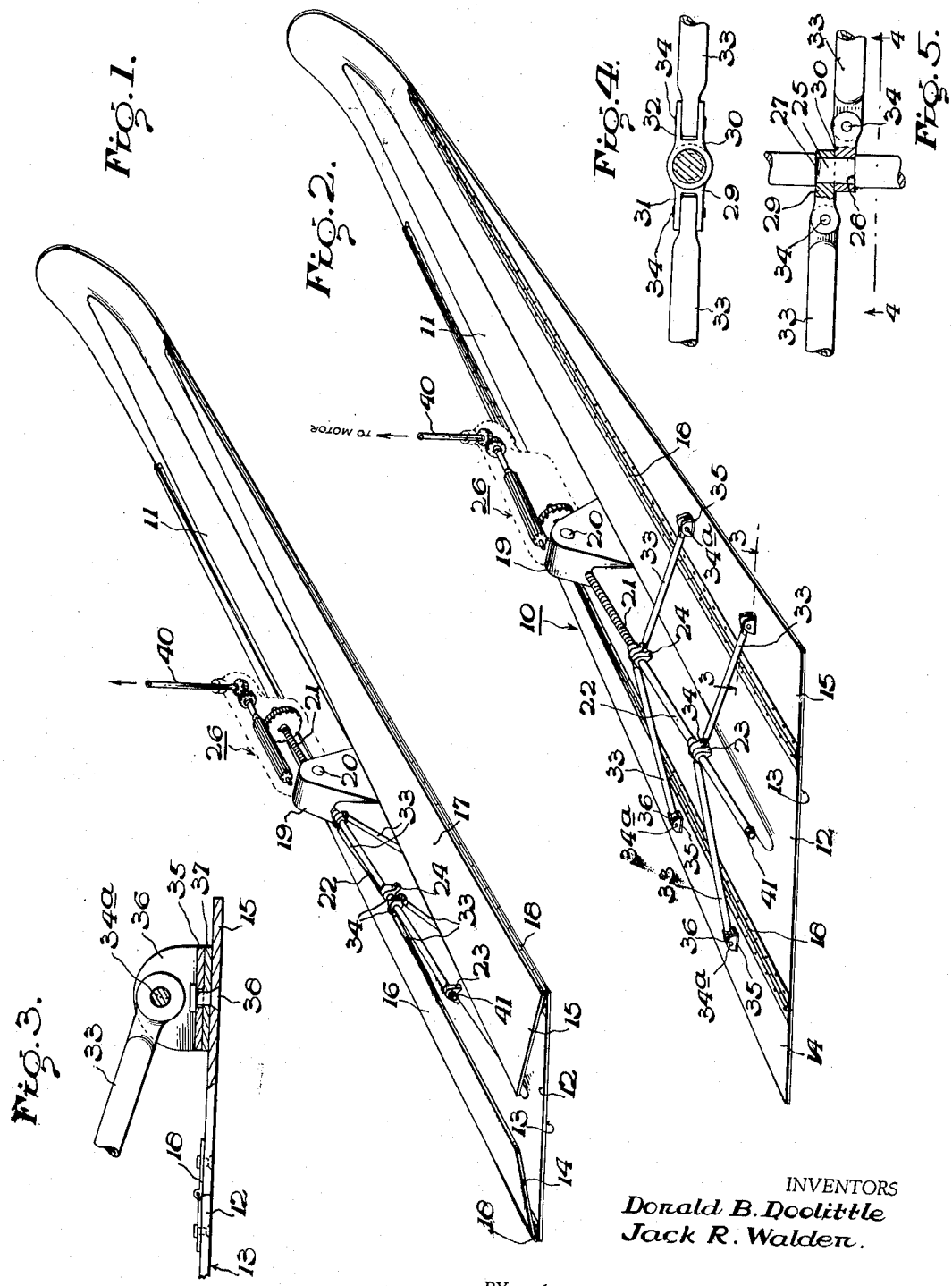
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PLANING SURFACE FOR AIRCRAFT AND HYDROCRAFT

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PLANING SURFACE FOR AIRCRAFT AND HYDROCRAFT

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Our present invention relates to aircraft undercarriages equipped for safe landings on various surface mediums, as water, snow, mud, grass or any combination of these mediums.

Heretofore, there have been developed various pontoon arrangements for landing on water. These pontoons are bulky and displace considerable water making all landings and take-offs slow. Also, pontoon structures cannot land safely on other than water surfaces, unless they are incorporated with landing wheels. The many disadvantages of pontoons are avoided by our present discovery and invention of a novel hydro-ski for airplanes. This hydro-ski permits safe, efficient and extremely rapid landings and take-offs from water of any depth, and in addition permits substantially equal landing and take-off performances on landing surfaces of all descriptions, such as marshes, grass, and the like.

An object of our invention is to provide a novel planing surface for airplane undercarriages adapted to land on many forms of landing medium.

Another object of our invention is to provide a hydro-ski for airplanes.

A more specific object is to provide a ski for airplanes which permits landing on water or land surfaces and also permits taking-off from water or land surfaces.

Another object is to provide a novel hydro-ski formed with a variable planing surface adaptable for landings and take-offs on and from any suitable medium.

A further object is to provide automatic control of the variable planing surface of a landing ski.

Many other objects and advantages of our invention will appear from the following detailed description, which refers by reference numerals to the several similarly numbered parts of the attached drawing embodying one form of the invention.

In the drawing:

Figure 1 is a top side perspective view of one form of our hydro-ski with a variable planing area.

Figure 2 is a top side perspective view of the form of Figure 1 shown with the planing area increased to maximum.

Figure 3 is a partial cross section view of one part of the connecting means used in the present form of our invention for varying the planing surface, taken along line 3—3 of Figure 2.

Figure 4 is a partial cross section view taken transversely of the variable planing surface actuator shaft and its connecting rods or links coupled to the part shown in Figure 3 and taken on the line 4—4 of Figure 5.

Figure 5 is a top view of the said actuator shaft partly in cross section and partly in elevation.

Referring in detail to the drawing and first with particular reference to Figure 2, there is

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illustrated a top view of a hydro-ski 10 formed with a central reinforcing rib 11 along its top section and a variable planing surface comprised of a main central section 12 with a planing surface 13 and side flap sections 14 and 15 having auxiliary planing surfaces 16 and 17, respectively. Each auxiliary planing surface is pivotally secured along each longitudinal edge of the main planing surface 13 by suitable means, such as the elongated hinge 18.

The hinge 18 permits the auxiliary planing surfaces 16 and 17 of the side ski flap sections to swing angularly with respect to the main planing surface 13 of central section 12 from an aligned unfolded position, as in Figure 2, into a folded position, as shown in Figure 1.

The central reinforcing rib 11 of the hydro-ski is formed with a pyramidal axle mounting 19. The axle mounting 19 has a through transverse opening 20 for receiving the axle of the aircraft undercarriage, to thereby mount the ski for use. The axle mounting of each pair of hydro-skis used serves as an operating base for the thread end 21 of an actuating rod 22.

The threaded end 21 of the actuating rod 22 threads completely through the axle mounting 19 in a threaded opening formed therein below and at right angles to the axle opening 20 and the unthreaded end of the rod is slidable through guide fittings 23 and 24 on top of the rib 11. The sliding action of the rod 22 caused by the threading in and out of the same in the axle mounting may be driven by any suitable power means, such as the gear train 26 and electrically or hydromatically driven shaft arrangement shown in Figures 1 and 2.

The actuating shaft 22 is formed with spaced apart short sections 25 of reduced diameter, thereby providing oppositely facing shoulders 27 and 28. Loosely encircling each reduced section 25 are pairs of connections 29 and 30 with apertured bifurcated ends 31 and 32. Each pair of connections have their respective bifurcated ends 31 and 32 extending radially from the rod 22 in opposite directions and pivotally connect with the apertured end of a link arm 33. When the bifurcated ends are coupled to a link arm 33 by suitable means, such as a vertical rivet or pin 34, see Figures 4 and 5, care is had to have the actuating rod 22 positioned on the rib 11 so that each set of connections 29 and 30 are on the inner or leading side of the fittings 23 and 24, respectively. When thus positioned the fittings serve as limit stops to control the axial thrust of the actuating rod 22 when the flap sections 14 and 15 are unfolded as will be more fully explained hereinafter.

There are similar link arms 33 connected to each one of the bifurcated ends of the connections 29 and 30. As shown in Figure 2 these links extend from each side of the actuating rod 22, and each of their extended ends are pivotally coupled by a pin 34a to a swivel bushing 35 formed

with upstanding spaced apart apertured ears **36** through which the pin **34a** extends, see Figure 3. Each of the bushings **35** have a base formed with a central opening mounted on a bearing plate **37** also with an opening aligned with the opening in the bushing base. Each swivel bushing **35** and the bearing plate **37** are secured together by a headed rivet **38** riveted to the top surface of their respective foldable ski section or flap **14** or **15**, so the bushing **35** is free to swivel or turn on bearing plate **37** when the actuating rod **22** is pulled forward with the arms **33** to raise or fold the side sections or flaps **14** and **15**. As shown these side flaps are of triangular shape to thereby merge with the leading end of the ski body **10**.

Operation

The variable planing surfaces of the hydro-skis are controlled from the pilot's seat by any suitable control means, not shown. This control means imparts power through shaft **40** and gear train **26** to drive the actuating rod **22**, see Figures 1 and 2.

When landing a plane equipped with hydro-skis on water the pilot maintains a taxiing speed as low or high as necessary to keep afloat. The more planing surface area provided the slower the taxiing speed may be and accordingly as the aircraft is slowed down the pilot may unfold the flaps **14** and **15** to increase the planing surface and thus compensate for reducing taxiing speeds.

When the flaps **14** and **15** are folded as in Figure 1, the actuating rod **22** is positioned forward from the trailing end of the rib **11** and the connecting links **33** are angularly directed toward the axle mount **19**. This position of the links is permitted because of the swivel bushing **35** and the pivoted connection of each link **33** on a pin **34**. The forward movement is stopped by suitable means, such as enlarged nut **41** on the end of shaft **22**.

As power is applied to the actuating rod **22** through gear train **26**, for example, the thread section **24** moves axially toward the trailing end of the hydro-ski **10** and turns the links **33** on their respective pivot pins **34**, until the connections **29—30** and **31—32** abut against the actuator shaft or rod guides **23** and **25** respectively. During the rearward sliding movement of the actuator rod **22** the links **33** impart power to unfold the flaps or side sections **14** and **15** to the substantially aligned position shown in Figure 2 for maximum area planing surface and minimum low taxi speeds.

Thus we have provided a novel under-carriage arrangement including hydro-skis for airplanes, which replace the usual landing wheels or pontoons and have many advantages thereover. For example, a craft equipped with hydro-skis is superior to an aircraft equipped with wheels due to the reduced drag of the ski configuration. Also, when taking off from water, acceleration from taxiing speed to take-off is materially more rapid than with conventional floats and there is much less spray and water disturbance when using hydro-skis. Then also hydro-skis permit landing on any surface, which is not possible with conventional landing gear.

Without further description it is believed that the foregoing is sufficiently complete, clear, concise and exact in terms to enable any person skilled in the art to practice our invention. However, it is to be expressly understood that although only one form of our invention is described and illustrated in detail, that other parts, arrangements and combinations of parts, which may now occur to others are likewise intended to be covered hereby. To determine the scope of our invention reference should be had to the appended claims.

We claim:

1. Landing gear for airplanes equipped with hydro-skis, having a water planing surface, the planing surface diverging rearwardly in width, and said skis having axle mountings for connection on the axles of the said gear.

2. In connection with landing gear for airplanes having the usual axles and shock absorbing struts, a hydro-ski comprising a planing surface rearwardly diverging in width, a centrally positioned elongated longitudinal reinforcing rib, and an axle mounting.

3. A hydro-ski for airplanes comprising a variable area planing surface, said surface being formed of a main central section and foldable side flap sections, a top reinforcing rib formed with said central section, an axle mounting formed intermediate the rib, and pilot controlled operating means partly mounted in the said axle mounting and connecting with each side flap section for folding or unfolding said side sections.

4. As an article of manufacture a hydro-ski for airplanes comprising a main body with a forwardly and upwardly curved leading end and a flat trailing end, elongated side flaps pivoted to each longitudinal side edge of said body, a longitudinally extending reciprocatable actuating rod connected to a pilot controlled source of power, and connecting links pivoted at intermediate spaced positions on the said rod, each of said links being universally connected to the top surface of the said side flaps, to thereby permit the side flaps to be folded over the said main body of the ski.

5. An undercarriage for aircraft including a pair of variable area planing surface members, each member comprising a main body formed with an axle mounting, said body having an upwardly curved leading end and a relatively flat trailing end, elongated triangular flaps pivotally secured to each longitudinal side edge of the main body, and remote control flap actuating means supported by the main body and connected to each flap for varying the area of the planing surfaces of said members by pivotal movement of said flaps.

6. Landing gear for airplanes equipped with hydro-skis or the like, each ski having a variable position planing surface, said planing surface of each ski including pilot controlled side planing sections vertically movable with respect to planing position, and each of said skis having axle mountings for connection on the axles of said respective landing gear.

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