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CONSTRUCTION OF RETRACTABLE LANDING GEAR

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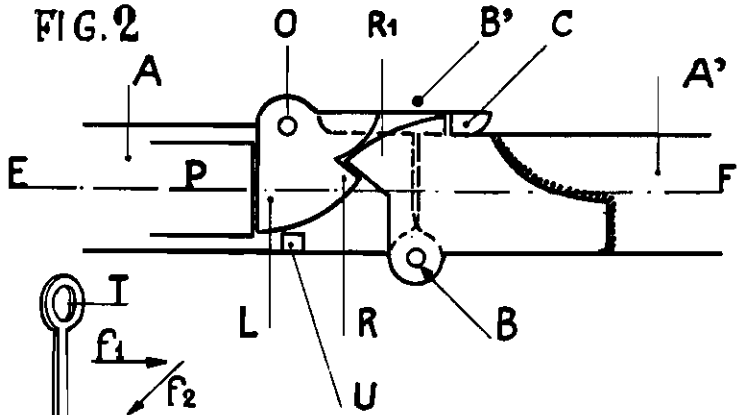
2 Sheets-Sheet 1

FIG. 2



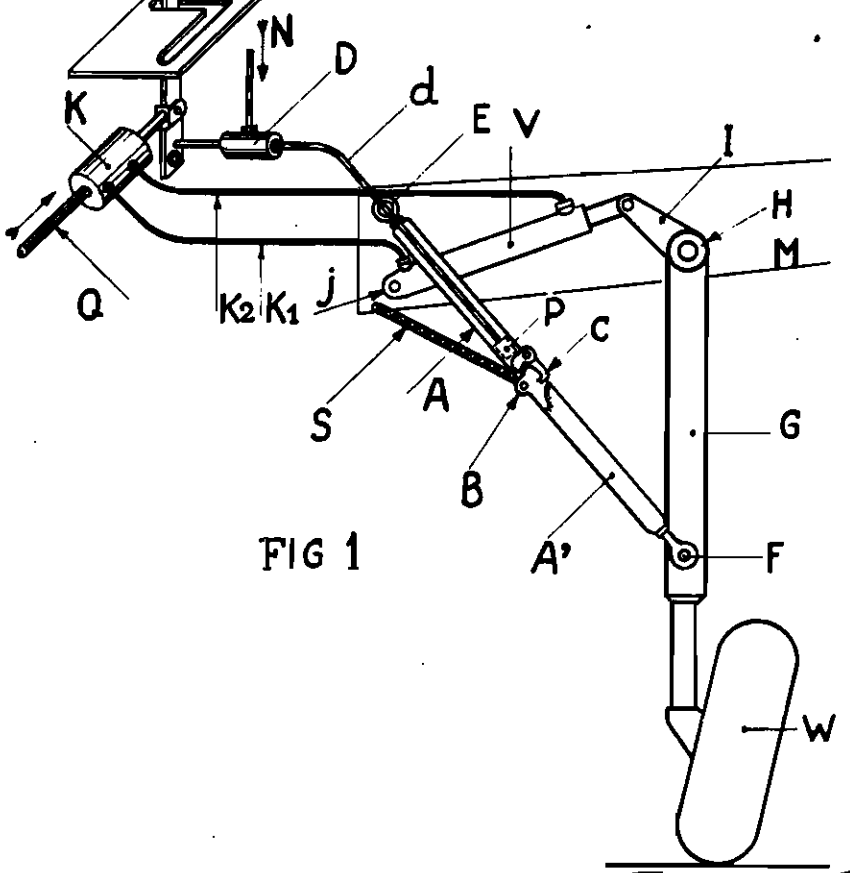


FIG 1

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FIG. 3

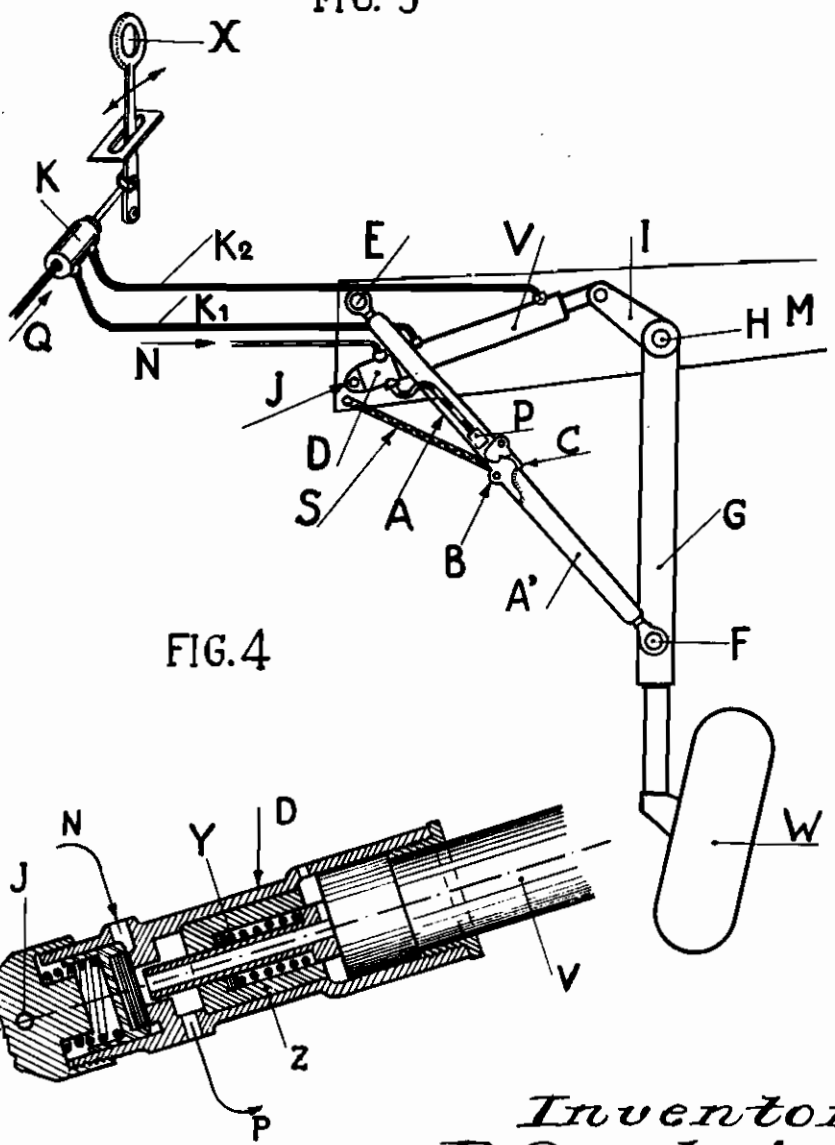

FIG. 4

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ALIEN PROPERTY CUSTODIAN

CONSTRUCTION OF RETRACTABLE LANDING GEAR

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The present invention relates to retractable landing gears of the type including a shock absorber which carries the wheel, pivoted to a fixed point of the airplane structure and maintained in the landing or extended position by a breakable strut pivoted on the one hand to a fixed point of the airplane and, on the other hand, to a point of the shock absorber.

The invention relates more particularly to landing gears of this type, in which the point at which the strut is pivoted to the shock absorber is located close to the lower end of the cylinder of the shock absorber, which ensures a very good resistance during landing.

In a more specific manner, the invention relates to retractable landing gears in which the strut is made of two portions pivoted to each other substantially at the middle point of the strut, in such a manner that, when the gear is in the landing position, the point of articulation of the two portions of the strut passes beyond the dead center position, so as to improve safety when landing, independently of the locking of the strut.

According to the invention, the folding or retracting of the landing gear is effected in two steps, the first of which consists, after the strut has been released, in breaking it so as to cause, in the particular case just above mentioned, the point of articulation to pass on the other side of the dead center line, the second step being performed by the action of a jack pivoted on the one hand to a fixed point of the airplane and, on the other hand, to the end of a lever rigid with the shock absorber, so as to cause the latter to pivot about the point at which it is mounted on the airplane.

One of the most serious difficulties which have to be dealt with in retractable landing gears, is to ensure the retraction of the gear with the minimum of efforts, which implies an efficient utilization of the power of the retracting means.

An object of the present invention is to provide a retracting device such that the first step, which starts the breaking of the strut, and the second step which causes the shock absorber to pivot about its point of articulation on the airplane, are produced by a thrust directed along a line making an angle as small as possible with the optimum direction, account being taken of the efforts to be exerted.

For this purpose, according to a feature of my invention, the strut includes a system of levers intended to break this strut and, in particular, to move the point of articulation thereof from one side to the other of the dead center line.

According to another feature of the invention, the lifting device proper is arranged in such manner that the lever arm on which the jack is to act increases, during the lifting movement, as the resistance itself increases, whereby the effort to be supplied by the jack never reaches very high values, since the force to be exerted at the end of the movement is relatively small.

Other features of my invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of my invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example and in which:

Fig. 1 is a diagrammatic front view of a landing gear made according to the invention;

Fig. 2 is a detailed view showing on an enlarged scale the means for releasing the strut and breaking it;

Fig. 3 is a view similar to Fig. 1, showing another embodiment of the invention;

Fig. 4 is a detailed view showing on an enlarged scale the valve of the operating jack used in connection with the device of Fig. 3.

In the embodiments of Figs. 1 and 2, G is the shock absorber which carries a wheel W and is pivoted at H to a fixed part M of the airplane. The shock absorber may be maintained or not in its plane, parallel to the fore-and-aft plane of symmetry of the airplane, by a thrust bar, the latter being eventually pivoted to a fixed part of the airplane at a point located behind point H, so that the whole can pivot about a longitudinal axis passing through these two points. The landing gear further includes a strut constituted by two portions A and A' pivoted to each other near the middle point thereof at B. These two portions are locked in the landing position by a locking member C which is shown in a more detailed manner by Fig. 2. This locking member is preferably controlled pneumatically by a valve D. E and F are the points where the strut is pivoted to the airplane and to the shock absorber respectively.

The retraction of the landing gear is obtained by rotating shock absorber G about point H, this movement being produced by the action of a jack V, one of the ends of which is pivoted to the airplane at a point J, while the other end is pivoted to an arm I rigid with the shock absorber.

Reference character T designates the operating

member, N is the compressed air inlet, K a distributer for controlling the inflow of oil under pressure and Q a conduit through which oil is fed to the distributor. Distributor K is further connected through pipes K^1 and K^2 to the respective ends of jack V. Finally, valve D is connected through a pipe *d* to a pneumatic piston P housed in strut A, A'.

This device will work in the following manner:

The first movement of the operating lever T, in the direction of arrow f^1, opens valve D, which causes compressed air to be fed into pipe *d*. Pneumatic piston P is actuated by this compressed air and pushes lever L, pivoted about an axis O, so as to bring the locking member C rigid with lever L (see Fig. 2), into inoperative position.

When the strut has been released, during the second part of the same movement, a projection R of lever L strikes a corresponding projection R' of portion A' of the strut, whereby the thrust of piston P breaks the strut just when the two projections disengage from each other. At this time, the movement of piston P is stopped by a lug U. During this movement, the point B about which the two portions of the strut are pivoted to each other, passes from a position below line E—F (where it was jammed in order to increase safety in case of non-operation of the locking means) to the position B' on the other side of said line E—F. The operating lever T is now at the end of its displacement in the direction of arrow f^1.

The second movement of this operating lever T, in the direction of arrow f^2, has for its effect to open, through distributer K, the inlet of oil under pressure, which passes through conduit K^1 into jack V, which pushes lever I and causes, by rotation of the shock absorber, the landing gear to be fully folded by the breaking of strut A—A'.

In the example which has just been described, the operating lever T is given two successive movements, one serving to control the pneumatic piston which starts the breaking of the strut, and the other operating the jack, which finishes the lifting operation.

In the embodiment shown by Fig. 3, the pneumatic control valve D is located between jack V and the point J of fixation thereof to the airplane. In this embodiment, the operation of the lifting device is simplified since it suffices to control the distributer K of oil under pressure.

When the operating lever X of Fig. 3 is moved, oil under pressure is fed through conduit K^1 to the jack, which tends to push lever I, on the one hand, and to open valve D on the other hand. As lever I resists the thrust thus transmitted thereto, because strut A—A' is locked and therefore cannot break, jack V compresses spring Y (see Fig. 4) and permits valve D to open. The compressed air fed through inlet N to this valve acts on piston P, brings locking member C into inoperative position and starts the breaking of the strut in the way above explained. The jack now bears against a piece Z, provided in the valve for limiting the movement, and lifts the shock absorber by pushing lever I.

The landing gear according to the invention has many advantages, among which the following may be cited:

First, the safety obtained when landing is very high, since the shock absorber is well adapted to resist transverse stresses, as it is held at a very low level by the strut. Furthermore, the latter cannot break accidentally since, even when it is not positively locked, said strut is blocked in the extended position by the compression stresses, in view of the position occupied by articulation B with respect to the direction E—F of the stresses. Therefore there is practically no risk of an accidental folding of the gear during landing, even under the most difficult conditions.

On the other hand, the landing gear is also very safe concerning the unfolding thereof. This operation is ensured by the weight of the landing gear, the counter-pressure in the jack and elastic cable S acting on strut A—A'.

Another advantage of the landing gear, according to the invention, consists in the fact that the stresses necessary for lifting the gear are reduced to a minimum. As above explained, the first movement, which starts the breaking of the strut, while unlocking it, necessitates but a very small effort in view of the particular arrangement of the levers and the projections carried by the parts of the strut. Furthermore, the lever arm, on which the lifting jack is acting, increases with the effort to be supplied, as above explained.

RAYMOND SAULNIER.