RETRACTABLE MAIN CARRIAGE FOR VERTICALLY STARTING AIRPLANES AND AIRPLANES STARTING ON A SHORT RUNWAY

ABSTRACT: A retractable main landing gear located behind the center of gravity of the airplane and comprising an adjusting mechanism operable selectively to adjust the landing wheel from a front supporting position, in which the landing wheel is closer to the center of gravity of the airplane, to a rear supporting position, in which the landing wheel is farther away from the center of gravity of the airplane, while the base or area over which the airplane is supported is increased.
RETRACTABLE MAIN CARRIAGE FOR VERTICALLY STARTING AIRPLANES AND AIRPLANES STARTING ON A SHORT RUNWAY

The present invention relates to a main carriage for vertically starting airplanes and for airplanes starting from a short runway and, more particularly, concerns a carriage of the above-mentioned type with a spring-supported tiltable lever carrying the carriage wheel and with an angle lever mounted on said tiltable lever while an adjusting device which is supported relative to the carriage is connected to said angle lever.

Carriages of this type are known. Thus, it has been suggested to withdraw a carriage of the above-mentioned design from its working position into its rest position within the fuselage. Furthermore, a carriage of the above-mentioned type is known by means of which the airplane can be lowered when at a standstill on the ground in order to facilitate the loading and unloading of the plane. The adjusting device serves as shock absorber for the starting as well as for the landing operation to absorb or cushion the shocks occurring during the starting or landing operation.

With a carriage for vertical starting and landing of airplanes, it is desirable for purposes of safely touching the ground, that the carriage for the vertical start and for the vertical landing have as large a base as possible. For the customary start at an incline, however, it is more advantageous to move the supporting point for the rear carriage close to the vertical transverse plane through the center of gravity of the airplane so that the tilting moment will be at a minimum. The heretofore known carriage designs do not furnish a satisfactory solution for vertically starting planes and planes starting from a short runway.

It is, therefore, an object of the present invention so to design the rear carriage that the requirements for the above-mentioned two types of starting of the airplane will be met.

It is another object of this invention to design a carriage of the type set forth in the preceding paragraph, which will be able to vary the location of the carriage relative to the center of gravity of the airplane, depending on whether a vertical start or a start at an incline is desired or involved.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawing, in which:

FIG. 1 illustrates a twin-wheel carriage according to the present invention while showing in dot-dash lines the landing wheels which have not yet been actuated.

FIG. 2 illustrates a spring system forming part of the landing gear shown in FIG. 1;

FIG. 3 is a diagrammatic layout of a plane showing the landing gear of FIG. 1 with regard to the center of gravity of the airplane; and

FIG. 4 is a side view of the landing gear of FIG. 1 as seen in the direction of the arrow A in FIG. 1.

The above-outlined objects have been realized according to the present invention by so associating the tilting lever, the angle lever and the adjusting device with regard to each other that the tilting lever is adjustable to a front supporting position in which the carriage wheel moves closer to the center of gravity of the airplane, and is also adjustable to a rear supporting position, which results in an increase in the base of the airplane.

By adjusting the tilting lever toward the front, the carriage wheel moves closer to the transverse axis passing through the center of gravity of the airplane so that a relatively small tilting moment prevails for the customary start at an angle. By adjusting the tilting lever toward the rear, the base which is defined by the front wheel which can be steered, the rear carriage and the lateral supporting carriage means will be increased when starting the vertical landing will be made safer.

According to a further development of the invention, it is suggested to couple the tilting lever with a tilting spring device. For purposes of obtaining the same spring characteristic in both positions of the carriage, the axis for the tilting lever is located in the same vertical plane as the center of gravity for the spring device.

Referring now to the drawings in detail, the landing gear or carriage 1 is equipped with a pivotal lever 2 which carries twin carriage wheels 3 (FIG. 4) and is pivotally supported by a shaft 4. Fixedly connected to the lever 2, e.g. by a key 4a, is a lever 5 having pivotally connected thereto at 6 a double-acting hydraulic cylinder piston system 7. The cylinder 7a of the cylinder piston system 7 has reciprocably mounted therein a double-acting piston 7b connected to the piston rod 7c, which in turn is operable to bring about a shifting movement of the pivotal lever 2 in either direction. The cylinder 7a is pivotally connected to the carriage 1 by means of a pivot 8. For cushioning the lever 2 with regard to the carriage 1, there is provided a spring device 9 (see in particular FIG. 2), which is pivotally journaling in the carriage 1 and is furthermore pivotally connected at 11 to the lever 2. Normally, the cylinder piston system 7 is not actuated. When it is desired to shift the lever 2 which carries the wheels 3 from their normal position to their rear position, the double-acting piston in cylinder 7a receives pressure fluid through the conduit 13. When it is desired to shift the carriage wheels 3 to their front position, pressure fluid is conveyed into cylinder 7a through the conduit 14. For length compensation of the spring device 9 during the said wheel shifting operation, the upper portion of the spring device 9 is provided with a resilient length compensating member 12. The pivot 4 on the carriage 1 is located below the pivot 10 pivotally journaling the spring device 9 in the carriage 1.

When the twin wheels 3 occupy the position shown in full lines in FIG. 1, viz are neither shifted toward the front nor toward the rear, the cylinder piston system 7 has no function, which means the piston connected to piston rod 7b and reciprocable in cylinder 7a slides in the latter without encountering any fluid resistance and moves in conformity with the spring movement of lever 2. The dot-dash line positions of the twin wheels 3 indicate the maximum stroke of the spring system or spring device 9.

FIG. 2 indicates that the resilient length compensating member or spring 12 is necessary in order during the shifting of the wheels 3 to move beyond the position in which the pivot shafts 10, 4 and 11 are located on a common straight line. In this position, spring 12 is temporarily and briefly compressed and expands after overcoming this particular position. The spring 12 rests, on one hand, against the upper cylinder end, and on the other hand, rests against the piston in said spring device 9 which piston rod, as mentioned above, is at 11 pivotally connected to lever 2. In the space between said last-mentioned piston and the bottom of the cylinder housing 12 there may be provided a pressure medium and/or friction springs.

When the carriage is in its fully moved out position, it is locked in this position as customary. Such locking mechanism may be of any standard type or suitable design or, in conformity with the specific showing in the drawing, may be arranged on the supporting strut 15 and may comprise a locking nose 16 at the upper strut 15a which nose by means of a bolt 17 engages the lower strut 15b. The nose 16 is by means of a spring mechanism 18 coupled to a torque connection 19 connected to the upper pivot 20 of a cylinder piston system 21.

When the carriage is to be lifted or retracted, the cylinder piston system 21 actuates the torque mechanism 19, and the locking mechanism is disengaged. This permits the main strut 22 to tilt, while the cylinder piston system 21 continues its stroke. The crosshead and shock absorber or spring device 9 is pulled into the main strut and through the folding of the wheel lever system the carriage is shortened. After the retracting operation has been completed, the nose 16 lockingly engages a pin on the main strut thereby securing the carriage in its retracted position. The lowering of the carriage or landing gear is, of course, effected in an analogous reverse manner.

It is, of course, to be understood that the present invention is, by no means, limited to the specific structure shown in the drawings and that various modifications are possible, the scope of the invention being determined by the appended claims.
We claim:
1. In combination with an aircraft having a longitudinal axis and center of gravity, a retractable landing gear located always behind the center of gravity of said aircraft and comprising: frame means including a landing gear leg portion, extending downwardly from said aircraft, shifting lever means pivotally supported by said landing gear leg portion of said frame means about a horizontal primary axis at the lower end of said leg portion, landing wheel means supported by said shifting lever means pivotable about the primary axis into forward positioning and rear positioning respectively of said landing wheel means in both forward and rear positioning thereof so that the axis of said landing wheel means is always located behind a plane which passes through the center of gravity of said aircraft transversely to the longitudinal axis of said aircraft, and actuating means operatively connected to said shifting lever means and operable selectively to shift said lever means into a front supporting position in which said landing wheel means stand in front of said landing gear leg portion closer to said center of gravity of said aircraft and into a rear supporting position in which said landing wheel means are behind said landing gear leg portion farther away from said center of gravity while increasing the base for the aircraft though retaining comparable shock absorbing characteristic in either of alternate front and rear positioning thereof.
2. A retractable main landing gear located always behind the center of gravity of said aircraft further in combination according to claim 1, which includes pivotable spring means coupled to said shifting lever means about a further pivot axis, the first mentioned primary axis of said shifting lever means being located below the further pivot axis in the same vertical plane as the further pivot axis for said pivotable spring means, said axis of said landing wheel means being at the lower end of said shifting lever means.
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION


Inventor(s) Gerhard Bock et al.

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

On the cover sheet [73] assignee should read -- Vereinigte Flugtechnische Werke Gesellschaft mit beschränkter Haftung fruher "Weser" Flugzeugbau/Focke-Wulf/Heinkel-Flugzeugbau --.

Signed and sealed this 22nd day of February 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR. ROBERT GOTTSCHALK
Attesting Officer Commissioner of Patents