May 22, 1945. R. H. MILES 2,376,374

LANDING GEAR FOR FLYING MACHINES

Filed June 1, 1942 2 Sheets-Sheet 1

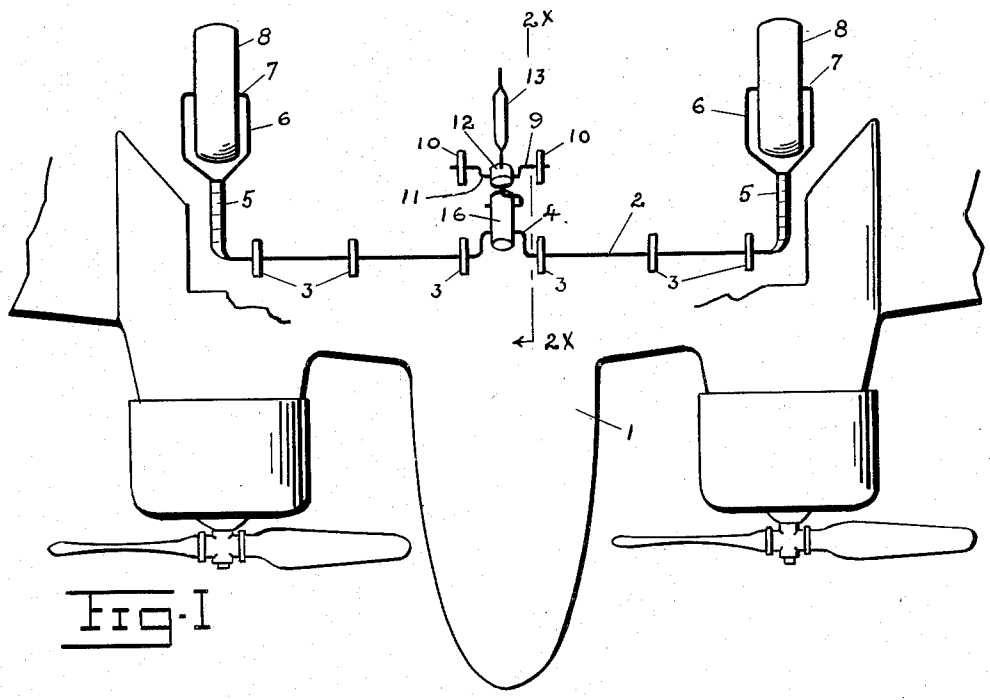


Fig. 1

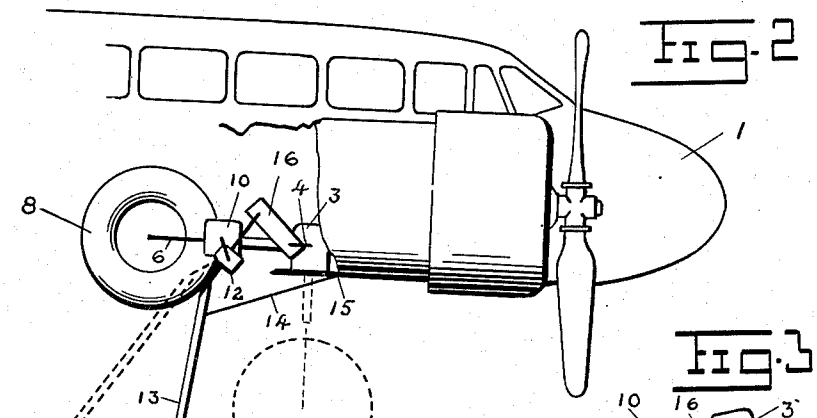


Fig. 2

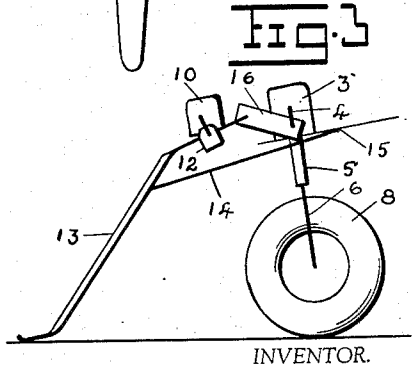


Fig. 3

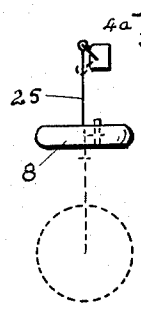


Fig. 4

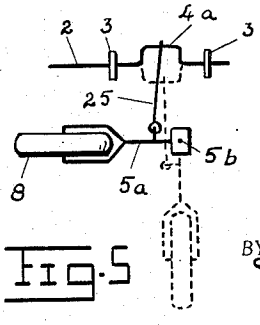


Fig. 5

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LANDING GEAR FOR FLYING MACHINES

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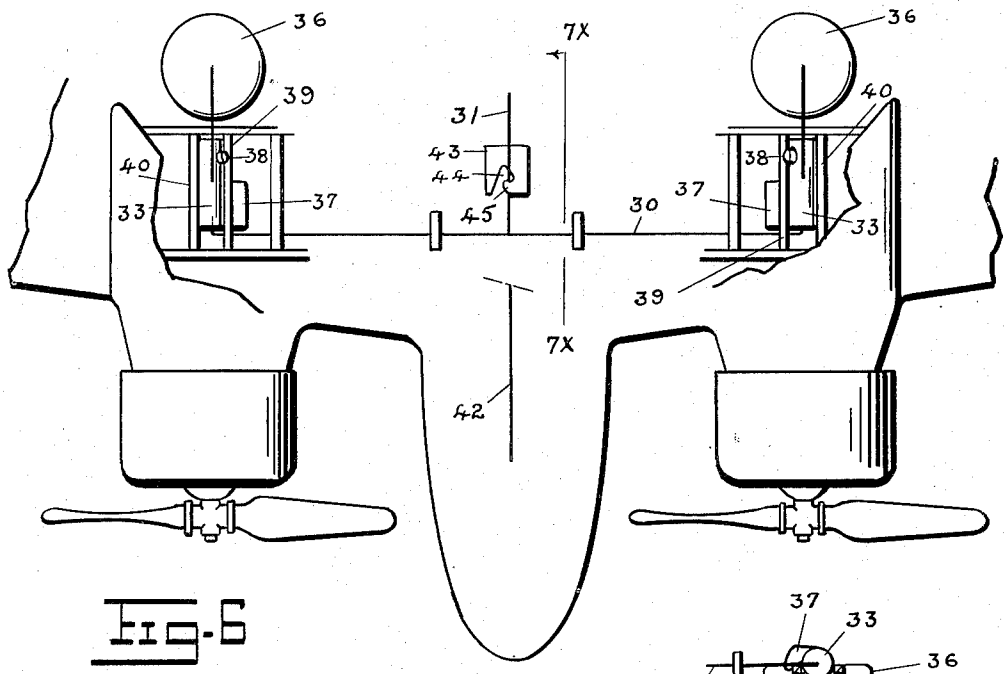
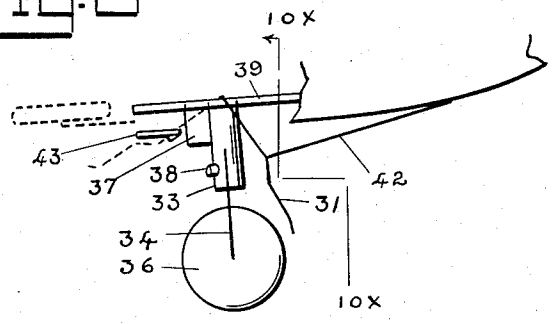


Fig-6

Fig-9

Fig-8



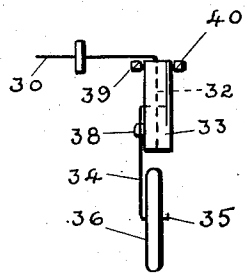


Fig-10

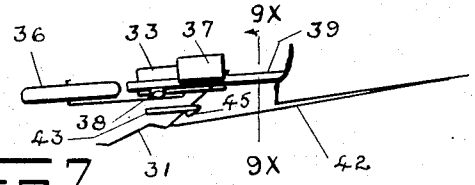


Fig-7

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2,376,374

LANDING GEAR FOR FLYING MACHINES

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Application June 1, 1942, Serial No. 445,290

5 Claims. (Cl. 244—102)

The object of this invention is to provide a new and improved landing gear for aeroplanes or flying machines which landing gear can be used either on a full sized flying machine or on a toy machine or on machines of intermediate sizes.

Another object of the invention is to provide means by which the wheels which are used to support the flying machine when resting or travelling on the ground will automatically be drawn up into the streamlined body of the flying machine as soon as the machine leaves the ground and will be brought down into landing or running or supporting position just before the flying machine can make contact with the ground.

Another object of the invention is to provide an arm that is pivoted on the body of the flying machine and normally extends down from the body of the flying machine so that the lower end of the arm will come into contact with the ground and will be swung rearward and upward as it trails along the ground. The upward movement of this arm is adapted to cause the landing wheels to be brought down into landing position under the body of the flying machine.

These and other objects of the invention will be fully illustrated in the drawings, described in the specification and pointed out in the claims at the end thereof.

In the drawings

Figure 1 is a bottom plan view of the landing mechanism with a skeleton view of the flying machine around it partly broken away, showing the relation between the fuselage of the flying machine and the landing gear.

Figure 2 is a side elevation of the flying machine partly broken away showing the landing mechanism in section, the section being taken on the line $2x$—$2x$ of Figure 1.

Figure 3 is a skeleton view of the landing mechanism showing the position of the parts when the wheels have been brought to their proper position on the ground under the flying machine. In each position in Figures 1, 2 and 3, the axis of each of the wheels in each case is horizontal or parallel to the horizontal axis of the machine.

Figure 4 shows a modified form of the landing mechanism in which one of the landing wheels is shown in dotted lines as it would appear in normal contact with the ground and shows the same landing wheel in full lines in retracted position. The position of the axis in the landing wheel when the wheel is in contact with the ground is horizontal and when it is drawn up the axis is perpendicular to its former position. It also shows the mechanism by which the wheel is moved from either position to the other.

Figure 5 shows the same mechanism and wheel of Figure 4 as it would appear when viewed from the right. In each case the front wheel on the far side of the plane is shown. Figure 4 shows one of the landing wheels as viewed from the side of the plane and Figure 5 shows the same landing wheel as viewed from the front of the plane.

Figure 6 is a bottom plan view of the plane containing another modification of my landing gear.

Figure 7 is a sectional view of the landing gear of Figure 6, the section being taken on the line $7x$—$7x$ of Figure 6 looking in the direction of the arrow.

Figure 8 shows the parts of Figure 7 as they will appear when the landing wheel has been brought into contact with the ground.

Figure 9 is a sectional view on the line $9x$—$9x$ of Figure 7 looking at it from the front of the machine or in the direction of the arrow, the section showing one of the landing wheels and the arm that supports it and the shaft by which the arm is operated the parts being in the position shown in Figures 6 and 7, the operating lever being omitted.

Figure 10 is a section on the line $10x$—$10x$ of Figure 8 the landing wheel being shown down in contact with the ground the operating lever being omitted.

In the drawings like numerals indicate like parts.

Reference numeral 1 indicates the body or fuselage of the machine.

2 indicates a rock shaft mounted in bearings 3, 3 on the body of the machine. In the middle of this rock shaft is provided a crank 4 and on either end of the rock shaft is provided an arm 5 each of which arms is bifurcated on the lower end as indicated at 6, 6 so as to provide two legs which support the shaft or axle 7 on which each of the wheels 8, 8 are adapted to turn.

Mounted parallel to the shaft 2 is the shaft 9 which shaft is rigidly supported in bearings 10 so that it can not turn therein. This shaft 9 is offset at its intermediate part so that it has the form of a crank 11, but as the shaft is stationary the crank does not turn or swing. On this intermediate part is mounted a bearing block 12, which is free to swing on the intermediate part of the shaft, but cannot slip sideways thereon. Mounted to slide in this bearing block 12 is the upper end of the lever 13, the lower part of which is adapted to trail on the ground when the land-

ing is made. When the machine is in flight the parts are in the position shown in Figure 2, the lever being held in this position by the tension of the spring 14 the rear end of which is attached to the lever 13 and the forward end of which is attached to the body of the flying machine as indicated at 15. When the machine lands the lower end of the lever 13 swings from the full line position shown in Figure 2 to the dotted line position and turns the bearing block 12 on the intermediate part of the shaft 9. The upper end of the lever 13 is attached to the rear end of the link 16, the forward end of which is attached to the crank 4 on the shaft 2. As soon as the lower end of the lever 13 touches the ground the upper end of the lever pushes on the link 16 and pushes the crank 4 from the position shown in Figure 2 to the position shown in Figure 3. In so doing the upper end of the lever 13 and the link 16 acts as a toggle causing the upper end of the lever 13 to slide down in the bearing block 12 so that the lever 13 and the link 16 stand almost in line with each other.

When the parts have reached this position, the arms 5, 5 and the wheels 8, 8 carried thereby are swung down from the full line position shown in Figure 2 to the dotted line position shown in Figure 2 and to the full line position shown in Figure 3. When the toggle has nearly straightened itself the lever holds the wheels in the correct landing position. The lever 13 when resting on the ground, holds, the wheels 8, 8 in the position shown in Figure 3 much more firmly than if the toggle arrangement were not present. When the plane takes off of the ground and the lever 13 rises from the ground the spring 14 contracts and draws the lever to the full line position shown in Figure 2 and this in turn draws the wheels to the full line position shown in Figure 2.

It will also be understood that by placing a rock shaft similar to the rock shaft 2 at the rear of the machine and connecting this with a long link to the lever 13, the extra shaft could be used to support a tail wheel, and operate the tail wheel in the same manner that the wheels 8, 8 are operated.

In Figures 4 and 5 I have shown a modified form of the landing mechanism in which the wheels instead of swinging rearwardly up into the body of the flying machine are caused to swing sideways up under the body of the flying machine. For this purpose the shaft 2 and crank 4 is used as above described. A crank 4*a* is provided at each end of the shaft 2. To each of these cranks 4*a* a link 25 is attached, which link is connected to the arm 5*a* pivoted at 5*b*. The wheel 8 is carried on the lower end of the arm 5*a*. When the shaft 2 rocks as the lever 13 moves from the full line position to the dotted line position, the crank 4*a* rocks from the full line position shown in Figure 4 to the dotted line position shown in Figure 4 and pushes the wheel 8 down so that it makes contact with the ground. When this happens the lever 13 stretches the spring 14. When the machine leaves the ground the spring 14 shortens and causes the crank 4*a* to rock in the reverse direction pulling the wheel 8 from the dotted line position in Figure 5 to the full line position shown in Figure 5.

The parts shown in Figures 4 and 5 are in the position which they would have on one side of the machine and the corresponding parts on the other side of the machine would appear in position reversed from right to left. When the wheels are drawn off the ground the wheels would be drawn toward each other, and when they are moved down into contact with the ground they would be moved away from each other.

In Figures 6 to 10 inclusive I have shown still another modified form of the landing mechanism in which 30 indicates the rock shaft having the lever 31 fastened centrally thereon. Each end of the shaft 30 is turned up to form an arm 32 extending at an angle of about 30° to the lever 31. On each of these arms is swiveled a block 33. On this block is carried an arm 34 which turns with the block 33. The lower end of the arm 34 is turned at right angles to form an axle 35 for the wheel 36. When the wheels are retracted the parts will be in the position shown in Figure 6 which shows the parts retracted as they would appear when viewed from below the machine.

In this position the rim of each wheel is in a plane parallel to the wing of the flying machine and is nested inside of the wing. If the wheels are merely swung down from this position shown in Figure 6 they would slide along the ground instead of roll. The wheels in order to roll on the ground must not only swing 90° with the rock shaft 30 but must also swing 90° on the arms 32 as the arms swing.

The result is secured as follows:

As above stated the block 33 is swiveled on the arm 32 and can turn thereon. On each of the blocks 33 are lugs 37 and 38. On the frame of the machine are provided the bars 39 and 40. The block 33 swings between these bars 39 and 40. When it swings down from the position shown in Figure 6 the big lug 37 contacts with the top side of the bar 39 and causes the block 33 to turn at right angles as the wheel and block are swung toward the ground. This brings the wheel 36 in to correct landing or trailing position so that it will rotate on the ground.

When the block 33 swings up in the opposite direction the small lug 38 will contact with the underside of the bar 39 and cause the block 33 and the wheel 36 carried thereby to turn at right angles so that the rim of the wheel is held in a plane parallel to the wing of the flying machine. The big lug 37 is made wide enough so that when the wheel 37 is in position to make rolling contact with the ground the lug 37 will fill the opening between the bars 39 and 40 and will hold the block 33 and the axis of the wheel against swiveling or turning.

The lever 31 is held in the full line position shown in Figure 8 by a spring 42. When the lever is swung back to the dotted line position shown in Figure 8 or to the full line position shown in Figures 6 and 7, the lever is positively held in this position by engaging with the plate 43 which plate has a V-shaped recess 44 cut therein. On one side of this recess is formed a shoulder 45. The wheels are retracted manually after the flying machine has left the ground, the operator pulling the lever 31 up from the full line position shown in Figure 8 to the dotted line position shown in Figure 8 at which time he swings the lever 31 into engagement with the shoulder 45. In this position the spring 42 is stretched to the position shown in Figure 7.

When the machine reaches the ground the lever 31 will strike the ground and will be swung rearwardly away from the shoulder 45 and against one side of the V-shaped recess which will act as a cam to throw the lever sideways away from the shoulder 45 permitting the lever to be pulled out of the recess by the contraction of the spring 42

thereafter bringing the landing wheels 35 down into correct running position on the ground.

It will also be understood that the lever 13 block 12 link 16 of Figures 1, 2 and 3 can be used interchangeably with the lever 31 etc. of Figures 6, 7 and 8 for the purpose of controlling the position of the landing wheels.

I claim:

1. In a landing gear for flying machines the combination of the body of the flying machine, a fulcrum mounted to rock thereon, a lever mounted to slide in and rock with the fulcrum, a link connected to the end of the fulcrum, a rock shaft having a crank therein to which the link is connected, arms extending at right angles to the ends of said rock shaft and forming a part thereof, a wheel mounted to rotate on the end of each of said arms, the parts being so connected that on the lifting of the end of the lever, the arms and the wheels are brought down from their normal position and on the lowering of the end of the lever the wheels are raised into their normal position.

2. In a landing gear for flying machines the combination of the body of the flying machine, a fulcrum mounted to rock thereon, a lever mounted to slide in and rock with the fulcrum, a link connected to the end of the fulcrum, a rock shaft having a crank therein to which the end of the link is connected, arms extending at right angles to the end of said rock shaft and forming a part thereof, a wheel mounted to rotate on the end of each of said arms, said arms being normally held in a horizontal position with the wheels close to the body of the flying machine and the lever depending from the body of the flying machine, the parts being so connected that when the end of the lever makes contact with the ground it is swung rearwardly and upwardly from its normal position thereby causing the wheels to be brought down from their normal position into running contact with the ground.

3. A landing mechanism for an airplane comprising a pair of arms swingably mounted on the body of the airplane, said arms each including a block mounted for rotation about the longitudinal axis of the arm, a landing wheel mounted on each of said blocks, means for causing said arms to swing up rearwardly from an extended position to a position under the body of the airplane, guide bars mounted horizontally on the airplane body at opposite sides of the arms and in parallelism with the movement thereof, and a lug on each block arranged to engage with an adjacent one of said bars as the arms are swung up to turn the block and associated wheel to a position in which the plane of the wheel is horizontal.

4. A landing mechanism for an airplane comprising a pair of arms swingably mounted on the body of the airplane, said arms each including a block mounted for rotation about the longitudinal axis of the arm, a landing wheel mounted on each of said blocks, means for causing said arms to swing up rearwardly from an extended position to a position under the body of the airplane, a horizontal bar mounted on said body adjacent each of said arms and in parallelism with swinging movement thereof, and a lug on each block arranged to engage with the adjacent bar as the arms are swung up to turn the block and associated wheel to a position in which the plane of the wheel is horizontal.

5. A landing mechanism for an airplane comprising a pair of arms swingably mounted on the body of the airplane, said arms each including a block mounted for rotation about the longitudinal axis of the arm, a landing wheel mounted on each of said blocks, means for causing said arms to swing up rearwardly from an extended position to a position under the body of the airplane, a horizontal bar mounted on said body adjacent each of said arms and in parallelism with swinging movement thereof, a lug on each block arranged to engage with the adjacent bar as the arms are swung up to turn the block and associated wheel to a position in which the plane of the wheel is horizontal, and a second lug on each block arranged to engage the adjacent bar and turn the block and associated wheel in a reverse direction as the arms are swung down.

ROBERT H. MILES.