

AN AIRCRAFT LOADER

An aircraft loader is a limited purpose vehicle used to load cargo containers into aircraft. The loader must be capable of having a deck elevated from a low level position to a high position whereby a cargo container can be rolled off the loader deck into the cargo or baggage hold of the aircraft being loaded.

The airline industry flies a plethora of aircraft designs, styles and sizes. Each aircraft design requires a slightly different load height as well as having different characteristics of suspension deflection as the aircraft is being loaded. Consequently, an aircraft loader that can easily be positioned to match the height of the aircraft being loaded is a desirable apparatus. Such aircraft loaders have been in use for a number of years.

A new requirement, however, is the goal of providing a single loader that can accommodate the side delivery of cargo container requirements of various airlines. Not only are cargo containers of different widths but they also may have to be turned on the aircraft loader so that the container can be loaded into the aircraft in a manner that is specified by the particular airline.

Earlier aircraft loader designs were hampered in operation and maneuverability by the necessity of having tall upwardly extending masts about one-third of the way back from the front of the loader. These masts contained the lift actuating cylinders and attendant hardware and were impediments to loading containers as they prevented containers having a length greater than the distance between the masts from being turned "widthwise" on the loader deck prior to the container being loaded into the awaiting aircraft.

The invention herein disclosed obviates the need for such upwardly extending masts by providing a hoisting unit that remains below the deck surface when the deck surface is elevated to an aircraft loading height.

According to the present invention there is provided an aircraft loader having an elevatable platform mounted by a scissors type linkage on a frame, and including a lifting means for the platform that comprises a first moveable support having at least two actuators mounted thereon for vertical displacement of respective actuator rod ends in opposite directions, one of said actuator rod ends acting against a first flexible non-extensible support means having one end thereof fixed to the elevatable platform and the other end thereof fixed to the moveable support, the other of said actuator rod ends acting against a second flexible non-extensible support means and having one end thereof fixed to the frame and the other end thereof fixed to the moveable support, so that vertical displacement of each actuator rod end results in vertical movement of the platform relative to the frame, and the lifting means do not protrude above the platform when elevated.

Preferably the actuators are hydraulic cylinders, and each actuator has a pulley thereon that acts against its respective non-extensible support which is in the form of a chain.

Preferably the actuators are arranged as a pair of outboard actuators mounted one at each end of the moveable support ends which act against a respective first flexible support, and a single actuator mounted in the center of the moveable support and which acts against the second flexible support.

The hydraulic actuators may be arranged so that each cylinder has a similar volumetric capacity. Alternatively the single central cylinder may have a piston which has an area which may be larger or smaller than the combined area of the two outboard cylinders dependent on the lifting requirements of the platform.

The invention will be readily understood after reading the following specification in combination with the drawing figures wherein:

Figure 1 is a side elevation view of an aircraft loader with the load deck raised.

Figure 2 is a detailed drawing of the hydraulic lifting system of the present invention.

Figure 3 is a schematic representation of Figure 2.

Figure 4 is a schematic representation of Figure 2.

Figure 5 is a schematic representation of Figure 2.

Figure 1 shows the general environment of the invention.

Presented is an aircraft loader generally 10 having ground support wheels 12 and 14 supporting a frame 16. At the front part of the vehicle an

elevatable forward or deck platform 36 is supported for vertical movement above a drive train compartment generally 22 of the aircraft loader. A rear elevatable platform or deck 24 is carried on the frame 16 and supported on two sets of scissor beams 26 for movement vertically above the frame 16.

In Figure 1 a cargo container, also referred to as cargo pallet or cargo skid, 30 is shown in a position where it is awaiting transport to the aircraft schematically shown as 32. The aspect of the aircraft loader that is the inventive contribution is represented by the hydraulic lift mechanism generally 34.

The hydraulic lift mechanism 34 is carried in the frame 16 of the aircraft loader and is designed to elevate the rear platform 24 and allow it to be lowered as necessary. It is significant that this lifting apparatus 34 does not protrude above the rear deck surface when the rear deck has been raised to meet with the forward deck 36.

While Figure 1 shows the general environment of the lift mechanism generally 34, Figure 2 presents the details of the structure.

In Figure 2 the frame 16 is partially broken away to show the lift mechanism but this frame does wrap around the lifting mechanism from the left side of the figure to the right side thereof. Inside the frame 16 an extensible support 40 is carried for vertical movement in the frame 16. Although not shown in Figure 2 there is a mirror image extensible support like 40 on the other (near) side of the lift mechanism -- it has been left out of Figure 2 for reasons of clarity. Fixedly attached to

both of these extensible supports is a first moveable transverse support (42) which is a major component of the lift mechanism.

This moveable transverse support (42) hosts a plurality of hydraulic rams including a matched pair of outboard hydraulic cylinders 44 and 46 mounted for vertical displacement at the outboard ends of the first transverse support 42 and a single hydraulic cylinder 50 having a rod end 52 mounted for vertical displacement in the center of the first moveable transverse support 42. The pair of outboard cylinders have their cylinder portions fixedly attached to the moveable transverse support 42 as does the single central hydraulic cylinder 50.

Also fixedly attached to the moveable transverse support 42 are the grounded ends of the two first flexible support means 54 and 56 which are shown to be attached at clevises 60 and 62, respectively. These flexible support means 54 and 56 can be chains that are carried on the rod end 52 of the single hydraulic cylinder. The rod end 52 shown in a preferred embodiment may have axle mounted rollers or pulleys such as 64 and 66 that accommodate the flexible support means 54 and 56. The second ends of each flexible support means are attached by retainers 70 and 72 to a frame component 74 of the rear elevator platform or deck 24.

The moveable transverse support 42 also provides a fixed anchorage for the second ends 76 and 78 of the second flexible support means 80 and 82. These second flexible support means 80 and 82 pass around individual support guide means 84 and 86 in the form of flanged wheels

pulleys mounted for rotation around a horizontal mounting means such as an axle on the lower side of the outboard ends of a second moveable transverse support 90. The second movable transverse support 90 provides a mounting location for the rod ends of the outboard cylinders 44 and 45 carried by the first movable transverse support 42. The second support 90 is also provided with a bore 92 in the central portion thereof to accommodate the single hydraulic cylinder 50 mounted on the first transverse support 42.

The first ends of the second flexible support means 94 and 96 are mounted by attachment means to the frame 16 of the aircraft loader and thus are grounded and not movable.

Figures 3-5 are schematic representations presented to show the various stages of elevation that are achieved by the lift mechanism as the hydraulic cylinders receive fluid from a pump source not shown but well known in the art. It should be clearly understood that these are schematic representations of the general timing that the device shown in Figure 2 will cycle through, however, Figures 3-5 do not represent a preferred embodiment of the invention. Whereas Figure 2 shows the lift device at almost full stroke, that is, almost fully extended, Figure 3 shows the lift mechanism schematically fully retracted. The first end 94 of the second flexible support means 80 is shown grounded to frame 16. The second flexible support means 80 is carried around the pulleys

84 and then the second end of the second flexible support means 76 is attached to the first movable transverse support 42. The second

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moveable transverse support is hidden behind the pulley 84. Both outboard matched cylinders such as 44 are fixedly mounted to the first moveable transverse support 42 as is the single hydraulic cylinder 50.

The first of a pair of the first flexible support means 54 is shown mounted at device 60 to the first moveable transverse support means 42 while the other end is mounted at retainer 70 to the elevator platform 24.

In operation, starting at Figure 3 and progressing to Figure 5 the single central hydraulic cylinder 50 will be pressurized causing its ram to extend with the axle mounted roller 64 acting on the chain 54 to lift the platform 24 as shown in Figure 4. In a preferred embodiment when this single cylinder 50 is fully extended hydraulic fluid flows will be diverted to the pair of outboard hydraulic cylinders 44 (and 46) causing each ram to extend and push the pulley 84 (and 86) against the respective chain 80 and thereby lift both the second moveable transverse support 90 vertically upward together with the first moveable transverse support 42 which will also be urged upwardly at the same time. Upon full pressurization of all the cylinders the frame component 74 and the rear deck bed will be at maximum height (now shown). As fluid is exhausted from the cylinders the rear deck bed will be gradually lowered until it is at rest on the frame 16 when theoretically all the cylinders will be raised of pressure.

An alternative embodiment would have a hydraulic circuit supply the single cylinder before the pair of outboard cylinders or vice-versa. Also the hydraulic supply could be such that all cylinders raise and lower at the same rate.



CLAIMS

1. An aircraft loader having an elevatable platform mounted by a scissors type linkage on a frame, and including a lifting means for the platform that comprises a first moveable support having at least two actuators mounted thereon for vertical displacement of respective actuator rod ends in opposite directions, one of said actuator rod ends acting against a first flexible non-extensible support means having one end thereof fixed to the elevatable platform and the other end thereof fixed to the moveable support, the other of said actuator rod ends acting against a second flexible non-extensible support means and having one end thereof fixed to the frame and the other end thereof fixed to the moveable support, so that vertical displacement of each actuator rod end results in vertical movement of the platform relative to the frame and the lifting means does not protrude above the platform when elevated.
2. An aircraft loader as claimed in claim 1 wherein the actuators are hydraulic cylinders each having respective piston rod ends.
3. An aircraft loader in accordance with claim 1 or claim 2 wherein each respective actuator rod end has a pulley mounted thereon which acts against its respective non-extensible support means which is constituted by a chain.
4. An aircraft loader according to any one of claims 1 to 3 wherein said actuators include a pair of outboard actuators mounted one at each end of the moveable support and which act against a respective first flexible support, and a single actuator mounted in the center of the moveable support and which acts against the second flexible support.
5. An aircraft loader as claimed in claim 4 wherein the actuator rod ends of said pair of outboard actuators each have a pulley thereon, and the two pulleys are mounted one on each end of another moveable support.



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6. An aircraft loader in accordance with claim 5 wherein said other moveable support is provided with a bore in the central portion thereof, said bore being provided to accommodate said central actuator mounted to said first moveable support.
 7. An aircraft loader in accordance with any one of claims 1 to 6 wherein said frame includes a guide means for guiding said moveable supports for vertical movement.
 8. An aircraft loader in accordance with claim 2 wherein each of said hydraulic cylinders has a similar volumetric capacity.
 9. An aircraft loader in accordance with claim 4 when dependent upon claim 2 wherein said single central hydraulic cylinder has a piston area larger than the piston end area of each of said outboard hydraulic cylinders.
 10. An aircraft loader in accordance with claim 4 when dependent upon claim 2 wherein the combined area of the pistons of said pair of outboard hydraulic cylinders is greater than the piston area of said single central hydraulic cylinder.
 11. An aircraft loader as claimed in any preceding claim wherein said elevatable platform is a rear elevatable platform and the aircraft loader is also provided with a front elevatable platform.
 12. An aircraft loader substantially as described herein and with reference to the accompanying drawings.
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