

March 24, 1942.

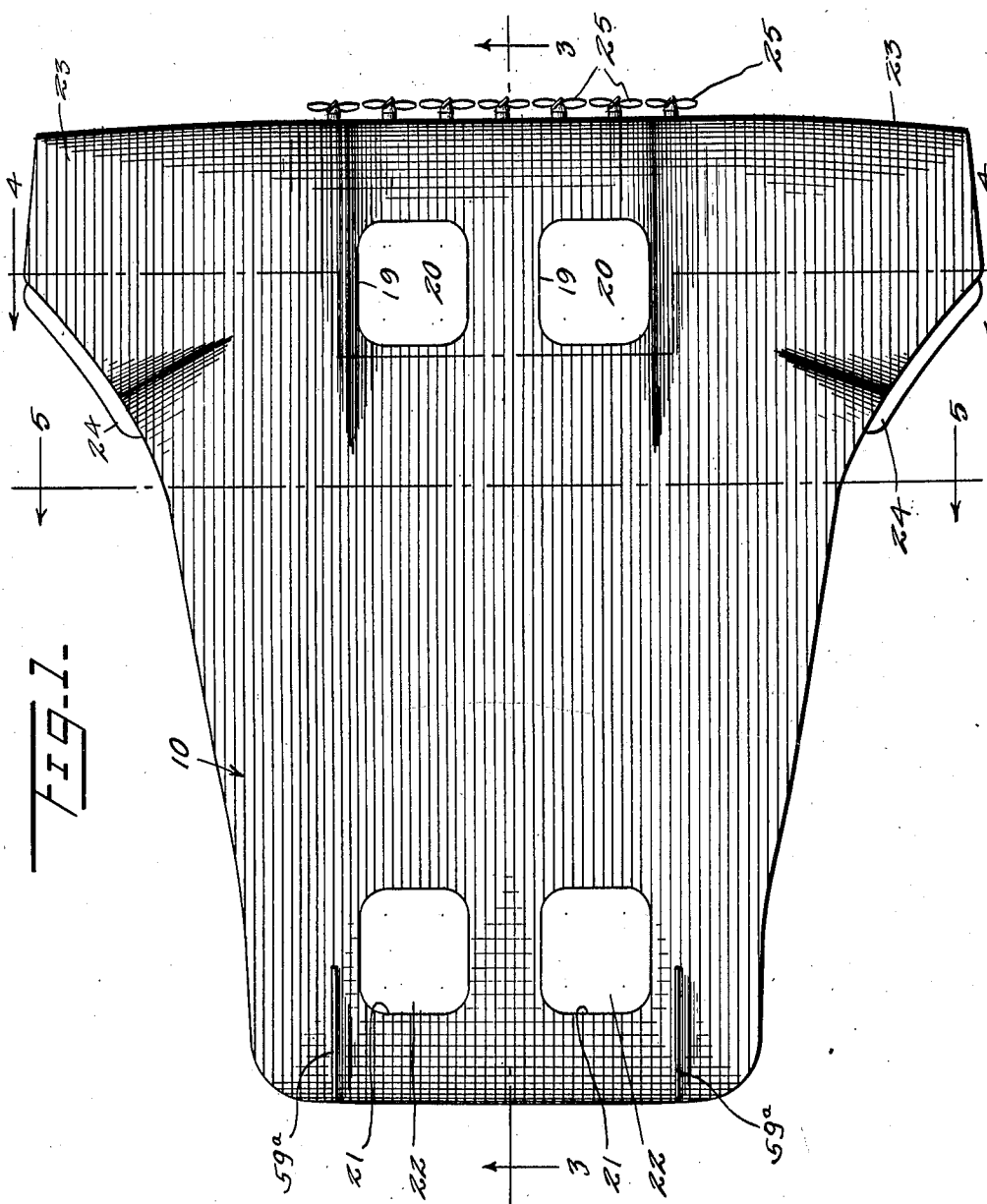
D. K. WARNER

2,277,620

SKIMMING CRAFT

Filed Jan. 23, 1939

4 Sheets-Sheet 1



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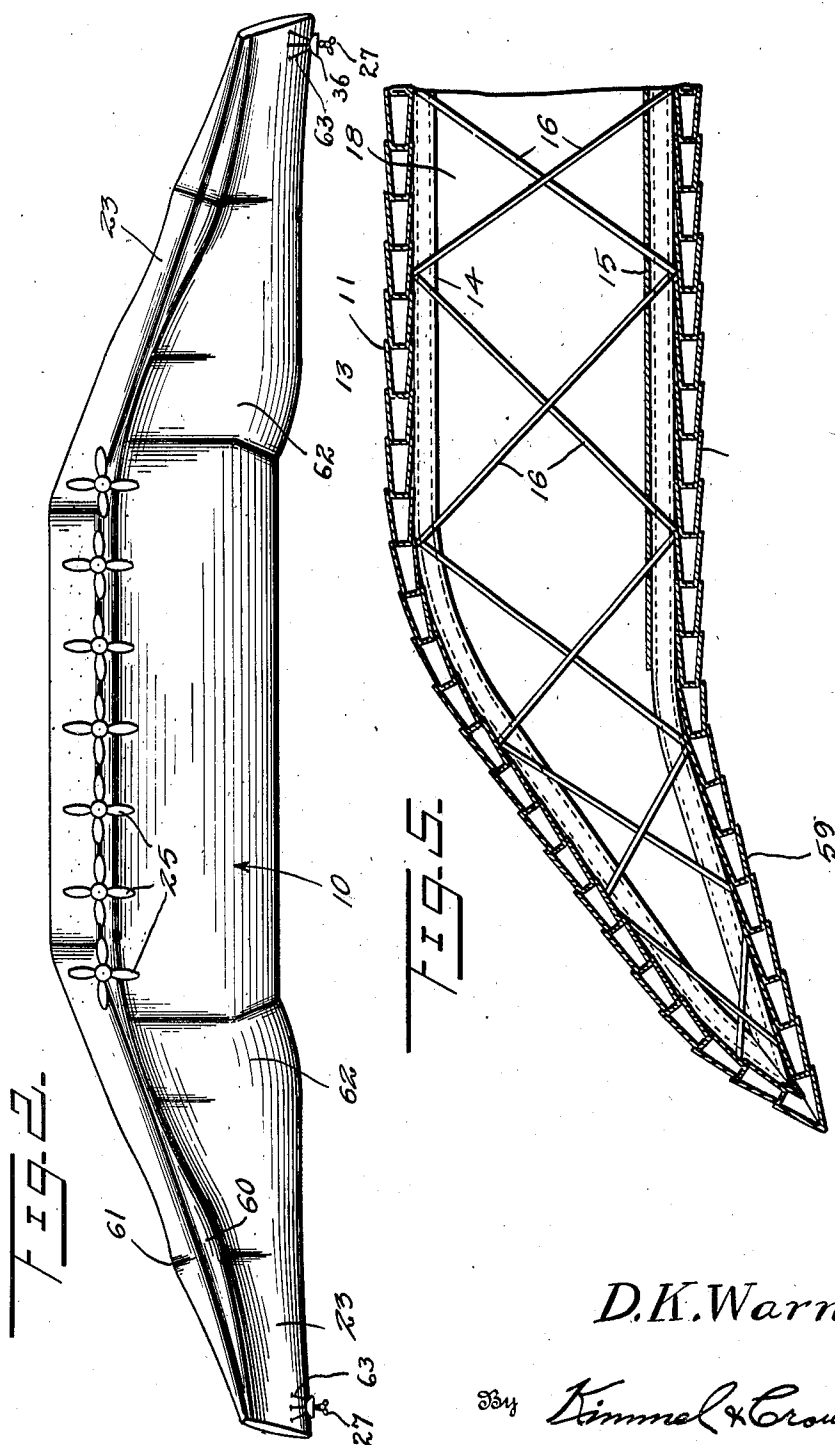
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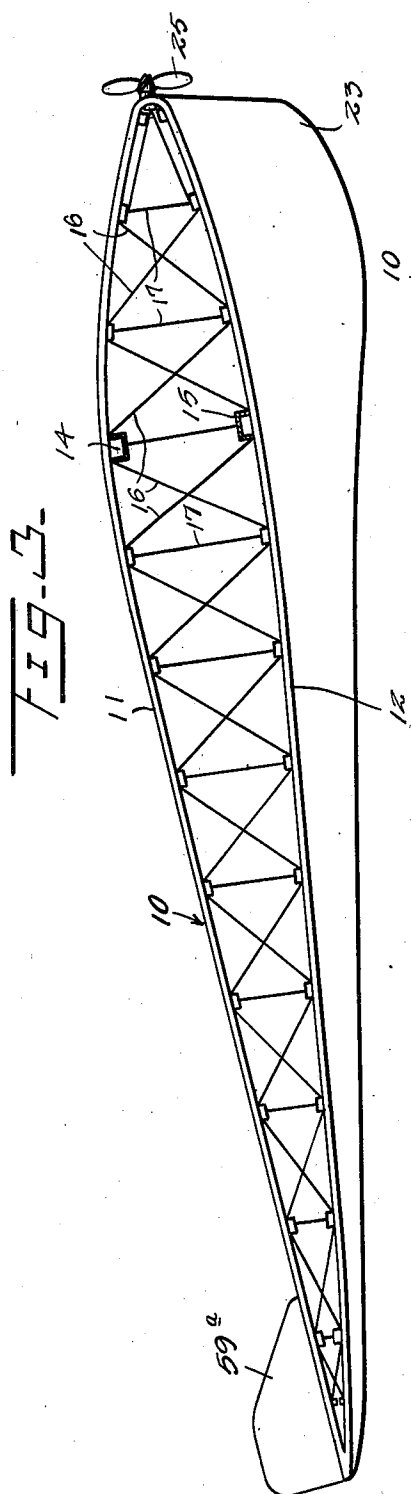
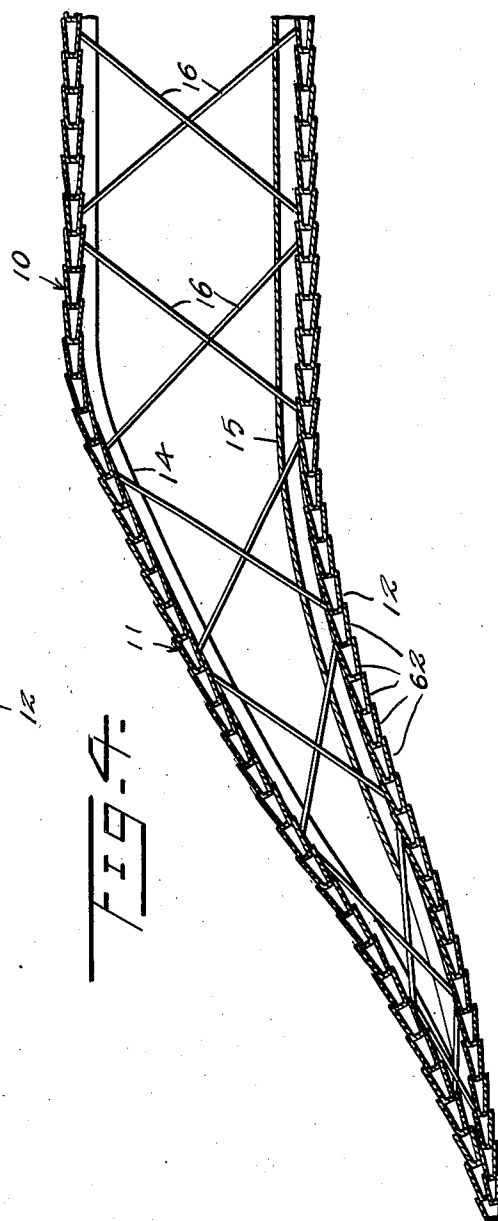
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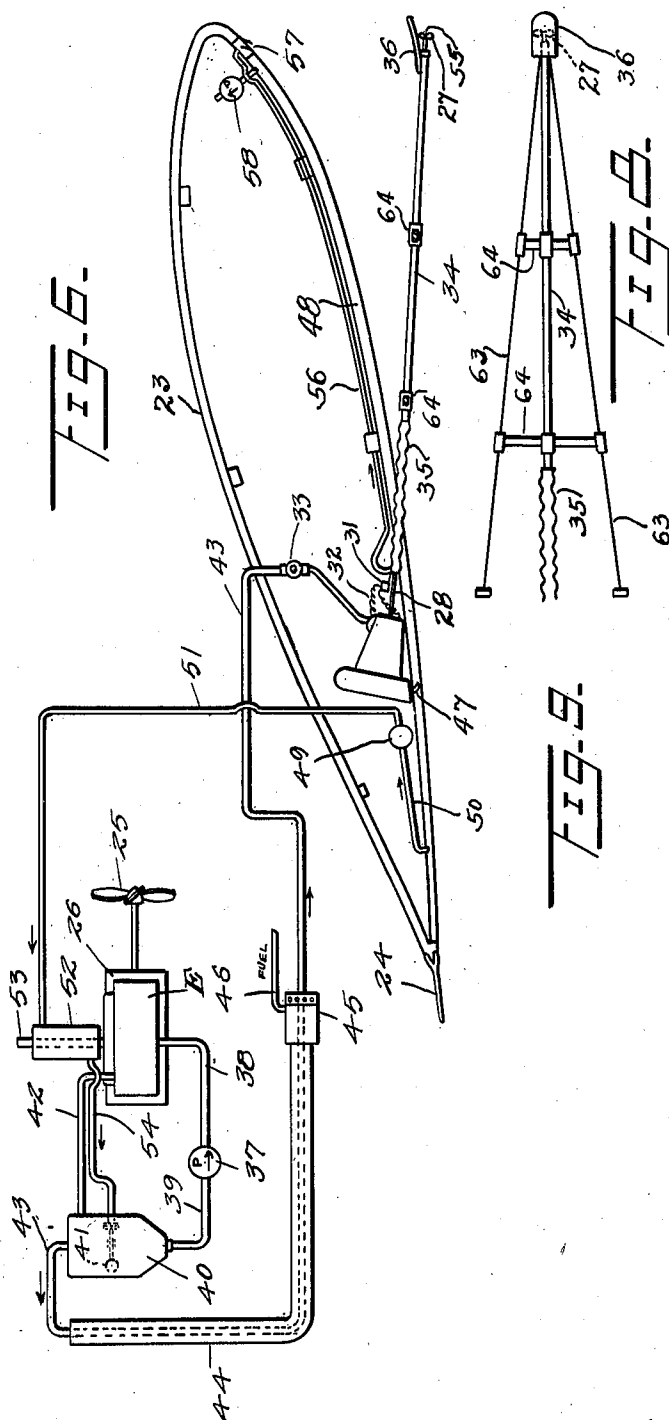
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SKIMMING CRAFT

Filed Jan. 23, 1939

4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,277,620

SKIMMING CRAFT

Douglas K. Warner, Sarasota, Fla.

Application January 23, 1939, Serial No. 252,476

11 Claims. (Cl. 114—66.5)

This invention relates to boats and more particularly to a high speed boat designed for use as an airplane carrier.

An object of this invention is to provide a boat or carrier which combines the principle of flying with water transportation so that the device may skim along the surface of the water and is so constructed that the water propellers are always submerged while the rest of the machine flies.

Another object of this invention is to provide a boat or carrier of this kind which is capable of exceedingly high speed so that it may be used in combination with very high speed airplanes in order that the airplanes may land on a moving and relatively small surface. At the present time, high speed airplanes have a relatively small wing spread and for this reason such high speed airplanes require an exceeding long runway either to take off or land. The provision of a movable landing surface will make it possible for airplanes of a high speed type to land on a relatively small surface which is moving with the airplane and for this reason the landing surface may be made considerably smaller than would be the case if the landing surface were stationary.

A further object of this invention is to provide a carrier of this type which is so constructed that when the device is in motion the main body of the carrier will be positioned above the water and with only a small portion thereof contacting with the water.

A further object of this invention is to provide a carrier which is so constructed that it uses both air propellers and water propellers, the water propellers being so connected to the engines of the air propellers that the major portion of the energy for the water propellers is derived from the waste of the air propeller engines.

A further object of this invention is to provide a carrier of this type which includes means whereby the main body of the carrier is prevented from lifting the lower portion of the carrier out of the water in the event a sudden gust of wind strikes the boat, a portion of the carrier being formed at such an angle relative to the remaining portion that the center of lift shifts backward and noses the plane down in the event the carrier is subjected to sudden air pressures which might have a tendency to lift the carrier from the surface of the water.

A further object of this invention is to provide a carrier of this type which includes means whereby the water propelling means is automatically

cut off or cut down in the event the main body rises above a predetermined height relative to the water so that the water propelling means will act as a drag and thus cause the main body to nose downwardly toward the water.

A further object of this invention is to provide a carrier of this type wherein the body is formed of hydro-plane surfaces, certain of the surfaces being positioned at the forward portion of the boat and certain others of the surfaces being positioned rearwardly of the boat and inwardly of the first surfaces so that the water agitated by the first surfaces will not engage the remaining hydro-plane surfaces.

Still another object of this invention is to provide a carrier of this type wherein the air propellers are operated by water jacketed engines and wherein the water for cooling the engines is placed under pressure and the heated water is then conveyed to a steam releasing means so as to provide power for turbines which are connected to water propellers, the boat being also provided with a condensing means for condensing the steam and returning the liquid water to the air propeller engines cooling jackets.

A further object of this invention is to provide a novel means for maintaining the water propellers in contact with the water and to maintain such water propellers at a predetermined depth relative to the water, irrespective of the position of the boat relative to the water.

To the foregoing objects and to others which may hereinafter appear, the invention consists of the novel construction, combination and arrangement of parts as will be more specifically referred to and illustrated in the accompanying drawings wherein is shown an embodiment of the invention, but it is to be understood that changes, variations and modifications may be resorted to which fall within the scope of the invention as claimed.

In the drawings:

Figure 1 is a detail top plan of a boat or carrier constructed according to an embodiment of this invention,

Figure 2 is a detail front elevation of the carrier,

Figure 3 is a sectional view taken on the line 3—3 of Figure 1,

Figure 4 is a fragmentary sectional view taken on the line 4—4 of Figure 1,

Figure 5 is a fragmentary sectional view taken on the line 5—5 of Figure 1,

Figure 6 is a diagrammatical view showing one end of a stub wing and the connections between

the water turbines and propellers and the engines for the air propellers,

Figure 7 is a fragmentary sectional view showing the shaft housing for the water propeller and the means for forcing sea water to the forward portion of the stub wings,

Figure 8 is a fragmentary sectional view of the forward portion of the stub wing showing the means for discharging the sea water on the under surface of the stub wings, and

Figure 9 is a diagrammatic view of one of the water propelling members.

Referring to the drawings, the numeral 10 designates generally the body of a boat constructed according to an embodiment of this invention. The body 10 is of hollow construction being provided with an upper wall 11 and a lower wall 12. These two walls are formed similar to the conventional configuration of an airplane wing structure. In the present instance, the upper and lower wall members 11 and 12 respectively, as shown in Figures 4 and 5, are formed from a plurality of longitudinally extending channel members 13 which are U-shaped in transverse section and which overlap each other at the free edges of the parallel legs thereof with the overlapping portions of one channel member engaging over the bight of an adjacent member and welded at the contacting portions between the two members. In this manner, the upper and lower walls or surfaces 11 and 12 respectively may be made of hollow construction, which construction will provide a very rigid body structure and at the same time a relatively light metal body structure.

A plurality of transversely extending box girder members 14 extend transversely across the body 10 and are secured to the under sides of the channel members forming the upper wall or surface 11 and are also secured transversely across the upper or inner surfaces of the channel members forming the lower wall 12 as shown at 15. A plurality of angularly disposed bracing members 16 extend between the two wall members 11 and 12 and a plurality of right-angularly disposed bracing members 17 extend vertically between adjacent box girder members 14 and 15. The under surface of the body 10 at the rear thereof provides a hydro-plane surface which during the initial movement of the boat over the water is adapted to contact with the water. The space between the two wall members 11 and 12 forms a compartment within the body 10 and in this compartment which is generally designated as 18 the working parts of the boat are adapted to be positioned in addition to the chambers or spaces which may be provided for the storing of smaller airplanes. The upper wall 11 adjacent the forward end of the body 10 is provided with one or more openings 19 which may be closed by a door or closure 20 and the rear portion of the body 10 is provided with one or more openings 21 which may be closed by a closure or closures 22. These closures may be of the sliding type which may be shifted either longitudinally or laterally with respect to the body 10.

The body 10 during the movement of the boat is adapted to be disposed in an elevated position relative to the water and the body 10 adjacent the forward end thereof is provided with a pair of laterally and downwardly projecting stub wings generally designated as 23. These stub wings 23 are disposed on an angle of incidence different from the angle of incidence of the body

10 and in addition, the stub wings 23 provide hydro-plane surfaces laterally of the rear portion of the body 10 which are adapted to contact with the surface of the water during the movement of the boat over the water. Each stub wing 23 in the rear thereof is provided with a resilient flap 24 which provides a shock absorbing means to relieve the wings 23 from shock during the downward movement of the boat or craft and by contacting the water surface prevent lateral escape of air from under the craft.

These stub wings 23 contact the water before take-off and hold the front part of the boat positioned therebetween at a fixed height above the water. At this time, the stub wings 23 act as hydro-plane steps, but by being disposed laterally at each side of the stern of the boat, they do not interfere with the lift at the stern which is, by my experiments, found to be very adversely affected by the conventional step placed directly forward of the stern. After take-off, these stub wings contact the air at almost the stalling angle, producing an extremely high forward lift and a correspondingly high drag which is below the center of gravity of the main part of the boat. The lift of the main body of the boat is, however, very much greater than the stub wings due to the very much larger surface of the main body, even though the surface of the main body is at a smaller angle of incidence. The center of lift of the main body is rearwardly disposed to that of the stub wings 23 so that the stern of the boat rises until the lift of the main body 10 has decreased sufficiently to balance the lift of the stubs about the center of gravity of the boat and the thrust of the propellers about this point.

If the main wing or body 10 of the boat is at a low angle of incidence, a slight decrease in this angle makes a proportionately large decrease of its lift, whereas a decrease in the stub wing angle makes a very much smaller percentage reduction of its total lift so that there is a definite point at which the lift of the main body and of the wings will balance each other about the center of gravity. While it is not necessary to have the stub wings positioned close to the critical angle of incidence, it is desirable that they be so related to the angle of incidence of the main body that the reaction of the boat will be very quick when the boat starts to rise with increased incidence. This angle also permits the use of smaller stubs for effecting stability and it also permits the positioning of the stubs at such a steep angle that the stubs will provide a better coverage for white caps on the water. The main body 10 at the forward portion thereof is provided with a plurality of air propellers 25 which are connected to engines designated as E, provided with water jackets 26. A water propeller 27 secured to a flexible shaft 28 is connected to a power device 29 carried by each stub wing 23. The power devices 29 are constructed in the form of steam turbines which are operatively connected with the engines E, as will be hereinafter described. The water propellers 27 provide a second means for returning the boat to the water's surface due to the fact that these water propellers may be used as a drag which is positioned closely adjacent the forward end of the boat and will, therefore, pull the forward end of the boat downwardly and thus vary the angle of incidence of the body 10 so that the body 10 will lose its lifting power. The water propellers 27 exert a forward thrust at a point almost directly below the center of

gravity of the boat and thus exert a turning moment about this center of gravity which keeps the nose of the boat up while the forward thrust is exerted. In the event a water propeller leaves the water, this forward thrust is lost, together with its turning moment and the effect is the same as though the boat load was suddenly shifted forward and the angle of incidence balance makes the boat guide down. As soon as the water propellers 27 meet the water, the forward thrust is restored and the balance moment between the water propeller thrust and the wing stubs and the main wing or body is restored to the original lifting angle. The air propellers have a considerably higher efficiency at high speeds and it will, therefore, be more economical to balance the thrust of the water propellers with the air propellers above the center of gravity. In this manner, when the water propellers leave the water their thrust will be lost and the thrust of the air propellers above the center of gravity will tend to nose the boat downwardly. In order to make this action effective before the water propellers actually leave the water, mechanism is provided through the medium of the flexible shaft 28 which is connected to the power member 29 so as to reduce the power exerted on the propellers 27 automatically with a slight increase in elevation of the wing stubs above the water level.

This power reducing means is provided by means of a link member 30 which is connected to an electrically operated member 31. The operator 31 is connected by a connecting member 32 to a stem valve 33 connected to the intake side of the power member 29. In this manner, the angular change between the drive shaft 28 and the power member 29 will actuate the operator 31 so as to thereby effect a variation in the quantity of steam passing to the turbine 29. In other words, when the stub wings 23 leave the water, the water propellers 27 may drop downwardly and the downward swinging of the shaft 28 will simultaneously operate the operator 31 so as to effect a closing of either all or part of the steam valves 33. A reduction in the speed of the water propellers 27 will have the effect of providing a water drag below the center of gravity and thus cause the nose of the body or the boat to turn downwardly toward the surface of the water. This swinging movement of the shaft 28 and the propellers 27 also has a tendency to prevent racing of the power member 29 as the propellers 27 will at all times be in contact with the water or the steam shut off.

Preferably, the propeller shaft 29 is rotatably mounted in a tubular housing 34 which is connected by a flexible connection 35 with the wing stub 23. The housing 34 is provided with a planing member 36 which is adapted to ride over the surface of the water above the propeller 27 and thus prevent the propeller 27 from swinging downwardly in the water. The planing member 36 also provides additional weight which will gravitatingly swing the propeller 27 downwardly in the event the boat leaves the water. By providing a flexible shaft 28 and means connected to the shaft and power member 29 whereby a drag is set up when one or more stub wings leaves the water, the boat is prevented from turning over if a gust of wind should pick up one stub. This is due to the fact that if one stub wing 23 is lifted far from the water, the associated propeller 27 will immediately set up a drag on that side of the boat by cutting off of the power member 29 on

that particular side of the boat. This will cause the opposite side to travel faster and increase its lift as compared with the dragging side, thus instantly leveling the boat laterally.

The use of water propellers and a directly connected turbine for each propeller permits the use of a by-product of the power of an air screw motor which has heretofore not been used because of the great weight in reduction gears normally associated with slow speed heavy marine steam turbines. The engines E are each provided with a water jacket 26 and the water is circulated under pressure in the jackets 26 by means of a pump 37, which is connected at one side by a pipe 38 to the jacket 26. The other or suction side of the pump 37 is connected by a pipe 39 to a separator 40. The separator 40 is provided with a float operated valve 41 which maintains a predetermined water level within the separator 40. The water passes through the jacket 26 where it is heated and then out through a pipe 42 into the upper portion of the separator 40 where the steam is released and is discharged through a steam outlet pipe 43. This pipe 43 extends through a tubular super-heater 44 which is provided at one end thereof with a heating member 45 connected by a pipe line 46 to a suitable source of fuel supply. The heating member 45 may be in the form of a jet heating device or any other suitable heater which contacts with the exterior surface of the pipe 43 so as to increase the temperature of the steam passing through the pipe 43. The pipe 43 is connected to the valve 33 which is connected to the intake side of the steam turbine 29. The outlet side of the steam turbine 29 is connected by a discharge pipe 47 to a condensing member 48 which is formed within the lower surface of each stub wing 23. As hereinbefore stated, the stub wings and the main body 10 are constructed of channel members which provide closed channels extending longitudinally of the boat, and in each stub wing 23 certain of these channel members are connected together at predetermined intervals so that a considerable quantity of high vacuum steam may be discharged into the stub members 23. These stub members 23 at starting, contact with the surface of the water so that the under surface of each stub member 23 will be cooled by the water and, therefore, form a condensing surface for condensing the steam discharged into the condensing chamber 48 through the pipe 47. The steam is discharged adjacent the rear portion of each stub member 23 and then flows upwardly and forwardly with the condensed water flowing backwardly toward the rear of a stub member 23 where it is picked up by means of a pump 49 which is connected by a pipe 50 to the lower end of the condensing chamber 48. The discharge side of the pump 49 is connected by a pipe 51 to a preheating jacket 52 which is positioned about the exhaust pipe or manifold 53 of the engine E. The preheating member 52 is connected by a pipe 54 to the separator 40 so that a complete and closed circuit is provided for the steam and water used in the jacket 26 for cooling purposes and used by the turbine 29 as steam for power purposes.

In order to provide a means whereby the steam in the condensing member 48 may be reduced to a liquid in the event the stub wings 23 are lifted out and maintained in a lifted position out of the water, I have provided a water pick-up scoop 55 which is carried by the shaft housing 34 at a point below the fin or planing member 36. The

scoop or pick-up member 55 which may be the hollow hub of the water propeller, is connected by a channel or pipe 56 to the forward end of a stub 23, but preferably connected to a discharge member 57 which is adapted to discharge the sea water downwardly and rearwardly for contact with the exterior surface of the stub wing 23. The forward movement of the boat will tend to drive the water discharged from the outlet 57 against the wing surface where this water will be evaporated and serve as a means for keeping the stub wing cool so that the steam in the condensing chamber 48 will be reduced to a liquid.

It is desirable to maintain the cylinder jackets 26 at slightly below 400 degrees Fahrenheit constant temperature. If water in the jackets surrounding the cylinders is maintained at approximately 200 pounds pressure and rapidly circulated, removing the steam in a remote separator, such a desirable cylinder temperature may be maintained. The power obtained from the steam turbine 29, if the air screw engine exhaust pipes are jacketed so as to form preheaters, will exceed 50 per cent of the total power of the air screw engines if the turbines are provided with water cooled surface condensers on the under sides of the stub wings. Where air is present in the condenser 48, this air is removed from the condenser by an air pump 58 which is connected to the forward portion of the condenser 48.

The side or longitudinal edges of the main body 10 are bent or inclined downwardly as shown in Figure 5 at 59. The downwardly inclined opposite side portions of the main wing member 10 provide a channel beneath the main wing where compression of air is set up between the main wing and the water. This channel formation on the under side of the main wing or body 10 retains the air between the main wing and the water until the air passes beneath the stern of the main wing and at this point the air is permitted a slight amount of expansion or reaction similar to a nozzle, thereby increasing the pressure and lift of the tail and using or regaining some of this rearward velocity energy.

The wing thickness ratios are adjusted to produce smooth lines and even strength at all points, thus the chord thickness of one experimental model is eleven hundredths over the seven inches at the center, nine hundredths at the sides where the truss decreases in thickness and then the thickness is increased to eighteen hundredths as the chord length decreases toward the tips of the stub wings and then decreases to twelve hundredths at the tips of the stubs to give a sudden break in the lift when the angle of incidence increases slightly.

At the extreme speeds of which this boat is capable because of its much lower air resistance in proportion to the weight carried by the air as compared to usual airplanes, the water propellers do not have a high efficiency but these propellers are made relatively small and rotate at a relatively high speed, say 15,000 R. P. M., by direct connection with the high speed turbines 29. Through the use of the water propellers from power ordinarily lost or thrown away, the waste power is used to provide stable operation of the boat and the light weight of such high speed steam turbines makes it possible for the boat to be operated economically and at a speed and cruising range far in excess of present airplanes.

The compact shape of the boat with an aspect ratio of one, that is, the boat is as long as it is

broad, makes its wing area about four times the wing area for a given wing spread over conventional planes and since the spread for the given wing chord is decreased to one-sixth the usual value, the strength for a given weight of wing surface is increased thirty-six times according to beam formulas and the boat made thirty-six times stronger or one thirty-sixth as heavy for the same strength. The angle of incidence of the main wing is say ten degrees when both tail and stub wings touch the water. When the tail lifts to stable equilibrium, this angle becomes six degrees. A slight camber may be used, if desired, in this section but as constant center of pressure is desired, it is not used elsewhere. Here, however, it does provide smoother lines in joining the next sections which are lower and of nine-hundredths thickness of chord length and still have the same chord. The incidence angle of this section, which is the largest portion of the wing area, is nine degrees at the starting position before the tail lifts, and five degrees in equilibrium. There is no camber and in this section, and here the chord decreases to forty percent of its greatest length and the leading edge becomes continually lower. Finally to compensate the rapidly decreasing wing thickness due to using the same nine-hundredths ratio, as the chord is shortened this ratio is rapidly increased to eighteen hundredths ratio with a corresponding increase in angle of incidence at which the extra thickness does not materially decrease the wing efficiency but does provide required strength. Then with still increasing incidence angle and less need for strength, the thickness is reduced to twelve-hundredths at the tip to provide an abrupt stalling angle close to the stable operating angle. It may be increased to twenty-five degrees with slight air resistance increase if space is needed for machinery installation.

The stern of the boat or body 10 is provided with a pair of upstanding fins 59^a which are disposed in parallel relation to each other. These fins 59^a may, if desired, be used as rudders, although they may also be fixed relative to the stern so as to act as guiding fins and where this is done, the fins 59^a may be fixed to the stern of the boat 10 on the upper side thereof.

In the use and operation of this boat, the engines E are of conventional internal combustion type and during the time that the boat is stationary, the body 10 will be positioned with the stern thereof contacting with the water. At this time, the stub wings 23 will be inclined to a point known as the stalling angle and when the engines or motors E are operated so as to rotate the air screws 25, the body 10 will swing upwardly with the stern thereof elevated from the surface of the water. The pump 37 will maintain a predetermined pressure of water in the jackets 26 of the engines E and as the water is heated through operation of the engines E, any steam rising from the water will be carried to the separator 40 and will then pass out through the pipe 43 down inside the jacket 44 which is heated by the heating member 45. The steam in the pipe 43 will be super-heated to a predetermined degree and will then pass through the valve 33 to the turbine 29. There is one turbine 29 and one water screw or propeller 27 in each stub wing 23. The exhaust steam from the turbine 29 will pass through the exhaust or outlet pipe 47 into the condenser 48 carried by the stub wing 23 and the condensed liquid will then

flow downwardly to the rear of the stub wing 23 where it is picked up through the suction pipe 50 connected to the pump 49. The pump 49 then returns the water through the pipe 51 to the preheating jacket 52 from which point the water passes through the pipe 54 to the separator 40 and then back to the jacket 26 through the pipe 38. Assuming that the boat is in motion with the air screws 25 operating and the water screws or propellers 27 operating, the planing member 36 connected to the propeller housing 34 will maintain the propeller 27 at a predetermined depth within the water and by planing or buoyancy will prevent the propeller being pulled downwardly in the water. The flexible connection formed by the flexible shaft 28 and the flexible connection 35 between the housing 34 and the stub wing 23 will permit this planing member to travel over the wave surface. When the boat is in motion, the angle of the stub wings 23 is such that these wings will readily ride over the surface of any waves being inclined to a degree slightly greater than the normal inclination of the waves. In the event the boat should suddenly rise almost completely out of the water and then drop, by reason of the shifting of the center of lift due to the pull on the forward end of the boat caused by the propellers 27, the shock of dropping back onto the water will be partly absorbed by the resilient fins or shock absorbers 24 which will take any shock not prevented by the water screw action. The boat may be steered by manually cutting down the speed of a selected turbine 29 so that the opposite turbine 29 will turn the boat. During the entire time that the boat is in motion sea water will be forced through the pipe 55 by reason of the open scoop 55 which will pick up the water and force this water through the pipe 56 and then out through the discharge member 57. While the stub wings 23 are in contact with the surface of the water, the discharge of the sea water as a condensing medium is unnecessary, but as soon as the wings 23 are substantially entirely out of the water, it is necessary to provide a separate condensing means for the condenser 43. By having the scoop 55 operating at all times, it is not necessary to manually control the passage of sea water, and in this manner, when the stub wings 23 leave the water, the sea water will be discharged through the discharge nozzles or openings 57 against the under sides of the stub wings where it will be evaporated and thus cool the under sides of the stub wings 23 and provide sufficient surface cooling to condense the steam in the condensing members 48.

This boat has been designed particularly as an airplane carrier capable of relatively high speeds, but so designed as to substantially skim over the surface of the water. As hereinbefore described, it is designed so that the water screws or propellers 27 will not at any time leave the water as when the stub wings 23 rise substantially entirely out of the water, the planes 36 will gravitatingly hold the propellers 27 in the water due to the weight of these planes and the propeller housing 34. This will cause the propeller housing 34 to swing downwardly relative to the stub wing 23 and operate the valve operator 31, which is connected to the valve 33. The effect of this will be that one or both of the turbines 29 will be shut down, either entirely or partially, and in this manner the submerged propellers 27 will act as a drag below the center of gravity of the boat and thus cause the boat

to nose downwardly. As soon as the stub wings 23 have lowered sufficiently to change the angular relation of the housing 34 to a full operating angle, the operating member 31 will open the valve 33 and the turbine 29 will then operate as before. As hereinbefore stated, the stub wings are provided adjacent their inner portions with bulges or enlargements 60 on their under sides and enlargements 61 on their upper sides at the change of the angle of incidence and permit the tapering off of the stub wings to the desired thickness. The connection between the stub wings 23 and the main body 10 is effected by means of inclined body portions 62 which are inclined downwardly at an obtuse angle to the transverse or horizontal axis of the main body 10. The inclined portions 62 provide a channel on the under side of the boat through which the air is forced by the propellers 25.

A boat constructed according to an embodiment of this invention will permit the use of relatively high speed airplanes over the water and will provide a moving landing surface for the planes which may be operated at a sufficient speed so that the high speed airplanes can readily land on an exceedingly short length landing surface. Conversely the moving landing surface will also provide sufficient length of surface for take-off as the boat may be operated at the desired speed during the take-off of the airplanes from the upper surface thereof. In this manner, the speed of the airplanes can be extended to any desired degree and will not be limited as at present by reason of the size of the landing field, which for high speed airplanes must be longer than for slower speed airplanes due to the higher landing and take-off speed.

This craft will permit small planes with landing speeds three times as high as where mile long landing fields are provided. This will permit a wing surface only one-ninth as large and thereby tremendously increase the top speed of the small planes.

As will be noted in Figure 9, the shaft housing 34 projects forwardly of the stub wing 23 and is held against lateral or whipping movement by means of a pair of forwardly convergent bracing members 63 which are pivotally secured at their rear ends to the wing 23 and at their forward ends to the housing 34. Intermediate struts or braces 64 connect the intermediate portions of the braces 63 to the housing 34.

The body 10, wings 23 and inclined side portions 59 are so shaped and related to each other that upon downward movement of the body, there is created a velocity of air laterally, forwardly and backwardly which provides a reaction on the underside of the body in an upward direction which has the effect of inducing additional lift.

What I claim is:

1. A skimming-craft comprising in combination, a combined airplane body and wing structure, air screw propelling means for said body, obliquely inclined stub wings carried by and formed as a continuation of said body, water propelling means carried by said wings and operatively connected to said air screw propelling means, and means connected to said water propelling means for controlling the speed of said water propelling means in proportion to the position of said wings relative to the surface of the water.

2. A skimming craft comprising a hollow body having a length greater than its width, laterally

and downwardly extending stub wings carried by said body, said stub wings being hollow and buoyant and capable of supporting the forward portion of the body above a body of water, the rear marginal edges of said stub wings being inclined inwardly and upwardly and merging with the opposite side edges of said body, the opposite side edges of said body being inclined downwardly and outwardly and correlated with said wings in providing a rearwardly reducing air space beneath said body.

3. A skimming craft comprising an airplane body including buoyant laterally and downwardly extending stub wings, air propelling means carried by said body, water propelling means carried by said wings, said water propelling means including angularly movable rotatable means extending forwardly of said wings, means correlating the operation of said wings, means correlating the operation of said air propelling means with said water propelling means, and means operable upon variation of the angular relation of said rotatable means with respect to said stub wings beyond a predetermined angle for independently regulating the operation of said water propelling means.

4. A skimming craft comprising an elongated body adapted when in motion to be disposed above a body of water, air propelling means for sustaining said body above the water, water propelling means swingably carried by said body and projecting forwardly thereof, and means connected with said water propelling means for retarding the speed thereof when said body rises above a predetermined height relative to the water to thereby effect a downward pull on said body.

5. A skimming craft comprising an elongated body adapted when in motion to be disposed above a body of water, air propelling means for sustaining said body above the water, a pair of flexible shafts extending forwardly of said body, operators for said shafts carried by said body, propellers on the forward ends of said shafts buoyant means holding said propellers at a predetermined depth in the water, and means connected with said flexible shafts and said oper-

ators for retarding the speed of said propellers when said body rises above a predetermined height relative to the water.

6. A skimming craft comprising a single wing or airfoil tapering from its forward to its rear portion with the widest portion foremost, laterally and downwardly extended stub wings having a maximum span approximately equal to its maximum chord, and means for blowing air beneath the airfoil.

7. A skimming craft comprising a single wing or airfoil tapering from its forward to its rear portion, laterally and downwardly stub wings, air propelling means in the leading edge of the airfoil and automatically variable water propelling means in said stub wings including adjustable means to retard the craft's motion and thereby lower the craft's nose whenever its incidence angle materially increases.

8. A skimming craft comprising an airfoil extending from end to end of said craft, the lateral edge portions of said airfoil inclined downwardly from the central portion thereof for contact with the surface of the water, thereby forming a channel beneath the craft extending from end to end thereof, the forward portion of each lateral edge formed to provide a wing portion, said airfoil formed to provide angles of incidence with respect to the longitudinal axis of the craft, the angle of incidence of said wing portions being greater than the angle of incidence of the central portion of the airfoil, thereby increasing the stability longitudinally of the craft.

9. A skimming craft as set forth in claim 8 in which the inclined lateral edge portions taper toward the rear to thereby provide for reducing of the depth of said channel in a rearward direction.

10. A skimming craft as set forth in claim 8 including power means for creating a blast of air rearwardly under said craft, thereby increasing the air pressure under said craft.

11. A skimming craft as set forth in claim 8 wherein the airfoil is formed with the lateral edge portions thereof in rearwardly convergent relation.

DOUGLAS K. WARNER.