Nov. 10, 1931. W. REED 1,831,136

SHOCK ABSORBING DEVICE FOR AEROPLANES

Filed Aug. 26, 1929

Fig. 1.

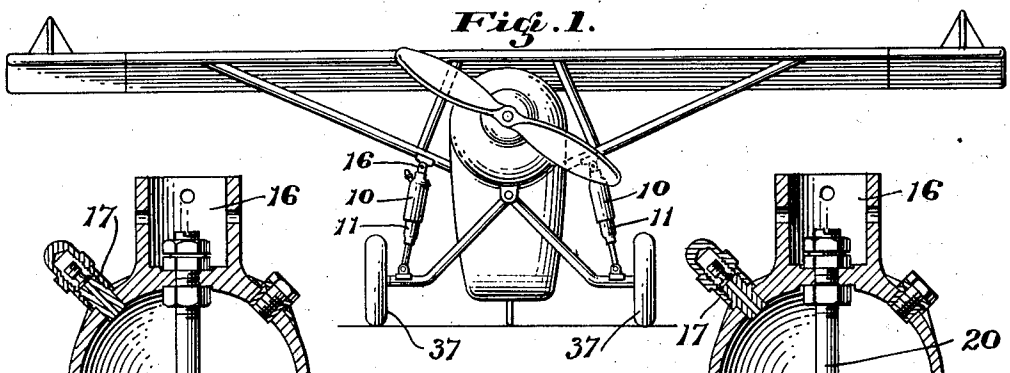


Fig. 2.

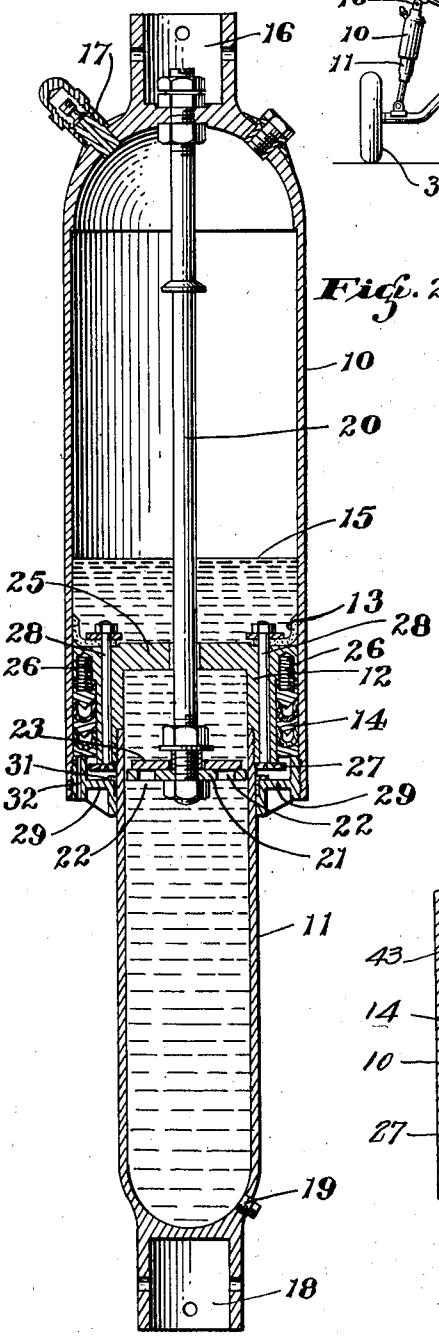


Fig. 3.

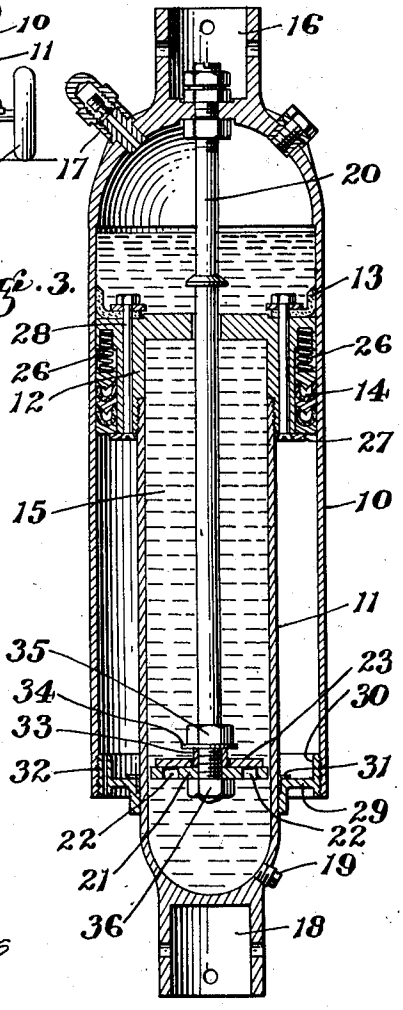
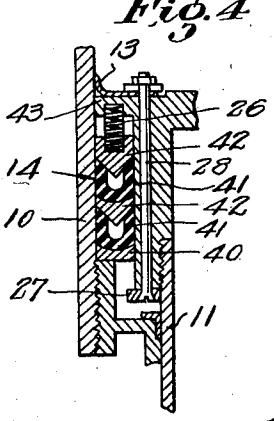


Fig. 4



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UNITED STATES PATENT OFFICE

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SHOCK ABSORBING DEVICE FOR AEROPLANES

Application filed August 26, 1929. Serial No. 388,515.

My present invention resides in the provision of a simply constructed, light, strong and durable shock absorbing device which may be readily incorporated with the running gear of an aeroplane and made to serve as a shock absorbing strut that will strengthen the running gear as well as positively and effectively check the shocks, jars and rebound actions which are occasioned in "taking off" and in landing aeroplanes.

An object of the invention is to provide a shock absorbing strut of the character described which employs a compressible cushioning medium and a non-compressible fluid in a novel and effective manner, together with such a construction and an arrangement of parts that the required cushioning action will be provided over a longer range of movement of the parts of the shock absorbing device than is required with similar devices when applied to land vehicles.

A further object is to provide in a device of the character described a novel means for causing a reliable checking of the shock and rebound actions, which means includes telescoped cylinders; a plunger carried by one cylinder with its especially constructed head working in the other cylinder, together with two mediums of control of the movements of these parts, one of which mediums will be a compressible yielding one to check and absorb violent shocks and jars, whereas the other medium will be non-compressible fluid and will hydraulically control the rebound action without detracting from the effectiveness of the shock cushioning medium.

Another object of my invention is to provide a novel arrangement of packings which will operate to effectively retain the oil or other fluid within the cylinders and, at the same time, operate in a novel way to properly lubricate the parts so that they will slide freely with respect to each other.

With the above mentioned and other objects in view, the invention consists in the novel construction and combination of parts hereinafter described, illustrated in the accompanying drawings, and set forth in the claims hereto appended, it being understood that various changes in the form, proportion, size and minor details of construction within the scope of the claims may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings—

Fig. 1 is a front elevation of an aeroplane of the monoplane type equipped with my improved strut,

Fig. 2 is a sectional view in elevation, showing the details and interior construction of my improved strut when extended, and

Fig. 3 shows the strut illustrated in Fig. 2 in its compressed condition.

Fig. 4 is an enlarged view in vertical section showing the details of construction of the packing.

In the present embodiment of my invention as illustrated in detail in the accompanying drawings, I show my improved strut in Figures 2 and 3 as having an upper cylinder 10 into which there telescopes a lower cylinder 11. The cylinder 11 carries a partial closing member 12 upon which there is maintained a suitable packing 13 which engages the inner wall of the cylinder 10 and immediately therebelow there is also a second packing 14 which also engages the interior wall of the cylinder 10. When the cylinders are thus assembled they will afford a liquid tight container which is adapted to hold a suitable non-compressible fluid 15, in the present instance a suitable oil. At the top of the cylinder 10 there is provided in addition to an attaching means 16, an air inlet valve 17 through which air under pressure may be injected into the cylinder 10 above the oil 15. At the lower end of the cylinder 11 there is also provided an attaching means 18, similar to the attaching means 16, the attaching means 16 and 18, it will be understood, are provided for the purpose of maintaining the strut upon the cooperating parts of the aeroplane fuselage and running gear adjacent to the attaching means 18. There is also shown a drain plug 19 by which means the cylinder 10 may be drained in order to renew the oil therein. With the above arrangement of parts it will be seen that when the cylinder 10 has been charged with a pre-determined amount of air under pressure and the cyl-

inder 11 filled with oil, that the parts will extend themselves, as illustrated, or to a point depending upon the amount of air pressure within the cylinder 10 and the weight being sustained. In other words, with an assembly as above described there will be provided what might be termed a pneumatic cushioning device air spring which will compress and extend in accordance with the forces applied thereto.

In order to provide a check against violent rebounding and recoil, I propose to provide a member 20 which is secured to the upper end of the cylinder 10 and extends axially downward therethrough to a point within the cylinder 11, and upon the end of the member 20 I provide a piston 21 which will function to check any tendency to rebound. The piston 21 is shown as provided with a plurality of openings 22 through which the oil 15 may flow freely and cooperating with the openings 22 there is shown a valve member 23 which operates somewhat after the fashion of a flap valve of a pump. This member 23, as will be readily understood, will function when in contact with the piston 21 to prevent a flow of oil through the openings 22 and in this manner it will restrict the flow of oil from above the piston 21 to the clearance between it and the walls of the cylinder 11, and thus act to check any sudden rebound or extension of the cylinders 10 and 11. This arrangement will at the same time permit a free flow of the oil 15 upwardly through the piston 21 so that full advantage may be taken of the elasticity of the air under pressure in the cylinder 10.

The packing generally indicated at 14 comprises a lower annular metallic seat 40 having a convex base upon which an annular packing ring 41 of substantially U or V section is positioned. The upturned edges of these members are inwardly inclined and receive the V-shaped face of the expanding rings 42. It is understood that the various metallic seats, expanding rings, and packings circumscribe the cylinder 11 and are interposed between the overhanging flange 43 of the cylinder 11 and a ring 27 carried by the cylinder 11 and spaced from the flange. The packing seats 40 and 42 and the packing rings 41 are capable of movement longitudinally of the cylinder 11 as confined between the flange 43 and the ring 27. This is due to the fact that expansion springs 26 are interposed between the upper metallic ring 42 and the flange 43, and also by reason of the movement taking place due to deformation of the packing rings 41 under varying operating and pressure conditions.

Upon examining the closure member 12 carried by the cylinder 11 it will be noted that it is provided with an inwardly extending flange 25 through the center of which the member 20 extends, with the provision of this flange 25 it will be seen that there will be present above the piston 21 a certain amount of compression of the oil 15 which will cooperate with the suction effect immediately below the piston in effecting the recoil checking action of the piston 21. It will also be noted that the closure member 12 also serves to support the packing 14 in a novel manner, in that the various portions of the packing 14 are adapted to move upon the head member 12. Normally, the packing member will be held in a position upon the head member 12, as illustrated in Figure 3 of the drawings, it being biased to this position by reason of a plurality of compression springs 26. These springs 26, it will be understood, are arranged in spaced relation around the head member 12 and in their operation tend to expand the packing portions of the packing 14. In order to retain the packing 14 upon a head member 12, I provide a ring 27 which has an overhanging edge against which the packing 14 abuts. This ring 27 is held in place by means of suitable studs 28 which also function to secure the packing 13 in place. With this arrangement it will be seen that when the packing 14 moves up and down upon the head member 12, as will be hereinafter explained, it will function to pump a portion of the oil 15 into and out of the space occupied by the springs 26.

Upon referring to the drawings, it will be noted that the lower end of the cylinder 10 is closed by member 29, through which the cylinder 11 projects. This member 29 is shown as having an upstanding outer annular flange 30 which is so disposed that the lower end of the packing member 14 will contact therewith when the strut is extended, as is illustrated in Figure 2 of the drawings. Under these conditions it will be noted, as illustrated in this figure of the drawings, that the packing member 14 is moved upwardly so as to compress the springs 26, and thus eject or pump any oil retained thereabout upwardly past the packing 13 and into the main body of oil This will serve to lubricate the walls of the cylinder 10 below the packing 13 and, in conjunction with the normal leakage of oil past the packing 13, serve to effectively lubricate all the parts. At the point in the member 29 where the cylinder 11 projects therethrough, there is also provided a dust excluding felt 31 which, under normal operating conditions will be saturated with oil resultingfrom any leakage past the packings 13 and 14, and, in this manner, the exterior wall of the cylinder 11 will also be properly lubricated.

In order to provide against air pressure within the cylinder 10 exterior to the cylinder 11, I have provided an air outlet or vent 32, through which any accumulation of air between these cylinders may escape. This vent will also admit air into these cylinders

as the two cylinders are compressed with respect to each other, and allow any excess accumulation of oil to escape.

In Figure 3 of the drawings, the strut is shown as in its compressed position with the member 23 in the position it will assume at the end of the compression stroke. The member 23 is in the form of an annular disc which slides freely upon a collar 33 held between the piston 21 and a washer 34 which abuts a nut 35, there being an additional nut 36 upon the end of the member 20 for retaining the piston in this assembled position.

Operation

When my improved strut is mounted upon a plane as shown in Figure 1 of the drawings, it will be understood that when the plane is in the air the parts of the strut will assume the positions illustrated in Figure 2 of the drawings. This will mean that the wheels 37 will assume their lowermost position and thus contact with ground will be made when the strut is most resilient. As the plane settles down and the wheels 37 take up the weight of the plane it will be understood that the strut will be compressed and that as the cylinder 11 telescopes into the cylinder 10, the air pressure within the cylinder 10 will be increased by reason of its compression until the pressure is sufficient to carry the weight of the plane. From the above it will be seen that upon landing the complete shock caused by contact of the wheels 37 with the ground will be absorbed by the air cushion within the cylinder 10.

In addition to absorbing the shocks upon landing, my improved strut will also provide for easy riding while taxiing the plane over the landing field as it will not only provide an air cushion complementary to the usual tires but also provide an effective rebound or recoil checking means which will prevent excessive rebound.

The operation of the recoil or rebound checking means is as follows, as the parts are compressed it will be understood that the cylinder 11 with its oil 15 will move upwardly past the piston head 21. During this movement the valve member 23 will assume a raised position which will permit the oil to flow freely through the openings 22. With this arrangement it will be seen that the piston head 20 will not seriously interfere with the free telescoping of the cylinders when under compression. When the plane rises or the wheels are suddenly brought out of contact with the ground as due to a rebound the valve member 23 will, when the cylinders 10 and 11 tend to extend themselves, move downwardly upon the piston head 21 and thus close the openings 22 therethrough so that any sudden extension of the cylinders 10 and 11 will thus be prevented.

With respect to the oil pumping operation as performed by the packing 14, it will be assumed, as described above, that the packing 14 will be at all times held in its lowermost position except when it comes in contact with the annular flange 30 upon member 29. Under these conditions it will be seen that any oil which escapes past the packing 13 will be entrapped between the packing 13 and the packing 14 in the cavity in which the springs 26 are located, and that upon the extension of the air spring to a position illustrated in Figure 2, it will be moved upwardly so as to eject or pump the oil thus entrapped back into cylinder 10 with the main body of oil so that, with this arrangement of the packing 13 and 14, there is provided a very effective oil and air sealing means between the cylinders. The relative movement of the cylinders 10 and 11 which will bring about a condition where the lower metallic seat 40 encounters the annular flange 30 of member 29 will tend to force the metallic rings 40 and 42 and the interposed packing 41 upwardly and compress them against the expansive action of the springs 26. This will have the desired effect of tending to spread the packing rings to make a tighter fit between the walls of the two cylinders, and to produce relative movement of the composite packing 14 with relation to the flange 43, so that any fluid which has leaked into the annular cavity between the flange 43 and the ring 27 will be forced outwardly into the cylinder 11 and around the free edge of the cup packing 13.

It will thus be seen that in the particular type of shock absorbing device here disclosed, and in other applications where a packing is required between relatively moving telescoping parts, that fluid will be effectively barred from passing between the parts, and any fluid which may reach the space between the contacting walls of the members will be ejected at the end of the stroke of the members.

While I have shown the preferred form of my invention as now known to me, I desire to have it understood that various changes may be made in the construction and arrangement of parts without departing from the spirit and scope of my invention as defined in the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In combination with a pair of members telescoping one within the other and having longitudinally reciprocating movement, a composite packing circumscribing the inner member and interposed between the faces of the two members, and means acting to produce longitudinal movement of the packing with relation to said members, whereby fluid entrained between the members will be ejected.

2. In combination with a pair of telescoping members having longitudinally recipro-

cating movement with relation to each other, a cup packing carried by the inner member and frictionally engaging the wall of the outer member, a secondary packing circumscribing the wall of the inner member and interposed between the faces of the two members, and means acting at the end of the stroke of the members whereby the secondary packing will eject fluid which has leaked past the cup packing.

3. In combination with a cylinder closed at one end, a member adapted to reciprocate longitudinally within said cylinder, a cup packing carried by said reciprocating member and having its annular flange contacting with the circumscribing wall of said cylinder, an annular packing carried by the reciprocating member and interposed between it and the circumscribing wall of the cylinder, said annular packing having relative longitudinal movement with relation to the reciprocating member, and means for producing said movement at the end of the stroke of said reciprocating member whereby fluid which has leaked around the cup packing and into the space between the two members will be ejected from said space.

4. In combination with a cylinder and a member adapted to longitudinally reciprocate therein, packing means carried by the cylinder to confine a fluid in the space between the end of the reciprocating member and the cylinder head, a compressible packing circumscribing the reciprocating member and interposed between it and the cylinder wall, and means acting to compress said packing at the end of the stroke of the reciprocating member whereby fluid which has leaked around the first named packing will be ejected from the space between the relatively moving members.

5. In combination with a cylinder and a member reciprocating therein, a cup packing secured at the end of the reciprocating member and adapted to be forced outwardly against the wall of the cylinder as the reciprocating member moves into the cylinder and toward the cylinder head, an annular space formed around the reciprocating member and into which fluid which has leaked between the cup packing and the cylinder wall will pass, and means within said annular space and acting at one end of the stroke of the reciprocating member to cause the fluid in said space to be returned to the cylinder.

6. In combination with a cylinder and a member reciprocating therein, a cup packing secured to and adjacent the end of said reciprocating member with its annular flange extending along the cylinder wall, and tending to be forced outwardly as the reciprocating member moves into the cylinder, an annular packing groove formed around the reciprocating member, an annular packing disposed within the groove and forming a seal between the cylinder wall and the reciprocating member, said packing having longitudinal movement within the groove, means yieldably holding said packing at one end of the groove, and means whereby the packing will be moved toward the opposite end of the groove at the end of the stroke of the reciprocating member to eject fluid which has leaked between the wall of the cylinder and the reciprocating member.

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