper, load supporting element 36 riding on rollers 37 rotatably mounted on a sub-frame 38, and a lower, intermediate element 39 riding on rollers 40 supported by sub-frame 38. In operation, the lower element 39 remains stationary while the sub-frame 38 and the load supporting element move relative to the carriage 18 and to one another to provide maximum extension into the bins.

The shuttle assembly 21 is mounted on a rotating table assembly designated generally by the numeral 44. The table assembly comprises a flat plate member 45 bolted or otherwise fastened to the load carriage 18, a stationary annular bearing member 46 attached to the plate 45, a rotating annular bearing member 47 supported on the stationary member by a plurality of balls 48, and a shuttle supporting plate 49 attached to the rotating bearing member 47.

The shuttle motor and integral reducer unit 31, 32 are mounted, as by bolts 50 to the plate 49 with the reducer extending upward through a hole 51 provided therein. The stationary fork elements 39 are welded or otherwise fastened to the plate 49, as are bearing blocks 52 supporting the shuttle drive shaft 34.

Rotation of the bearing member 47 and operatively attached shuttle assembly 21 is provided by a motor 53 mounted on the underside of carriage 18 by means of a depending bracket 54. It is to be understood that for purposes of the present invention any convenient drive means can be provided; however, in this embodiment a chain and sprocket system are employed. A small sprocket (not shown) on the motor shaft 55 and sprocket teeth 56 formed on the rotating bearing member 47 provide the necessary drive connection and speed reduction.

An important facet of the present invention is the provision of lift pad assemblies 57, 58, 59, 60 (see FIG. 2 for locations). Each lift pad assembly is essentially identical and only the pads designated 57 and 58 are shown in detail in the drawings. Each lift pad assembly essentially comprises a gear box 64 securely mounted on the carriage 18, and a lift tube 65 movable up and down relative to the gear box.

Referring particularly to lift pad assembly 57 (FIG. 3) there are numerous well-known and commercially available mechanisms for converting rotary motion into linear motion; therefore, the mechanism need not be described in great detail. Suffice it to say that some form of jackscrew, driven by a worm or bevel gear, can be employed to move the lift tube 65 upward from the position shown in FIG. 3 to the position shown in FIG. 4. As illustrated in FIGS. 3 and 5, lift pad assemblies 57 and 58 are driven directly by a motor and reduction gear assembly 67 by means of a sprocket and chain arrangement designated generally by the numeral 71. Lift pad assemblies 58 and 59 are driven by cross shafts 68 (one shown) coupled to the drive shafts 70 of pad assemblies 57 and 60.

Referring again to FIG. 3, a steady bearing 74 may be provided to give added support to the lift pad assembly under load. As shown, the steady bearing simply comprises a welded bracket assembly 75 attached to the carriage 18 and including a tube member 76 surround-

ing the tube 65 of the lift pad and in free sliding engagement therewith.

OPERATION

When a load is to be transferred from a bin to an exit conveyor, or the like, the stacker/retriever vehicle is directed to the correct vertical row of bins and the load carriage 18 is lifted to the exact bin location. This is accomplished either automatically according to a preselected program, or manually by an operator carried in platform 22 which moves with the load carriage. The shuttle assembly 21 is then activated to extend the shuttle table 26 into the bin to pick up the load in a conventional manner. When the shuttle is retracted the load carriage 18 can be returned to its lowermost position as shown in full line in FIG. 1 and vehicle 11 moved down to the end of the aisle to an exit conveyor (not shown) running perpendicular to the aisles or to some other form of discharge means located adjacent the end of an aisle.

To discharge the load from the end of the load carriage 18, it can be appreciated that the shuttle table or forks 26 must be rotated 90° as illustrated in FIG. 2. To accomplish this the lift pad assemblies 57, 58, 59 and 60 are raised simultaneously by means of the sprocket and chain drive shown in FIGS. 3 and 5 to lift the load L from the shuttle table. It can be appreciated that a typical load would be supported on a standardized pallet represented by the outline 78 in FIG. 2. When the load is free of the shuttle table the shuttle assembly is rotated 90° by rotating the table 44 as described above.

Since the load itself does not rotate the aisle 25 need be only as wide as necessary to accommodate the stacker and standard pallets with no space wasted to allow rotation of the pallets. By providing means for supporting the load while the shuttle is rotated the design of the rotating mechanism is simplified.

Referring to FIG. 6, there is illustrated an alternative embodiment of the invention which incorporates fixed lift pads and means to lower the entire shuttle assembly to deposit the load on the lift pads.

Specifically, the shuttle assembly 21 is identical to that shown in FIG. 3, including the shuttle table or forks 26, and the rotating table assembly 44. However, the table assembly 44 is supported on four lift pads 101, 102, 103 and 104 (two of which are shown), which are shown in their raised position in FIG. 6. The lift pads 101-104 can be similar in construction and operation to the lift pads 57-60; however, it can be appreciated that they will be operated in a reverse manner, that is, they will be lowered from their illustrated position to free the shuttle table of the load.

To support the load when the lift pads 101-104 are lowered, four stationary support pedestals 105, 106, 107, 108 (two of which are shown) are provided, and are mounted on the load elevating carriage 18 in substantially the same relative positions as the lift pads 57-60, as illustrated in FIG. 2.

Thus, when it is necessary to rotate the shuttle assembly for purposes of endloading, the entire shuttle assembly 21 is lowered by means of the lift pads 101-104, until the load is supported on the pedestals 105-108 and the shuttle assembly drops free of the load. After rotating 90°, the shuttle assembly is raised to again support the load so that the load can be deposited on an exit conveyor, or the like, by means of the extendible table or forks 26.

I now claim:

1. A material handling vehicle comprising a main frame assembly including a vertical mast, an elevating load carriage mounted for vertical movement along said mast, a shuttle assembly rotatably mounted on said carriage and adapted to support a load, means for extending a portion of said shuttle assembly transversely to said frame assembly, means for rotating said shuttle assembly in a horizontal plane, auxiliary load supporting means mounted on said carriage, and means for moving said shuttle assembly and said auxiliary load supporting means relative to one another to transfer a load from said shuttle assembly to said auxiliary load supporting means while said shuttle assembly is rotated free of said load.

2. A material handling vehicle as claimed in claim 1, in which said auxiliary load supporting means includes load engaging means and means for extending said load engaging means to lift a load from said shuttle assembly.

3. A material handling vehicle as claimed in claim 1, in which said auxiliary load supporting means comprises a plurality of auxiliary load support members surrounding said shuttle assembly.

4. A material handling vehicle as claimed in claim 3, in which each of said auxiliary load support members comprises a housing, a load engaging pad mounted for vertical movement relative to said housing, an input shaft extending from said housing, means for rotating said shaft, and means within said housing for converting rotary motion of said input shaft into vertical movement of said load engaging pad.

5. A material handling vehicle as claimed in claim 4, including four of said auxiliary load support members arranged in a generally rectangular pattern about said shuttle assembly, said four auxiliary load support members being driven by a common power source.

6. A material handling vehicle as claimed in claim 5, in which said common power source includes a chain and sprocket drive system driving interconnected pairs of said load support members.

7. A material handling vehicle as claimed in claim 1, in which said shuttle assembly comprises a shuttle table extendible transversely to said frame assembly.

8. A material handling vehicle as claimed in claim 1, in which said shuttle assembly comprises a first bearing

plate rigidly mounted on said carriage, a second bearing plate overlying said first bearing plate, said first bearing plate including an upwardly extending annular portion, and said second bearing plate including a downwardly extending annular portion disposed in overlapping relation to said upwardly extending annular portion; and anti-friction bearing means disposed between adjacent surfaces of said overlapping annular portions.

9. A material handling vehicle as claimed in claim 8, in which said bearing means comprises a plurality of ball bearings distributed about complementary grooves formed in said adjacent surfaces.

10. A material handling vehicle as claimed in claim 8, including drive means for rotating said second bearing plate relative to the first, said drive means comprising a motor mounted on said carriage, a sprocket wheel on the output shaft of said motor, sprocket means formed on said second bearing plate in vertical alignment with said sprocket wheel, and chain means interconnecting said sprocket wheel and sprocket means.

11. A material handling vehicle as claimed in claim 1, including means mounting said shuttle assembly for vertical movement relative to said carriage, said mounting means comprising load engaging means, and means for retracting said load engaging means to transfer a load from said shuttle assembly to said auxiliary load supporting means.

12. A material handling vehicle as claimed in claim 11, in which said auxiliary load supporting means comprises a plurality of load support members surrounding said shuttle assembly.

13. A material handling vehicle as claimed in claim 11, in which said means for mounting said shuttle assembly for vertical movement comprises a housing, a load engaging pad mounted for vertical movement relative to said housing, an input shaft extending from said housing, means for rotating said shaft, and means within said housing for converting rotary motion of said input shaft into vertical movement of said load engaging pad.

14. A material handling vehicle as claimed in claim 11, including four of said auxiliary load support members arranged in a generally rectangular pattern around said shuttle assembly.

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