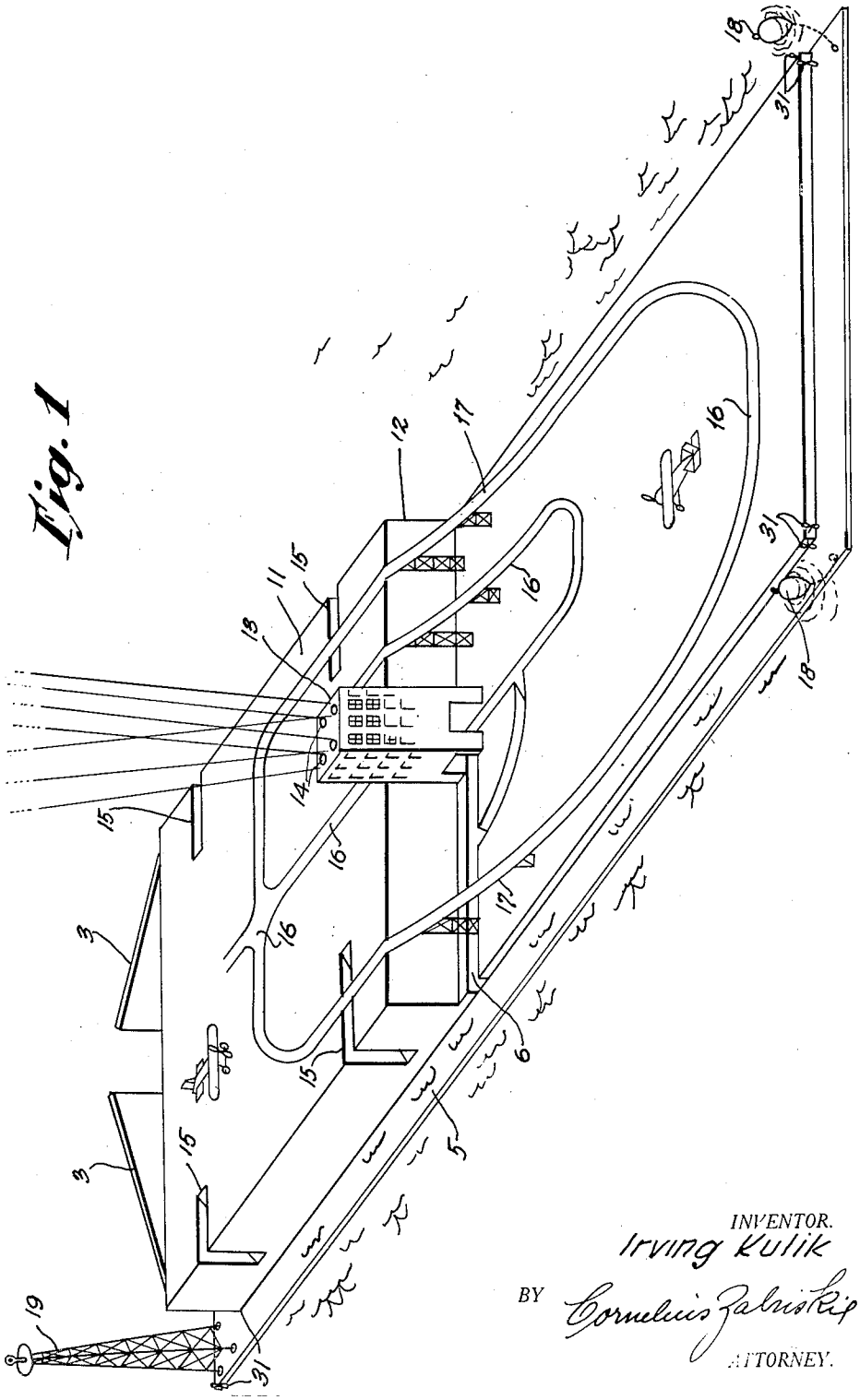
Feb. 7, 1933. I. KULIK 1,896,546

FLOATING AIRPORT

Filed Jan. 20, 1930 3 Sheets-Sheet 1

Fig. 1



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FLOATING AIRPORT

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Fig. 2

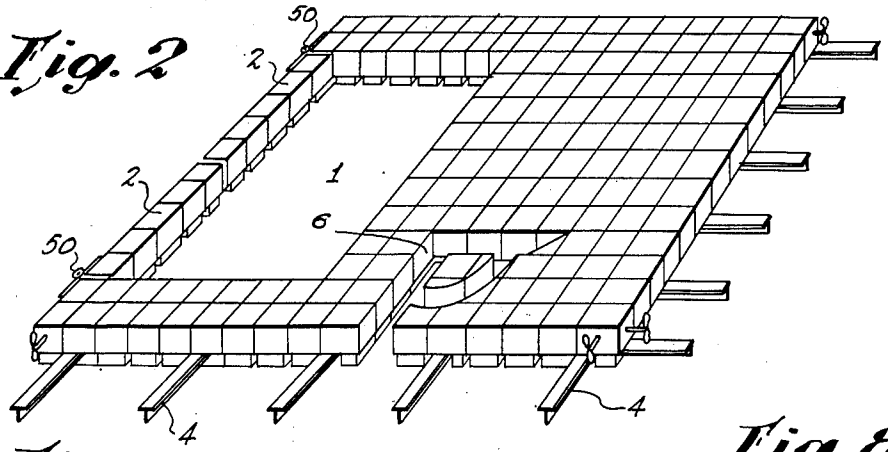


Fig. 7

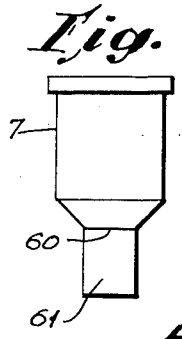
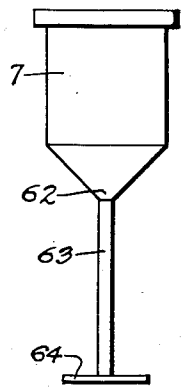


Fig. 8



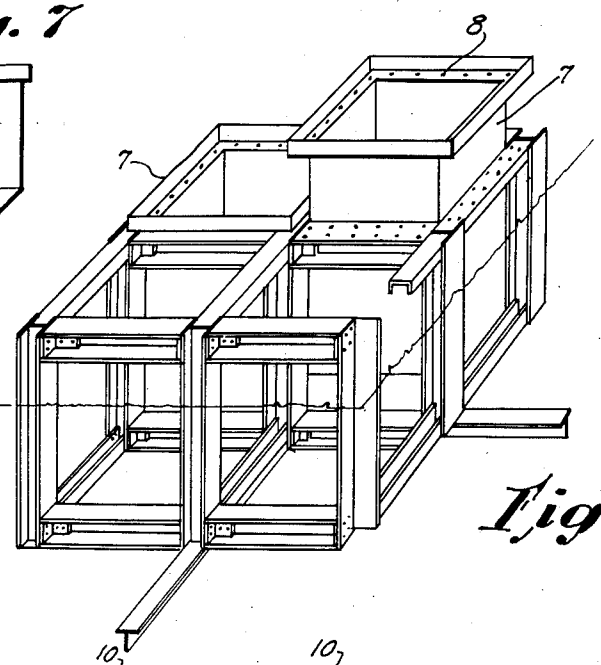


Fig. 3

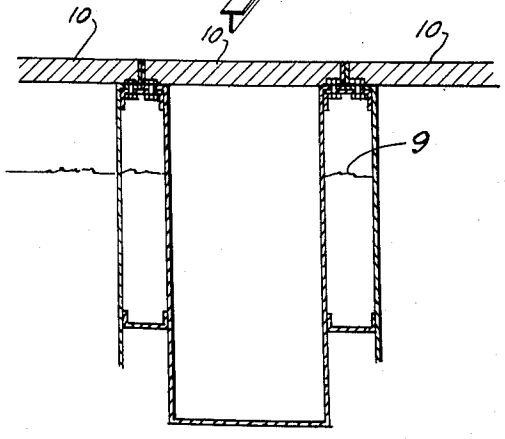


Fig. 4

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FLOATING AIRPORT

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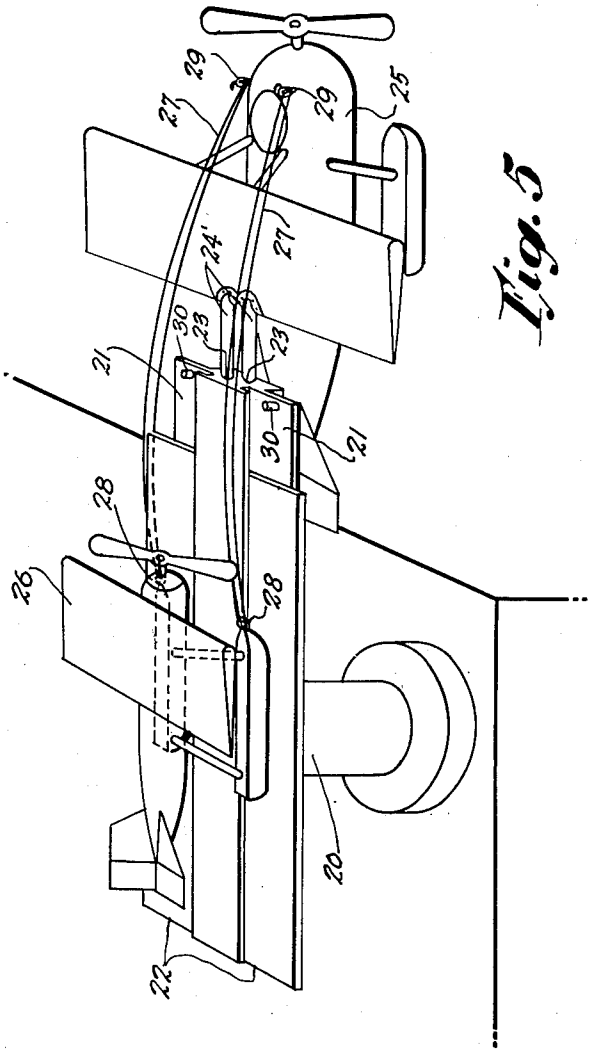


Fig. 5

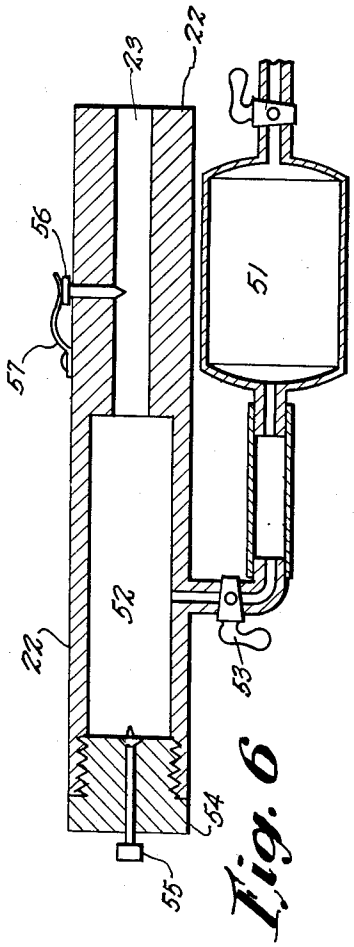


Fig. 6

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UNITED STATES PATENT OFFICE

IRVING KULIK, OF BROOKLYN, NEW YORK

FLOATING AIRPORT

Application filed January 20, 1930. Serial No. 421,941.

This invention relates to airports and more particularly to airports adapted to float whereby they may be moored far out at sea, as well as close to the shore and are equally adaptable for use on inland lakes and other waterways.

The object of the present invention is to provide a buoyant airport which will constitute a substantially complete aviation field with housing facilities for aircraft, appropriate runways, repair shops, hotel accommodations and other facilities which go to make up a complete unit for the care and maintenance of aircraft, and the housing and comfort of the operating personnel and passengers.

The invention embodies numerous novel features of construction all of which combine to render the structure of this invention wholly practical and efficient in the performance of its intended functions. These numerous features will be hereinafter more fully set forth, but some of the most important of them may be briefly referred to as follows.

A secondary float arrangement made up of a large number of buoyancy chambers which may be separately and individually assembled, dismantled or removed to increase or decrease the size of the port or to permit of repair thereof. The utilization of a floating landing field, different portions of which are at different levels, the portions having the upper levels provided within themselves housing facilities for aircraft. The employment of floating doors for closing the entrances through which aircraft are received into the confines of the port also constitutes a novel feature of this invention. I also consider as highly novel the employment about the floating port of a submerged shelf which extends outwardly from the margins of the landing stages submerged a short distance below the surface so that if accidents should occur adjacent these landing surfaces which would bring about sinking of aircraft adjacent thereto, such aircraft will come to rest below the surface of the water on this shelf and can be readily recovered.

Another feature of the invention consists in the use of appropriate lighting equipment which will be hereinafter more fully described, as well as landing, mooring and take off apparatus which will presently be described in detail.

Features of the invention, other than those specified, will be apparent from the hereinafter detailed description and claims, when read in conjunction with the accompanying drawings.

The accompanying drawings illustrate different practical embodiments of the invention, but the construction therein shown is to be understood as illustrative, only, and not as defining the limits of the invention.

Figure 1 is a perspective view of a floating airport embodying the present invention.

Figure 2 is a perspective view diagrammatically showing the buoyant portion of the structure.

Figure 3 is a perspective view showing the manner in which the buoyant part is fabricated.

Figure 4 is a vertical section through the buoyant part of Figure 2, showing portions of adjacent buoyancy chambers in section.

Figure 5 is a perspective view showing launching apparatus forming part of this invention.

Figure 6 shows a cross section of the interior of platform 22.

Figure 7 shows a view in side elevation of a tapered bottom buoyancy chamber with a fin extending below it.

Figure 8 shows a view in side elevation of a tapered to a point bottom buoyancy chamber with a post extending below it.

I wish it understood at the outset that the floating airport of this invention may be of any suitable shape and size depending upon conditions and locality of use. It may be made relatively small for use on inland waterways or lakes, whereas for use far out at sea, it may be made of gigantic size. The present invention is not limited in this regard, but the arrangement is so conceived that it is in effect expansible in the sense that it may be added to or subtracted from to vary its size as desired.

In the illustrative showing of the drawings, the general plan layout is as exhibited

in Figure 2. In this figure, there is shown a substantially honeycomb construction embodying a large number of air cells or buoyancy chambers associated with one another to form a buoyant platform. For the particular design shown the platform is provided with a reentrant portion 1 at one end, across the open side of which are arranged buoyancy sections 2 for supporting doors. These sections may be hinged at 50 with respect to the rest of the structure, so that the doors 3 which are superimposed on and carried by said sections may be floated into open and closed position and vice versa, with respect to the reentrant portion 1 which forms a mooring basin. The beams 4 shown in Fig. 2 are for the purpose of supporting the shelf 5 shown in Figure 1 and hereinafter more fully described. A second branching reentrant portion 6 is shown in Fig. 2. This is in the nature of a passage into the confines of the port and into which passage or runway, which has flowing water on the bottom of it, a craft may "taxi" to a take off or to a stop. The passage 6, by having fluid on the bottom of it is, therefore, a runway with fluid at the bottom of it for the take off and the landing of pontooned aircraft.

The honeycomb construction to which I have referred in connection with Fig. 2 may be fabricated in various ways without departing from this invention, but in Figs. 3 and 4 I have shown a very satisfactory form of construction. Here a series of structural metal shapes are bolted or riveted together to form the honeycomb structure in a manner which will permit of the addition or subtraction of any number of sections as may be desired and by so fabricating such structure, a series of pockets are formed in each of which is positioned a buoyancy chamber in the form of a receptacle 7. These receptacles which are best shown in Figs. 3 and 4 are adapted to be laid down from the top of the honeycomb frame into one of the pockets therein and preferably project as shown in Fig. 4 a distance below the bottom of the frame, so as to produce relatively extensive buoyancy means, sufficiently small nevertheless to be readily handled. The tops of the buoyancy chambers 7 are flanged so as to limit their downward movement and the flanges are perforated as shown at 8, so that they may be bolted firmly to the frame. In practice, the frame is submerged through substantially the plane of the line 9 which indicates the water level and such being the case, it will be apparent that when it is desired to remove any particular chamber 7 for repair, this may be accomplished by releasing the bolts which hold it in place whereupon it will float to the surface of the water and can be readily removed. To replace the chamber, it is brought into floating position within the appropriate pocket of the frame and then filled with water. This will lower the chamber sufficiently to permit it to be bolted to the honeycomb frame, whereupon it will be pumped out and will thereupon function as a buoyancy chamber.

It is also possible in practice to properly "trim" the port, i. e., to maintain it level by pumping into or out of the respective buoyancy chambers sufficient water to give this result.

The upper surface of the honeycomb frame may be covered by a suitable platform or may be provided with a floor formed in sections, so that one section will fit into the flanges at the top of each buoyancy chamber as indicated at 10 in Figure 4. In this way, ready access may be had to the interior of any buoyancy chamber. It will be noted from Figure 1 that substantially one half of the length of the port is at the lower level formed by the platform sections 10. The remaining portion of the port is at a higher level indicated at 11. This higher level forms the roof of a suitable housing 12 built up structurally upon the honeycomb frame in any suitable manner, and provided with a hollow interior adapted to serve as a hanger or housing for aeroplanes and lighter than air aircraft admitted through the opening at the back of the port when the doors 3 are opened so that such craft may be housed against storm and the elements within a closed housing. A depot building 13 with runways to its upper and lower floors may also be built on the port and this building may be sufficiently large and provided with appropriate doorways to permit the entry and exit of aircraft directly thereinto and for unloading and loading passengers and freight within the building an elevator may be provided for raising and lowering the craft to the various floors or from the upper to the lower moorings as may be desired. In this building are appropriate machine shops, such space and rooms for guests, employees, restaurants, etc., and on top of the building and at the sides thereof if desired may be powerful searchlights 14, or radio beacons or other illuminating devices to facilitate landing or direction of aircraft.

As hereinbefore stated, the port is adapted to float upon the water with the shelf 5 submerged a few feet below the surface. The shelf may be of any appropriate construction, but should be so fabricated that if the craft should sink adjacent the port, they will be arrested by the shelf and can be readily recovered. Aeroplanes are adapted to land and take off from either the upper or lower levels and amphibian craft is adapted to be launched through runways 15 which run right down into the water or surface from which the housing 12 extends and are of any appropriate construction. Hydroplanes or amphibians may also enter or leave the port through the channel 6 leading from the ex-

terior edge of the port to the depot building 13. Runways 16 are provided at both the upper and lower levels and such runways connect between the upper and lower levels by ramps 17 which may serve as take off runways if desired. It will be noted, that one of these runways is in the form of a loop with gradient portions thereby giving a continuous path of travel, so that should a take-off be attempted down one of the ramps 17 and insufficient speed obtained to safely take the air, it is possible for the pilot to taxi back to the point of starting at the upper level and try again. The runways 16 may be disposed in any convenient way to suit conditions. To facilitate anchorage of craft in the water, buoys 18 are provided and a mooring mast 19 may conveniently be mounted on the shelf 5, extending from below the surface of the water as shown or on any other suitable portion of the port to render the arrangement most convenient and capable of carrying out its functions with the highest efficiency.

A port with a shelf 5 below it and alongside of it and with buoys 18, as described, has considerable advantages. The buoys 18 connected to the port, in the manner described, can prevent undue submersion of the port during the impact of landing of a heavy aircraft on the port, while the shelf 5 will tend to steady the port during the impact and will prevent a sudden bobbing up of the port out of the water when an aircraft takes off from the float and thus suddenly lessens the load on the float. Also, the buoys, by being connected to the port in the manner shown, sort of immobilizes the port with respect to lateral movements upon the body of water upon which the port floats, and considering this immobilization, the shelf 5 which is submerged below the surface of the port and alongside of the port serves as an artificial bottom upon which a boat can drop an anchor. At the same time the flat and wide submerged shelf 5 can break up and dissipate the roll of a wave or waves to prevent the rocking of the port.

What applies to the port in general, of course, applies to the housing or shed 12 which the port embodies. And the shed 12 in turn embodies also the novelty of having doors for entrance and egress to the shed, which doors are supported on water by means of floats. Also, cut into or notched into the roof and walls of said shed are runways or ramps 15 which lead to the water which supports the shed. These notches into the mammoth shed incidently serve to produce a stream line for the shed to counteract the effect of wind stresses, besides affecting a counteraction factor against the well known contraction and expansion of materials brought about by temperature changes, and which in the case of mammoth sheds is an important consideration. The roof of the shed 12 serves for landing aeroplanes, just like the water level portion of the port. When an aeroplane is landed anywhere upon the port the shock of landing is taken up in a novel way and movement of the port during landing is checked in a novel way, as explained in the following. The floor of the shed 12 is made up of the water upon which the shed 12 floats. This water will react with the inner walls of the shed 12 to prevent movement of the port in lateral directions when an aircraft is landed upon the port. Also, upon landing of an aircraft the air within the shed will be compressed against the surface of the water on the bottom of the shed to thus prevent undue submersion or downward movement of the port during the landing of an aircraft thereon.

In a sense the shed is a portable inverted cradle. It has no floor and can be moved up over the top of a lighter than air aircraft to cradle the aircraft and to berth it. The housing 13, which is associated with the shed 12 with its glass roof and searchlights beneath the glass, giving a skyward light, will help considerably in this berthing process.

I also preferably associate with the airport of this invention a launching apparatus which greatly facilitates the launching of craft. This launching apparatus is of a catapult nature. The great difficulty that has happened upon the use of catapults is the great strains to which the craft has been subjected and the shocks which the pilot must incur by this operation.

In Fig. 5 of the drawings, I have illustrated a method and apparatus embodying, generally speaking, a catapult operation with marked variations over prior practice which render the present structure practical for general uses. The underlying principle involved in this arrangement is to provide a special catapult craft so designed and built as to stand great strains and to act after the manner of a tractor whereby it is adapted to draw heavy loads after it both off of a platform and to maintain such loads in the air. The method consists in catapulting this so-called tractor plane and utilizing said plane to draw after it one or more planes which it is desired to launch, the operation being had with sufficient cushioning effect upon the latter planes as not to impose undue strain either upon the plane structure or upon the passengers.

By reference to Fig. 5, wherein one form of the structure which I may use is illustrated, 20 designates a suitable standard which is adapted to be mounted in fixed and firm position on any suitable part of the airport preferably on the upper level. This standard, which may be of any height, supports a suitable guide 21 on which a platform 22 is mounted for longitudinal sliding

movement. Antifriction devices may be associated with the platform and guide catapulter to facilitate this sliding movement.

At the front end of the platform are openings 23 and into these openings are adapted to extend rods 24′ which are permanently attached to any suitable portion of a tractor plane 25. Within the guide 21 there is provided appropriate catapulting means either in the form of springs or other appropriate pressure devices, mechanical, pneumatic or hydraulic or explosive, well adapted to rapidly eject the rods 24 from the holes 23 and with sufficient velocity to impart to the tractor plane 25 a substantially flying speed. By this operation the tractor plane 25 is launched in the air at a speed well adapted to permit it to continue flight. The plane to be launched is indicated at 26 and is adapted to rest upon the platform 24 when the platform is slid back to the rear end of its travel. Two cables 27 are anchored permanently at one end to the tractor plane 25 and are thence carried rearwardly to and loosely pass through eyelets 28 on the plane 26 and thence return to and secure to the tractor plane 25 as by the hooks 29. When the plane 25 is catapulted as stated, it will draw the plane 26 after it and the platform 22 will slide forward until it strikes the stops 30 which will arrest the movement of the platform while the plane 26 will be launched from the forward edge thereof without that shock or snap to which the tractor plane is subjected by the catapulting operation.

The cables 27 are left attached until the craft 26 is in satisfactory flight preferably above the ship 25, whereupon the pilot of the ship 25 may release the hooks 29 and thus permit the plane 27 to be slowly released. By the means described, there will be no direct and violent starting of the craft 26 as all of this shock will be taken by the craft 25 which is built to withstand the initial impact of the catapult, although it can before or after be used as well for all other purposes that a plane is intended, and may serve moreover to sustain the craft 26 in the air if it should fail of its own power to maintain flight. If desired, a plurality of planes similar to 26 may be launched at the same time by providing the plane 26 with cables similar to the cables 27 to be attached to another plane positioned on the platform directly back of the plane 26 so that the plane 26 and said other plane are launched in tandem. The cables between these two latter planes as well as between the plane 26 and the plane 25 may be kept connected so long as desired, the craft thus flying spaced apart but associated with one another by cable connection, the first plane thus being a tractor and the planes that follow being trailers.

The airport of this invention may be anchored in the desired position by means of suitable anchors not shown but is preferably provided with means whereby it may be moved under its own power. For this reason, I preferably provide at each of the four corners of the airport, or in any other position hydropropellers 31 adjacent the shelf 5, as shown in Fig. 1. The shelf 5 acts then in connection with the propellers in the nature of a fin, the propellers' slip streams or eddies and the fin reacting. Power plants for operating these propellers may be in the form of motors positioned within the corner buoyancy chambers 7 or may be otherwise mounted without departing from this invention. One very important advantage in utilizing a self contained source of power for shifting the port resides in the fact that through proper control of the propellers the port may be shifted around into different relations with respect to the direction of winds to facilitate landing and take off of the planes and this is true either when the port is used on inland waters or on the ocean.

The bottoms of the buoyancy chambers 7, instead of being flat, may taper down to a point or edge and said buoyancy chambers may extend for any length desired below the structure Fig. 3.

As shown in Fig. 7, the buoyancy chamber 7 can taper down to an edge 60, and a fin 61 can extend from the said edge 60 for any distance desired, and on a single float buoyancy chambers having fins 61 of different length can be employed. As shown in Fig. 8, the buoyancy chamber 7 can taper down to a point 62 and a post 63 can extend from the said point 62 for any distance desired and on a single float buoyancy chambers having posts 63 of different length can be employed. A wide square or circular flange 64, accommodating in size to surrounding structures, can be positioned at the end of the said post 63. A choice of either of these buoyancy chambers (with posts or with fins), or any combination of both of these tapering bottom forms of buoyancy chambers or flat bottom form of buoyancy chambers can be used in connection with the structure, Fig. 3, to produce the float Figs. 1 and 2.

The fin 61 and the post 63 with its flange 64 will serve well in connection with the buoyancy chambers and the float in rough water. It is well known that while the surface of a body of water is rough the same body of water approaches calmness with the increase in depth. Thus the fin 61 or the post 63 with its flange 64 will keep the float steady at all times by extending to a depth below the surface of the water where it is calm. The shelf 5 may or may not extend beneath the reentrants 1 and 6.

All forms of craft while on the surface of the water can be securely anchored to the buoys 18 or to the mast 19 which extend from the shelf 5. A submarine may lie at

rest on the shelf 5, or may be anchored there unseen. In general it thus can be seen that an artificial form of anchorage is provided for use anywhere, and even an anchor can be dropped on the shelf from a craft. Of course, at the anchorage places the shelf 5 is low enough to accommodate the ships mentioned in the various ways explained.

The hinges 50 may be unlockable so that the doors 3 may be floated clear of the airport if so desired. The airport shown is a good airport layout even for upon land use.

The interior structure of the platform 22 is shown in vertical section in Fig. 6, with rod 24′ removed. The section is along one of the openings 23 into which one of the rods 24′ of the plane 25 fits before the said plane is catapulted. Fig. 6 shows the manner in which the catapulting power is supplied to react through the openings 23 with the rods 24′. If the catapulting is done pneumatically air under very high pressure from the tank 51 is delivered into the breach 52, after the valve 53 is opened, to forcibly expel the rod 24′ of the plane 25, which rod lies within the opening 23. If the catapulting is done by explosive powder a large center fire blank shell or cartridge is inserted into the breach 52 and the closure or breach block 54 which is previously removed is tightly reapplied. The cartridge is fired by a blow upon the firing pin 55 to forcibly expel the rod 24′ of the plane 25, which rod lies within the opening 23. Thus the said plane 25 is catapulted into the air. The description given for one breach 52 and one opening 23 suffices for the other similar breach and opening interiorly of the structure 22.

Steam under high pressure, water associated with a hydraulic press, and so forth, can also be efficiently employed so long as plenty of pressure fills the breach 52. To help in the launching or catapulting a check pin 56, kept under tension by a leaf spring 57, can hold the rod 24′ fast until the breach 52 is filled with a maximum of pressure (air, steam or water pressure), whereupon, the said check pin 56 can be raised and the rod 24′ with its plane 25 forcibly expelled and thrown into flight.

The interior structure of the platform 22 is analagous to a gun with 52 similar and acting the same as the breach of the gun and 23 similar and acting the same as the muzzle of the gun.

If so desired, a powerful built motorless plane (a glider) can be employed for 25 and also instead of the two cables 27 being attached from 25 to the plane 26 the said cables can be attached from the plane 25 to the platform 24, which may be winged and have no checks 30 to stop it. When 25 is catapulted it will forcibly draw the platform 24 forward to later launch out from off the platform the plane 26 mounted thereon.

The foregoing detailed description sets forth the invention in its preferred practical form, but it will be noted however that the invention embodies numerous novel features, some of which may be employed without necessarily employing them all. For this reason, the invention is to be understood as fully commensurate with the appended claims.

This application is a continuation in part of application Ser. No. 143,703, filed Oct. 23, 1926 which pertains to aircraft contact, and application Ser. No. 308,029, filed September 24, 1928 which pertains to airports.

Having thus fully described the invention, what I claim as new and desire to secure by Letters Patent is:

1. A floating airport having different landing levels, and an endless track extending over a plurality of levels and embodying ramps between said levels.

2. A floating airport provided with a raised landing area provided beneath the same with a hollow housing to serve as a hanger, said housing having an entrance door floating on the water and adapted to be supported by the water.

3. A floating airport provided with a raised landing area provided beneath the same with a hollow housing to serve as a hanger, doors for said hanger, and floats associated with the doors to support the weight of the latter.

4. A floating port provided along the margin thereof with an outwardly extending submerged shelf, whereby craft upon sinking along the edge of the port will be arrested and supported by said shelf.

5. A floating airport provided along the edge thereof with a submerged laterally extending shelf, and a mooring mast mounted on said shelf.

6. A floating shed for aircraft, and a take off ramp or runway extending through the roof and walls of said shed.

In testimony whereof I have signed the foregoing specification.

IRVING KULIK.