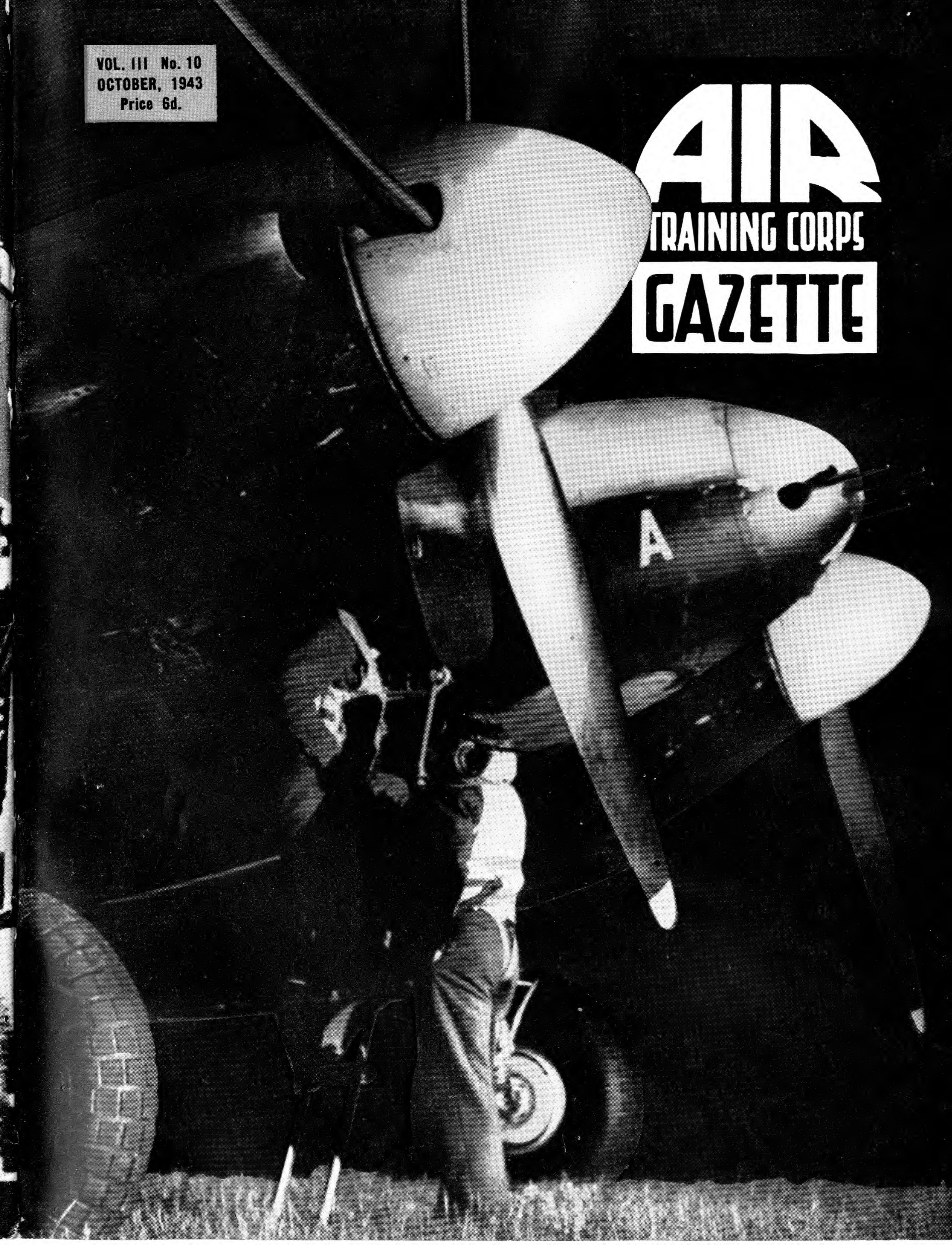

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AIR TRAINING CORPS GAZETTE

Artist's impression of a Typhoon intruding on a Nazi aerodrome in Northern France

AIR TRAINING CORPS GAZETTE

VOL. III NO. 10 OCTOBER 1943

Edited by Leonard Taylor

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The Years Ahead

"Whereas We deem it expedient to provide for Our Youth the means of preparing themselves for air service in Our Air Force or in its Reserves or Auxiliaries or in the Fleet Air Arm of Our Navy:

Our Will and Pleasure is that there shall be established a corps to be entitled the Air Training Corps which shall be constituted and governed in accordance with regulations to be made from time to time by Our Air Council."

Extract from the Royal Warrant establishing the Air Training Corps.

NOW that the war progresses more and more in our favour, increasing thought is being given to the future. It is not surprising, therefore, for me to find that wherever I go the same question is on everybody's lips: "What is going to happen to the Air Training Corps in the future when peace returns?"

On April 14th, in the House of Commons, Sir Lindsay Everard asked the Secretary of State for Air whether it is the intention of the Government to maintain the Air Training Corps after the termination of the war. Sir Archibald Sinclair replied: "Yes, Sir; that is the present intention."

The Air Training Corps was formed under the stress and because of the needs of modern war.

It may now seem appropriate, therefore, to consider the aims and objects of the post-war Air Training Corps, together with the machinery for implementing them. Should the aims be widened to include all military and civil flying services and the air and ground requirements of aeronautical engineering firms? What should be the ages for membership? Should squadrons for girls be included? Should units of the Air Training Corps be formed in the Colonies? What is to be the relationship of the Air Training Corps with the corresponding corps in the Dominions?

Should facilities for flying and gliding be so greatly extended that every cadet during his service will have the opportunity to pilot, if not powered aircraft, at least a glider?

How will the Air Training Corps be affected by the recent Government proposals in connection with the extension of education issued recently in their White Paper on educational reconstruction?

How closely is the Air Training Corps to be linked with the Royal Air Force? What will be the requirements of the Royal Air Force and the air arms of the other two Services and the air auxiliaries and air reserves?

Is civilian administration and responsibility for the Corps' activities to be extended? What opportunities will there be for cadets of the Air Training Corps to do part of their training in various parts of the Empire now that travel by air has eliminated the time factor?

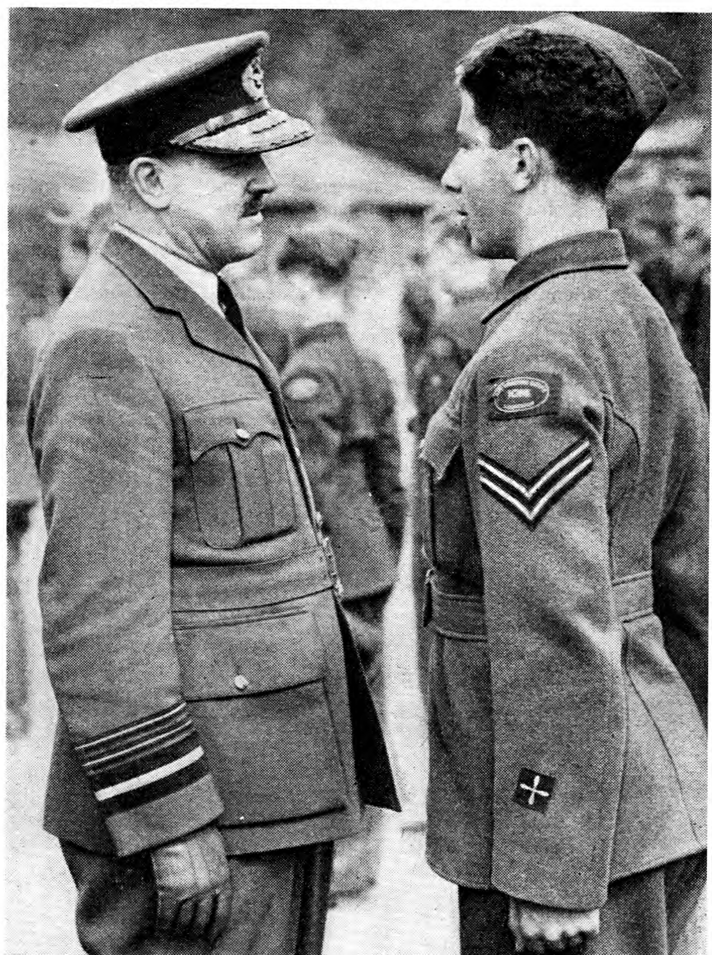
How will duties with the Air Training Corps affect employment or be of advantage in the event of compulsory national service remaining?

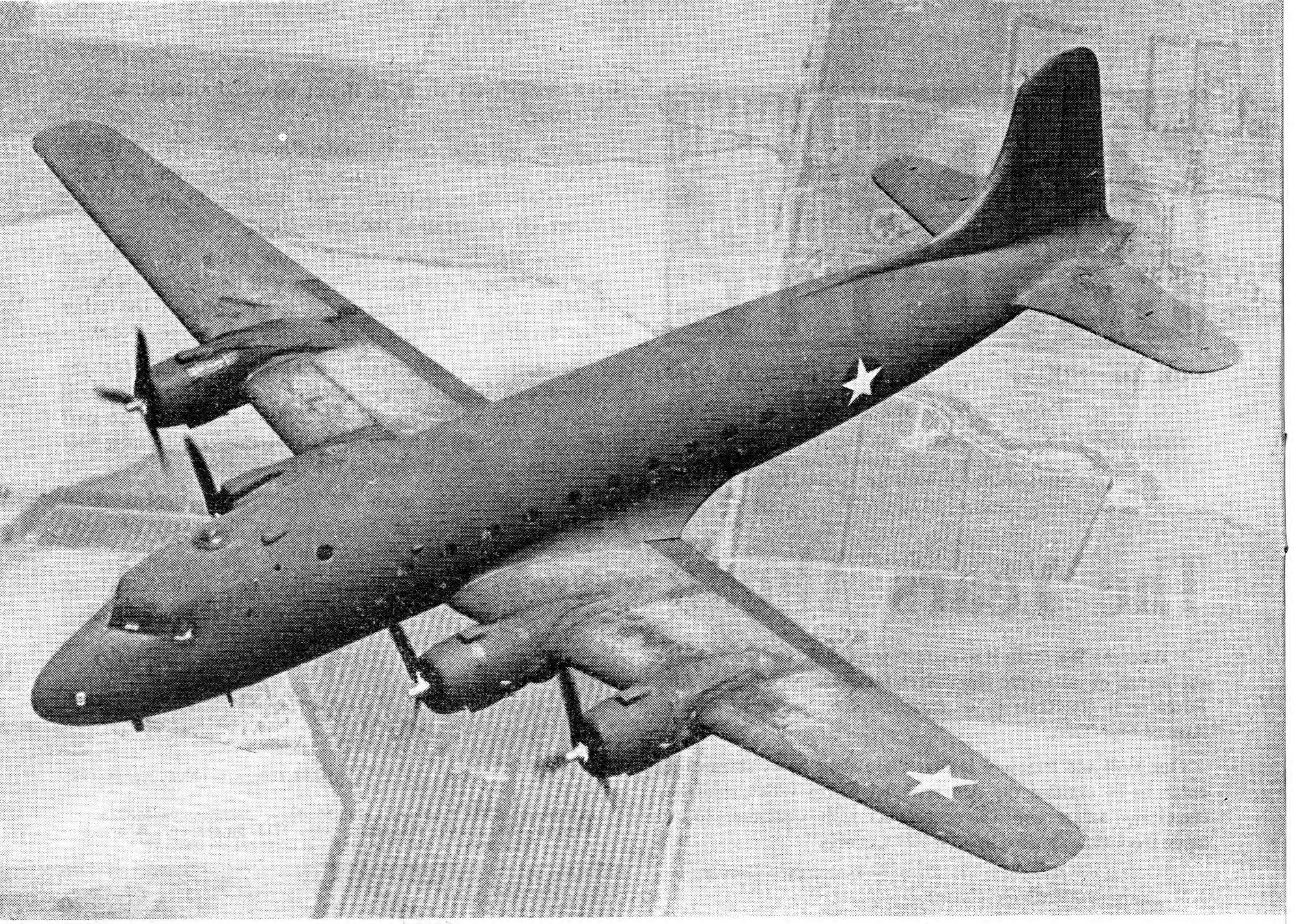
These are some of the questions now being examined so that the post-war plan for the Air Training Corps can be finalised.

W. W. Wakefield

DIRECTOR, AIR TRAINING CORPS.

Air Marshal Sir Trafford Leigh-Mallory, Commander-in-Chief, Fighter Command, inspecting No. 1014 Squadron. A short biography of the Air Marshal appears on page 18.





The Douglas Skymaster

by **Michael Lorant**

THE Douglas C-54 is every day flying the Atlantic between dawn and dusk with a useful load in excess of 10 tons.

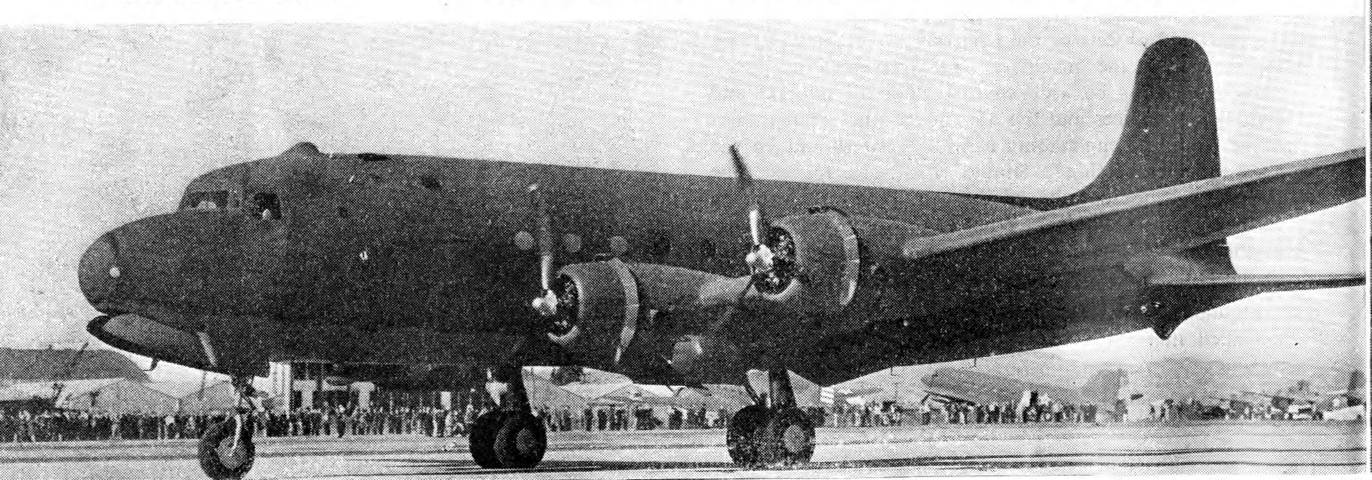
Originally designed as the DC-4 cargo and passenger transport to fill the air traffic demands, this aircraft was engineered and in process of production at the time of Pearl Harbour. During 1942 it comprised a large share of the production effort of one of the biggest Douglas plants in the U.S.; and this year it consumes the entire capacity of a new plant built by the American Government for its exclusive production.

A tricycle landing gear not only permits crosswind landings on small fields without danger of capsizing, but gives space between cabin floor and ground to suspend items of heavy equipment such as tanks and guns, whose size and shape make them impractical cabin cargo.

Being the pioneer effort in super cargo transports, the Skymaster represents probably the most exhaustive and expensive series of experiments in transport aviation. Revolutionary progress in aircraft construction which paralleled the building of the prototype caused the design to be abandoned after a year of tests. New designs resulted in a plane which was 20 per cent lighter than the original and 20 per cent faster.

On the basis of Douglas record of achievement, scores of these planes were contracted for by air lines while they were still in blueprint stage.

Engineering and tooling had been completed and actual production on the first nine aircraft was well advanced when further modifications became necessary to bring them into line with Army specifications as troop and cargo transports.



A STOOGE PILOT says — I have flown hundreds of hours for you

FOR two and a half years I was a "stooge" pilot helping to train naval observers and air gunners. Many were ex-A.T.C. cadets, and I think those of you destined for the Navy might like to know about some of the problems which you will undoubtedly meet.

Imagine me sitting in the driving seat of a Swordfish or Albacore at the dispersal point of a naval air station while two ex-A.T.C. cadets with parachutes, chart boards, and all the paraphernalia of their trade clamber into the back. While I am a trained pilot, with something like 1,000 hours experience, the crew behind have yet to complete 100 hours. They are, however, in charge of the aircraft. It is they who will order me to steer certain magnetic courses, and as we disappear into the haze over the North Sea it will be their responsibility to bring me safely home. Being something of a sceptic, however, I know that sooner or later they are going to lose me, and that somewhere, 70 or 80 miles from land, I am going to hear a plaintive voice down the intercom. asking to be taken home.

Finding a Wind

Before we take off we shall all have been briefed in the operations room, just as though this was an operational flight. For the first half-dozen trips only elementary exercises will be set. You will have to learn how to find a wind accurately, which means to within two degrees for direction and two knots for speed. On these preliminary exercises I shall take you out over the sea, and fly on a rock-steady course at a steady speed until I hear down my intercom. the words "Stand by to drop a smoke float . . drop." I shall then wait for your second instruction, "Stand by to turn . . . turn." On hearing this I shall make an accurate rate one-and-a-half turn through 180 degrees, and after flying on the new course one and a half minutes I shall expect your instructions to turn again. The smoke float burning on the sea will come up either to port or starboard, depending upon the drift of the aircraft. As we pass, you will take bearings. Twenty minutes later I shall hear your voice announcing the direction and strength of the wind, while the air gunner will be transmitting the information in code back to base. A few months later you will give me this information not in twenty minutes, but in two minutes, and your answer will be accurate.

The importance of wind in naval air navigation will soon be impressed on your minds. I remember the shock suffered by my observer—and by myself—when we left the coast one day and flew out to sea for only twenty minutes. I was given a course home again which should have brought us back over the point from where we started. When after flying for one hour and there was still no sign of land—which of course we should have recrossed in twenty minutes if there had been no wind—I must admit that I myself was beginning to get a little anxious. I even made the "Boy Scouts' " check on the compass by pointing the hour hand of my watch at the sun. It was actually one hour and fourteen minutes before we sighted an island in the Firth of Forth 30 miles to the south of our starting-point. You yourselves can work out the strength of the wind and its direction with the information that our indicated speed was 120 miles an hour while the course we were steering on the outward journey was 090 degrees true.

Variable Winds

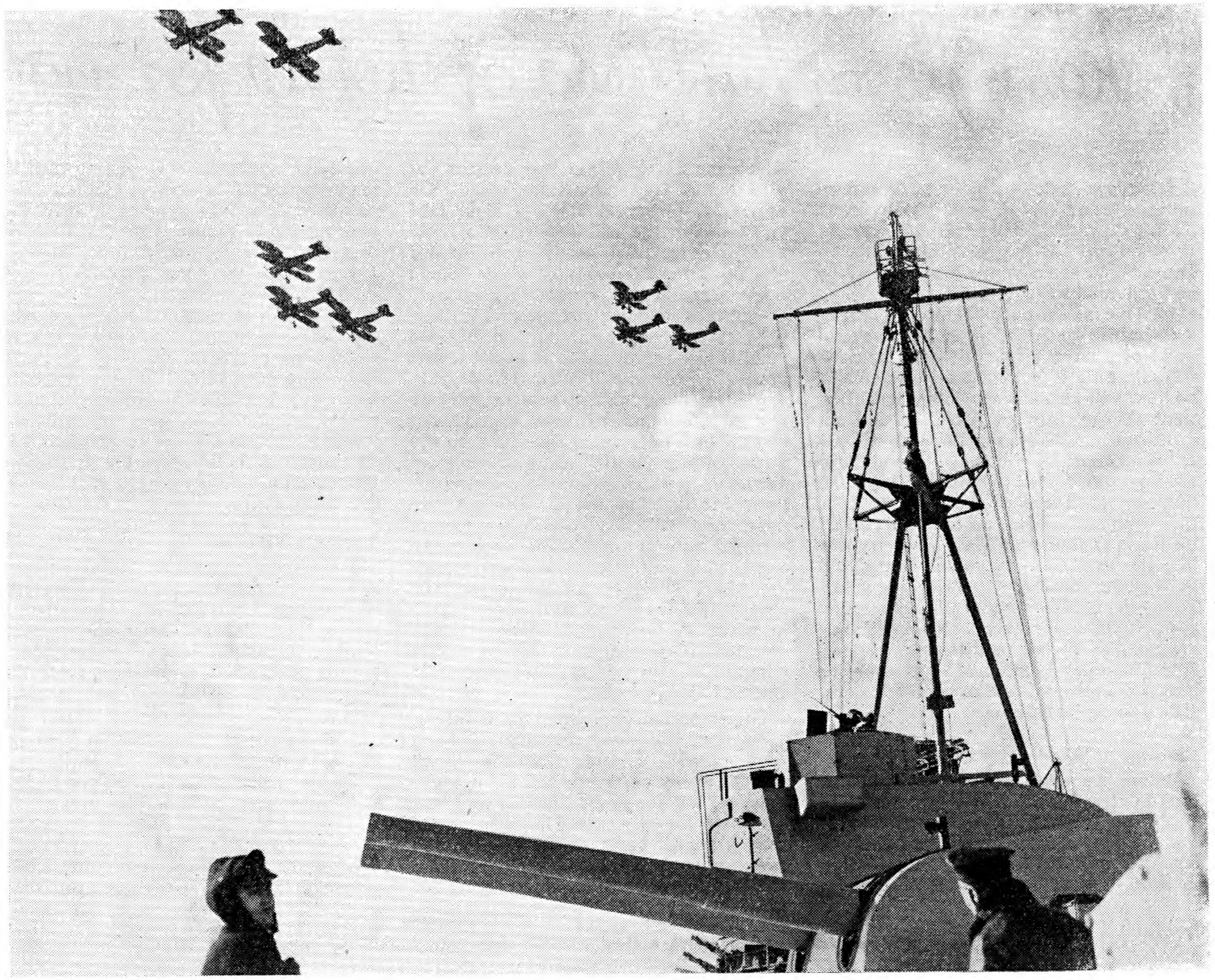
Wind speeds invariably surprise observers during their training. I was recently in the met. office of a fighter station where the following wind forces were chalked up on the board. These figures are by no means unusual, though the wind speed at 30,000 feet will surprise many.

Ground-level - -	12 m.p.h.
1,000 feet - - -	25 m.p.h.
4,000 feet - - -	50 m.p.h.
30,000 feet - - -	100 m.p.h.

Problems

After the first three months my crews generally improve rapidly. As we come

H.M.S. Victorious on patrol, photographed from her sister ship, H.M.S. Indomitable.



Fleet Air Arm Swordfish flying over H.M.S. Shropshire.

in over the North Sea, when all of us are searching for the first sight of land, it is a safe bet that we shall find ourselves within 10 miles of our estimated position. Only a few weeks later, I am very surprised when you fail to bring me home within two miles. At this stage your instructions in the briefing office may well be something like the following:

"Make good a track of 070 for 20 miles, then 095 for 70 miles, and return so as to intercept a carrier which was steaming from the point of your departure at a speed of 20 knots on a course of 350. Find a wind before your departure and on your last leg."

Assuming that your indicated air speed is 100 knots and that the wind which you find is 25 knots from 180, then what are the true courses which you will instruct the pilot to steer, and how long after departure would you expect to be over the carrier again?

The majority of our pupils get very good at working out such problems on the ground within a few weeks, but to find the accurate answers in the draughty cockpit of a Swordfish, with the distraction of engine noises, to say nothing of bumps, requires a lot of practice.

Fun and Games

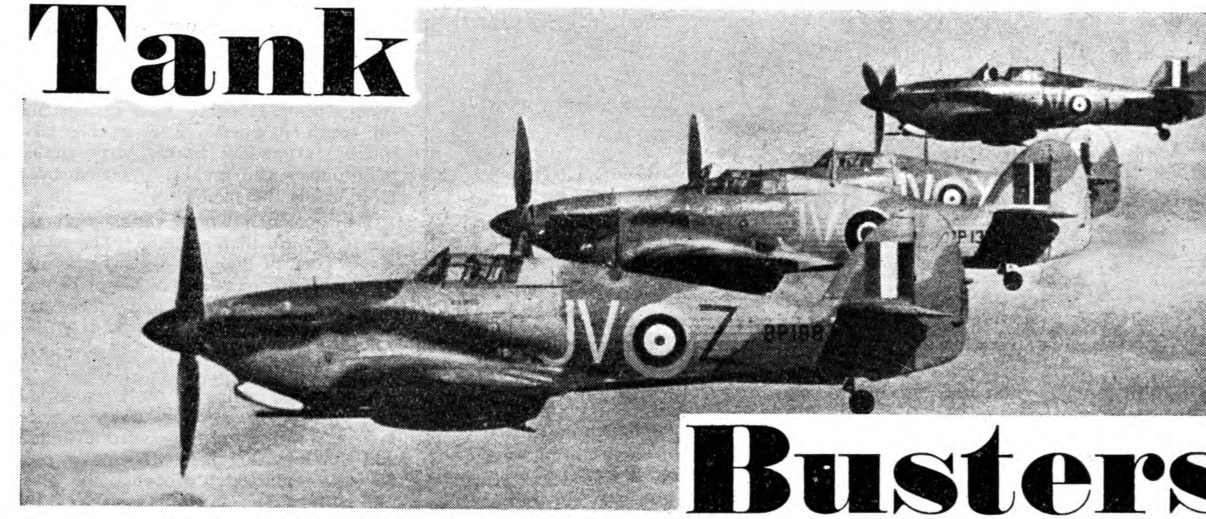
Quite apart from these exercises, we shall have great fun together playing hide-and-seek with a ship which we shall be detailed to shadow. The courses which the ship steers, and her speed, will have to be estimated accurately from a distance of about seven miles, and the information sent back to base. We shall, too, on other occasions, go out on photographic exercises, when I shall do my best to see that you get a fair chance of taking first-class pictures of pin-points, which I shall expect you to find yourselves. Then we shall do some shooting from the rear guns. There was one week on air firing when on two occasions the observer put a burst from the Browning gun through the tail of the aircraft; the next observer chose the bottom of the fuselage. By the grace of Providence he missed the control wires, and we landed safely. By plain speaking after such experiences we learn to handle the guns with respect.

Finally, you will take your passing-out examinations. By this time I should be happy to fly with any one of you anywhere in any weather conditions. You are a very highly finished product when you leave us.

Not a Joking Matter

Just one final word of warning which has a moral of its own. A fellow "stooge" pilot was out over the North Sea while an observer was carrying out his last air navigation, upon which he was being tested. Naturally he was extremely anxious to do well, so when he heard the voice of his pilot instructing him to put a pan of ammunition on the gun he complained pitifully that he was really too busy. At that moment a Ju 88 had been sighted by the pilot between the clouds, and my friend was fully justified in threatening to turn the aircraft upside down and shake the crew out if his orders weren't obeyed. This is a reminder that our naval training is carried out under operational conditions.

Tank Busters



Hawker Hurricane II-Ds in formation. These are armed with two 40-mm. cannon and two .303 machine-guns.

As soon as tanks had shown themselves dangerous and fast-moving weapons of attack in modern warfare, they had to keep an eye open for air attack. With the increase of armour, an attack held no great menace except for the lighter types. Aircraft machine-gunning was fortunate if it caused damage, and only accurate dive-bombing or close-misses from fairly heavy bombs perturbed the occupants. As the war continued, first from the Russian front and then from Libya came stories of fighter aircraft armed with "heavy stuff"—aircraft that could check the hitherto irresistible *Panzer Divisonen*.

The machine chosen for modification by this country was the Hawker Hurricane. The guns are of 40-mm. calibre, one beneath each wing, capable of firing small explosive shells singly or automatically, each weighing about two pounds. These guns are similar to the type that British tanks were armed with until recently, when the heavier six-pounder came into use.

The job of tank-busting is one requiring a special technique. The ground, to start with, is something on which the tank-busting pilot must now get literally a new angle. The idea of ground cover for aircraft may seem strange, although it is not so new to those who knew air fighting in the last war. The idea is still much the same—that of giving cover from fire and the fullest element of surprise to the attacking aircraft. Hills, forests, cliffs, buildings, must all be used to render the approaching tank-busters invisible just before the last moment of attack. So far as the tanks are concerned, the approach is silent. The crews of tanks on the move cannot hear approaching aircraft owing to the incredible din of their own engines and tracks when travelling on anything at all like firm ground. Only a large number of aircraft flying in formation can be heard. The tank commander depends entirely upon his eyesight.

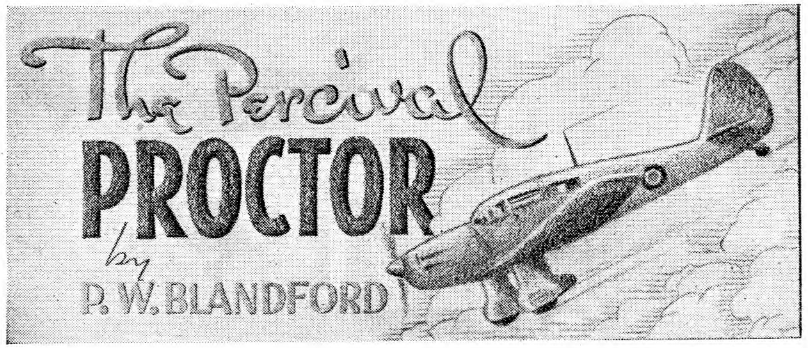
The long range of the machine-guns which the Hurricane still retains gives it the big advantage of "keeping heads down" and preventing fire from being opened on it while the pilot closes in and concentrates on the follow-through of the tank-crippling cannons.

The most dangerous period for the aircraft is immediately after the attack, when during the getaway a low-flying aircraft presents a large and undefended target; but the fighter speed and mobility of the Hurricane serve again to give it the advantage.

British experts seeking to defend our own tanks have not such a deadly foe in the present German counterpart of the Hurricane II-D. The Henschel Hs 129 is a twin-engined monoplane mounting one 30-mm. gun under the fuselage. Though the rate of fire and the number of rounds carried may be greater, the manœuvrability and fire-power are not as good as those of the Hurricane. Germany would doubtless like to continue research and improvement on this vital new air weapon, but she is held back by the pressing demands of the Luftwaffe in maintaining its strength in other directions.

From the strategist's point of view the situation is interesting. Armoured forces forming the spearhead of land attack or defence are difficult to counter by other ground forces. Medium tanks costing in the region of £15,000 each are only on equal terms as opponents, whereas the same figure will purchase rather more of the present-type tank-busters, with many factory production and material advantages, plus saving of man-power and maintenance in operation. Certainly there is no doubt of the damaging effect of tank-busting aircraft upon armoured fighting vehicles, and the R.A.F. is already directing an increasing number of men to this newest proof of its versatility.

The guns of the Westland Whirlwind are not good enough for tank-busting, though it is an aircraft that can be used effectively against other ground targets.



NEVER coming into the limelight, seldom even mentioned, yet doing valuable if not spectacular work, the Proctor is one civil machine which has changed over from the vivid colouring of the private aircraft and the surroundings of a civil flying club to the drab camouflage and hard work of Service life.

The Proctor, which is the Service version of the Percival Vega Gull, is used in large numbers for training wireless operators and navigators, and for communication work. Powered by a Gipsyqueen II engine and capable of carrying three or four people, it is a typical light British aeroplane.

To anyone who has gained his aeronautical experience during the war on high-powered, multi-engined Service types the Proctor, as a specimen of light aero-engineering practice, presents several interesting points. It weighs, empty, 1,875 lb. and has a span of 39 ft. 6 in. and length of 25 ft. 10 in. With a wing area of 197 sq. ft., this gives a wing loading of 16.5 lb./sq. in. The undercarriage is fixed and the wings are arranged to fold for convenience in stowage. The joints in the wings are just outboard of the undercarriage legs. A part of the trailing edge folds up at each side, allowing the wings to be folded back alongside the fuselage, and making the width, when closed, 16 ft. 4 in.

Construction

The construction is mostly of spruce, with fabric and plywood covering. The main planes have spars built up in box form from spruce and plywood, ribs and diagonal bracings of spruce, plywood leading edges and tips, and the fabric-covered main areas. The cabin has a large transparent canopy and a large door at each side. Metal footsteps fitted into the wings prevent damage to the skin.

For the size of the aeroplane the undercarriage track is comparatively wide, being 9 ft. 9 in. The shock-absorber legs are of the oleo-spring type, the landing shocks being taken by steel springs and oil recoil dampers. The wheels have internal expanding brakes, very similar to ordinary car brakes, operated by a lever beside the pilot's seat.

The accommodation varies with the use of a particular machine. The pilot's seat is fixed at the port side. There may be a second-pilot's seat, or his place may be taken by equipment and other seats arranged for pupil and instructor.

Power

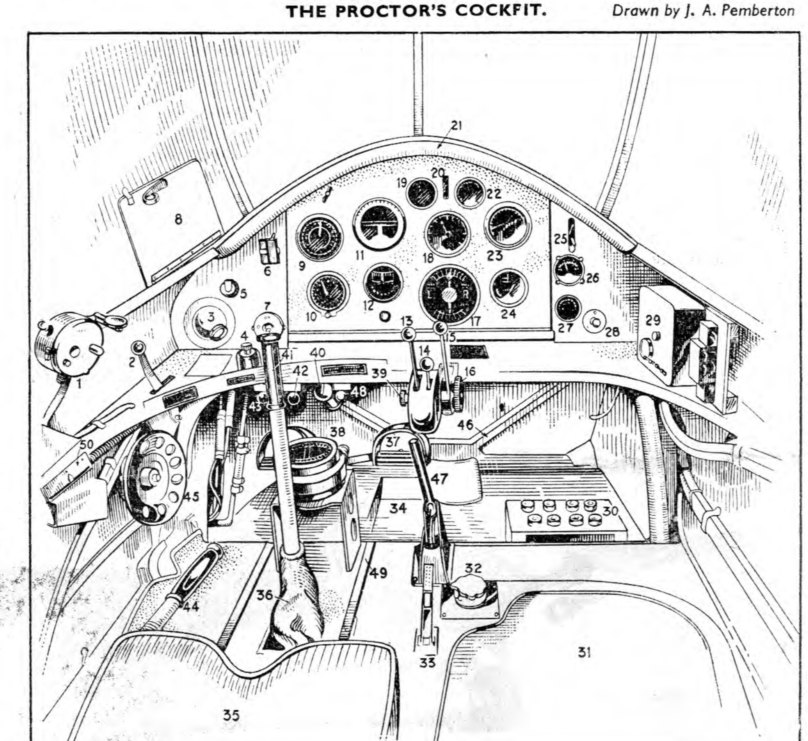
The engine is one of the latest of the long line of de Havilland aero engines. It has six inverted air-cooled cylinders and develops 205 h.p. Driving a two-bladed variable-pitch propeller, this gives the aeroplane a maximum speed of 180 m.p.h., its cruising speed at 7,000 ft. being 172 m.p.h.

Although the Gipsyqueen II is normally aspirated (i.e. it is not supercharged), because of the fitting of a constant-speed propeller it is necessary to fit a gauge showing manifold pressure. If there were no gauge, although the propeller would hold the r.p.m. constant, the pilot would have no way of checking the amount of throttle opening necessary at any particular speed. Although there is no actual boost, an ordinary boost gauge is fitted on the instrument panel, and this shows the pressure in the manifold, which, when the engine is at rest, is 14.7 lb./sq. in. (normal atmospheric pressure).

Key to Drawing.

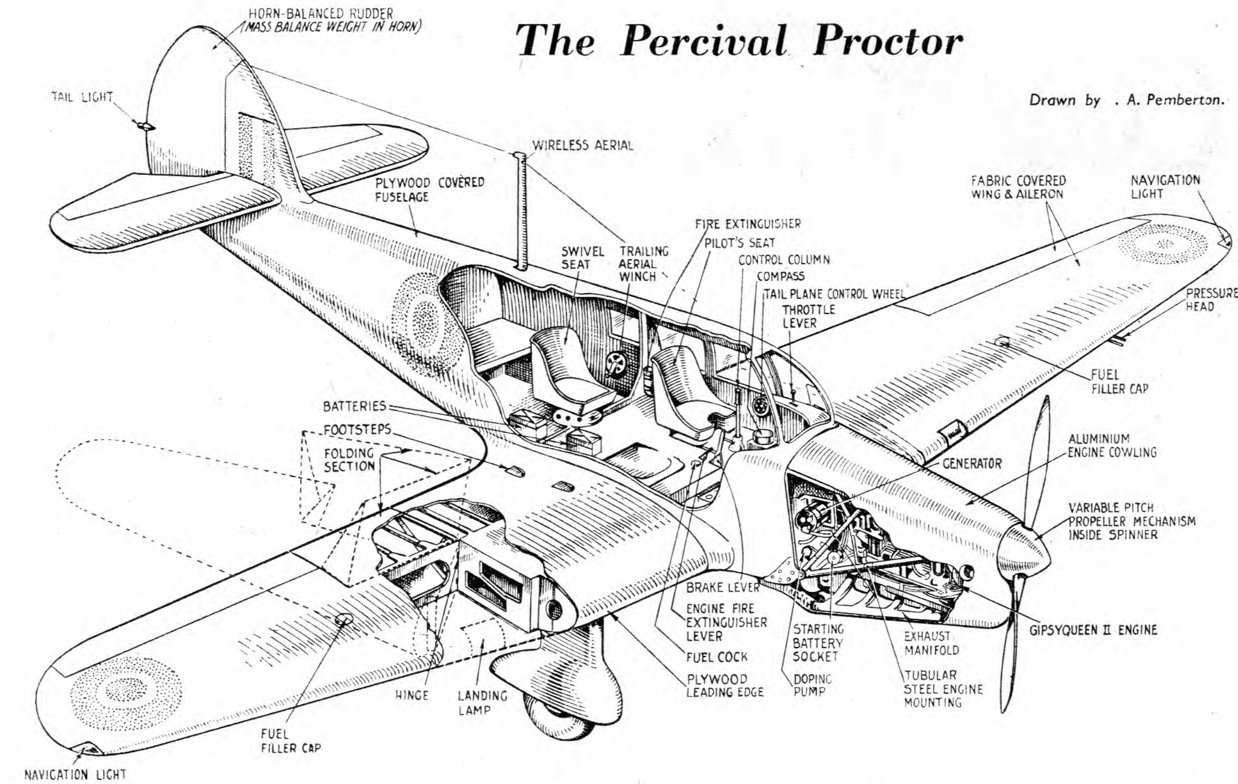
1. Signalling switchbox.
2. Extra throttle lever.
3. Ventilator air inlet.
4. Dimmer switch for compass light.
5. Engine starter push-button.
6. Fuse box. 7. Ignition switches.
8. Direct vision window.
9. Airspeed indicator.
10. Altimeter. 11. Artificial horizon.
12. Directional gyro. 13. Throttle lever.
14. Mixture lever.
15. Propeller speed control lever.
16. Friction adjuster.
17. Turn and bank indicator.
18. Rate of climb indicator.
19. Port fuel tank contents gauge.
20. Fuel tank contents gauges switch.
21. Padded coaming.
22. Starboard fuel tank contents gauge.
23. Engine speed indicator.
24. Manifold pressure gauge.
25. Air temperature gauge switch.
26. Air temperature gauge.
27. Oil pressure gauge.
28. Vacuum system test connection.
29. Switchbox, with fuses inside.
30. Signal pistol cartridges in rack.
31. Position for equipment or second pilot's seat.
32. Fuel cock knob.
33. Engine fire extinguisher control lever.
34. Well for pilot's right heel.
35. Pilot's seat.
36. Leather protecting boot over base of control [column.
37. Rudder pedal.
38. Compass. 39. Friction adjuster.
40. Compass light.
41. Control column.
42. Fuel pump priming knob.
43. Carburettor flooding control.
44. Flap operating lever.
45. Tailplane actuating gear control wheel.
46. Spruce and plywood fuselage construction.
47. Wheel brakes lever.
48. Carburettor air intake knob.
49. Rails supporting seat.
50. Tail plane incidence indicator.

THE PROCTOR'S COCKFIT. *Drawn by J. A. Pemberton*



The Percival Proctor

Drawn by . A. Pemberton.



The fuel tanks are in the wing, with a cock control in the floor of the cabin. Before the engine is started the engine fuel pump and the carburettor are primed by pulling a knob marked "Carb." under the instrument panel and pumping another beside it. For doping the engine there is a pump on the starboard side of the engine. Electric starting is used, current being provided by the aeroplane battery or a trolley battery plugged into the socket near the doping pump.

Controls

The pilot's controls and instruments are somewhat simpler than on larger types. The control surfaces are operated in the usual way by stick and rudder pedals. Tailplane actuating gear is provided, with its control wheel on the side of the fuselage. On larger aircraft (the Lysander is an exception) the job of trimming the tailplane is done by trimming tabs, instead of altering the incidence by actuating gear, which would be too cumbersome. The trailing-edge flaps are controlled by a lever at the left of the pilot's seat. This has a movement opposite to what might be expected, being pulled up to move the flaps down.

The throttle, mixture and propeller levers are in quadrants below the centre of the instrument panel. This conforms to the usual dual-control practice, but there is an additional throttle lever on a shelf at the port side, so that the pilot can operate it with his left hand if he wishes.

The instrument panel carries the usual blind-flying instruments together with the engine gauges. The compass is on a bracket fixed to the floor between the pilot's legs. For navigational training there is a large table at the after end of the cabin.

A SIGH FROM A CADET

The following letter is from an ex-cadet, now a flight sergeant in the R.A.F. He has sent it in the hope that present cadets and other young men thinking of joining the Air Services will learn their lesson beforehand. He writes: **"I have had one or two shocks since I've joined up with regard to tests we have undergone. I think if you were to pass it on to some of the A.T.C. cadets it might make them realise a little more what is really expected for a thorough pass into the I.T.W. and, more important, to pass out of it.**

"Much attention is paid as to previous A.T.C. experience, and I would say that to really ensure success no less than a 90 per cent pass in maths., eight or ten words a minute in Morse, as near 100 per cent as possible in navigation, and as high as possible in aircraft recognition, are required. Much attention is paid to navigation. We get two hours a day, five days a week, for twelve weeks, and an hour a day for five days a week at signals.

"This may shake some of the cadets a little. It did me at first, but I really am thankful that I did attend A.T.C., and I only wish now that I could have received more instruction in maths. and navigation.

"There is also another thing. Everbody must be able to swim at least one hundred yards before they pass out. Great attention is paid to this.

"I hope this isn't too dry, but I feel that I would like the other chaps to get a better start than I did."

Amphibious BEHAVIOUR

by A. M. COLBRIDGE

A PART from the obvious warning of not landing an amphibian on the sea with the land undercarriage down, and vice versa, there are several other peculiarities of the type of which the pilot must be aware.

Dealing with the obvious point first, it will be realised that the only danger likely to arise from misplacement of the landing gear will occur only during landing. An amphibian cannot take off from land with its land undercarriage retracted, neither will it normally take off from water with its land undercarriage down. In the former case the reason is obvious; and the same reason, excessive drag, applies to the other. The resistance to motion through water of the wheels and undercarriage legs is large enough to prevent any normal machine from reaching its hump speed, and thus it will not take off.

During landing, then, is the one time to make sure that everything is as it should be.

A Cumbersome Brute

On land an amphibian is a cumbersome brute. A characteristic of all marine aircraft is the high placing of the thrust line, this to raise the airscrew clear of spray. Thus on land the high thrust line tends to pull the machine over on to its nose, resulting in what is termed "bucking."

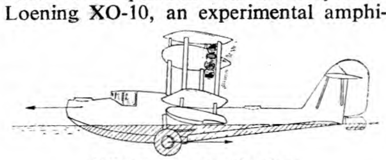
This effect is accentuated by the short wheelbase, that is, the distance between the main wheels and the skid (generally a combination of water rudder and tail skid), so that on taxying the machine tends to tip up until the nose of the hull or float is rubbing along the ground. If it is allowed to continue in this attitude it will only result in excessive wear on the forebody bottom, and the tail must be forced back by pulling the stick back and giving a burst of throttle.

Bucking

Bucking occurs only at low taxying speeds, when elevator control is very weak; so to avoid this it is often advisable to taxi an amphibian slightly faster than a normal landplane. The ideal solution is, of course, the nosewheel undercarriage, when it is impossible to buck the machine in the accepted sense. It is interesting to note that such a layout has been adopted on the Catalina III-A (Cansos in the R.C.A.F.), and this should make this machine particularly easy to handle on the ground.

Even though bucking is a common fault of the normal amphibian layout, the machine will tip up only so far, i.e. until the nose is resting on the ground. Thus it is impossible to turn an amphibian right over on land (except during a crash landing), and in this respect they are somewhat safer than a landplane with a normal-type undercarriage.

There has been an amphibian built with only one wheel, this being housed in a compartment in the main hull. The machine in question was the Keystone-Loening XO-10, an experimental amphibian built for the United States Army in the early nineteen-twenties. To maintain lateral stability on the ground a skid was fitted to each of the two outrigged auxiliary floats. The engine was a Wright Typhoon, an air-cooled V-12, again an experimental type, which gave the boat a top speed of just over 100 m.p.h. The XO-10 was, incidentally, used for the first practical experiments conducted by the U.S. Army on amphibian types, although the U.S. Navy had shown their interest since 1918.



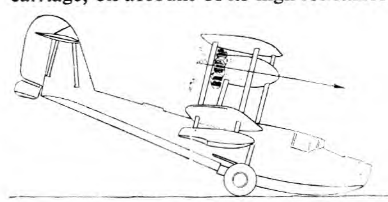
Wheels as water brakes.

Take-off

Taking off from water involves exactly the same procedure as for any normal marine aircraft, once the land undercarriage has been raised, although the type with wheels inset in the floats may possess certain peculiarities. In spite of attempts to shield wheels set in floats by suitable fairings the water drag is often high.

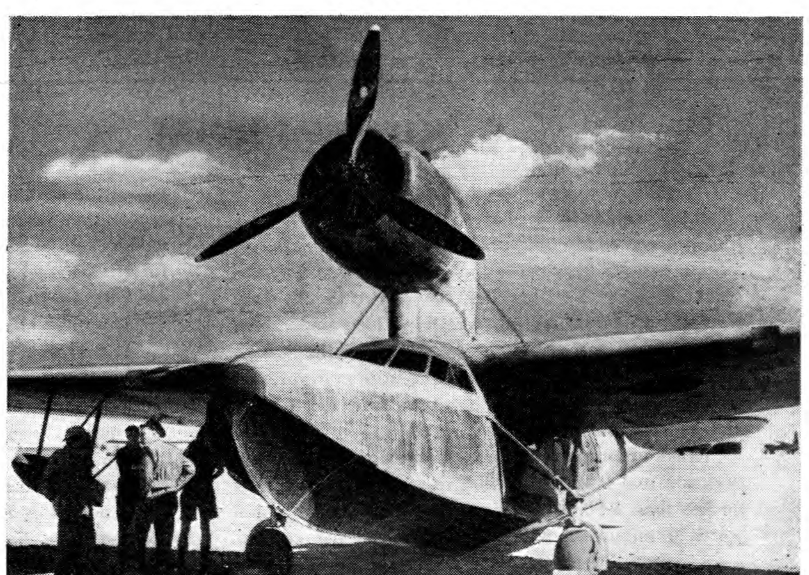
Some of these types are worse than others. Often a difference of only a few degrees in attitude during take-off will double the water resistance. One or two types suffered so badly from this that if they were held at a certain attitude during planing the resistance was so great that it was impossible to take off, or even to reach the hump speed, especially in a dead calm. A difference in attitude of only two degrees would often change these conditions, and thus the pilot had to know at exactly what attitude to hold the machine during take-off to ensure that it did get off.

There are occasions when it is definitely advantageous to lower the land undercarriage when in the water, but always at comparatively low speeds. The undercarriage, on account of its high resistance, makes an admirable water brake. Thus in beaching the machine can be run up to the slipway at a greater speed than normal, and thus minimising drift effects, and the wheels lowered to act as a brake at the right moment. Amphibians are considerably less bother to manhandle in and out of the water, being able to waddle out on to the slipway with but the minimum of assistance and dispensing entirely with beaching trolleys and winches.



Bucking.

Front view of a Fairchild 91 amphibian used by the Air/Sea Rescue Service of Middle East Command.



DE-ICING

by HAROLD P. LEES

DE-ICING means the removal of ice or hoar frost, after it has formed on the aeroplane surface, by mechanical or other means; or the prevention of its forming by the application of suitable preventives.

Ice forms on aerofoils, propellers, control surfaces, aerial masts, windscreens, air intakes and numerous other parts of the aeroplane, either when it is picketed, during the take-off or when it is airborne. The general effect of ice on an aerofoil is to cause a reduction in lift and an increase in drag, and, in the case of propellers, a reduction in thrust. If this happens during take-off a longer run is necessary to overcome the loss of propeller efficiency and the increase in drag, and an increase in speed to make the machine airborne on account of the reduction in lift.

In the air, especially at high altitudes where the temperature is cold, if the aeroplane flies through moisture-laden atmosphere there is a possibility of ice forming on the leading edges. When the cold surface of the aeroplane hits the cold drops of moisture they immediately fasten themselves to it in the form of ice.

Precautions are always taken when a machine is picketed out in cold weather to prevent ice or hoar frost forming. Either the aerofoils and control surfaces are protected by fabric covers, or the susceptible parts are sprayed with a special fluid which prevents ice forming.

Prevention of ice forming in the air is rather a more difficult matter, and there are two methods of dealing with it.

De-icing paste is a thick yellow grease which contains constituents which are soluble in water and which prevent it freezing at low temperatures. Thus a layer of fluid forms between the paste and the ice trying to get a grip on the surface, and prevents it from adhering. The airflow removes the loose ice, and it is swept away. The paste is applied to the leading edges of the aerofoils and about a third of the way back, the leading edges of the control surfaces and hinges, wireless aerials, fins, etc. It is laid on evenly to a depth of about $\frac{1}{16}$ of an inch. If it is not laid on evenly a heavy shower of rain can wash it away in places, and that enables the ice to get a grip. It retains its de-icing action for about seven days, after which time it has to be scraped off and fresh paste applied.

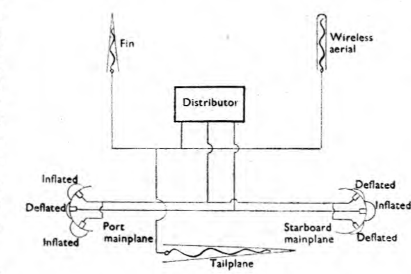


Fig. 1.

A layout for a set of de-icing equipment, starting from the distributor which alternatively inflates and deflates the rubber shoes. The port mainplane shows the two outer tubes inflated and the centre one deflated. The starboard shows the next operation which is to deflate the outer tubes and inflate the centre one. In actual practice, of course, both port and starboard are synchronised and the corresponding tubes of each work together.

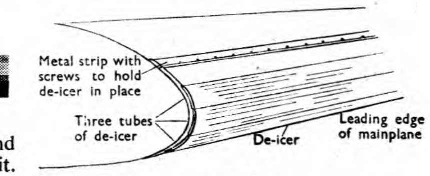


Fig. 2.

A rubber de-icing shoe in position.

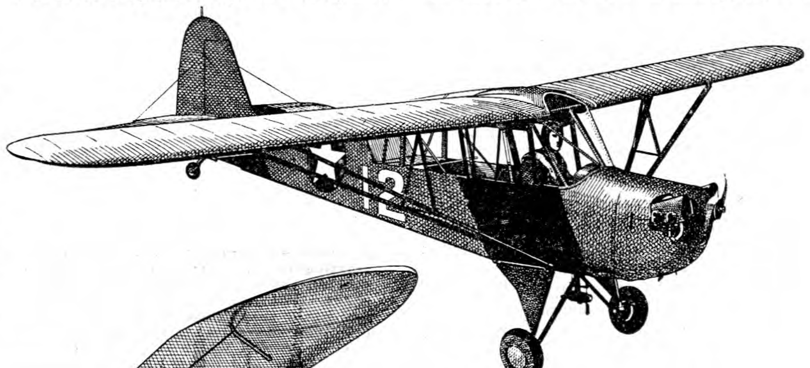
The mechanical method of de-icing takes the form of laying rubber shoes along the leading edges of the surfaces affected. Along the inside of the rubber shoes are three rubber tubes which can be inflated with compressed air, and immediately deflated by taking away the pressure and allowing the shoes on top of the tubes to push all the air out. This pulsation, or expanding and contracting action, breaks up any ice forming on the surface. When the part is narrow, like the leading edge of the fin or the wireless mast, only one tube is used, arranged spirally. Providing the de-icer is not in action when the machine takes off, the rubber shoes do not affect the efficiency of the aerofoil.

A different method of de-icing is used on propellers, where the ice tends to form on the spinner and along the inner portions of the blades. A de-icing fluid is used. At the back of the propeller hub is a slinger ring, into which de-icing fluid is fed from the de-icing tank, either by gravity or air pressure. From the slinger ring, tubes run to the centre of each blade at the end next to the hub, and centrifugal force throws the fluid along the blade. The spinner is covered with a special solution which prevents ice gripping.

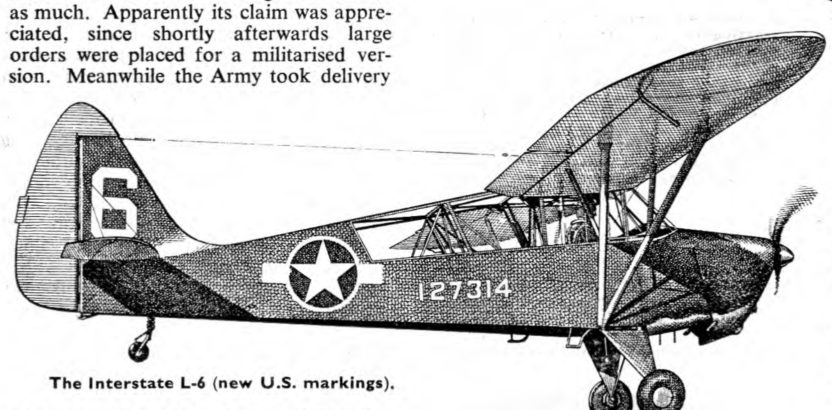
The Flying Fortress seen here and in the title picture is fitted with elaborate de-icing equipment.

Liaison Aircraft for the U.S. Army

During the summer of 1941 a small number of light sporting aircraft were supplied to the U.S. Army with a view to their employment as artillery spotters and on courier and liaison duties with ground troops. Seven Piper Cub Trainers attached to the 2nd Army during the Tennessee military manœuvres put up such a good performance that official eyes were soon directed to the possibilities of the general use of such types with all army formations, particularly armoured divisions and artillery units. At the same time three Aeroncas joined the 120th Observation Squadron at Biggs Field for experiments in army co-operation during local troop exercises. The Aeronca Aircraft Corporation claimed that their aircraft could do the same job as machines then in use costing fifteen times as much. Apparently its claim was appreciated, since shortly afterwards large orders were placed for a militarised version. Meanwhile the Army took delivery



The Aeronca L-3c (old U.S. markings).



The Interstate L-6 (new U.S. markings).

of more civil models, these rapidly being converted for military use by the application of a little paint and the fitting of service radio sets and other slight interior modifications. Pipers were given a similar contract, together with two other firms, Taylorcraft and Stinson.

The following is a short review of the types at present in use by the U.S. Army and the firms engaged in the above building programme.

The Aeronca Aircraft Corporation, of Middletown, Ohio, is at present producing the following light types: The Defender two-seat trainer, the TG-5 glider, the Super Chief ambulance for the Civil Air Patrol and the L-3 for the U.S.A.A.F.

The first Aeroncas to join the Army were the two-seat Defenders, now relegated to training duties, and were given the designation O-58. This was later changed to L-58 when it was decided to distinguish these small types from the heavier observation machines. Finally, a new duty designation and number series was created by the Army Air Force, L for Liaison, the Aeronca being allotted the number 3.

The Defender was soon supplemented by the L-3, which had been modified from the Defender to conform to the specification issued for the new Liaison class. This called, among other things, for increased rear vision and the provision in the rear cockpit of complete radio equipment and a chart table and map stowage.

A floatplane version is used by the Army Air Force as a trainer.

The Interstate Aircraft and Engineering Corporation, El Segundo, California. The Aircraft Manufacturing Division of this firm is making the S-1A Cadet, approved for use under the Civilian Pilot Training Plan, a new twin-engine trainer for the U.S. Navy, and the L-6. Production facilities are set aside for the extensive supply of accessories, mainly landing gear and armament installations, to the Air Force and the Navy.

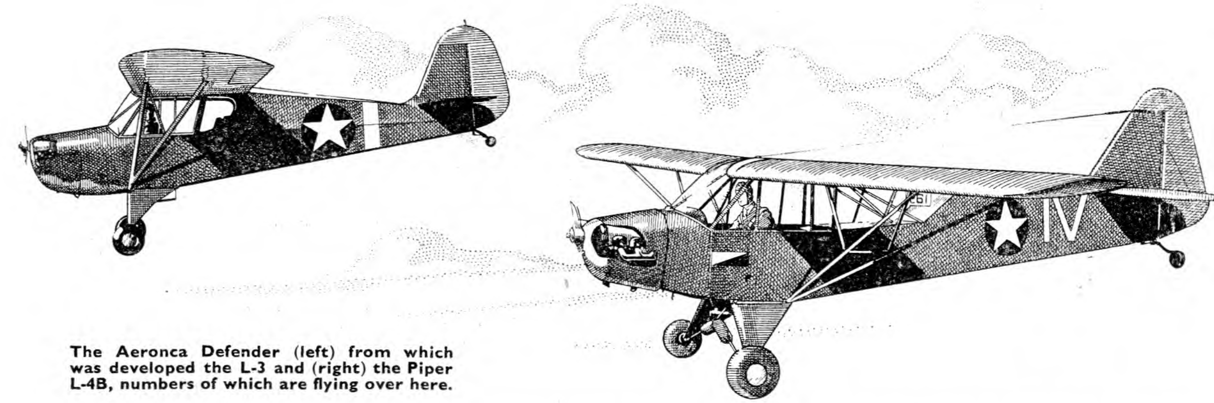
The L-6 is a development of the Cadet and differs externally in such details as the removal of the spats and the extending of the transparent hooding to well down the fuselage. Data for the Cadet are: Span, 35 ft. 6 in.; length, 24 ft.; max. speed, 107 m.p.h.; initial rate of climb, 625 ft./min.; service ceiling, 15,000 ft.; range, 375 miles at 100 m.p.h. The motor is either a Continental or Franklin of 65 h.p. Reports indicate that the L-6 may have a 65-h.p. Franklin and a top speed of 107 m.p.h.

The Piper Aircraft Corporation, Lock Haven, Pennsylvania. At the end of 1941 over 10,000 Cubs had been built, and the majority of them are now on official business. As far as can be ascertained, only the following types are at present in production: the L-4 Grasshopper, the naval NE-1 and the HE-1 ambulance plane, and the TG-8 glider trainer. The Piper J-3 Patrol is used by the U.S. Civil Air Patrol.

Modified Piper Cub J-3s, known as the O- or L-59, were first adopted by the A.A.F., and have been supplemented by the military version, the L-4, which is often seen flying in this country. Some L-4s have a swivel seat in the rear cockpit, enabling the observer to face forward to handle the dual controls, or to the rear to attend to his spotting duties. A map-table and two-way radio are standard equipment.

The Stinson Division of the Vultee Aircraft, Inc., Wayne, Mich., is building two types, the L-5 liaison monoplane, and a special version of the Reliant four-seat cabin monoplane used by our Fleet Air Arm as a navigational trainer.

The L-5 is heavier than any of the previous types mentioned, and although developed from the Voyager three-seater, it has been re-designed to military specifications and to make use of wood and plastics, resulting in the saving of 20 per



The Aeronca Defender (left) from which was developed the L-3 and (right) the Piper L-4B, numbers of which are flying over here.

cent. steel and 70 per cent aluminium. It is a two-seater, with a welded steel-tube fuselage, fully slotted and flapped wooden wings and an all-wood tail unit. The rear fuselage has been altered to improve the view from the cockpit, and fin area is increased.

About two years ago some two-seater models of the 105 were purchased by the A.A.F. as army co-operation aircraft, and still earlier orders by the French had been taken over by the Royal Air Force. Experience gained with the Stinson 105 (the forerunner of the Voyager) was incorporated into the design of the L-5, an interesting example being that the stroke of the oleo landing gear of the L-5 has been greatly lengthened to absorb alighting shocks on rough ground. An impression of the L-5 is contained in the heading design of this review.

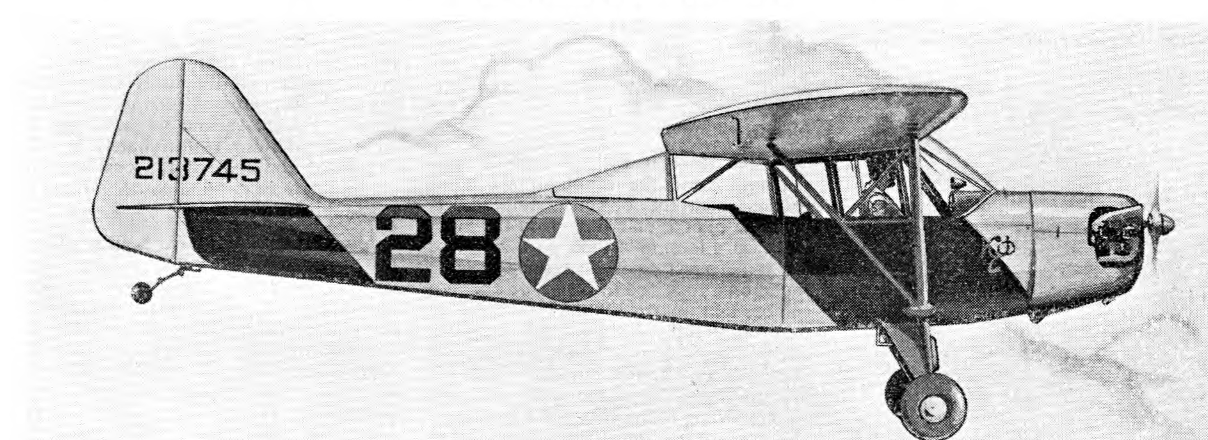
The Taylorcraft Aviation Corporation, Alliance, Ohio, in 1941 turned its entire manufacturing capacity over to defence needs, and is now making the L-2 Grasshopper and the TG-6 glider, both of which are developed from the Tandem Trainer. Fabric-covered two-spar wooden wings and welded steel-tube fuselage and tail unit are used in both the Tandem Trainer for the Civilian Pilot Training Plan and the L-2. Service Tandem Trainers, first numbered L-57A and then L-2A, were replaced by a new model, the L-2B, with Perspex rear-view panels, which is illustrated on these pages.

Vultee Aircraft Inc., Vultee Field, California, is producing at its Nashville, Tennessee, branch the L-1 Vigilant, a Stinson design. The Vigilant comes midway between the light Grasshopper types and the heavy observation machines such as the Curtiss O-52 Owl and the North American O-47B. It is also known as the 0-49B and in the R.A.F. as the Vigilant I.

U.S. ARMY LIAISON AIRCRAFT

Makers' Name	Army Designation	Motor	H.P.	Span ft. ins.	Length ft. ins.	Height ft. ins.	Weight Empty (lb.)	Weight Loaded (lb.)	Max. Speed m.p.h.	Range miles	at Spd. m.p.h.	Initial Climb ft./mn.	Service Ceiling (ft.)
Aeronca Defender	Grasshopper L-3C	Continental A-65-9	65	35 0	21 10	6 9	793	1,260	95	225	87	450	10,000
Aeronca Defender	Grasshopper L-3B	Lycoming O-145-B3	65	35 0	21 10	6 9	793	1,260	95	225	87	450	10,000
Piper J-3	Grasshopper L-4B	Continental A-65-9	65	35 2½	22 3	6 8	651	1,100	90	206	75	850	12,000
Taylorcraft	Grasshopper L-2B	Lycoming O-145-B3	65	36 0	22 0	6 8	700	1,200	105	375	95	600	15,000
Stinson 74	Vigilant L-1	Lycoming R-680-9	285	50 10¾	33 11½	10 6	2,591	3,322	123	350	90	1,160	17,000
Stinson 76	Sentinel L-5	Lycoming	190	34 0	24 0	—	—	2,100	—	—	—	—	—

The Taylorcraft L-2B Grasshopper.



Black-Out

by A NAVAL OFFICER

As the speed of flight of aircraft increases, so the ability of the pilot to withstand the great physical strains to which he is subjected becomes more and more important. Of these, black-out is probably the most heard of. The explanation of black-out is quite simple, and needs no great medical or technical knowledge to understand.

Pain, smells, noise, etc. — all these physical and mental sensations are caused by the reactions of the nerves in the body to what is happening outside the body, or needless to say in the case of a stomach-ache, to something that is happening inside the body.

The whole body is covered with nerves which, like the branches of a tree, all radiate from the main trunk, which has its roots in the brain. When you hear a sound, it is because sound waves beating upon your eardrum have caused the nerves connected to it to pass back a sensation to the brain which registers in the form of sound. Similarly, when you see an object it is because the light-rays caused by that object have struck your eye, causing the nerves therein to react and pass back an impulse to the brain that is registered as a shape possessing colour and distance.

All these nerves are fed by the blood that flows round all the small vessels in your body. If the supply of blood is interrupted, even only temporarily, the nerves will lose their power and the sensations will be dulled.

So black-out is nothing more than a temporary failing of the nerves of the eye due to loss of blood in the small blood-vessels of the eye feeding the nerves, the loss being due to the blood draining away under the action of the force of acceleration caused by a change of direction of the aircraft, and with it the pilot, travelling at high speed.

If you tie a stone on to the end of a piece of string, and swing it round your head, it will, as it starts to go faster, begin to pull harder and harder on the string, i.e. its relative weight increases. If it is a big stone, and you swing it fast, either the string will break or you will get pulled off your feet. This force, known as centrifugal force, is directly proportional to the weight of the body and the speed with which it is travelling, and is measured as a value of 'g', which is the simple force of gravity on a body that gives it what we call weight. If, therefore, you have a stone weighing 1 lb. and swing it round your head on the string at such a speed that it is subjected to a force of 3 'g', it really means that the pull on your hand and on the string will be 3 lb. When a pilot turns at high speed or pulls up out of a dive he is subjected to exactly the same force as the stone on the end of the string, and as he is affected, so is every part of his body, including the blood in it.

The heart, which pumps the blood round the body, was built to do its job for the natural functions of walking and running about on the ground, and not for flying through the air at great speeds. As the force 'g' is increased and the relative weight of the blood is increased, so the heart has more and more work to do lifting it up to the eyes and brain, and eventually the time will come when it is no longer capable of doing its job. The blood drains away from the head and falls into the lower portions of the body. Thus the nerves of the eyes, and eventually of the brain, are starved, and the pilot experiences first a loss of vision, and then, if the force is maintained, loss of consciousness. If a force of 7 'g' is applied, the blood in the body attains the same relative weight as that of molten iron; and 7 'g' is a force that can easily be achieved in a modern fighter before any damage is done to the aircraft.

So much for the actual cause of the black-out; the next question is, How do we stop it, or at least make its occurrence less common?

There are two ways—first, by adjusting the position of the pilot so that the blood does not tend to drain away from his head, and secondly by restricting the arteries so that it is not so easy for the blood to flow away.

Remember that the force of 'g' acts outwards from the centre of the circle round which the object is turning. If then the pilot is standing up in the aeroplane, in a loop or a tight turn, it will be the same effect as if he is being swung round on a rope tied to his head; and you can see that not only is the blood tending to drop straight down towards his feet, but his heart has got to pump against this force for the full distance between it and the brain. If, on the other hand, the pilot is swung round lying on a flat board there will be no tendency for the blood to fall towards his heart, and he will not be subject to black-out until very high values of 'g' are obtained.

Since a pilot has other things to do besides avoid black-out, it is not practical for him to fly lying down, though it is interesting to know that before the war the Germans were experimenting with an aeroplane in which the pilot did lie flat on his face looking out of the front. Though it may not be practical for the pilot to lie down, things can be made very much better for him by sitting him in such a position that his feet are well up and his body is lying back at an angle. This is in fact done. A Spitfire has two sets of rudder bars, the one higher than the other, so that when the pilot is flying fast he puts his feet in the top rests and so raises his knees and counteracts the tendency of the blood to fall into his legs.

It is quite easy to imagine the favourable change of the height of the column of blood that the heart has to support by changing the position of the pilot.

The second method of checking the tendency to black-out is by restricting the flow of the blood in the arteries.

The best way of all would be to hold the blood in your head by tying something round your neck and stopping the artery completely. Unfortunately this is not exactly a practical solution, but a certain degree of restriction can be obtained by tightening the muscles of the neck. This action presses them against the artery and closes it slightly, which, incidentally, is why you get red in the face when you do it or have it done to you. The same effect is achieved by shouting, which explains why in some of the rather wilder type of American aviation films you see the pilot shouting madly as he goes into his test dive.

Another way of assisting is a tight belt round the stomach, which prevents the blood flowing down into the big arteries there, and so holds up the column in the arteries of the neck. An energetic inventor thought that he had got just the answer to this problem. He produced a contraption consisting of a pair of rubber corsets, hollow, and connected by a tube to a cushion which was filled with water and on which the pilot sat, the idea being that when the aircraft went round a corner the relative weight of the pilot on the cushion increased, driving the water up into the corset, and so restricting the stomach arteries. Unfortunately he miscalculated the area of the cushion, and on going round his first corner rather fast nearly broke all his ribs.

Many other ideas have been tried and found wanting. Black-out is becoming a very serious problem in modern aviation, particularly in air combat, where it is most applicable, since the aircraft are twisting, turning and diving all over the sky. Needless to say, the pilot who has taken the best precautions will in all probability win the day, since he will retain his vision and consciousness the longer.

"Catch me going up in one of those things."

RED AIR FORCE in ACTION

Of the pictures on the left the three upper are the PE-2 and the lower group taking off are YAK-1 fighters. On the right are four Stormoviks, and below is a LAGG-3 fighter.

A formation of R.A.F.
North American Mitchell Bombers

A superimposed picture from America of Lightnings accompanying a Fortress on its trial flight. Both are produced in the Los Angeles area

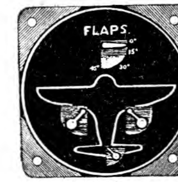


Fig. 2.

Undercarriage POSITION INDICATORS

by 'ASTRO'

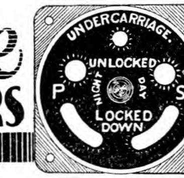


Fig. 1.

ONE of the worst objections to the earliest retractable undercarriages was that they tended to fold up when the aircraft was moving over the ground. The back pressure of forward motion and the weight of the aircraft were too much for the feeble locks then in use. Another objection was that in low-wing monoplanes with the cockpit set well over the wings it was impossible for the pilot to see if the wheels were down when making a landing. Consequently there were many crashes due to collapsing undercarriages and involuntary belly landings.

I recall one occasion when Captain Hubert Broad, then test pilot for de Havillands, was test-flying the all-green Comet which came in third in the Melbourne air race of 1934. Captain Broad had flown the Comet for some time, putting it through astonishing aerobatics over Stag Lane aerodrome. Streamlined monoplanes were something to stare at in those biplane days, and a big crowd had gathered on the airfield to watch. When he decided to land he had forgotten to lower the wheels. Everyone watching him began to shout and wave their handkerchiefs. He saw them and just avoided damaging the precious Comet. Everyone there agreed that some instrument was essential to tell the pilot when the wheels were up or down. Now, after nearly ten years of retractable undercarriages, the problem of knowing whether the wheels are locked down for landing has been effectively solved. Crashes due to faulty undercarriage locks are rare.

In those ten years many devices have been tried out as undercarriage indicators, from the little tab with "Down" printed on it, which used to bob up out of the mainplanes on the early Spitfires, to the simple but highly ingenious electrical system of warning lights and hooters which are in use at present.

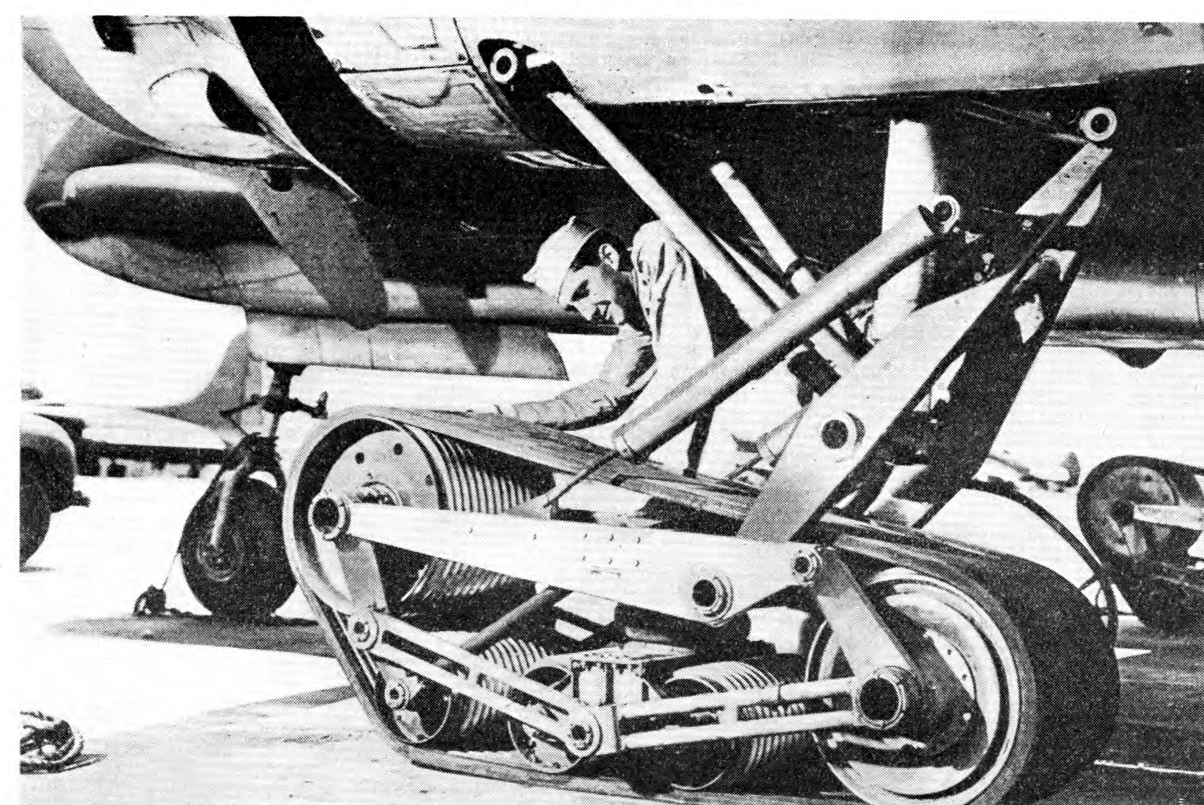
Two electrically operated instruments have been chosen to illustrate the modern undercarriage position indicator. Fig. 1 is a British indicator found on many of the most up-to-date aircraft. Fig. 2 is an American instrument, also of modern design.

Fig. 1 is wired directly from the "Up" and "Down" locks of each undercarriage leg. When the undercarriage bottom locks engage and the wheels are locked down, the two bottom green lights, marked "Locked Down," come on. Each light is separately connected to each lock, so if one light only comes on the pilot realises that he has one wheel not properly locked down and takes the necessary precautions. I have seen some excellent landings made on one wheel. Of the two evils, no wheels or one wheel, the risk is less on one wheel if the pilot is skilful. The three lights marked "Unlocked" are coloured red and are on all the time when the undercarriage is up. When selection is made for "Down" the red lights go off, and the green lights come on when the undercarriage is locked for landing. The knob in the centre is used for night or day flying. For night flying the knob is turned to the left, and the dial is then illuminated. This instrument is always fitted in a position where it is clearly visible.

Fig. 2 is an American instrument for indicating the actual position of the wheels or flap at any moment between "fully down" and "fully up." This instrument is always illuminated. The act of putting it into operation by the appropriate switch illuminates it as well. The "wheels" on the instrument are wired direct to a micro-switch on the undercarriage legs. As the legs move, the "wheels" on the instrument move in unison with them, so indicating the position of the landing wheels at a glance. The same applies to the flap indicator on the same dial (Fig. 2).

Also wired in series with the "undercarriage up" locks and the throttle lever is a klaxon horn fitted just behind the pilot's head. When the engine is throttled right back for a landing the horn will blare out unless the wheels are down. So with this and the position indicators to warn him, the most forgetful pilot can hardly make an involuntary belly landing these days — unless, of course, the hydraulic system has been damaged.

A new landing gear developed in America, applying the principle of wide tracks similar to those used on tanks. The new gear is constructed with steel bracing and grooved aluminium bogie rollers; the wide endless rubber track has a wire beading and is grooved to fit into the roller.



SIR TRAFFORD LEIGH-MALLORY

by **C. G. Grey**

AIR MARSHAL SIR TRAFFORD LEIGH-MALLORY, K.C.B., D.S.O., Air Officer Commanding-in-Chief, Fighter Command, has one of the most responsible and harassing jobs in the Royal Air Force. Whereas in the earlier days of the war the A.O.C.-in-C. Fighter Command commanded day- and night-fighters, and controlled the anti-aircraft guns and searchlights and the Royal Observer Corps when enemy aircraft attacked this country, to-day the Army Co-operation Command has also been placed under him. That means all sorts of fighter-bomber oddments which never troubled his predecessors in the Command, and co-operation with the Army such as close contact over enemy positions, ground strafing, tank-busting, short-range bombing of enemy troop-assemblies, dumps, railways, camps, billets and so forth.

The Tactical Air Force

Not only do these operations come under him when they are part of day-to-day operations over enemy-occupied territory, but when the Allied armies get going on the Continent all the work of blasting the enemy out of the way of our advancing troops is his affair also. In fact, the A.O.C.-in-C. Fighter Command controls the Tactical Air Force, the new development of Army support which has superseded Army Co-operation Command.

The uses of a tactical air force were developed by bitter experience during the to-and-fro waging of the desert war. Strategy has to do with operations which affect the area of war. Tactics are concerned with the *field of battle*. So, roughly, we may say that bombing sources of war material in Germany and Italy and their allied and occupied countries is strategic bombing, whereas attacking enemy troops, lines of communication, supply dumps and the country immediately behind them is tactical air action, because it gives close support to our armies in their advance into or towards the enemy's country.

Although sheer bombing may shake any enemy into surrender, the only thing that consolidates victory is the armed infantryman protected by an air umbrella. And the A.O.C.-in-C. has to organise, supply and command all the air operations which get the soldier there. Which means that he and the army commanders, and often the naval commanders, whose job is to assure sea transport, must work closely together. If one fails all will fail.

Besides that, in these days the A.O.C.-in-C. co-operates with the U.S. Army Corps, to give full support to their bomber operations. And, just as a sideline, Fighter Command runs its own Air/Sea Rescue Service, which works in connection with the daylight sweeps across the Channel, because the regular Rescue Service is mostly concerned with the crews of strategic bombers or of anti-submarine patrols. Thus you may see that the A.O.C.-in-C. has to be a man of long and varied experience.

Education

Trafford Leigh-Mallory was born in July 1892 at Mobberley in Cheshire. He was educated at Haileybury, which school produced, among other men who have done well, Air Chief Marshal Sir Robert Brooke-Popham (now retired) and Air Marshal Sir John Slessor, now A.O.C.-in-C. Coastal Command. From Haileybury he went to Magdalen College, Cambridge—where Air Chief Marshal Sir Arthur Tedder, now A.O.C.-in-C. Mediterranean, was slightly his senior. There he took a History Exhibition, Honours in History Tripos and Law Tripos, and an LL.B. degree.

Soldier

Two days after war began in August 1914 Trafford Leigh-Mallory joined the 10th (Territorial) Battalion of the 7th Foot, the King's (Liverpool) Regiment. The battalion was known as the Liverpool Scottish, and its backbone was the Rugby football club for which he played. Hence his becoming a Scot temporarily. Within a few weeks he was given a commission in the 4th Battalion of the Lancashire Fusiliers. And with them he fought in France till he was wounded and sent home.

Pilot

He joined the Royal Flying Corps late in 1915 as an observer, although he wanted, as most people do to-day, to be a pilot. And, as happens to-day, his papers were mislaid. But, by way of compensation, when they were found he was sent off at once for training as a pilot. How History does repeat itself. In fact, he went to his flying-school in January 1916, although he was not officially seconded till July 1916, and by that time he had his wings.

A week later he was in France with No. 5 Squadron doing artillery observation. He specialised on that work all through the war. By May 1917 he was a major commanding an artillery observation squadron. When the R.A.F. came into being in April 1918 he transferred as a Major "A," which meant that he flew, and he still does so. From June 1918 till the Armistice he provided all the co-operation for the Tank Corps in their highly successful battles.

More Army Experience

In the New Year's Honours of 1919 he was made a Companion of the D.S.O. During 1920 he was Inspector of Recruiting, and then in February 1921 he went to the School of Army Co-operation at Old Sarum, where he stayed for more than two years, barring a senior officers' course in 1922.

From May 1923 until 1925 he was doing Air Staff duties in the Air Ministry. As a wing commander he went to the R.A.F. Staff College for a year. After that he did staff work at No. 22 Group for another year. And then in April 1927 he went back to Old Sarum as O.C. School of Army Co-operation for nearly three years.

On January 1st, 1930, he went to the Army Staff College at Camberley as an instructor, which was very much Army Co-operation. After 18 months of that he came back to the Air Ministry for various sorts of Staff work, till in January 1934, as a Group Captain, he went to the Imperial Defence College, the highest kind of staff college.

He went to Iraq in November 1935 and was promoted Air Commodore. In December 1937 he was made A.O.C. No. 12 Fighter Group. There he was promoted to Air Vice-Marshal, and there he was when war broke out.

In the Battle of Britain

As A.O.C. No. 12 Group Air Vice-Marshal Leigh-Mallory did great work during the Battle of Britain. His group protected the East Coast from Essex to the Firth of Forth, and sent down south squadrons which gallantly supported the left wing of No. 11 Group, who held the Coast from Essex to Dorsetshire, with No. 10 Group on their right flank.

In December 1940 A.V.M. Keith Park (who commanded No. 11 Group during the Battle of Britain) went to a Training Group, and from there to Egypt, where he was made a K.B.E., and so to Malta, where he has been in command all through the Battles of Tunisia and Sicily. A.V.M. Leigh-Mallory took over No. 11 Group from him and was promoted to Air Marshal in July 1942. In November he was made A.O.C.-in-C. Fighter Command, and in the New Year's Honours List of 1943 he was promoted from Companion of the Bath, which honour he had received in July 1940, to Knight Commander of the Bath.

Since then he has not only shouldered the burden of Fighter Command, with its defensive responsibilities and offensive technique (for the initiation and development of which he was largely responsible), but he has also been charged with the organisation of the Allied Expeditionary Air Force which will eventually form the spearhead of our return to Western Europe. It is a great responsibility, and nobody is better fitted to undertake it.

For key see page 24

CAPTAIN NORMAN MACMILLAN M.C. A.F.C. says—

Plan your FUTURE CAREER Now

IT cannot be too early impressed upon prospective aircrews that the act of flying is simply a means to an end. This is so in every branch of air activity, and it applies both in Service and civil aviation to pilots and other members of aircrews.

The purpose of the fighter pilot is to fight to obtain and retain mastery of the air wherein he operates.

The purpose of the strategic bomber pilot is to produce the maximum of damage to the war potential of the enemy, and thereby to wear down the enemy's power of resistance. The bomber pilot's work is rendered easier by the combats of fighter pilots with enemy fighters.

Specialist Pilots

The pilot engaged upon naval duties has for his objective the ultimate command of the sea for the free use of his own ships and the denial to the enemy of freedom of movement by water.

The pilot engaged in army operations has for his task the easing of the arduous work of the soldier through the co-operation that can be given from the air.

Divided Duties

In the R.A.F. the senior pilot in manipulative command is also usually the captain of the aircraft, irrespective of his rank, and the purpose of each member of aircrew who flies under his command is to aid him in carrying out the task which has been allotted to the aircraft. The aid rendered may take several forms —navigation, communication (both inter-communication within the aircraft and external radio or visual communication with the ground, ships, and other aircraft), defence by gunnery, engine supervision, bomb aiming. But their duties all combine towards the achievement of one common task whose most efficient discharge is the primary function of the captain of the aircraft.

The captain is responsible for the aircraft in his charge, for the members of aircrew when they fly with him, and for the actual pilotage of the machine, with, in the larger types, a second pilot to take over when required, while in some of the largest aircraft more than two members of aircrew may be qualified pilots. These considerations apply both in military and civil aviation.

Manipulative Skill

In view of the multiplicity of the duties which devolve upon the captain of an aircraft, it is clear that the relative importance of the manipulative skill of pilotage recedes as experience and responsibility grow. This does not mean that manipulative skill need be less. Often it must be more highly developed. But it does mean that other matters become more important and require conscious attention, and by demanding attention from the pilot thrust into the background the ever-present pilotage operations which in the first days of flying seemed so all-absorbing.

Start at the Flying-School

So it is that the acquisition of the ability to pilot an aeroplane competently is only one stage, and that almost the first stage, in the road towards the goal of the ambitious who aspire to become captains of aircraft. Nevertheless, because the ability to pilot an aeroplane really well is almost the basic essential to advancement towards the highest posts in the Royal Air Force, and because it is the open sesame to the highest-paid and most responsible executive flying jobs in civil aviation, it is good for everyone who aspires to make operational aviation a career to travel from the beginning by way of the flying school.

It takes longer to train an operational pilot than any other member of aircrew, largely because the necessary manipulative skill can be acquired only by "the constant repetition of familiar feats." And the degree of manipulative skill required to execute current operational flying efficiently is necessarily very advanced.

The Captain

The term "captain of aircraft" ought of course to be reserved to describe those in command of crew-carrying types of aeroplanes larger than the two-seater class. These are aircraft with the greatest range and carrying capacity. In spite of the difference in characteristics between the military and civil versions of these large types of aircraft, and the difference in the duties of some members of the military and civil crews, there is yet the closest operational affinity between military and civil flying in the actual pilotage and navigational operation of these classes of aircraft. This difference is reduced to its minimum in the case of military transport aircraft, for then it is the objective of the operation rather than the type of aircraft or the duties of its crew that marks the line of cleavage between military and civil flying.

Post-War Expansion

In the post-war age there will be a great expansion of aviation compared to that which we knew before the war began. Air routes which did not exist have been opened up by the needs of war. Those who remember the struggles of civil aviation after the Great War know that the greatest handicap which it suffered came from the lack of organised routes and the lack of money to prepare them. The Royal Air Force blazed the trail through the Middle East from Egypt to the Persian Gulf, and north and south and east and west through the African continent. The commercial airlines followed later. But national economy forced this development to move on a scale which now seems absurdly small. This war has changed that.

Plenty of Room

No one can yet say just what the post-war flying world will be like nor how large the military and civil air fleets will be, but it is certain that there will be scope for captains of aircraft and aircrews in both departments of flying, and room for more than there was after the last war. It is not possible to forecast how the aircraft of the future will be proportioned in respect of small fighters and large bombers and transports. That must depend upon the conditions which prevail in the world at large. But it seems reasonable to imagine that there will be a bigger demand for pilots for the larger types of aircraft to meet the combined requirements of the military and civil branches of flying.

The flying of fighters and of the larger bombers, flying-boats and transports appeals to different types of pilots. Some prefer the swift thrill of the fighter's duties. Others are at their best in the fuller routine of the bigger aircraft. All must possess that basic quality of having learned to fly manipulatively until the act of piloting has become instinctive. Their further qualities, those that distinguish them from one another, spring from the different kind of knowledge that must be acquired to be efficient as a fighter pilot or as a bomber pilot.

Learn What You Can

The ideal, of course, is to be able to learn fully the flying game by being both a fighter and a bomber pilot, and, if possible, a flying-boat pilot too. But that good fortune does not come to everyone. So it is a good plan to realise that after the war there will be a demand for pilots, as fighter, instructor, bomber, transport and flying-boat pilots, and for a few specialised test-pilots. Each category of pilot has its special opportunities for employment and promotion within and outside the Service. It is a sound plan to think out what you would like to do in life after the war, and, if you intend to remain in aviation, use the present as a time of good fortune wherein you have opportunity to fit and equip yourself for the post-war flying-world.

Goodness—only Knowses

For key see page 24

The Handley-Page SLOT

by R. H. WARRING

TOWARDS the end of the last war Sir Frederick Handley Page, as well as producing a number of successful large bombers, such as the O/100, O/400 and V/1500, had post-war civil development close in mind. He was particularly concerned with increasing the safety of the aeroplane, and worked on a device to eliminate stalling, which, often followed by a spin, results in the death of so many pilots.

(During the years 1934-1938 there were 690 fatal civilian aircraft accidents in U.S.A., 466 being caused by accidental stalling and/or spinning, a number which would no doubt have been substantially reduced if slots were more extensively employed on light aircraft.)

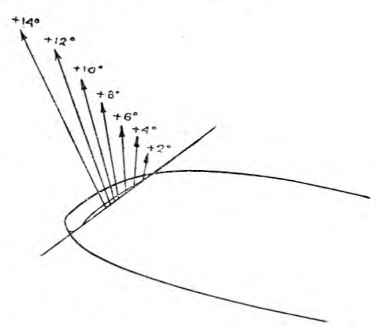


Fig. 1. Aerodynamic force acting on slat at various angles of attack.

The Slat Makes the Slot

From the early experiments conducted in the Handley Page wind tunnel was evolved the Handley Page slot, one of the greatest safety devices aviation has known. Essentially, the arrangement consists of a small aerofoil or winglet called a slat mounted ahead and close to the main wing. The slot so formed by the slat and the main wing regulates the airflow at high angles of attack, preventing an early breakaway of the flow and appreciably delaying the stall, as well as increasing the maximum lift.

All this was discovered in 1919, and a large number of patents were taken out by Handley Page, covering many types and combinations of slots, fixed and movable, single and multiple.

In Germany Dr. Gustav Lachmann was also, quite independently, working along the same lines and had reached similar conclusions. Handley Page and Lachmann co-operated, although remaining in their respective countries, until Lachmann came to England towards the end of the 1920s and joined the staff of Handley Page's.

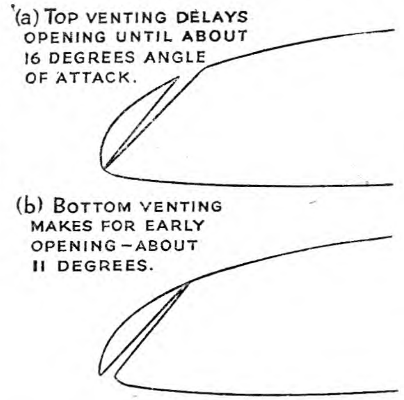


Fig. 2.

The First Slot

The first machine on which the H.P. slot was fitted was a D.H.9, this in October 1920. The undercarriage of the normal machine was replaced by one of greater height, to take advantage of the higher stalling angle and increased maximum lift (thus reducing the landing speed), and fixed slots were fitted along the whole span of both the upper and lower wings.

The same machine was tested with wings of different aerofoil section, including RAF 15, RAF 6 and RAF 19, in order to determine the optimum position of the slat for each section.

At about the same time the flap was also being developed. Sir Richard Fairey was one of the first designers to appreciate their use and employ them successfully. The combination of slot and flap offered great possibilities, and thus the H.P. slotted flap came into being.

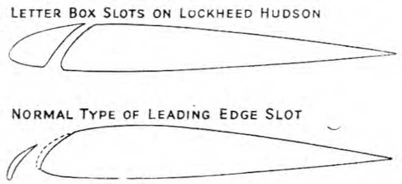


Fig. 3. Types of slot.

Automatic Types

All the early types of slots were either fixed or manually operated; that is, they were opened and closed by link controls. Then in 1927 came the automatic slot. In this the slat is so arranged that the aerodynamic forces set up upon it cause it to be pulled forward, on suitable linkage, at high angles of attack. The particular angle can be predetermined, and thus the slot opens automatically just when required. This was particularly useful, as it relieved the pilot of the responsibility of opening the slot at the proper time; and possessed an additional advantage over the fixed type in that at low angles of attack the slot, being closed, had far less, in fact negligible, drag. Provision is made for locking movable slats in the closed position for aerobatics, etc.

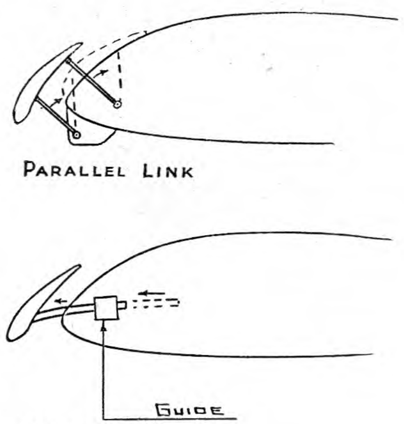
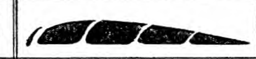
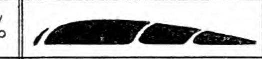
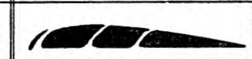


Fig. 4. Slot Linkage.

Slot linkage is generally of two main types, either the parallel link or the sliding beam. When closed the slat must lie snugly against the leading edge of the main aerofoil, so that a true section is formed. As the stalling angle is approached the air forces tend to suck the slat away from the leading edge, i.e. open the slot, so that no manual force is required. Fig. 1 shows the aerodynamic forces acting on a slat at various angles of attack.

SLOT COMBINATION	STALLING ANGLE	MAX.* LIFT	SLOT COMBINATION	STALLING ANGLE	MAX.* LIFT	SLOT COMBINATION	STALLING ANGLE	MAX.* LIFT
	15°	100%		24°	148%		25°	146%
	24°	138%		24°	146%		24°	143%
	21°	124%		23°	140%		22°	130%
	19°	120%		25°	150%		22°	129%
	17°	111%		24°	146%		19°	117%

*Max. lift compared with normal aerofoil, which is taken as 100%.

Based on N.A.C.A. Technical Report No. 478.

Fig. 5.

Venting

A certain measure of control over the angle of attack at which the slot opens is made possible by venting. This also minimises any suction effects which may be set up tending to retard the opening.

A bottom vent (Fig. 2b) is the more common. The slat is mounted so that a small vent is left at the bottom junction of the slat and the main aerofoil. At low angles of attack the normal air pressure keeps the slot closed, but at about 10 or 11 degrees the pressure in the vent increases, tending to force the slat outwards and thus making for early opening of the slot.

The top vent, designed to delay the opening of the slot up to about 16 degrees angle of attack, is rarely used. Here the vent builds up a suction force opposing the force on the slat itself, and it is not until just before the stalling point that this force is able to overcome the suction and open the slot.

In each case the actual force opening the slot is that aerodynamic force acting on the slat itself; the bottom vent merely assists, whilst the top vent hinders, this effect.

The two forms of venting are shown in Fig. 2. These diagrams are considerably exaggerated; only very narrow vents are permissible, otherwise the slot will remain permanently open or closed.

More recently the letter-box slot has appeared, rendered popular on the Lockheed series of twin-engined monoplanes such as the Electra, Hudson and Ventura. This is neater, involves no movable parts, and the drag increase due to the slot being permanently open is quite small. Comparative data on different slots and slot arrangements are given in Fig. 5.

BOOKS

Reviewed by LAURENCE FLETCHER

The opinions expressed have no official approval.

Watch and Make

THE ART OF SCALE MODEL AIRCRAFT BUILDING. By V. J. G. Woodason. Useful publications. 4/11. 112 pages. 8½″×5⅜″. Many drawings and photographs.

One of the best books on modelling. The author, a professional model-builder, covers the whole subject in great detail, from materials and methods to painting the finished model. An interesting chapter deals with transparent mouldings for gun turrets, cockpit covers, etc., which often prove a stumbling-block to amateurs. Methods of mounting and viewing the models are shown which should be of great help in teaching aircraft identification. The book deserves a better binding.

Fitting, Small Tool Making, Lathework and Screwcutting

By A. E. Leeson, B.Sc., and Peter Sampson. Sir Isaac Pitman & Sons Ltd. 3/6. 88 pages. 8½″×5½″.

A small handbook which may serve as an introduction to some of the tools and processes used by the fitter. Tools and methods are set out on the left-hand pages, and on the facing pages are exercises involving their use.

As the book includes a section on lathework, it is rather inconsistent to find some examples of handwork advocated which could, and in practice would, be done on the lathe to better effect—for example, pp. 49 and 52, washers; also p. 39, preparing a screw.

Aircraft Electrical Engineering

By F. G. Spreadbury, A.M.Inst.B.E. Sir Isaac Pitman & Sons Ltd. 21/-. 272 pages. 8½″×5½″.

Mainly concerned with design of aircraft power supply and ignition equipment, there are seven chapters on these subjects, and two on magnets and pyrometry. A book for the expert; of no value to beginners.

Camouflage '14-'18 Aircraft

By O. G. Thetford. Harborough Publishing Co. Ltd. 3/6. 80 pages. 8½″×5½″. Eight colour plates and many photographs and diagrams.

Here you will find the old battle-wagons in all their glory of plumage. The coloured plates will bring a feeling of nostalgia to some of the veteran flyers, while the present generation will find the comparison between modern ideas in camouflage and those of these early birds a matter of interest.

1000 Questions and Answers for Aero-Engine Mechanics

By P. W. Blandford and H. C. B. Mackey. Hutchinsons. 2/-. 88 pages. 7¼″×4¾″.

The field covered is applicable to the ground engineer and flight mechanic, and will also assist air cadets and apprentices.

There are ten chapters on fitting, engine theory, construction and maintenance, carburation, fuels, etc.

The questions are simply put and the answers direct and concise.

Understanding Aircraft Components by Question and Answer

By W. Hazell. The English Universities Press Ltd. 2/6. 152 pages. 7¼″×5″.

Here the questions are really sub-headings to the chapters. Mainly in the form of "State the data with regard to . . .", they allow of fully detailed answers, many of which are illustrated by drawings provided by component manufacturers and the Air Ministry.

The principle, operation and maintenance requirements of dashboard instruments, V.P. propellers, fuel pumps, pipe lines, etc., are all clearly outlined, and an index is included.

BOOKS

Reviewed by the Editor.
The opinions expressed have no official approval.

Fighter Controller
By Squadron Leader J. D. V. Holmes, R.A.F.V.R. Bernards Ltd. 2/-. 70 pages. 7⅛″×4½″. 9 illustrations.

A last-war officer gives a brief picture of modern R.A.F. life as seen from the control room and officers' mess of a fighter station. It is a pity that the only airman to whom more than a couple of lines are given should be an incompetent batman by the name of Cockroach.

How Sleep the Brave
(1943.) By Flying Officer "X." Jonathan Cape. 2/6. 80 pages. 4½″×7⅛″.

Stories of the R.A.F. in which the facts are similar to those which are recorded almost daily in R.A.F. reports. The method of presenting them is that of the skilled writer who dramatises each incident, so that the reader may feel it, and who makes each character a living person instead of a mere name in a report.

Plane Facts and Features
By Roger Tennant. Argus Press. 2/-. 96 pages. 4¾″×7⅜″.

In addition to 40 three-view silhouettes, the book contains 80 diagrams and cutaway drawings indicating the location of armament and other details. There are terse and informative notes on the history and features of the aircraft, which are classified by functions.

The booklet is a useful addition to aircraft recognition literature.

Aeroplane Production Year Book and Manual (1)
By Group Captain G. W. Williamson, O.B.E., M.C. Paul Elek. 40/10. 562 pages. 8¼″×5½″. Illustrated.

Here is much useful information—articles by experts on various aspects of aircraft production, illustrated with good photographs and diagrams. The editor has selected and arranged the matter well, and the book is well indexed.

The snag is in the price. Many of the articles have appeared in other publications. Nearly a hundred pages of advertising add very little to the value of the book (at least for the purchaser), and should have enabled it to be sold for less. Before the war a book of this weight, with less than half this number of advertisements, and appealing to a much smaller number of likely purchasers, cost only £1. 1s.

Key to ***That's a—***

(Where American aircraft are shown only the British names are given.)
(*see page* 19)

1, Douglas Dauntless; 2, Vought-Sikorsky Chesapeake; 3, Supermarine Spitfire V-B; 4, Republic Thunderbolt; 5, Vickers Wellesley; 6, Curtiss Kittyhawk II; 7, Dornier 17p; 8, Douglas Boston III; 9, Messerschmitt 109F; 10, North American Harvard; 11, General Aircraft Hotspur II; 12, Grumman Martlet; 13, Bristol Beaufighter I; 14, Handley Page Hampden; 15, Avro Anson; 16, Junkers 87B; 17, Douglas Dakota; 18, Consolidated Catalina; 19, Fairey Albacore; 20, Consolidated Liberator; 21, North American Mustang; 22, Hawker Hurricane I; 23, Fairey Battle; 24, Bristol Blenheim I; 25, North American Mitchell; 26, Martin Baltimore; 27, Boeing Fortresses II; 28, Vought-Sikorsky Kingfisher; 29, Avro Lancaster.

Key to ***Goodness—only Knowses***

(*see page* 21)

1, Armstrong-Whitworth Whitley; 2, Curtiss Tomahawk; 3, Consolidated Catalina; 4, De Havilland Mosquito II; 5, Lockheed Vega Ventura; 6, Airspeed Horsa; 7, Lockheed Hudson; 8, Avro Lancaster; 9, Boeing Fortress II; 10, Short Stirling; 11, Handley Page Halifax I; 12, Douglas Boston III; 13, Martin Marauder; 14, Bristol Beaufighter; 15, Martin Baltimore; 16, Bristol Beaufort; 17, Curtiss Commando; 18, Bristol Blenheim IV-L (often called the IV-F).

Published for the Proprietors, The Air League of the British Empire, Kinnaird House, 1a Pall Mall East, London, S.W.1, by the Rolls House Publishing Co., Ltd., Rolls House, Breams Buildings, London, E.C.4, and printed by the Stanhope Press Ltd., Rochester, Kent.

The artist here has depicted a Belgian Typhoon pilot shooting down a Ju 52 over Belgium, close to the house in which he lived before the invasion