

[54] **MATERIALS HANDLING TRUCK**
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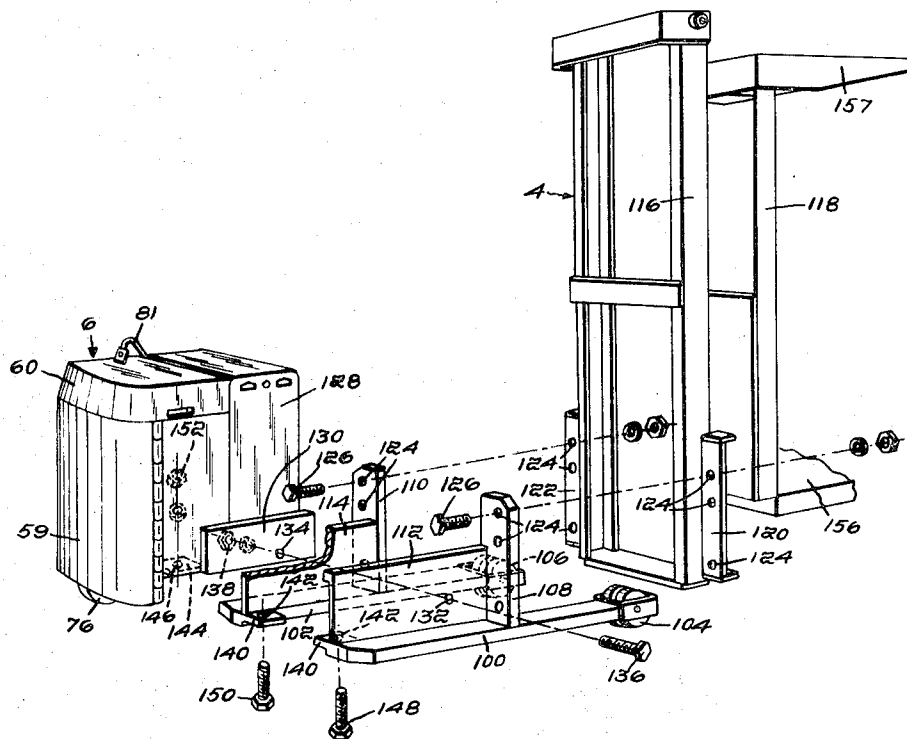
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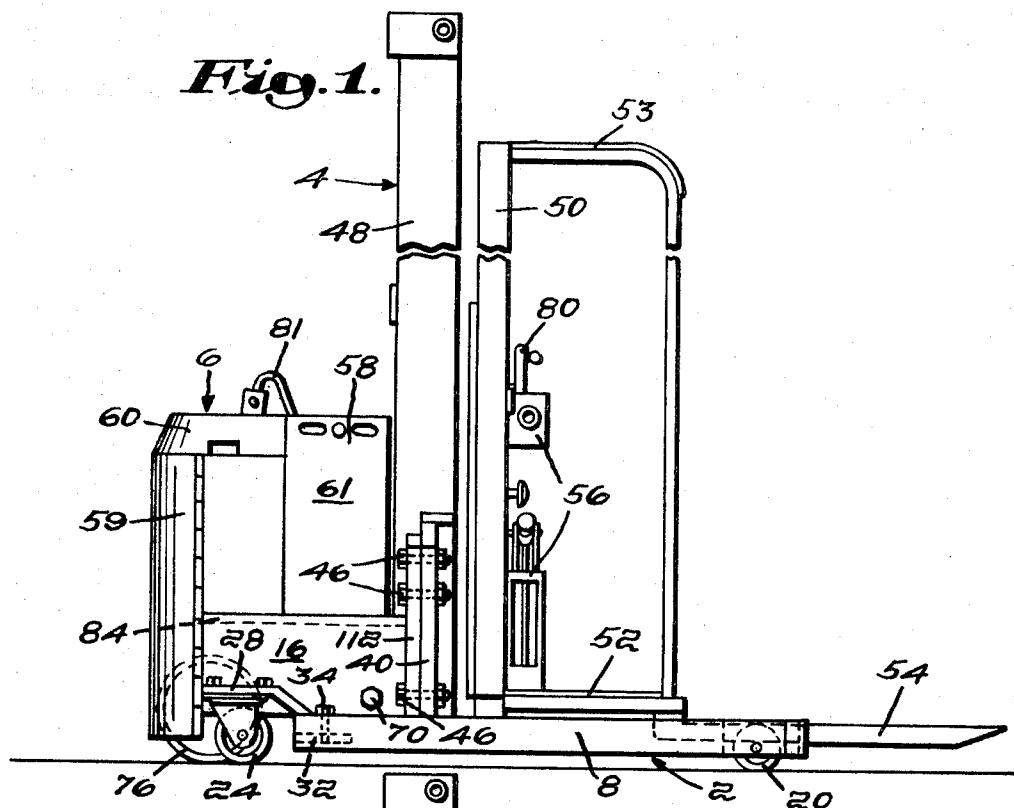
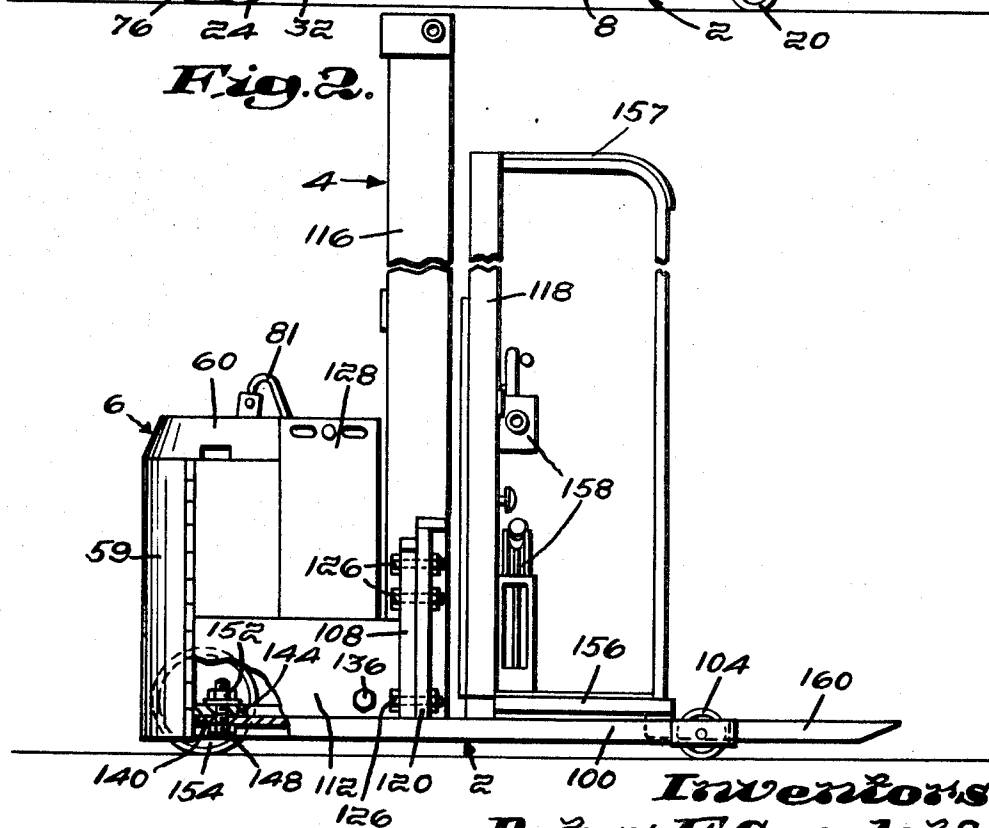
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[57] **ABSTRACT**

A materials handling truck consisting of base, mast and power modules. The three modules, all of which have common dimensions at the points of connection, are detachably bolted together. Selected modules can be combined to produce a variety of truck models of various sizes and capacities.

5 Claims, 5 Drawing Figures





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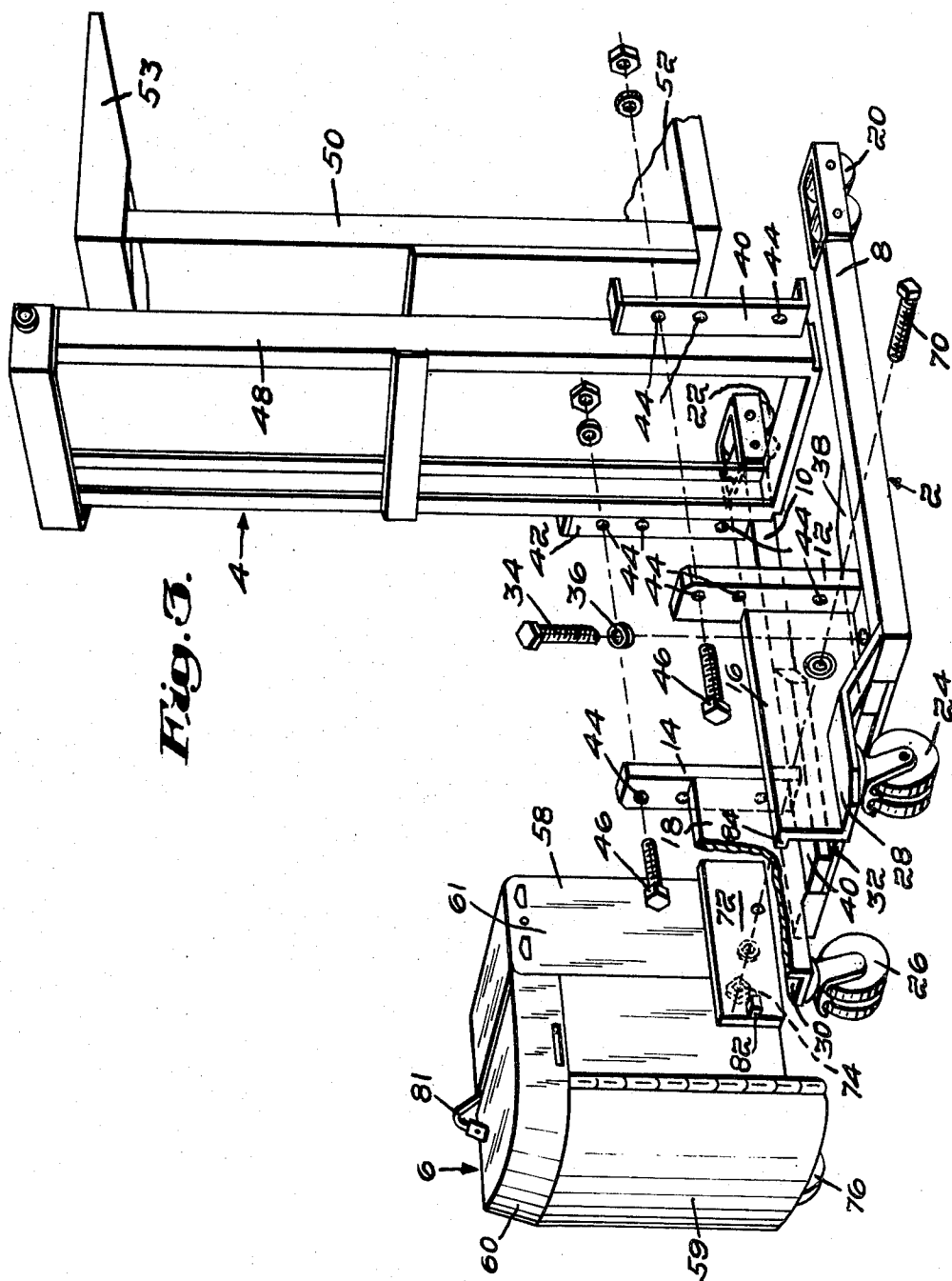
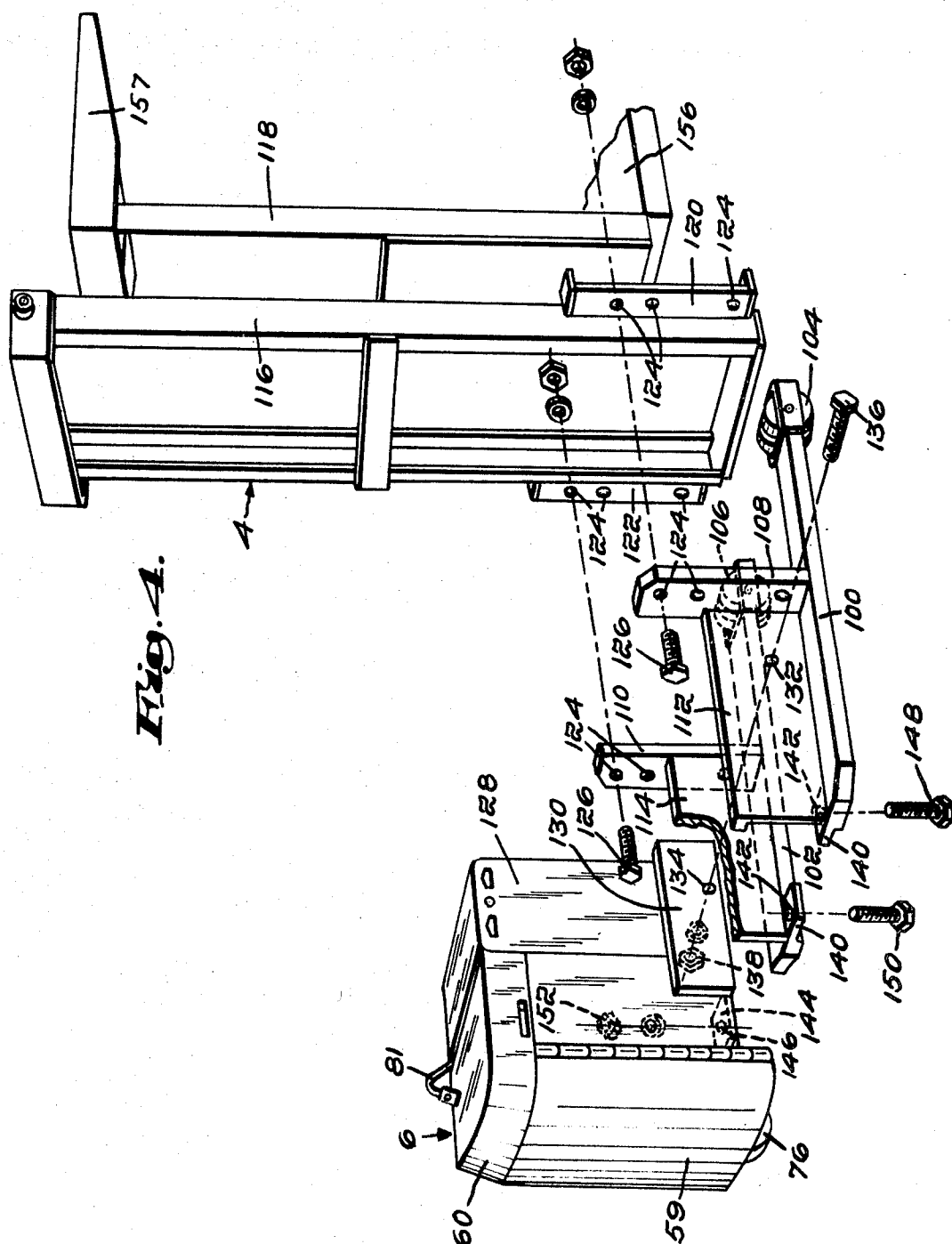


Fig. 3.

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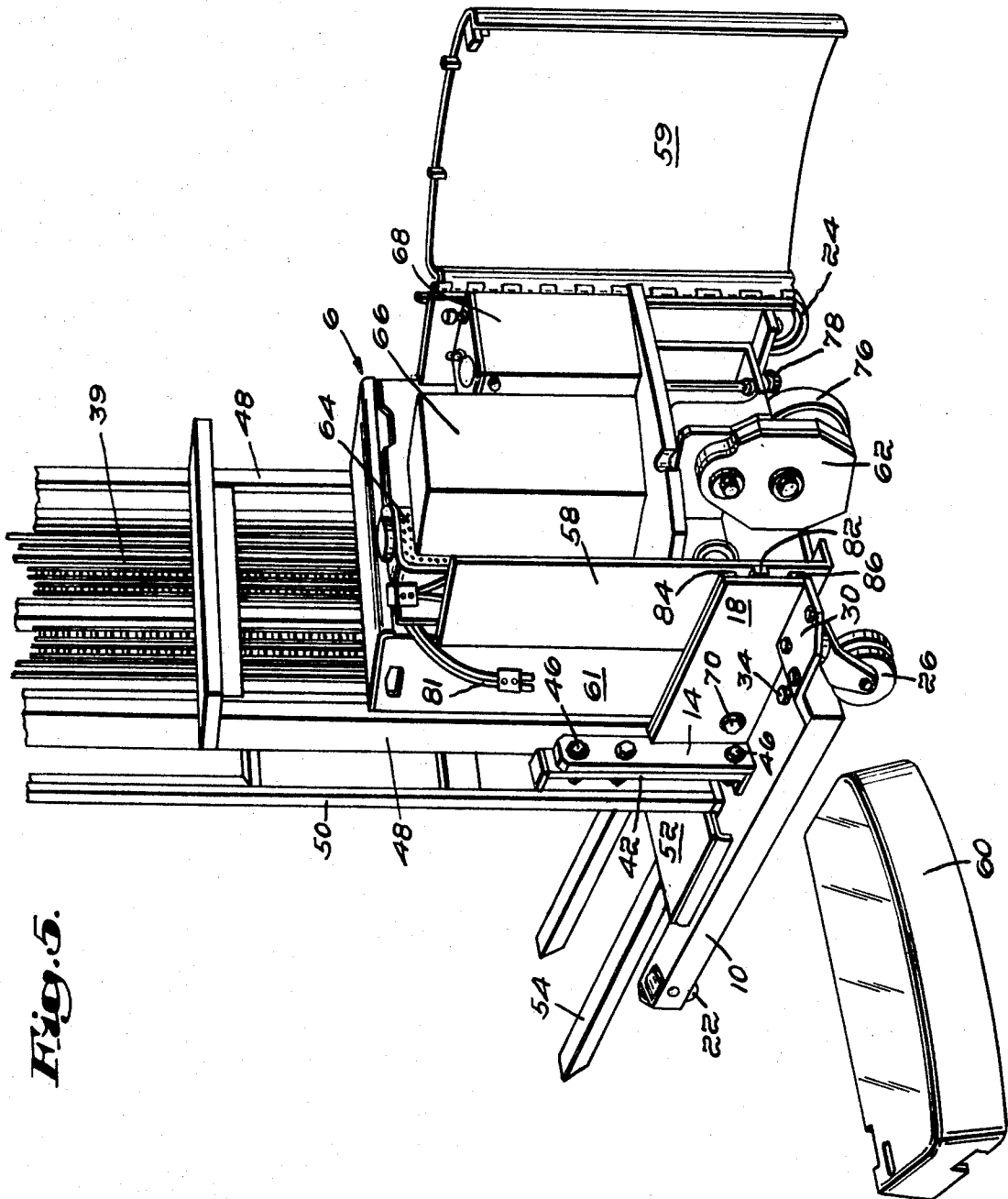


Fig. 5.

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MATERIALS HANDLING TRUCK

BACKGROUND OF THE INVENTION

Heretofore in the manufacture of materials handling trucks, it has been customary to build as individual units, a line of trucks to assorted specifications to meet the requirements of the purchaser. The trucks are designed to carry particular types of loads, to raise known loads to different heights, to have different power capacities according to the loads to be moved, and to have differing wheel bases and widths to meet the space requirements where the loads are to be manipulated.

According to the present practices, a conventional materials handling truck includes a base structure which provides the basic supporting frame, a mast, and the power driving unit. These elements individually and collectively are designed to meet the customer's requirements and are assembled and welded into one unitary structure. In many cases the differences between trucks may be slight. For example, the difference between trucks might reside solely in the mast structure. In one case, the truck might have a two-part mast, and in another case a three-part mast. In another instance, the difference might reside solely in the length of the forks, or in the length of the base arms. Thus, to carry in stock a full line of trucks of varying characteristics for quick delivery to customers, requires a very large inventory.

SUMMARY OF THE INVENTION

The principal object of the present invention is to minimize inventory requirements by constructing all trucks in a simplified manner in which each truck will consist of a base module including two base arms, a mast module, and a power module. These three modules are so designed that, while the modules themselves may vary in dimension and capacity, any three modules (base, mast and power) can be bolted together in a very short time to form a complete finished truck meeting the customer's requirements and industry standards. Through the use of this concept, the inventory of parts and finished trucks may be greatly reduced without affecting the manufacturer's capability of supplying the trade with any truck of particular characteristics. For example, if the customer wished a straddle type truck having a three-part mast with a long fork, the manufacturer would merely select from his module supply a straddle type base arm module, a three-part mast with a long fork and a power module of proper capacity and bolt the units together. The electrical and hydraulic connections from the power module are of uniform construction capable of being plugged into any control panel mounted on the mast module. The truck is then ready for operation. On the other hand, if the purchaser wished a truck of the same fork and power characteristics but with a two-part mast, then to produce such a truck would require only the substitution of a two-part for the three-part mast module.

From the foregoing, it will be understood that according to previous practices a supply of two base arm structures, two masts and two power units would produce an inventory of two trucks, whereas according to the present invention the same inventory in the form of two base arm modules, two mast modules and two power modules would permit the assembling of any two of eight different models thus enlarging the manufacturer's ability to meet various orders. The bolting to-

gether of the modules instead of utilizing the conventional welding processes greatly speeds up the final assembly of the required truck.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of a so-called straddle type truck having four wheels on the base arms module, a mast module and a power module pivoted to the base arm module.

FIG. 2 is a side elevation of a so-called counter-balanced type of truck in which the base arms module have wheels at their rear ends only, a mast module bolted to the base arms module and a power module rigidly affixed to the base arm module.

FIG. 3 is an exploded view of FIG. 1 showing the three separate modules which are adapted to be bolted together.

FIG. 4 is an exploded view of FIG. 2 showing the three separate modules which are adapted to be bolted together.

FIG. 5 is a perspective view of FIG. 1 looking from the front and broken away in part with the covers of the power module removed to show the general organization of the elements therein.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIGS. 1, 3 and 5, there is disclosed a so-called straddle type truck. The truck is comprised of three modules, the base module 2, the mast module 4, and the power module 6. These modules are bolted rather than welded together.

The base module 2 comprises a pair of spaced base arms 8 and 10. These arms include vertical supports 12 and 14 and vertical webs 16 and 18. At the rear end of the arms are wheels 20 and 22 which may be either single wheels, as shown in FIGS. 1 and 5, or a double set of wheels, as shown in FIG. 3. At the front ends of the base arms are casters 24 and 26 mounted under the raised shoulders 28 and 30. The front ends of the base arms 8 and 10 are connected by a tie plate 32 which assists in maintaining the base arms in parallelism. Tie plate 32 is preferably bolted to the base arms, one bolt and nut being shown at 34 and 36 in FIG. 3. The length of the base arms 8 and 10 and their lateral spacing may vary according to the design requirements.

In the construction shown in FIGS. 1, 3 and 5, the base arms 8 and 10 have inward extensions 38 and 40 which serve as foundations for the vertical supports 12 and 14 and the vertical webs 16 and 18. The base arms, vertical supports and vertical webs are all welded together to form strong individual units fully capable of supporting the mast module 4 and power module 6 which will subsequently be attached.

The mast module 4 is of conventional construction. It may be a two or three section mast according to customer requirements. It will include all of the conventional mechanisms and controls for causing upward movement of the mast section which includes the operator's platform and the fork. These mechanisms may ordinarily comprise hydraulic cylinders (not shown) and lifting chains which are suggested in FIG. 5 at 39. These conventional operating elements although part of the truck are not part of the present invention.

The mast module 4, as best shown in FIG. 3, has welded thereto at the lower part of the fixed mast side-plates 40 and 42. The lateral spacing of these plates is

the same as the lateral spacing of the vertical supports 12 and 14. The side-plates and supports are drilled to provide a plurality of aligned holes 44 whereby the supports and plates may be bolted together by a plurality of bolts 46 as shown in FIG. 1. Obviously the time required to bolt the mast module to the base module is a matter of minutes. The bolted structure is fully as strong and secure as if the mast had been welded to the base.

The mast shown in FIGS. 1, 3 and 5 is a two-part mast in which the fixed part is indicated at 48 and the upwardly movable part at 50. The movable part 50 includes an operator's platform 52 and overhead guard 53 and integral forwardly extending forks 54. Controls whereby the operator can drive the truck and raise and lower the platform 52 and fork 54 are suggested at 56. These controls are conventional with the power being supplied by the power module 6 in a manner shortly to be explained.

The power module 6 consists of an outer housing 58 within which the various power elements are contained. The housing included a door 59 and a removable cover 60 (see FIG. 5). The power elements which are conventional consist of batteries (not shown) located in the back part of the housing as at 61, a motor and drive unit shown in FIG. 5 at 62, a second motor 64 for driving a hydraulic pump that serves to raise and lower the movable mast section and actuate other conventional devices. The electrical traction controls are located within housing 66 and the hydraulic supply tank is at 68. All of these mechanisms are conventional and comprise no part of the invention except insofar as they collectively comprise the power module 6.

The power module 6 is of appropriate width so that it may be placed without undue clearance between the two vertical webs 16 and 18 of the base module 2. When so positioned, the power module is held in pivoted relationship by means comprised of a pair of bolts shown at 70 in FIGS. in 3 and 5. The bolts extend through the webs and into side supporting plates 72 which are affixed to the lower sides of the power module housing 58. With the bolts 70 in place, the nuts 74 are applied on the inner sides of plate 72 to hold the power module 6 securely in pivoted relation with the front part of the base module.

The pivot bolts 70 are located close to the rear end of power module 6. Since the center of gravity of the power module is a considerable distance to the front of the pivots, it follows because of the weight of the batteries, motors, fluid tank etc. that the drive wheel 76 (see FIG. 5) is pressed against the floor or road surface with sufficient force to provide adequate traction. The pivoted arrangement is necessary in the straddle type truck because if the power module were rigidly secured to the four wheeled base module 2, there would be occasions when the drive wheel 76 would cease to be in contact with the floor due to irregularities in the floor surface.

With the mast module 4 and the power module 6 affixed to the base module in the manner explained, power connections are then made between the power unit and the controls 56 on the mast. These consist of conventional electric and hydraulic connections, as well as a conventional connection to the steering sprocket 78 which by a chain connection to the motor and drive unit 62 permits the operator through rotation of the steering wheel 80 to direct the movement of the

truck as required. The disconnected electrical cable is shown at 81.

In order to prevent the housing 58 from hitting the forward side of mast 48 should the drive wheel 76 be raised excessively by floor irregularities, a stop mechanism is provided in the form of a member 82 (see FIG. 5) affixed to the side of housing 58 and adapted to engage with flange 84 to limit upward movement of the power module 6 before it has touched mast 48. Downward pivoting movement of the power module 6 is limited by engagement with the tie plate 32.

From the foregoing description of the construction of FIGS. 1, 3 and 5, in which three modules (base, mast and power) are bolted together, it is apparent that by maintaining a stock of two base modules of differing lengths, two mast modules of differing vertical characteristics and two power modules of different power characteristics, it will be possible to provide any one of eight different combinations to meet customer's requirements. Stating it differently, a total of six modules equal in value to an inventory of two trucks enables the manufacturer to meet an order for any one of eight models, whereas under current manufacturing procedures, a total stock of eight complete trucks equivalent to the values of 24 modules would be required. Thus the provision of a construction plan whereby differing modules may be bolted together in differing combination to meet order requirements provides the manufacturer with great savings in inventory and effectively increase his stock for making deliveries of particular combinations.

A modification of the invention is shown in FIGS. 2 and 4. This truck construction is referred to as a counter-balanced type as distinguished from the straddle type shown in FIGS. 1, 3 and 5. In the straddle type, the power module not being rigidly bolted to the base module provides only limited weight at the front of the truck. Hence, it is necessary that the base arms extend a greater distance toward the front of the truck so that the required load can be carried without overturning. In the counterbalanced type (about to be described), the truck has only three wheels, the two rear wheels on the base arms and the driving wheel of the power unit. The casters at the front of the base arms shown in FIGS. 1, 3 and 5 are eliminated. In the counterbalanced type of truck, the power module 6 is bolted rigidly to the front of the base module 2 and thus all of the weight of the power module, which is considerable, is available to prevent rearward overturning of the truck by the load carried by fork 54. Because of this weight distribution, the rearward extensions of the base arms may be considerably shortened. Such shortening of the base arms increases the maneuverability of the truck within limited spaces.

Referring now to FIGS. 2 and 4, the relatively short base arms of the base module 2 are indicated at 100 and 102. These arms have wheels 104 and 106 at their front ends, but there are no wheels at the front ends. Intermediate the length of the base arms are vertical supports 108 and 110 similar to the supports at 12 and 14 shown in FIGS. 1, 3 and 5. Extending to the front from the supports are vertical webs 112 and 114. These three parts, base arm, vertical support and vertical web, are welded together to form a rigid base arm unit. The mast module 4 may be in any conventional form the same as the mast module referred to in FIGS. 1, 3 and 5. In the form shown in FIGS. 2 and 4, it comprises a

fixed mast 116 with an upwardly movable section 118, but it will be understood that any conventional or known type of mast may be used according to customer requirements. The lower parts of the mast have affixed thereto sideplates 120 and 122 of dimensions to match the dimensions of the vertical supports 108 and 110. The sideplates and vertical supports are provided with matching holes 124 permitting the mast to be quickly and easily secured by bolts 126 into rigid permanent engagement with the base arms.

The power module 6 is designed so that the exterior casing 128 will fit snugly between the vertical webs 112 and 114. The casing 128 has fastened to its sides, strong support plates 130 which are properly spaced to engage the inner sides of the spaced vertical webs 112 and 114. Webs 112 and 114 and plates 130 are drilled at 132 and 134 to receive bolts 136 which may be secured in position by the related nuts 138.

The base arms 100 and 102 have small inward extensions 140 drilled at 142 which extensions support the front of power module 6. The power module includes oppositely spaced supporting plates 144 which are appropriately drilled at 146 to match holes 142 permitting the power module to be secured additionally to the base arms by the bolts 148 and 150 and related nuts 152.

Since the truck of FIGS. 2 and 4 is a three-wheeled vehicle, the substantial weight of the power module 6 holds the drive wheel 154 in firm engagement with the floor or road to enable the truck to be properly driven on the surfaces over which it normally travels.

The movable mast section 118 includes an operator's platform 156, overhead guard 157 and the usual group of controls 158. Suitable conventional electrical and hydraulic connections are made between the power module 6 and the mast module 4 whereby the operator is enabled to drive and steer the truck and to raise and lower the mast 118 and the related fork 160.

The advantages presented by the construction of FIGS. 2 and 4 are the same as those presented in FIGS. 1, 3 and 5, namely, that with a limited number of modules all of which are designed to be selectively bolted together, any one of a large number of different capacity trucks of differing wheel bases mast sizes and power units may be quickly assembled to meet customer's orders.

It will be further understood that the details of the power module 6 disclosed in FIG. 5 are also representative of the power module 6 shown in FIGS. 2 and 4. The major difference between FIGS. 1, 3 and 5 and FIGS. 2 and 4 is that the power module in the first form is in movable pivoted relation to the base arms, whereas in the latter form it is rigidly affixed to the base arms. However, the distinction between the straddle type construction of FIGS. 1, 3 and 5 and the counterbalanced type of FIGS. 2 and 4 does not vary the ease with which three selected modules may be assembled to produce the truck of the required specifications.

In the construction of FIGS. 2 and 4, there is no need to have an intermediate tie plate such as plate 32 shown in FIG. 3 between the front ends of base arms 100 and 102 because the power module 6 provides the interme-

mediate rigid connection which will hold the base arms 100 and 102 in parallelism. In FIGS. 1, 3 and 5, the parallelism of the arms 8 and 10 is maintained by the transverse members of the mast 4 and the tie plate 32 leaving the power module 6 free to pivot according to ground irregularities that may be encountered by the drive wheel 76.

Modifications and further applications of the invention will now be apparent to those skilled in the art without departing from the spirit and scope of the invention.

We claim.

1. A materials handling truck comprising:

an elongate base having a pair of spaced base arms extending parallel to the longitudinal axis of the base, the base arms having wheels at their rearward ends and vertical supports intermediate their lengths;

means defining a channel along the longitudinal axis of the base;

a mast having a fixed and movable section, the fixed section being detachably bolted to the vertical supports, and an operator's platform and fork mounted upon the movable section of the mast;

a power unit mounted partially within the channel and between the front ends of the base arms and secured thereto at a position to the front of the mast, the power unit being pivotably attached to the base arms and pivotable in a vertical plane; the power unit comprising a drive motor and a pivotable drive wheel which in part supports the power unit;

and controls on the movable section of the mast connected to the power unit and operable by an operator on the platform whereby the materials handling truck may be driven.

2. The construction as set forth in claim 1 the power unit comprising additionally a second motor and pump driven thereby and associated hydraulic means for raising and lowering the movable section and fork under the control of the operator.

3. The construction as set forth in claim 1 the base arms having other wheels at their front ends laterally spaced from the power unit, the power unit being pivotally related to the spaced base arms about a horizontal axis located between the drive wheel and the mast and rearward of the center of gravity of the power unit whereby the load of the power unit on the drive wheel will be adequate for driving the truck, and stop means for limiting the angular movement of the drive unit about the axis.

4. The construction as set forth in claim 1 the base arms in the rearward direction being substantially coextensive with the platform and the power unit being immovable with respect to the base arms.

5. The construction as set forth in claim 1 wherein the means defining a channel includes vertical webs located to the front of the vertical supports and between which the power unit is positioned and to which the power unit is detachably affixed.

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