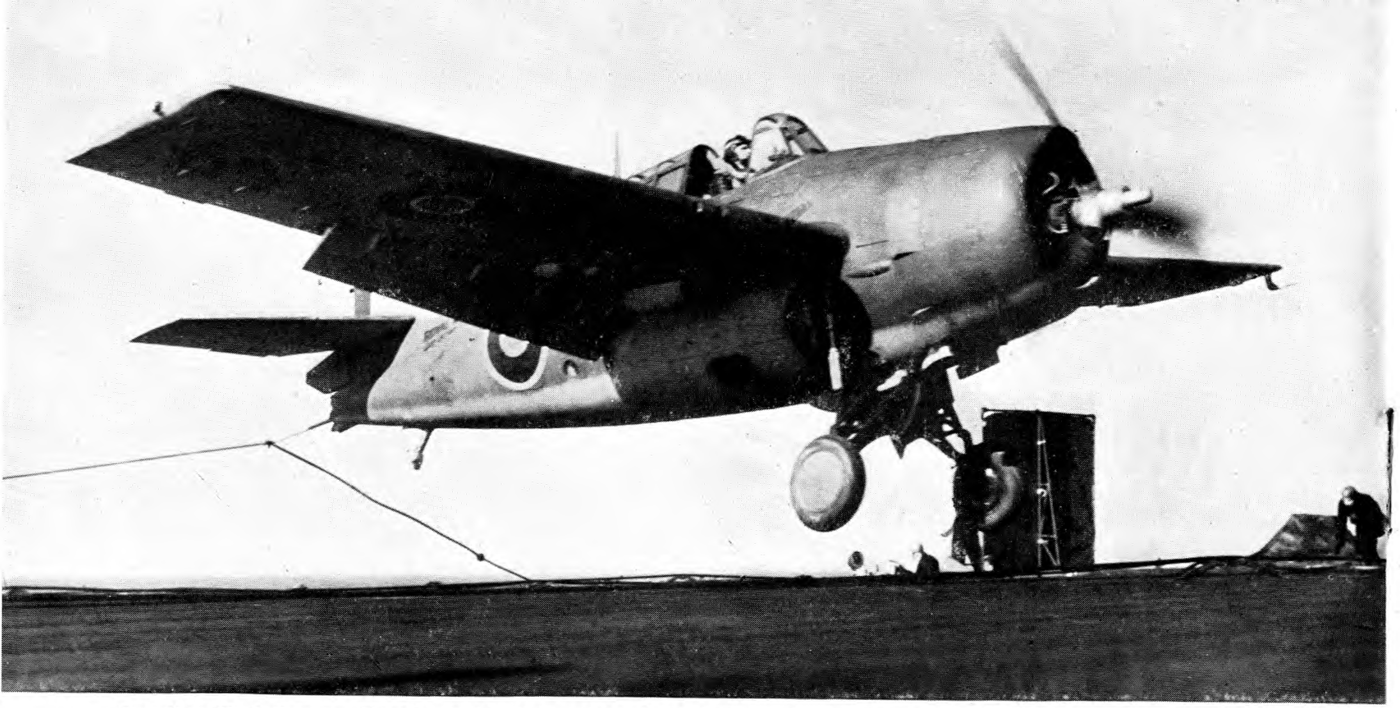
# AIR TRAINING CORPS GAZETTE

Vol. IV No. 7 JULY 1944 6d.



Landing Techniques. The Fleet Air Arm pilot's hook has caught the arrester wire, but his wheels have not yet touched down. Frank N. Piasecki, President of P-V Engineering Forum, Philadelphia, has an easier job.



# AIR TRAINING CORPS GAZETTE

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VOL. IV NO. 7 *Edited by Leonard Taylor* JULY 1944


# The Chief Commandant's Report

*Continuity Drill at Clapham and Barnstaple*

*Ex-Cadets at Willesden*

*Durham and South Tyneside Parade*

*New Gliding Schools Opened*

NOTHING has given me greater satisfaction during my past few weeks' inspection of Air Training Corps units than the displays of "continuity drill" which I saw at No. 1351 (Clapham) Squadron and at No. 1146 (Barnstaple) Squadron. These were most "polished" demonstrations, and because of the great value to cadets of this sort of training, especially to those who will later become aircrew, it is worth commending to other units.

The squadrons went through most of the movements in the drill book, repeated several times without a spoken order. Such training in physical control and mental concentration builds up the ability to react rapidly and automatically, an invaluable quality when flying in an aircraft under combat conditions.

At Willesden Wing I was happy to perform a very pleasing task—meeting a large number of ex-cadets now in the Services, who had come to the Wing's anniversary dance. Most of them, I was glad to see, were aircrew members; and it was very gratifying to find that so many had spared a few hours from their leave to visit their old A.T.C. comrades.

During the month I was privileged to be the guest lecturer to the Senior R.A.F. Officers Administrative Course at the R.A.F. School of Administration, and took the opportunity of telling my audience something about the A.T.C. I found these Administration Officers, whose duties are concerned with running the machinery of R.A.F. stations, most interested in the Corps and very willing to help our cadets when visiting their stations. It is up to us to see that we retain and strengthen that interest, when on training visits there, by maintaining at all times a smart and airmanlike bearing. On these occasions the A.T.C. must give evidence of its high reputation for smartness and discipline.

Another interesting direct contact with the Royal Air Force was during an inspection of a fine hutted camp on an R.A.F. station which cadets of North-East Command will occupy during their annual training and week-end visits. It was evident that both the Station Commander, Group Captain Paddon, D.S.O., and his officers are taking the keenest interest in their A.T.C. visitors, which is much appreciated and makes the A.T.C. feel very much "part of the R.A.F."

In the North-East I saw a fine parade of over 1,000 cadets of the County of Durham and South Tyneside squadrons at Rowlands Gill; and later was glad to be able to open officially the Elementary Gliding Schools No. 21, at Lambton Park, near Sunderland, and No. 26, Greatham—another step towards our object of getting as many of our cadets as possible into the air.

E. L. Gossage, Air Marshal,
*Chief Commandant and Director General, Air Training Corps.*

**Air Commodore A. D. Cunningham, C.B., D.S.O., admiring the All-London Rotary Club Aircraft Recognition Trophy, which was won for the third successive time by No. 628 (Pinner County School) Flight.**

## Honours for Cadets

### D.F.C.

Pilot Officer J. Barrass, of Hull (No. 763 Squadron).
Pilot Officer J. W. Robb, of Aberdeen.
Pilot Officer A. G. Clark, of Newton Abbot.
Flying Officer J. W. Lowrie, of Peebles.

### D.F.M.

Sergeant C. L. Spink, of Goole (No. 243 Squadron) (since reported missing).
Sergeant L. H. J. Wise, of Eastcote (Uxbridge Squadron).
Sergeant A. David Chandler, of Watford (No. 3 Squadron).
Sergeant P. J. Drought, of Brixton (No. 50 Squadron).
Pilot Officer W. Mortimer, of Hull (No. 1324 Squadron) (commissioned since award).


# Catapulting

PHILIP BANBURY

THERE are at least 500 aircraft at sea in the battleships, cruisers and merchant ships of the United Nations; they are nearly all seaplanes or amphibians and are launched by catapult. Six ships may carry as many as 24 aircraft between them.

These aircraft, their crews and mechanics, work under conditions which are probably more arduous than any experienced by land- or even carrier-based squadrons.

The arduous conditions include exposure to wind and weather, especially to corrosive salt spray, shock and vibration caused by the firing of the ship's guns, stresses set up in aircraft and crew by catapult launching, stresses in aircraft due to alighting on rough seas, and wear and tear while being lifted on to the catapult or out of the water.

A ship's catapult, rigged for action, is nearly 100 feet long and requires 25 feet clear space on either side of it for the free passage of the aircraft's wings. Nearby must be a crane to lift the aircraft (which may weigh 10 tons) out of the sea and on to the catapult. In the world's navies is to be seen almost every method by which catapults, cranes and aircraft can be carried on a deck already filled with guns, fire-control equipment, funnels, masts and boats.

**Early Launchings**

The daring experiment of launching an aeroplane from a warship was made here and in the United States just before the last war. The aircraft took off under its own power from a platform built above the fore heavy gun turret. The idea was that if necessary the ship should steam into wind to assist the take-off. The position of the runway was bad; warships with their low freeboard and high speed ship enormous quantities of salt water and spray over the bow, and the top of the fore turret is almost the wettest place in the ship. When a ship's heavy guns fire, the whole vessel shudders and something somewhere always breaks. Certainly no 1912-14 stick-and-string aeroplane could stand up long to the recoil and concussion of the two 50-ton guns just underneath. Aircraft have never been carried in this position since, and the catapult has superseded the runway, though in the late 'twenties a mailplane was launched from a platform built amidships on the U.S. liner *Leviathan*.

**A description of the various methods of accommodating catapult aircraft on old and new ships. The aircraft in the title picture is a Hawker Osprey.**

**Some Methods Compared**

The U.S.N. *New Mexico* (Fig. 1) illustrates the practice of building the catapult above a gun turret and using the turret to swing it into the flight position (from fore and aft to some direction giving a clear take-off). Doubtless when the ship was refitted after Pearl Harbour this obsolete feature was superseded. The older British battleships and cruisers (Fig. 2) have a turntable catapult amidships and stow the aircraft on it. The catapult folds into small space when not in use. *Ajax* at the River Plate carried two Seafoxes, which were badly shaken by blast from their ship's guns, and only one could be flown off. That one spotted for the squadron, was brought back, refuelled and relaunched during the action. In the same fight *Exeter's* two Walruses were damaged by splinters and could not be flown off.

With these mishaps in mind we pass on to up-to-date British practice in battleships and cruisers. The *King George V* battleships (Fig. 3) and the *Belfast* class cruisers have a fixed athwartships catapult (a catapult does not have to point into wind for launching) and a hangar forward of it. Aircraft are protected from blast and splinters until required, and no time is lost in rigging the catapult.



Modern U.S. Navy practice is shown in the sketch of the cruiser *Wichita* (1937) (Fig. 4), which has two turntable catapults aft, a single crane right in the stern and a lift to the hangar below. The "square" stern, which is growing in favour with naval architects, gives useful space for carrying aircraft.

The catapult-armed merchant ship (C.A.M.S.) is one of this war's heroic stopgaps. Fig. 5 shows the catapult on one of these ships with a Hurricane upon it. The life of the aircraft was one flight only, and the pilot hoped to return to his ship by parachute and dinghy.

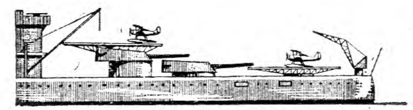


**Fig. 1. U.S.S. New Mexico.**

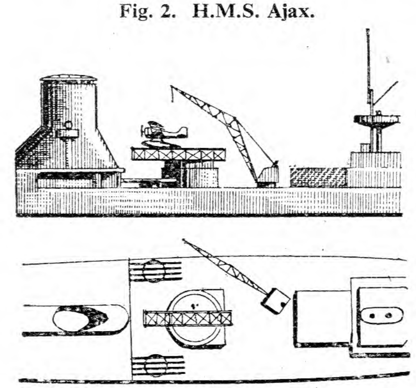
The Swedish cruiser *Gotland* (Fig. 6), launched 1933, 4,775 tons, carries eight seaplanes, originally Hawker Ospreys, but there is space for eleven. Each aircraft sits on a self-propelled trolley, which is driven on to the catapult and connected to the compressed-air launching mechanism. An aircraft can be launched every two minutes.

None of the belligerents has revealed whether it has seaplane-carrying submarines in operation. A seaplane, hangar and catapult were carried on H.M. Submarine M.2 before the war. In general, the present-day submarine is of moderate size, about 1,000 tons displacement, which is too small for the purpose.

**Recovery**

The recovery of the aircraft is much more difficult than launching it, and present methods are not very satisfactory, as they entail a high accident rate and may require the ship to break off the action while she makes a "slick" of smooth water to leeward of herself for the aircraft to alight on. First-class cranes are essential. They must be able to recover the aircraft from the sea to port or starboard. Operation must be very gentle, as any tendency to "snatch" will tear the lifting hook out of the aircraft. Acceleration must be smooth but very rapid when required, so that the driver can take advantage of any fleeting favourable circumstance of wind and sea. The driver must have delicate "spot-on" control to enable him to deposit his precious load just where it is wanted as quickly as possible, without smashing it into the many obstacles that lie between the water and the hangar.

**Fig. 2. H.M.S. Ajax.**



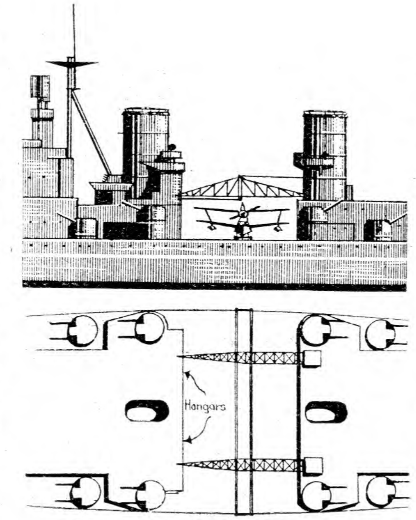



**Fig. 3. H.M.S. King George V.**

British ships usually carry starboard and port cranes, which lie very flat and snug when not in use. They are electrically driven, and cranes and control gear are made by specialist manufacturers.

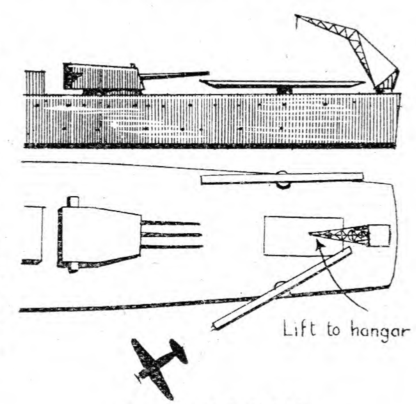



**Fig. 4. U.S.S. Wichita.**

The German South Atlantic airline which used flying-boats catapulted from ships experimented with a canvas "apron" trailed behind the ship to smooth out the sea for the incoming aircraft. The Italian Navy built a platform on a cruiser from which a Cierva Autogiro was operated successfully. The *vertical* landing-speed of a gyroplane can be very high, and if the ship is rising on a wave just as the autogiro touches down damage may be done to the undercarriage.

The aircraft now carried are suitable for reconnaissance, spotting and ship-to-shore work only. For these duties Walruses and Seafoxes, and later Kingfishers and Seamews, have proved excellent. Some years ago H.M.S. *Hood* carried a Swordfish and a Shark experimentally, indicating that a striking-force of torpedo-bomber seaplanes could be sent to sea in this way. No seaplane fighter has yet been made that could compete successfully with a landplane. In the past Italy had a single-seat flying-boat like a Baby Walrus, which perhaps indicates a line of development.

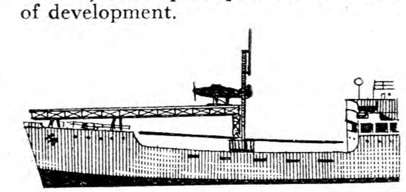
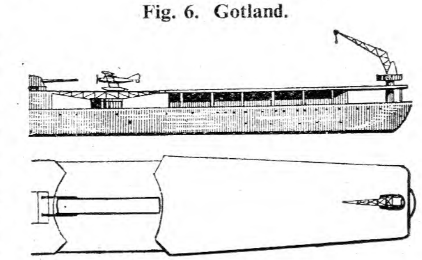


**Fig. 5. C.A.M.S.**

Floatplanes, whether single- or twin-float, are much behind the landplane in speed, manœuvrability, range and load capacity, and for ship work they have to be built very solidly to stand up to catapulting and handling stresses. The Seamew and Kingfisher and the Japanese Sasebo 00 biplane are excellent examples of modern practice, and show how difficult it is to clean up the design any more. Although the first two have upward-folding wings, backward folding is preferable for this service to keep the ship superstructure as low as possible.

The fundamental difficulty in small flying-boat design is the high propeller thrust line arising from the necessity of raising the propeller tips clear of the water. With the high propeller position goes a high engine mounting, which causes much higher drag than a landplane layout. This source of drag may be overcome, as experiments were proceeding before the war with the engine mounted inside the hull and driving the propeller through a vertical shaft and gearing. If the propeller could be eliminated and jet propulsion provide the means, the flying-boat would be very little behind the landplane in performance and not much different from it in appearance, though there would still be the drag of the stepped planing bottom to overcome.

**Fig. 6. Gotland.**



# AIRSHIP PILOTING

## by Lord Ventry

**Introduction**

THE U.S. Navy is making extensive use of non-rigid airships against the U-boats.

The non-rigid consists of a collapsible envelope, dependent on internal pressure for rigidity and shape. Slung from the envelope is the car containing crew and motors. On the stern of the envelope are the stabilising and control planes.

Every non-rigid has two or more air balloons, called ballonets, inside the envelope. With these it is relatively easy to keep the envelope to any desired pressure. If pressure falls, air is blown in; when it rises, air is valved.

Since it is necessary for airship pilots to have a thorough knowledge of the theory of lighter-than-air flight, here is an outline on aerostatics as applying to non-rigid airships.

**Lift**

The net lift of an airship is the difference between its own weight plus the weight of the gas in its envelope and the weight of the air it displaces. If the barometer stands at 30 in., or mean sea-level, and at 60 degrees F., 1,000 cu. ft. of air weighs about 75 lb., and 1,000 cu. ft. of hydrogen weighs about 5 lb. Therefore the lift of 1,000 cubic feet of hydrogen would be 70 lb. That is true only when air and gas temperatures are the same.

When the barometer rises, the air, if the temperature remains steady, becomes denser and so heavier; hence there is a gain in lift. The opposite is true for falls in the barometer. As the barometer falls about one inch per 1,000 feet, the air density is approximately one-thirtieth less, and so that much lift is lost for each 1,000-foot climb if there is no air in the ballonets.

Another factor which affects lift is the purity of the gas. If the purity be 90 per cent, there is a ten per cent loss of lift.

**Humidity**

Humidity also plays its part, but to a much smaller degree, except for the actual weight of water which might be collected. As dry air is heavier than damp, the less the humidity the greater the lift, and vice versa.

**Aerostatics in Practice**

Suppose that an airship is on the landing-ground waiting to go up, and that the envelope is full of gas and that there is no air in the ballonets. As she rises, the envelope cannot expand, and so her volume remains constant, and the expanding gas is valved. Obviously, then, as she cannot displace more air, and she is ascending into a constantly decreasing density of air, she will be losing one-thirtieth of her lift for every thousand feet.

If there is air in her ballonets her lift will remain the same provided air and gas temperatures are the same. For then the gas will expand at the same rate as the weight or density of the air decreases.

This ignores the probability of superheating of the gas by the sun, for the gas heats up much quicker than the surrounding air. If the gas temperature is higher than the air, expansion will be faster, and this will increase the amount of air displaced if there is air in the ballonets, and so give a false lift by the weight of this air, and also limit the ceiling.

Temperature usually falls with height, the normal lapse-rate being just over three degrees per thousand. This fall of temperature makes the gas contract, and this partly counteracts the expansion of the gas with height, and is one of the reasons why that at about 19,000 feet the lift is about half what it was at mean sea-level. If there was no fall in temperature, half the lift would be lost at about 15,000 feet. On the other hand, superheating must be allowed for, and that is one reason why an expansion of one-thirtieth for each thousand feet can be assumed.

As temperature makes such a difference in the lift, piloting is easier at night-time and in winter. Lift is greater on a cold winter day than a hot summer day, and on a dry, rather than a damp, day, and when a ship is newly inflated.

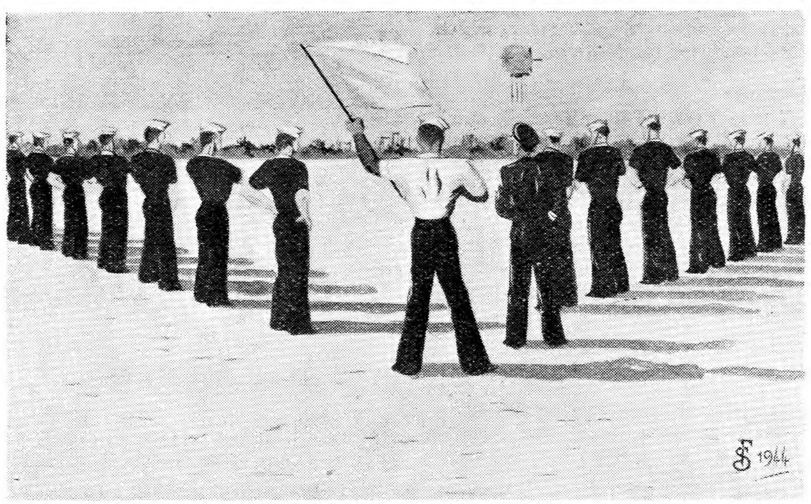
**Bumpy Conditions**

Handling is also affected by the type of country being flown over. Rising and falling columns of air have to be counteracted. In hot weather, when flying over sand or cut grass, and so on, hot currents of air will tend to make the airship rise; whilst trees and water cause falling currents. Conditions are easier over the sea, where the temperature does not vary so much as over the land.

**Actual Piloting**

Now, for the actual flying of the ship. The pilot does not work the controls himself, except in small airships. Steering is by foot-pedal or wheel; a wheel mounted in a fore-and-aft direction takes the place of the joystick. Ballast and gas controls are usually worked by pulling out knobs or toggles.

The pilot has to keep a constant eye on his manometers, or pressure gauges, for the safety of the ship depends on the correct pressure being maintained. Small changes of pressure are counteracted by rising if the pressure falls, and descending if the pressure rises. In more extreme cases air can be valved from the ballonets, or blown in, either from the propeller slipstream or from an auxiliary blower driven by a motor.



The ground handling party.

**Dynamic Lift**

Besides static lift, due to their displacement, airships have a dynamic lift (due to their movement). Hence they can be flown either heavy or light; but the ideal is to keep as much equilibrium as possible.

Flying very heavy or light is a tricky



business. Eventually control may be almost lost, and this is especially true when flying over bumpy ground, such as hills, trees and lakes; and here is rather a paradox, for a "light" ship flying bows down may dive in spite of the fact that she is light. One of the main problems of maintaining equilibrium is the loss of weight due to the burning of fuel. In a large non-rigid, lift may increase, for this reason, several hundred pounds per hour flown at high speed. This can be offset over water by picking up ballast. A hose is lowered with a pump, and the water is pumped up. It is also possible to transform exhaust gas into water, but this means heavy apparatus, not yet fitted to small airships.

**Controlling the Airship**

When under way the airship is usually steered by a rudder and by elevator planes. If the latter should fail it is possible to blow in air forward to cause a descent, and aft to cause a rise; and in some ships it is possible to move the crew or to use shift weights. If the rudder becomes inoperative, it is possible to steer by engines when these are outrigged.

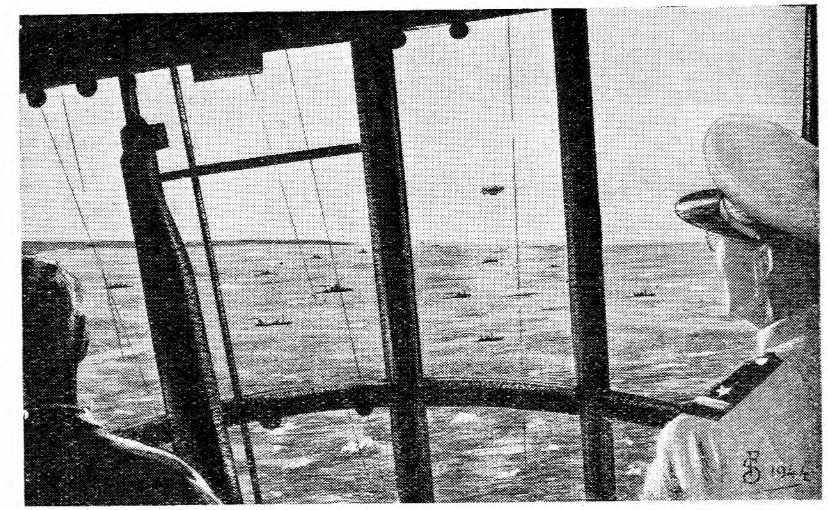
In the old days swivelling propellers were used, by means of which the propeller thrust could be used to drive the ship vertically up and down, or ahead or astern, thus making it possible to reduce the landing-parties, and to rise and descend into small tree-surrounded fields. Ships could therefore take off heavy and land light. Modern American airships have landing-wheels, and so can take off like an aeroplane; or, of course, they can take off light, rising like a free balloon, and the propeller can be set to turn when clear of obstructions.

**Airships and the Weather**

Fog flying is inconvenient, but except for remote danger of collision, not dangerous. Airships can fly in zero weather, if need be. Winds slow a ship down or cause drift, but provided there is plenty of fuel are not dangerous. Electric storms, line squalls and vertical currents may be very dangerous. Luckily, however, they are usually fairly easy to recognise in advance. An arch or line of low, black, turbulent looking clouds, perhaps stretching for three to four hundred miles, or towering thunderclouds (cumulo nimbus) give the game away. Also steep temperature gradients and high humidity. Severe icing may also be dangerous.

**Ballasting Up**

Ballasting up is a most important preliminary to leaving or landing, for then the pilot is able to adjust his lift and trim as desired. If there are no obstructions, and the ship has a high speed, it is possible to leave with a considerable overload by taking off like an aeroplane. If the flight is not to be a long one it is possible under these



U.S. blimps keep watch on coastal convoys.

conditions to so ballast the ship that at the end of the flight she will either be in equilibrium or still a little heavy, so that no gas would have to be valved or ballast taken in during the flight.

**Times for Leaving and Landing**

If a long flight is contemplated it is best to start at night, when lower temperatures give a greater lift and there is no loss of gas through superheating. It is best to open shed doors for some time before a flight, to equalise as nearly as possible the inside and outside temperatures.

During the flight the pilot can work out his lift. He has air and gas thermometers, and he knows the barometer pressure, and also knows how much ballast and fuel he has expended, and, of course, his fixed weights. Apart from this, he knows by the feel and angle of the ship if she is heavy or light. If she is heavy she will fly up by the bows, and if light down by the bows.

The best time for landing rather depends on the trim of the ship. For example, if she should be heavy the sun will give her a false lift and so help her. If she is very light it is best to land in the evening, before the temperature has fallen much but after superheat has disappeared.

**Before Landing**

On landing, the pilot would normally get his ship as nearly into equilibrium as possible. In this case he ballasts up by putting his ship head into the wind, slowing down his engines, so that all forward way is lost, and therefore all dynamic lift disappears. Then, if she is too light to land, he will have to valve gas, or, if heavy, let go ballast, and he must blow air into his forward or aft ballonets to bring the ship into a good horizontal trim.

Then, having ballasted up, he would if necessary circle the landing ground, and come in head to wind, with nose towards the landing-party, which is drawn up in the form of a V, pointing in the direction the ship is travelling. He can then make a high landing by dropping his tail rope, maybe a couple of hundred feet long. This is seized, and the ship is hauled down vertically. Better, he will come down so that his long bow guys touch the ground, and are seized by the landing-party. The ship should be as nearly on a level keel as possible.

**Steerage and Pressure**

Steerage way must not be forgotten, so a sufficient speed must be maintained for the ship to be kept under proper control, and accurate steering is essential, a dead aim being made for the landing-party V. As the older airships were slow and sluggish on their controls, a high trail-rope landing was the usual thing. Today landing on the guys is the usual practice, the ship then being under better control. When the ship's speed has fallen and dynamic lift disappears the importance of accurate ballasting up is shown. If she is too light she will start to rise, and a large ship might even take up careless members of the handling party at the end of her handling guys. If she is heavy the car party may find it impossible to save the car from being damaged if it should hit the ground.

When landing, the pilot must not forget his pressure, and must either set his engine blower going or "rev" his engines up beforehand to obtain a higher pressure than is needed. Landing in a steady wind is in many ways easier than in a calm, for the ship can then be brought up fairly fast, and it is easier to keep up pressure, and the wind itself will slow her down at the right moment; while if there is no wind she is apt to drift on, unless reversible propellers are fitted.

# NEWS from the Axis

by Roy Cross

### THE JU 88E

The latest Ju 88, of the A4 series, has two Junkers Jumo 211 J motors of 1,300 h.p. at 12,500 feet. Other data are: Speed, 287 m.p.h. at 14,000 ft.; flying weight, 30,300 lb.; crew 4; fuel capacity, 640 galls.; bomb load, 4,400 lb.; armament, six or seven 7.92-mm. guns and one 20-mm. cannon. The span is 66 ft., length 47 ft., and the wing area 590 sq. ft. The A4 represents a further development, chiefly in armament and motors, of the A1 and A6 series day bombers.

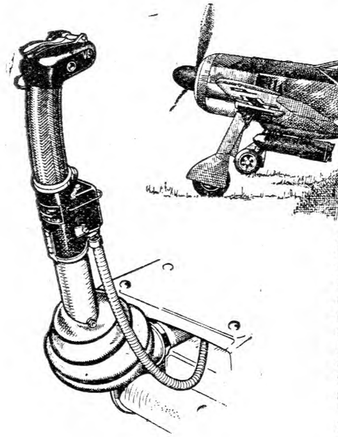
### THE JU 188

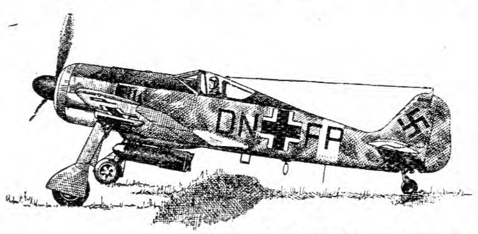
A major modification from the Ju 88 about which accurate details are now available is the Ju 188, which has visited this country on "tip-and-run" raids. The 188 is definitely a big improvement on the 88 both in performance and military load. The "beetle-eye" nose has given way to a longer transparent cabin of slightly more refined aerodynamic form. On the top of the cabin is a revolving powered turret housing one 13-mm. gun. Other armament is disposed as follows: one 20-mm. cannon in the nose, firing forward, one 13-mm. gun in the dorsal position, two 7.92-mm. guns in the ventral position, firing to the rear beneath the fuselage. Two B.M.W. 801 two-row radials of 1,530 h.p. at 20,000 ft. give a maximum speed of about 325 m.p.h. at 20,000 ft. A bomb load of 7,700 lb. is carried on both external and internal racks. The wings are extended, and the span is now 72 ft. 6 in. The tailplane and the fin and rudder are slightly altered in shape.

### THE FW 190

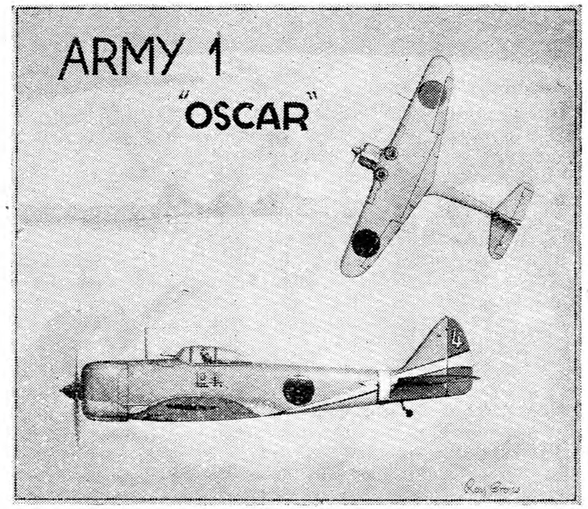
A Mercedes-Benz DB 603 in-line inverted-vee motor powers recent models of the Fw 190. The DB 603 is enclosed in a long circular cowling with radial cooling radiators in the nose. The installation is similar to that of the Jumo 211s in the Junkers Ju 88. From a distance the main difference between the earlier B.M.W.-engined 190s and the new machine is the longer nose.

Developed from the A3, the Fw 190A4 and A5 have improved radio installations, including a redesigned aerial attachment on the tail and a D/F hoop beneath the fuselage. The hinged inner undercarriage fairing doors are dispensed with. A new engine-mount for the B.M.W. motor of the A5 increases the overall length of the machine to 29 ft. 7 in. Fighter-bomber versions of these sub-types, designated A4/U and A5/U, have fuselage and wing bomb-carriers, as in the sketch of an Fw 190A/5U3 on this page. Long-range fuel tanks may be exchanged for the wing bombs.






Above: An FW 190 A5 fighter-bomber. The machine depicted was left by the Germans on Monte Corvino aerodrome, and was one of the many German aircraft captured intact by the Allied armies in Italy.
Left: A close-up of the control column of the Fw 190 on which is the gun trigger and safety catch, and a gun selector switch. A "send receive" button for W/T is also mounted.




Oscar, the Army I single-seater—believed to be a Nakajima design—has for some time been the standard Japanese Army fighter. Span is 37 ft. 8 ins., the maximum speed and range 320 m.p.h. and 750 miles. Armament is two fuselage 0.5 in. guns.

### THE SIEBEL SI 204

Designed and built in 1941 by the Siebel Flugzeuwerke G.m.b.H., the Siebel Si 204 is developed from the Fh 104A commercial monoplane (two 280-h.p. Hirth H.M. 508H motors) produced in 1937 and now used on communications in the Luftwaffe. The new aircraft is available in two main versions—a light personnel and cargo transport (Si 204A), and an advanced trainer (Si 204D) equipped for tuition in blind flying, wireless operating and navigation. The transport has a normal enclosed nose with luggage compartment forward of the pilot. In the Si 204D trainer a large transparent enclosure replaces the solid nose, affording an extensive field of vision from the pilot's position, which has dual control. In both versions power is provided by two Argus As 411 12-cylinder inverted-vee motors of 440 h.p. each. These are air-cooled engines, and drive two-bladed variable-pitch airscrews. For wireless training full W/T, R/T and D/F equipment is carried; the rear cabin may be fitted up as a flying classroom for navigation and radio instruction, with accommodation for five pupils.

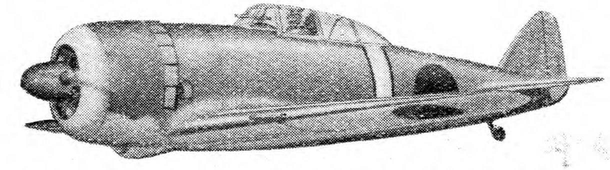
Large numbers of the Si 204 were built in France, and its construction by such firms as S.N.C.A. de Centre and S.N.C.A. du Sud-Ouest is an example of the use of French production facilities by the Germans. There can be few, if any, French aircraft firms which are not obliged to produce equipment to German orders; consequently much more attention has lately been paid to French factories by Allied bombers. Attacks on the Billancourt (Farman) and Chateauroux Deols plants have further retarded the Si 204 building programme, which was already in arrears.



Data for the Si 204 is: Span 69 ft.; length, 39 ft.; height, 14 ft.; wing area, 495 sq. ft.; loaded weight, 12,345 lb.; empty weight, 8,598 lb.; cruising range, 1,100 miles at 210 m.p.h.; maximum speed, 225 m.p.h.; rate of climb, 3,200 ft. in 3.3 minutes and 9,800 ft. in 9 minutes.

### ITALIAN TYPES

Two new Italian fighters, both probably being used by the Germans, have been officially mentioned. They are the Reggiane Re 2005 and the Fiat G55, developed respectively from the Re 2001 (DB 601A motor) and the Fiat G50 Falco (Fiat A74 RC 38). Both machines have a Mercedes-Benz DB 605 1,350-h.p. motor.



The new Japanese Shoki fighter, now identified as the Army 2, code-name Tojo. The span is 30 ft. 10 ins.

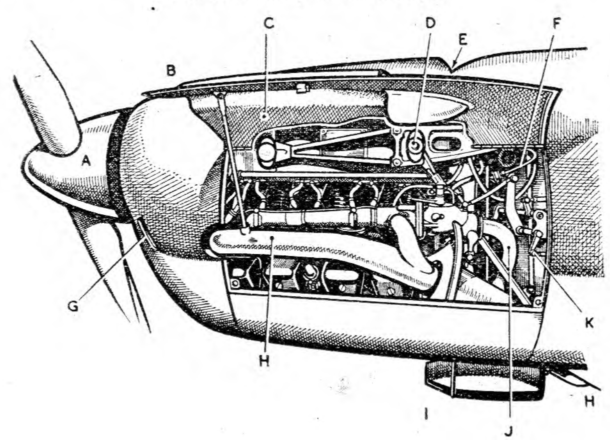
### PLUNDER FROM FRANCE

It has been known for some time that first-line German types have been built in numbers by various units of the French aircraft industry. For instance, in late 1941 orders were placed with French firms for some 2,000 aircraft, including Me 109s and Fieseler Fi 156K Storches, as well as for radio and equipment. Not content with the substantial output of their own aircraft by these factories, Germany is now drawing on French aircraft and engines to reinforce the depleted ranks of the Luftwaffe. Three fairly recent German types are flying with French Gnome-Rhone radial motors. These are the Messrschmitt Me 323 "powered glider" transport, with six Gnome-Rhone 14N 14-cylinder twin-row radials each giving 965 h.p. at 13,200 ft.; the Gotha Go 244, with either 700-h.p. or 965-h.p. Gnome-Rhones; and the Henschel Hs 129B ground-assault aircraft, with two Gnome-Rhone 14M motors (800 h.p. at 8,000 ft.). This latter aeroplane has been used in both Russia and the Central Mediterranean areas, but not with any outstanding success. The Hs 129B's armament consists of two 7.92-mm. MG 17 guns and two 15-mm. MG 151 cannon in the sides of the fuselage, firing forward, with a single 30-mm. tank-busting cannon in a special container under the fuselage. Removal of the 30-mm. gun enables a greater bomb load to be carried. The crew position and the belly are armoured with from 6- to 12-mm. plates, the windscreen is three inches thick, mounted in a 6-mm. bulletproof frame, while the undersides of the motors have 5-mm. protection.

French aircraft used by the Germans include the Morane-Saulnier MS 406 (reported as in service in Russia), the Loire-et-Olivier LeO 45, originally a bomber for L'Armee de L'Air and now used as a transport, and the versatile Potez 630. Both the Caudron Goeland and the Bloch 157 all-metal fighter are in production for Germany, and the French aircraft which were used by the late Vichy Air Force are presumably absorbed into the squadrons of the Luftwaffe, some of whose equipment must by now literally consist of "six of one and half a dozen of the other."

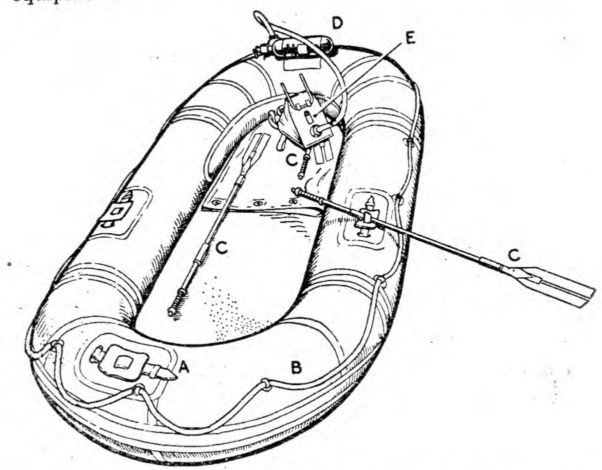
The French aircraft industry is now supervised by a special department of the Ministry of Production, the Aeronautical Industry Directorate, and contracts are awarded, in close liaison with the German authorities, by the Contract Allocation Office.

One of a long line of famous German light aero-engines, the Argus As 10E/3 below is shown installed in an Me 108B communications monoplane. Features of the installation are: A, v.p. airscrew, manual control; B and E, crankcase cooling air intake and outlet; C, hinged inspection door (either side); D, anti-vibration forged engine mount; F, anti-fire spray nozzle; G, air intake for cylinder bank cooling; H, exhaust manifold; I, oil cooler; J, carburettor air pipe from main air intake; K, engine controls. The As 10E gives 270 h.p. maximum output.




### DORNIER DO 217J

This new German night-fighter is a development of the Do 217E bomber. The nose is solid and accommodates four MG 17 rifle-calibre guns in front of the cabin and four 20-mm. MG FF cannons in a floor installation, all guns firing forward. Two 13-mm. guns fire aft, one in a powered dorsal turret at the rear of the cabin and one in the ventral position. The Do 217J, as with the Ju 88B, has complete radiolocation and specialised night-fighting equipment.




A German bomber-type dinghy. A, leather row-locks; B, hand-line; C, three-piece oars may be disconnected for stowage; D compressed air bottle; E, hand bellows for topping up. A watertight package in the dinghy contains rations, flares and smoke signals, etc. Radio is also carried in the dinghy.

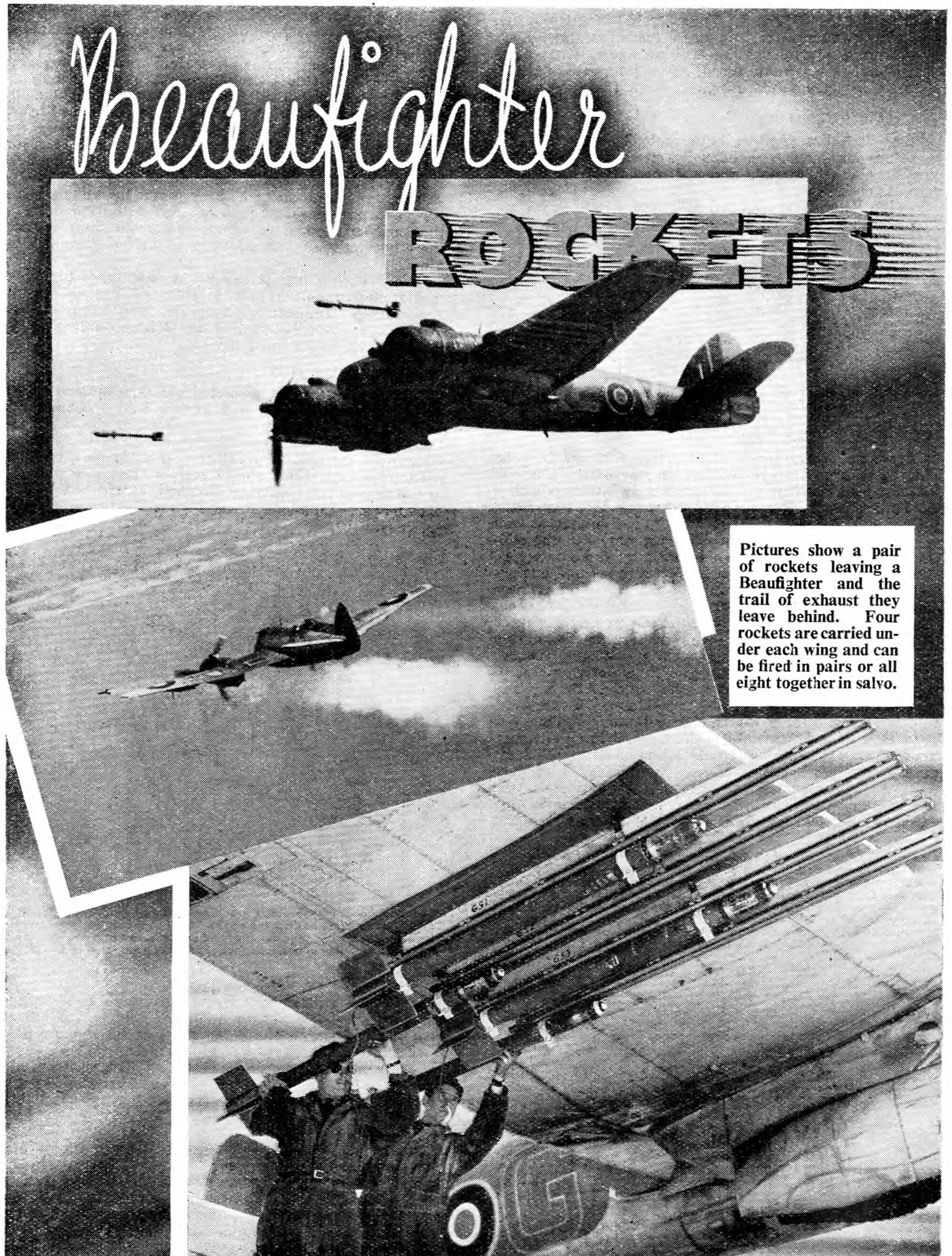
### TANK-BUSTING JUs

Ju 87 dive-bombers have been fitted with two 37-mm. cannon for low attacks on armoured vehicles, pill-boxes, etc. The cannon are slung one under each wing and fired from the cockpit. Two 37-mm. guns can be exchanged for the usual armament of the Hs 129 ground-attack aircraft. The Ju 88C, too, has a sub-type mounting a single heavy-calibre cannon suitable for tank-busting.

### BV 222

Germany's largest and latest flying-boat, the Blohm and Voss Bv 222, has been named "Viking." Powered by six engines the Viking will carry 100 fully-equipped men or their equivalent in cargo weight. Either Bramo Fafnir 323 radials or Jumo 207 diesels provide the power. Armament includes three power-operated gun turrets. The Bv 222 was designed as a commercial boat before the war, to be used on the Atlantic run to America. Both military transport and commercial versions are flying.

# Beaufighter Rockets



Pictures show a pair of rockets leaving a Beaufighter and the trail of exhaust they leave behind. Four rockets are carried under each wing and can be fired in pairs or all eight together in salvo.



## THE MEASUREMENT of Fuel CONSUMPTION

by R. G. Worcester

To obtain a consumption range a flowmeter is introduced into the main fuel supply of the engine. The flow is then compared over a wide range of different engine conditions. It has proved a mistake, however carefully the figures are worked out, for the pilot to treat them as a fuel contents indicator, and it would be unwise to fly the aircraft to fine limits on these results. The main purpose they serve is to determine what are the best revs and boost on which to fly for any given conditions.

The flowmeter will probably be either the Mass type or the Kent.

Firstly, the Mass type, which consists of a glass tube, and as the flow in the fuel lines becomes greater so a pointer is pushed farther up the tube. Along the back of the tube is a scale calibrated in tens of pounds of fuel per hour, which can be converted into gallons per hour. It is ample for the operator during the test to take eight or ten consecutive readings, allowing ten seconds between each reading.

Secondly, the Kent-type flowmeter. This instrument records direct in gallons per hour, and incorporates a stopwatch with a split hand. The action of the flowmeter is rather complicated:

(1) The main hand registers a flow from zero.
(2) After a pause the split hand joins it to "mark the spot."
(3 The main hand returns to zero.
(4) After ten seconds the main hand registers a new flow (and immediately the operator will appreciate the fresh reading, since the split hand is still marking the previous one).
(5) A pause to allow the operator to note the difference.
(6) The split hand joins the main hand at the new reading.
(7) At once the main hand returns to zero; and so on.

To get the fullest possible range it is best to start with the highest boost allowed for continuous cruising by the manufacturers and, at rated altitudes, record the consumption from a range of airscrew settings from, say, 1,800 to 2,300 r.p.m. at intervals of 50 r.p.m. All these r.p.m. figures have to be repeated throughout a range of decreasing boost pressures until the aircraft begins to lose height. The test takes some time, since the flowmeter may have to be read 100 or 150 times to cover the different combinations of boost and revs.

The best way of doing the test is to label each condition with a number: No. 1 will be a throttle setting of 27-in. boost and airscrew at 1,800 r.p.m.; No. 2 will be the same setting at 1,850 r.p.m.; and No. 3 also the same setting at 1,900 r.p.m.; and so on.

When the pilot has adjusted his controls to suit the first condition he will continue to fly straight and level for a moment to let the machine settle down, then signal the operator to commence the eight or ten readings on the flowmeter. While they are being taken down he should note the airspeed, height and temperature on a pad, labelling it with a proper number.

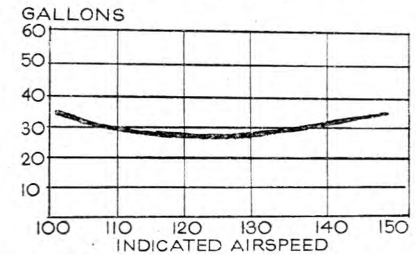



**Fig. 1. A typical consumption curve for a medium twin-engined aircraft, over a 100-mile stretch.**

The results can be reduced when they are separated into the following groups:

(*a*) The flowmeter should first be corrected for instrument error, and then the readings reduced to one average figure (a system should be arranged that vastly divergent readings that sometimes occur should not affect the remaining figures, which have, in all probability, formed a pattern).

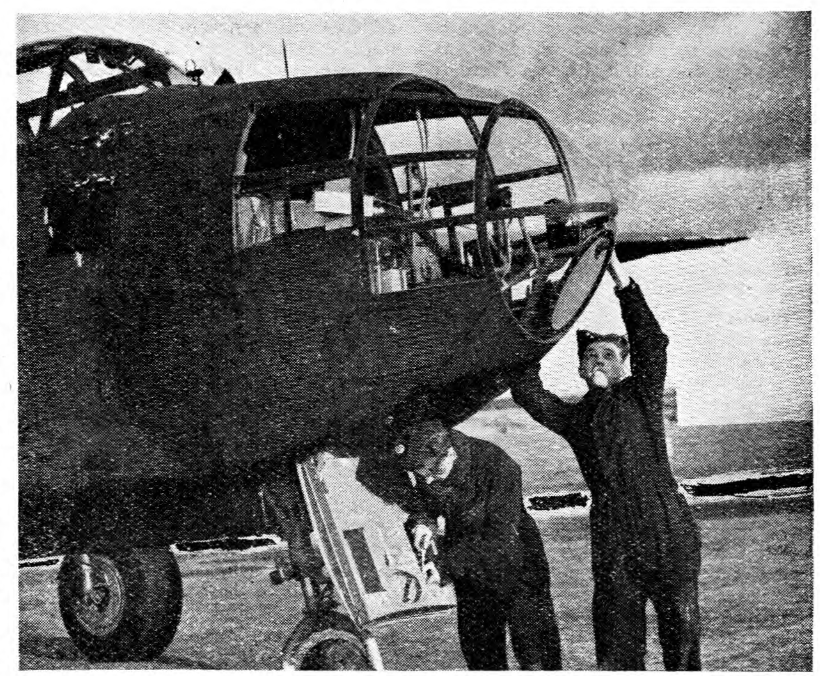
(*b*) The altimeter to be corrected against one of known error and the standard height arrived at by taking the difference in temperature between standard temperature and actual temperature. A difference of 60 feet per degree Centigrade is added to the altimeter if the actual is higher than the standard, and subtracted if it is lower. Then $\sqrt{\sigma}$ (relative density) is taken from this corrected height.

(*c*) The A.S.I. is corrected for instrument error, and Vi is obtained by either adding or subtracting the position error, which varies according to the position of the pitot head. (The position error (P.E.C.) can either be calculated from generalised curves or measured against A.S.I. with an aneroid. ) A small compressibility error forms in the pitot head of fast aircraft; this can be read from a graph suitable for any aircraft, and subtracted. The true airspeed (T.A.S.) can then be found with standard height.

(*d*) The airscrew is assumed to be a constant-speed unit, and so r.p.m. instrument error only need be taken into account.

Taking (*a*), (*b*) and (*c*) above, the air miles per gallon figure can be worked out direct, and the result is approximately accurate for any aeroplane similar. A simple graph can be drawn of the consumption over the entire range of engine conditions, and at a certain point will be the most economical speed. In practice the curve is usually very flat at this point, and nearly always a difference in speed of 10 m.p.h. and sometimes 15 m.p.h. makes a considerable difference to the miles covered, yet the consumption is hardly affected. The best speed to fly is usually some 10 m.p.h. faster than the most economical engine condition.

**Checking up a Boston after a flight.**



# Cross Country

by 'Stringbag'

IT was a fine day, and anybody on the beach at Blackpool or Brighton would have agreed. It was warm and sunny, and even if there was a bit of a haze it didn't prevent one sunbathing. Only the pilot of an aircraft on a cross-country flight would have regarded it with a lift of his eyebrows and returned to study his maps with particular care.

There are a great many operational duties on which the pilot does not have to bother much about maps. He has his wireless, and probably an observer to look after the navigation for him. If he loses himself he has only to call up his base to get a homing within 15 seconds. It is the ferry trip—the simple passage from A to B—on which many otherwise good pilots have come to grief and which is apt to remind one suddenly that there is still an art in unassisted cross-country flying.

The day in question—that day of sunshine and haze—provides a typical example of the type of conditions in which a Service pilot often finds himself with a cross-country job to do. It isn't operational, it isn't very important, and yet it is strangely easy to "make a mess of it."

We left London, climbing to a thousand feet during a preliminary circuit of the aerodrome, and then flew well back in order to cross the field dead over its centre and within a degree of the predetermined course. The Staines reservoirs were an indeterminate blur ahead, the Heston gasometer was just visible on the beam. Immediately underneath was the network of roads leading into London. But before we had reached this stage some important preliminary work had been done on the ground which would enable us to reach our destination in Cornwall with the practical certainty of a pleasant trip free from anxiety.

Back in the flying-office a straight line had been drawn from the Staines reservoirs to Padstow, covering three quarter-inch maps. Had the visibility been good this would probably have been all that was necessary, for there are many recognisable features on the

**Stringbag reviews a cross-country flight and makes a note of some of the things which should be done or avoided.**

route which would have made the journey a simple exercise in map-reading. As, however, the haze had cut down the horizon to two or three miles, it seemed just as well to be on the safe side by doing a little extra work.

If you have a map of your own you will see that the magnetic course is approximately 261, and today the allowance for the northerly wind given by the "met" people entailed steering 270 at 150 miles per hour. I forget for the moment what the ground-speed worked out to be, but with the original maps before me I see that I marked in pencil successive points over which I should pass every eight minutes. This, of course, is not an arbitrary figure; it merely happened to be convenient. I will agree, moreover, that any A.T.C. cadet in his first year's training would have done exactly the same thing, and that I am consequently suggesting nothing new or of particular interest. The little problem really became interesting only when studying the map before take-off and deciding what objects would be recognisable in the comparatively poor visibility existing. This was a matter of flying experience, and I think it is true to say it is the solution of cross-country journeys without either a navigator or wireless aids.

The first obvious check was to be Virginia Water, after only about two minutes' flying. Water is the easiest thing of all to see, and it would provide a check to within a hundred yards as to whether the correct allowance had been made for the wind. This, of course, meant that the journey had to be started exactly over a fixed point at the beginning of the track. Now, following down this track over the next hundred miles, I expected to recognise the corner of a big wood, a hill with a bunch of trees on the top, another big wood with a railway running through it, and then after exactly 13 minutes' flying I expected to cross a thin strip of wood running from north-east to south-west and nearly three miles long. Such a long strip would be absolutely unmistakable and would be the first really important check on the journey.

For the next 15 minutes there were not likely to be any vital landmarks, although a couple of railways and a river might be a useful check, particularly the main line running north-west from Salisbury. But the big thing to which real importance could be attached was the great wood over two miles across and nearly four miles long which I should meet at the end of this time. It would be impossible to miss that wood unless I was more than three miles off track.

Exactly six minutes later I wanted the town of Wincanton and the railway line running through it. By this time I should expect to have settled the course to steer beyond the need for any further corrections. Wincanton simply had got to turn up six minutes after the big wood. I did not expect to be very interested in the country below for the next quarter of an hour, although I did make a mental note that the high ground to the north of Sidmouth reached a height of 1,000 feet. A thing I was far more interested in was a railway junction on the line running north-west from Exeter. It lay in a valley, and for at least three miles I should be close to the left-hand branch of the line. At exactly 24 minutes after leaving Wincanton it should be directly below.

It was at this stage of the proceedings that care might be necessary if by any chance the clouds were down, for five minutes later Exmoor, with a 2,000-foot peak would lie within three miles of the track. On the other hand, there was always the railway line which could be followed to Okehampton. Okehampton lay on the track, and was definitely a point which should be seen. Thereafter there was nothing whatever to worry about, because another 16 minutes' flying must inevitably bring me out at some point on the Padstow estuary, a feature which could not be missed even with a visibility of down to one mile.

Regard the journey once again as a whole. The map indicated a perfect channel of escape, in the event of the weather closing down, from Wincanton north-west through the lowlands of Somerset to the Bristol Channel. Thereafter a journey round the edge of the coast of Devon and Cornwall must be a simple matter.

It will be seen from the foregoing that almost everything on the map, with the exception of lakes, woods and railway lines had been ignored. It so happened that some very big woods lay on this particular track, and when these are scheduled to arrive within 30 seconds either way they are hardly mistakable. A big wood of distinctive shape is almost as good as a lake of equal size in bad visibility.

The actual journey went to schedule after a correction of two degrees to the course owing to a slightly stronger wind than had been reported. The unfailing regularity with which the selected landmarks turned up against the watch freed one from any sort of anxiety.

I remember another occasion when flying over country which I knew intimately when these tactics, excellent as they are for all ordinary conditions, would have been inadvisable. The weather closed in about 40 miles from base, leaving a ceiling of perhaps 300 feet over the low ground. As the country over which the track lay at one point reached 1,400 feet, it was quite obvious that a precautionary landing at the nearest aerodrome was the correct procedure. On the other hand, I did know this particular area really well, and by dropping down on to a railway line and flying at about 100 feet, I did what is known as a "Bradshaw." This entailed flying between two hills by which the railway passed, but intimate local knowledge made the passage quite safe. It was merely a matter of flying on that side of the railway which was clear of the high ground (at one point the line ran close under the hill).

In spite of the preceding paragraph the good cross-country pilot is the man who knows his own limitations, that is, he recognises when the moment has come to turn back or to make a precautionary landing. This is a moment which will vary between individuals. Some of my friends will complete their journeys time after time in weather which I would never face myself. They are not necessarily better or worse pilots, but they know, just as I know, what is within their particular capabilities. It is the youngster who has insufficient experience to recognise his personal limitations who comes to grief. He feels that it is up to him to get through—the most fatal feeling a pilot can have. The correct procedure on every occasion is to turn back when in doubt.

There is no need to say anything here of the stupidity of flying up valleys when the weather is likely to close in behind you, nor need I stress the obvious advantages of a coastline to follow. These things are well enough known. It is rather the religious planning of the ordinary cross-country journey, regardless of the weather, which is so often skimped and which is so important. You will find that the best pilots—so good you wonder why they carry maps at all—always work out their E.T.A. and carry out the detailed procedure which has been indicated in these notes.

## For You to Name

(SEE PAGE 22)

1, Grumman Avenger; 2, Douglas Dakotas; 3, Boeing Fortress II; 4, Douglas Boston; 5, Consolidated Liberator; 6, Grumman Wildcat; 7, North American Mustangs; 8, Bell Airacobra; 9, Fairey Fulmar; 10, Republic Thunderbolt; 11, Vickers-Supermarine Spitfire XII; 12, Airspeed Horsa; 13, Curtiss Kittyhawk; 14. Commonwealth Wacket Wirraway; 15, Consolidated Catalina; 16, Armstrong-Whitworth Warwick; 17, Fairchild Cornell; 18, Douglas Dauntless; 19, Douglas Digby; 20, Heinkel 113; 21, Heinkel 59; 22, Iluchin 1-15B; 23, Hawker Hurricanes; 24, Martin Mariner; 25, Martin Mars; 26, Gloster Gladiator; 27, Junkers Ju 88; 28, Focke-Wulf Fw 190; 29, Fairey Swordfish; 30, Blohm and Voss Ha 139.

# ALLIED EXPEDITIONARY AIR FORCE

## by Air Chief Marshal Sir Trafford Leigh-Mallory, Air C-in-C., A.E.A.F.

WHEN historians record the part played by the air arm in the European theatre of operations, the Allied Expeditionary Air Force will claim special chapters.

It is comparatively a new command, even in these days when forces are constantly being created to cope with the changing circumstances of war. But the air umbrella it provided over the invasion beaches and its earlier all-out effort in breaking up German communications in enemy-occupied territory alone can earn it a special niche in history.

Many people, however, have only a slight idea of the functions or the component parts of the Command. So I propose to outline them.

Three forces—the 2nd Tactical Air Force, the Ninth U.S. Air Force, and Air Defence of Great Britain—have been unified in this Command. And the grouping has created the greatest air force ever established.

Some idea of the tremendous strength of the A.E.A.F. can be obtained from the fact that in one month alone British-based pilots of this Command flew more than 65,000 sorties. That is a figure which, I think you will agree, is tremendous even at a time when we are witnessing a dramatic rise in air power.

Let me briefly sketch the activities of the three component forces. First of all, the *2nd Tactical Air Force*, which is commanded by Air Marshal Sir Arthur Coningham, who controlled the 1st Tactical Air Force in Tunisia, Sicily and Italy.

Its functions are extremely diverse, covering many activities in addition to its chief role of supplying protection and, at the same time, giving support to operations on land and sea.

Its fighters have provided escorts for the great American daylight heavy-bomber raids, while its light and medium bombers were attacking airfields, factories and enemy communications deep inside France, Belgium and Holland. Those operations were supplemented by widespread daily sorties by its fighters and fighter-bombers, who are maintaining constant daily vigil against military objectives, noting changes in the disposition of the enemy's forces and identifying new targets.

One of the principal features of this force is its extreme mobility. It is a vital essential that any of its wings can be transported to other areas in the shortest possible time.

Now we can come to the *Ninth U.S. Air Force*. This is in action as the American component of the A.E.A.F. and, one might add, as the fighting partner of the 2nd T.A.F.

The Ninth, as it is usually known, gathers into one striking force all the American aircraft earmarked for tactical use from a few hundred yards to hundreds of miles forward of the Allied front lines. It includes medium and fighter-bombers, fighters and transport aircraft.

For many weeks prior to the invasion its pilots attacked enemy ground defences, not only along the Western coastline of Europe but also far inland. It has continued that good work, the purpose of which, of course, is to disorganise the elaborate Nazi defence systems and communications network.

The Ninth has greatly increased in scope and frequency during the year. Whereas at one time only small numbers of its aircraft crossed the North Sea, hundreds have been flying daily over north-west Europe during the last two months. Often they make as many as seven or eight separate attacks on German targets.

It is almost impossible to overemphasise the importance of those raids. In the first place, airfields from which the Luftwaffe might have flown to attack Allied convoys were made useless. Secondly, the Hun's transport system was disrupted by their systematic destruction of railway yards, bridges and supply depots.

These attacks by the Ninth, which is under the command of Lieutenant-General Lewis H. Brereton, were made principally by Mauruader medium bombers, which have been flying from Britain since the summer of last year, Thunderbolt fighter-bombers and Mustangs. The latter frequently swept northern France in strong packs or split up into small flights in continuous efforts to persuade the Luftwaffe to fight.

The Mustangs made excellent combat records by their performance while escorting British-based "heavies" of the U.S. Strategical Air Force. They guarded them over targets as distant as Berlin, Regensburg and Bordeaux.

One must remember, however, that the Ninth came here with the experience of a long and extremely difficult desert campaign behind it, for they officially began operations in the Middle East in September 1942. Their area then extended from Palestine in the North to Eritrea in the south, and from the Persian Gulf westward to the line held by the British Eighth Army. Their Mitchells and fighters supported the Eighth on its journey from El Alamein to Cap Bon, while their transport aircraft flew continuously from supply depots in the rear to fighting units in the forward areas.

The third Force—*Air Defence of Great Britain*—was formed to carry out the job its title indicates—to counter any blows the German Air Force might attempt to deliver on our bases and towns. Its period of watchfulness is constant.

Its skill and readiness to defend Britain was fully proved when the Germans decided to return to their night-bombing attacks of our cities. The Hun paid dearly for those efforts, Mosquitos of A.D.G.B. claiming a high toll.

In addition to its Mosquito squadrons of night interceptors, the force possesses some of the world's fastest interceptors in the latest Spitfires and Typhoons.

At one period the day squadrons were busily employed shooting down enemy aircraft which crossed our coast. As soon as Goering began to send fewer over, these aircraft of A.D.G.B., which is commanded by Air Marshal Sir Roderic Hill, took to patrolling further afield.

These, then, are the three forces which, while retaining their original titles, are carrying out schemes planned as combined operations by the Allied Expeditionary Air Force.

British, American, Dominion and Allied pilots fly the planes, and many other nationalities are represented among the air- and ground-crews.

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**THE ALLIED EXPEDITIONARY AIR FORCE**

*(commanded by Air Chief Marshal Sir Trafford Leigh-Mallory)*

***It consists of***

**2nd TACTICAL AIR FORCE**

*(commanded by Air Marshal Sir Arthur Coningham)*

**NINTH U.S. AIR FORCE**

*(commanded by Lieut.-Gen. Lewis H. Brereton)*

**AIR DEFENCE OF GREAT BRITAIN**

*(commanded by Air Marshal Sir Roderick Hill)*

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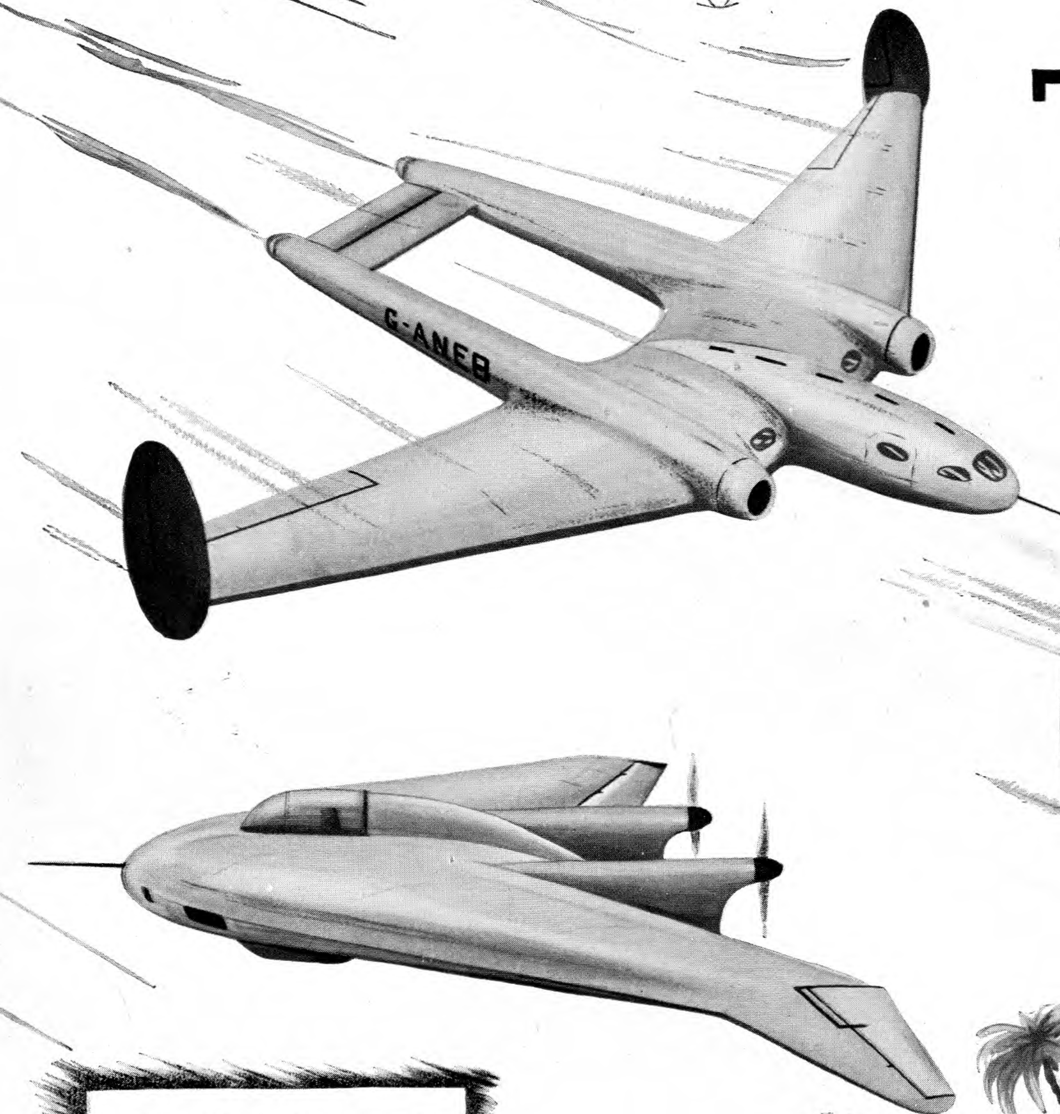
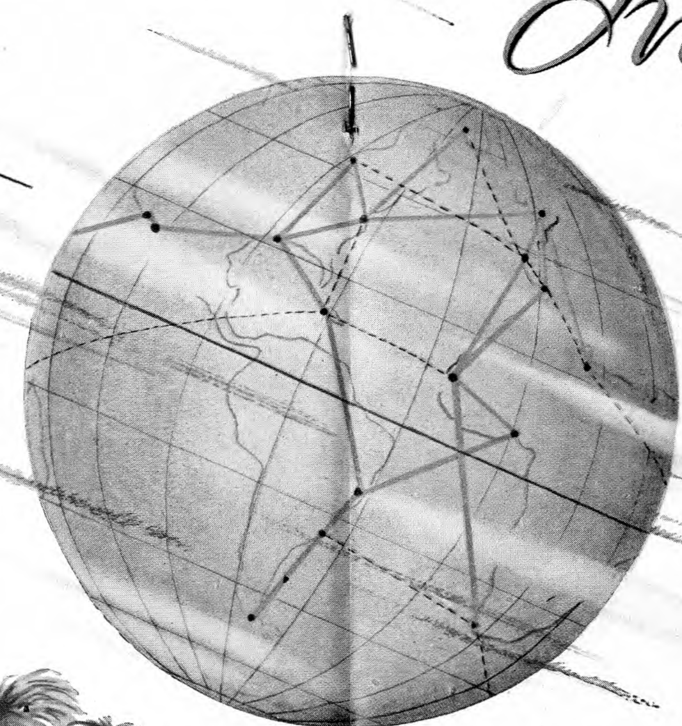
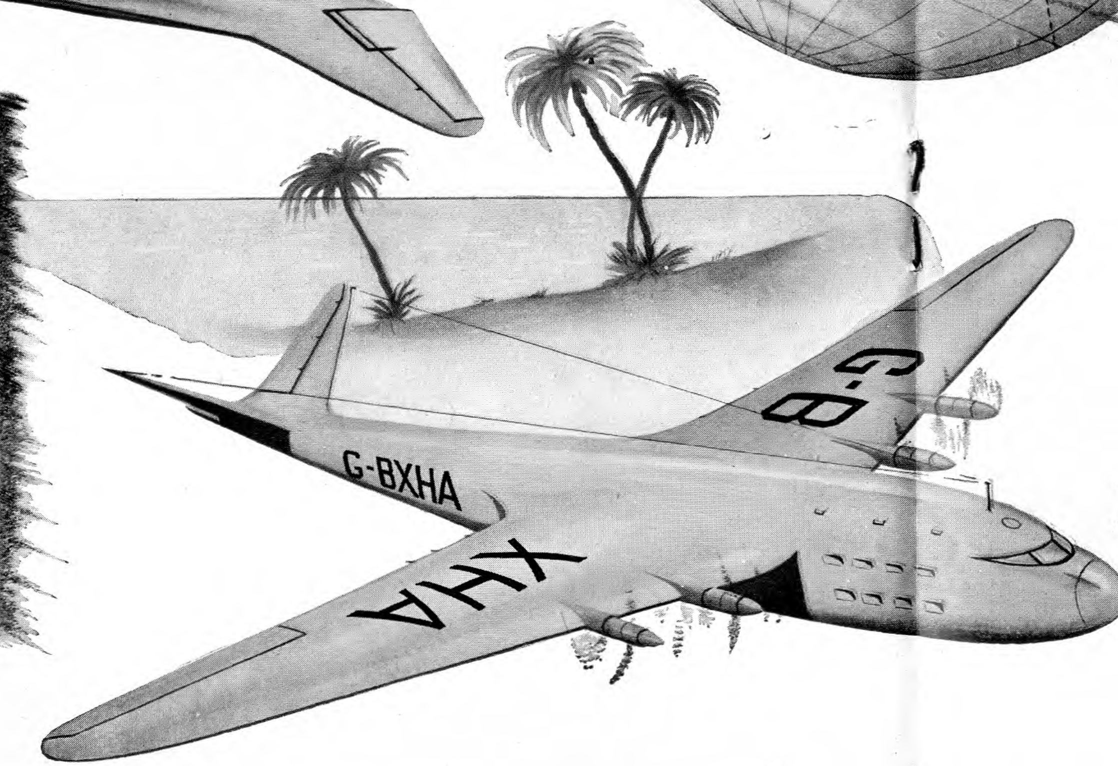
Moisture above and below. The upper picture is of a sea of clouds over Germany, the vapour trails at the top indicating that the scene is not so peaceful as it looks. The lower picture is of Hurricanes dispersed at a water-logged airfield.

# THE FUTURE *In the Air*



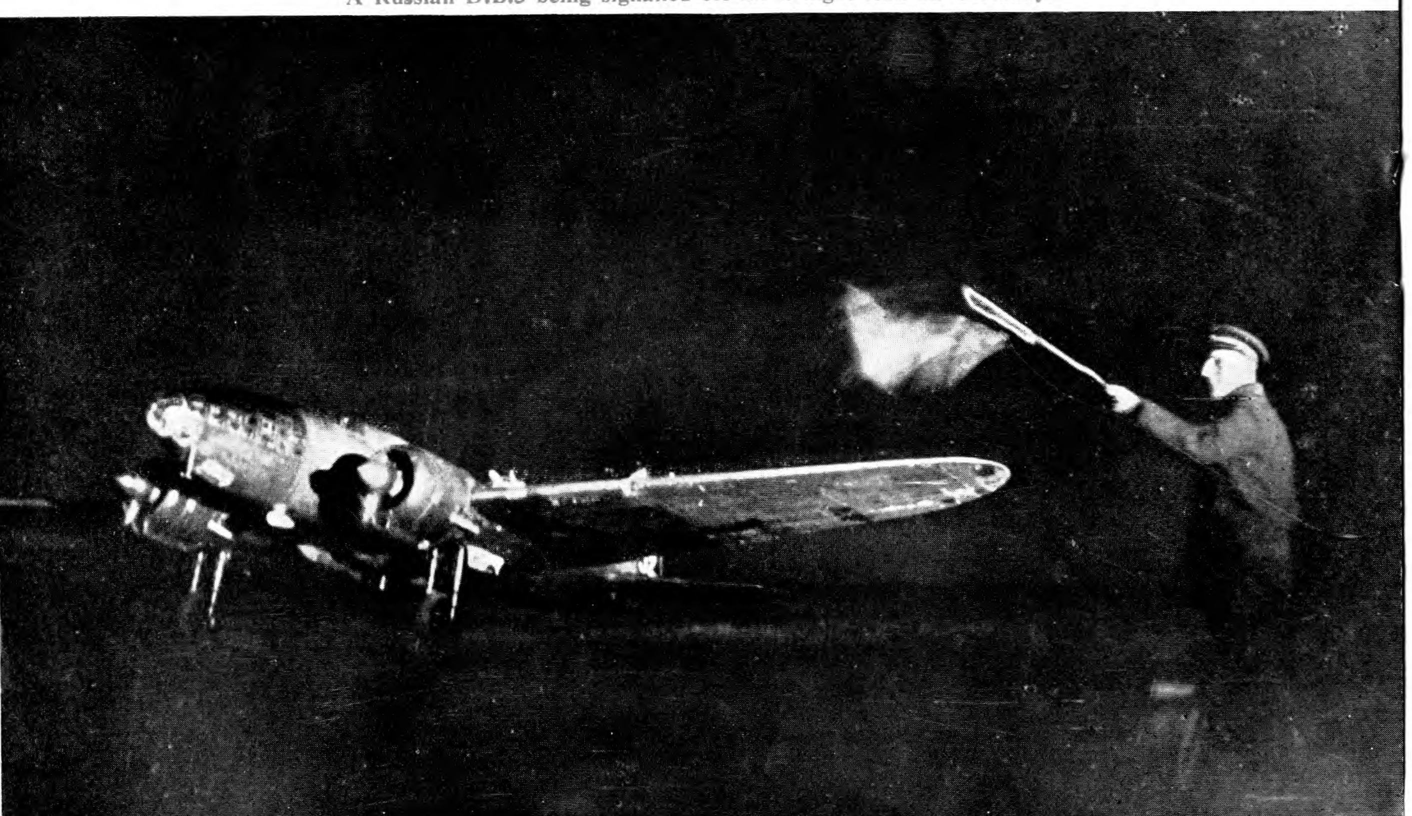



The next twenty years are certain to see some remarkable developments in aircraft design, but the experts caution us not to expect too much at once. Sir Roy Fedden at the Wilbur Wright Memorial lecture said that the petrol engine has still many years of useful life in front of it, and that aircraft only slightly different from those in use today are likely to remain in use for some years after the war. Our artist, Frederick Steward, here gives some ideas of the immediate post-war period. In the top left of the picture is a jet-propelled aircraft. Steward has drawn on his imagination for this. The other three aircraft more closely resemble designed or projected aircraft. Under the jet-propelled aircraft is his drawing of the Northrop flying wing, a twin petrol-engined pusher aircraft which has actually flown. Below that is suggested improvement of present conventional types, based largely on the Bristol and Miles projects. On the right is a Sikorsky helicopter, built a year or two ago, as indicated by the marking.

Steward 1944

Interior of the Warwick transport, showing the flight engineer's panel.

A Russian D.B.3 being signalled off for a night raid on Germany.



# *Correlating Engine Controls*

by J. A. KYD

**J. A. Kyd sums up his articles on engine controls**

DURING the last few months a series of articles has appeared in this journal explaining some of the intricacies of modern aero-engine operation.

These articles, explaining as they did the operation of one control each month, stood alone. For those readers who may have missed one or two, or who may have forgotten the contents of some of the earlier ones, it is now proposed to show how, although each subject dealt with plays a separate and distinct part in the operation of the aero-engine, they are all dependent upon one another for the maintenance of proper running.

### Take-Off

When the pilot has completed the ground checking of the engine and has taxied to the end of the runway, he lets the aircraft run forward a few yards to ensure that the tailwheel is straight, thus avoiding swing when he starts the take-off run, and then applies the wheel brakes. The engine is given a short burst of throttle to clear any oiling of the plugs which may have occurred during prolonged taxying at low engine speed, although occasional bursts of throttle during taxying should have avoided this. He then checks that the engine temperature is satisfactory—it sometimes gets a bit high during prolonged downwind taxying over bad ground — checks his fuel gauges and fuel cocks, checks that his propeller speed control lever is in the fully-forward (maximum r.p.m.) position, checks that his supercharger gear change is set for "M" (low) gear, adjusts his cooling gills, on an air-cooled engine, to the position which he knows by experience is the most satisfactory (usually nearly closed), or his radiator shutters, on a liquid-cooled engine, to the usual position (there is also automatic thermostatic control of the coolant temperature), checks that the surrounding air and other runways are free of aircraft, lets off his wheel brakes and opens the throttle firmly but steadily.

When the aircraft is gathering speed along the runway full take-off boost and r.p.m. are attained and kept constant by the automatic boost control and the constant-speed propeller respectively. The former unit keeps the throttle butterfly valve in the carburettor adjusted, through the action of its aneroid-controlled valve, to allow only the desired amount of boost in spite of the supercharger's capacity for giving a much higher boost than is permissible when at ground-level. Obviously the automatic boost control really starts to do its job when the aircraft begins to climb and the atmospheric pressure decreases, for when this occurs there is less weight of air going *in* to the supercharger, and the delivery of boosted mixture *from* the supercharger is proportionately reduced, and the automatic boost control gives the throttle butterfly valve a larger opening to keep the weight of mixture in the inlet manifold constant.

To come back to the runway: The constant-speed propeller has a difficult job to do during take-off to keep the engine speed constant, the aircraft will be rapidly accelerating from 0 to perhaps over 100 m.p.h. within a very short space of time, and in rather the same way as a windmill revolves faster as the wind speed increases so the engine speed will want to rise. To obtain the maximum acceleration of the aircraft from rest, the propeller blades are set to allow the maximum permissible engine speed to be attained when the throttle is opened at the beginning of the take-off. Naturally, the engine speed is trying hard to rise, but the propeller governor unit at once starts to adjust the blade angles to a more and more coarse pitch as the forward speed of the aircraft becomes greater and greater.

### Airborne

Once the aircraft is airborne the pilot continues to climb, and does not alter his control settings until he reaches a height of about 1,000 feet above the airfield. Then, if he intends to continue the climb, he throttles back to a setting where a boost suitable for prolonged climbing is obtained, and moves his propeller speed control back until the engine speed drops to the equivalent r.p.m. for the boost being used. The lowering of the engine speed will not have affected the boost, since the automatic boost control will have opened the carburettor butterfly valve slightly to compensate for the slight fall in output from the supercharger when its rotational speed dropped. The power output, of which there is no visible indication in an aircraft, drops slightly, with a decrease in engine speed for any given boost.

With the continuation of the climb at a lower boost and r.p.m. the pilot will check his coolant or cylinder-head temperatures and make any adjustments necessary to the radiator shutters or cowling gills. He will also check that his oil pressure and temperature are satisfactory.

### Climbing

When the aircraft has climbed to a considerable height—say, 12,000 feet —the pilot will note that his boost begins to drop. The engine speed will remain constant, due to the action of the governor unit, but the power output will fall with the boost. When this fall in the boost takes place it is an indication that the lower rated altitude has been reached. This is the point where the supercharger running at "M" (low) gear is unable to keep the boost pressure in the induction manifold up to the desired figure, in spite of the fact that the automatic boost control has opened the carburettor butterfly valve as wide as possible.

The pilot waits until the falling boost is beginning to have a serious effect on the climbing rate of the aircraft, and then he moves the supercharger change-speed lever into the "S" (high) position. He will find that the original boost pressure is restored, and his r.p.m.—if he has allowed the power to drop very much before changing to high gear—will come back to the figure at which the governor unit has been set to control.

Although his boost and r.p.m. are restored, the power output, which, as stated above, he is not able to measure, will have dropped, because although the lack of atmospheric pressure at the exhaust tends to allow the power to increase as the aircraft climbs, this is more than offset by the increased power required to drive the supercharger in high gear.

After the aircraft has climbed a few more thousand feet the boost will again commence to drop as the higher rated altitude is reached, and eventually the aircraft will not have sufficient power to climb any higher.

Although only the operation of the engine during a climb to its ceiling has been described, it has been possible to show the purpose and function of all the engine controls, which are obviously dependent upon one another.

## Notable Points

(SEE PAGE 25)

1, Vickers-Supermarine Spitfire; 2, Handley Page Hampden; 3, Westland Lysander; 4, North American O-47-B; 5, Saro Lerwick; 6, Dornier Do 217; 7, Grumman Wildcat; 8, Vought-Sikorsky Kingfisher; 9, Lockheed Vega Ventura; 10, Focke-Wulf Fw 200 Condor; 11, Messerschmitt Me 109F; 12, Douglas DC-3 Dakota; 13, Consolidated Catalina; 14, Republic Thunderbolt; 15, Airspeed Oxford; 16, Brewster Buffalo; 17, de Havilland Tiger Moth; 18, de Havilland Flamingo.

# *Flying Commentary*

by The Editor

The conferment of a Knighthood on Air Commodore J. A. Chamier, the founder of the Air Defence Cadet Corps and the first Commandant of the Air Training Corps has met with widespread satisfaction throughout the Corps, and letters of congratulation have been pouring in to him. Mr. W. W. Wakefield, M.P., the former Director, has been similarly honoured, no doubt also as a recognition of his services to the Corps, and our heartiest congratulations go also to him.

Air Commodore Chamier, I understand, will be known as Sir Adrian Chamier.

There was another knighthood in the June Honours List which perhaps received less notice in the Corps. I refer to that conferred on Mr. Simon Marks. It is not so widely known as it might be that Mr. Marks was one of the founders of the Air Defence Cadet Corps, and gave a large sum of money to get it going. He acted as treasurer throughout its existence and attended nearly every committee meeting. He now serves on the Air Training Corps Council of Welfare.

Among the other honours conferred on Air Training Corps officials are the M.B.E. to Flight Lieutenant J. Parry, Staff Officer, Northern Ireland, the O.B.E. to Mr. C. E. Brady, President of the Harrow District A.T.C. Committee, the O.B.E. to Bailie T. Sawers, Chairman of the Edinburgh Wing, the M.B.E. to Mr. N. G. Lancaster, Chairman of No. 2016 Squadron and Secretary of No. 496 Squadron, the M.B.E. to Mr. W. J. Moore, Hon. Secretary of Swansea Squadron, and the B.E.M. to Warrant Officer J. Pettiat, of the Newcastle-on-Tyne Wing. To all of them our congratulations.

### OUR DISTINGUISHED CONTRIBUTORS

Some of our readers expressed the hope that the article by Air Marshal Saundby on Bomber Command's aims and achievements, which appeared in last month's *Gazette,* would be followed by articles from other distinguished officers. That hope has been realised. Although he has quite an important war on his hands, Air Chief Marshal Sir Trafford Leigh-Mallory, Air Officer Commanding-in-Chief, Allied Expeditionary Air Force, has written a special article for the *Air Training Corps Gazette* on the subject of his Command. The fact that he has done so is an indication that the Air Training Corps is not lost sight of in the R.A.F., even in the heat of battle.

### THE FLEET AIR ARM

Although the Allied Expeditionary Air Force is mostly in our minds at the moment, we have in this number devoted several pages to Fleet Air Arm matters. After the Allies have occupied Berlin there will still be some fighting to be done in the Pacific against Japan. In this the Fleet Air Arm must play a large part, and many members of the Corps will be concerned in it.

### MODELLING

To come from large matters to small, we hear that a new body the Association of British Aeromodellers, has been formed. The Society of Model Aeronautical Engineers is still in existence, but we understand that the new Association has been formed by modellers who are not satisfied with the work of the governing committee of the S.M.A.E. We prefer not to take sides in the controversy, but we may mention that the new Association is backed by the *Aeromodeller* and the Harborough Press, whose aeromodelling publications are so well known. Mr. D. A. Russell, the editor of the *Aeromodeller,* and his colleagues have done their work so well in the past that there is no doubt that they will make the Association of British Aeromodellers a useful organisation.

# BOOKS

UNOFFICIALLY REVIEWED

**Overture to Life**

By John M. Townend. Rich & Cowan. 7/6. 150 pages.

A reprint of a series of letters sent home by a young man of the Fleet Air Arm when he left England to undergo his flying training in Canada. Mr. Townend, who clearly has a talent for writing and a faculty for acute observation, describes both his flying and social experiences. He takes you flying with him during the day and round the town with him at night. Those cadets who expect to go to Canada for their training can enjoy their experiences in advance by reading this. Others can learn rather more about it than by casual conversation with returning airmen.

**High Endeavour**

By Edward Seago. Collins. 12/6. 79 pages. Illustrated with the author's drawings.

The hard work, enterprise and dogged determination that must go to the acquisition of a pair of wings seldom get their full measure of publicity. The hero of this true story is a circus man who has plenty of guts and a pair of good hands that stand him in good stead for actual flying, but who lacked the elementary education. The record of how he persisted in his applications until he was accepted and how he slaved at his mathematics and navigation until he could pass his examinations and get his commission should be an inspiration to those who are faced with similar difficulties. To those readers — and they are many — who write to the *Gazette* for advice as to how to make the Selection Board change their minds, we recommend this example.

**The Aircraft Recognition Manual**

By C. H. Gibbs-Smith, R.O.C. Newnes. 7/6. 128 pages.

The earlier editions of Mr. Gibbs-Smith's book have been praised before in these columns. This new edition has been improved both in the printing and binding and by bringing the contents up to date. It is undoubtedly the most complete and useful guide to aircraft recognition.

**Practical Astronomy for the Forces**

By Lieut.-Colonel R. M. Lester. Hutchinson. 2/6. 84 pages.

Designed to be of value to all three Services, this book forms a general introduction to the study of stars, and deals with more than the limited number of air navigators' stars recommended by the Air Ministry.

**British Standard for Workshop Practice**

British Standard Handbook No. 2. British Standards Institution, 28 Victoria Street, London, S.W.1. 7/6 (8/3 post free). 464 pages.

A book of reference necessary in every drawing office, because, by adhering to these standards of practice, reductions in time and cost of manufacture can be effected and interchangeability of parts made easy.

The book covers a large field of engineering practice, with data and notes on cast iron and wrought steel, and a final chapter on hardness scales, metrical conversion tables, and particulars of wire and sheet gauges.

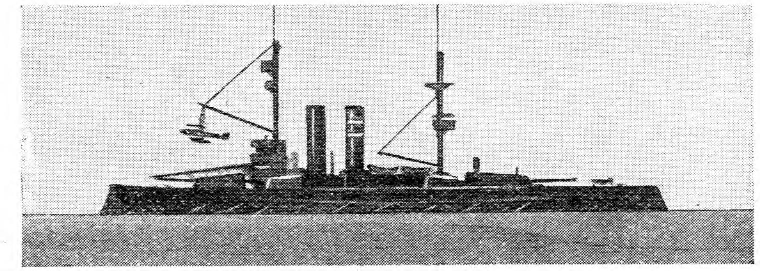
The many contents of this most useful volume have been summarised from a number of British Standard Specifications, and so can be relied upon for their accuracy.



# AIRCRAFT CARRIER *Parade*

by W. MEGORAN

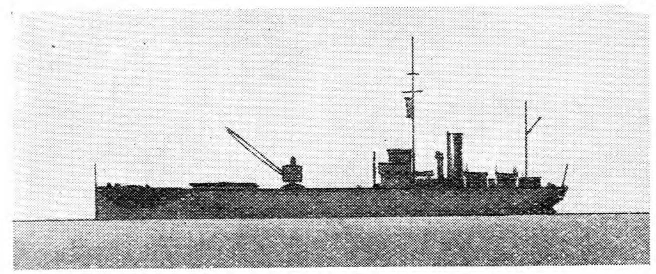
*A Brief Pictorial History of the Progress made in Carrier Design during the last thirty-two years*



**1912**

**H.M.S. *HIBERNIA***

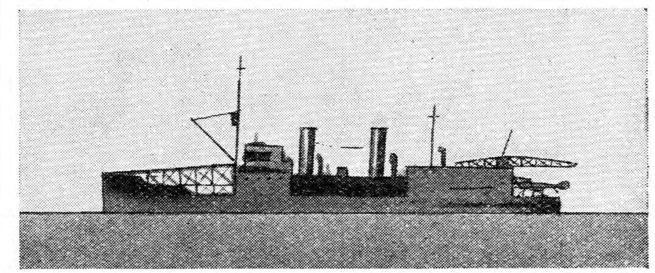
One of eight battleships of the King Edward class from which experiments were made in 1912. Commander Samson flew off the deck of this vessel in the first British amphibian, a modified Short S27 fitted with floats and wheels.



**1914**

**H.M.S. *ARK ROYAL***

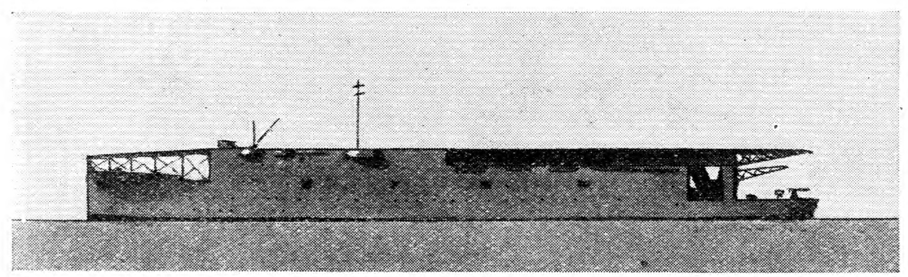
Originally a merchant vessel, she was purchased by the Royal Navy whilst under construction at the Blyth S.B. Co. In her early days she was employed as a seaplane carrier, but has since been used in experimental work with aircraft landing rafts and catapults. Her name was subsequently changed to H.M.S. *Pegasus.*



**1917**

**H.M.S. *NARIANA***

One of a class of fast cross-channel steamers chartered by the Navy and refitted to carry and maintain seaplanes. A specially constructed stern gantry was fitted which hoisted the seaplanes into a hangar aft. The H.M.S. *Engadine,* a similar vessel of the same class, was the first carrier to have her planes in action at the Battle of Jutland



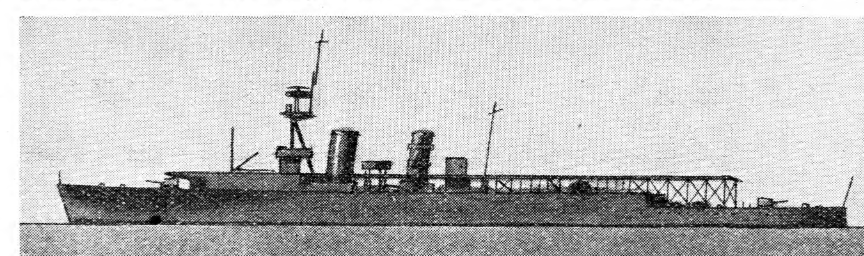
**1918**

**H.M.S. *ARGUS***

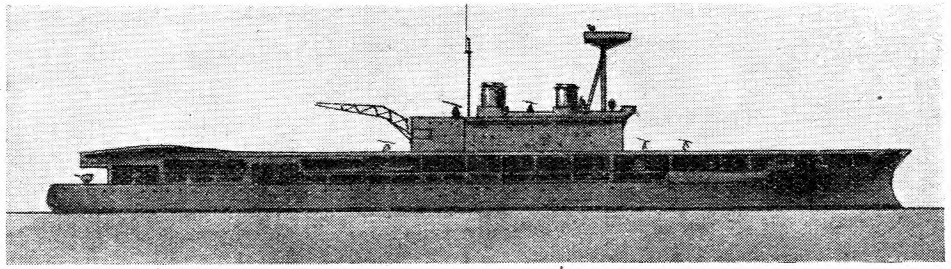
Originally built as the Italian liner *Conte Rosso;* later bought and converted into the first flush-deck carrier. Funnels and bridge omitted from the flight-deck, giving a run free from obstructions and furnace gases. The chart-house lowers into the hull during flying operations, and funnels were replaced by smoke-ducts astern.

[BELOW] **1918 H.M.S. *VINDICTIVE***

Commenced by Harland & Wolff as the light cruiser *Cavendish,* she was converted to do temporary duty as a carrier and renamed *Vindictive,* a flight-deck being added. In a few years she reverted to the cruiser originally intended.

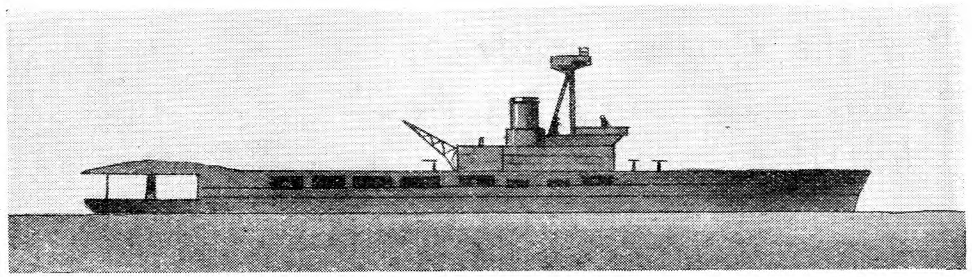


### 1923
### H.M.S. *EAGLE*



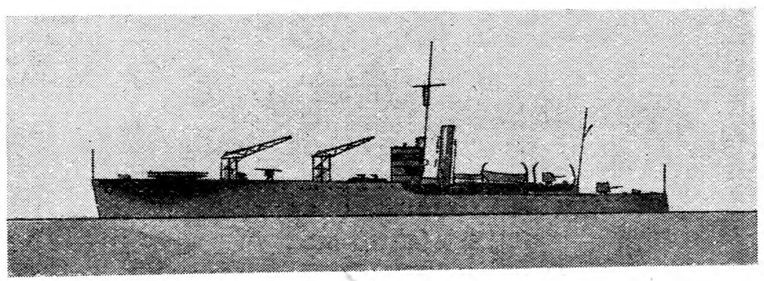
Designed as the *Almirante Cochrane* for the Chilian Government, she was taken over by the British Navy whilst under construction and converted into a carrier. A prototype of the island superstructure, she was fitted with a massive structure on the starboard side, mounting two funnels and a tripod mast. She was torpedoed by an enemy submarine in the Western Mediterranean on August 11th, 1942.

### 1924
### H.M.S. *HERMES*



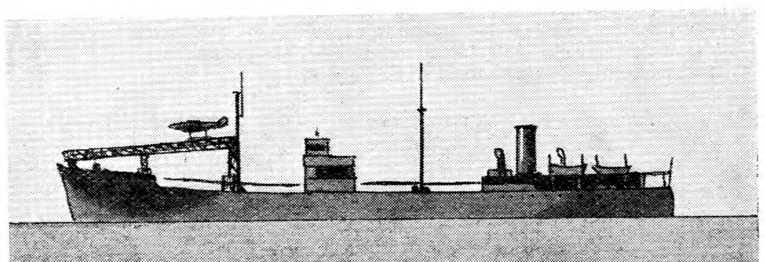
The first warship to be designed and built specifically as a carrier for the Navy. She was similar to, though smaller than, the *Eagle*, notable features of difference being the almost straight, raked bow and the presence of only one funnel on the superstructure. She was sunk in action with Japanese aircraft seventy miles south of Trincomali on April 9th, 1942.

### 1928
### H.M.S. *ALBATROSS*



Laid down at Sydney in 1926 for the Royal Australian Navy, and completed towards the end of 1928. There is accommodation for nine seaplanes, and a catapult is fitted on the foredeck. She was transferred to service with the Royal Navy in 1938.

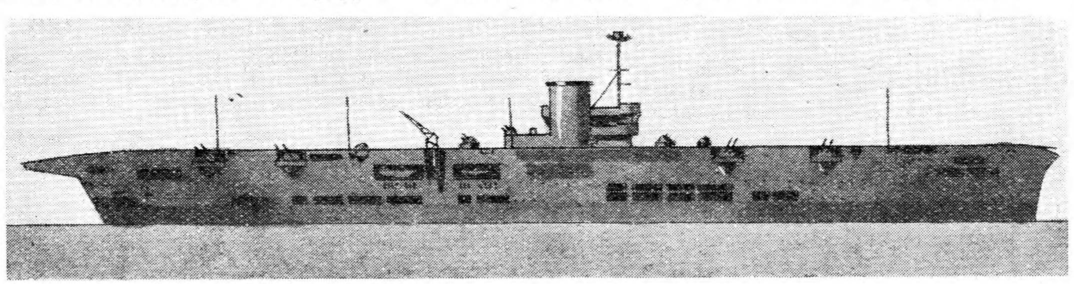
### 1941
### CATAPULTING FROM MERCHANTMEN



To combat bombing attacks on convoys the Admiralty introduced this new type of adapted merchantman early in 1941. A catapult was fitted on the forecastle and a Hurricane kept in instant readiness. The first pilots were volunteers from the Fleet Air Arm, and when air attacks were frequent they introduced an excellent element of surprise for unsuspecting Focke-Wulfs.

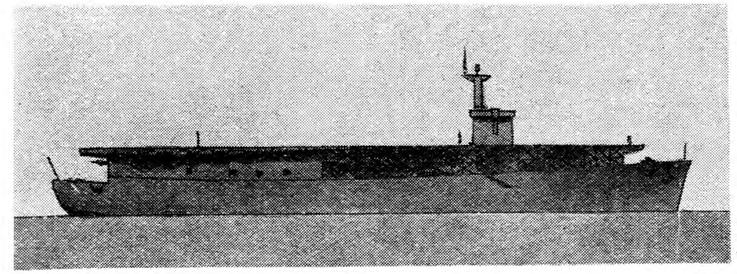
### 1937 H.M.S. *ARK ROYAL*

Commissioned in 1938, she was the first large aircraft carrier to be designed for the Royal Navy. Embodying all the past experience of carrier construction, she was equipped with three hangars, two lifts, accelerators for catapulting and an emergency crash barrier. She met her end at the hands of a German submarine in the Mediterranean, about a hundred and fifty miles east of Gibraltar, on November 14th, 1941.



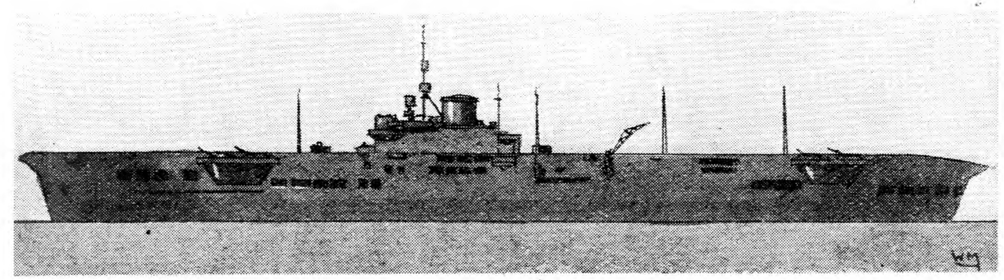


### ESCORT CARRIER



A recent addition to the Fleet, this class of converted merchantman is employed on convoy protection. The majority are built in the United States, and are provided under Lease-Lend. They may be regarded as a modern reversion to the small carrier of earlier days, with the increased hitting power of modern planes.

### *ILLUSTRIOUS* AND *INDOMITABLE* CLASSES

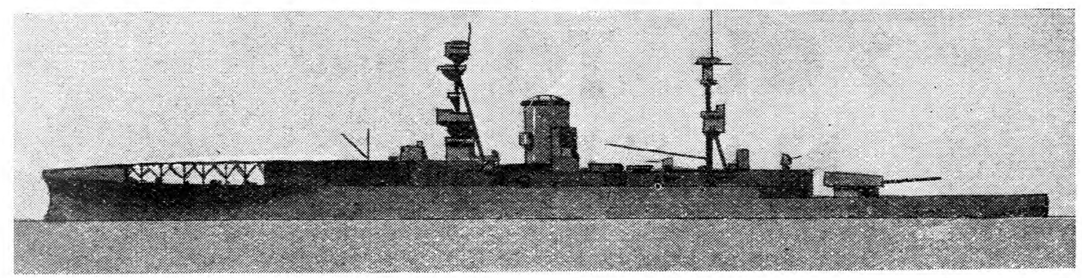


The most modern carriers in the Navy at the moment. They include *Victorious, Formidable, Indomitable, Implacable* and *Indefatigable*. Of 23,000 tons displacement, they have a length of 753 feet and accommodate a complement of 1,600 officers and men. The machinery is Parsons geared turbines, developing a speed of thirty-one knots. Islands are streamlined to prevent wind eddies on the flight-deck.

## 1916 H.M.S. FURIOUS 1939

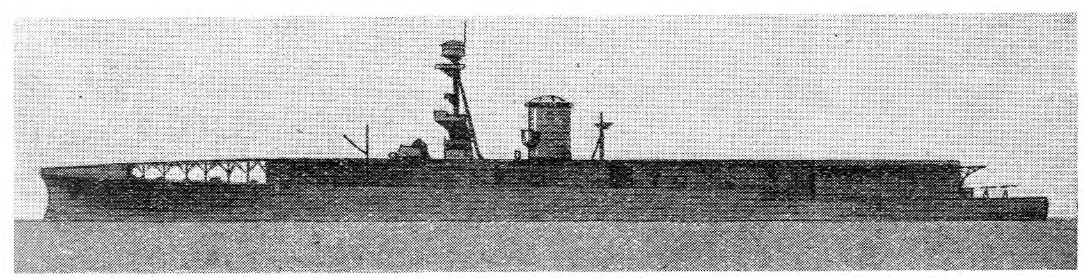
The three illustrations below depict the main stages in the development of the *Furious*. This vessel is a good example of cruiser conversion, and illustrates the trend of carrier design from the early experimental stages to the present day.

### 1916



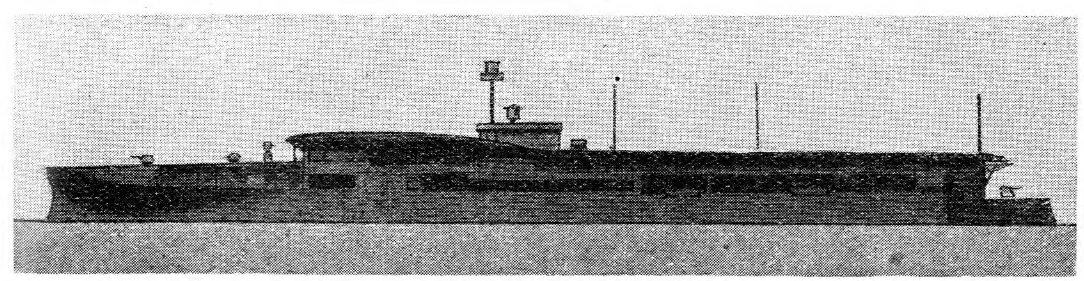
Laid down in 1916 as the last of Lord Fisher's "hush-hush" cruisers. In 1917 her forward 18-inch gun was removed to make way for a hangar and forward flight-deck. Aft of the bridge she still retained her cruiser characteristics.

### 1918

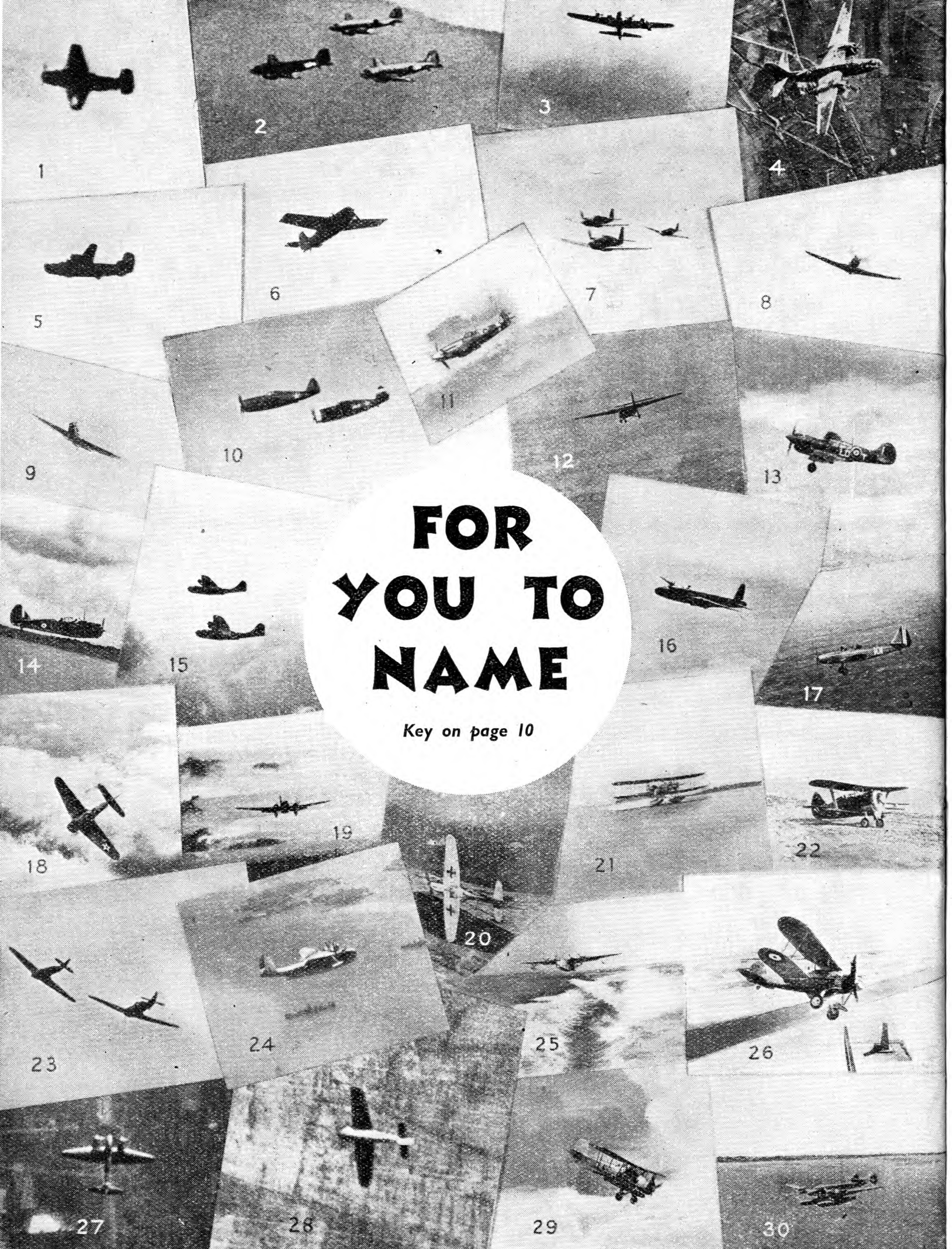


The next development took place in 1918, when a new landing-deck was constructed aft of the funnel. The tripod mainmast and after gun were removed to make way for the new hangars. In 1921-5 her appearance was again altered, by the removal of the funnel and mast.

### 1939



Her last major refit early in 1939 introduced a new superstructure and pole mast on the flight-deck, as illustrated on the right.




# FOR YOU TO NAME

Key on page 10

# *The* Holley CARBURETTOR

*By a Naval Engineer Officer*

THE Holley is a diaphragm carburettor which has been in use for some time in Fleet Air Arm aircraft. As suggested in the *A.T.C. Gazette* of April 1944, it is not a development of the simple type carburettor. A different principle is introduced to meter the fuel in proportion to the weight of air passing through it.

Reference to Figs. 1 and 2 shows that the throttle is not of the conventional type. It is in two parts, like double doors, shaped to form a venturi when either partially or fully open. Fig. 2 shows them in the cruising position. A venturi of fixed size measures the flow of gas or liquid through it, the greater the flow the greater the pressure drop at the throat or narrowest part. But as the airflow in the Holley carburettor increases or decreases according to variations in the size of the throat of the venturi, it follows that throughout the range of engine power there is little variation in the pressure drop or suction in the throat. This suction is used to draw the fuel into the airstream, but clearly it does not govern the fuel metering. We must look for other means.

### Fuel Regulation

In general, the quantity of fuel passing from one chamber to another is governed by the difference of pressure which moves the fuel, and the area of the narrowest part of the passage along which it flows. It has been shown that the suction at the fuel discharge nozzle is sensibly constant at all powers, and assuming only small changes of pressure in the diaphragm chamber, it follows that fuel metering must be accomplished by varying the area of the narrowest part of the metering channel, i.e. at the valve. This is, in fact, the case.

Referring to Fig. 1, the fuel enters the fuel inlet, passes successively through the compensator venturi and the fuel valves, between the main fuel diaphragms, along the metering channel, past the valve named the metering pin, and enters the main airstream through the fuel discharge nozzle. The metering channel is arranged across the air inlet, and can be partly seen in Fig. 3.

As the throttles are opened to increase the air passage the metering pin cam is rotated. The cam bears against a pin in the centre of a lever, one end of which is hinged and the other connected by a ball and socket joint to a valve known as the metering pin. When the throttles are opened the cam bearing against the lever opens the metering pin to increase the fuel flow. The cam profile is designed to give a constant fuel/air ratio for all throttle openings.

### Diaphragm Assembly

Before considering how the variations from the constant fuel/air ratio necessary to meet the requirements of an aircraft carburettor are obtained, it is necessary to understand the object of the diaphragm mechanism. The diaphragm assembly consists of three chambers, separated by two diaphragms. The two outer chambers are subject to atmospheric pressure, and the inner chamber to the fuel pressure on the discharge side of the fuel valve. Each diaphragm is connected at its centre by a flexible ball joint to one end of a lever, the other end of which bears against the fuel valve. As the fuel rises in the chamber it forces the diaphragms outwards against the atmospheric pressure, and the movement of the levers tends to close the fuel valves and reduce the supply of fuel. As the chamber empties the reverse happens. Thus the duty of the diaphragm mechanism in a Holley carburettor is exactly the same as the float mechanism in the older types of carburettor: it maintains constant conditions from which the suction will draw fuel.

### Mixture Variations

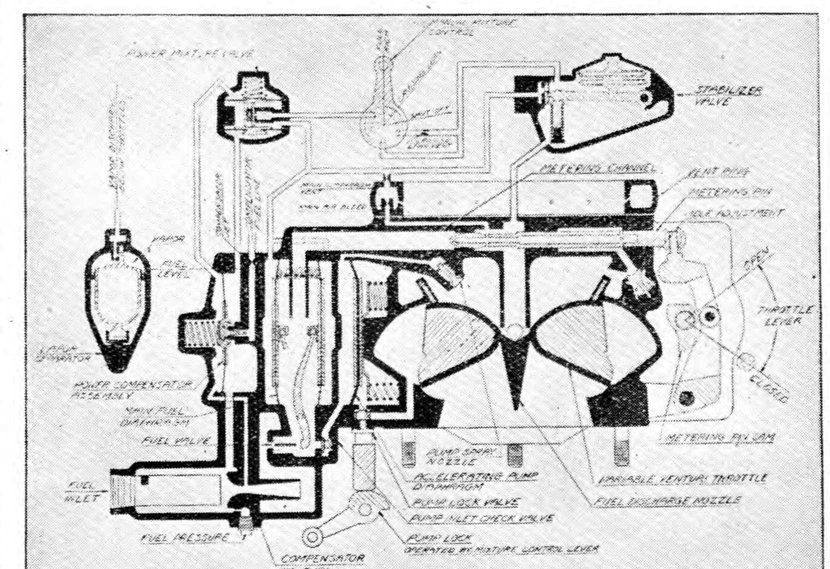
The requirements of compensation for altitude and weak mixture for economical cruising are met by reducing the quantity of fuel. A combination of two methods is used. Firstly, air is bled into the suction above the fuel discharge nozzle; this reduces the suction available for drawing fuel past the metering pin. Secondly, by drawing this air from the chambers outside the main diaphragms the fuel valves are partially closed, thereby tending to reduce the head of fuel in the diaphragm chamber. The details are as follows:

The chambers outside the main diaphragms are connected to the fuel discharge nozzle by two passages in parallel, one leading through the manual mixture control valve and the other through the power mixture valve assembly and the stabiliser slide valve. The latter is operated by the movement of two capsules filled with air at normal temperature and pressure, acting on a lever. As the aircraft gains height the reduced pressure of the atmosphere allows the capsules to expand, the slide valve opens, and the opening in the first passage is increased. Alternatively, when the manual mixture control is moved to cruising lean, the second passage is fully opened. In either case the air bleed to the fuel discharge nozzle and the suction behind the main fuel diaphragms are increased.

### High Powers

For take-off conditions an increasingly rich mixture is provided by the

Fig. 1.



power compensator assembly. This is a valve in the centre of a diaphragm normally held on its seat by a spring. The valve side of the diaphragm is subject to fuel at pump discharge pressure, while the other side is connected to the throat of the compensator venturi. When the fuel flow is large the suction created at the throat of this venturi is enough to overcome the pressure of the spring, the valve is opened, and the additional fuel passes along the compensator fuel line into the fuel discharge nozzle. At the same time the power mixture valve automatically comes into operation. This ensures that the second air bleed passage, referred to in the previous paragraph, is automatically closed if the manual mixture control is still in cruising lean.

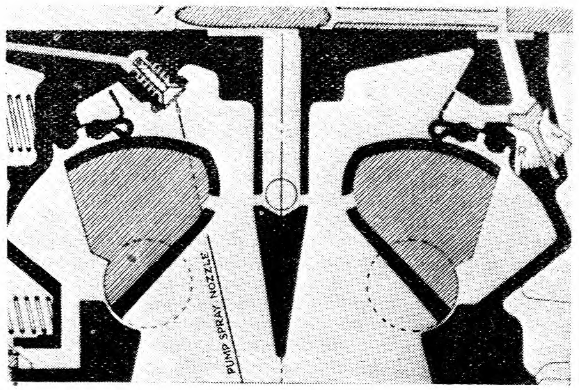



**Fig. 2.**

**Other Details**

An accelerator pump is arranged to maintain a correct mixture when the throttle is advanced. The depression at the throttles draws the accelerator pump diaphragm against its springs and allows the chamber on the other side to fill with fuel. On sudden acceleration the depression breaks down, and the springs, acting on the diaphragm, force the charge of fuel through the pump spray nozzle into the main airstream.

When the engine is slow-running the throttles are closed and the metering pin valve is on its seat. The pin, however, is hollow. Fuel can pass through a small hole in its point and out through radial holes to the fuel discharge nozzle. Air can be admitted into the other end of the pin and be drawn out with the fuel, forming a fine spray. The size of the air passage between the main airstream and the metering pin can be varied (see Fig. 2). This forms the idle adjustment, which gives variations in the strength of the mixture when slow-running.

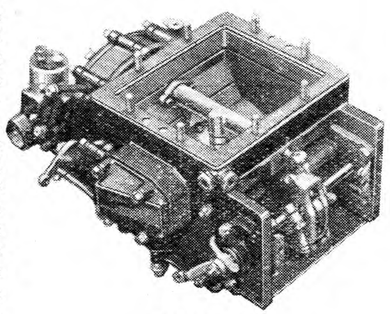


**Fig. 3.**

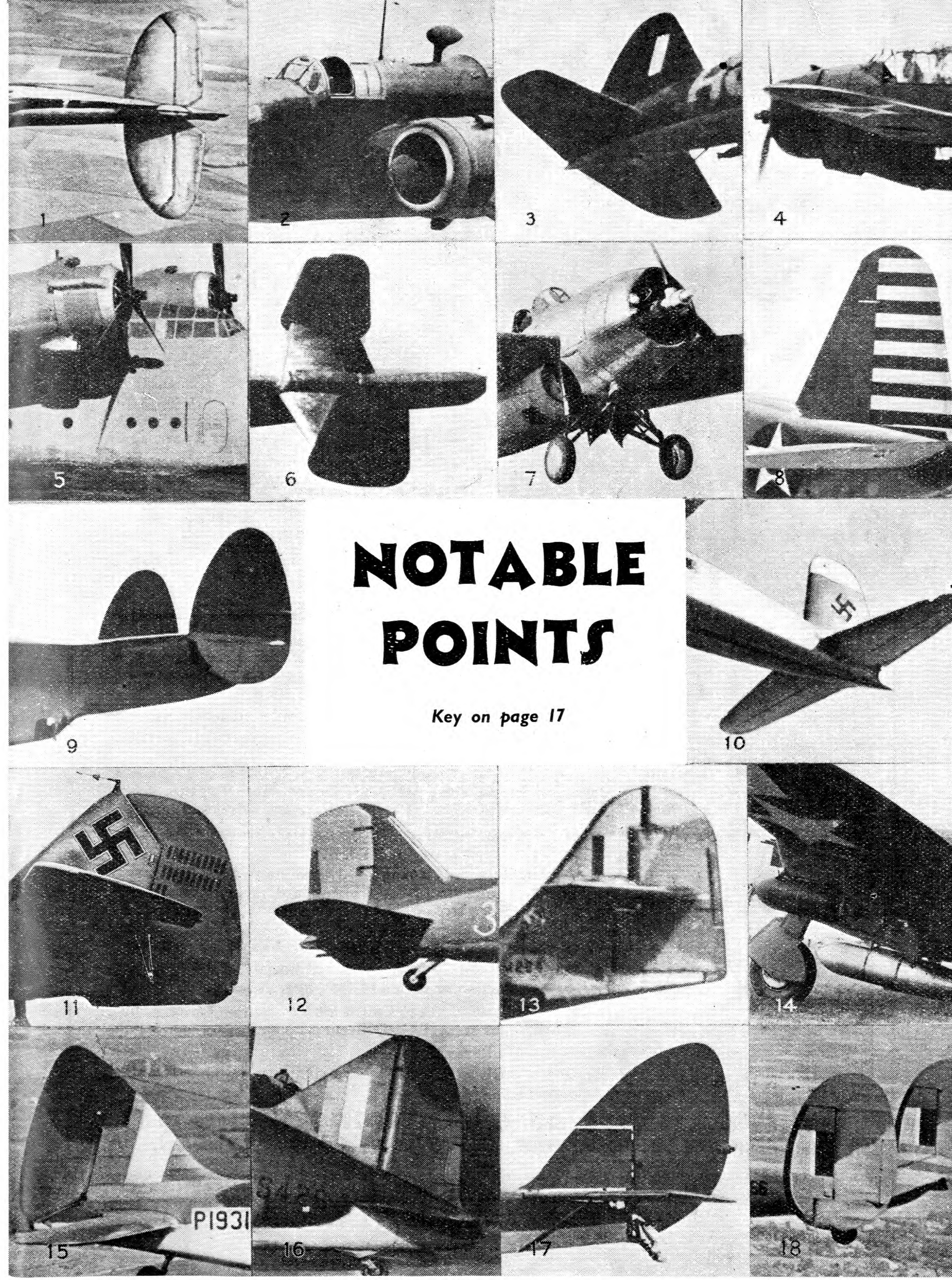
The Holley carburettor should continue to work smoothly during aerobatics, since the diaphragm mechanism should maintain constant conditions in the diaphragm chamber, even during inverted flight. Avoidance of high depressions in the main venturi reduces the liability of ice formation which is experienced in certain other types. Holley carburettors fitted in Fleet Air Arm aircraft also incorporate certain features which cannot be dealt with in this article.





# NOTABLE POINTS

*Key on page 17*



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Steam-cleaning a P.38 Lightning after its arrival from the U.S.

Glider fuselages awaiting the fitting of their wings.