the large number of actuators makes it difficult and excessively time-consuming to unload the airplane in the event the tractor breaks down.

~~The invention aims to~~ Embodiments of the present invention avoid these drawbacks by proposing an airplane tractor comprising a gripping device making it possible to improve the loading and unloading of the airplane on the tractor, and in particular a gripping device adapted to pull an airplane toward a takeoff runway.

~~To that end, an airplane tractor is proposed having~~ Disclosed herein a gripping system for gripping the nose gear of the airplane, comprising:

- a chassis;
- wheel modules connected to the chassis, each wheel module including at least one actuator for inducing a vertical movement of the module in relation to the chassis;
- a gripping platform of the nose gear of an airplane, the platform together with the chassis having freedom of movement substantially in circular translation; and
- an actuating means connecting the platform and the chassis, said actuating means also constituting a damping means for damping the free movement of the platform in relation to the chassis.

The tractor ~~according to the invention~~ can also comprise at least one of the following features:

- at least one gate intended to oppose the force exerted on at least one wheel of the nose gear of the airplane by the gripping platform;

- the gripping platform comprises a locking device for locking at least one wheel of the nose gear of the airplane;

- the locking device of said at least one wheel of the nose gear is installed on a turret positioned on the gripping platform, the turret rotating freely around a substantially vertical axis in relation to the gripping platform;

- the locking device for said at least one wheel comprises:

  - a wheel abutment for the nose gear of the airplane;

  - a tightening device to maintain the wheel of the nose gear of the airplane against the abutment;

- the tightening device comprises a tightening plate connected to a triangle actuated by a cylinder;

- the tightening plate is retractable in the absence of an airplane wheel on the platform;

- the abutment has an adjustable location;

- the actuator of each wheel module is a hydraulic cylinder;

- the cylinder of the tightening device is a hydraulic cylinder;

- the damping and actuating means constitutes a sensor of the relative movement between the platform and the chassis;

- the platform has a base connected to the chassis by vertical tie rods;

- an actuator for inducing an incline of the base of the platform in relation to a horizontal plane;

- the vertical tie rods have adjustable lengths and/or adjustable fastening points to the chassis;

- each wheel module has a respective angle of rotation in relation to a longitudinal axis of the tractor and around an axis of rotation substantially vertical to the chassis of the tractor;

- the turret comprises at least one sensor measuring an angular displacement of the turret in relation to the gripping platform, and each respective angle of rotation is determined as a function of the measured angular displacement of the turret.

~~Also proposed is a method for gripping the nose gear of an airplane using an airplane tractor comprising:~~

~~— a chassis;~~

~~— wheel modules connected to the chassis, each wheel module including at least one actuator for inducing a vertical movement of the module in relation to the chassis;~~

~~— a gripping platform for gripping the nose gear of an airplane, the platform being moveable substantially in circular translation in relation to the chassis, the platform going from a retracted position to a gripping position by way of an equilibrium position;~~

~~— a damping and actuating means connecting the platform and the chassis.~~

~~The method comprises the following steps:~~

~~- actuating the damping and actuating means to place the gripping platform in the retracted position;~~

~~- lowering the chassis;~~

~~- moving the tractor so as to place the retracted gripping platform in contact with at least one wheel of the nose gear of the airplane;~~

~~- actuating the damping and actuating means to move the gripping platform from its retracted position toward its gripping position while adjusting the height of the~~

~~chassis by controlling the actuators of at least two wheel modules so as to slide the gripping platform under the wheel;~~

~~- raising the chassis;~~

~~- bringing the platform back to its equilibrium position.~~

According to a first aspect of the present invention, there is provided a method for gripping a nose gear of an airplane using an airplane tractor, the airplane tractor including: a chassis; wheel modules connected to the chassis, each of the wheel modules including at least one actuator for inducing vertical movement thereof in relation to the chassis; a gripping platform for gripping the nose gear of the airplane, the gripping platform being moveable in a substantially pendular movement in relation to the chassis, the platform gripping going from a retracted position to a gripping position by way of an equilibrium position; and a damping and an actuating means connecting the gripping platform and the chassis: the method comprising: actuating the damping means and the actuating means to place the gripping platform in the retracted position; lowering the chassis; moving the tractor so as to place the retracted gripping platform in contact with at least one wheel of the nose gear of the airplane; actuating the damping means and the actuating means to move the gripping platform from the refracted position toward the gripping position, while adjusting a height of the chassis by controlling the actuators of at least two of the wheel modules so as to slide the gripping platform under the at least one wheel; raising the chassis; bringing the platform back to the equilibrium position.

According a second aspect of the present invention, there is provided a method for pulling the airplane, comprising: loading the airplane on the tractor according to the method of the first aspect; making the tractor travel at a constant speed; and regulating the speed of the tractor as a function of the force measured by the damping means and the actuating means.

The gripping method for gripping the nose gear of an airplane using an airplane tractor can also include at least one of the following features:

- a step consisting of closing a gate of the tractor when the gripping platform is in contact with said at least one wheel of the nose gear of the airplane;

- a step consisting of opening the gate of the tractor when the chassis raises;

- when the gripping platform has been slid under the wheel, a step consisting of moving the tractor to bring said at least one wheel onto a locking device;

- steps consisting of:

  - setting the location of an abutment as a function of the type of airplane and/or the type of wheel;

- bringing said at least one wheel onto the locking device against the abutment;

- bringing a tightening plate against the wheel to maintain it against the abutment;

- a step consisting of inclining the platform in relation to a horizontal plane.

Also ~~proposed~~ disclosed is a method for pulling an airplane comprising the following steps:

- loading the airplane on a tractor according to the gripping method for gripping the nose gear of an airplane using an airplane tractor;

- making the tractor travel at a constant speed;

- regulating the speed of the tractor as a function of the force measured by the damping and actuating means.

The method for pulling a airplane can also comprise at least one of the following features:

- the speed of the tractor is checked when the measured force exceeds a dynamically determined threshold level;

- the platform of the tractor comprises a turret receiving said at least one wheel of the nose gear of the airplane, the turret freely rotating around a substantially vertical axis in relation to the gripping platform, the direction of the tractor being modified as a function of the rotation of the turret in relation to the gripping platform;

- the rotation of the turret is induced by a rotational movement of the nose gear;

CLAIMS

1. A method for gripping the nose gear of an airplane using an airplane tractor comprising:
   - a chassis;
   - wheel modules connected to the chassis, each wheel module including at least one actuator for inducing a vertical movement of the module in relation to the chassis;
   - a gripping platform for gripping the nose gear of an airplane, the platform being moveable in a substantially pendular movement in relation to the chassis, the platform going from a retracted position to a gripping position by way of an equilibrium position;
   - a damping and actuating means connecting the platform and the chassis.

   the method comprising the following steps:
   - actuating the damping and actuating means to place the gripping platform in the retracted position;
   - lowering the chassis;
   - moving the tractor so as to place the retracted gripping platform in contact with at least one wheel of the nose gear of the airplane;
   - actuating the damping and actuating means to move the gripping platform from its retracted position toward its gripping position while adjusting the height of the chassis by controlling the actuators of at least two wheel modules so as to slide the gripping platform under the wheel;
   - raising the chassis;
   - bringing the platform back to its equilibrium position.

2. The method according to claim 1, also comprising:
   - a step consisting of closing a gate of the tractor when the gripping platform is in contact with said at least one wheel of the nose gear of the airplane.

3. The method according to claim 2, also comprising:
   - a step consisting of opening the gate of the tractor when the chassis raises.

4. The method according to claim 1, also comprising, when the gripping platform has been slid under the wheel:

- a step consisting of moving the tractor to bring said at least one wheel onto a locking device.

5. The method according to claim 4, also comprising the following steps consisting of:
   - setting the location of an abutment as a function of the type of airplane and/or the type of wheel;
   - bringing said at least one wheel onto the locking device against the abutment;
   - bringing a tightening plate against the wheel to maintain it against the abutment.

6. The method according to claim 1, also comprising:
   - a step consisting of inclining the platform in relation to a horizontal plane.

7. A method for pulling an airplane comprising the following steps:
   - loading the airplane on a tractor according to the gripping method of claim 1;
   - making the tractor travel at a constant speed;
   - regulating the speed of the tractor as a function of the force measured by the damping and actuating means.

8. The method for pulling an airplane according to claim 7, wherein the speed of the tractor is checked when the measured force exceeds a dynamically determined threshold level.

9. The method for pulling an airplane according to claim 7, the platform of the tractor comprises a turret receiving said at least one wheel of the nose gear of the airplane, the turret freely rotating around a substantially vertical axis in relation to the gripping platform, the direction of the tractor being modified as a function of the rotation of the turret in relation to the gripping platform.

10. The method for pulling an airplane according to claim 9, wherein the rotation of the turret is induced by a rotational movement of the nose gear.

11. A method for pulling an airplane by an airplane tractor comprising:
   - blocking the primary brakes of the airplane;
   - gripping the nose gear of the airplane by tractor;
   - exerting a pulling force on the airplane by the tractor;

- releasing the primary brakes of the airplane thereby causing the resistance force of the airplane to be less than the pulling force of the tractor, and allowing the pulling force to drive the tractor together with the airplane.

12. A method according to Claim 11, wherein the step of gripping the nose gear of the airplane is performed before the step of blocking the primary brakes of the airplane.

13. A method according to Claim 11, wherein said tractor comprises: a chassis; wheel modules connected to the chassis, each wheel module includes at least one actuator for inducing a vertical movement of the module in relation to the chassis; a gripping system for gripping the nose gear of an airplane, the gripping system comprising a gripping platform moveable substantially in circular translation in relation to the chassis, the platform going from a retracted position to a gripping position by way of an equilibrium position; a damping and actuating means connecting the platform and the chassis; and wherein said step of gripping the nose gear of the airplane comprises:
    - actuating the damping and actuating means to place the gripping platform in the retracted position;
    - lowering the chassis;
    - moving the tractor so as to place the retracted gripping platform in contact with at least one wheel of the nose gear of the airplane;
    - actuating the damping and actuating means to move the gripping platform from its retracted position toward its gripping position while adjusting the height of the chassis by controlling the actuators of at least two wheel modules so as to slide the gripping platform under the wheel of the nose gear;
    - raising the chassis;
    - bringing the platform back to its equilibrium position.

14. The method according to Claim 11, wherein the step of releasing the primary brakes of the airplane is performed by the airplane's pilot.

15. The method according to Claim 11, further comprising a step of accelerating the tractor until it reaches a constant cruising speed.

16. The method according to Claim 11, further comprising a step of regulating the speed of the tractor is performed as a function of the force measured by the damping and actuating means.

17. The method for pulling an airplane according to Claim 16, wherein the speed of the tractor is controlled such that the measured force exceeds a dynamically determined threshold level.

Claims:

1. A method for gripping a nose gear of an airplane using an airplane tractor, the airplane tractor including:

a chassis;

wheel modules connected to the chassis, each of the wheel modules including at least one actuator for inducing vertical movement thereof in relation to the chassis;

a gripping platform for gripping the nose gear of the airplane, the gripping platform being moveable in a substantially pendular movement in relation to the chassis, the platform gripping going from a retracted position to a gripping position by way of an equilibrium position; and

a damping and an actuating means connecting the gripping platform and the chassis;

the method comprising:

actuating the damping means and the actuating means to place the gripping platform in the retracted position;

lowering the chassis;

moving the tractor so as to place the retracted gripping platform in contact with at least one wheel of the nose gear of the airplane;

actuating the damping means and the actuating means to move the gripping platform from the refracted position toward the gripping position, while adjusting a height of the chassis by controlling the actuators of at least two of the wheel modules so as to slide the gripping platform under the at least one wheel;

raising the chassis;

bringing the platform back to the equilibrium position.

2. The method according to claim 1, further comprising closing a gate of the tractor when the gripping platform is in contact with the at least one wheel of the nose gear of the airplane.

3. The method according to claim 2, further comprising opening the gate of the tractor when the chassis raises.

4. The method according to claim 1, further comprising, when the gripping platform has been slid under the at least one wheel, moving the tractor to bring the at least one wheel onto a locking device.

5. The method according to claim 4, further comprising:

setting the location of an abutment as a function of the type of airplane and/or the type of wheel;

bringing the at least one wheel onto the locking device against the abutment; and

bringing a tightening plate against the at least one wheel to maintain it against the abutment.

6. The method according to claim 1, further comprising inclining the platform in relation to a horizontal plane.

7. A method for pulling the airplane, comprising:

loading the airplane on the tractor according to the method of claim 1;

making the tractor travel at a constant speed; and

regulating the speed of the tractor as a function of the force measured by the damping means and the actuating means.

8. The method according to claim 7, wherein the speed of the tractor is checked when the measured force exceeds a dynamically determined threshold level.

9. The method according to claim 7, wherein the gripping platform of the tractor includes a turret receiving the at least one wheel of the nose gear of the airplane, the turret freely rotating around a substantially vertical axis in relation to the gripping platform, the direction of the tractor being modified as a function of the rotation of the turret in relation to the gripping platform.

10. The method according to claim 9, wherein the rotation of the turret is induced by a rotational movement of the nose gear.