RECOGNITION AIR TRAINING CORPS GAZETTE CALENDAR

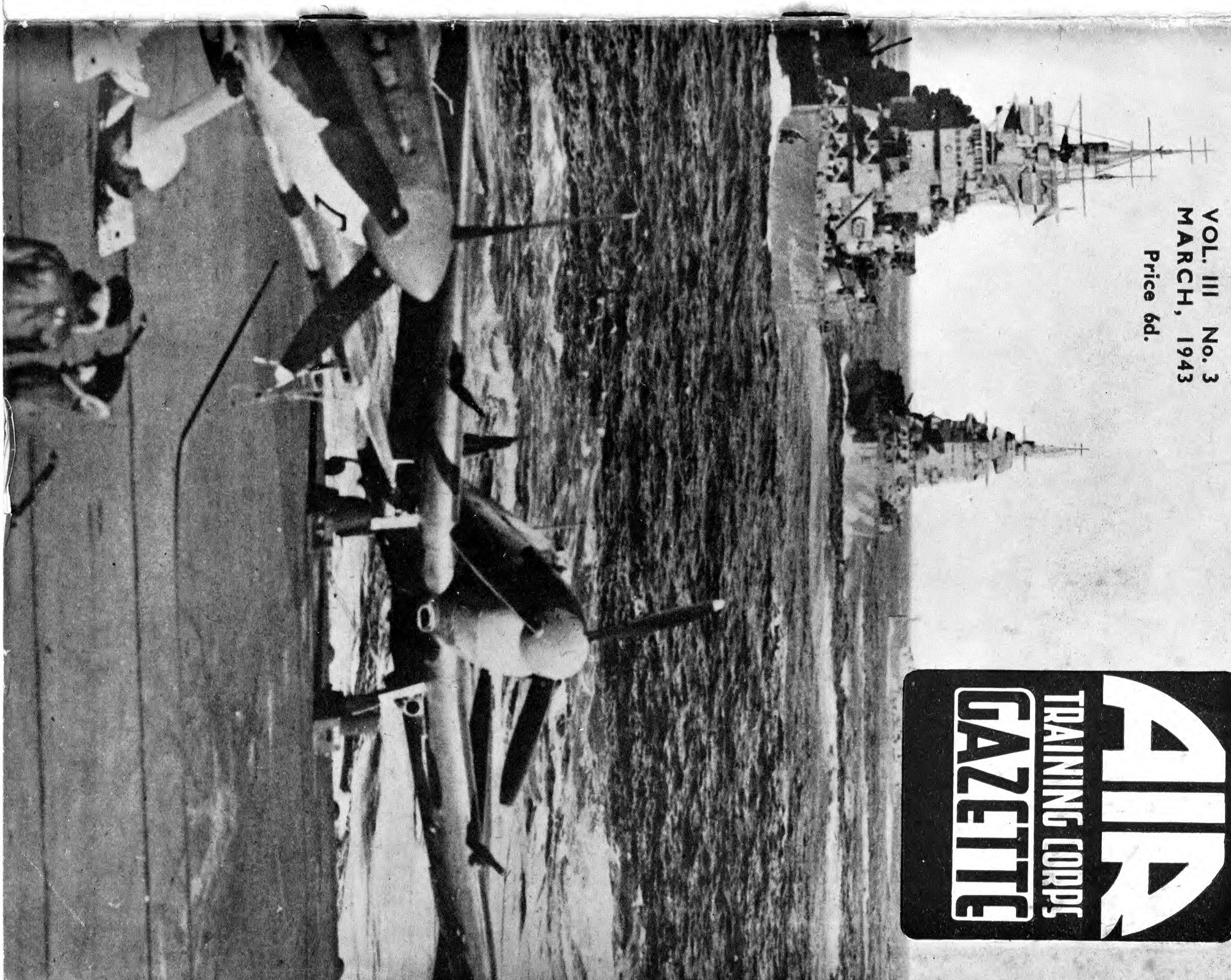
APRIL 1943

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

KEY.—1, Junkers Ju 86K-1; 2, Caproni Bergamaschi Ghibli; 3, Lockheed-Vega Ventura; 4, Saro London II; 5, Piaggio P.32 bis; 6, Martin Marauder I; 7, Junkers Ju 52/3m; 8, Savoia Marchetti S.M. 85; 9, Vickers Armstrongs Wellington II; 10, Meridionali R.O. 37 bis; 11, Dornier Do 18K-2; 12, Martin Baltimore.

13, Caproni Ca. 312 I.S.; 14, Focke-Wulf Fw 189; 15, Vultee Vengeance I; 16, Savoia Marchetti S.M. 81 Pipistello (Bat); 17, Consolidated Liberator II; 18, Douglas Havoc II; 19, Cant Z.1007 bis Alcione (Kingfisher); 20, Vickers Vildebeeste; 21, Blohm und Voss Ha 140; 22, Blackburn Roc I; 23, Dornier Do 17P; 24, Short Sunderland I.

25, TB-?; 26, Blohm und Voss Bv 142; 27, Junkers Ju 52/3m.W; 28, Cant Z.501; 29, Breda 65; 30, Douglas Boston III.



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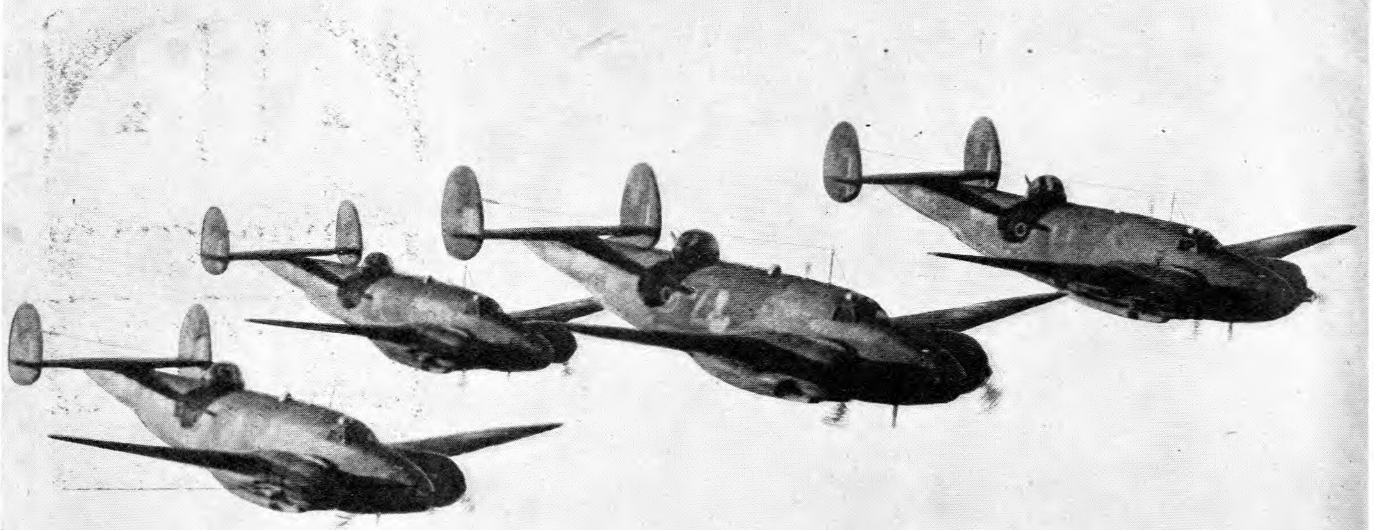
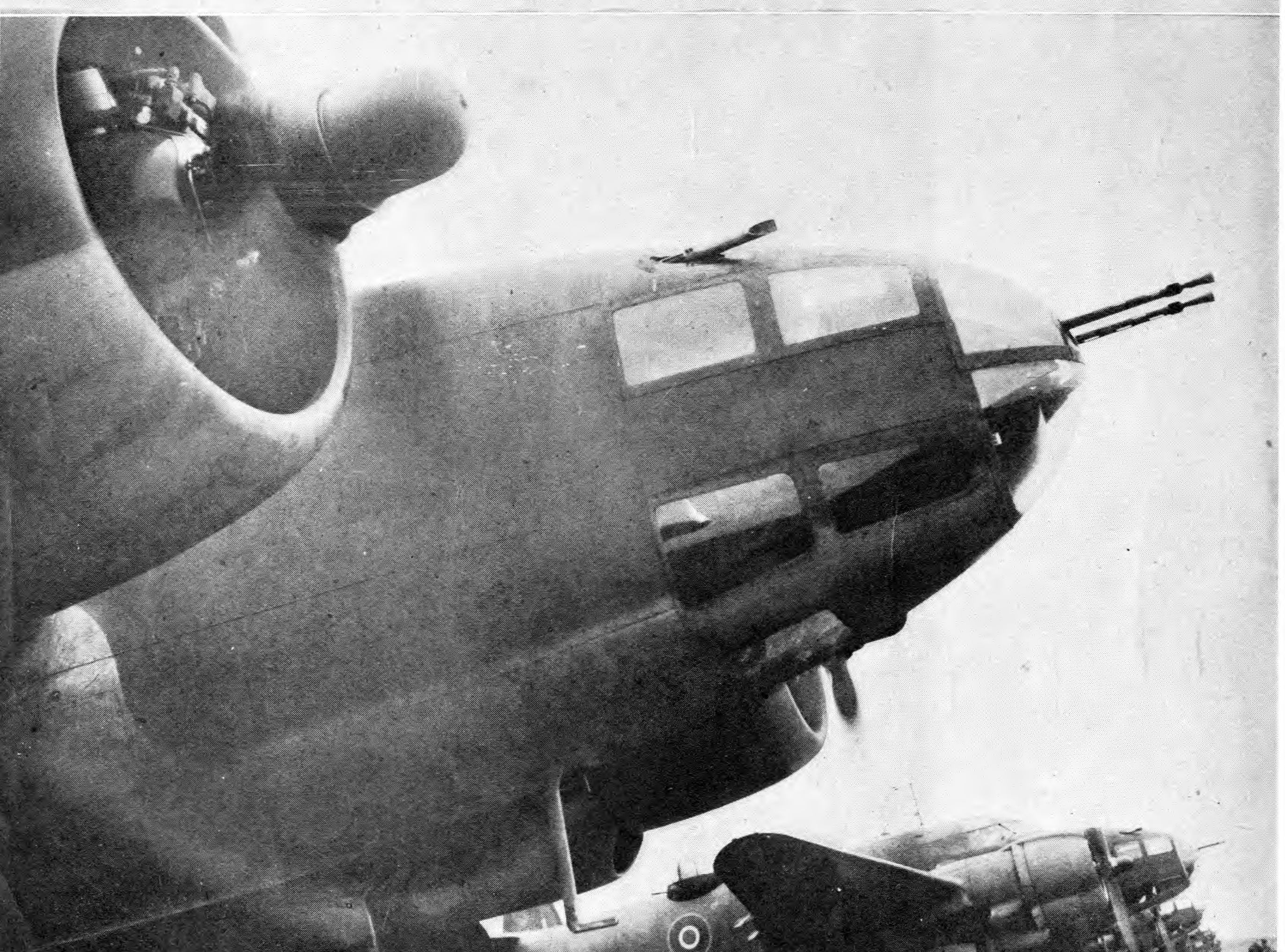


Powered with Pratt & Whitney Double Wasp engines of 2,000 h.p. each, Lockheed-Vega Venturas have scored a number of successes in daylight bombing operations with Coastal Command. The Ventura (span 65 ft. 6 in.) is a development of the Hudson and is based on the civil Lodestar. Note the heavy nose armament.



Vol. III MARCH
No. 3 1943

AIR TRAINING CORPS GAZETTE

Edited by Leonard Taylor

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The Right Outlook

TWO years ago, when the Air Training Corps was getting under way, I used a phrase which caught the fancy of the Northern Press, namely, that we wanted "young men with guts." During the two years that have gone by you have amply proved that you have this quality.

There are different kinds of fortitude, however, some of which you may not recognise at first; and I will give you one example.

The other day I was shaking hands with a cadet flight sergeant who was leaving for the Air Force the next day, and I was wishing him luck when I noticed that he had no Proficiency badge upon his sleeve. I asked how this was, and his officer explained that the flight sergeant was well above Proficiency I standard and almost up to Proficiency II. In reply to my question as to why he had not sat for the examination, the flight sergeant replied that he had heard from his friends who had gone into the R.A.F. so much about the benefits of the I.T.W. course that he was afraid that if he passed the examination he might miss some of that course and be handicapped in his Service training.

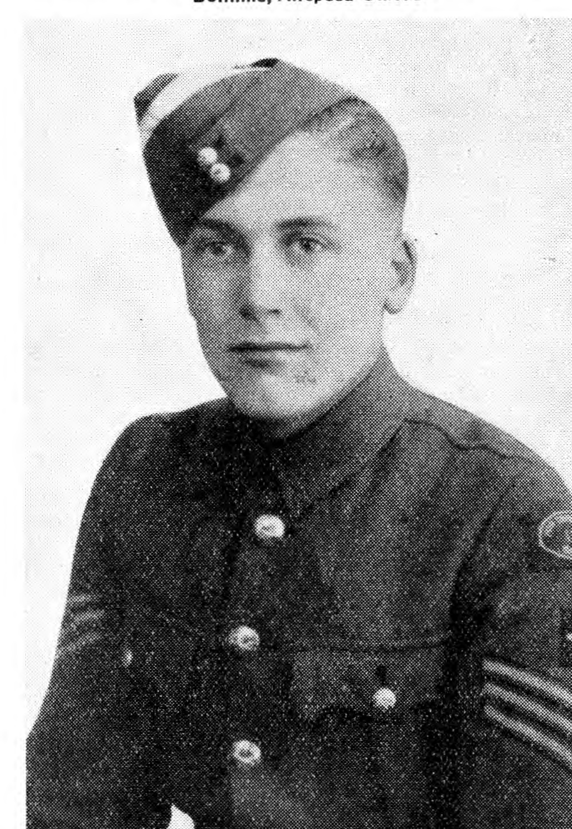
That is surely the right spirit. We have set ourselves to be of the utmost value to the R.A.F., but every cadet should really try to get his Proficiency badges. We do not, therefore, want to talk about what training we get or avoid, but how well we do in that training, which is indeed a very different matter.

The R.A.F. from time to time in the course of war may have to alter its training as aeroplanes get more and more complicated and calls on young men's mental alertness become greater. We should be entirely satisfied if we can gain entry into the Service and prove ourselves well prepared for whatever training the R.A.F. may wish to give us.

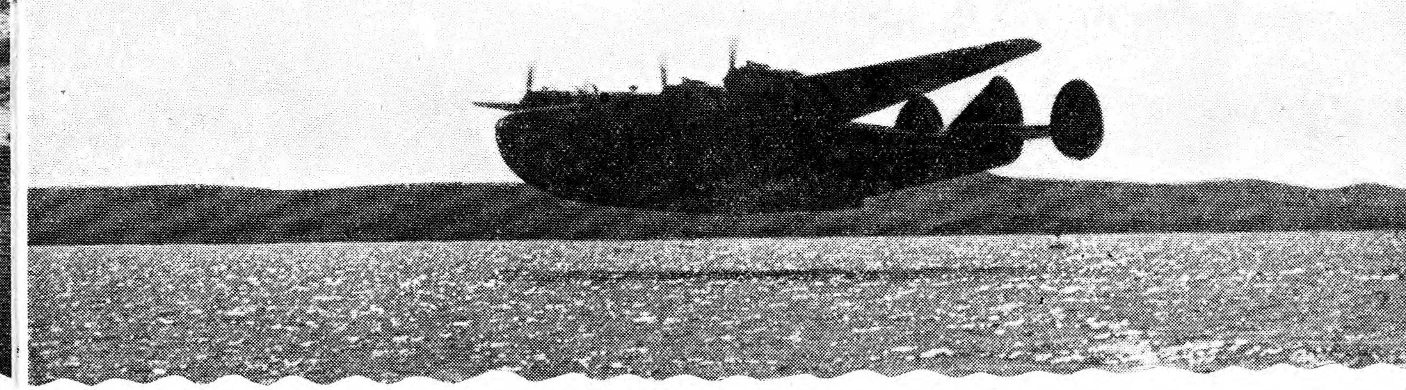
No one wants to fail, and I sometimes think how awful those young men must feel who come to grief during the process of their training and are returned to this country for remustering, when their heart was in the air. I think that not many of these young men have failed for lack of guts, but because training on the ground, the classroom work, proved so arduous that they were all burnt up and had few brains left for the strain of learning to fly. If you do your work thoroughly in the Corps there should be small chance of finding yourself among the rejects.

AIR COMMODORE
INSPECTOR, AIR TRAINING CORPS

IS THIS A RECORD? Cadet Flight Sergeant Pinnell of No. 1244 Squadron, during the course of his training in the A.T.C., supplemented by experiences at his work at an aerodrome, had about 12 hours flying in various aircraft, including the following: Miles Master, Blenheim Mark IV, Tiger Moth, Whitley, Blenheim Mark I, Westland Lysander, Miles Magister, de Havilland Dominie, Airspeed Oxford.



A Kingfisher (span 36 ft. 0 in.) touches down on a calm sea.



The Boeing Berwick (span 152 ft. 0 in.) 40-ton flying-boat coming in to land.

EARLY marine aircraft, particularly flying-boats, were very unstable on the water and inefficient in the air, but the specialised attention which the flying-boat has received during the last ten years has resulted in the production of sea-planes which compare favourably with the most efficient landplanes.

"Stickiness"

From the very first, difficulty has been experienced in taking off from water, and the modern practice of increasing the wing loadings has tended to increase the length of the take-off. Happily, the parallel improvements in engines, airscrew and boat or float design have served to overcome this difficulty.

With variable-pitch airscrews the large modern flying-boat may require a take-off run of up to one mile when fully loaded, whilst with a fixed-pitch airscrew designed for cruising flight, take-off in still air and calm sea conditions might be impossible.

Painstaking research has worked to produce the ideal float and body design (sometimes with ventilated steps breaking the line of the underwater body), having low air drag and yet being capable of planing smoothly over the water and unsticking readily at flight speed.

With only a small reserve of power for take-off the pilot might be unable to unstick in calm weather. Many light-plane enthusiasts who have fitted floats to their aircraft have found this out to their embarrassment. At one time American private owners had a craze for fitting twin floats to light aircraft. Even with well-designed floats the take-off was slow and pilots adopted peculiar tricks to get off the water.

Ingenuity for Take-Off

A favourite dodge was to lift one float off the water first. Then with the one float clear and the other planing the surface of the sea, it was possible to lift the whole machine off. With a "popple," or slight ripple, on the water the floats unstick far more readily, as the surface is already broken up. Many early types of marine aircraft took off into artificial ripples caused by the wake of a motor launch which was sent to cross their paths.

One enthusiastic American light-float-plane owner, proudly hoping to demonstrate his machine's capabilities, tried to take off with passengers and a large amount of luggage. After a dozen futile runs the two occupants hit upon the bright idea of standing up and sitting down in unison repeatedly. After much exertion they caused a vertical oscillation of the aircraft which increased gradually until the floats unstuck.

Versatility

The ability of marine aircraft to land sucessfully on an aerodrome has occasionally been accidentally demonstrated. A Walrus has been seen to make a perfect landing on grass with the undercarriage tucked up—the only damage resulting in each case being a slightly dented wing-tip float. Seaplanes have even been taken off from grass fields.

Immersibility

A pilot once brought a Walrus down on to the sea with the wheels in the down position. As soon as the machine touched the water the drag of the wheels and undercarriage legs threw the Walrus over on to its back under the horrified gaze of a worthy admiral, waiting with all the dignity afforded by his rank to embark in the aircraft.

Not all such accidents have a humorous ending. At least one fatal landing has been attributed to the pilot attempting to land on a mirage, although little evidence has been brought forward to substantiate this theory.

Optical Illusions

It is well known that a flat, "glassy" calm is extremely deceptive for landing purposes and makes height judging most difficult. In the Mediterranean area, for example, the water is so calm that the bottom of the sea is often clearly visible. Several serious accidents have resulted from the pilot misjudging his height under such conditions and either flying into the sea or "landing" too far above the surface. The technique of the handling of marine aircraft must therefore be carefully studied, and special courses are necessary for the training of air and ground crews for these types.

Directional Control

One of the first things that a pilot accustomed to flying landplanes will notice on changing over to marine aircraft is that they have poor directional control on the water. On few types only are water rudders provided, so that the machine always tends to head into the wind, particularly if it possesses considerable "weathercock" stability. On multi-engined aircraft, steering when taxying cross- or down-wind is best accomplished by differential throttling of the port and starboard motors, or on single-engined aircraft by the ailerons operated in the reverse of the flying manner.

Once you are headed into wind the rudder alone will generally be quite effective, especially as speed is increased. Taxying in rough weather must be done slowly to prevent the aircraft from nosing into a wave and to reduce shocks to the structure.

Taking Off

In the take-off the tail plane is generally trimmed to neutral. The throttles are then pushed forward and the stick pulled back to raise the bows of the machine. Once the bows have lifted, the stick is eased forward and kept there during planing to avoid porpoising. When the airspeed indicator shows that enough speed has been attained for flight the stick is pulled back gently, easing the machine off the water; easing forward again when unstuck, and then gently taking up the climbing attitude.

If difficulty is experienced in unsticking, the stick may be "pump-handled" gently backwards and forwards, but only with a small movement. This method is not recommended in any but fine weather.

A further point to bear in mind is that the wings must be kept horizontal, otherwise a wing-tip float may dig into the water with disastrous results.

Take-off is complicated by rough weather. The points to note are that care must be taken not to bury the nose of the machine into an oncoming wave, and that porpoising must be avoided. If the latter motion starts it is better to slow down and start again. It may even happen that the craft is bounced off the water by a wave before flying speed has been reached. The danger of stalling is great if the pilot attempts to hold the machine off when this happens.

Alighting

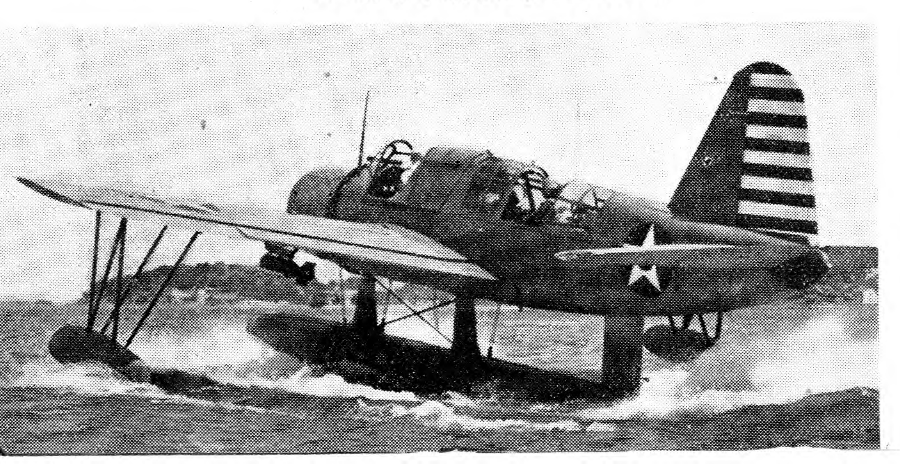
Landing is very similar to that of a normal landplane, with the exception that the tail is generally held higher, although lower than for free flight. A tail-down attitude may be used to advantage in rough-weather landings. A "rumbling" landing is generally to be preferred, particularly in dead calm when, as has already been mentioned, there is a danger of misjudging height. The craft should be flown on to the water, the throttles being closed immediately contact is made with the surface. For judging heights, observation of ships and buoys is most helpful.

Beautiful Night Landings

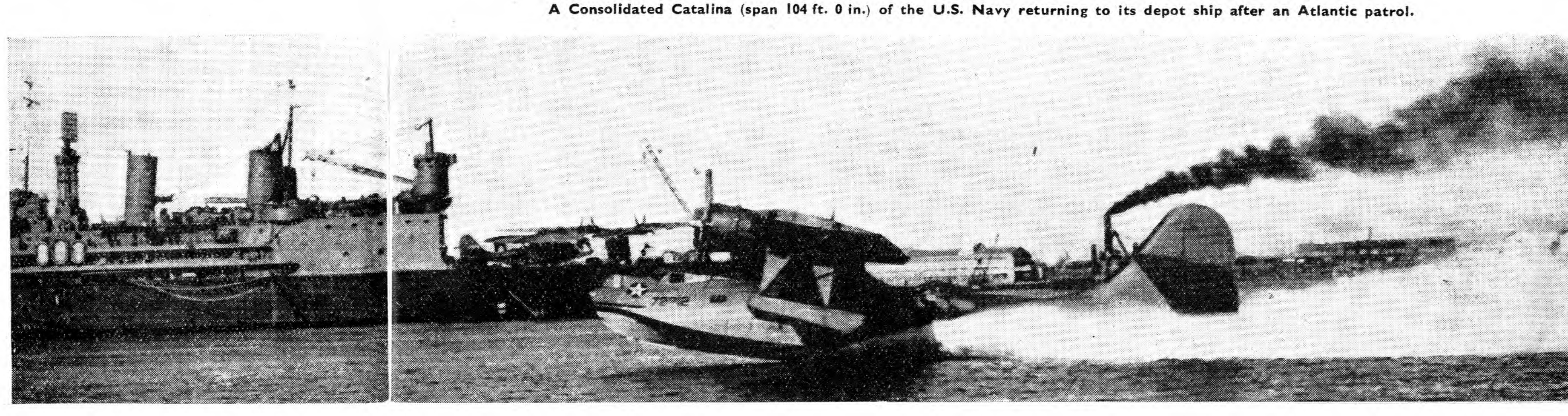
HOWEVER experienced the pilot, he is incapable of judging his height over a glassy sea, and is as likely to fly straight into it as to drop his aeroplane into it from ten or twenty feet. Therefore, he comes in at the near-stall, so that his machine is in its landing attitude while still in the air, and only throttles back when he feels the water beneath his hull. Landing on the sea at night, when waves and ripples are invisible, is done in just the same way; and there is no lovelier feeling in the whole of flying than this, especially in the tropics—to feel the dark, invisible water suddenly grip your hull, and as suddenly spring into luminous life, a beautifully V-shaped phosphorescent wave running away from the nose, white, surging swirls round the wing-tip floats, glowing sprays of water spurting over them. It seems magical, because the moment before you touched down, the water was velvety-black, you did not even know where the water was. And there is an illusion by which the water seems to have a different texture at night. In daylight it is hard, crisp, lively: at night it seems milky-soft, almost glutinous, an altogether unfamiliar and fascinating liquid.

—From *The Fleet Air Arm*, by John Moore (*see Book Reviews, page* 24).

Kicking up spray, a Kingfisher takes off.



A Consolidated Catalina (span 104 ft. 0 in.) of the U.S. Navy returning to its depot ship after an Atlantic patrol.



A VERY modern aeroplane but already a veteran, the Martin Baltimore attack bomber has won its aerial spurs chiefly in North Africa. In many ways the Baltimore resembles its doughty forebear, the Maryland. Both are designed and built by the Glenn Martin Co., of Baltimore, Maryland, U.S.A.

Outlook Good

Externally, the Baltimore's most striking feature is the completely transparent nose, which provides an unobstructed forward view for the navigator/bomb-aimer. It must be the grandest of all grandstand seats. The plexiglas is of exceptional thickness, no doubt affording better protection than its complete transparency suggests. Such a nose might be fitted to future airliners as an observation car. It would be an added attraction for long-distance air travel when we have shot the last air bandit out of the sky and made the world's air routes safe again, thanks to aircraft like the Baltimore.

Immediately behind the nose is the bomb-aimer/navigator's seat and the usual instruments—outside thermometer, air-speed indicator, etc., bomb sights, folding table and map cases. There is also an emergency control column, used only if the pilot is unable to control the aircraft himself, which swings to the starboard side right out of the way when not required. The escape hatch for the nose compartment is on the top and the entrance door is below, and is locked with a Yale lock, which is a doubtful advantage.

A bulkhead partially separates the nose compartment, which is immediately in front and slightly below the cockpit, but a most ingenious means of communication has been devised. It is a small clothes-line, hauled along pulleys, with messages attached to it by a clothes-peg. It is also used on a number of other medium bombers, the Boston, for instance.

The Cockpit

The fuselage of the Baltimore is narrow and the pilot's cockpit is not much wider than the Spitfire cockpit. A big half-moon control wheel is mounted on a cranked support, leaving plenty of leg room for the pilot. Engine, airscrew and trimming-tab controls are neatly arranged on ledges around the pilot, so the narrowness of the cockpit is not noticed. If the Baltimore has anything unusual, it is the clever way so much equipment has been packed into so small a space without unduly cramping the crew. The arrangement of the flying instruments, on a small vibrationless panel in the centre, is exactly the same as the standard British layout. The usual flying instruments are fitted. The lower portion of the panel, containing the gauges, engine thermometers and tachometers, is tilted slightly to make their indications more easily read. A black glare-screen is also fitted above the instrument panel and just below the wind-shield to prevent the glaring African sunlight from glinting in the instrument dials.

In the air the view all round is excellent The usual American pull-out gun chargers are fitted below the instrument panel for priming the four wing guns. The pilot sights these by a ring-and-bead sight fitted just in front of the wind-shields and fires them by a button on the control wheel.

The Radio Operator

Immediately behind the pilot is the bulkhead which separates him from the rear radio and gunners' compartment. In this bulkhead are two windows giving direct contact between the pilot and the radio-operator/rear-gunner. To speak of the pilot the radio-operator squeezes past the radio crate, which is on the starboard side, and past eight large-capacity oxygen bottles on the floor of the port side. A slim person can manage this easily, though it may be rather difficult for others.

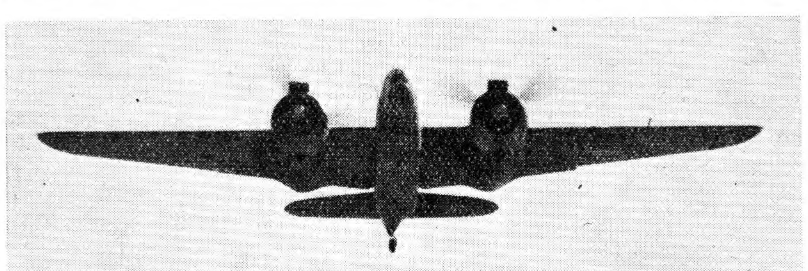
But the radio-operator is very comfortably provided with space behind the radio crate, and he sits in a real de-luxe armchair facing forward with his small desk and radio dials before him on a neatly arranged panel. For so tightly packed an aeroplane, and with so narrow a fuselage, the roominess aft of the cockpit is surprisingly good.

The Gunners

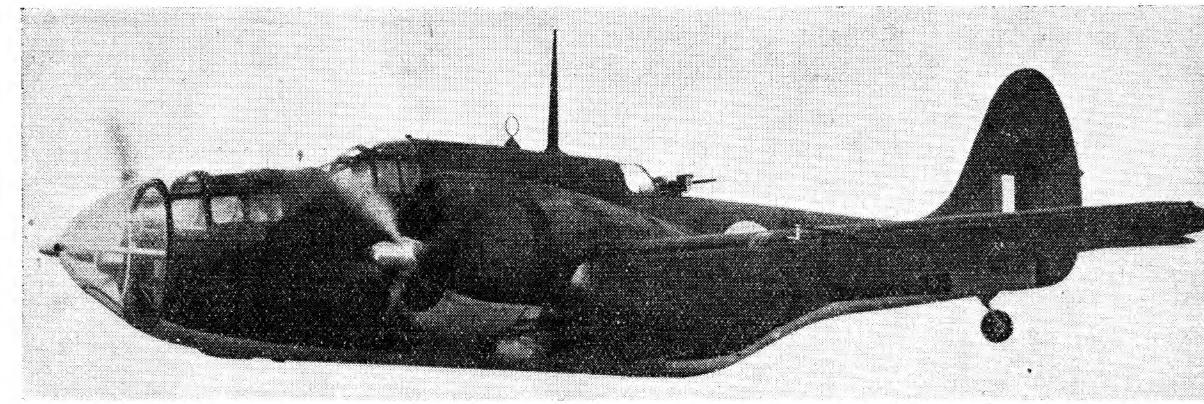
From the radio compartment there is a drop of about 18 inches to the lower gunner's position, which is prone for firing. Right above him the top gunner is seated inside a swivelling gun ring carrying two guns firing above the fuselage. This position provides a good view backwards and 360 degrees upward arc of fire. A ring-and-bead sight is used. The lower gun position also has a wide field of view owing to the step-up of the fuselage at this point, a noticeable feature of both the Maryland and the Baltimore. At this step a "glass" panel is fitted which is pulled up vertically into the fuselage by turning a ratcheted hand lever. This opening provides a clear view for the lower gunner as well as an excellent emergency escape hatch. The four lower guns are fixed.

Coverings

A non-slip material is laid on the floor of the rear compartment, so there is no fear of damage to ankles and shins when



In this head-on view of the Baltimore (span 61 ft. 4 in.) note the large engine nacelles which form one of the main recognition differences between the Baltimore and Maryland. The engines are Wright Double-Row Cyclones.



In company with another American medium bomber, the Boston, the Baltimore has been giving wonderful service in the Middle East. It is fast, can carry a good load of bombs, and on more than one occasion has chased an Italian fighter back home. Well-armed and armoured, the Baltimore is regarded with favour by American and British aircrews.

the crew are scrambling about the rather narrow space between the radio equipment and the rear guns. A wide, curved sheet of armour protects both the top gunner and radio operator from rear attack. The Baltimore is exceptionally well provided with both armour and armament, and with its excellent flying qualities and speed should be a powerful fighter when occasion demands.

Equipment

The ceiling is considerable, as indicated by the number of oxygen bottles and the special electric strato-heater in the rear cockpit. A noticeable feature of the Baltimore is the amount of light inside it, due to the large amount of "glazing."

Two windows are fitted in the radio compartment, and one above and another below the rear gun compartments, not to mention the transparent nose and pilot's cockpit. To provide de-icing fluid for all this "glass" a big glycol tank is fitted just aft of the bulkhead which separates the pilot and radio operator. Glycol sprays seem to be everywhere.

Internally, there is a noticeable absence of cables, the controls being operated by push and pull rods which disappear into the dim recesses of the tail behind the radio receiver.

External Features

Externally, the Baltimore has several unusual features. For instance, the stressed skin is flush riveted on the front portion of the aircraft only, while all the rear half of both fuselage and wings is snap-head riveted. The wheels and landing gear are exceptionally sturdy, and indicate the modern tendency to use wide tracks and big wheels, which make for easier operation from bad emergency landing-fields. Treaded tyres are also fitted for the same purpose. The track of of the Baltimore is 17 ft. 3 in., while the wheel diameters are more than three feet, with a tyre width of 15 inches. These figures are only slightly less than those of the Wellington, a much bigger aircraft in span and length.

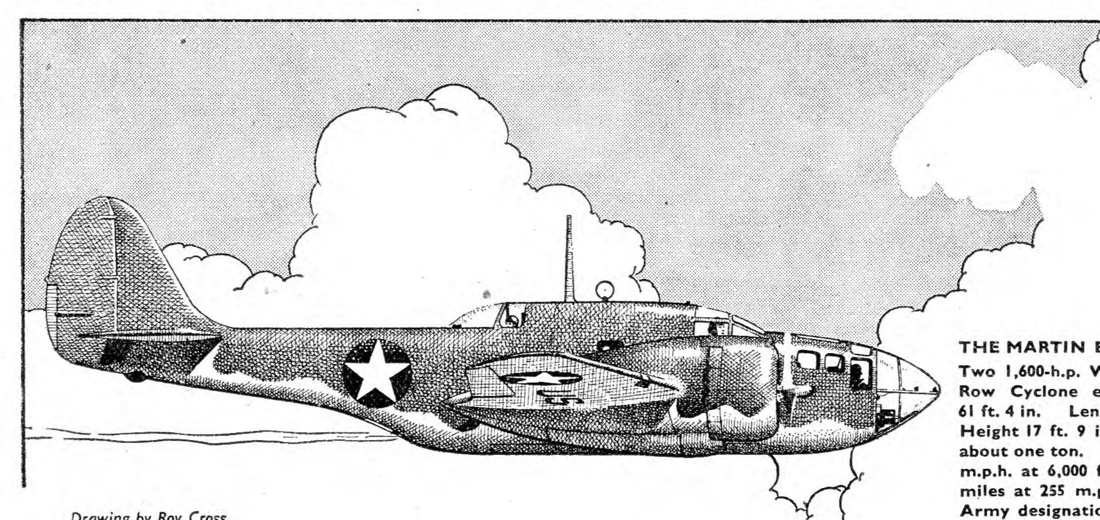
Hydraulic power operates the undercarriage, bomb doors, flaps and brakes. The tail wheel is not retractable. An hydraulic accumulator stores oil under air pressure for ground operation and testing. The flaps are of the fully slotted type which widen out to include the rear portion of the engine nacelles, so adding considerably to the effective flap area. The flaps also assist take-off with full load, and can be used at the same angle (about 30 degrees) for flying in bad visibility.

Performance

Two Wright Cyclones give the Baltimore 2,800 h.p., and Hamilton hydromatic constant-speed airscrews effectively translate most of it. Conventional stressed-skin, light-alloy construction is used throughout, though the long bomb doors have a little wood incorporated in their construction. The bomb bay reaches from below the pilot's cockpit almost to the rear-gun step.

The Baltimore handles well in the air, and its performance is equal to its fine lines, which is praise indeed, for this aircraft is particularly attractive to those who like to see a graceful shape.

The Baltimore is typical of the excellent war material America is sending us, and using herself all over the world, to the discomfiture of our enemies.



Drawing by Roy Cross.

THE MARTIN BALTIMORE I. Two 1,600-h.p. Wright Double-Row Cyclone engines. Span 61 ft. 4 in. Length 48 ft. 6 in. Height 17 ft. 9 in. Bomb load about one ton. Top speed 312 m.p.h. at 6,000 ft. Range 1,200 miles at 255 m.p.h. American Army designation: the Martin A-30 Attack Bomber.

Operational Flying

by **Captain Norman Macmillan,** M.C., A.F.C.

OPERATIONAL flying has a dual capacity — to discover what the enemy is doing and to strike him hardest where it will hurt him most.

Operational flying may be concerned with concentrated targets, or with a variety of targets spread thinly over great distances on either land or sea.

It may be tactical in nature or strategical. When it is tactical the aircrews are able to formulate for themselves by immediate observation a shrewd idea of the success of the operation. This was the case during the Battle of Libya, which chased the Axis forces out of Egypt and through Libya into Tunisia; it was the case also in Papua, where, operating from Port Moresby, the Australian and American forces, with admirable air co-operation, drove the Japanese out of the Papuan peninsula of New Guinea.

When operational flying is strategic the aircrews often see only a fragment of the whole picture envisaged by the directing mind, thrilling even though these individual parts may be. So it is with the attacks upon European transport, German industry, Italian ports, and the enemy U-boat organisation by land and sea.

The Key to Success

Large air fleets are now marshalled to fly over great distances with the precision which formerly attended the movement of foot soldiers over a few miles of country; and the key to the success of flying operations on the scale of to-day is organisation—the balanced efficiency of intelligence, administrative and supply staffs in fulfilling the requirements of the commander and his executive staff.

Each of the great Powers now at war has developed its air arm upon certain lines, with the same ultimate object of obtaining the utmost efficiency in operational flying within the capacity of its own air strength.

R.A.F. Organisation

Britain reorganised the Royal Air Force at Home into its present Command system in June 1936. This system of separate operational Commands co-ordinated through a central Air Ministry has proved to be flexible and efficient under the stress of war. The underlying idea is that each Command exists to perform a particular duty or series of duties. The Admiralty assumed complete control over the Fleet Air Arm (instead of only operational control) in July 1937; the Admiralty assumed operational control over Coastal Command in May 1940. The Coastal Command Groups and Naval Commands fight their triple war over, on and under the sea through combined headquarters. The needs of war have produced the Army Co-operation Command and the Army Air Corps; the first is an R.A.F. Command, the second is virtually an Army transport unit, capable of placing soldiers into action swiftly by means of towed gliders.

The Luftwaffe

The German Luftwaffe was created with a view to tactical requirements, and to that end it was organised in Air Fleets to operate principally with the German Army in offensive operations. A small section of the force was trained for naval co-operation. The Luftwaffe controlled anti-aircraft equipment of all kinds, including guns, making provision of Army requirements in addition to territorial defence. The needs of war have forced the Germans to modify their organisation to a considerable extent to provide for the defence of Germany and parts of Occupied Europe by day- and night-fighters, due to the constant action against them of R.A.F. Commands and the United States Eighth Army Air Force stationed in the United Kingdom.

Italian Arrangements

Italy also organised a separate air force and called it the Regia Aeronautica. It has proved to be consistently less efficient in equipment and organisation than the R.A.F., and is to-day relatively a back number in operational flying.

Army and Navy Air Forces

Russian military aviation was organised in an Army Air Force, a Naval Air Force and an Independent Striking Force. The first two are, in principle, tactical, while the third is strategical.

The United States and Japan organised their operational air forces as separate Army and Navy forces, administered and controlled by the War and Naval Departments of State. Both have carried out strategic and tactical operations by land and sea.

Flexibility

The flexibility of Anglo-American relations and air organisation has made it possible for Britain to detach air units to operate under American commanders, and for American units to operate under British commanders. American air squadrons are based in British colonies, fight in North Africa alongside British squadrons, and fly (almost as Bomber Command flies) against Germany and German-occupied Europe from the United Kingdom. Britain has a squadron of Coastal Command flying from America's Atlantic coast. All over the world there is co-operation between British and American air units; and by British I mean the British Dominion Air Forces too, and not the R.A.F. alone.

The Basis of Development

Air operations have developed rapidly since the war began. This development has been rapid, because the way was prepared for it in the years between the wars, by sound organisation and by operational experimental flying of many kinds, involving long-distance flights over continents, height records, speed contests like the Schneider Trophy, and formation flights like those carried out by the R.A.F. throughout Africa and from Ismailia to Port Darwin non-stop.

The basis of the development between wars was the experience acquired during the last war, when from unarmed aeroplanes the air forces developed effective fighters and powerful bombers in fewer than four years, and learned how to use them in conjunction with armies and to a lesser extent in relation to sea war.

Italy was probably the first nation to use aircraft in war operations, for the Italian army employed an aeroplane in Libya during the Italo-Turkish War of 1912, which first gave Italy the colony she has now lost.

First Aeroplane Reconnaissance

In January 1911 Sir Douglas Haig issued the first official orders ever given by a British general for an aeroplane to fly and bring back information about troops opposed to his. That happened in India during Army manœuvres. The pilot was a civilian, and the aeroplane the property of the Bristol Aeroplane Company. The observer was Captain Sefton Brancker of the Royal Artillery, who was later to become Director-General of Civil Aviation and die in the crash of the airship R.101 at Beauvais, France.

An observation balloon accompanied Lord Roberts' advance on Pretoria in 1900.

When in 1783 the Montgolfier brothers made the first thing which could be called a flying-machine, a fire balloon, they proposed that it should be used to attack Gibraltar, where the British were then besieged.

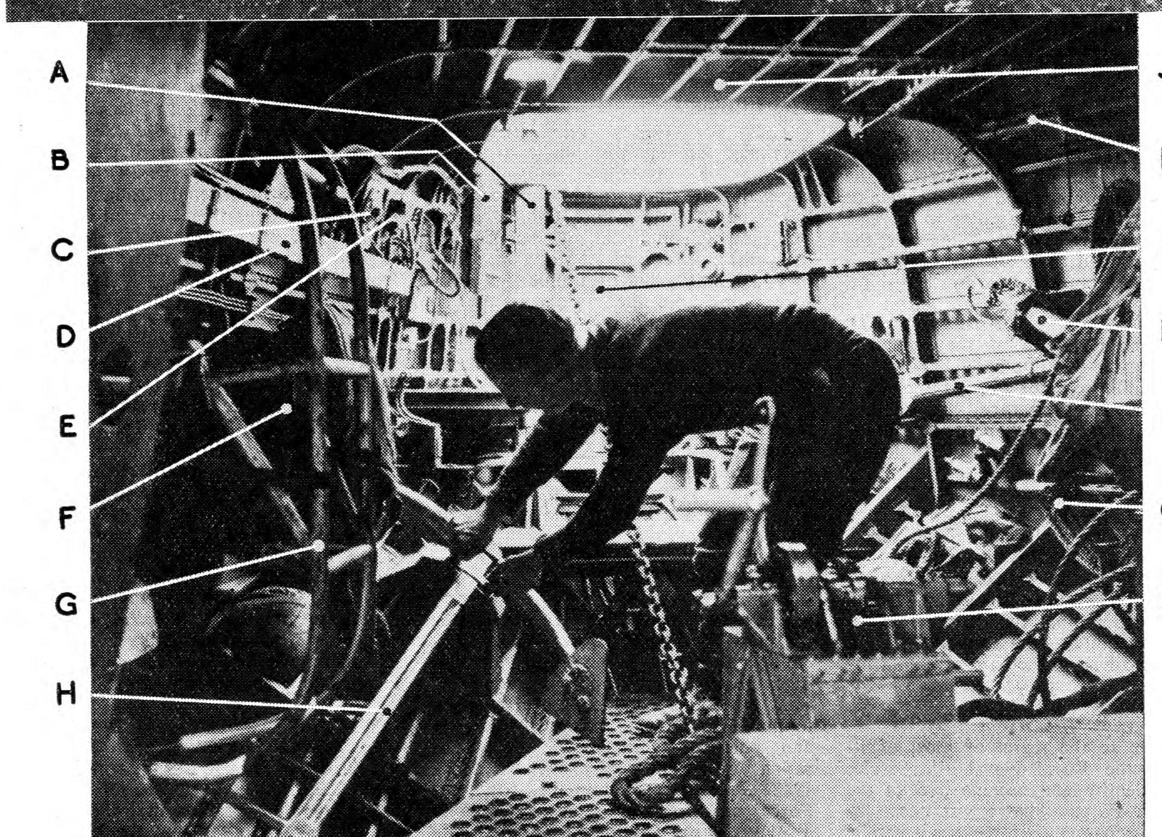
As an operational aircraft, the dirigible balloon failed during the Great War. The aeroplane is now supreme.

The repetition of the work of designers, the organisation of commanders of air forces, factory workers, metallurgists, chemists, physicists, every pilot and member of aircrew who have ever flown since 1903, have all played a part in the development of operational flying. Each member of prospective aircrews who now goes forward into training takes the march of progress one step further. There could be no better motto for each and all who go to learn to fly than that of the Wright brothers: "Skill comes by the constant repetition of familiar feats."

The Short Sunderland

(Span 112 ft. 10 in.)

THE BOW COMPARTMENT *(below)*
A—Mooring bollard. B—Instrument panel (altimeter and A.S.I.). C—Warning horn. D—Duct for electrical leads. E—Intercommunication call lamp. F—Parachute stowage. G—Mooring ladder for use on outside of hull. H—Anchor. J—Gun deck-turret retracted for mooring operations. K—Mooring lamp mast. L—Bomb-aimer's window. M—Boat hook. N—Heating duct. O—Warp line. P—Anchor winch.



THE NAVY'S AIR LORE

A Martlet (span 38 ft. 0 in.) taking off from the flight deck of an aircraft carrier.

SAILORS have always been men of the air. Long before the Wright brothers headed their biplane into the wind for the first flight the sailors had understood and mastered the ways of the air. Until a mere hundred years ago, before the days of the steamship, the air was the prime motive power of the sea. Mariners had charts and catalogues of winds on all the oceans in the globe and knew where to look for favourable winds, where to expect unfavourable winds, and how to set their sails to extract the last ounce of power from the shifting currents of the air. Even after the coming of the steamship, with its ability to plough its way through the teeth of a gale, the air retained a measure of its importance, for the state of the air still governed the moods of the waters, and a knowledge of its vagaries enabled the sailor to forecast a still or stormy sea. Realising this, the Navy continued to train its young men in sail before putting them in steamships.

The R.N.A.S.

With the invention of the aeroplane the air became of still greater importance. The admirals were not anxious to embark on an air armament race, because they saw clearly that the aeroplane would deprive the warship of much of its power. But once the race had started the Navy got to work, and by 1918 the Royal Naval Air Service had reach a high standard of strength and of efficiency, considering the primitive equipment then available. It had produced seaplanes, aircraft carriers, torpedo aircraft, flying-boats airships and squadrons of fast, up-to-date fighters—the Camel—which it was able to lend to the hard-pressed army in France.

End of the R.N.A.S.

In 1918, to the regret of most of its members the Royal Naval Air Service lost its identity and became part of the Royal Air Force. That it was necessary to have a separate air force was generally acknowledged, but whether it was necessary to deprive the Navy of its own air service continued to be hotly disputed until 1937, when the argument was settled by giving the Navy full control of its own ship-borne aircraft. During those 19 years betwen 1918 and 1937 all naval aeroplanes belonged to the Royal Air Force, and their pilots were Royal Air Force pilots, though some were really naval officers temporarily attached to the Royal Air Force. A naval officer commanded the seacraft and a Royal Air Force officer commanded the aircraft.

The Illusion

Thus for twenty years the idea developed among the public that the air was a mysterious thing which could only be understood by a man in a light-blue uniform whose apprenticeship was measured in hours, but was beyond the comprehension of seafaring men who had had long years of training as navigators, engineers gunnery experts and so on. And all the time young men straight from school, old men of seventy and women of all ages, were flying aeroplanes of almost the same speed as those used in the Services, and flying and navigating them so well that they broke record after record over land and sea. It all seems rather ridiculous now, but those years were mad years. Stranger and sillier things happened in them, as we know to our cost to-day.

Resumption of Control

The decision to give the Navy its own air arm was made in 1937, but it was not until 1939 that the Navy regained full control over carrier-borne aircraft and over the land aerodromes necessary for training. The Fleet Air Arm given back to the Navy did not include flying-boats and coastal reconnaissance squadrons which formed part of the R.N.A.S. in 1918. These remained in the Royal Air Force organised as Coastal Comand. To-day Coastal Command, although still part of the Royal Air Force, works in close co-operation with the Navy, and it has been laid down that "the ultimate decision concerning any operation must rest with the Royal Navy." It sounds rather like 1918-1937, but we know by results that between them they are doing a good job of work, and the country has been assured in Parliament and elsewhere that everyone is perfectly satisfied with the present arrangements.

Wider Experience

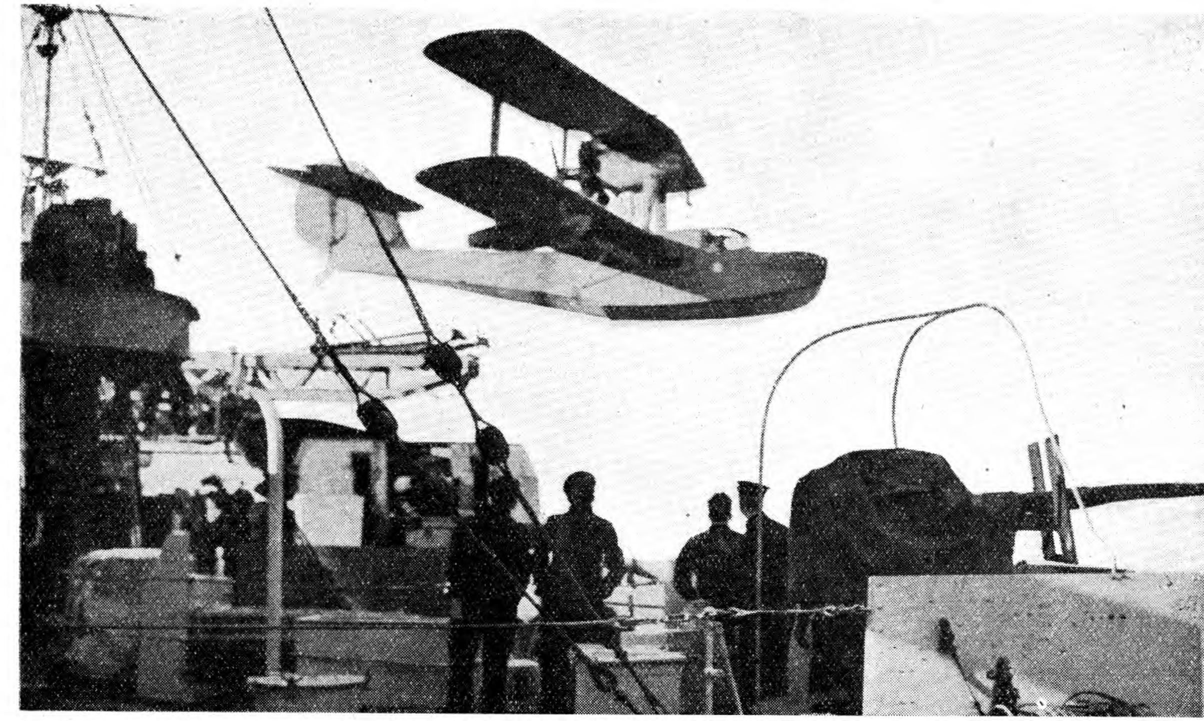
By means of this close co-operation the Navy is gaining daily in air experience apart from the operation of its own ship-borne aircraft, though it still has not the same measure of control that it had in 1918, even over its own aeroplanes, since these have to be ordered through another Government department instead of direct as in 1918, when the Navy ordered the Camels from Sopwith and flying-boats from Shorts.

Naval Types

Until a few years ago it was considered that naval fighters must necessarily be inferior to Royal Air Force aircraft, but to-day that opinion seems to be changing. Curiously enough, the same ideas were held about Army Co-operation aircraft, until Mustangs started replacing the old Lysanders. In the Navy, Seafires and Sea Hurricanes are taking the place of the biplanes and of the slow monoplanes with which carriers were previously equipped. Naval pilots after much experiment have mastered the technique necessary for landing and taking off these fast aircraft from the decks of carriers, and modifications have been made to the carriers to accommodate them.

A Part of the Navy

Many young, ambitious men are turning their thoughts to the Fleet Air Arm to-day, but those who do so must realise that they will be sailors first and all the time. That is to say that the Navy, in-



A Walrus (span 45 ft. 10 in.) being catapulted from H.M.S. Shropshire, a County class 8-in.-gun cruiser.

stead of segregating its airmen into a separate "service" (the R.N.A.S.), as it did in 1914-1918, prefers to regard its pilots, observers, mechanics, whether officers or ratings, as an essential part of the Navy, just like other specialists in armament, signals and gunnery.

In fact, the Navy regards flying just as another of its manifold duties. Though there will always be officers and ratings specifically allocated to those duties, some knowledge of the air will be considered as an essential part of the qualifications of an executive officer. Similarly, the aircrews and mechanics must also be sailors.

How You Can Join

You can enrol for the Fleet Air Arm at the age of 16½. If you are already in the A.T.C. or Sea Cadets, you can enrol later, but there are obvious advantages in enrolling as early as possible. Eighteen is the usual age for call-up, but for certain maintenance trades in the Fleet Air Arm you can volunteer to be called up at 17½. Up till recently candidates for pilot or observer in the Fleet Air Arm have had to qualify as officers, but it is now possible to volunteer for training as a naval air pilot with a view to serving as rating or petty-officer pilot.

An important point to remember is that you need not possess a School Certificate or its equivalent. The Navy knows the value of the School Certificate. Its opinion of you will not be great if you have obviously neglected opportunities of passing examinations. But it knows, as we all know, that there are plenty of good men who have not had those opportunities. With hundreds of years' experience behind it and all modern resources at its disposal, the Navy is confident of its ability to get the very best out of young men who are made of the right stuff.

There are in the A.T.C. to-day about 12,000 cadets who have expressed a preference for the Fleet Air Arm. Thousands have already visited naval air stations, have flown in naval aircraft and been given a right royal welcome. And, what is more important, thousands have already joined, have been trained to a high pitch of efficiency, are upholding naval traditions and serving their country by performing arduous duties at great risk as members of happy and efficient ships.

The hangar of an aircraft carrier.

Rate of Climb Indicator

by **ASTRO**

THE Rate of Climb (and Descent) Indicator is employed a great deal in blind-flying training. The instrument indicates any change of altitude, and is used for maintaining level flight by indicating any changes of attitude of the aircraft which result in a given rate of ascent or descent. For increase of altitude (climb), the pointer moves in a clockwise direction, and for decrease of altitude (dive) the pointer moves counter-clockwise. To make the instrument more natural in its indication, the pointer is arranged to move up for a climb and down for a dive (Fig. 1). The spacing out of the dial markings is usually in feet per minute, sometimes in thousands of feet per minute and sometimes hundreds of feet per minute. The dial at Fig. 1 is marked in thousands of feet per minute, each space representing a thousand feet per minute. Some are marked in metres per second, but these are not fitted on British or American service aircraft.

How many do you know?

The Rate of Climb Indicator is sometimes called a Vertical Speed Indicator. The range of the majority of Rate of Climb Indicators is from 0 to 2,000 feet per minute, as in Fig. 1A, though some have a range of 0 to 4,000 feet per minute. While on the subject, can you say offhand the rate of climb of the latest Spitfire? Or the Hurricane? Or the Kittyhawk? In a fighter aircraft the rate of climb is a vital part of its performance. Successful interception depends on it, yet it is surprising how many people disregard this aspect of aircraft performance. They know the top speeds, cruising speeds, horse-powers, aspect ratios, wing spans, armaments and range of many aircraft, but they have not even the vaguest idea of their rates of climb. I suggest a competition to see who can answer questions on the lesser-known aspects of performance. Rates of climb will provide a useful start. The competition must be impromptu, or there will be a lot of frantic last-minute swotting up, and though the value of the competition will not be lost, most of the fun will.

Progress in Rates of Climb

Another interesting point is to compare the increase in rates of climb through the various marks of fighters like the Spitfire and Hurricane. So important is this part of aircraft performance that a fighter aircraft with an otherwise excellent performance will be useless if the rate of climb is too low for effective interception. It will also be a vital factor in civil flying when aircraft with pressure cabins regularly operate at high altitudes.

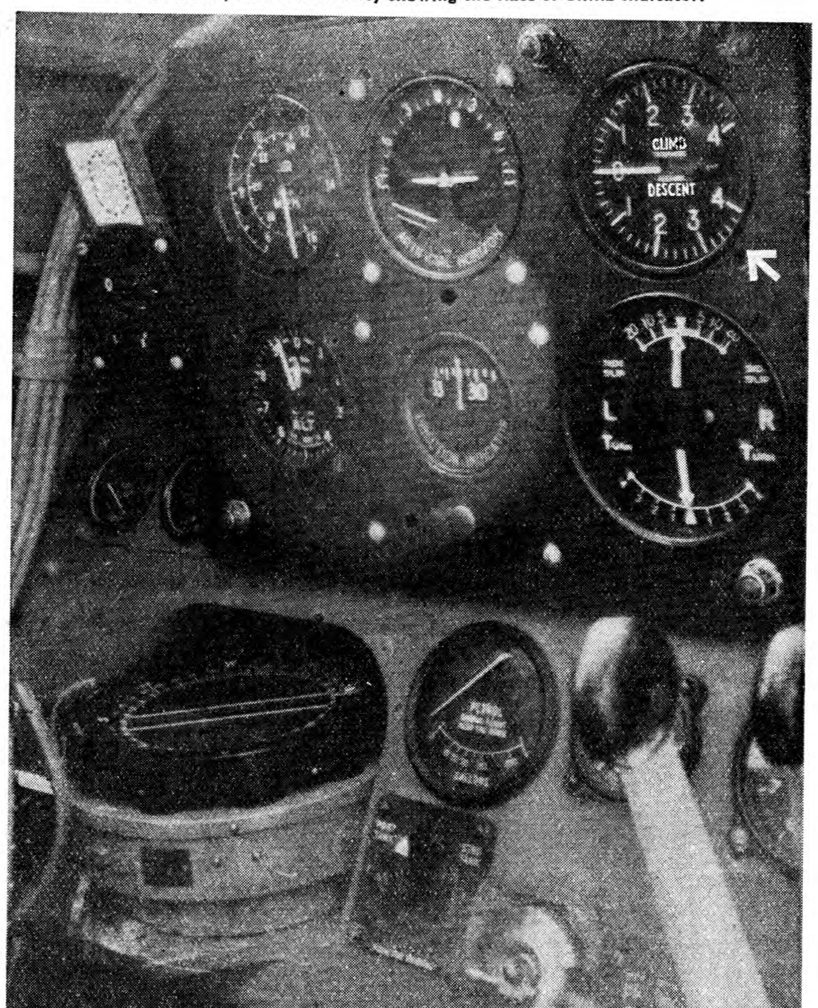
How the Instrument Works

The operation of the Rate of Climb Indicator is similiar to that of the altimeter. Fig. 1B shows the principle much simplified. The capsule G is rather like a concertina in operation, and can be compressed or extended to indicate the difference between the air pressure inside and outside it. The case or "capacity" (F) is sealed to prevent air leaks. The only way air can get into or out of the case F is through the small leak hole L. It will be seen that the leak hole enters the pipe C which leads directly from the inside of the capsule G to the outside atmosphere at the static side of the air-speed indicator pressure head. The case F is also open to the atmosphere at C, but only through the leak hole L.

As the aircraft climbs, the air pressure in the capsule G will decrease faster than that in the case F, the pressure in which can adjust itself only through the leak L. Therefore the greater air pressure in the case than that in the capsule will press the capsule down. This will cause the pointer P to move up. The faster the climb, the faster the air will leave the capsule, and the pointer P indicates the difference by moving further up. In a dive the air pressure increases inside the capsule faster than it can increase in the case through the leak, so the capsule will expand by the increasing pressure inside it. A coil spring at D will then move the pointer down as the capsule expands. The movement of the capsule is transferred to the pointer in various ways. That shown in the diagram is simplified and operates by a chain fastened to the top of the capsule and passing round the sprocket fixed to the pointer P. In level flight the air pressure inside the case and the capsule are the same, so the needle remains at zero.

A, Fig. 1, shows the instrument dial; B is the same instrument with the front removed. As the rate of leak from or into the case is constant at L, no compensation is necessary, so the pilot has no corrections to make to the reading of the Rate of Climb Indicator in flight.

Instrument panel of a Whitley showing the Rate of Climb Indicator.



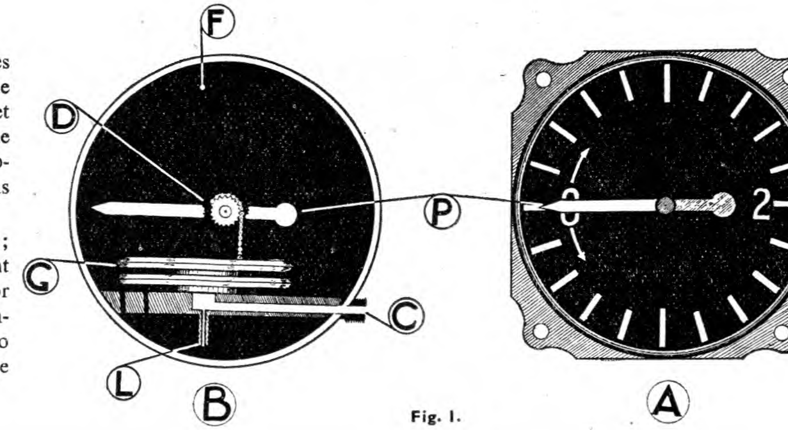
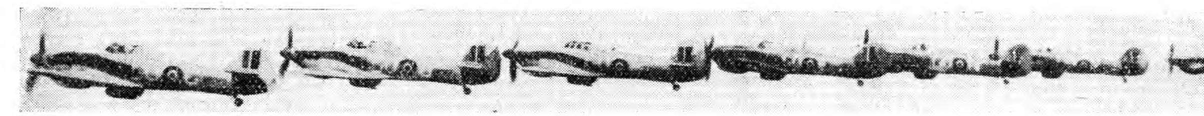


Fig. 1.



SYNTHETIC RUBBER IN AIRCRAFT

by Peter Garrod Chinn

ACCORDING to the nature of the materials used in its compounding, synthetic rubber can be made to possess the same qualities as natural rubber, but with greater resistance to oils and acids, to heat, ageing and weather. It may be made as flexible or elastic as required for the work it has to do, and has proved itself invaluable in many instances where natural rubber, leather, cork, fibres or metals are unsuited.

Reducing Costs

Synthetic rubber was first experimentally produced in small quantities some 15 years ago, and its conception dates back over 40 years, but until recently the abundant supplies and lower cost of natural rubber restricted the commercial development of the synthetic product. Yet, although synthetic rubber produced in America before the war cost four times as much as natural rubber, over 1,700 tons of it was sold in that country during 1939, and within two years many companies had reduced costs by half. There is no doubt that, had we foreseen the loss of our rubber plantations in Malaya, the synthetic rubber industry would have been enlarged and adapted to meet a large part of the total war-time rubber consumption.

Aircraft Parts

In aircraft construction, synthetics can be used for nearly every purpose for which rubber is employed. Tyres made solely from synthetic rubber were proved many years ago to be equal to those made of the natural product. Many small aircraft parts, such as fuel-pump diaphragms, shock-mountings and couplings, gaskets, washers, grommets and oil-seals are made of synthetic rubber. Synthetic rubber de-icing boots are better than those of natural rubber, because of their better weathering properties. Synthetic covering for electric cables gives excellent results, insulation being ensured by its greater resistance to heat, oils and cold. Other uses include fuel-pipes, lines in hydraulic systems and the Goodrich expander-tube brake.

Varying Qualities

The Goodrich Company, among others, have made much progress in the development of synthetic rubber. "Ameripol," manufactured by that company, probably approaches as near to natural rubber as any synthetic yet produced. It can be processed and vulcanised like natural rubber, yet is not greatly affected by contact with oil or acid. "Ameripol," the makers state, has petroleum as its basic raw material. During manufacture the petroleum is processed and mixed with other ingredients to which a soap is added to produce a milky substance, which, heated and agitated, forms an emulsion similar, in its molecular structure, to the latex obtained from rubber-producing trees. Thenceforward, the method used for obtaining solid rubber is almost the same as that for doing so from natural rubber. That is to say, the latex is made to congeal with an acid, then dried into sheets. Some two years ago Goodrich started making "Ameripol" motor tyres for commercial use, and these have proved extremely successful.

Other proprietory synthetics include "Neoprene," "Koroseal" and "Thiokol." Each differs a little from the others in composition; each has its own characteristics of texture, resistance and wear. The basic raw material of "Neoprene" is acetylene. It has excellent all-round qualities, including that of retaining its moulded shape under heat and pressure.

"Koroseal," another synthetic manufactured by the Goodrich Company, is a polyvinyl chloride thermo-plastic, and, being a thermo-plastic, will lose its moulded shape at high temperatures. It is, however, highly resistant to corrosives and has a high tensile strength. Its base is limestone and coke. "Thiokol" is another thermo-plastic. Thermo-plastics, while not resistant to excessive heat, have the advantage of being easily remade from waste and scrap. "Thiokol" also has good oil- and acid-resisting properties. Its base material is sulphur.

Each of these synthetics, all differing in their chemical composition and thus in their qualities, has its own use. "Neoprene" is used for the fabrication of fuel-pump diaphragms, washers and grommets; "Thiokol" for oil-seals and cups, and "Ameripol" and "Neoprene" for pressure-hoses and tyres. Other types of synthetic rubber are under development, and there is little doubt that even better materials will soon be appearing, each adapted to a particular need.

The Glider in War

By John Ibsilon

BEFORE the Cretan episode the glider was regarded fairly generally as a novelty, useful perhaps for surprise tactics, or transporting small bodies of men from place to place, but not of utility as a serious weapon of war. Now estimates of the cost and the prohibitive losses involved are seen to have been wrong. Britain is building gliders and, it is to be hoped, preparing to use them on a large scale, for they can be of infinite assistance to a modern army in defence and in attack. They can evacuate armies as well as take them to the assault, and fuel and reinforcements can be flown to hard-pressed units.

Russian Experiments

It is to Russia that much of the credit for glider development goes. One type in particular, designed several years before the war and holder of many records—a sailplane, the GN-7—was outstanding. Unlike most non-powered craft, the GN-7, a single-seat ship, had gull wings almost at the bottom of the fuselage with the wing tips only 18 inches from the ground. The wing loading was high; but comparatively high wing loadings are not bad in themselves. Indeed, for towing purposes it is necessary to maintain loadings above a certain lower limit. Prominent among the Soviet pilots and organisers of the sport were Master Pilots Kartasheff, Rastorguyeff and Ilchenko.

German Progress

In Germany an extensive gliding scheme for Nazi youth was organised by Oscar Ursinus, watched closely by the German Air Force Chiefs, not principally because of glider warfare possibilities, but because of the training of pilots for the new Luftwaffe which Hitler was beginning to flaunt before the world. Other figures to the forefront were Flight Captain Hanna Reitsch, Peter Riedel, Captain Kamp and Inge Wetzel. Well-known German sailplane types are the Minimoa, Rhonsperber, Rhonadler, Habicht and Kranich, all orthodox high-wing or shoulder-wing aircraft. Even at this time multi-seat gliders were flying inside Germany, and it is perhaps significant that details concerning them were hard to come by. Gliding activity in the Reich centred mainly around Wasserkuppe.

Gliding in America

America treated the "sport" in a singularly unmilitary manner, for she was not preparing for war. Nevertheless, American flyers seized many records. Prominent figures were Lewin Barringer, of the Soaring Society of America, Dr. Wolfgang Klemperer, vice-president of the S.S.A., Richard du Pont, Elmer Zook, Emil Lehecka and Edward Bellak, all of these being accomplished pilots as well as patrons.

Operation

In sport flying, gliders and sailplanes are more often launched from the ground than towed by aeroplanes and subsequently cast off, although of course the latter method is essential for attempts on distance records and durations, and the only useful method for military operations. However, even towed gliders must start from the ground somewhere. Take-off procedure is fairly simple. Provided the towing aircraft is powerful enough—and in military operations this can be ensured—a single glider may be "taken off" by merely hooking it to the towing machine and giving the towing pilot the all-clear. When a chain of gliders in line astern has to be towed off an aerodrome the difficulty is that the length of towing cable is so great that there is no room for a sufficiently long take-off run. (The distance separating each glider in the air should be anything from 200 to 400 feet.) An invention from Russia disposes of this stumbling-block. In the nose of each glider there is a revolving drum, on to which the wire attached to the tail of the glider ahead is wound, thus reducing the space taken up by the formation on the ground. At the moment before the take-off the brakes on the drums are released so that the wire may unwind. The towing aeroplane then takes off with the cable from the first glider unwinding freely. When the towing machine is about half-way across the aerodrome the brake is applied to the nose drum of the first glider, which now begins to move. By the time the first glider is half-way across the aerodrome the towing aircraft will have taken off; the brake on the nose drum of the second glider may then be applied, and it, in its turn, will begin to move forward. It is not known what the German procedure is, but if the German claim that a Junkers Ju. 52/3 m. can tow off six 24-seat gliders is to be taken seriously, it seems likely that they have adopted the method just described. Once in the air the craft may be cast off either one by one or simultaneously. Pre-war multiple towing was usually carried out with the gliders on separate tow cables.

Troop Carriers

Despite the good beginnings made in Russia, that country has not utilised gliders for military purposes, although several troop-carrying specifications are known to have been approved by the Glavavioprom (the Russian equivalent of our M.A.P.), and to be in the prototype stage.

In Germany at least ten types of troop-carrying gliders are in production. The first of these, the Deutsche Forschungsanstalt fur Segelflug 230 A1, was used in the attack on Crete; since the success of that experiment it has been to a large extent ousted to make way for larger types. The D.F.S. 230 A1 is a ten-seat craft weighing, when loaded, 2,980 lb.

The Gotha Go. 242, a type that has been in action in Libya, is a 23-seat glider carrying 21 soldiers and a crew of two, which weighs, when loaded, 8,500 lb. It is a tail-boom layout, and this is supposed to greatly enhance manœuvrability. The troops may be replaced by ammunition, food or fuel. Both the D.F.S. 230 A1 and the Gotha Go. 242 are usually towed by Junkers Ju 52/3m transports (three 830-h.p. B.M.W. 132 D motors), but Focke-Wulf Kuriers are also used. There is nothing to prevent smaller machines such as the Messerschmitt Me. 210, Junkers Ju. 88, etc., being impressed into service should the need arise.

That glider trains would be cold meat for fighters is probably true to a certain extent. Nevertheless, in addition to any armament of its own, the glider can be defended by the weapons of the troops it is carrying, fired through the side ports. Most of the gliders at present in service are, however, badly protected against attacks from the upper and lower hemispheres. Also, such towing machines as the Junkers Ju. 52/3m are hard put to it to look after themselves when subjected to fighter attack. Successful military glider operation must therefore depend on air mastery by fighter aeroplanes.

GLIDING IN AMERICA

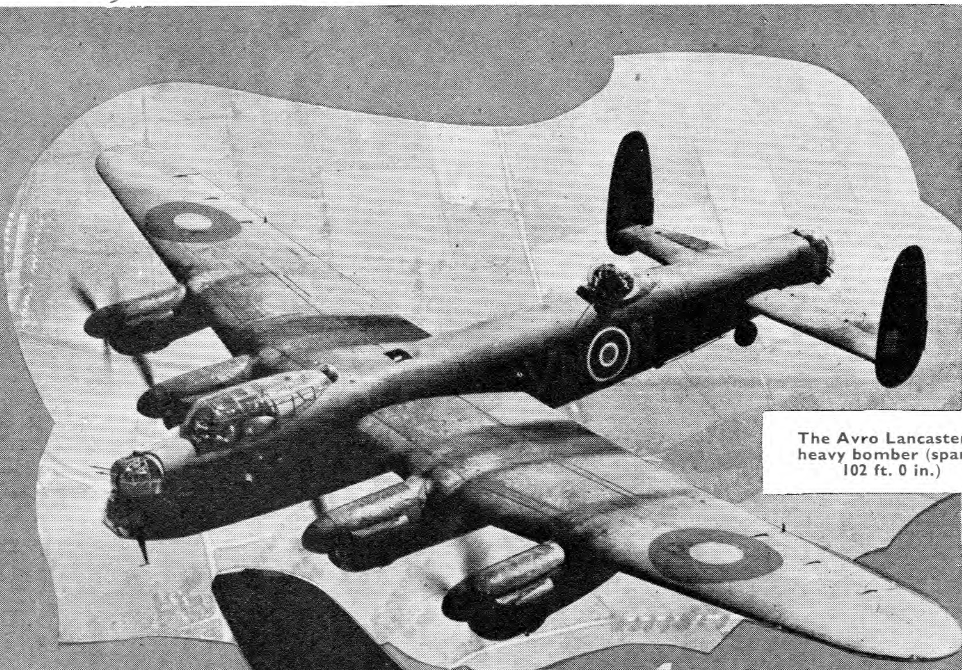
The speed-up in gliding training in America at first taxed the equipment of the manufacturers. The Aeronca Aircraft Factory, Middleton, Ohio, discovered that its two-seat tandem trainer, already being built, could be re-designed as a three-seat glider trainer, chiefly by leaving out the motor and replacing the nose piece.

Notice the few controls and the simplicity of the instrument board. Vision is excellent. Training gliders have cruising speeds of about 30 miles an hour and a sinking speed of about four to five feet a second.

A triple tow is seen in the upper picture the towing aircraft being a Vultee Vigilant. The gliders leave the ground before the tow-'plane takes off and remain slightly above it throughout the flight in order to avoid the slipstream. Pilot of glider can release the tow line when he wishes and remain aloft for a period that depends upon the glider's altitude at the time of release.

ATLANTIC EXCHANGE

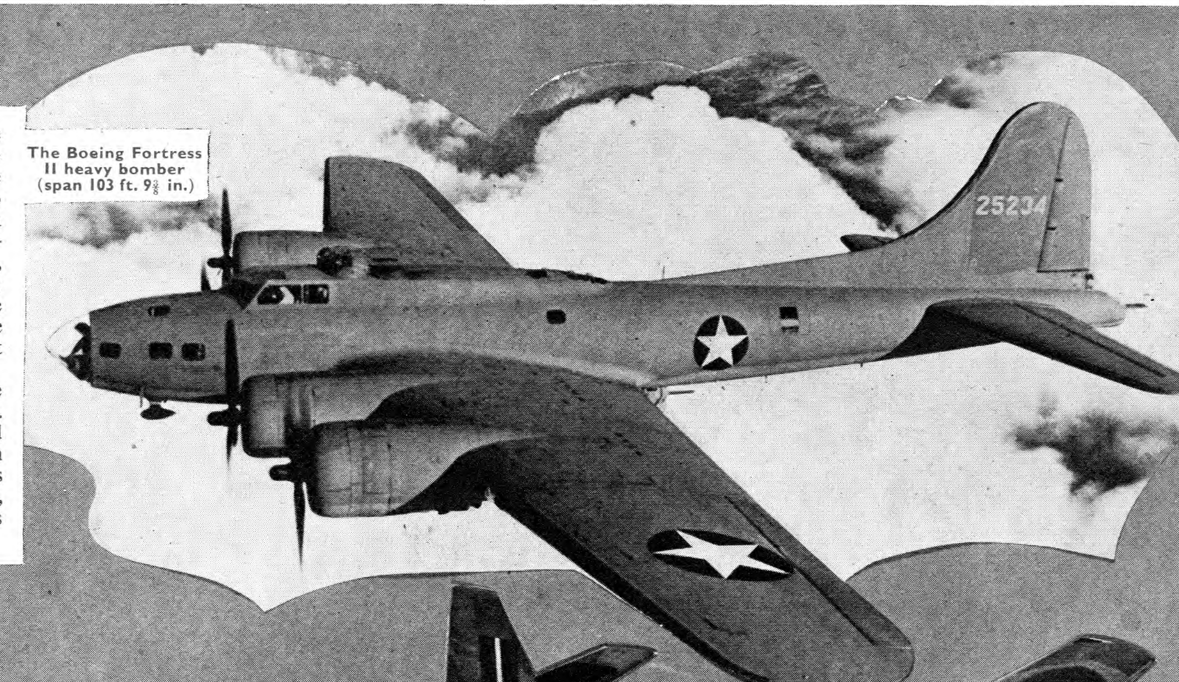
by C. G. Grey



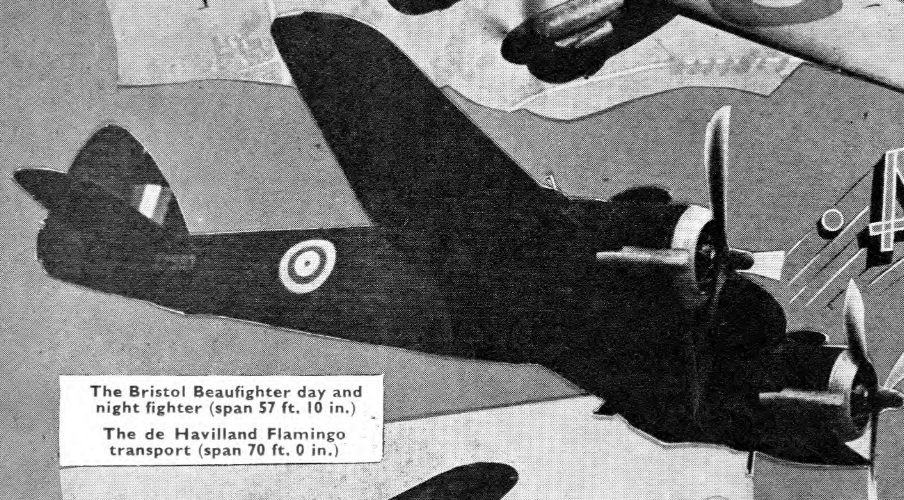
The Avro Lancaster heavy bomber (span 102 ft. 0 in.)

WE people on each side of the Atlantic owe a lot to one another. Yes! I know—we still owe our debts of World War I; but I do not mean that sort of debt. I mean debts of aeronautical knowledge—technical progress, fighting tactics, bombing technique, flying training; in fact, everything that goes to make an Air Service and to arm it. So we may both profit by taking a look at what we have done for one another.

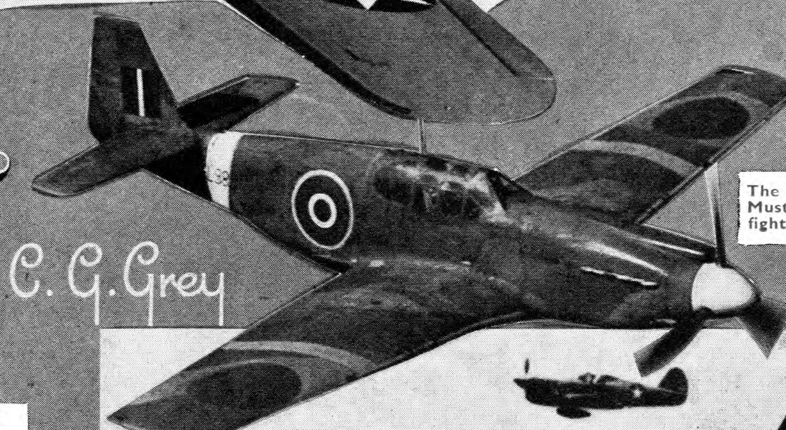
In the first place, we English owe our first flying to the United States. The Wright brothers were, beyond dispute, the first people who flew (in 1903 and 1906), but their designs stopped dead in 1911. Glenn Curtiss, who began in 1908 making machines which really flew, went on and on, and contributed largely to the world's air progress, till he dropped out of aviation in 1924.



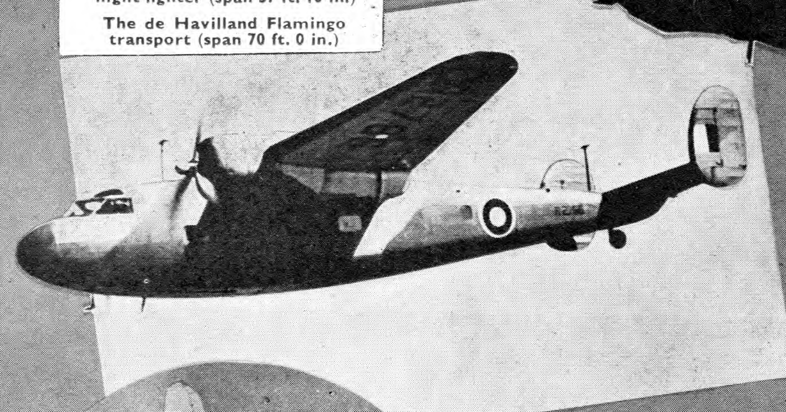
The Boeing Fortress II heavy bomber (span 103 ft. 9⅜ in.)



The Bristol Beaufighter day and night fighter (span 57 ft. 10 in.)



The North American Mustang close-support fighter (span 37 ft. 0 in.)



The de Havilland Flamingo transport (span 70 ft. 0 in.)

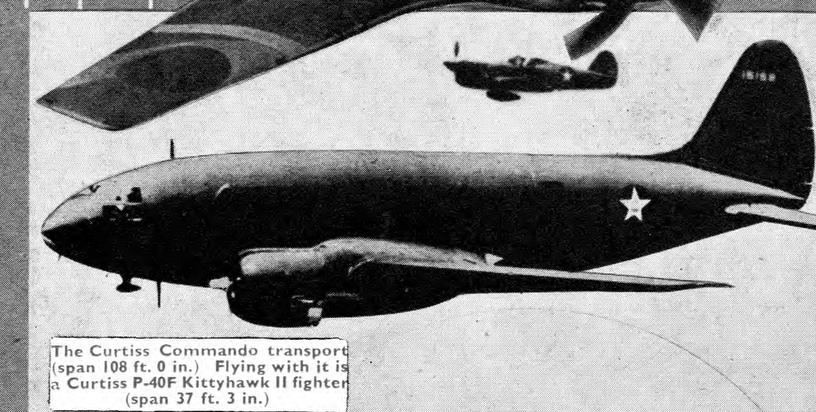
Flying-Boat Development

During the War 1914-18 each of us owed much to the other. Glenn Curtiss had built the world's first flying-boat in 1912. In 1914 Lieutenant John Porte of the British Royal Navy, one of our best pilots, went to Hammondsport to help Curtiss build a three-motor boat to fly the Atlantic. John Wanamaker, of the Store, was to pay for it. War broke out. Porte came back and joined our Royal Naval Air Service. Curtiss developed the boat as a two-motor job, and we bought dozens of them.

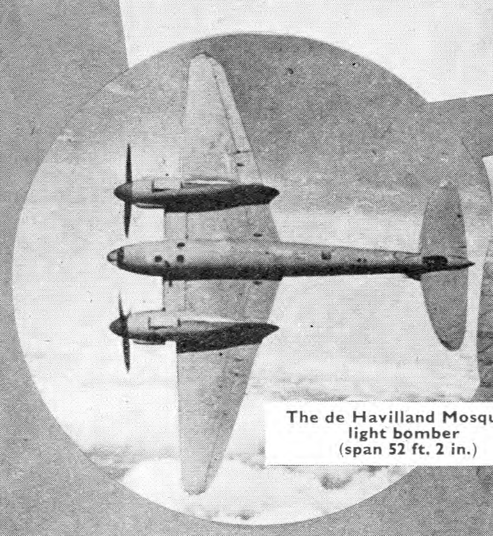
Also, Curtiss, a great engineer, produced the Jenny, with his own OX motor, and we bought hundreds, perhaps thousands, of them as primary trainers. And the queer thing is that there the U.S. contribution to progress in aircraft stopped. Many other firms in the U.S. tried to build warplanes, but none succeeded, although the demand began in 1914.

War Production

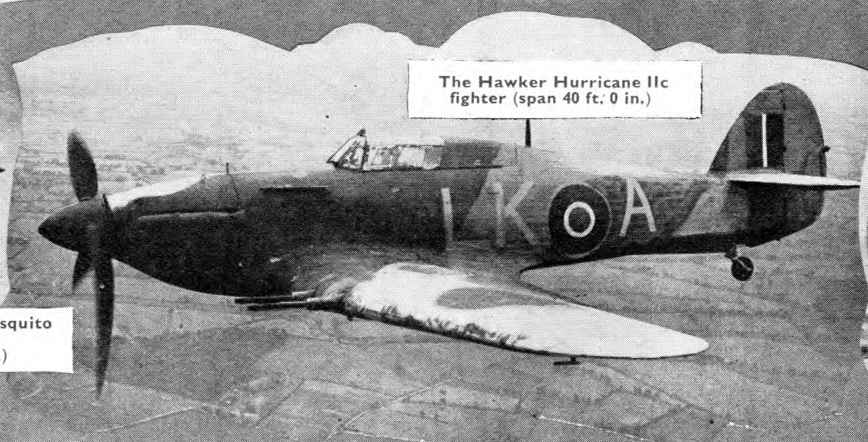
Colonel Edgar Gorrell, D.S.M., D.S.O., Legion of Honour, and late of the U.S. Army Air Service (before it



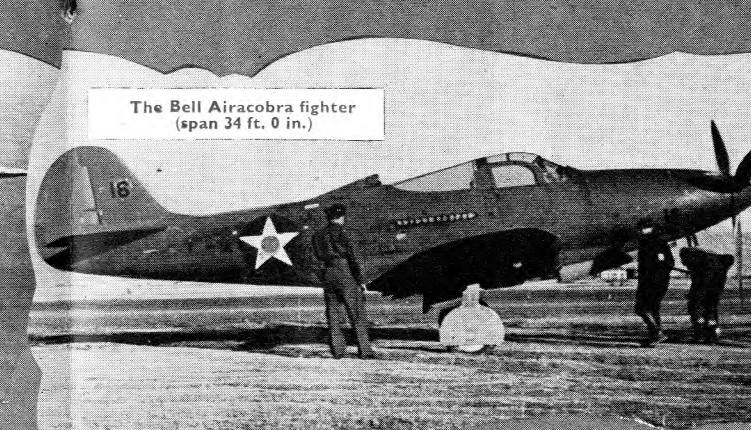
The Curtiss Commando transport (span 108 ft. 0 in.) Flying with it is a Curtiss P-40F Kittyhawk II fighter (span 37 ft. 3 in.)



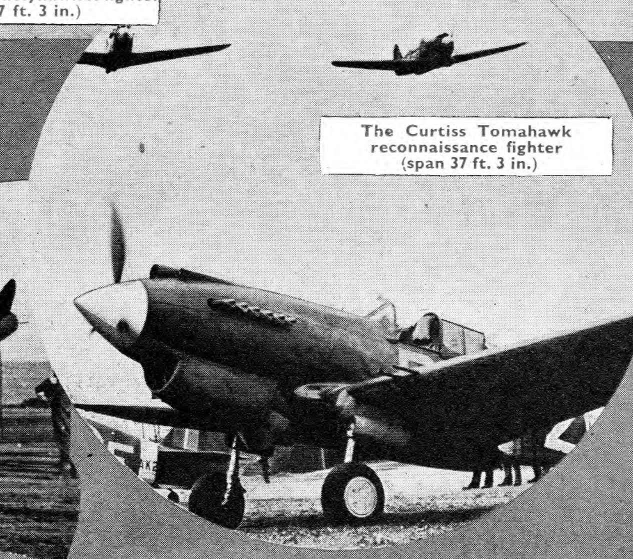
The de Havilland Mosquito light bomber (span 52 ft. 2 in.)



The Hawker Hurricane IIc fighter (span 40 ft. 0 in.)



The Bell Airacobra fighter (span 34 ft. 0 in.)



The Curtiss Tomahawk reconnaissance fighter (span 37 ft. 3 in.)

A formation of Supermarine Spitfire IXs above the clouds. This version of the Spitfire is fitted with the Rolls-Royce Merlin 61 engine and has a four-bladed airscrew. No dimensions may be published.

became the Air Corps), tells in his book, *The Measure of America's World War Aeronautical Effort*, published in November 1940 by the James Jackson Cabot Professorship at Norwich University, Vermont, of the efforts made by the U.S. Air Service to provide American aircraft for the Air Service, American Expeditionary Force. He got his figures from the *Final Report of the Chief of the Air Service, A.E.F.*—60 volumes, 5,000 photographs, and as many charts and tabulations—of which the one solitary copy is mouldering in the vaults of the War Department at Washington.

The Men

After watching the war from August 1914 to May 1917, quite a lot of aeronautical technical knowledge was available—and there were lots of grand pilots from the U.S. flying in our Royal Flying Corps who crossed the border in 1914 or 1915 and joined up as near-Canadians. That is another debt we owe to the States. I knew many of them, and there were none better.

When the U.S.A. came in officially in 1917 the French suggested that by the spring of 1918 the U.S. Air Service should have 4,500 airplanes, 5,000 pilots and 50,000 mechanics on the French Front. In default of U.S. designs, the U.S.A.A.S. ordered, in October 1917, the building of copies of the British D.H.4 (de Havilland reconnaissance) and the French Spad (combat). The first U.S.-built D.H. arrived in France in May 1918. The first U.S. pursuit squadron, in Spads bought from the French, reached the Front in April 1918. The first D.H.s off the production line in the States reached France in July 1918.

The U.S. Squadrons

At the Armistice on November 11th, 1918, the First U.S. Army had at the Front 28 squadrons, which were mounted in 272 French Spads, 137 French Salmsons, 80 U.S. D.H.4s, 43 French Breguets and 12 English Sopwith Camels. The Second U.S. Army had 13 squadrons in 56 Spads, 20 Salmsons, 116 D.H.4s and 4 S.E.5as—all told, 740 aircraft. So in that case the U.S. owed most of its aircraft to France, and the designs of its D.H.4s to England. No aircraft of U.S. design reached the Front.

An interesting side-issue is that U.S. manufacturers delivered 3,431 D.H.4s to the U.S. Government up to Armistice day. Of these 1,213 reached France before Armistice day, and another 230 up to February 12th, 1919. How momentum does carry on!

The Liberty Engine

Then the debt shifted over the other way. During 1918 the U.S. Army Air Service developed the Liberty Engine, a great lump of a 12-cylinder water-cooled job which made a noise like a reaping-machine but kept on keeping on for ever. We adopted it for our D.H.9as after the war, and it did a general handyman's job for about ten years in the R.A.F., in the Middle East, in India and at home.

All-Metal Aircraft

In 1920 Short Bros., our flying-boat firm, built the first all-metal aircraft in the world, a biplane of standard type, but wings and tail and all covered with aluminum sheet. The rest of the British aircraft industry did not think much of the idea, so, although our Air Ministry ordered Short boats with duralumin hulls, and some with stainless-steel bottoms, the all-metal wings and all that were not taken up. But the U.S. aircraft industry saw the sense of stressed skins and went ahead.

Whether the States owe Short Bros. a debt for starting the all-metal idea, or whether we owe the States a debt for developing the stressed skin, I shall not argue. Probably a bit of both.

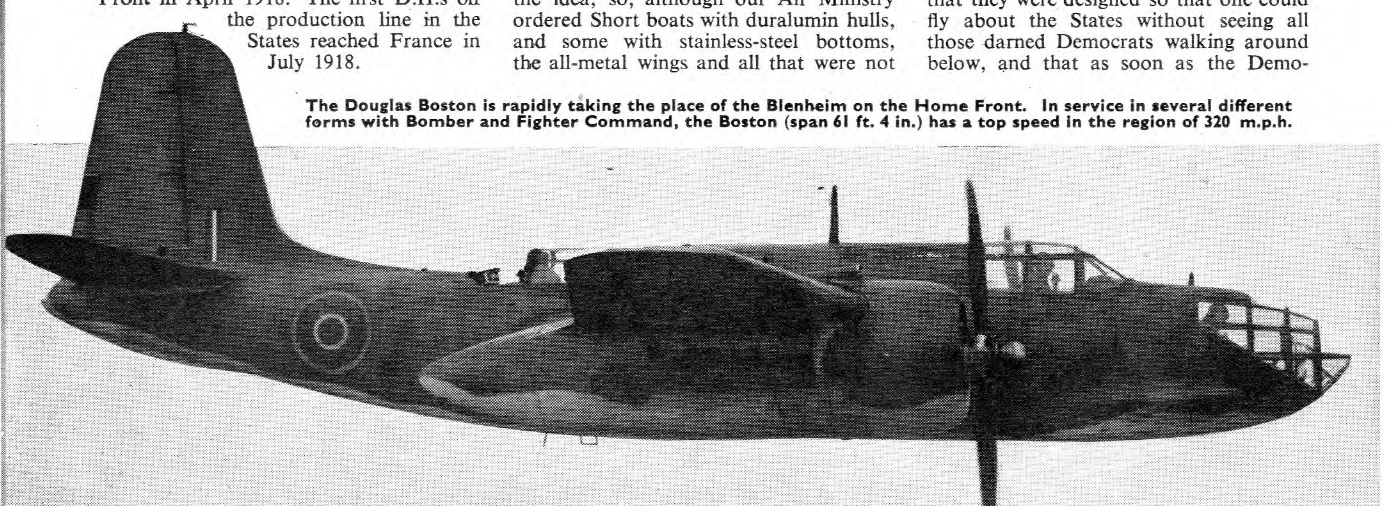
Retractable Undercarriages

Nor shall I argue who started retractable undercarriages. My friend Grover Loening, now adviser to the U.S. Government, shook me a few months ago by producing an account of one made in the States somewhere about 1917. I thought that the earliest, on paper, was 1918 or 1919. Anyhow, I give the U.S. full marks for tucking up its undercarts—the more so because one of our most prominent, I will not say leading, designers argued with me that less power was needed to push a well-streamlined undercart through the air than to carry around the weight of the retracting gear. He was the same bright lad who argued that a shaft drive for an airscrew could not be designed to weigh less than one pound per h.p. I wonder what Mr. Lawrence Bell and the Airacobra think of that. I hardly think that the gear for the Allison weighs 1,200 pounds

Low-Wing Monoplanes

Then there are the low-wing monoplanes. They certainly came into being in the States—I fancy that Jack Northrop had a lot to do with them, after he built that beautiful Lockheed Vega, one of the world's loveliest aircraft. Anyhow, a rabid Republican friend of mine said that they were designed so that one could fly about the States without seeing all those darned Democrats walking around below, and that as soon as the Democrats were out the U.S. would go back to high wings—I notice a distinct tendency in the States towards middle-wing monoplanes.

My advocacy of U.S. ideas — metal structures, low wings, retractable undercarts, sheer streamlining and so forth—got me in all wrong with the British aircraft industry at one time, and they rewarded my foresight by cancelling a big lump of advertising in *The Aeroplane*, which I was then running. A few years later, when we drew a bit ahead and I felt that my duty was to criticise U.S. airplanes, I was attacked by the U.S. Press. Prophecy is a chancy trade, and saying "I told you so" does not bring much profit to the prophet.



The Douglas Boston is rapidly taking the place of the Blenheim on the Home Front. In service in several different forms with Bomber and Fighter Command, the Boston (span 61 ft. 4 in.) has a top speed in the region of 320 m.p.h.

Flying-Boats

The next stage was when, just before this war, we went right ahead with our big Short flying-boats, which were flying on the Empire routes to Australia and the Cape long before the Clippers got going. But Martin and Boeing and Vought-Sikorsky soon began to catch up in size and engine-power.

Fighters

Then, close up to the war, came our lead in fighters—or combat airplanes. The Hawker Hurricane got in first with its eight guns, thanks to Lord Londonderry as Air Minister and Air Vice-Marshal (as he now is) Ralph Sorley, and to T. O. M. Sopwith, who put 1,000 Hurricanes into production without waiting for Air Ministry orders. The Spitfire, although designed first, was hung up in its development. So there were five Hurricanes in the Battle of Britain for every one Spitfire, and the Hurricanes shot down more enemy aircraft than did all other fighters (British and German and Italian) put together.

Thanks, also, to their Rolls-Royce Merlin motors, our fighters were a long way the fastest and highest climbers in the world. And our Bristol radial air-cooled motors gave our bombers a good lead over the enemy. The U.S. was down on fighters, for lack of a tried-out liquid-cooled motor, but the very high-powered U.S. radials got ahead of us early in the war, and we must wait and see what happens in the near future.

Anyhow, Merlins are being built in the States, and my Rolls-Royce friends tell me that they are interchangeable with ours of the same "mark." But by this time we are probably a mark or two ahead.

Armament

We fell down a few years before the war by not developing the 37-mm. Vickers cannon-gun—although it gave good results in a Blackburn flying-boat—and by not developing the .5-inch gun for aircraft, although we did so for ground service. The U.S. did develop the .5 for fighters and bombers, but they did not fit enough of them, so we had to re-arm, and armour, all the U.S. aircraft which came over here until well on in 1942.

Yet another feature the fair exchange of which has been no robbery is flaps. Mr. C. R. Fairey used flaps to change the camber of the wings of his seaplanes, to help them in getting off and to slow them in landing, just about the end of 1918, and he stuck to them, in spite of his critics, till, ten years or more later, his rivals in trade had to use them, largely because in the meantime they had been so thoroughly developed in the States. There they had Mr. Zapp's flaps, and Jack Northrop's split flaps, and the Lockheed sliding flaps, and assorted perforated and slotted and slit flaps on dive bombers, and landing flaps and take-off flaps, and even flaps on engine cowling to regulate the flow of cooling air. But I am pretty sure that Mr. Fairey can claim to have started them.

Turrets

We got a big lead with Archie Nash's gun-turrets and with the Boulton-Paul electric turrets. They saved hundreds of aircraft and thousands of lives for us, and will for the U.S.A.A.C.

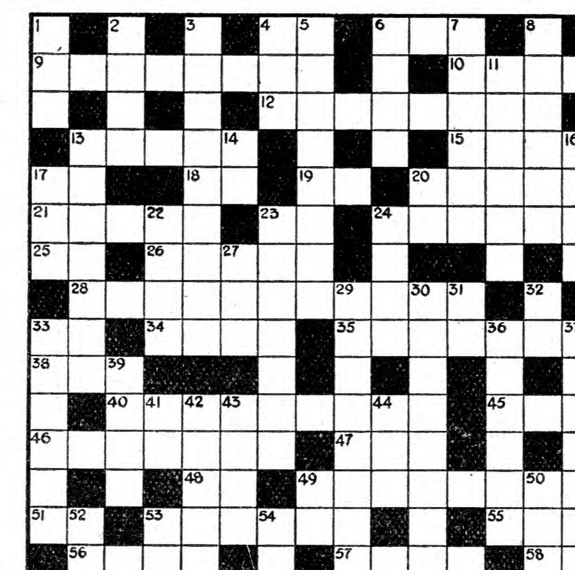
On the subject of big bombers I will not argue. The Liberator and Fortress are in a different category from the Lancaster, Halifax and Stirling. Ours are tens of miles per hour faster and carry tons more bombs. The U.S. bombers climb higher, fly farther and carry bigger guns, so let it go at that.

Radio-Location

We got well away with radio-location and with strange instruments used for anti-submarine patrol and for night-fighting. All our knowledge has been handed to the U.S. Army Air Corps and to the U.S. Navy. And to balance that the U.S. has provided us with quantities of air-transport craft, with which the airborne troops of our Army Air Corps did fine work in the invasion of North Africa.

CROSSWORD

Compiled by Flight-Lieut. S. C. Nunn. *Solution on page 24.*

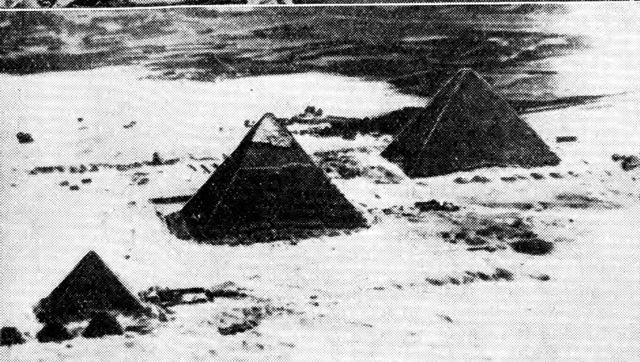


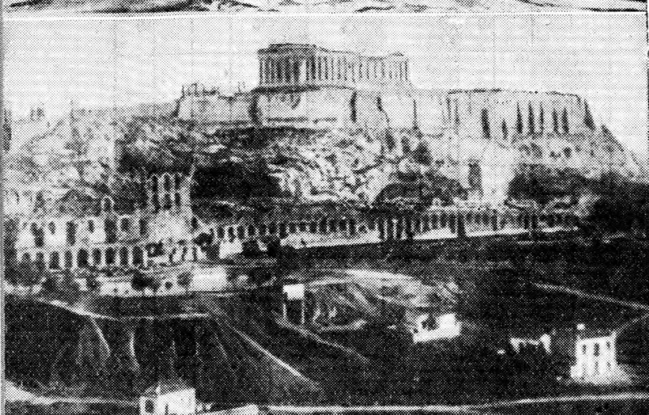
ACROSS

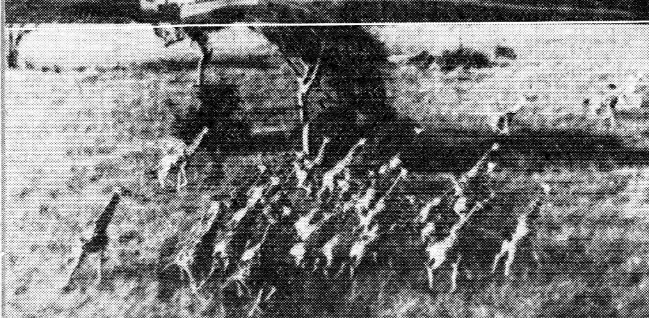
4. Peruvian civil aircraft marking (2).
6. Wise saying (3).
9. A Martin robber (8).
10. Target tract (4).
12. A form of government (8).
13. A Blackburn fish (5).
15. Cierva roundabout (4).
17. Weather permitting (2).
18. Initial training (2).
19. Set course (2).
20. An Avro teacher (5).
21. Douglas damage (5).
23. Advanced trainer (2).
24. Declare (6).
25. Orderly room (2).
26. Artless (5).
28. Republic storm accompaniment (11).
33. Lighter than air (2).
34. Discerned (4).
35. A D.H. jungle beast (7).
38. Air Navigation Act (3).
40. Vultee revenge (9).
45. Returned to unit (3). (7).
46. Vought - Sikorsky pirate (7).
47. Mixed ash (3).
48. I needed for vim (2).
49. A Stinson soldier (8).
51. Seafire belongs here (2).
53. A Westland wild animal
55. Are mixed (3).
56. Famed for their flying snake (4).
57. A Martin planet (4).
58. Ground speed (2).

DOWN

1. Electrical member of the Air Council (3).
2. End of a Miles (4).
3. Hawker storm (9).
4. Nearly over (3).
5. From where the Buffalo roam (8).
6. Blackburn bird (4).
7. Supermarine amphibious mammal (6).
8. High-handed Hawker (6).
11. To whom the Riot Act applies (6).
13. Ascetic cruiser (7).
14. Knight (abbr.) (2).
16. Mixed star (4).
17. Relative pronoun (3).
20. End of some naval fighters (2).
22. Responsibility (4).
23. Grumman retributive agent (7).
24. Bitter juice (4).
27. End of a Dragon (3).
29. Bristol battle (8).
30. Lockheed constellation (8).
31. O from top (2).
32. King's Regulations (2).
33. Republic cavalryman (6).
36. Italian bird (6).
37. A dauntless manufacturer (7).
39. Maker of cities (4).
41. Centre west (2).
42. Pertaining to 51 Across (5).
43. Fishing line (4).
44. Ada would make this a place were pilots train (3).
49. Stratus clouds (2).
50. Tail of an iceberg (3).
52. Note well (2).
53. End of cowl (2).
54. That is (2).







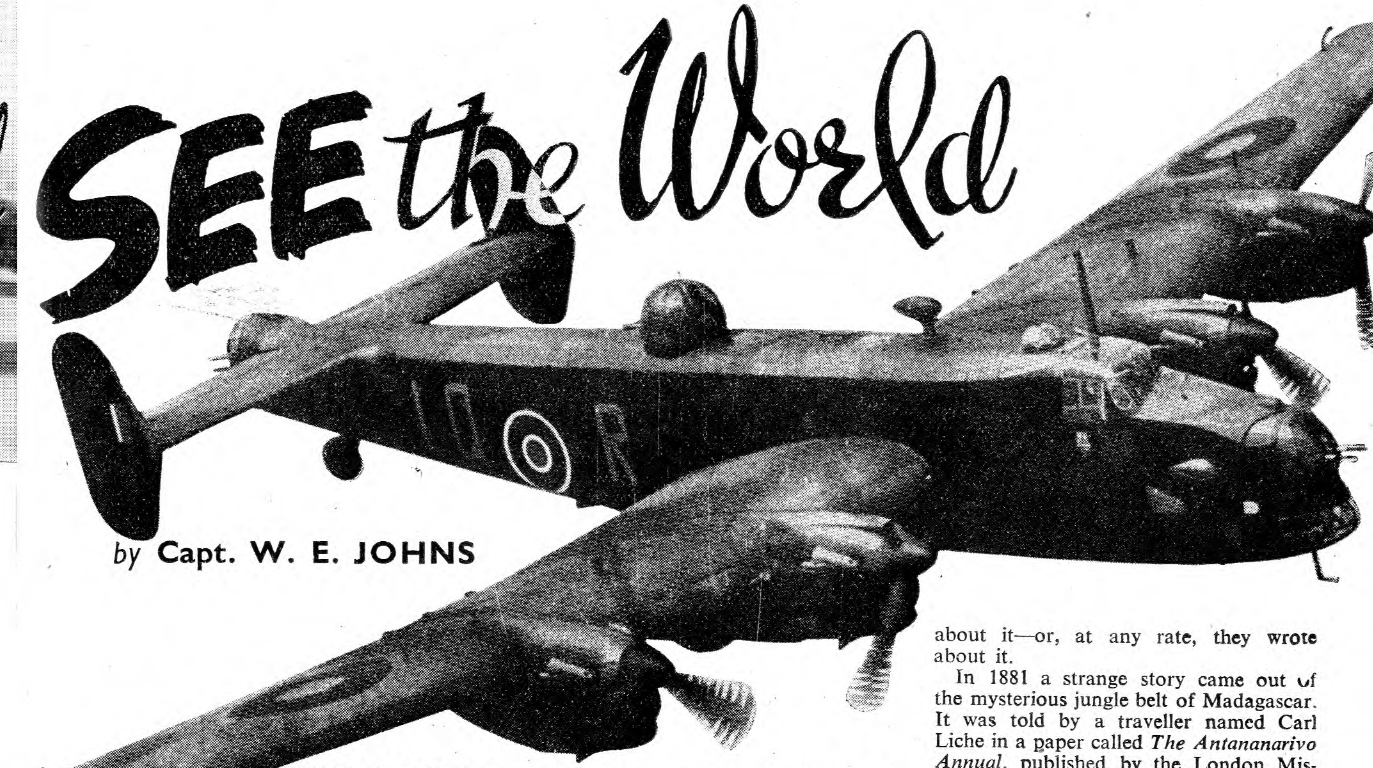
...and SEE the World

by **Capt. W. E. JOHNS**

WITHOUT taking credit for thinking of the slogan, "Join the Royal Air Force and see the World," I can at least claim to have been present when it was selected from scores of others. I was on the staff of the Inspector of Recruiting, and my vote went for it. It went because, by that time, my days of sheer ignorance were passing, and I realised that I had travelled over much of the world without seeing it.

A lot of fellows now in the R.A.F. are seeing the world—or are they? Speaking from experience, I suspect that a lot of them are getting around without *really* seeing it. They just look. Presently you will perceive more clearly what I mean, but before we come to that there is another point to be held in mind. It is this. An armed force can go, and often does go, to places where a peace-time traveller could not hope to get—at any rate, could not get without spending a considerable sum on a fully equipped expedition. So fellows who wear the King's uniform, and the R.A.F. in particular because they fly high and fast, do, in fact, have exceptional opportunities for seeing the world. Not only do they travel free of charge, but they are paid for doing it. The point is worth remembering.

When we come to seeing the world there are two outstanding angles on which to focus. First, there is the straightforward scenic aspect, and secondly there is the profit-taking side. Let us deal with the enjoyment angle—it won't take long, because it is pretty obvious. It is a good thing for a man to see the greatest wonders of Nature, and the splendid monuments left by civilisations that have gone before. If he has any imagination these things put him in his place. I will go so far as to say that no man can regard his education as complete until he has seen these things—things like the stupendous pyramids of Egypt and the incredibly lovely Taj Mahal of India. No picture can do them justice. Not until you have been to Isaphan, in Persia, can you begin to grasp the atmosphere of the Arabian Nights. But always remember that seeing doesn't mean much, unless you know something about the thing you're looking at. Unfortunately, in war, an airman doesn't always know where he's going; but if you are ever posted overseas, and you do know where you are going, make a point of getting a good book on the country and read it on the way out. Then the things that you will see will mean something more than just bricks and mortar.



Handley Page Halifax (span 98 ft. 10 ins.)

Now let us turn to the commercial side of seeing the world. I'm not going to suggest that the Service be turned into a business undertaking. That isn't the idea. But there is no reason why a knowledgeable fellow, by taking note of what he sees, should not turn it to good account, particularly if the country profits by it as well as himself. Let me give you a few examples of the sort of thing I mean.

I once watched an airman on leave in India chipping little pieces off a rock. At the time this struck me as a singularly futile way of passing a hot day when there was good bathing to be had at no great distance. It turned out that this enterprising young man had been a student of metallurgy. He had spotted, in passing, an outcrop of bauxite, from which aluminium is derived. I forget how much he got for his concession, but it was a considerable sum. At the same time he did the country a service. That's what I call really seeing the world with the R.A.F.

The first time anything of this sort came to my notice was away back in the last war, in Eastern Macedonia, where, in the early spring, the mountains are gay with flowers. Once, during a halt, I saw a man in my squadron, a lad named Jackson, digging up tulip bulbs with his bayonet. I ran into him after the war, and asked him how his posies were getting on. The laugh was on me, though, when he told me that he had sold twelve of these bulbs to a famous firm of growers for £20 apiece. He had recognised a new species of tulip—which, incidentally, is now in cultivation in this country. That, too, was seeing the world with eyes that really see.

I know another man who, while stationed at Singapore, made a nice packet of money by marking down valuable timber from the air as his duties took him over the Mergui Archipelago—that nearly uninhabited string of islands, about 400 of them, that trickles down the west coast of Malaya. It would have cost a lot of money to survey these islands in the ordinary way, and a timber concern was glad to pay cash for this information. And I remember another fellow who, in Burma, spotted and pin-pointed several thousands of acres of bamboo. At home he had been in the paper business, so he knew that this particular weed was in demand for high-grade paper. After he left the Service he got a concession and exploited it himself. He ran it for a year or two and then sold out to a big company for £5,000 cash and a rake-off on the profits. At least, that's what he told me, and as he was driving a Rolls I had no reason to doubt it. I had flown over that same area, yet I had not so much as an Austin Seven! See what I mean about seeing the world?

These days, when I hear of a squadron going overseas, I find myself thinking of the things I should keep an eye open for if I were in the party. Let us take just one example. I remembered it when I learned that our fellows had landed in Madagascar, for this is the reputed home of that vegetable monster, the man-eating tree. After the first fiction story had appeared in print, at the close of the last century, the writer claimed to have invented this horrific tree. He was a long way out. The ancients knew about it—or, at any rate, they wrote about it.

In 1881 a strange story came out of the mysterious jungle belt of Madagascar. It was told by a traveller named Carl Liche in a paper called *The Antananarivo Annual*, published by the London Missionary Society, which must have been convinced of its truth before going into print. In No. 5 of that Annual, dated Christmas 1881, you will find the story of the devil-tree by one of the few white men who have seen it.

Here, briefly, is the story. Liche and a companion named Hendrik were exploring when they encountered a primitive race who worshipped the tree. Hearing that sacrifice was to be made, the explorers persuaded the natives to allow them to be present. In the heart of the jungle they came to an area of bare earth, in the centre of which flourished a pineapple-like growth about eight feet high, thick at the base and about two feet in diameter at the top. From the top, eight leaves, regularly spaced, hung to the ground. They ended in sharp points, and were equipped with hook-shaped thorns. The leaves were dull green, and hung limply. In the top of the tree was a sort of receptacle filled with viscid fluid.

From beneath this nasty mess emerged a series of long green tendrils, which moved like serpents. The natives seized a woman for sacrifice, and forced her at the points of their spears up to the liquid. She drank, and became unconscious. The tendrils enfolded her. The huge leaves now rose slowly and closed over the victim. They remained in this position, says Liche, for ten days, when they went back to their original positions, exposing all that remained of the woman—just a heap of white bones.

Such is the story of Carl Liche. Were I in Madagascar I should look out for this vegetable, for which I can think of several uses. As a find, it would certainly be sensational.

WHY MATHEMATICS?

by Squadron Leader J. L. MITCHELL, D.F.C.

THE accurate navigating of an aircraft must be a fact on which all can rely: it should not be an exceptional or meritorious achievement.

Experience in three years of war has shown that this accurate navigation has been a hard aim to achieve. Progress in navigation training, though slow in peace-time, made rapid strides after the outbreak of the war. In R.A.F. schools to-day the staffs are largely ex-operational and with considerable flying experience. In addition, the training syllabus itself has been continually revised. It contains all the practical details required for current and future operations, together with the correct balance of theoretical background, bearing in mind the most economical training time available.

Present-day navigational technique has, however, reached a new high intensity, and the cadets have to absorb more concentrated digests of a variety of subjects during their training. To help the cadet in his R.A.F. training the A.T.C. provides the sound background.

The essential basis of all navigation is Dead Reckoning, which is defined as the process of determining an aircraft's position from various factors—speed, direction, wind and any other influences which may have affected it since its last known position.

This Dead Reckoning is fundamentally mathematical, and until you have a firm grip on elementary mathematics you are most unlikely to succeed as a navigator. That is why such a large amount of time in the A.T.C. syllabus must be devoted to this subject. No cadet, however bright and clever in other directions, will be able to cope with his subsequent training as a pilot or navigator if his pre-entry training is deficient in mathematics.

Results have shown that R.A.F. entrants whose education is barely sufficient to scrape through the Aircrew Recruiting Centre examination are very likely to fail at a later stage in training, owing to the inability to absorb the concentrated R.A.F. training.

Any efforts you make to improve your power of learning, particularly in mathematics and science, are well worth while. In order to stress the importance of mathematics in actual operational flying, here is an example of the type of problem which is continually recurring.

The Problem

A Halifax returning from a raid on the Baltic ports is damaged by gunfire. The outer port engine is knocked out and has stopped. The inner starboard has been damaged in the coolant header tank and is running very hot, compelling the pilot to reduce his revs. In consequence, the remaining sound engines are being flown at maximum permissible boost (for level flight) in order to maintain height. In addition, the captain suspects that the starboard-wing tank may be leaking.

The forecast winds are given as 190/25 knots at 15,000 feet, 240/20 knots at 5,000 feet. Should the captain risk a long sea crossing to his base in Yorkshire flying high (with the wind abeam), or should he alter course for East Anglia (about 100 miles nearer), flying low against a lesser head-wind?

How the Problem is Solved

He can decide this only from the navigator's calculations. Obviously certain information is wanted.

In the first place the navigator needs to know an approximate petrol consumption. (Note: consumption at rated altitude, 15,000 feet, is less than consumption at any other attitude). This can be done by reading the tank gauges over a given period long enough to be accurate—say, twenty minutes.

$$\text{Consumption} = \frac{\text{Difference in readings}}{\text{Time in minutes}} \times 60 \text{ gallons per hour.}$$

Secondly, the amount of petrol remaining in the tanks is wanted. This is taken from the gauge readings at the time. Finally, the distances to the two possible aerodromes from the point of altering course are required.

To decide which is quicker, the navigator must determine the true air speed for his aircraft's cruising speed, both at 15,000 and 5,000 feet.

Armed with this information he can now determine his ground speed for the different winds on each course, thus calculating the estimated times of arrival in each case.

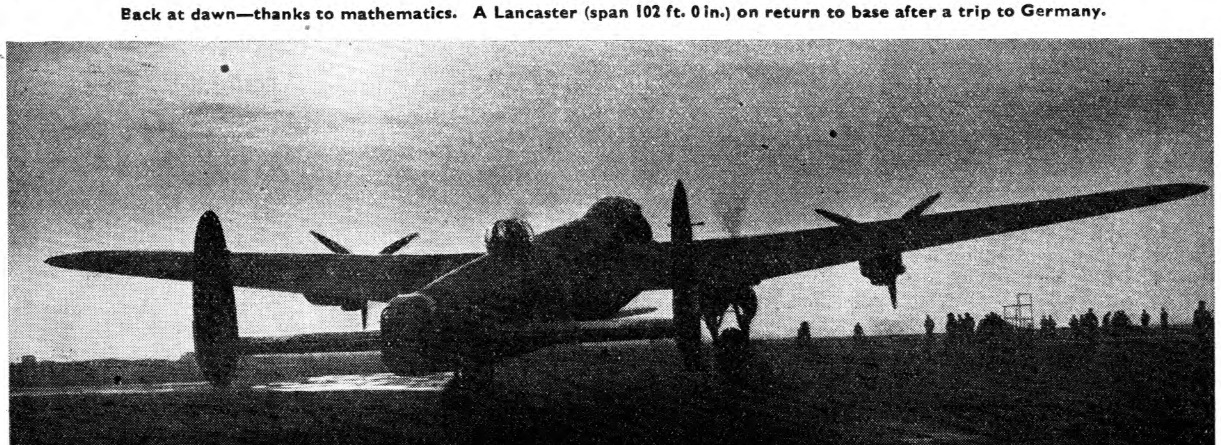
Quite Simple

There is nothing in this problem beyond simple arithmetic and accurate plotting. Obviously a difference of five minutes might well make the difference betwen safety and disaster. The onus of this work falls entirely on the navigator, and his decision will probably be required within five minutes. Such is the responsibility of the navigator.

This is a most elementary example. Astronomical navigation, in which every navigator must be qualified, calls for more advanced work.

The basis of navigation is, therefore, mathematics, and without the elementary qualification called for by the A.C.R.C. you cannot hope to succeed as a navigator. Further articles dealing with the principles of navigation are to follow.

Back at dawn—thanks to mathematics. A Lancaster (span 102 ft. 0 in.) on return to base after a trip to Germany.



Your Parachute

by P. W. BLANDFORD

ALL the early parachutes had one big drawback. When released, they started oscillating, and the flier swung like a pendulum, with ever-lengthening swings until, if he was unlucky, he hit the ground at the end of a swing. This increasing oscillation was caused by the air having to find its way out around the canopy. This meant that as the parachute swung as it dropped through the air, the air trapped underneath tried to escape from the higher side, thus tending to lift it higher, so increasing the length of each swing.

The fault was cured in the Irvin parachute by making a hole in the centre of the canopy. This had the effect of causing the length of the swings to diminish instead of increase, so that by the time the flier touched the ground he was almost certain to be suspended vertically.

Construction

The modern general-purpose parachute is made of silk and has a canopy of 24-ft. diameter with a hole of 2-ft. diameter at the top. It is divided into 24 "gores" or main divisions, each of which is divided into four panels. By breaking it up into so many small parts, the strength of the parachute is increased and any damage localised. If the material is cut the splits will all be confined to one panel, as they cannot travel further than the seam in any direction, and the parachute will not become completely unserviceable.

The flier is suspended by 12 rigging lines which pass through the seams between the gores and across the canopy, the 24 ends passing down in four groups of six which are fastened to D-rings on the harness.

Operation

There are two types of parachute in general use—the pilot type, which is worn all the time, the pack being used as a seat; and the observer type in which the harness is worn all the time, but the pack is only clipped on when needed in an emergency. Both parachutes are the same, except for differences in the harness, pack and position. The pilot-type parachute hangs down behind the wearer and the rip-cord is brought up to the handle in a convenient position on the left-hand side of his chest. The observer-type pack has the rip-cord handle fixed in front of it so that when the pack is in position, the handle is within convenient reach of the right hand.

Silk, as you have probably proved by squeezing a silk handkerchief, can be compressed considerably, yet will spring out as soon as pressure is released. The parachute is compressed inside a canvas pack which is held closed by a pin through some eyes attached to the canvas sides. When the rip-cord is pulled this pin comes out of the eyes and the canvas sides are pulled open by elastic cords. A small parachute which is fitted with springy ribs immediately bursts out followed by the main parachute. The small parachute assists the main one to open as quickly as possible.

The harness is fitted with a quick-release box, so that the wearer can get out of it quickly when he reaches the ground. The ends of the four main straps fix to a square metal block in front of the wearer's body. These can all be released quickly if the knob on the block is turned in readiness and then given a smart hit, when all the harness will fall away.

Checking

Regular fliers have their own parachutes, but when you visit an airfield and are taken up, you will be issued with a spare one. It is almost certainly in perfect condition, but nevertheless, for the sake of practice rather than from any suspicion that your hosts have been careless, you may wish to check it for yourself. There are only a few points, and it takes only a few moments to check them:

1. Look at the pack and make sure that it does not carry a white label bearing the word "Instructional." If it does you know that that parachute is not meant to be taken in the air, and is only used for training in packing.

2. Lift the flap at the centre of the pack and make sure that the pin is not bent. See that the red thread on the pin is intact. This thread is used to prevent the pin being pulled out by an accidental knock on the rip-cord handle.

3. See that the pack is not wet or greasy.

4. Test the quick-release knob on the harness.

5. Make sure that you cannot feel any hard lumps in the pack.

6. Finally, remember that there is a log-book for every parachute. Each parachute is subject to periodical inspection, and has to be opened out and dried every month. An entry has to be made in the log-book every time this is done, so in case of doubt it can be verified that the last entry is not a month old.

This picture of Sergeant L. R. Tonkin, an Australian, leaving a Stirling, presents a good view of the observer-type parachute pack and harness.

False Gremlins

by **DUTY PILOT**

"IF you have a Gremlin in your squadron, get rid of it. It is not on our side." Those are the words of a Welshman, Warrant Officer Hugh E. Jones, who lives at a place called Tonypandy, in Glamorganshire. Wales is often thought of as one of the last homes of fairies, elfs, goblins and what not. The name Tonypandy itself sounds like a province of fairyland. But Mr. Jones, besides being a Welshman, is a hard-headed engineer who was in the R.F.C. in the last war. He tells in a letter of some accidents he saw which he attributes to carelessness rather than to Gremlins, and goes on to say: "We had little trouble with Gremlins in our squadron, because we used to place them in the guardroom. There is a danger that cadets may accept this Gremlin stuff not as myth but as an accepted factor and reasonable excuse for accidents." But perhaps it is not because he is an engineer, but because he is a Welshman and therefore knows more about fairies than simple-minded Anglo-Saxons, that Mr. Jones believes Gremlins are bogus.

"The sort who would pine away and die if ..."

The Origin of Gremlins

The origin of Gremlins has been hotly disputed in fun and in all seriousness. One theory is that they have something to do with a beer bottle. Whether that is true or not, there is no doubt that some of the things for which they are blamed could be traced to too many empty beer bottles.

The real explanation is simple. There is in all warfare an element of luck. However good you are, however well you know your job, there is a chance that the fortunes of war will lay you low. You may, for instance, collide over the North Sea with a German who is returning your call of the night before. Such things are chances which elude the international laws of warfare, the rules of air navigation and the axioms of air tactics. Our devout forefathers ascribed them to the will of God, or to the machinations of the Devil. The rationalist of scientific and mathematical training can explain them by a simple exposition of the permutations of numbers. But many people to-day have lost their faith in God without acquiring a scientific understanding of the works of nature. They have fallen between two stools. Yet not being complete fools, they know that everything must have a cause, and so to save themselves further trouble they turn to the Gremlin for explanation of all they do not understand.

Freedom of Faith

They may be right. There are more things in heaven and earth than this world dreams of. God forbid that anyone should deny to the fighting-men in their arduous duties any comfort of mind that Gremlins can give them. This is a free country, and freedom means that we are free to believe either in God or in Gremlins. This is also a polite country, which means that one does not laugh or sneer at other people's faiths, whether faith in God or faith in Gremlins. But because it is a free country, we are also entitled to question in a calm, unprovocative manner the existence of Gremlins, just as we are free to question the existence of God.

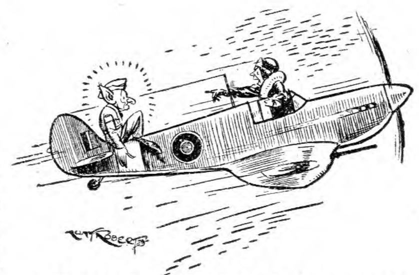
False Gremlins

I will not go so far as Mr. Jones. All I want to do is to point out that there are certainly false Gremlins. And I will discuss false Gremlins with the same reverence towards the real thing that a devout Christian might use in exposing the claims of false gods.

Take, for instance, this business of landing with the undercarriage up, for which the Gremlins are so often blamed. I have investigated many such cases, and never once has it been finally established that a real Gremlin was to blame. It has always been enemy action, a careless pilot or a careless mechanic disguised as a Gremlin. A burst tyre, on the other hand, might sometimes be properly ascribed to a Gremlin. Not the really powerful, everlasting Gremlins, but the sort who would pine away and die if the aerodrome surface were properly cared for, if the tyres were always properly inflated and not allowed to become too worn, and if aircraft were never brought down too heavily.

Gremlins Cleared

In all the accidents investigated by the Accidents Branch of the Air Ministry it is seldom proved that a Gremlin has been at work. When the pilot has himself been cleared and has good-naturedly been content to cast responsibility on the Gremlins, the Accidents Branch in its further investigations has with uncanny skill been able to trace the fault to a careless mechanic, an overhasty aircraft worker, to a faulty piece of staff-work, or to sheer ignorance. In fact, only about once in a hundred times does the Accidents Branch ever attribute an accident to a Gremlin, and even then in its cold scientific and official way it does not mention the word Gremlin at all, but uses instead a cold scientific phrase which means in effect that its own Gremlins have prevented it from arriving at the real cause of the mishap.



"The bad Gremlin delights in the company of fools."

The Good Gremlins

Besides the bad Gremlins, there are good Gremlins, creatures who are supposed to come to the aid of the flying-man. The more I hear about events in which their influence has been exerted, the more I am convinced that good Gremlins are intellectual snobs who come to the aid of only the most competent flyers. I have never yet heard of a good Gremlin bringing home a bad navigator, and good Gremlins will never do anything to cast any doubt on the truth of the old proverb, "A fool and his aeroplane are soon parted." But the bad Gremlin delights in the company of fools, and in the aeroplanes of the ignorant and the idle he waxes strong and multiplies.

By all means believe in Gremlins if you wish. If faith can move mountains it may create Gremlins where no Gremlins existed. But be sure that the bad Gremlins you believe in are real Gremlins and not yourself or other people in fancy dress. And if you believe in Gremlins make quite certain that you get your fair share of the good Gremlins who, being intellectual snobs, prefer the company of the competent.

"We used to place them in the guardroom."

SOME FUNDAMENTAL Radio Circuits AND PRINCIPLES

by JOHN SINCLAIR

The Crystal Receiver

ALTHOUGH the crystal receiver has no modern application, except as a "stand-by" instrument, the basic circuit embodies one or two features which can be regarded as of fundamental importance. Consider Fig. 1. This circuit includes a device known as a variometer. It took the form of a pair of coils, one of which could be rotated inside the other. The two coils were connected in series, and by rotating the inner coil the magnetic field of the latter was made to assist or oppose that of the outer coil, and so alter its inductance. The effect of altering the inductance was to vary the tuning of the circuit, which, although not sharp compared with modern standards, was at least satisfactory in view of the type of wave emitted by the transmitter.

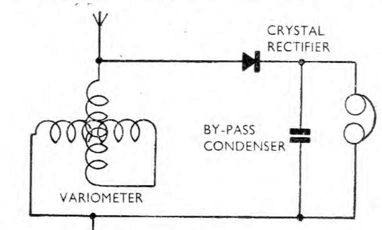


Fig. 1.
A crystal detector circuit employing a variometer for tuning, a device still incorporated in certain R.A.F. sets.

The fact that a crystal set, designed originally to receive spark telegraphic signals, can also be used to receive speech and music undoubtedly contributed in no small measure to the instantaneous success of organised national broadcasting when it was introduced. A crystal set is extremely simple to construct, and is even now regarded as one of the most satisfactory devices if high-quality reproduction is required without regard to selectivity.

Readers who are acquainted with the well-known T1083 transmitter will remember that a variometer is embodied in the circuit.

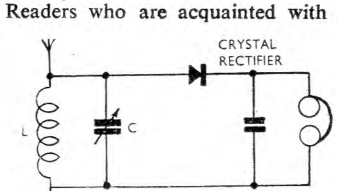


Fig. 2.
The parallel method of tuning—here shown applied to a crystal detector circuit—is in universal use.

In order to obtain sharper tuning some crystal receivers employed a variable condenser and fixed inductance connected in parallel, as shown in Fig. 2. This system of tuning forms the basis of many modern receiving circuits. Forget for a moment all the intricate systems, such as ganging, and think only of the principle behind them. We find a coil (L) and a condenser (C) arranged to produce a condition of "resonance."

The parallel method of tuning is more efficient than the series arrangement (i.e. coil and condenser in series with aerial and earth), because it provides for a greater wave-range to be covered with a given tuning coil.

The aim in all tuned circuits is to obtain the maximum voltage at resonance. When, as in this case, the tuned circuit is across a detector we are concerned specifically in transferring the maximum signal voltage from the aerial into the detecting device.

Detectors

The crystal is perhaps the best-known simple detector (or, to be more accurate, "rectifier"), but in considering basic circuits we must not forget that the "diode" (two-electrode) valve was developed many years earlier for a very similar purpose. The original Fleming valve was a perfectly good rectifier, but because of later developments, which culminated in the invention by Lee de Forest of the "triode" (three-electrode) valve, its usefulness in that respect was masked. It was not until recent years that the diode again came into prominence as a detector or rectifier, by which time it had been considerably improved. The circuit of Fig. 3 shows a diode operating as a rectifier of radio frequency signals.

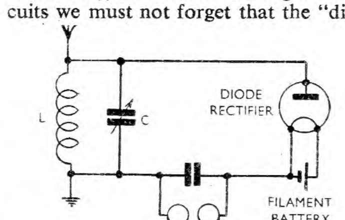


Fig. 3.
The diode valve used as a rectifier of radio frequency signals. A similar device is used in modern broadcast receivers for combined detection and the production of automatic volume-control voltage.

The Triode Valve as Oscillator

The introduction of the triode valve—the modern Aladdin's Lamp—revolutionised all radio communication, because it enabled engineers to overcome one of the greatest difficulties they had had to face up to at that time, namely, the production of a wave which did not suffer from the effects of "damping." Prior to the "arrival" of the triode the spark system of transmission had held almost full sway, although high-frequency alternators had met with some measure of success.

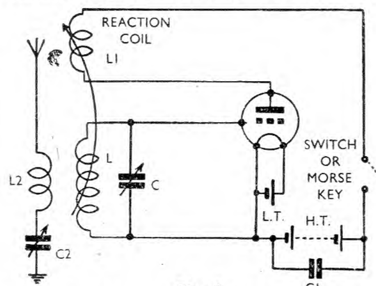


Fig. 4.
The triode valve arranged to produce R.F. oscillations. By introducing reaction the selectivity of a receiver can be considerably increased. An oscillating triode can be used to transmit telegraphic signals by keying the H.T. circuit.
LC—Input tuned circuit.
L1—Reaction coil.
L2, C2—Aerial tuning circuit.
C1—Bypass condenser.

The triode permitted the production of "undamped oscillations" with a very considerable increase in efficiency. Undamped waves, or, as they are usually termed, "continuous waves," can be produced in many ways. The essential requirement is that the valve shall be so arranged as to permit some portion of the energy built up in the anode circuit to be fed back into the grid circuit. A circuit of an elementary oscillator is shown in Fig. 4. The main tuned circuit LC is connected betwen grid and filament, whilst the coil L1 in the anode circuit is placed so that its magnetic field interacts with the coil L. When the H.T. is connected to the valve a current will flow through L1 and through the valve. The magnetic field so produced will cut L and induce, say, a negative voltage on the grid. This will reduce the current through the valve.

(*Continued on page* 24)

Radio Circuits

(*continued from page* 23)

and as a result the voltage in L will be reversed, as the current in L1 is decreasing instead of increasing. A positive voltage will then be applied to the grid, resulting in the anode current again increasing. This process will continue, with the result that continuous waves are produced. Oscillations can be produced by capacitative as well as by inductive coupling.

Reaction

In referring to Fig. 4, reference was made to the coil L1 without naming it. This is known as the "reaction" coil. The introduction of reaction into a receiver circuit enables us to increase its efficiency very considerably. Furthermore, the selectivity, or sharpness of tuning, is greatly increased. It is no exaggeration to say that the principle of reaction revolutionised receiver design as no other single principle has ever done.

There is one danger to be avoided when employing reaction—namely, the tendency to increase reaction to the point where the valve bursts into oscillation. Many cases have occurred where an oscillating receiver has caused widespread interference over large areas. The observant reader will have seen that the circuit of Fig. 4 could be used for transmitting purposes with only minor modification. By the insertion of headphones in series with the H.T. battery it would become a single-valve detector circuit. It was from a circuit of this type that modern communication receivers have been developed.

. . . .

RECOMMENDED PUBLICATIONS

(1) *Radio Receiver Circuits Handbook.* Squire (Pitman.)
(2) *A First Course in Wireless.* "Decibel." (Pitman.)
(3) *Foundations of Wireless.* Sowerby. (Iliffe.)
(4) *Radio Simplified.* Clarricoats. (Pitman.)
(5) *Amateur Radio Handbook.* (Radio Society of Great Britain.)

CROSSWORD SOLUTION

(*see page* 17)

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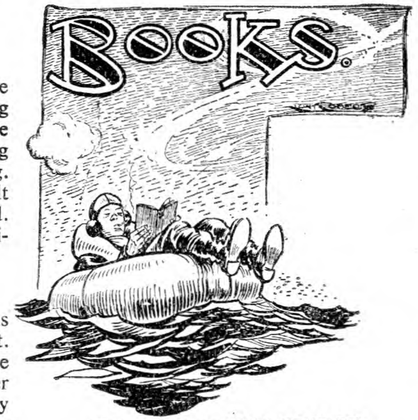

REVIEWED BY THE EDITOR

The opinions expressed are those of the Editor of the AIR TRAINING CORPS GAZETTE, *and should not be taken to imply any approval or disapproval on the part of the Air Ministry or the Air Training Corps*

Bombre Pilot

By Squadron-Leader Leonard Cheshire, D.S.O., D.F.C. Hutchinson. 6/-. 136 pp. 8¾″×5½″. 21 illustrations.

There have been fewer books written by bomber pilots than by fighter pilots. This one makes up in its quality for the disparity in numbers. The reader is carried along by the sheer interest of the story, and the vivid reporting, but at the same time absorbs a good deal of technical and tactical knowledge that will stand him in good stead when he enters the Royal Air Force. The book has plenty of good humour, yet does not gloss over the tragedies. It emphasises that a man's enterprise and fortitude in action are of no account unless he has taken the trouble to make himself efficient in his training. The author starts on Whitleys at the beginning of the war, goes on to Halifaxes, does a bit of coastal reconnaissance, and some Atlantic ferrying, finishing up with a description of the 1,000-bomber raid on Cologne. The book is full of action and holds your attention to the end.

Seven Pilots

(January 1943.) By Charles Graves. Hutchinson. 8/6. 176 pages. 7¼″×4¾″. 17 illustrations.

Ordinary fiction about air fighting is a waste of time in this war when there are so many unsung heroes, and when truth is so much more stranger and so much more thrilling. But Mr. Graves's account of the seven pilots, a sequel to *The Thin Blue Line* and *The Avengers*, is based closely on fact. Its heroes are real people thinly disguised, and the exploits it recounts are matters of R.A.F. history. It is good reading.

R.A.F. in Russia

By Hubert Griffith. Hammond, Hammond & Co. 5/-. 96 pages. 7¼″×4¾″. 15 photographs.

"The Conference was of pressing interest to all concerned, because (*a*) immediate action was imperative, and (*b*) all preconceived notices of what was going to happen had suddenly fallen to the ground."

You will realise from that short extract that this account of the R.A.F.'s activities in Russia is written in the pedestrian style that is appropriate to adjutants. But if you want such facts as may be disclosed they are here without embellishment.

The Fleet Air Arm

(February 1943.) By John Moore. Chapman & Hall. 5/-. 140 pages. 7½″×4¾″. 10 illustrations and 3 maps.

Mr. Moore, an experienced Fleet Air Arm pilot and an experienced writer having sixteen books to his credit, has produced a very fine book about the Fleet Air Arm. His technical details are accurate, his descriptive writing vivid and his comments on air and naval strategy are shrewd. There is a brief account of the development of the Fleet Air Arm from the R.N.A.S., but most of the book deals with operations in this war. A book that every cadet should read whether he is going to enter the Navy or not.

Coastal Command at War

By Squadron Leader Tom Dudley-Gordon. Jarrolds. 7/6. 192 pages. 7½″×4¾″. 44 Photographs.

This book has been rather overshadowed by the official book *Coastal Command*, published at 2/- by the Stationery Office. Those who have read the official book and want to learn more will find that Squadron Leader Gordon's book will help to complete their picture of the very fine organisation that operates over the waters round our coasts and far beyond.

Flight Handbook

(Third Edition, November 1942.) Flight Publishing Co. 6/-. 203 pages. 7½″×4¾″. Well illustrated and with 10 special illustrations.

This Third Edition of the Flight Handbook has been greatly enlarged, improved and brought up to date. It appears anonymously, but many experts seem to have contributed to it, and the result of their combined work is that you get in one small book 200-odd pages of really useful, accurate, clear technical information on aerodynamics, aircraft structures, gliders, airscrews, engines, superchargers, instruments and other subjects, including such modern developments as turbo superchargers.

Advanced Flying

(January 1943). By Captain Norman Macmillan, M.C., A.F.C. Allen & Unwin. 2/6. 72 pages. 6½″×4¼″.

Already in its short life the *A.T.C. Gazette* has seen articles from its pages find their way into the more permanent literary form of books. This is an indication that its contents are more than of mere ephemeral value. Captain Macmillan's new book (his fourteenth) is compiled partly from his articles which appeared in the *A.T.C. Gazette* some months ago. Readers of those articles hardly need to have the book recommended to them.

The Air Scout Handbook

Published by the Boy Scouts Association. 1/-. 104 pages. 7¼″×4¾″.

A miscellany of aeronautical information intended for boys, but useful also to A.T.C. recruits.

The Raid Spotter's Note Book

Compiled by C. Griffith. Charles Letts. 2/3. 5½″×4¼″.

Information on 103 aircraft of all types, including such machines as the Me. 210 and the Mosquito, is included in this note book, which deals also with first aid, sound spotting and war gases, among other things. The book is good value and should be useful to civilians and Servicemen engaged in the recognition of aircraft.

English for Air Cadets

(January 1943.) By Harry Bell, B.A.(Cantab.), Ed.B. Thomas Nelson. 2/-. 111 pages. 7½″×5″.

If you want to enter the officers' mess you should make every effort to become master of your own language, particularly that part of it which deals with your own profession, so that you may understand others, make yourself understood, and by the clarity and decisiveness of your speech and writing command the respect of your subordinates and the approbation of your superiors. A study of *English for Air Cadets* will help you in this achievement. Assuming an average knowledge of English grammar, it deals specifically with aeronautical idiom by means of exercises based on good recent air literature, and brings to a classroom subject a breath of fresh aerodrome air.

Aircraft Calculations

(1942.) By S. A. Walling and J. C. Hill, B.A. Cambridge University Press. 3/-. 159 pages. 7½″×5″.

A revised edition of the book which has already circulated widely as *Aircraft Mathematics.*

The Morse Code

(January 1943.) By R. G. Shackel. Longmans Green. 1/-. 64 pages. 7¼″×4¾″.

Revised edition of booklet which has proved of value to many instructors and learners of the Morse code. This edition includes the American as well as the British phonetic alphabet and the exercises have been carefully graded.

A First Course in Air Navigation

(1943.) By F. F. Crossley, B.Sc. Macmillan. 2/6. 89 pages. 7¼″×4¾″.

Navigation, map-reading, meteorology and instruments are dealt with briefly in this book. At the end of it there are test papers with answers.

Tally-ho! Yankee in a Spitfire

By Arthur G. Donahue. Macmillan. 7/6. 167 pages. 7½″×5″.

An interesting account of the author's experiences in the Battle of Britain. Writing for the American public, the author goes to the trouble of explaining in detail things which many other writers assume that the readers know. The book is therefore informative as well as a pleasure to read.

Paratroops

(January 1943.) By Captain F. O. Miksche. Faber & Faber. 10/6. 164 pages. 8″×5″. Maps.

Captain Miksche's book is concerned with the technical and strategic use of paratroops rather than the instruments themselves, and the military student can profit much from his detail of history of paratroop actions which have already occurred and his explanation of the future possibilities of this form of action.

Achievement in British Aircraft

By S. E. Veale. Pilot Press. 2/6. 36 pages. 10½″×14″. 80 illustrations. Paper covered.

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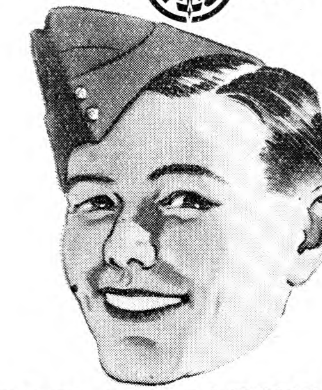

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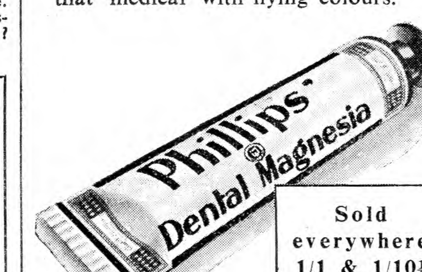

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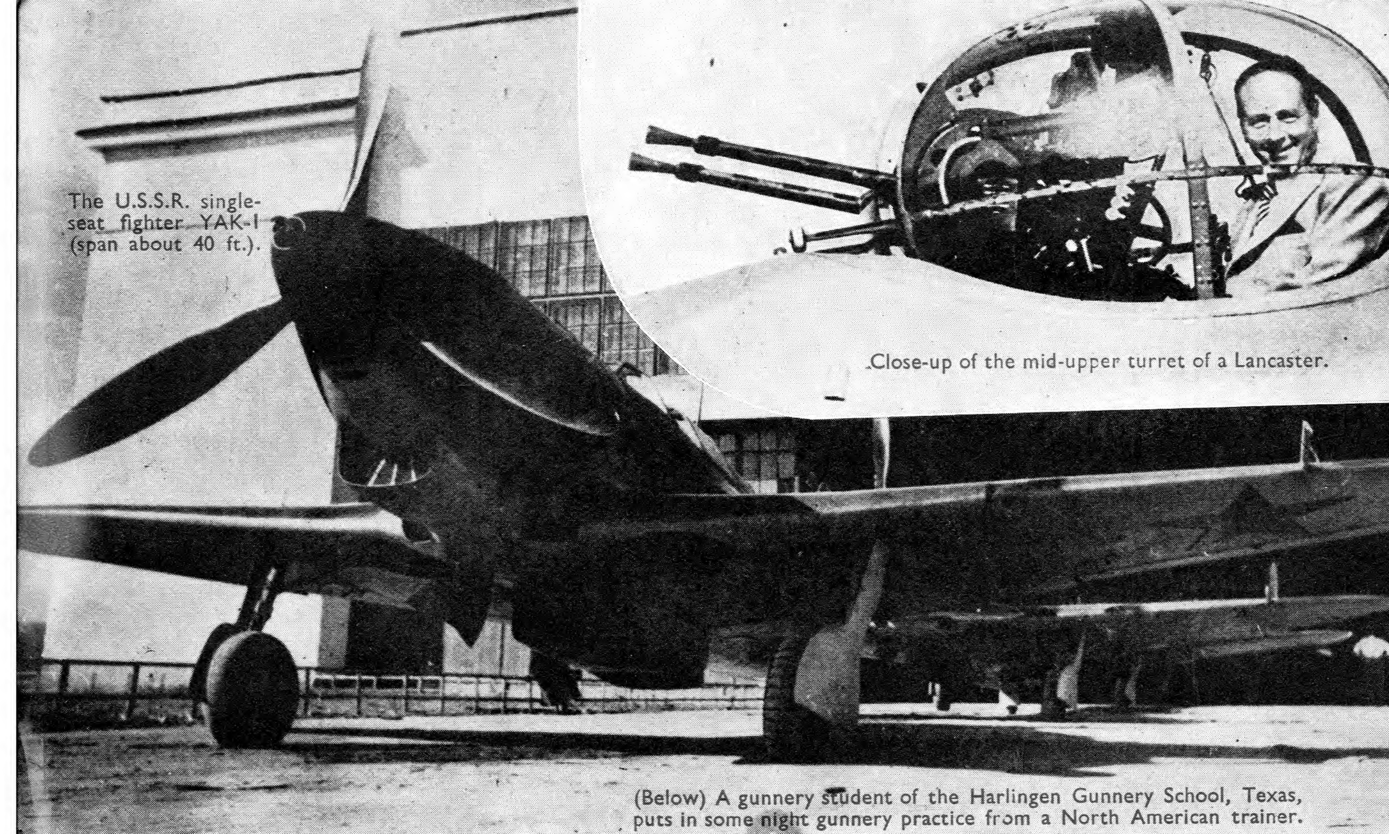
Published for the proprietors, The Air League of the British Empire, Kinnaird House, 1a Pall Mall East, London, S.W.1, by the Rolls House Publishing Co. Ltd., Rolls House, Breams Buildings, London, E.C.4, and printed by The Stanhope Press Ltd., Rochester, Kent.



The U.S.S.R. single-seat fighter YAK-1 (span about 40 ft.).

Close-up of the mid-upper turret of a Lancaster.

(Below) A gunnery student of the Harlingen Gunnery School, Texas, puts in some night gunnery practice from a North American trainer.