

Oct. 30, 1945.

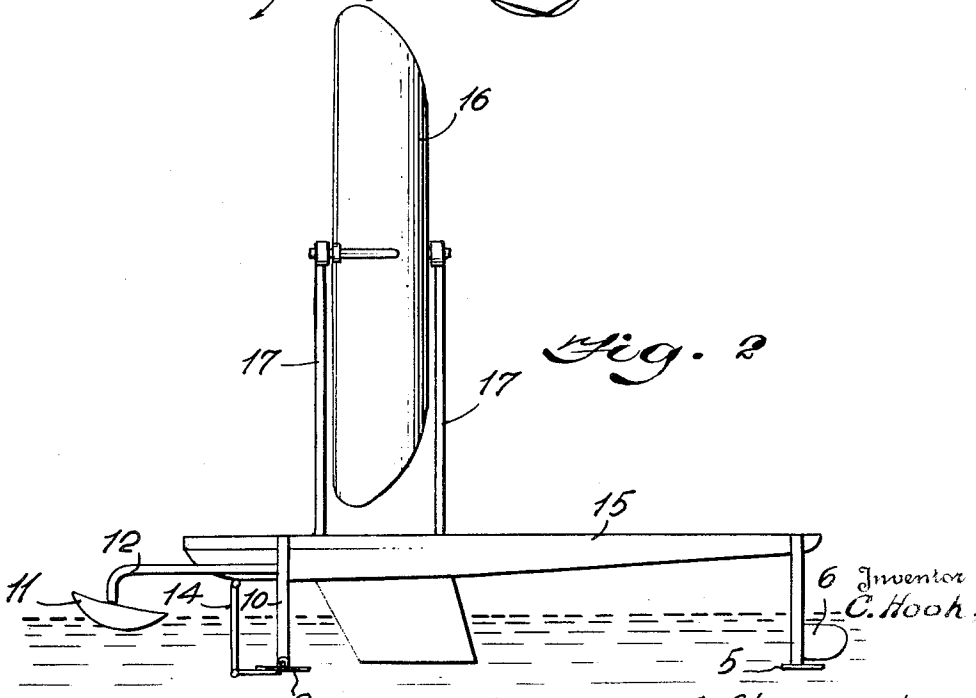
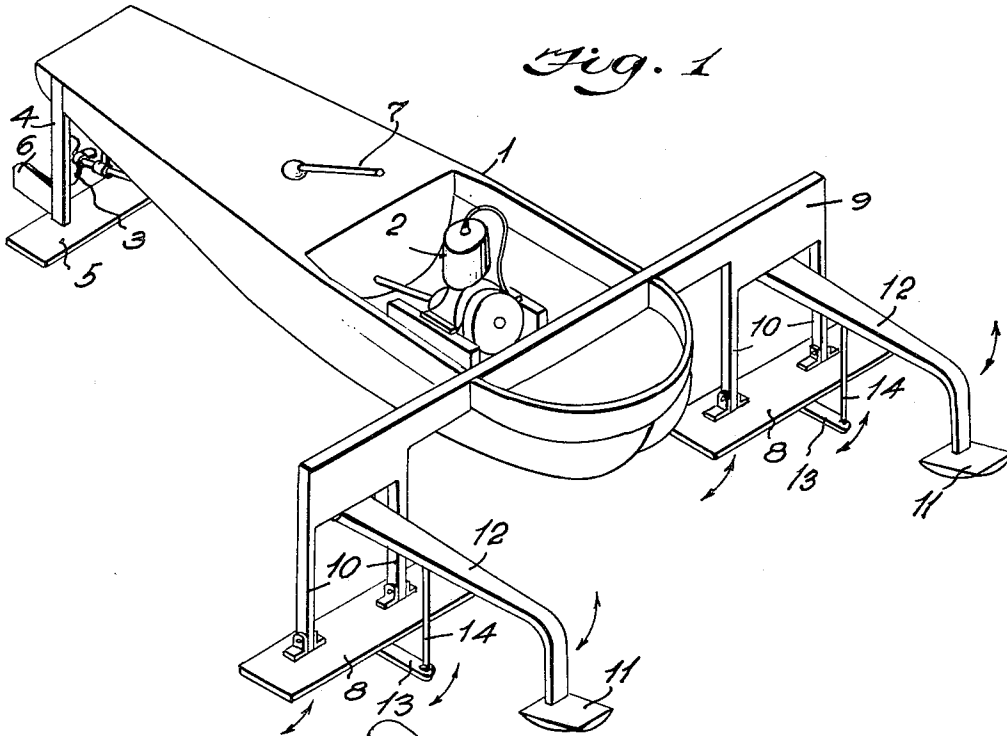
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2,387,907

CRAFT OF THE HYDROPLANE TYPE

Filed Oct. 26, 1943

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

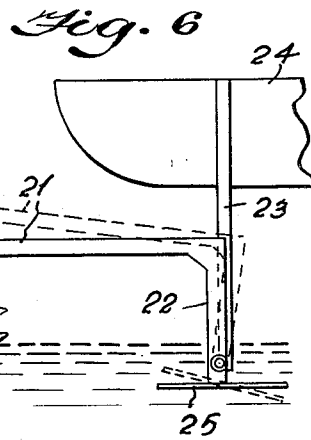
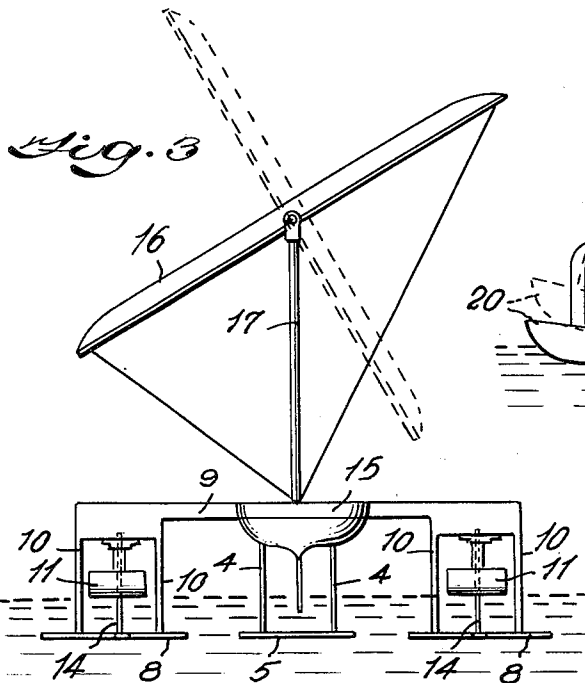


Fig. 4

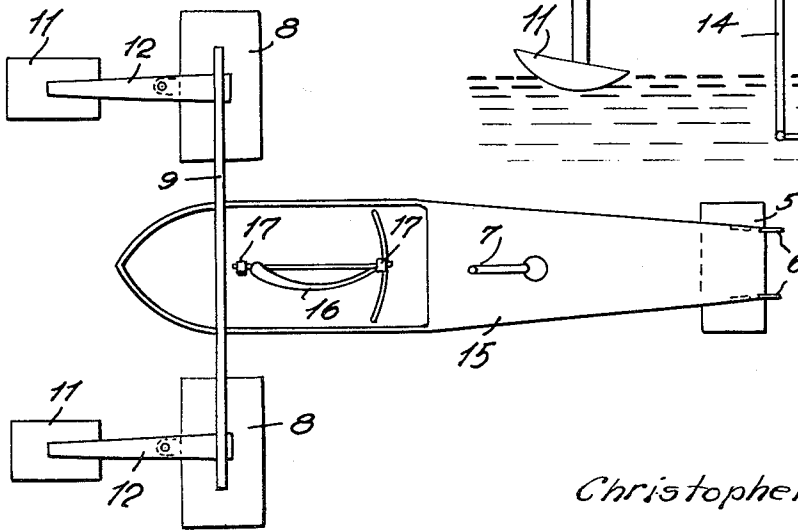
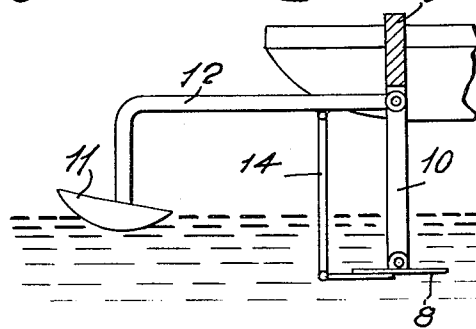


Fig. 5



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Fig. 7

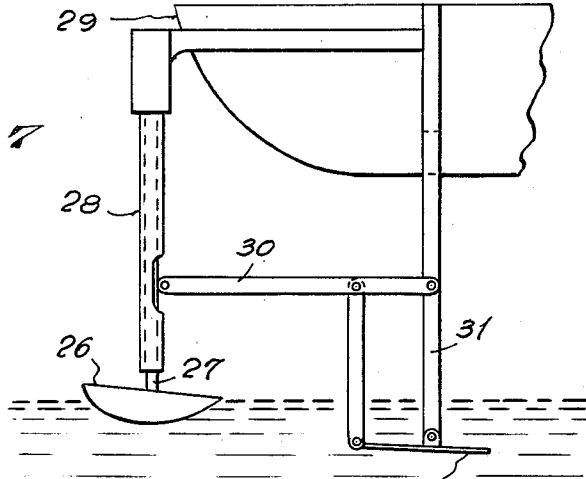


Fig. 8

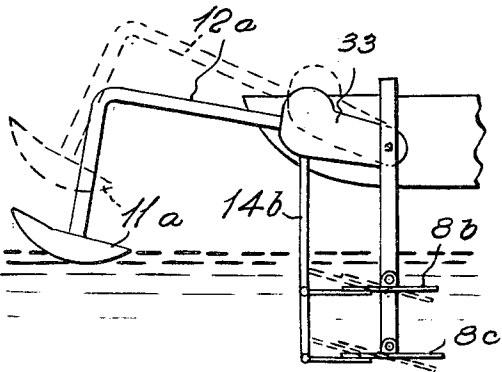


Fig. 9

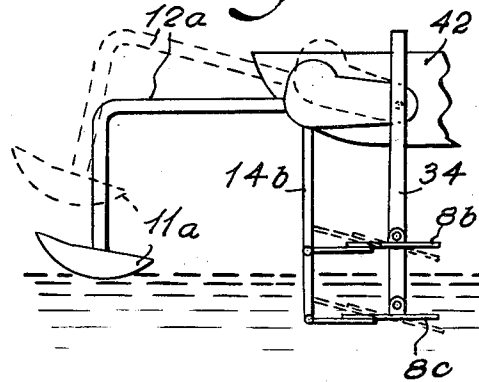
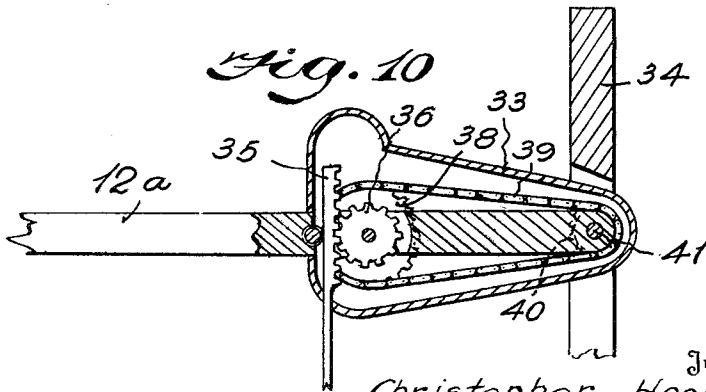


Fig. 10



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UNITED STATES PATENT OFFICE

2,387,907

CRAFT OF THE HYDROPLANE TYPE

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Application October 26, 1943, Serial No. 507,712
In the Union of South Africa November 3, 1942

7 Claims. (Cl. 114—66.5)

This invention relates to craft of the hydroplane type, i. e. to craft capable of traveling over or above the surface of the water while being supported and stabilized thereby.

According to the invention broadly a craft having mechanical or wind-operated means of propulsion, and arranged to travel on or above the surface of water by being connected to submerged supporting fins which are disposed in a horizontal plane or planes and are tilted to a suitable angle of incidence so that, at a predetermined speed, the craft is partly supported above its normal floating position or entirely supported a short distance above the water and/or held in a stable upright position thereon by the "lift" created by said fins on being caused to cut through the water by the action of the propelling means, is characterized in that means adapted to float on and/or skim along the surface of the water, are connected to said supporting fins in such a manner that the angles of incidence of said fins are automatically controlled so that the distance of the craft above its normal floating position or above the surface of the water, and/or its stable position, remains substantially constant so long as its speed does not fall below a predetermined minimum. These supporting fins act in a similar manner to the wings of an aircraft except that their medium of support is a liquid as against air in the case of the aircraft.

It is to be understood that the aforesaid supporting fins besides maintaining the craft at a predetermined distance above its normal floating position or above the surface of the water, are so arranged that they also maintain both its lateral and longitudinal stability.

To achieve this purpose a plurality of fins supporting a craft are suitably spaced from one another in a horizontal plane; either singly or in groups. Each separate supporting fin or separate group of fins is independently controlled as regards its angle of incidence by the aforesaid controlling means. Preferably the supporting fins are spaced so as to give three-point support to the craft and to this end comprises a starboard fin or group, a port fin or group and a stern or bow fin or group, on which the craft is supported by vertical struts. The stern and bow fins are preferably fixed as regards their angles of incidence.

The means for controlling the angle of incidence of a supporting fin or the fins of each group, consists of a control plane adapted to skim along the surface of the water, which plane is so connected to a supporting fin or group of fins,

that the deeper said fin or fins becomes or become submerged, the greater becomes its or their angle or angles of incidence and vice versa, whereby the distance by which the craft is maintained above its normal floating position or above the surface, remains substantially constant irrespective of variations in the load and/or within limits the speed of travel. The said control plane in a preferred form of the invention, is made in the nature of a float, which is streamlined to reduce frictional resistance. From the foregoing description it will be understood that the supporting fins which are adjustable, are mounted for pivoting movement about horizontal axes.

To enable the invention to be more clearly understood and carried into practice, reference is now made to the accompanying drawings in which like references denote like parts throughout the several views.

In the drawings:

Fig. 1 is a perspective view of a small mechanically propelled craft constructed according to the invention,

Fig. 2 is a side elevation of a small sailing craft constructed according to the invention;

Fig. 3 is a front elevation of the craft of Fig. 2.

Fig. 4 is a plan view of the craft of Figs. 2 and 3.

Fig. 5 is a fragmentary part sectional side elevation of the fin controlling mechanism as employed in Figs. 1 to 4,

Fig. 6 is a similar view showing a modified arrangement of the fin controlling mechanism.

Fig. 7 is a similar view showing a further modified arrangement of the fin controlling mechanism.

Figs. 8 and 9 are likewise similar views showing yet another modified construction for the fin controlling mechanism, and

Fig. 10 is a vertical sectional view through the adjusting mechanism of Figs. 8 and 9.

According to a first embodiment of the invention, the control plane is rigidly attached to the end of a substantially horizontal lever arm pivotally connected to a craft supporting strut at a point above its lower end, to which lower end a supporting fin is pivotally connected, and wherein a pivotally connected vertical link connects a point on said lever arm remote from its fulcrum, to a point on or an extension of said fin, remote from its pivoting axis. Preferably the said vertical link connects a point on the lever arm forwardly of its fulcrum or pivoting axis, to a point on or adjacent the leading edge of the

supporting fin. The lever arm is of substantially L-shape with the control plane fixed to the downwardly directed end of one short leg thereof.

It is also to be understood that the control plane has a fixed angle of incidence, and is preferably arranged ahead of the supporting fin.

Referring to the drawings, and more particularly to Figs. 1 and 5, reference 1 denotes the hull of a small craft having an internal-combustion engine 2 driving a propeller 3. The stern is connected by vertical struts 4 to a fixed supporting fine 5. Twin rudders 6 are mounted on the lower ends of the struts 4 and operated by the tiller 7. The bow of the craft is connected to twin pivotally mounted supporting fins 8 by the cross beam 9 and vertical struts 10. A control plane 11 preferably in the form of a streamlined float, is rigidly fixed to the downwardly directed end of the short leg of each of the L-shaped lever arms 12, each of which is pivotally connected by its other end between the struts 10. Each arm 12 is furthermore connected from a point forwardly of its pivoting axis to a front extension piece 13 of a supporting fin 8, by a pivotally connected vertical link 14.

Since the control plane 11 skims along the surface of the water, the angle of incidence of a supporting fin 8 is directly dependent upon the depth of said fin 8 beneath the surface of the water as will be clearly understood from a study of Fig. 5.

Since a craft constructed according to the invention is rendered automatically stable both laterally and longitudinally while travelling in its normal upright position, it is particularly adaptable for wind propulsion such as by sails, wings or a wind turbine.

It is well known that the use of sails with the ordinary type of sailing craft for propulsion purposes is very inefficient, due to the tendency of the craft to heel over and spill the wind from its sails as soon as the wind freshens. Actually the force of wind may be divided up into three components. The first tends to cause the craft to heel over and is counteracted by the addition of dead weight to the keel, the second tends to force the craft under the water and is counteracted by increasing the displacement above what would normally be required, and the third, which is the smallest, gives the craft its way in a forward direction. In the case of a sailing craft fitted with the invention, the wind force which tends to upset either its lateral or longitudinal stability, is immediately and automatically countered by one or other of the previously described groups of supporting fins, whence it follows that the sails will be held upright and will act more efficiently as a means of propulsion, and the requirements for extra weight on the keel and extra displacement are eliminated.

The invention also includes the substitution for the usual sails of a sail plane of streamlined aerofoil section which is pivotally mounted about a horizontal axis between fore and aft masts, so that it may be partly rotated when changing from one tack to another. For the position of "hove to" the said plane is rotated to a horizontal position similar to the wing of an aircraft.

It is to be understood that provision is made for swinging the trailing edge of the sail plane to port or starboard according to the direction of travel and with regard to the direction of the wind. By canting the sail plane with its top end into the wind, a certain amount of "lift" will be obtained as well as forward propulsion.

Figs. 2, 3 and 4 illustrate the application of the

invention to a sailing craft hull 15 which in this case is provided with a pivotally mounted sail plane 16 of aerofoil section. This sail plane is carried by the two upright supports or masts 17 while provision is made for swinging the rear-most of said supports 17 in an arc so as to enable the trailing, edge of the sail plane 16 to be swung to port or starboard as required.

Fig. 6 shows a simplified construction in which a control plane 20 is rigidly attached to the front downwardly directed end of a substantially L-shaped connecting arm 21, which arm is pivotally connected at the lower end of its short leg 22 to the bottom end of a vertical strut 23 depending from a hull 24. A supporting fin 25 is in this case, rigidly attached to the extreme end of the short leg 22 of the arm 21.

Fig. 7 illustrates a further modified arrangement in which a control plane 26 is rigidly attached to a rod 27 which is slidably mounted in a forwardly disposed hollow strut 28, forming a fixed part of a hull 29. In this case a lever arm 30 pivotally connected by its rear end to the rear strut 31, and by its front end to the sliding rod 27, takes the place of the arm 12 as previously described with reference to Figs. 1 to 5, and is connected to the front or leading edge of the supporting fin 32a by the vertical link 14a. Figs. 8 and 10 show still a further modified arrangement in which two supporting fins 32b and 32c are employed in stepped or superimposed relationship and in which a mechanism enclosed in a casing 33, is incorporated for adjustment of the effective length of the vertical link member 14b controlling the angles of incidence of the said fins 32b and 32c. In this case a control plane 11a is rigidly attached to the downwardly directed end of the short leg of an L-shaped arm 12a, the opposite end of which is pivotally connected to a vertical strut 34. The top end of the link member 14b is formed in the nature of a rack 35 which is held in meshing engagement with a toothed pinion 36 by a roller 37. Rotation of the pinion 36 is effected through the medium of a chain wheel 38, chain 39 and chain pinion 40 mounted on a shaft 41, which is adapted to be rotated in either direction by suitable control gear in the hull 42 of the craft.

The purpose of employing two stepped supporting fins is to obtain increased "lift" particularly at starting at slow speeds or with heavy load. At normal speeds and with normal loads the craft will ride with only the lower fins 32c submerged as indicated in Fig. 9.

In all the above described modifications, suitable stop means will be incorporated so as to ensure that under no circumstances will it be possible for a control plane and its associated mechanism, to cause a supporting fin to adopt an angle of incidence outside the range of angles determined by the constructor for normal travel of the craft. In practice these angles will range from a small negative angle, to a positive angle slightly less than that which would result in "stalling."

While the drawings only illustrate the application of the invention to water craft, it is to be understood that the invention is equally applicable to aircraft of the flying boat and float plane type.

What I claim is:

1. Craft of the character described comprising a hull and propulsion means therefor, and means for supporting said hull, at any predetermined speed, at a predetermined height relative to the

normal floating position of said hull, said supporting means comprising strut means depending from said hull at the stern thereof, a supporting fin fixed to said strut means at the lower end thereof, means extending transversely across and laterally beyond each side of said hull at the bow thereof and including depending strut means on each said side, a laterally stabilizing and supporting fin pivotally connected to each said last-named strut means at the lower end thereof, and means associated with each of said pivotally-connected stabilizing and supporting fins and mounted to skim along the surface of the water forwardly of said hull and severally connected to said pivotally-connected stabilizing and supporting fins at the front thereof so as to control the angle of incidence thereof, whereby each said pivotally-connected stabilizing and supporting fin is independently controlled as regards its angle of incidence so that the position of the hull relative to its normal floating position remains substantially constant at said speed.

2. Craft of the character described comprising a hull and propulsion means therefor, and means for supporting said hull, at any predetermined speed, at a predetermined height relative to the normal floating position of said hull, said supporting means comprising strut means depending from said hull at the stern thereof, a supporting fin fixed to said strut means at the lower end thereof, means extending transversely across and laterally beyond each side of said hull at the bow thereof and including depending strut means on each said side, a laterally stabilizing and supporting fin pivotally connected to each said last-named strut means at the lower end thereof, and control plane means in the form of a float associated with each of said pivotally-connected stabilizing and supporting fins and mounted to skim along the surface of the water forwardly of said hull and severally connected to said pivotally-connected stabilizing and supporting fins at the front thereof so as to control the angle of incidence thereof, whereby each said pivotally-connected stabilizing and supporting fin is independently controlled as regards its angle of incidence so that the position of the hull relative to its normal floating position remains substantially constant at said speed.

3. Craft of the character described comprising a hull and propulsion means therefor, and means for supporting said hull, at any predetermined speed, at a predetermined height relative to the normal floating position of said hull, said supporting means comprising strut means depending from said hull at the stern thereof, a supporting fin fixed to said strut means at the lower end thereof, means extending transversely across and laterally beyond each side of said hull at the bow thereof and including depending strut means on each said side, a laterally stabilizing and supporting fin pivotally connected to each said last-named strut means at the lower end thereof, and control plane means in the form of a float of aerofoil configuration with a fixed angle of incidence associated with each of said pivotally-connected stabilizing and supporting fins and mounted to skim along the surface of the water forwardly of said hull and severally connected to said pivotally-connected stabilizing and support-

ing fins at the front thereof so as to control the angle of incidence thereof, whereby each said pivotally-connected stabilizing and supporting fin is independently controlled as regards its angle of incidence so that the position of the hull relative to its normal floating position remains substantially constant at said speed.

4. Craft of the character described comprising a hull and propulsion means therefor, and means for supporting said hull, at any predetermined speed, at a predetermined height relative to the normal floating position of said hull, said supporting means comprising strut means depending from said hull at the stern thereof, a supporting fin fixed to said strut means at the lower end thereof, means extending transversely across and laterally beyond each side of said hull at the bow thereof and including depending strut means on each said side, a plurality of spacedly superposed laterally stabilizing and supporting fins severally pivotally connected to each said last-named strut means adjacent the lower end thereof, and means associated with each of said pivotally-connected stabilizing and supporting fins and mounted to skim along the surface of the water forwardly of said hull and severally connected to said pivotally-connected stabilizing and supporting fins at the front thereof so as to control the angle of incidence thereof, whereby each group of pivotally-connected stabilizing and supporting fins is independently controlled as regards angle of incidence of the fins so that the position of the hull relative to its normal floating position remains substantially constant at said speed.

5. Craft as claimed in claim 2, wherein the said control plane means is rigidly attached to the end of a substantially horizontal lever arm pivotally connected to said last-named strut means at a point above the lower end thereof, and wherein a pivotally connected vertical link connects a point on said lever arm remote from its fulcrum, to its respective laterally stabilizing and supporting fin, remote from the pivotal connection of the latter.

6. Craft as claimed in claim 2, wherein the said control plane means is rigidly attached to the end of a substantially horizontal lever arm pivotally connected to said last-named strut means at a point above the lower end thereof, and wherein a pivotally connected vertical link connects a point on said lever arm remote from its fulcrum, to its respective laterally stabilizing and supporting fin, remote from the pivotal connection of the latter, and wherein means are provided for adjusting the effective length of said pivoted vertical link member, whereby the controlling effect of the control plane is made adjustable according to varying operating conditions.

7. Craft as claimed in claim 2, wherein the said control plane means is rigidly attached to the end of a substantially horizontal lever arm pivotally connected to said last-named strut means at a point above the lower end thereof, and wherein a pivotally connected vertical link connects a point on said lever arm remote from its fulcrum, to its respective laterally stabilizing and supporting fin, remote from the pivotal connection of the latter, and wherein the effective length of the pivoted vertical link member is adjustable by means of a rack and pinion arranged to be operated from the craft by chain gear mechanism.

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