PUBLISHED

MAY 25, 1943.

BY A. P. C.

P. E. MERCIER

LANDING GEARS WITH DIRIGIBLE LANDING WHEEL

Filed April 17, 1940

Serial No. 330,007

5 Sheets-Sheet 1

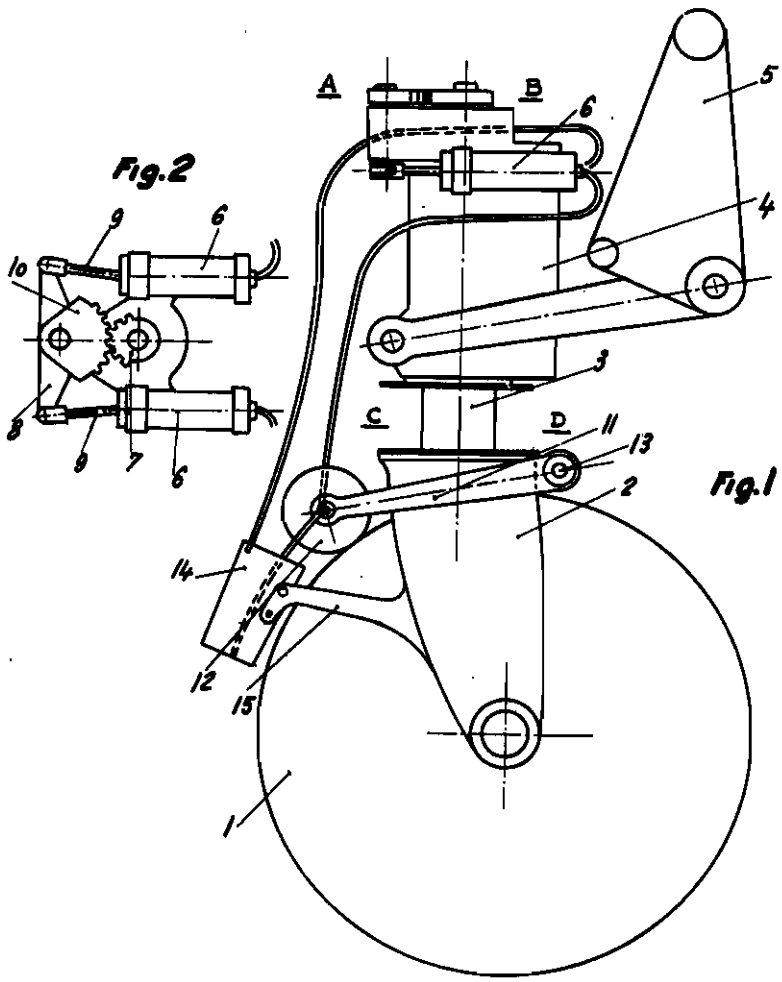

Fig.1

Fig.2

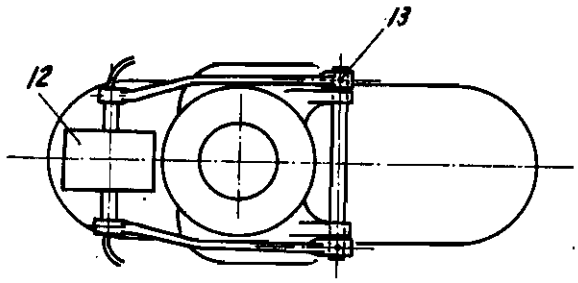

Fig.3

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Fig. 4

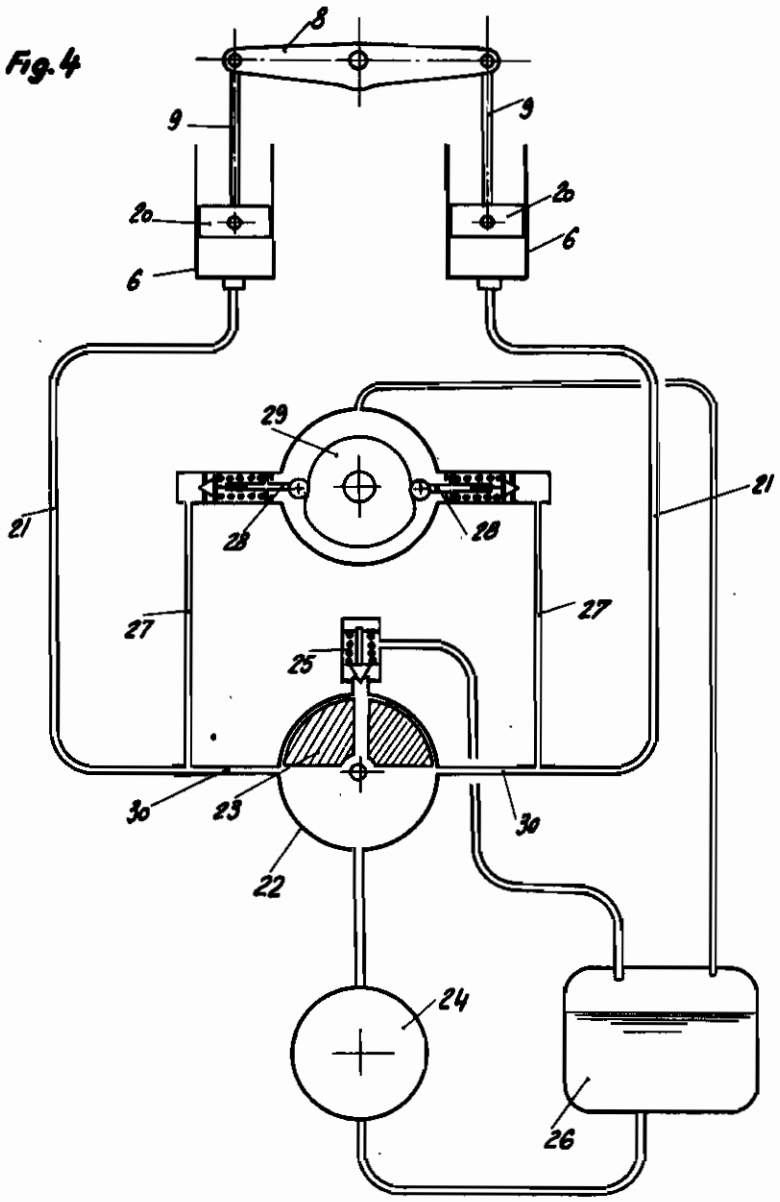

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Fig.6

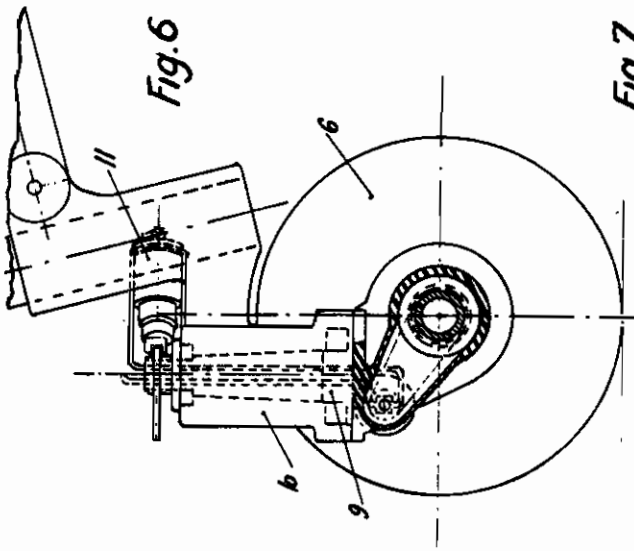

Fig.7

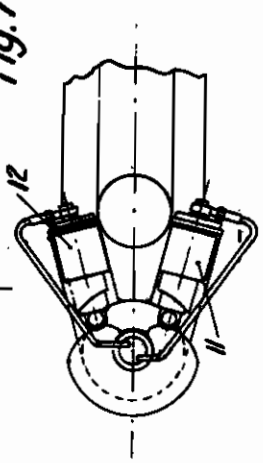

Fig.5

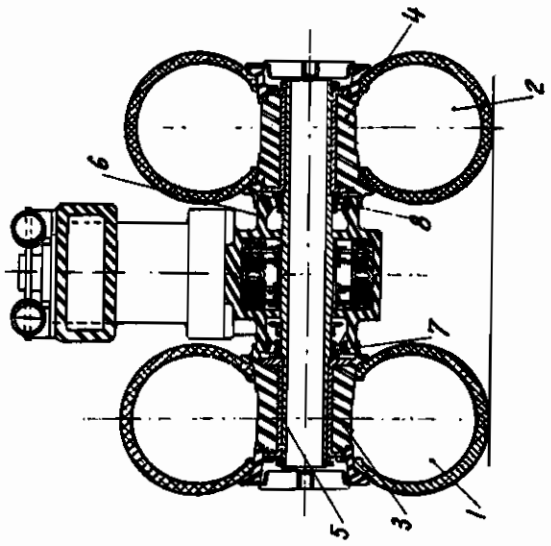

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Fig. 11

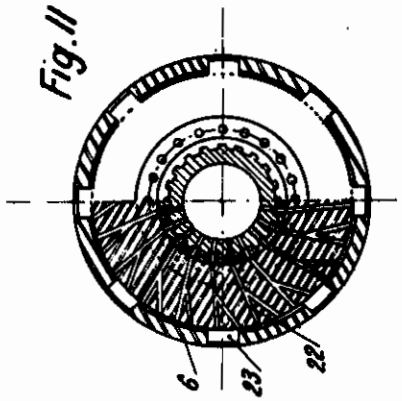


Fig. 10

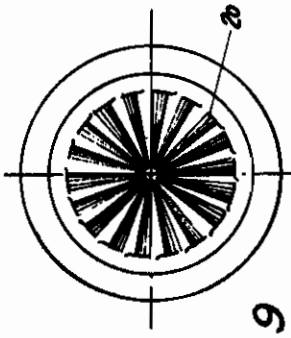


Fig. 9

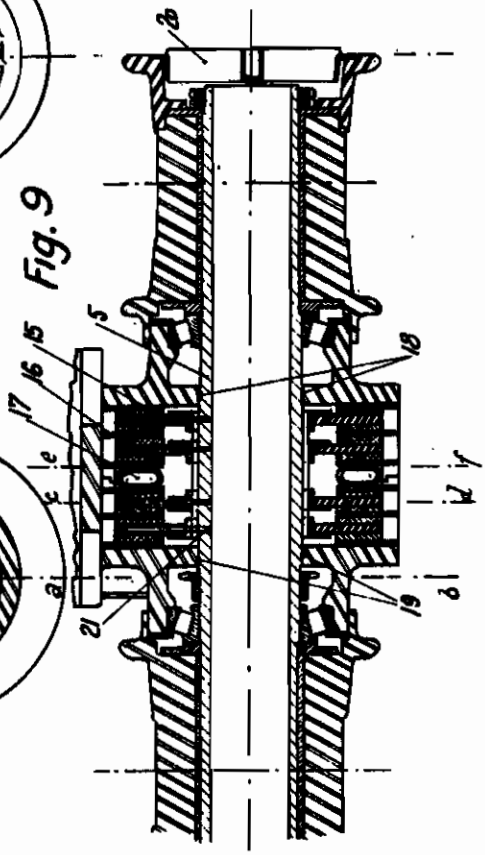
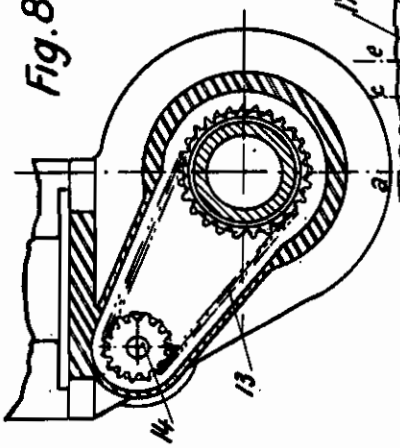


Fig. 8



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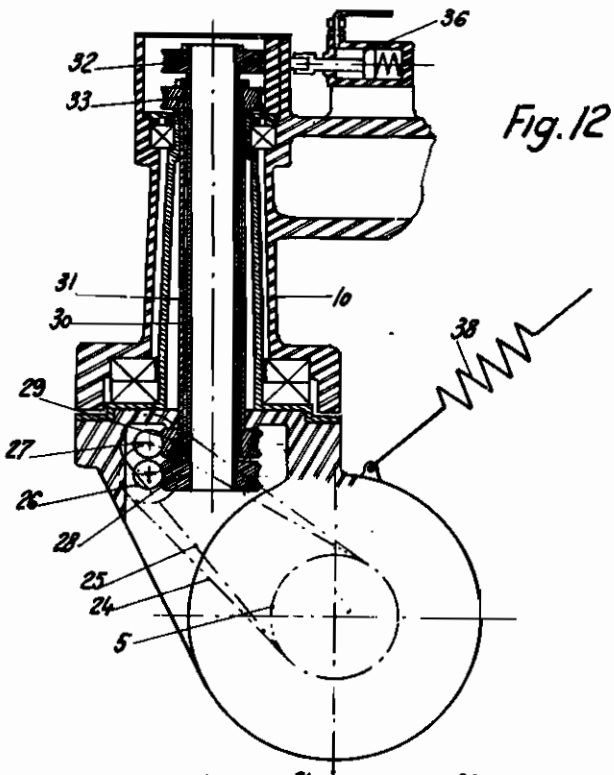

Fig. 12

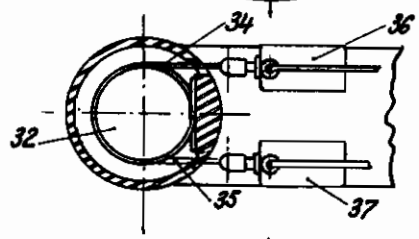

Fig. 13

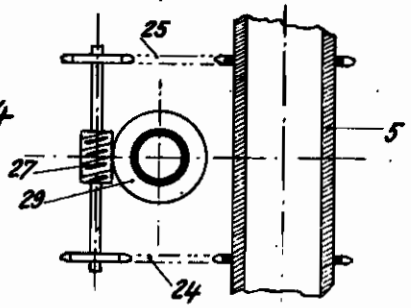

Fig. 14

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ALIEN PROPERTY CUSTODIAN

LANDING GEARS WITH DIRIGIBLE LANDING WHEEL

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vested in the Alien Property Custodian

Application filed April 17, 1940

This invention relates to improvements in landing gears with dirigible landing wheel.

There are recognised peculiar advantages to landing gears with dirigible landing wheel, and particularly to those of the three wheeled kind. Now the direction control of the governor wheel is of interest for evolutions on ground, but it needs, for mean and heavy load aeroplanes, the use of a servo-motor.

It is known to use compressed air or a fluid under pressure to feed such servo-motors. The power source is then located into the structure of the aeroplane and it is re-charged, or drawn by energy collected on the motors.

In order to simplify the corresponding installations and to avoid failures due, notably, to the consumption of compressed air at the instants where the wheel direction control is to be used, particularly when landing, it is advantageous to collect on the wheel itself the energy necessary for diriging it.

This is the principle of the present invention.

It is clear that the said invention may admit numerous modifications. For example, one may think that the power is collected from the rotation of the wheel by means of gears, one of which is drawn by the wheel, or through cylinders rolling on the tyre of the said wheel.

The energy thus collected my be used as mechanical energy, or in any other form.

Amongst all those modifications, there will be hereafter described an example corresponding to the case of an hydraulic servo-motor.

This servo-motor is provided with a power source, consisting of an hydraulic pump, drawn through a cylinder rolling on the tyre, and two cylinder receivers exerting antagonist forces on the direction of the wheel.

Besides, the mechanism comprises a distributing head, with automatic pressure limitation, remote controlled by the pilot and a feeding tank for the pump.

Further, the said mechanism is provided with means for damping the so called "shimmy" oscillations which often appear on dirigible wheels.

The invention is illustrated by means of the appended drawings in which:

Figure 1 shows in lateral elevation a dirigible single landing wheel according to the invention, together with part of its movable frame;

Figures 2 and 3 are horizontal sections, respectively along lines AB and CD of Figure 1;

Figure 4 is a schematic drawing of the hydraulic circuits and parts of the direction control system;

Figure 5 is a cross section of a double dirigible landing wheel according to the invention, with its supporting frame;

Figures 6 and 7 are respectively a side view and a horizontal view corresponding to Figure 5;

Figures 8, 9, 10 and 11 are sections at an enlarged scale of some parts of Figure 5;

Figures 12, 13 and 14 relate to an entirely mechanical solution of the problem of which an example of hydraulic solution is given with reference to the preceding figures.

Referring to Figure 1 and to its subordinate Figures 2 and 3, wheel 1 is carried by a fork 2, the shaft of which is numbered 3. This shaft is guided in the body of the dash-pot 4 serving as a wheel carrier. The wheel and its accessories being elements of a collapsible landing gear, there has been shown at 5 the collapsing frame of part 4.

The cylinders of the direction servo-motor are numbered 6, 6 on Figures 1 and 2.

There is shown on Figure 2 a gear wheel 7, rotating with shaft 3, owing to the intermediary of a grooved box, located in part 4 and not shown of Figure 1.

A lever 8 is fixed on a toothed sector 10 gearing with part 7.

Lever 8 is acted upon by rods 9, connected to the operating pistons of the cylinders 6.

The hydraulic pump is mounted in the inside of roller 12 carried by arm 11, pivoted at 13 on fork 2.

The feeding liquid tank 14 for the pump is carried on the fork by means of arms 15.

On Figure 4 are again shown the cylinders 6 in which move pistons 20 which drive lever 8 through rods 9. Springs, not shown, produce the pulling back in the axis at the instant of the collapsing of the wheel.

The pipe system 21 for the feeding of cylinders 6 end on a four way cock 22, the inner box of which is numbered 23.

In its symmetrical position, as shown on Figure 4, the said box establishes a communication between pump 24 (located in roller 12) on the one part, cylinders 8 and a weighted valve 25, on the other part, with return to tank 26.

Further, with pipes 21 are connected two symmetrical branches 27, leading to two valves with variable biasing tension, by means of roller push rods 28 and of cam disc 29.

Cam disc 29 and box 23 are coaxially mounted and remotely controlled by the pilot.

The working is as follows:

When the aeroplane is driven along a straight

course, box 23 and cam disc 29 are in the symmetrical positions shown on Figure 4.

The pump then delivers liquid through valve 25 into tank 26.

The adjustment of the valve is so provided that the pressure of the piston rings 20 ensures a correct damping of the "shimmy" oscillations. It is possible, if necessary, to adjoin to such damping means a suitable choking of pipe sections 30. By this means, cylinders 20 are, moreover, maintained constantly full of liquid.

When the pilot wants to turn, he causes the simultaneous rotation of box 23 and of cam 29. The liquid issuing from the pump is then admitted only in one or the other of cylinders 6 and the pressure of the liquid on the piston of the corresponding cylinder is adjusted by means of the variable tension of the homologous push rod 28.

On the other side, the cam form being suitably designed, the other push rod frees the opposed valve and the second cylinder empties into the tank under the action of the lever.

In this manner, the force applied to the wheel is, as desired, a function only of the position of the controlling parts and it cannot exceed the intended values, which ensures the elimination of the risk of capsizing on the ground.

The above described embodiments of the invention were more particularly related to the case of a single dirigible landing wheel. There will now be described some more embodiments relating to the case where there is used a double dirigible wheel.

This case is of a special interest, because it allows for a better repartition of the load on the ground. Moreover, if both wheels are bound together in rotation, the damping of the "shimmy" oscillations is automatically ensured by such coupling.

At last, the location of the steering swivel carrier part between the two wheels allows for disposing the braking and steering parts in an air tight casing, insulated from the tyres.

In order to benefit of the whole advantages of such a situation, the invention provides for the use of disk brakes, the movable disks of which are ventilated by means of air intakes through the axle inner bore, the refrigerating air of the brake disks being evacuated at the periphery of said disks, through suitable opening in the casing and being accelerated during rolling, by means of movable bladings carried by the said disks.

In order to secure a better refrigeration of the disks themselves, it is recommended to provide, in their width, air circulation channels and, therefore, the said disks may be of a mixed construction, with a central flange of light metal.

At last, the direction control may be obtained by means of an hydraulic pump (driven by the wheel) and of cylinders and pistons acting on a director cam, but it is also possible, on smaller dimensioned apparatus, to use an entirely mechanical control, as shown further, by once more using the rotational energy of the wheel in order to develop the directional forces.

On Figure 5, under reference numbers 1 and 2 are designated the twin tyres, the wheels 3 and 4 of which are keyed on the same shaft 5.

Shaft 5 is carried by the swivel carrier part 6 which comprises bearings 7 and 8.

On Figure 6 there is shown the swivel 9, fixed to part 6 and movable in the hollow part 10, on which are visible at 11 (11 and 12 on Figure 7) the direction control oil cylinders.

Figure 8 is a vertical section through part 6, along the plane of a transmission chain 13, which transmits to toothed wheel 14 the wheel movement. This toothed wheel 14 acts on the hydraulic pump feeding the cylinders 11 and 12.

Figure 9 is a section on a larger scale, along the plane of Figure 5. On this figure are visible the movable brake discs such as 15 and the fixed ones such as 16. An expansible chamber 17 allows for the actuation of the braking by means of a fluid under pressure.

Fluid tight systems (not shown) located at 18 and 19 allow to avoid the leaking of oil or grease from the bearings towards the disks.

The hubs of the wheels comprise air in take flanges 20, shown laterally on Figure 10 through which the air is introduced into hollow shaft 5, which is provided with channels, such as 21, in order to ensure the disk ventilation.

On Figure 11 are shown channels, such as 22, which are provided in the movable disks.

Openings such as 23 allow for the refrigerating air getting out of casing 6, after its passing through the disks.

Figure 12 shows an example of directional control by entirely mechanical means. Power is collected by chains 24 and 25 on shaft 5, schematically drawn and in superposed horizontal views on Figure 14.

Chains 24 and 25 act on toothed wheels keyed on tangential screws shown by their ends at 26 and 27 on Figure 12.

These screws drive the toothed discs 28 and 29, respectively fixed on the hollow shafts 30 and 31, which carry the brake pulleys 32 and 33.

This is completed by band brakes 34 and 35 shown in horizontally superposed views on Figure 13.

The remote control by the pilot of the band brakes may be assumed by small screw jacks such as 36 and 37 on Figures 12 and 13.

A back pulling in the axis by a simple spring is schematically indicated at 38.

The direction angles of the movable gear with reference to supporting part 10 may be limited by suitable stops.

The invention will of course allow for numerous modifications according to the dimensions, forms and materials of the various parts, assuming the respective functions of the whole device which forms its object.

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