

Developing a system used to determine the path of raising and lowering the plane's wheel

^[1]Yousif k. A. Al-juboori

Refrigeration and Air Conditioning Department/Imam Jaafar Al-Sadiq University/ Kirkuk , Iraq

Abstract

As is known, the types of aviation accidents are divided into: 40% occur in the air and 60% occur on the ground. Most accidents that occur on the ground occur during landing, and most of them are due to a defect in the wheel raising and lowering system. This case was studied and a user system was developed to determine the path of the front wheel while raising and lowering the wheel of the aircraft

1. Introduction

1.1 Duties of the aircraft's hydraulic system

The hydraulic system has many and varied duties, including (raising and lowering the wheels, opening and closing the air stops, moving the front flaps, moving the rear flaps, moving the air intake cone, moving the air intake gates, controlling the rotation of the front wheel, moving the wing if it is of the mobile type, moving the control surfaces of the aircraft to control it, and other duties.

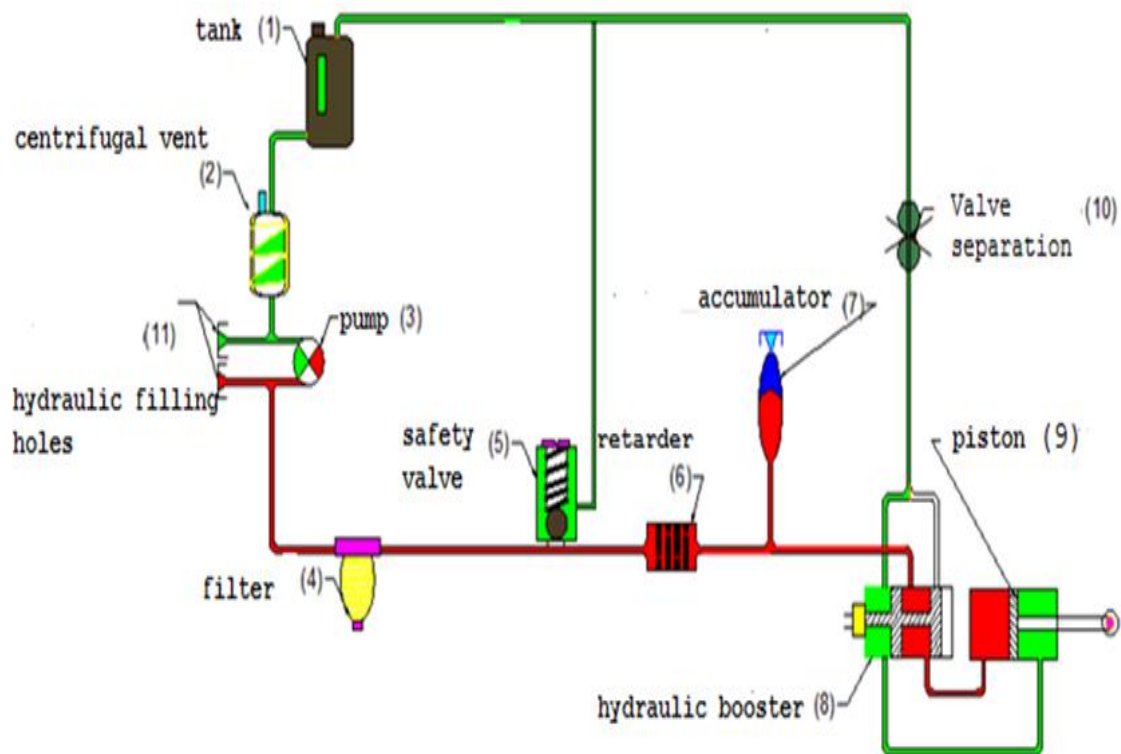
1.2 Components and working principle of the hydraulic system in the aircraft:

The operation of the hydraulic system as in Figure No. (1) The hydraulic pump (3) works to pull the hydraulic from the tank (1), and it passes through the centrifugal vent (2), which works to expel air from the system, if any exists. Then, by pumping the pump, it passes through the filter (4) to filter the hydraulic from impurities, if any, after which it passes through The safety valve (5) works to escape excess pressure into the return line. In normal condition, the hydraulic passes through the retarder (6) in order to slow down the hydraulic pressure, then passes through the hydraulic accumulator (7). Which works to regulate pressure and eliminate fluctuations resulting from the operation of the pump, then passes through the hydraulic booster (8), which works to control the movement of the piston for raising and lowering the front wheel (9). Then the hydraulic moves to the return line, passing through the separation valve (10), which maintains the Hydraulic in the system during maintenance and maintenance, then the hydraulic enters the tanks so that the cycle is repeated continuously. As for No. (11), they are the hydraulic filling holes. At the same time, they are used for the purpose of checking the performance of the hydraulic system on the bearings and without operating the plane.

1.3 general (detailed) description

One of the duties of the hydraulic system is to raise and lower the wheels, as the system is instructed to perform the following:

- 1- Unlocking the wheel gates
- 2- Opening the gates
- 3- Lowering or raising the wheels



(figure 1)

1.4 Types of systems used to keep the front wheel of the aircraft straight during the lifting and lowering process

There are two types of systems for raising and lowering the front wheel of the aircraft: an internal system and an external system

1.4 a. internal system

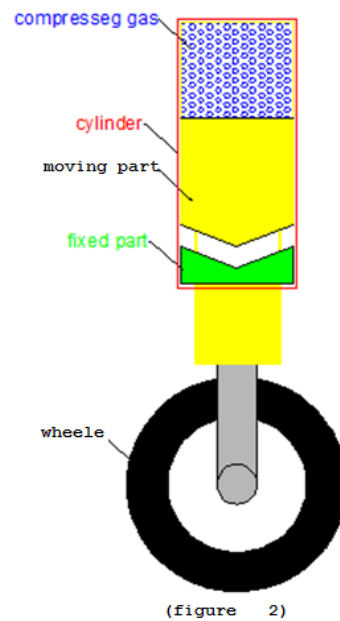
Two cylindrical shaped pieces are placed in the body of the front wheel leg.

One is fixed and the other is mobile, and its working principle is as follows

-When the front wheel is raised, there is a compressed gas in the upper section of the front wheel leg, which compresses the moving part so that it engages with the lower fixed part.

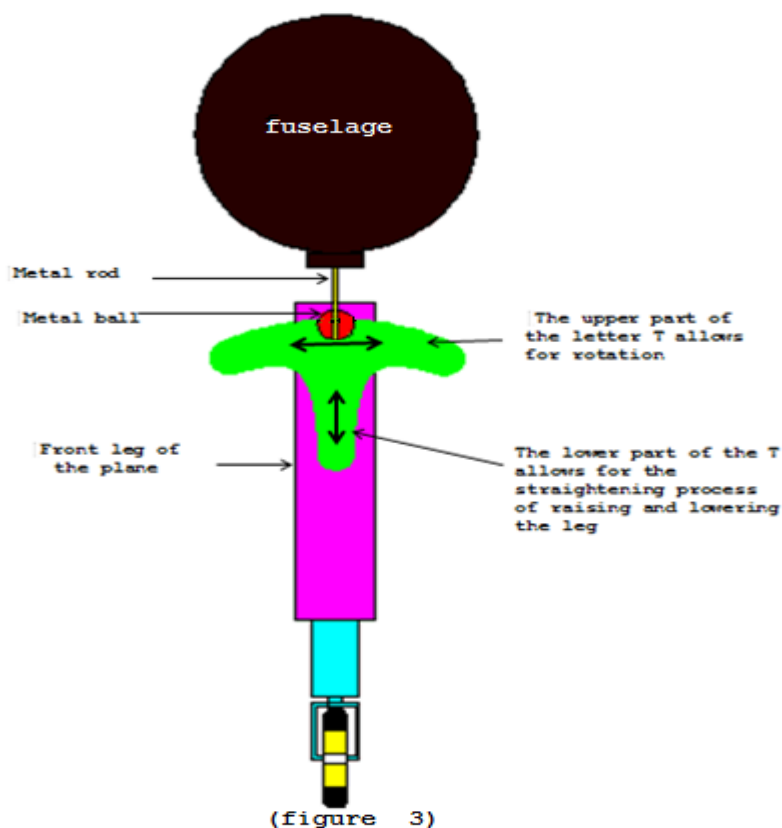
This keeps the front wheel straight and prevents it from spinning

- When the front wheel touches the ground, the moving part moves upward, pressing on the trapped gas and is released from the fixed part to allow the front wheel to perform the duty of turning and rotating freely on the ground, as shown in Figure (2).



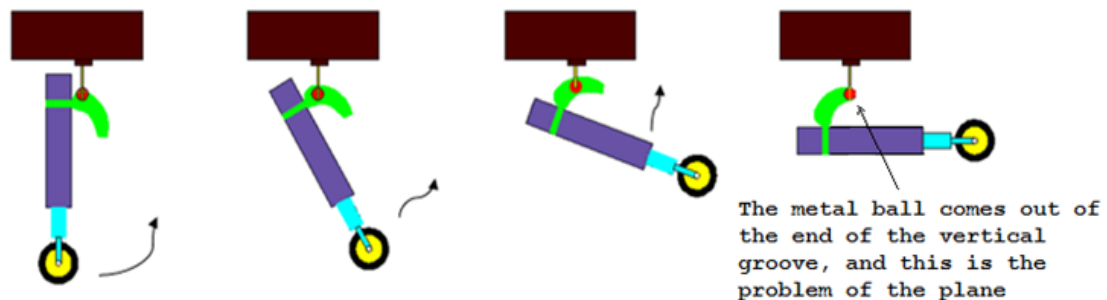
1.4 .b The external system

Where a limiter is placed in the shape of the letter T, and the T-shape is hollow from the inside, allowing a metal ball to move freely in it. This ball is attached to a metal arm, and this arm is attached to the fuselage of the plane in the hiding place of the front wheel. The upper part of the letter T performs the duty of rotating on the ground, and the lower part of the letter T performs the duty of maintaining the alignment of the wheel during the raising and lowering process as shown in figure (3).



2. T-shaped external limiter problems

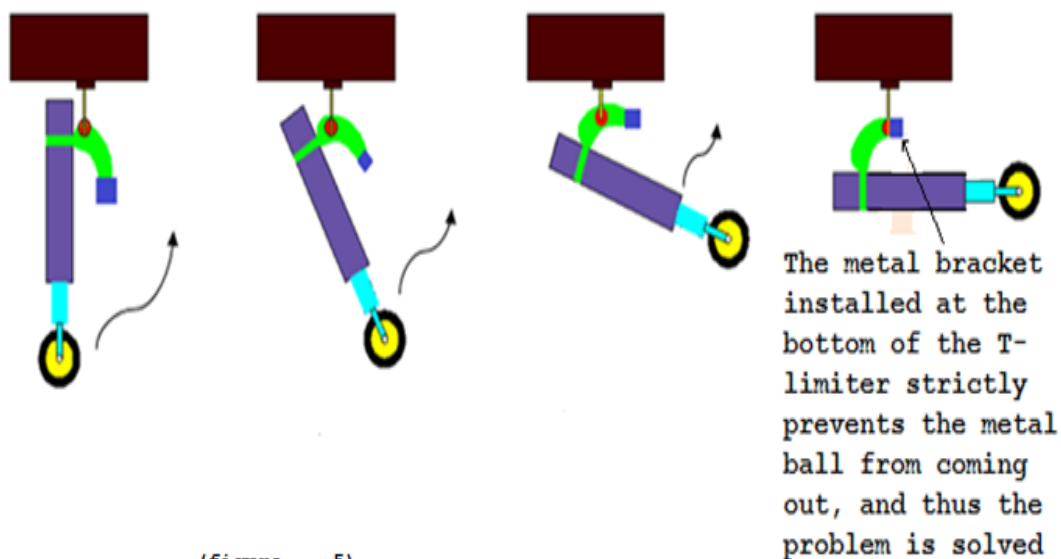
It has been observed in aircraft that have a T-shaped limiter that there is a deflection of the front wheel of the aircraft during landing, which leads to the break of the front leg of the aircraft, with serious damage to the aircraft and lives. Therefore, I conducted research and study of the external limiter by placing the plane on Supports and performing the process of raising and lowering the wheels manually several times. Under different circumstances and for several aircraft, I noticed the metal ball coming out of the letter T from the bottom, causing the front wheel to deflect and leading to the aircraft crashing during its landing, as showing in figure (4)



(figure 4)

3. Solve the T-shaped determinant problem

After a deep study of the problem, I found that the ideal solution is to design a metal bracket that is installed and welded under the T-shaped vertical limiter, which in turn absolutely prevents the metal ball from coming out from the bottom and thus prevents the aircraft from being destroyed as shown figure



(figure 5)

4. Proposals

The development is carried out on all aircraft that have a T-shaped limiter.

Acknowledgements

I thank my fellow engineers working in the field of aviation for their continuous support, and I especially thank them for their encouragement to complete this design.

References

- [1] Aresearchers guide to aerospace engineering – Natalie Spagner (2019)
- [2] Aerospace engineering pocket reference –Sean Travaers (2015)
- [3] Aerodynamics of road vehiles - Tthomas Chirstian schuetz (2015)