Dec. 1, 1953 H. J. FRAMHEIN 2,661,183

CLOSE COUPLED TRUCK

Filed April 7, 1951 3 Sheets-Sheet 1

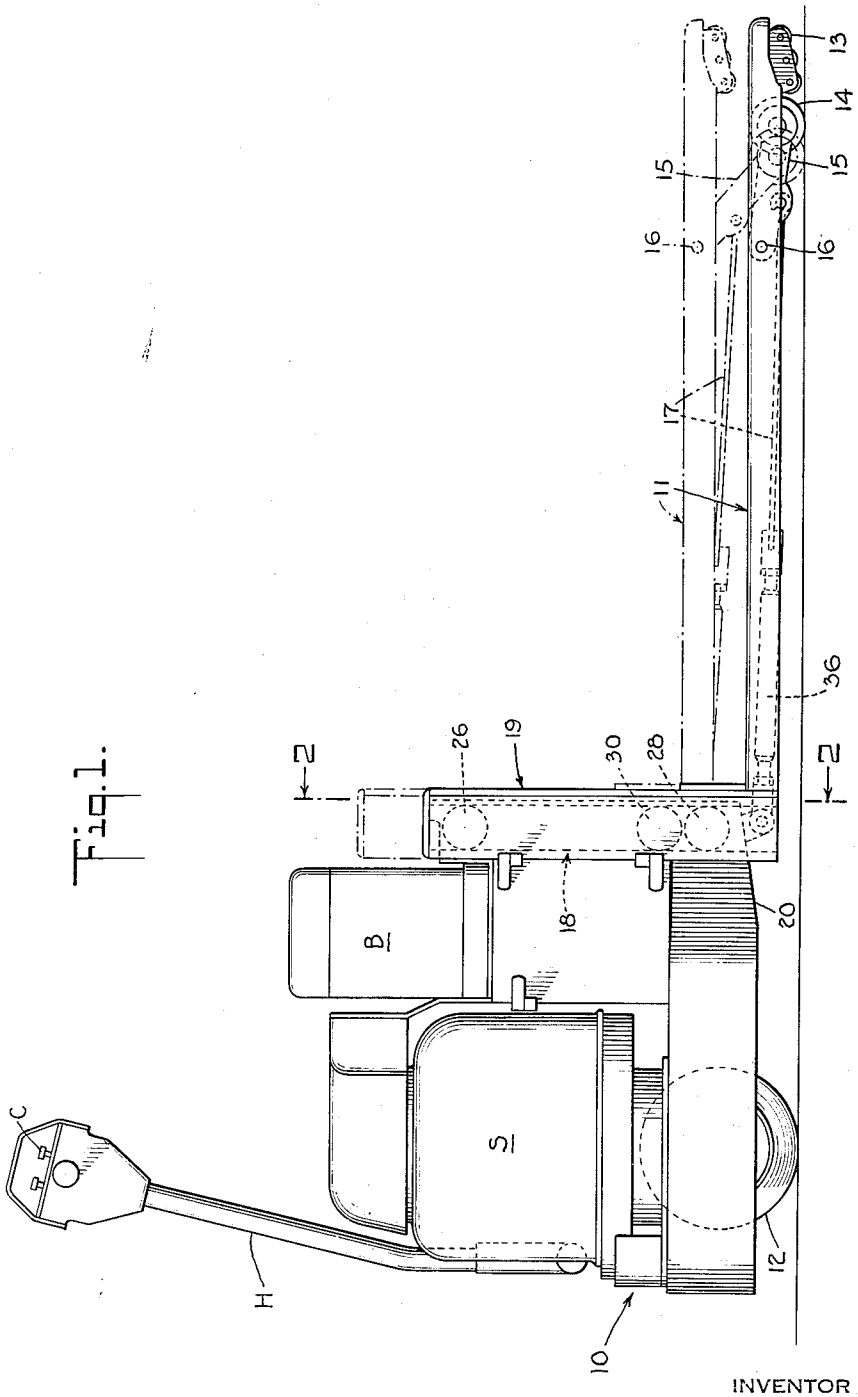


Fig. 1.

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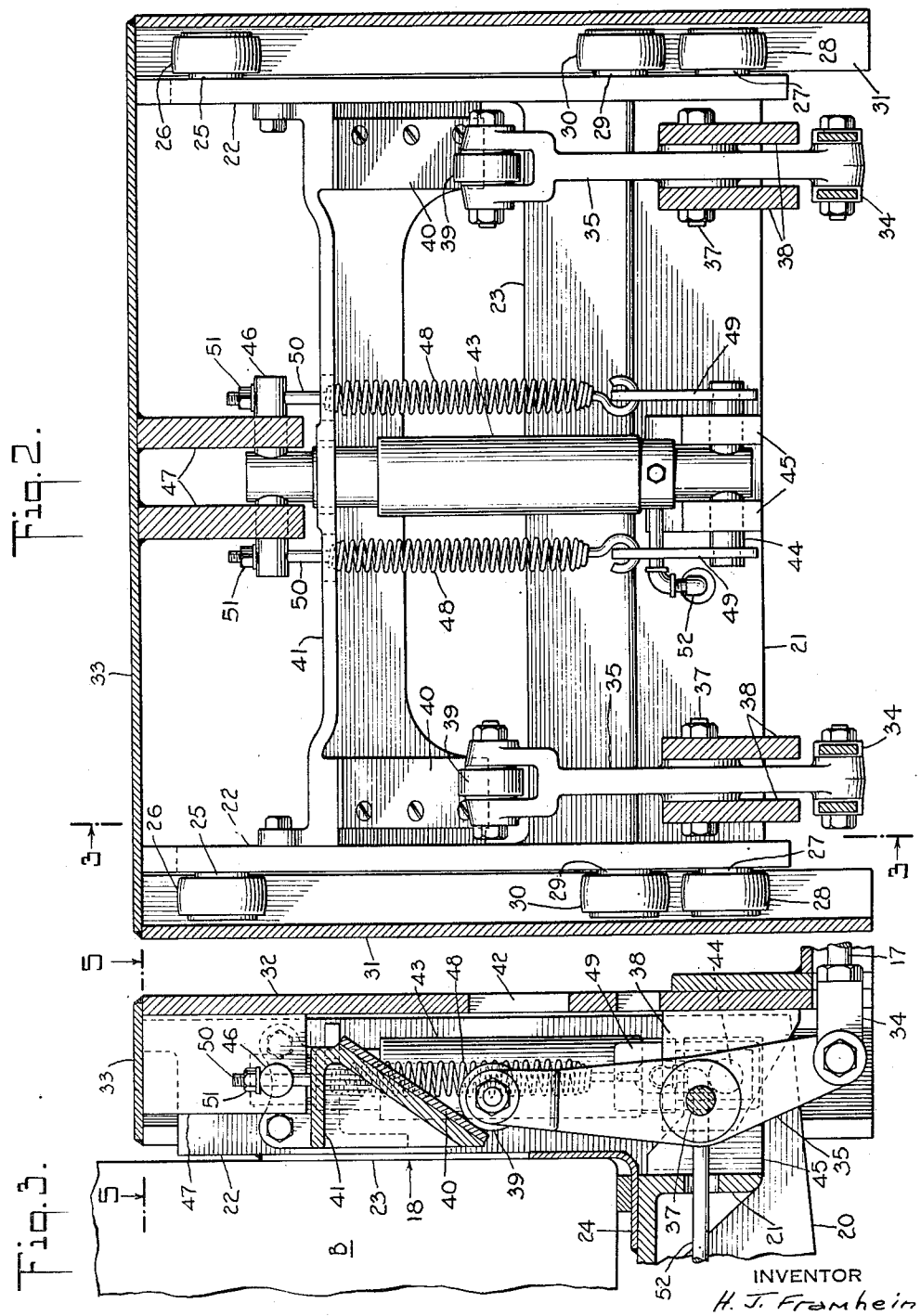


Fig. 2.

Fig. 3.

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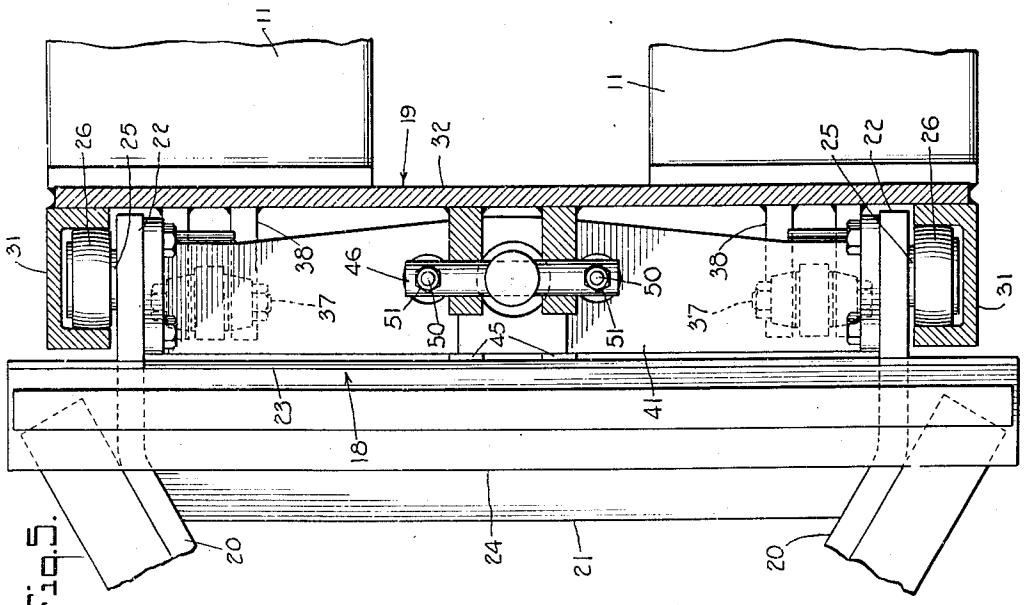


Fig. 5.

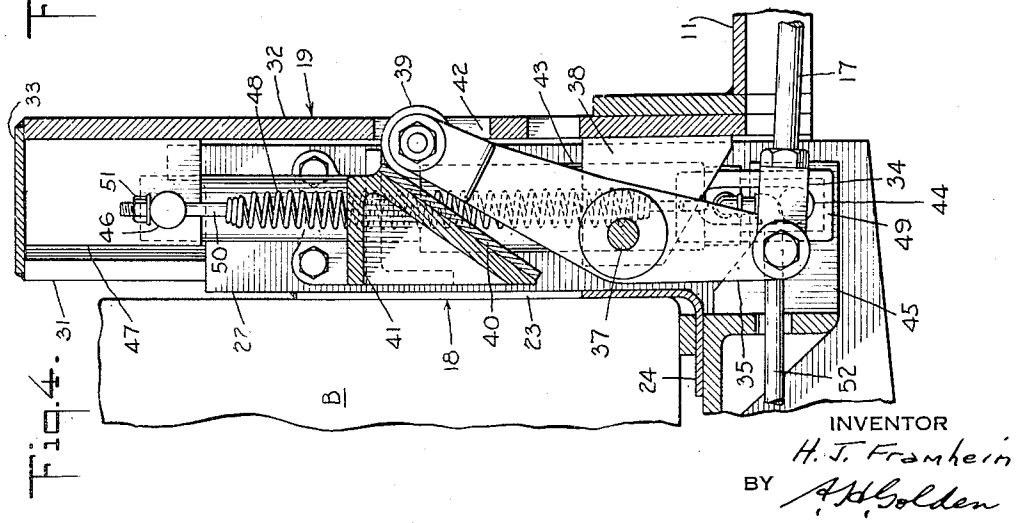


Fig. 4.

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UNITED STATES PATENT OFFICE

2,661,183

CLOSE COUPLED TRUCK

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Application April 7, 1951, Serial No. 219,784

6 Claims. (Cl. 254—2)

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This invention relates to industrial trucks of the class having an elevating platform upon which the load is carried, and in which the platform is supported for lifting movement at its front end on a lifting head and at its rear end upon suitable wheeled lifting means that serve as the rear wheels of the truck. More particularly, my invention relates to improvements in the mechanism whereby the elevating platform in such trucks is connected with and moved relatively to the lifting head.

It has been customary to provide the elevating platform and the lifting head in trucks of this general class with standards to accommodate the connecting mechanism, one example of such a construction being disclosed in my prior patent, No. 2,519,128 dated August 15, 1950, and entitled "Lift Truck." The standards there provided have contributed materially to the length of the truck, and this is particularly true because the connecting mechanism involved swinging links. The utilization of a vertical rectilinear mounting in my prior patent is not possible except through a wide spacing between the vertical standards of the truck.

I have now provided a novel truck of the class described in which the standards and the lifting and connecting mechanisms occupy less space longitudinally of the truck than has been possible previously, thereby permitting the truck to be made shorter and more maneuverable without any sacrifice in its load handling capacity.

As one feature of the invention, I construct the connecting mechanism in such a way that the lifting and lowering movements of the elevating platform will occur in a straight line relatively to the lifting head. This straight line movement of the platform permits one of the standards to be arranged compactly within the other, since the only relative movement between the standards is longitudinally thereof. The connection between the standards preferably is effected by a track and follower means which may take the form of channel members in one standard engaged by rollers on the other standard. The movement of the elevating platform relatively to the lifting head operates the lifting means for the rear end of the platform through a cam on the lifting head, and because the movement of the platform is rectilinear, the effect of the cam will be proportional to the movement of the elevating platform.

As a further part of this feature of the invention, any necessity for a cross-connection to assure equal movements of opposite sides of the elevating platform is avoided since such control

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is inherent in the track and follower means that forms a part of my invention.

As another feature of my construction, the assembly of the truck is facilitated through the particular arrangement whereby the elevating platform moves relatively to the lifting head. Thus, these parts may be assembled by sliding one of the standards into the other in such a way that the rollers on one standard enter the channels in the other standard, and this operation may be accomplished without the necessity for carefully aligning and positioning the parts as is the case when swinging links connect the lifting head to the platfrom.

Another feature of the invention resides in the construction whereby the front end of the elevating platform is lifted by a force that is applied always in a direction aligned with the movement of the platform. This is accomplished in the preferred form of the invention by mounting the lifting ram within the standards in a position parallel to the track and follower means, and not only results in a very compact arrangement, but also minimizes stresses and wear on the parts.

I have thus outlined rather broadly certain features of my invention in order that the detailed description thereof that follows may be better understood, and in order that my contribution to the art may be better appreciated. There are, of course, additional features of my invention that will be described hereinafter, and which will form the subject of the claims appended hereto. Those skilled in the art will appreciate that the conception on which my disclosure is based may readily be utilized as a basis for the designing of other structures for carrying out the several purposes of my invention. It is important, therefore, that the claims to be granted me shall be of sufficient breadth to prevent the appropriation of my invention by those skilled in the art.

Referring now to the drawings:

Fig. 1 is a side elevation showing the preferred form of my novel lift truck as it would appear when the elevating platform is in lowered position, and also showing a raised position of the platform in broken lines.

Fig. 2 is a cross-sectional view taken on the line 2—2 of Fig. 1, showing the standards and the connecting and lifting mechanisms therein, as they would appear when the elevating platform is in lowered position.

Fig. 3 is a longitudinal sectional view taken on the line 3—3 of Fig. 2.

Fig. 4 is a view similar to Fig. 3, but showing

the parts as they would appear when the elevating platform is in raised position.

Fig. 5 is a sectional plan view of the same, taken on the line 5—5 of Fig. 3.

In the drawing, my invention is shown as embodied in a lift truck having a lifting head 10, and a rearwardly disposed elevating platform 11 connected for lifting and lowering movement relatively to the lifting head. As is customary in trucks of this general class, the lifting head 10 is carried upon a wheel 12 that is mounted in a steering unit S pivoted in the lifting head, thereby permitting the operator to steer the truck through a handle H on the steering unit. The wheel 12 serves as the front wheel of the truck, and preferably is driven by a suitable drive means in the unit S. A battery B that is mounted on the lifting head 10 rearwardly of the unit S serves as a source of power, and suitable control means C is located upon the handle H in a position convenient to the operator.

The elevating platform 11 may take any form suitable for receiving the skids or pallets with which it is to be used, and preferably is bifurcated to provide forks adapted to enter opposite sides of pallets having a central partition. The platform 11 is sufficiently thin to permit it to enter between the floors of a double faced pallet when the platform is lowered to a position closely adjacent the ground, and preferably is tapered at its rear end and provided with an inclined series of rollers 13 which will facilitate entry of the platform into the pallet.

The rear wheels of the truck are provided by one or more wheels 14 mouned below the rear portion of the platform 11. The rear wheels 14 are adapted to support the rear end of the platform 11 through their mountings which are in the form of swingable links 15 pivoted within the platform by transverse pins 16. The rear wheels 14 and the links 15 are so constructed that they may be withdrawn almost completely within the platform 11, thus supporting the platform in a very low position and offering no obstruction to their entry into a pallet, while also permitting the links 15 to be projected as shown in Fig. 1 to lift and support the rear end of the platform and a pallet thereon. This lifting action of the links 15 is produced through forwardly extending tension rods 17 connected to the links and operated by means to be described hereinafter.

As in existing trucks of this class, the elevating platform 11 is guided and restrained to occupy parallel positions as it is moved to different levels relatively to the lifting head 10, and connecting mechanism for this purpose is accommodated in standards at the rear end of the lifting head and at the front end of the elevating platform, respectively. In my improved lift truck, however, I construct the standards and their related mechanisms in a particular manner whereby the truck has novel features that were not heretofore possessed by trucks of the class described.

Thus, I provide the lifting head 10 with a vertical standard, indicated generally as 18, that is located within a complementary vertical standard, indicated generally as 19, on the front end of the elevating platform 11. The lifting head frame upon which the standard 18 is formed comprises a pair of rearwardly extending side frame members 20 at the underside of the lifting head 10, these side frame members being joined by a transverse angle member 21 beneath the battery B. The side frame members 20 are

extended rearwardly and then vertically upward to provide parallel vertical plates 22 that form the opposite sides of the standard 18. The side plates 22 are laterally braced by a U-shaped vertical plate 23 that is welded to the front edges of the side plates 22 just rearwardly of the battery B, and that has a horizontal bottom flange 24 welded to the upper surface of the transverse angle member 21. The vertical side plates 22 serve as roller brackets and are provided adjacent their upper ends with a pair of outwardly extending stub shafts 25 carrying rollers 26, and adjacent their lower ends with a pair of outwardly extending stub shafts 27 carrying rollers 28. Provision is also made of outwardly extending stub shafts 29 carrying intermediate rollers 30 closely adjacent the lower rollers 28 for a purpose that will appear.

All of the rollers 26, 28 and 30 serve as followers in a track means that preferably takes the form of a pair of inwardly facing vertical channel members 31 that constitute the opposite sides of the complementary standard 19 on the elevating platform 11. The channel members 31 are attached to and laterally braced by a transverse vertical plate 32 that is integrally attached to the front end of the elevating platform 11, and are further braced at their upper ends by a horizontal top plate 33. It will therefore be observed that the elevating platform 11 will be restrained to parallel positions at all stages of its movement with respect to the lifting head 10. It will also be observed that the lifting and lowering movements of the elevating platform will have no horizontal component, and the lifting head standard 18 will remain compactly arranged within the standard 19 at all times. Further, eccentric warping stresses such as might result from unbalanced loading of the platform 11, or from other causes, will be taken by engagement of the vertical channel members 31 with the vertical side plates 22, or with the ends of the stub shafts, thereby eliminating any necessity for links or other cross connections to maintain the platform 11 in proper alignment with the lifting head 10.

In order that the rear end of the elevating platform 11 shall undergo lifting and lowering movement upon the rear wheels 14 simultaneously with lifting and lowering movement of the front end of the platform, the front ends of the tension rods 17 are provided with clevises 34 that are pivotally connected to the lower ends of a pair of levers 35 located within the standards 18, 19 just inwardly of the vertical side plates 22. The tension rods 17 may, if desired, have turnbuckles 36 interposed therein (Fig. 1) in order to facilitate adjustment of the rear wheel links 15. Each of the levers 35 is mounted at an intermediate point thereof upon a pivot pin 37 supported by brackets 38 that are attached to the front end of the platform 11 through the transverse plate 32. The upper ends of the levers 35 are provided with cam followers in the form of rollers 39 engaged with inclined cams 40, that are fixed relatively to the lifting head 10. The cams 40 preferably are mounted upon a transverse member 41 that is attached at its ends to the inner surfaces of the vertical side plates 22, thus forming a part of the lifting head standard 18 and further increasing the rigidity of said standard. It will therefore be noted that this arrangement eliminates any necessity for taking horizontal components of movement of the pivot shafts 37 into account, since the pivot shafts move only in a vertical direction relatively to the cams 40.

In order to take full advantage of the compactness that is permitted by the rectilinear movement of the standards relatively to each other, the transverse plate 32 of the standard 19 is formed with apertures 42 that allow the upper ends of the levers 35 and the rollers 39 their full range of movement, while permitting the transverse plate to be located farther forwardly than would otherwise be possible.

As a means for lifting the elevating platform 11, a hydraulic ram 43 is centrally located in a vertical position within the standards 18, 19. The lower end of the ram 43 is mounted upon the lifting head 10 by a cross-pin 44 received in apertured brackets 45 attached to the transverse frame member 21, and the upper end of the ram is attached to the standard 19 on the front end of the platform 11 by a cross-pin 46 held in apertured brackets 47 secured to an upper portion of the vertical plate 32. The ram 43 thereby exerts a direct lifting force that is at all times aligned with the direction of lifting movement of the platform, and the cross-pins 44, 46 undergo no pivotal movement other than may be required to accommodate minute irregularities in the relative movement of the standards 18 and 19.

At such times as there may be little or no load upon the elevating platform 11, it may be necessary that a downward force be exerted upon the platform in order to assure its downward movement when such movement is desired. For this purpose, I provide a pair of coil springs 48 that exert a certain downward force upon the standard 19 on the elevating platform at all times. As shown in Fig. 2, the lower ends of the springs 48 are provided with hooks anchored to opposite ends of the lower cross-pin 44 by apertured yokes 49. The upper ends of the springs 48 are attached to threaded rods 50 adjustably held in apertures in opposite ends of the upper cross-pin 46 by nuts 51. Thus, it will be seen that the force of the springs 48, as well as the force of the ram 43, is exerted in a direction that is aligned with movement of the elevating platform 11, and neither the springs nor the ram can produce any oblique force that would tend to bind movement of the parts, or to interfere in any way with the operation of the platform. Inasmuch as the cross-pin 46 is located above the transverse member 41, this member is, of course, apertured in order to permit free operation of the ram 43 and the springs 48. Further, because of the fact that the ram 43 is not required to undergo any substantial swinging movement, it may be supplied with fluid under pressure through a relatively rigid conduit 52, this conduit being connected to a suitable pressure source, as will be understood by those skilled in the art.

The operation of connecting the elevating platform to the lifting head in the process of assembly may be very readily accomplished by passing the elevating platform standard 19 vertically downward over the lifting head standard 18 so that the channel members 31 receive the rollers 26, 28 and 30. At this time the transverse member 41 will not have been assembled with the standard 18, and the levers 35 and their brackets 38 which are mounted in the standard 19 may therefore pass freely downward within the standard 18. Otherwise, however, the assembly of the parts may be substantially complete, and it will only be necessary to install the transverse member 41 and to connect the ram 43 and the springs 48 properly in order to complete the truck.

It is believed that the operation and the advantages of my novel lift truck will be apparent from the foregoing description. It may be stated briefly, however, that the arrangement of the rollers 26, 28 and 30, within the channel members 31, provides a vertical rectilinear movement of the elevating platform 11, this movement having no horizontal or other waste components of movement. Thus, the standard 18 may be located entirely within the standard 19, so as to occupy a minimum of space longitudinally of the truck and permitting a truck of a given load capacity to be made shorter than was heretofore possible in trucks of this class. Further, the operating forces exerted upon the platform are in a vertical direction resulting in improved efficiency of force application. Movement of the elevating platform 11 relatively to the lifting head 10 is attended by corresponding movements of the rear end of the platform because of the action of the levers 35 that is transmitted to the rear wheel links 15. Here again, the cams 40 which operate the levers 35 move only in a rectilinear direction with respect to the pivots 37 of the levers.

The relatively large spacing of the rollers 26 vertically above the rollers 28 is a factor in maintaining the platform 11 rigidly in parallel positions as it is moved relatively to the lifting head 10. When the elevating platform 11 is in raised position, as indicated in dotted lines in Fig. 1, the lower rollers 28 will, however, be located closely adjacent the lower ends of the channel members 31, and the intermediate pair of rollers 30 will be of particular value at that time to insure that the standards 18 and 19 will be maintained securely assembled with each other.

I now claim:

In a truck of the class described, a lifting head, an elevating platform, a pair of vertical rectilinear channel members on the front end of said elevating platform, roller brackets on said lifting head extending between said channel members, rollers on said roller brackets engaged in said channel members whereby to guide and restrain the front end of said elevating platform for vertical rectilinear lifting and lowering movement of said elevating platform relatively to said lifting head, a cam fixed on said lifting head between said channel members, a lever mounted on and movable bodily with said elevating platform relatively to said lifting head, said lever being engaged with said cam between said channel members and swung thereby when said lever is moved bodily with said elevating platform relatively to said lifting head, means supporting said elevating platform rearwardly of said channel members for lifting and lowering movement, and means whereby said lever actuates said platform supporting means to lift and lower said elevating platform simultaneously with rectilinear movement of said platform relatively to said lifting head.

2. In a truck of the class described, a lifting head, an elevating platform, a pair of vertical rectilinear channel members on the front end of said elevating platform, a pair of vertical roller brackets on opposite sides of said lifting head between said pair of channel members, rollers on said roller brackets engaged in said channel members whereby to guide and restrain the front end of said elevating platform for vertical rectilinear lifting and lowering movement of said elevating platform relatively to said lifting head, said vertical channel members being open at their lower ends whereby to receive said rollers during

assembly of said elevating platform with said lifting head, a cam fixed to and between said brackets, a lever mounted on and movable bodily with said elevating platform relatively to said lifting head, said lever being engaged with said cam between said brackets and swung thereby when said lever is moved bodily with said elevating platform relatively to said lifting head, means supporting said elevating platform rearwardly of said pair of channel members for lifting and lowering movement, and means whereby said lever actuates said platform supporting means to lift and lower said elevating platform simultaneously with rectilinear movement of said elevating platform relatively to said lifting head.

3. In a truck of the class described, a lifting head, an elevating platform, a pair of vertical channel members on the front end of said elevating platform, a pair of vertical roller brackets on said lifting head between said channel members, rollers on said roller brackets engaged in said channel members whereby to guide and restrain the front end of said elevating platform for vertical lifting and lowering movement of said elevating platform relatively to said lifting head, a ram for lifting said elevating platform relatively to said lifting head, means mounting said ram in a vertical position between said roller brackets whereby the force exerted by said ram will at all times be aligned with the vertical movement of said elevating platform relatively to said lifting head, a transverse member fixed between said roller brackets, a cam fixed on said transverse member between said roller brackets, a lever mounted on and movable bodily with said elevating platform relatively to said lifting head, said lever being engaged with said cam between said roller brackets and swung thereby when said lever is moved bodily with said elevating platform relatively to said lifting head, means supporting said elevating platform rearwardly of said channel members for lifting and lowering movement, and means whereby said lever actuates said platform supporting means to lift and lower said elevating platform simultaneously with vertical movement of said platform relatively to said lifting head.

4. In a truck of the class described, a lifting head, an elevating platform, a pair of vertical uprights on the front end of said elevating platform, a pair of vertical uprights on said lifting head, rollers mounting the vertical uprights of said elevating platform for vertical movement relatively to the vertical uprights of said lifting head and guiding the front end of said elevating platform for vertical rectilinear lifting and lowering movement relatively to said lifting head, a cam fixed relatively to said lifting head between its vertical uprights, a lever pivotally mounted on and movable bodily with said elevating platform relatively to said lifting head, said cam engaging said lever between said uprights and swinging said lever relatively to said elevating platform when said lever moves bodily upwardly with said elevating platform relatively to said lifting head, means supporting said elevating platform rearwardly of its uprights for lifting and lowering movement, and means whereby said

lever actuates said platform supporting means to lift and lower said elevating platform simultaneously with rectilinear movement of said platform relatively to said lifting head.

5. In a truck of the class described, a lifting head, an elevating platform, a pair of vertical uprights on the front end of said elevating platform, a pair of vertical uprights on said lifting head, rollers mounting the vertical uprights of said elevating platform for vertical movement relatively to the vertical uprights of said lifting head and guiding the front end of said elevating platform for vertical rectilinear lifting and lowering movement relatively to said lifting head, a ram bearing between said lifting head and said elevating platform for lifting said platform relatively to said lifting head, a cam fixed relatively to said lifting head between its vertical uprights, a lever, pivot means mounting said lever medially of its ends on said elevating platform for movement bodily with said platform, said cam engaging one end of said lever and swinging said lever on its pivot means when said lever moves with said elevating platform relatively to said lifting head, means supporting said elevating platform rearwardly of its uprights for lifting and lowering movement, and means whereby the end of said lever opposed to said one end actuates said platform supporting means to lift and lower said elevating platform simultaneously with rectilinear movement of said platform relatively to said lifting head.

6. In a truck of the class described, a lifting head, an elevating platform, a pair of vertical uprights on the front end of said elevating platform, a pair of vertical uprights on said lifting head, rollers mounting the vertical uprights of said elevating platform for vertical movement relatively to the vertical uprights of said lifting head and guiding the front end of said elevating platform for vertical rectilinear lifting and lowering movement relatively to said lifting head, a ram bearing between said lifting head and elevating platform for lifting said platform relatively to said lifting head, a cam fixed on said lifting head between said vertical uprights, a lever, pivot means mounting said lever on said elevating platform for movement bodily with said platform relatively to said lifting head, a part of said lever engaging said cam between said uprights and coacting with said cam to swing said lever on its pivot means as said ram lifts said elevating platform relatively to said lifting head, means supporting said elevating platform rearwardly of said uprights for lifting and lowering movement, and means whereby said lever actuates said platform supporting means to lift and lower said elevating platform simultaneously with rectilinear movement of said platform relatively to said lifting head.

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