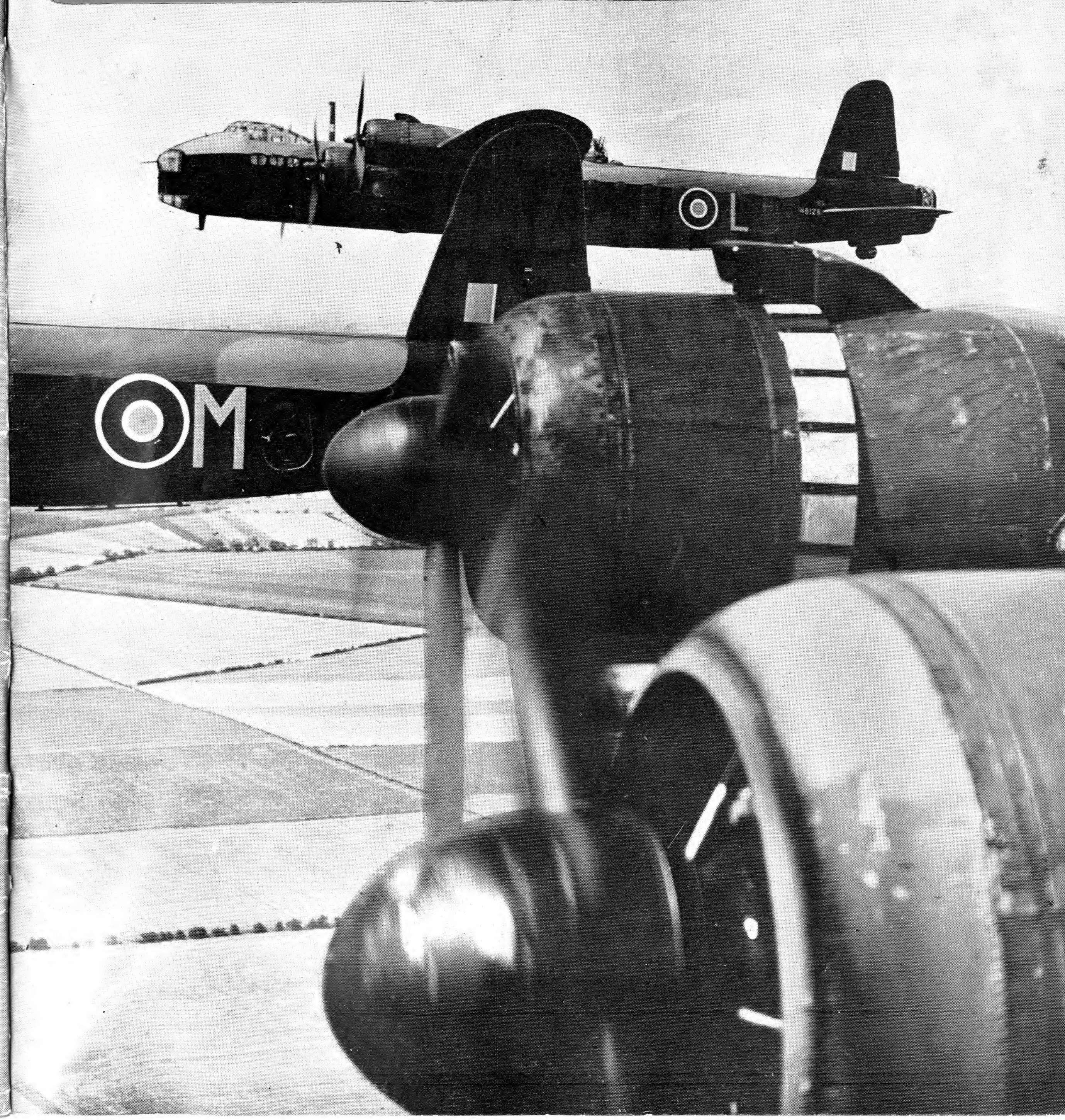
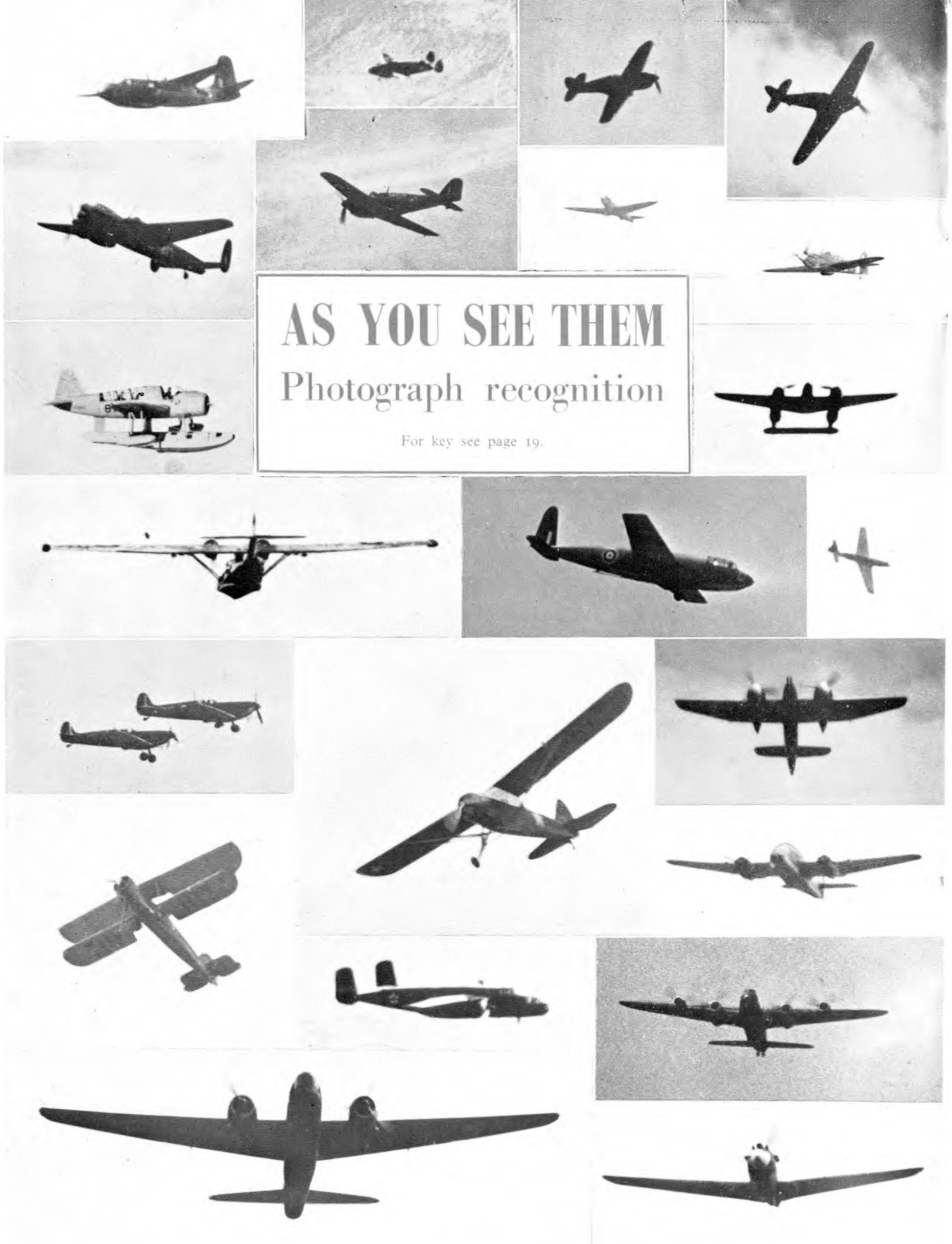
DO YOU KNOW WHY?

Answers by David Vine on p. 32

AIR TRAINING CORPS GAZETTE

VOL. II No. 10 OCTOBER, 1942 Price 6d.





AS YOU SEE THEM

Photograph recognition

For key see page 19.

Vol. II
No. 10

OCTOBER
1942

AIR TRAINING CORPS GAZETTE

Edited by Leonard Taylor

Editorial and Advertisement Offices
1a Pall Mall East
London, S.W.1
Tel. ABBey 5041

Publishing Agents
Rolls House Publishing Co., Ltd.
2 Breams Buildings
London, E.C.4

"The Game's Afoot"

SHAKESPEARE is not very popular reading nowadays, but we of the Air Training Corps who wish to improve our English could do worse than to read him and more particularly the fighting plays which have so much fine stuff in them.

Listen to the following:

"Now set the teeth and stretch the nostril wide,
Hold hard the breath and bend up every spirit
To his full height. On! on you noblest English
Whose blood is fet from fathers of war proof.

I see you stand like greyhounds in the slips
Straining upon the start. The game's afoot.
Follow your spirit and upon this charge
Cry God for Harry, England and St. George."

We do not, of course, make speeches like this nowadays; in their place over the radio intercommunication, pilots of the Allied Air Forces may hear the cry of 'Tally ho!' or 'Remember Pearl Harbour,' but the result is the same.

We are heartened to strain every nerve to win—and determined men cannot be stopped.

That is the spirit we want to cultivate in the Air Training Corps. We should go into our training like stiff-legged dogs about to fight. I hope that most of you will not have to fight in this war or in another, but we must all prepare ourselves in body and in mind and we must cultivate a spirit which overcomes obstacles, which ignores difficulties, and which is careless of anything but the will and the way to win.

Book learning is necessary for training to play our part in war and in life, but the spirit is more important still. It is in that spirit that the Air Defence Cadet Corps was founded, and it is that spirit that the Air Training Corps inherits from the R.A.F. and the Royal Navy.

Like King Henry, I could surely say to-day "I see you stand like greyhounds in the slips."

I hope that as the months go by we shall still be able to say the same thing.

J A Chamier

AIR COMMODORE,
INSPECTOR, AIR TRAINING CORPS.

P.S.—I hope that Scotland, Wales or N. Ireland will pardon the references to England and the English: that is Shakespeare's fault not mine.

Gliding is good exercise in team work. For every short flight a large amount of work has to be done on the ground—signalling, towing, retrieving and so on. These photographs (above and below) were taken in South-East London, where Flying Officer Furlong and others took cadets up for short dual flights. The machine is a Falcon two-seater, which is capable of sustained soaring flights. Soaring flights are, of course, banned during the war, and the cadets had to be content with brief 'up and down' trips.

SPORT as training for WAR

I HOPE that in spite of travelling difficulties, as much football as possible will be played by A.T.C. units this winter for outdoor recreation. For indoors there is nothing like boxing to encourage the qualities of quick thinking, co-ordination of hand, foot and eye and the development of stamina, all of which are so essential for the successful carrying out of aircrew duties.

In war time it is not possible to devote the amount of time to practice that any individual or team, to be any good, must devote in times of peace. But in peace time if a team is to be successful, each individual must be playing in a position for which he is best suited. This is the task for the selectors who pick the team. For a team to be successful, then, each individual must do his utmost to make himself as proficient as he can by study and practice.

When I was playing football I used to read all I could about the game, ask questions and discuss tactics with the best players, and I learnt much by watching experts at play. Above everything else, I tried to keep myself physically fit. You will find all first class players, whether of football or cricket, or champions at boxing or athletics, only become first class by continual practice and hard and continuous application.

Team Work

If a team is to be successful, each individual must know what is expected of him, and he must know how to help a team mate who may be hard pressed. The right team spirit and good team work naturally follow when members of a team thoroughly understand what they are required to do, and how each can best help the other. It is the duty of the captain to encourage and develop these qualities in the individual, and at the same time to be quite sure that all understand and obey his directions. In every hard and equally contested game, a time comes when the slightest easing up spells failure. Success can only come to the fittest and best-trained side. This means that each man must be fit or he will let his side down.

All this, which is so apparent in a game of football, is equally applicable in the air.

First of all, shortly after you enter the Royal Air Force you are graded, that is to say you are selected for a position in the aircrew in which it is thought you are most likely to be successful. This is where your training in the Air Training Corps will stand you in good stead. If you have passed your Part I proficiency certificate and keep yourself to standard at the I.T.W., you are guaranteed an air test.

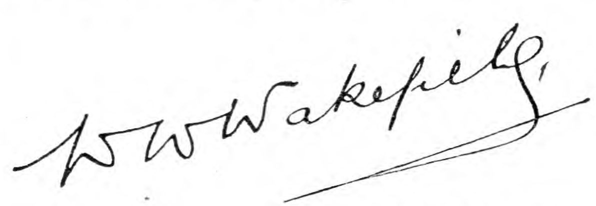
The success of our fighter squadrons in the Battle of Britain was due to skill, practice and good team work. The success of our bomber crews in getting to their objectives and frequently defeating enemy fighters invariably depends on good captaincy and team work.

Team Work in the Air

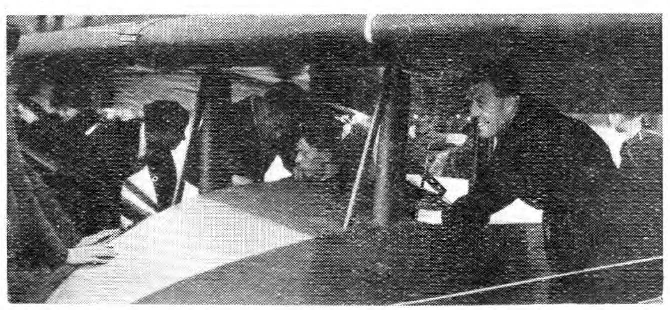
In air fighting, each pilot must know what is expected of him, and he must be ready to help a hard-pressed comrade. The squadron which fights as a team is the one which will win. The bomber whose crew—pilot, navigator, wireless operator and bomb aimer—each know their job thoroughly and work as a crew, will be successful. Testing time comes as in a game of football when things go wrong. If each man knows his job and all work under the captain as a team, then as we have seen time and again in this war, in spite of enormous difficulties, a mission is successfully accomplished and the aircraft and crew get back home.

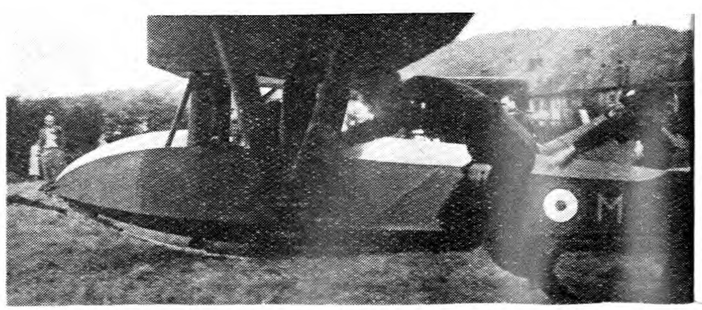
No Short Cut

Remember this; just as in the playing of a game, so in air fighting all famous airmen and good aircrews have only become famous and successful by continual study and practice and by a determination to make themselves absolute masters of their aircraft and its equipment. There is no short cut. Achievement can only be gained by hard and steady work. But what a joy and pleasure it is, and how great the satisfaction, when the target has been achieved. There is nothing out of the reach of any of us if we really set our minds upon our goal and determine to get there.



DIRECTOR OF THE A.T.C.





BIRDS v AEROPLANES

by **Frank W. Lane**

A RECENT analysis made in America showed that since 1936 more than 61 bird-aeroplane collisions have been recorded. As the smaller airlines do not keep such records it is safe to assume that the total number of accidents is probably nearer 100.

It might be thought that the modern, strongly made aircraft is proof against damage from any bird. The records do not bear out such a conclusion.

One pilot collided with a flock of five swans at night. One swan penetrated the leading edge of a wing, the second almost tore off the left fin and thus jammed the rudders, the third bird struck and dented the engine cowl and the other two swans went through the airscrew.

Much smaller birds than swans can inflict serious damage. Allen L. Morse, of the American Civil Aeronautics Administration, says one small bird penetrated the windshield of an aeroplane, then passed through the bulkhead, travelled the length of the cabin, penetrated the rear cabin wall and ended up by lodging in the baggage compartment!

Eagles are probably the most dangerous of all birds. Their large size and weight (up to 15 lb.), their habit of diving on their prey, be it bird, animal or aircraft, and their great speed in a headlong swoop (one record, admittedly high, gives this speed as approaching the terminal velocity of a medium-sized bomb), make eagles formidable antagonists to any machine.

This fact is officially recognised by the Air Ministry. A notice issued in 1934 warned all pilots in the Near and Middle East to fly above kites and eagles, as these birds invariably dived when frightened or angry.

Probably the most formidable case of an attack by eagles is that related by J. Wentworth Day, who writes that about eight years ago "Prince George Bibesco bought a tri-motor all-steel passenger plane built to carry 16 passengers and then about the biggest aircraft of its kind in the world. I went for a trip in it with Lord Sempill and Sir Alan Cobham, and when we were well over Reading I said to Cobham: 'Nothing short of an anti-aircraft shell would fetch this thing out of the skies.'

"Three weeks later a couple of eagles dive-bombed it near Allahabad in India and crashed it, killing the pilot and injuring some of the crew. The first flew straight into the middle engine, while the second dived from 10,000 ft. and went through the steel wing like a stone, ripping a great hole. This was undoubtedly a deliberate attack."

In America farmers charter aeroplanes to shoot down eagles which menace their flocks. But the eagles are wary, and use their superior manœuvrability to keep out of danger. The pilots have found that the best way to kill the eagles is to fly high and bank down, shooting from above. In Texas 13 eagles were thus shot in two days.

At least one eagle attacked its attackers. But now the eagles seek safety by dropping to earth and hiding among the scrub.

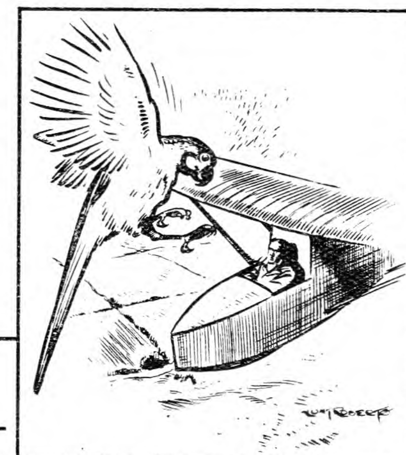
It is not only aeroplanes which are attacked by birds. A glider was attacked over Whipsnade Zoo by a macaw, that rather gaudy edition of a parrot. Screaming furiously, the bird attacked the pilot with beak and claws, and kept it up for about a quarter of a mile.

A favourite part of an aircraft for avian attack is the windshield. Only a few months ago a big American observation aircraft was forced down owing to a sparrow crashing through the shield. Tests have therefore been made to see how windshields can be made immune from such attack.

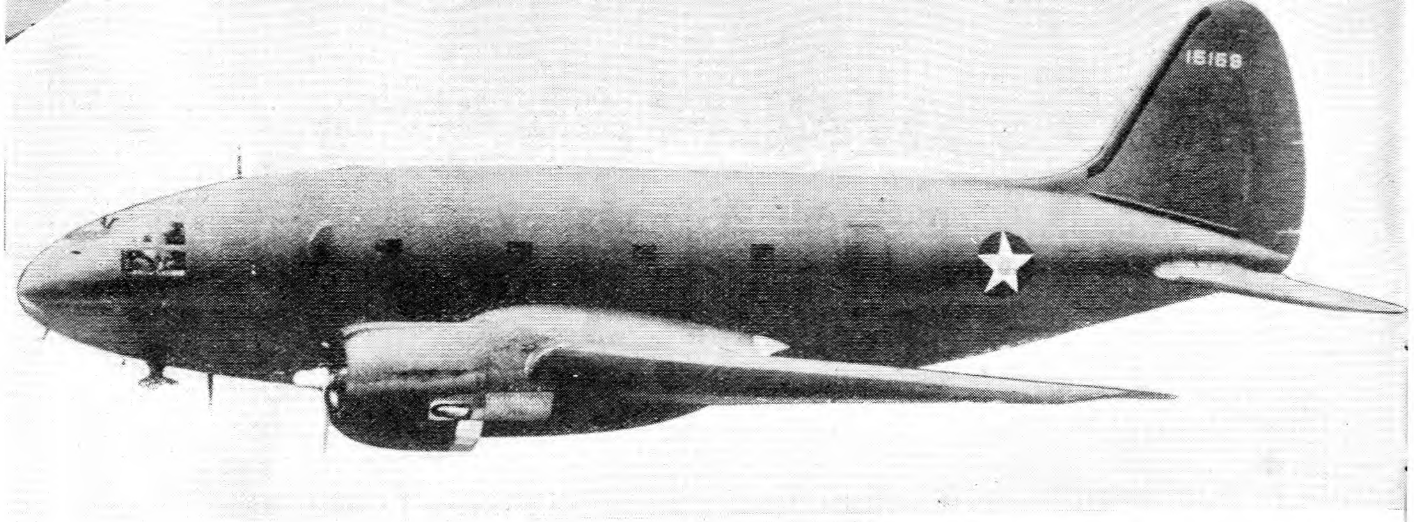
Experiments have ranged from splattering tomatoes and paper bags filled with water against windshield glasses to shooting small chickens and other freshly killed birds from large airguns. The latest suggestion is for 16-lb. geese to be fired from a compressed-air gun with a velocity of 270 m.p.h. (200 for the aeroplane and 70 for the bird). If a windshield can stand such an impact it should be proof against anything that Nature can hurl against it.

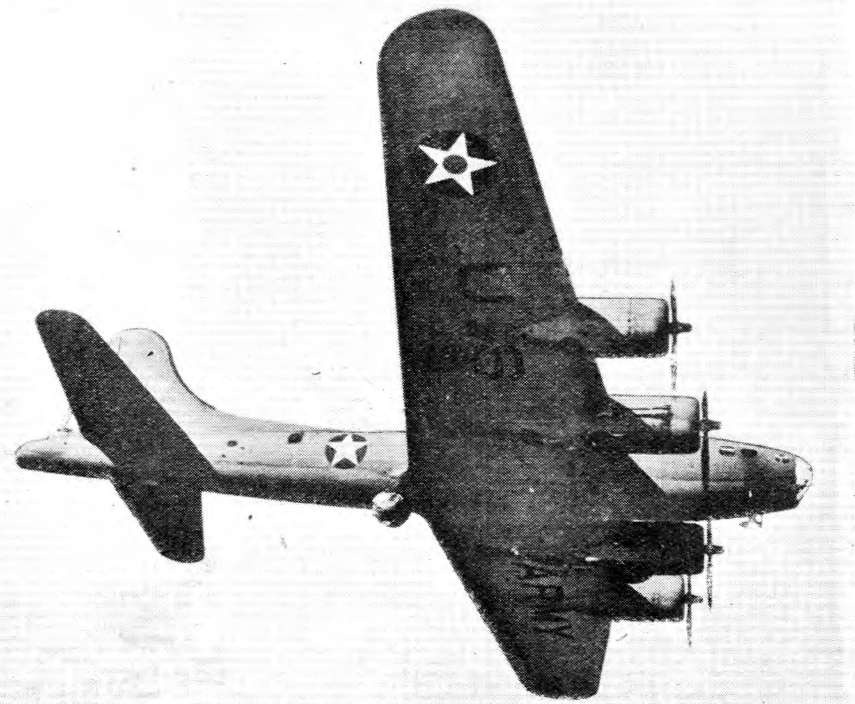
Sketches by Lunt Roberts.

The photograph is of an eagle. Their weight, speed and offensive spirit make them the airmen's most formidable bird opponent. The drawing shows how aeroplanes are employed in Texas to shoot them down.



(Above) Macaw attack on a glider. (Left) "One small bird penetrated the windshield."





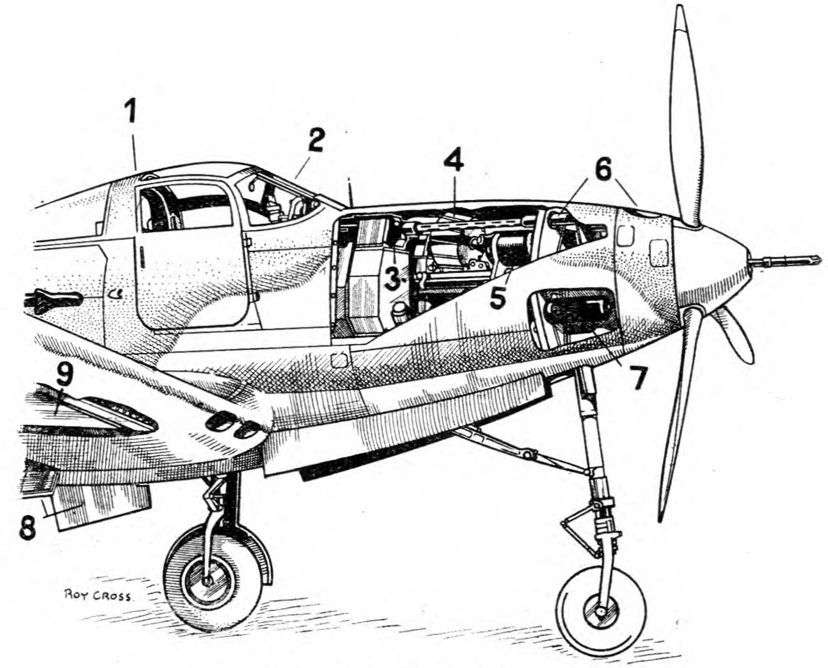
NEWS FROM AMERICA

The production version of the CW-20 civil transport, which is flying under the name of St. Louis with B.O.A.C. over here, has been adopted by the U.S. Army Air Forces as a military transport. Commando is the name selected for it, and it is reported to have two 1,700-h.p. Wright Double-Row Cyclone motors giving a top speed of 254 m.p.h.

Below the transport is an American bomber which has already mixed it with the Hun. Manned by U.S. aircrews and escorted by Spitfires, these Boeing B-17Es have struck at targets in the Occupied Countries time and time again, inflicting heavy damage. Similar to the Fortress II of the R.A.F., the B-17E has 13 machine-guns of .50 in. calibre, four of them in power turrets. A new amphibian is seen at the foot of the page, the Consolidated 28-5a, known as the Catalina III by the R.A.F. and the OA-10 by the U.S. Army. Powered by two Twin Wasp motors it has a top speed of 190 m.p.h. Here it is shown in Royal Canadian Air Force markings. The tricycle undercart must affect the useful load to some extent in comparison with the Catalinas I and II, but the amphibian gear makes the Catalina III an ideal U-boat hunter, as it can re-fuel from land or sea bases.

AIRACOBRA CUT-AWAY

by **Roy Cross**



(See text for key to drawing).

The Bell Airacobra is the most interesting of the American single-engine fighters at present in service with the R.A.F., with the possible exception of the Curtiss Kittyhawk. The armament is heavy and the machine well armoured as is shown in the drawing. In the crash arch (1) behind the seat is a bullet-proof glass screen which, as well as giving protection to the pilot, provides an extremely good view to the rear. Armoured glass is also fitted on a tube mounting inside the windscreen (2) and both ring and bead and reflector sights are fitted. The installation of the Allison V-1710-E4 motor amidships allows of much equipment being stowed in the nose. Two 0.5-in. Browning machine-guns are synchronised to fire through the airscrew (3) via blast tubes (6) and a drum-fed 20-mm. cannon (4) fires through the reduction gear and propeller boss. The reduction gear itself is armour-protected, and oil for its lubrication is supplied from the tank (5). The oxygen supply is also in the nose (7).

The tricycle undercarriage is interesting; the main components retract inwards and are then completely enclosed in the wing by flaps (8). The nosewheel is puncture-proof and retracts backwards into the fuselage through two hinged doors.

In addition to the fuselage armament, two 0.3-in. machine-guns are in either wing, each with enough ammunition to fire a 54-second burst at a rate of 1,100 r.p.m. Self-sealing fuel tanks (9) are built integral with the wing construction and have a total capacity of 100 imperial gallons.

The Bell P-39 Airacobra as supplied to the U.S. Army Air Forces has, in place of the 20-mm. cannon on British models, a heavier weapon of 37-mm. calibre, whose rate of fire is 120 shells per minute. Only 30 rounds can be carried however, compared with the 60 rounds contained in the British 20-mm. drum feed.

Maintenance on an Airacobra in operation with Fighter Command. The exhaust pipes and air intake visible behind the cockpit give indication of the rearward-placed engine.

Mark VB Spitfires at the dispersal point with pilots in cockpit ready to take off.

FIGHTERS in OPERATIONS

Captain Norman Macmillan, M.C., A.F.C. continues his exposition of fighter tactics

OPERATIONS demanding the employment of fighter aircraft are to-day many and varied in character. So because the tactical handling of fighters depends upon the type of operation in which the aircraft are employed, let us enumerate a few operations, and consider the differences between them.

1. Examples of patrols by sections of fighters to prevent the passage of small formations of enemy reconnaissance or bombing aircraft over specific areas were seen in France prior to May, 1940, throughout the Norway campaign, and in the United Kingdom before the Battle of Britain.

In these circumstances it is usually possible to hold the despatch of fighters intended to prevent the approach of enemy aircraft until intelligence reports are received from observer screens or radiolocation. The visual observer screen in north Norway was operated by Norwegian women who passed simple messages by land-line telephone; this method worked fairly well in Norway, where there is a long but narrow belt of country running north and south, over which the approaching German aircraft coming north from Trondheim were forced to fly. Although at the close of the campaign there was continuous daylight, owing to the mountainous country—radio between ground and aircraft in flight did not prove a satisfactory means of communication, and standing patrols were of little use; aircraft had to be kept at a constant state of readiness on the ground, and by this means interceptions were successfully made.

In France prior to May, 1940, an R.A.F observer screen was posted along the Maginot Line. This screen gave advance intelligence to the operations rooms of the Advanced Air Striking Force. Ground-to-air radio communication there was good, and it was often possible to deflect aircraft in flight to bring about interceptions.

In the United Kingdom, prior to the Battle of Britain, standing patrols were sometimes used; so were readiness aircraft. Generally, interceptions were satisfactory, even when attacks were launched against ships in convoy along the eastern coasts of Britain.

2. Defensive attack by large formations of fighters against numerous and powerful enemy formations was seen in its most highly developed form during the Battle of Britain. This method of fighter engagement was dependent almost entirely upon ground organisation. It was the truest example of air battle that the world has ever seen. It was a trial of organisation between the commanders of the Luftwaffe and the commanders of the Royal Air Force. The R.A.F. won.

The principle behind that defence organisation was the creation of the intelligence system which gave the R.A.F. commanders on the ground exact knowledge of the line of advance and the disposition of the enemy forces; in much the same way the military commander of the Napoleonic era took his station on a commanding hill so that he could survey the battlefield by eye and send his aides-de-camp galloping out with orders. The speed and mobility of air forces are today stepped up so steeply compared with the foot-and-horse forces of the old days that the hilltop no longer suffices the commander who would survey his field of battle in the air. Radio-locator screens, observer screens and all the scientific precision of modern communication engineering are harnessed to his needs, so that the moving panorama of the enemy attack can be visualised as a whole, just as an old-time cavalry assault fell within the vision of the commander seated on his charger on the hilltop.

But the fighter-defence commander need not see an aircraft battle to take measures to defeat enemy air assault; W/T and R/T, line telephone and teleprinter take the place of his galloping aides-de-camp.

Intelligence establishes which ground sector the enemy aircraft are approaching, what height and speed they are flying at, their number, and disposition in bombers and fighters. The required number and movement of the defensive fighter units—flights or squadrons—can then be decided upon, and orders issued for the defence aircraft of the particular sector involved to take off. Their course and the height they are to climb to are given to them by radio telephony. Code is used where necessary to keep the messages secret from the enemy, who can also tune in. But the code is simple and direct—the substitution of false names for the correct ones, names which the pilots memorise.

The defending aircraft can be reinforced—by sections, flights, squadrons, or wings—when necessary, and all can be concentrated so that their attack will be strongest over a given zone.

Once he sights an enemy, the formation leader reports the fact to ground control, and then assumes responsibility for the final tactical handling of his formation. He deploys his aircraft for attack in accordance with pre-practised routine formation drill. Short sentences spoken over the R/T almost possess the crispness of infantry drill commands, and direct the following fighters to take up station as required by the leader so that a certain method of attack can be made with the greatest accuracy.

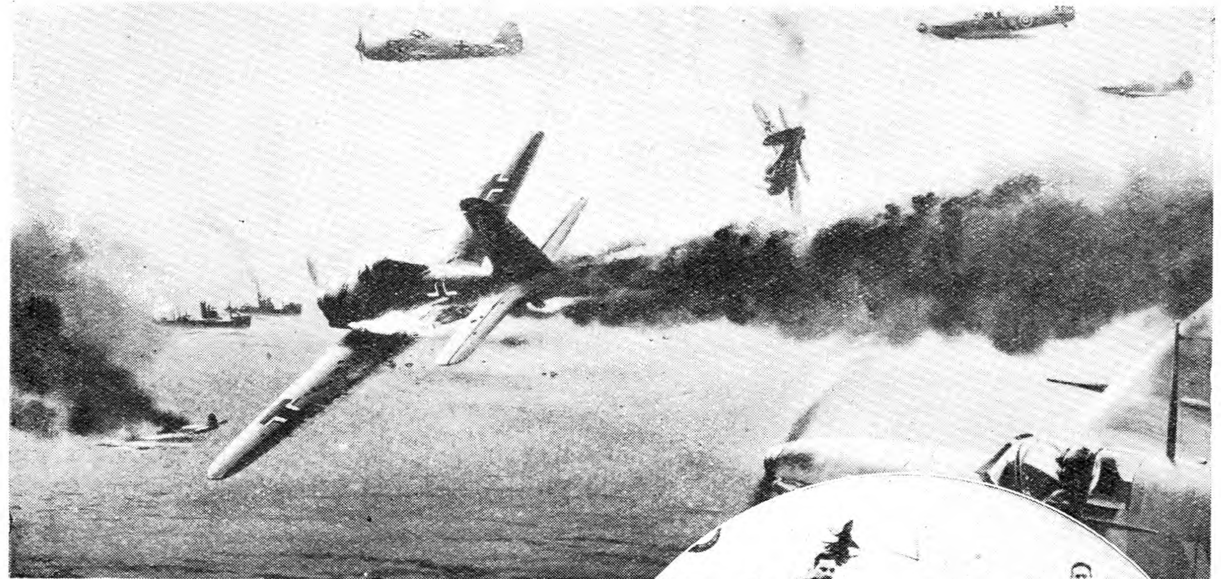
In the deployment of his forces, the selection of the kind of attack to be made, and the choice of direction from which he will go in, can be seen the skill of the master tactician among formation leaders. Upon this man, and those who follow him into the fight, everything ultimately depends.

The fame of the supreme commander rests in the end on the bravery of his fighting-men. But he can do much in advance to ensure their success by the quality of their previous training, by the suitability of their equipment, and by his skill in placing them in the most advantageous position for the actual assault. All these conditions in commander and commanded combined to produce the glorious victory of the R.A.F. in the Battle of Britain over a foe numerically four times stronger in all types of aircraft.

3. Offensive fighter sweeps by formations of fighters, sometimes, but not always, escorting bombers, organised in wings and groups and led by senior officers, may engage large forces of enemy fighters. Here the pre-planning is carried out with less urgency. Time does not press so hardly upon the commander responsible. The operation can be visualised in advance, and planned to the minutest detail of timing and formation arrangement. Courses, heights, speeds and targets can be assigned to flights, squadrons, or wings of aircraft.

Perhaps the object of the sweep may be to tackle enemy fighters to wear their numbers down with the ultimate intention of gaining superiority in the air, or possibly to relieve an ally by forcing the enemy to withdraw fighters from another front. Whatever the objective, this type of operation is not, to the senior ground commander, an air battle like that of the Battle of Britain; the highest commander is here concerned with the strategic side of the operation. Such an action is more like a naval battle than a land battle; the tactical handling throughout lies in the hands of those "flying admirals," the formation leaders, in whose skill and tenacity, experience and wisdom, lie the elements that make for success.

By such operations the R.A.F. imposes upon the commanders of the Luftwaffe the necessity to conduct defensive air operations after the manner of the air Battle of Britain. And, on the whole, the Luftwaffe commanders have not shown themselves to be equal in brilliancy in the direction of air defensive fighting to the commanders of the R.A.F. This, I think, can be attributed to two things: first, superior tactical handling of the R.A.F. and allied nations' aircraft by the formation leaders, and, second, less highly organised ground-to-air defensive arrangements upon the part of the Luftwaffe. In other words, the technique of the R.A.F., both on the ground and in the air, is superior to German air technique by a margin which at least matches the conscious personal superiority of the individuals who comprise the air crews of the R.A.F. over their opposite numbers among their opponents. This does not mean that the air crews and commanders of the Luftwaffe are poor, but it does mean that those of the R.A.F. are better.



Above: An artist's impression of Focke Wulf Fw. 190s being shot down by Spitfires while attacking shipping. A glimpse of one of the operations rooms of Fighter Command is given in the circle.

BOOKS

Ten Fighter Boys
Edited by Wing Commander Athol Forbes, D.F.C. and Squadron Leader Hubert Allen, D.F.C. Collins 6s. 176 pages. 7½″×5″. With photographs.
The fighter pilots' books get better and better. This one is inspired. The editors persuaded ten of the pilots of their squadron to write a chapter each on their experiences in the Battle of Britain and elsewhere, and the stories they have to tell make enthralling reading.

Aeroplanes in Detail
By J. H. Clark. English Universities Press. 2/6. 24 pages. 11½″×17″.
Cut-away drawings of famous aircraft and engines reproduced from *The Aeroplane*, with large size photographs. A fascinating book for those who want the inside gen about aircraft. Eleven aircraft and two engines are accurately and fully dealt with.

Camouflage Simply Explained
By Lieut.-Col. C. H. Smith. Pitman 6d. 32 pages. 7″×5″.
A useful explanation of the elementary principles of camouflage.

Model Gliders
By R. H. Warring. Harborough Publishing Co. 4s. 96 pages. 10″×7½″.
Interesting, accurate and useful instructions for the building and flying of model gliders. Well illustrated and clearly written.

1,000 Questions and Answers for Airframe Mechanics
By Harold P. Lees. Hutchinsons. 1/3. 96 pages. 7″×4″.
A large amount of valuable knowledge of this subject summed up briefly in questions and answers.

Elementary Mathematics for Wireless Operators
Second Edition. By W. E. Crook. Pitman. 3/6. 76 pages. 8½″×5″.
A clear exposition which may help many cadets over some mathematical stiles.

The Book of the Wellington
Real Photographs. 1/3. 18 pages. 5½″×7½″.
Descriptions, photographs and drawings of this famous aircraft.

Introduction to Sea and Air Navigation
By W. M. Smart. Longmans Green. 5/-. 114 pages. 8½″×5″.
A first course on the main principles of navigation, other than astro-navigation for seamen and airmen.

Properties and Strength of Materials
Fourth Edition. By J. D. Haddon. Pitman. 8/6. 192 pages. 8½″×5½″.
A solid technical book for students of aeronautical engineering.

Aero Engines
By D. Hay Surgeoner. Longmans Green. 3/6. 110 pages. 7″×5″.
A lucid introduction to the functioning of aero engines.

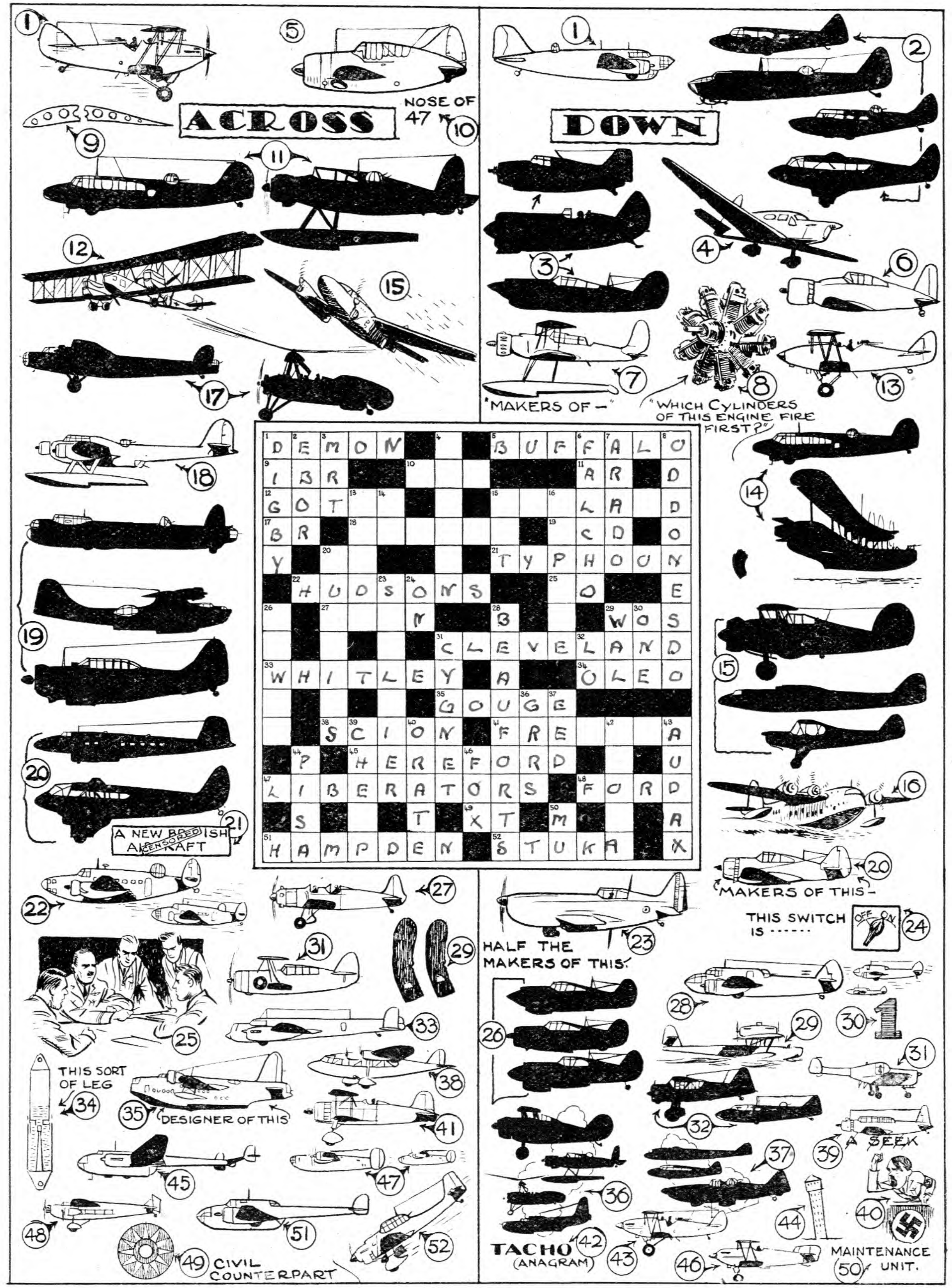
Teach Yourself Algebra
September 1942. By P. Abbott. English Universities Press. 2/6. 307 pages. 7″×4½″.
This is well up to the standard of the "Teach Yourself" series of books. The explanations, especially in the earlier part of the book, are clear and ample. A.T.C. cadets with an instructor to help them over difficulties should find it most useful in learning algebra or refreshing their knowledge of it.

Victory Through Air Power
By Major Alexander Seversky. Hutchinson. 9/6. 160 pages. 7½″×4½″. 43 illustrations and drawings.
A book which the thoughtful cadet who aspires to high places should undoubtedly read. The author explains how the growth and increasing size and range of air power is affecting strategy, and makes it clear that Britain and her allies, if they want victory, must fly to it, using aeroplanes of great size and range in larger and larger numbers.

Pictorial Crossword

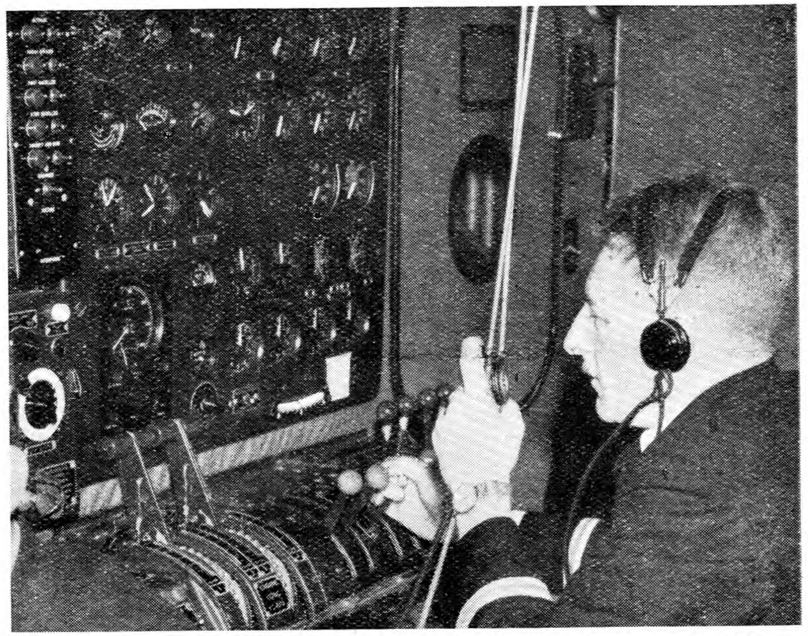
HERE is a new *A.T.C. Gazette* idea, a Pictorial Crossword. The crossword was devised by S. C. Nunn and drawn by Lunt Roberts. In this a few things other than aircraft have been introduced, besides a number of old aeroplanes such as the Gotha, Iris, Ford and several variants of the Hart family, Audax, Demon, Hardy, etc.

In this puzzle plurals are indicated by two drawings of the same machine. In the case of blacked-in groups of aircraft, initial letters of the names provide the solution. A group of aircraft of the same make but different type may give a name which is common to all of them, e.g. Hawks. Another Pictorial Crossword on page (*Solution on page 20.*)



FLIGHT ENGINEER

by David Vine



A Flight Engineer at the control panel of the Boeing Bristol. The two nearest levers operate the engine cowl flaps.

MANY flight engineers are now under training, all of them volunteers and not below the rank of L.A.C. For years the ground crews have had their grumble about not being included among the flying personnel of the R.A.F., and no doubt many ground-crew cadets in the A.T.C. have felt a twinge of inferiority when compared with their fellow cadets training for air-crew duties. All that is now over. The increasing size of modern aircraft has made it impossible for the pilot to concentrate effectively on flying his aircraft while attending to a multitude of gauges, thermometers, instruments and switches. So now the pilot, like the captain of a ship, has an engineer who keeps a vigilant eye on all the switches and the non-flying instruments and gauges.

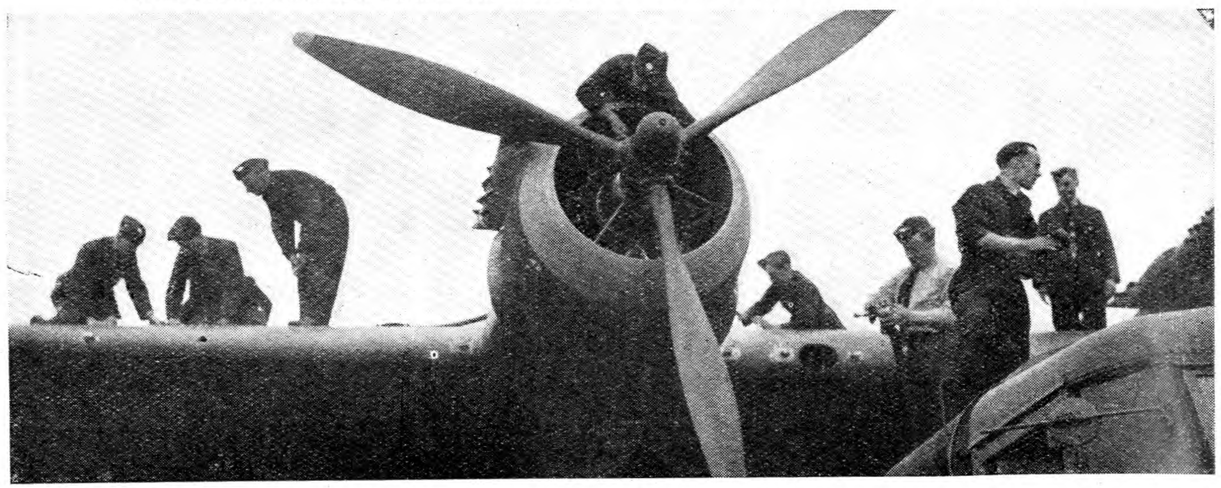
Looking for Trouble

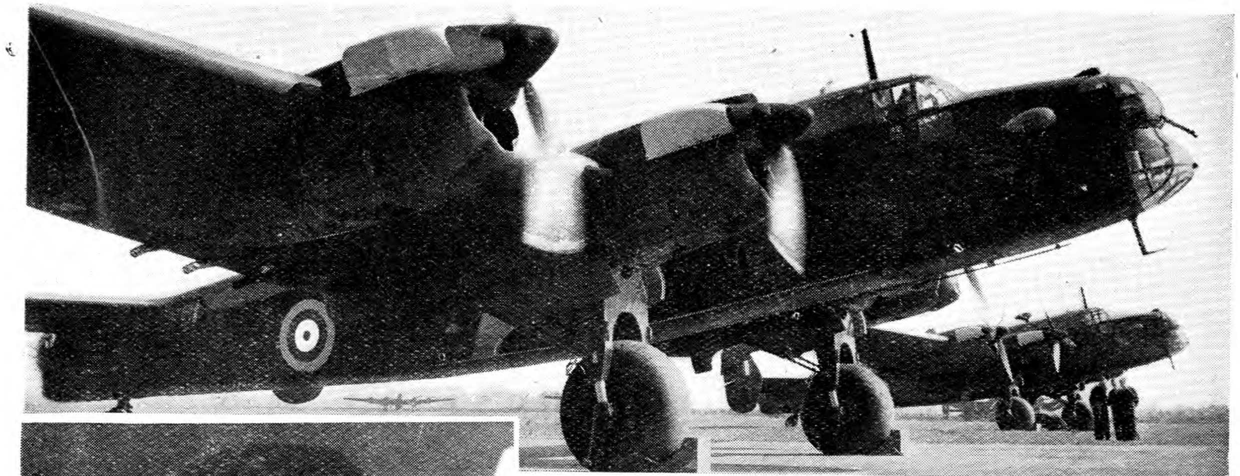
The temperature of the radiators, the pressure of the compressed air in the brakes, the pressure and temperature of the oil in the engines, the pressure of the fluid in the hydraulic system, are all under the supervision of the flight engineer. If any mechanical defects or damage occur in flight, he must be able to diagnose and, if possible, cure them. If an engine begins to cough and splutter because of a choked fuel line or a damaged fuel pump, he must be there ready to ascertain its cause and put it right. The fuel change-over cocks, so long the pilot's nightmare, are now the responsibility of the flight engineer. The revolutions of the engines, the pitch of the airscrews, the mixture control for take-off, are all the flight engineer's duties. In fact, he is responsible for everything mechanical in the aircraft. If a hydraulic pipe line is shot away he has to endeavour to minimise the worst results of it and, above all, get the undercarriage down for a safe landing.

After pre-flight ground tests, he has to set the flaps for the take-off and raise the undercarriage when the aircraft is airborne. He has to lower the undercarriage and flaps for landing. The position of the cooling gills and the temperature of the cylinders are controlled by him in his seat at the instrument panel behind the pilot's cockpit. A bomb door is jammed down: he has to "unjam" it, if possible. The de-icer pumps are not working properly: he has to see to it that they do.

He is the first aboard and often the last to leave. In an emergency landing he must open the jettison valves which drain the petrol tanks. Very often it is his responsibility to inform the captain that the aircraft cannot reach base. The captain relies on him implicitly for all mechanical reports in flight. Often the safety of the entire crew and aircraft is in his hands. The ability of the flight engineer to "nurse" his aircraft, and especially the engines, after a knocking about by shrapnel or shell, may mean the difference between baling out over enemy territory or making base.

On the ground it is the Flight Engineer who must supervise maintenance and refuelling—in this case on a Stirling.





It is to Viscount Trenchard, says the author, that we chiefly owe our present-day strength in the air. The R.A.F. is built on the foundations he laid.

Aerobiographies IV—by C. G. Grey

VISCOUNT TRENCHARD

FOR the Royal Air Force as it is to-day we have to thank, before anybody else, that distinguished officer who is now Marshal of the R.A.F. the Viscount Trenchard, G.C.B., G.C.V.O., D.S.O.—which means that we have to thank him for the winning of the Battle of Britain, which saved us from invasion, for the defeat of the night-raiders and their blitzes, for the defeat of the U-boats on our side of the Atlantic, and for the raids and sweeps of the R.A.F. over Europe which will, in the end, win the war.

Hugh Montague Trenchard was born in February, 1873, so that he is not an old man as "Elder Statesmen" go. And those members of the R.A.F. and of the A.T.C. who have been inspected and addressed by him in the past year or two know how young he is in speech and outlook. He joined the Royal Scots Fusiliers from the Militia in 1893, and was a captain in the South African war in 1900. There he commanded irregular cavalry—and, believe me, irregular cavalry in South Africa were very irregular.

He was made a brevet-major in 1902 for that; after which he went to Nigeria and ran a country about as big as Wales with two or three white officers, a few N.C.O.s and some companies of Hausa troops. Their wars were pure bush-fighting—which was why, in a discussion some twenty years later on Staff work, he described himself as "a bush-whacker by trade."

He was made a Companion of the Distinguished Service Order (D.S.O.) in 1906, but some years of the bush broke his health, and he was carried on board ship at a West African port and sent home to die.

Much to the surprise of all Old Nigerians, Major Trenchard, with wings on his tunic, suddenly reappeared—as Assistant Commandant of the new Central Flying School on Salisbury Plain, in 1912. There his deep voice and brief speech won for him the nickname of "Boom," which has been used as a term of affection by his faithful followers ever since. And there he set to work to build a Flying Service for the first time.

When war broke out in August, 1914, and *all four* squadrons of the Royal Flying Corps went to France, Major Trenchard was sent to Farnborough, H.Q., R.F.C., to build (for a second time) a new Flying Corps in a row of empty sheds, with a few officers unfit for service overseas. At the end of 1914 he had done so well that he was made a Companion of the Bath. He was made a brevet lieutenant-colonel in 1915, and by the end of that year he had built up an R.F.C. far bigger than the first one, besides organising it for still greater growth.

During 1915 the R.F.C. took a terrific hammering in France, so Major-General Trenchard, as he had become, was sent out to build up (for the third time) the R.F.C. morally as he had already built it numerically. By the end of 1917 the R.F.C. was well on top of the enemy, and General Trenchard was fetched home to become first Chief of the Air Staff to the newly created Royal Air Force. And for the fourth time he set to work to build a Flying Service.

In April he and Lord Rothermere, the first Secretary of State for Air, disagreed, and General Trenchard resigned. Such a row was raised that Lord Rothermere resigned a few weeks later, and Sir William Weir (later Lord Weir), who took his place, asked General Trenchard to come back. But "Boom" refused to push out General Sykes, who had meantime been made C.A.S., so Sir William Weir gave him the job of creating an Independent Air Force (the fifth time) in Eastern France to bomb Germany's industrial centres, and he was made a K.C.B. He did so well that he was appointed Generalissimo of *all* the Allied Air Forces—but the Armistice came before he could take command.

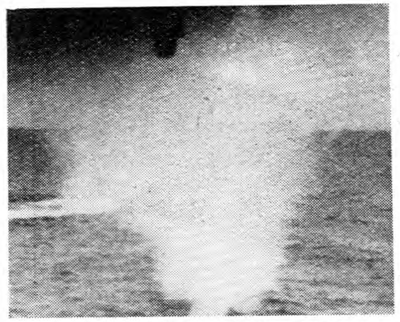
In 1919 General Sir Hugh Trenchard again became Chief of the Air Staff, and an Air Marshal when the new rank-titles were invented. Mr. Winston Churchill, doubling the parts of Secretary of State for War and for Air, cut down the R.A.F. from 30,000 officers and 300,000 men, at the Armistice, to 3,000 officers and 30,000 men (a true decimation); and for the sixth time "Boom" started to build a Flying Service.

Between then and 1930, when he resigned, Sir Hugh Trenchard, loyally helped by Sir Samuel Hoare, who was Secretary of State for Air most of the time, and by the late Sir Philip Sassoon, as Under-Secretary, laid down the foundations and the basic organisation on which the present Air Force has been built. He was made a Baronet in 1919 and promoted to Air Chief Marshal in 1922. In 1924 he was promoted to the Grand Cross of the Order of the Bath, and to Marshal of the R.A.F. in 1927.

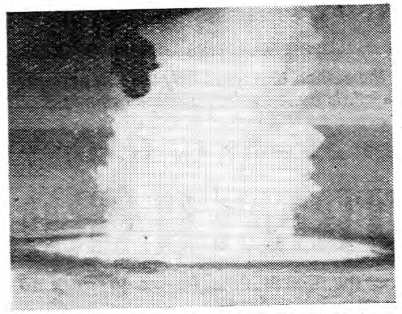
(*continued on page* 13)

U-BOAT HUNTING

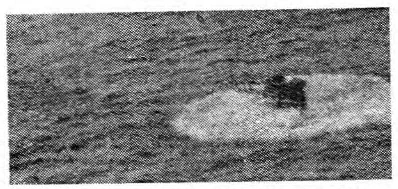
Capt. W. E. JOHNS



Spotting a U-boat in the Bay of Biscay, a Coastal Command Whitley dives to drop a stick of bombs.

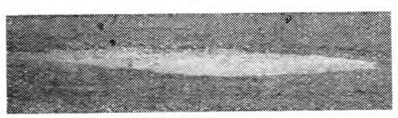


Straddling the submarine, the bombs burst, throwing up huge columns of water.



The conning tower is sighted as the submarine is forced to the surface.

As the Whitley zooms, the rear-gunner has a go. With his four Brownings firing, he lashes the sub. with lead.



The U-boat's stern rises until it is almost vertical and then it sinks from sight, leaving a patch of oil nearly 200 yards in diameter and a healthier sea.

AIRCRAFT are playing a vital part in what has become known as the Battle of the Atlantic, although this has been going on for so long that "campaign" might be a more apposite word. In the end aircraft will win. Yet, contrary to what the earthbound spectator might suppose, perceiving that aircraft have all the advantages of speed and extremely long sight, the battle will not be easy. The submarine has many useful qualifications, and for this reason U-boat chasing has become a highly specialised job. In one respect it is a disappointing job. In air combat the victor knows when he has won a duel. He sees his opponent fall. Even the bomber has the satisfaction of seeing his missiles hit or miss the target. But more often than not the U-boat straffer can only hope; he is denied the satisfaction of certain victory.

Sorting Things Out

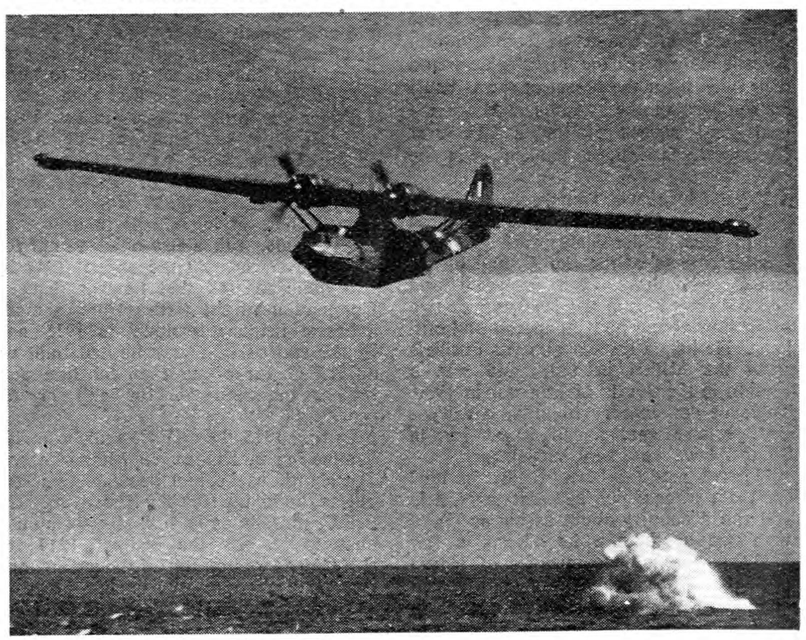
The submarine-hunter's job is usually wearisome. All sorts of things float on the surface of the sea in war-time, and he must investigate everything he sees. Time and time again what he hopes is his quarry turns out to be a crate, a barrel, a seagull or a big fish. More than one pilot has bombed a whale.

The submarine commander does his work with one eye on the sky, and is rarely caught napping. In hostile waters he usually operates in a condition known as "trimmed down"—that is, he proceeds with his decks awash, ready for instant diving. In less than a minute he can be a hundred feet under the water, and, having dived, he can turn in any direction away from the spot where he submerged. Every minute takes him farther from that spot, and the air pilot must guess his position.

Trails

A submarine at periscope depth leaves a definite wake. The ease with which it is seen from the air depends entirely on the state of the sea and the light. In good weather and calm sea a periscope is comparatively easy to see. In choppy conditions and with an overcast sky, it is difficult to see. But there is always a chance that there may be visible evidence of the submarine's position. The expert hunter knows what to look for. The first thing is oil. Once a submarine has dived there should be no trace of oil on the surface. Every precaution is taken to prevent the escape of this significant clue. The propeller shafts have special self-sealing bushes. Exhausts close automatically when the submarine dives. Nevertheless, there may be a small amount of oil on the upperworks of the ship; oil can also cling to the outside of the exhausts; it can rise from a strained plate if the submarine has been long at sea or been damaged in action. Sometimes a submarine bruises itself on the bottom, and this may cause a tiny leak through which oil can escape. So although every precaution is taken to prevent it, oil *may* come to the surface. It needs only a few spots to leave the tell-tale mark for which the airman seeks.

Smoke bombs being dropped by a Catalina at practice in the Mediterranean, where the water is sometimes clear enough to see U-boats many feet below the surface.



Underwater Visibility

There is a common impression that a submarine can be seen from the air even when she is quite deep in the drink; and this, I know from experience, is true to a certain extent. But, obviously, just how far down a sub. can be spotted depends on the state of the water. The water round our coasts is usually murky, although at the western end of the Channel it can be surprisingly clear. In the eastern Mediterranean the water is very clear, but not as clear as the water round the West Indies, where, even from a ship, it is sometimes possible to make out every detail of the sea-bed a hundred feet below.

Two other factors must be taken into consideration. The first is the sea-bottom—assuming that the water is not very deep. Normally a grey-painted sub. shows light green when under the water, but over a sandy bottom it can look black. The other factor is the position of the sun. When it is more or less overhead it is possible to see deeper into the water than when it is at an angle, say, at dawn or dusk.

Stalking

As a general rule, I think it may be said that until he is spotted all the advantages are with the submarine commander. He is for ever watching and listening, and at the first sight or sound of danger he has gone, leaving no trace except perhaps the tiny trail of oil to which we have referred. Oil on the water is a common sight on shipping lanes, or on the route taken by a convoy, and if the air pilot bombed every patch of oil he saw he would soon run out of bombs. He must have more definite proof, and to obtain this he must exercise tremendous patience, skill and cunning. He needs the patience of a cat watching a mousehole to sit over a patch of oil, waiting for the hiding enemy to make a blunder or take the chance that will give him away. It is disappointing after following a slim trail of oil to find that it ends at an empty oil can dropped from a passing ship.

An artist's impression of a Sunderland in at the kill. More often the trail leads nowhere. Skill, tenacity and patience are required to carry out the long and arduous stalking. This Italian submarine was caught in the Bay of Biscay; the Sunderland's gunners swept the hull with bullets, and depth charges finished the job.

Suppose a pilot does find definite proof that his enemy is below him. He drops his bombs. Nothing happens. The raider may be lying on the bottom, helpless, or he may be slinking away, unharmed. The pilot doesn't know; he may never know. He can only hope. Even although oil and air bubbles appear on the surface this does not necessarily mean a kill, for by this means the wily submarine commander may try to hoodwink his watching enemy.

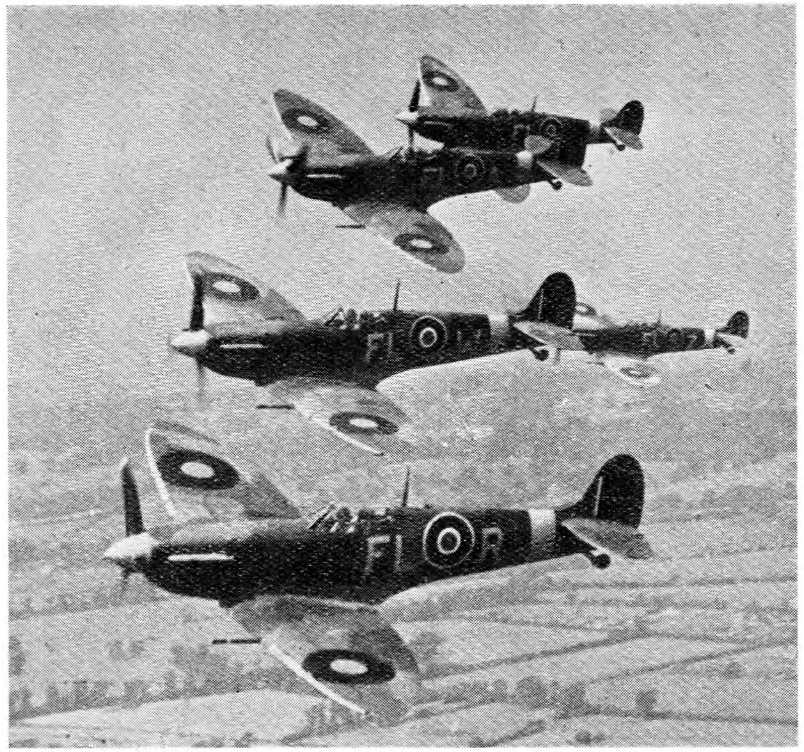
Viscount Trenchard (*continued from page* 4)

When he left the Air Ministry in 1930 (and was made a Baron) he remarked that he had laid the foundations on which a castle could be built, and that if nobody wanted to build anything bigger than a cottage, it would at any rate be a jolly good cottage. The R.A.F. to-day is a far bigger castle than even Lord Trenchard imagined, but it stands firmly on his foundations.

After leaving the Air Ministry he became Commissioner of the Metropolitan Police. He was given the Grand Cross of the Royal Victorian Order on leaving that post in 1935, and was created a Viscount in 1936. Since then he has devoted his time to the welfare of the R.A.F.; and to-day he is very much a power behind the scenes. And all the men at the top of the R.A.F. to-day are "Trenchard's men," whom he picked and promoted.

SPEED & HORSE-POWER

by **John Ibsilon**



Supermarine Spitfire VB twin-cannon fighters of the R.A.F., whose engine, the Merlin XLV, is quoted as having a maximum power of 1,300 h.p., giving a top speed in the region of 370 m.p.h.

THERE is for ever proceeding between designers and their obstinate creations a struggle which may be symbolised by the words "speed and horse-power." Speed is the essential grace of many types of military aircraft. The fighter must have it, coupled with manœuvrability and a high rate of climb, and must in addition carry heavy armament. The bomber it might be said needs speed alone, though if it cannot be endowed with enough to render it invulnerable to attack by interceptors then it must also possess armament. The general-purpose aircraft, which has in the past year or two taken over almost all the duties of the specialised reconnaissance machine, except in the tactical field, is yet another military type which depends largely upon high speed for the success of its mission. The dive-bomber requires speed (this the Germans discovered to their disadvantage in the Battle of Britain), but is denied it because of the very robust structure needed to support a heavy bomb, and because of the extraordinarily high velocity developed by a clean shape in dives approaching the vertical angle.

The conditions demanded to obtain speed are twofold: the packing of the greatest possible horse-power behind the smallest possible frontal area, and its incorporation in a good streamlined form. In complying with these conditions, many difficulties arise which are eliminated by a combination of skill and luck.

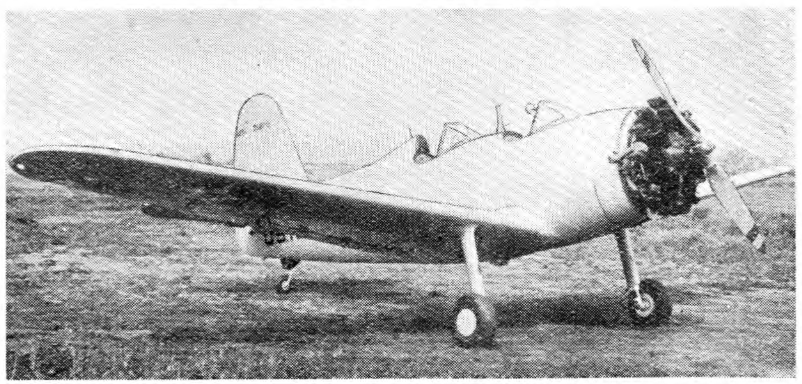
Frontal Area

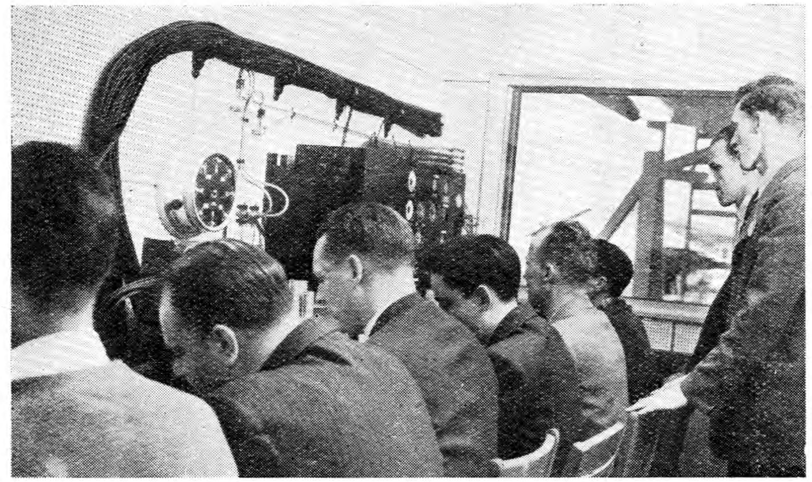
It is the engine with its accessories which accounts for a great deal of the weight of a modern military aircraft, but this is not a grave handicap as long as size can be restricted. Reduction in size for engines of greater horse-power (which latter has now become the loftiest ambition at which it is possible to aim without appearing ridiculous) resolves itself, after all the intricate refinements to the individual parts have been exhausted, into a game of arranging and rearranging the cylinder banks. The most well-known cylinder installations are the vee, radial and in-line, but the almost universal adoption of these is by no means a guarantee of their lasting utility. When it has been said that for the present horse-power which military necessity demands they represent the most economical and generally efficient means of attainment (i.e. that they are comparatively easy to streamline and can be installed in convenient positions for overhaul, etc.), then their principal virtues have been enumerated. But a vee, radial or inline engine is not, speaking by and large, the most effective method of packing the now almost indispensable 2,000 horse-power behind the smallest frontal area. "W" engines (a "W" engine consists of two vee engines placed side by side) compose the power which drives Germany's newest bomber, the Heinkel He. 177 (though the Heinkel is sometimes called a four-engined aircraft). "X" engines are also in use.

Buried Power Units

Buried power units present vast fresh fields for investigation. In the middle of 1940 the American firm of Lycoming brought out a flat aero motor, the model O-1230-D developing 1,200 h.p., which had been specially designed for installation inside the wings of an aircraft. The elimination of the drag which is induced by an orthodox nacelle is estimated to give an aircraft fitted with the Lycoming a speed of 330 m.p.h. and a range of 1,150 miles, compared with 300 m.p.h. and 1,000 miles for a machine equipped with normal engines of the same power. A little earlier Bugatti had brought out a double-eight flat engine which developed 1,500 h.p. at 3,000 r.p.m. at an unspecified height. This power plant had overhead camshafts, and was therefore probably even shallower than the Lycoming. It had also a better output per lb. weight (1 lb./h.p. compared with 1.104 lb./h.p. for the Lycoming). I do not think that there would be much difference in practice, for the figure quoted for the Bugatti refers to dry weight. The invasion of France prevented the continuation of research which might have resulted in the designing of even more excellent flat engines. Not much work has been done in this direction in other countries, but a Junkers opposed-piston engine was successfully installed in the wings and fuselages of certain German aircraft.

This American aircraft, the Timm PT-175K, one version of which has a 175-h.p. Kinner radial, is largely constructed of plastics.



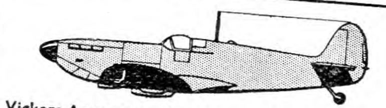


Engine Test Crew. These men are recording the output of a new engine mounted on a rotatable test bed at the Boeing Works, Seattle.

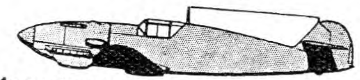
Lightness of Construction

A word might be appropriate about another method which has been used to get more speed from less horse-power. Many of France's Caudron designs obtained high speeds (over 300 m.p.h.) from engines of not more than 500 h.p. Wood and plastics were used, and lightness of construction was the watchword; but it was alleged that the French aircraft built to this formula were very vulnerable to incendiary bullets. Generally speaking, economy of this sort is unjustifiable, except perhaps in the case of bombers (not dive-bombers), where semi-wooden construction may be employed with safety in the wings. Otherwise the improvement secured in performance usually results in a deterioration in all-round efficiency.

Lastly, careful conservation of space and meticulous attention afforded to general layout play no small part in producing the perfect streamlined shape so necessary for high speed. Military aircraft must put comfort last; roomy corridors are taboo—to-morrow may hear the cry: "Buried engines and man-wide fuselages." This will indicate that yet more lessons are being learnt about speed and horse-power.

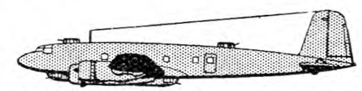


Vickers-Armstrongs Supermarine Spitfire VA, one 1,300-h.p. Rolls-Royce Merlin XLV motor. Top speed about 370 m.p.h.

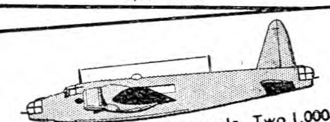


Messerschmitt Me. 109F-1, one 1,200-h.p. Mercedes Benz DB 601N motor. Top speed 371 m.p.h. at 22,000 feet.

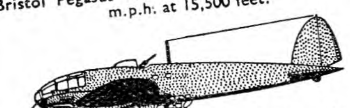
Short Stirling I. Four 1,595-h.p. Bristol Hercules XI motors. Top speed 280 m.p.h. at 14,000 feet.



Focke-Wulf Fw. 200K-2 Kurier. Four 1,600-h.p. B.M.W. 801 motors. Top speed 279 m.p.h. at 18,100 feet.

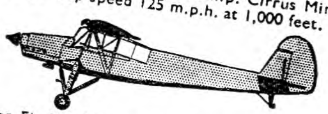


Vickers-Armstrongs Wellington Ic. Two 1,000-h.p. Bristol Pegasus XVIII motors. Top speed 230 m.p.h. at 15,500 feet.



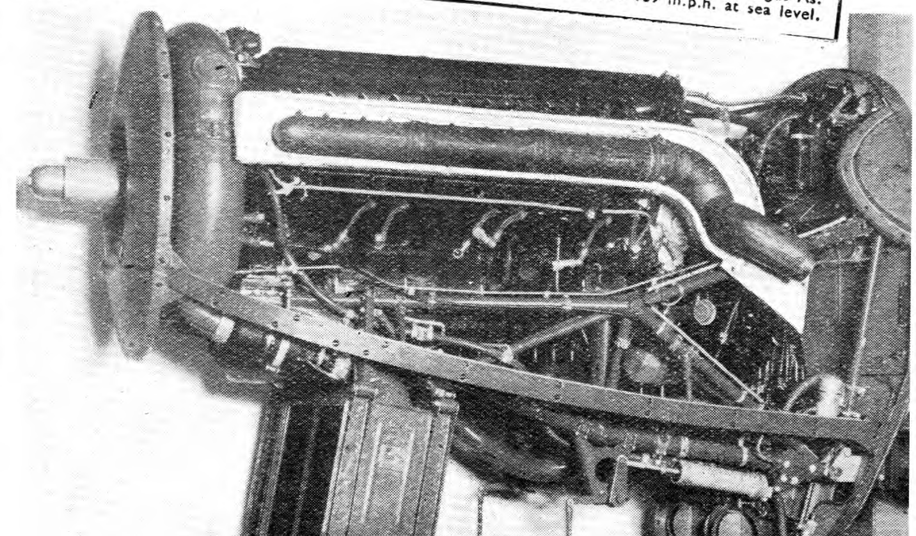
Heinkel He. 111K5A. Two 1,200-h.p. Junkers Jumo 211D motors. Top speed 274 m.p.h. at 12,300 feet.

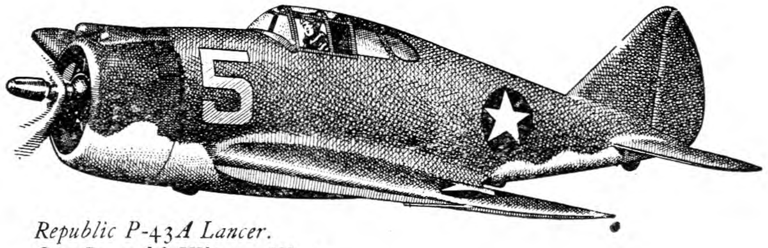
Taylorcraft Model D. One 90-h.p. Cirrus Minor motor. Top speed 125 m.p.h. at 1,000 feet.



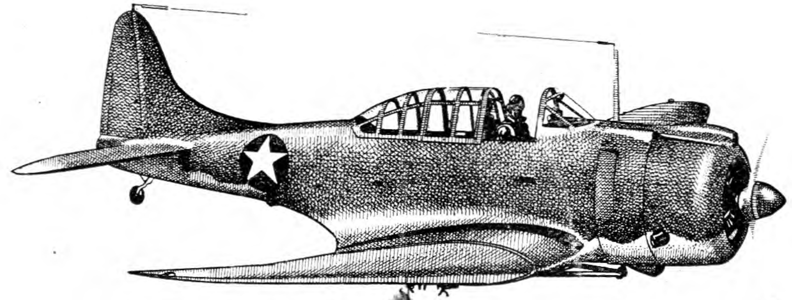
Fieseler Fi. 156 Storch. One 240-h.p. Argus As. 10C motor. Top speed 109 m.p.h. at sea level.

The Rolls Royce Merlin XX develops 1,260 h.p. at 12,250 feet in low super-charger gear, and 1,175 h.p. at 21,000 feet in the high gear.

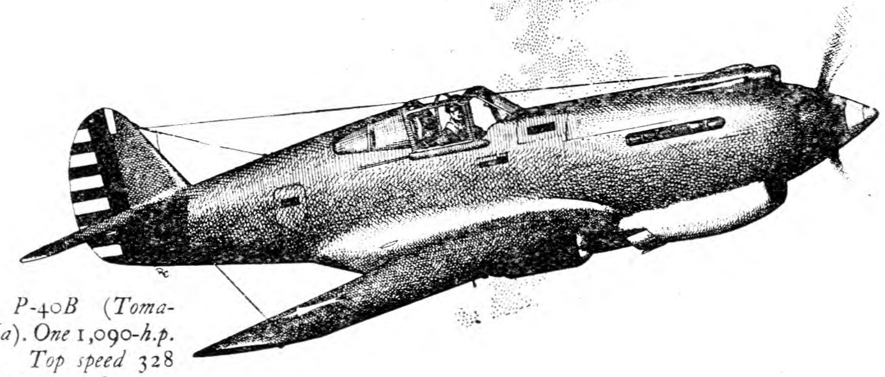




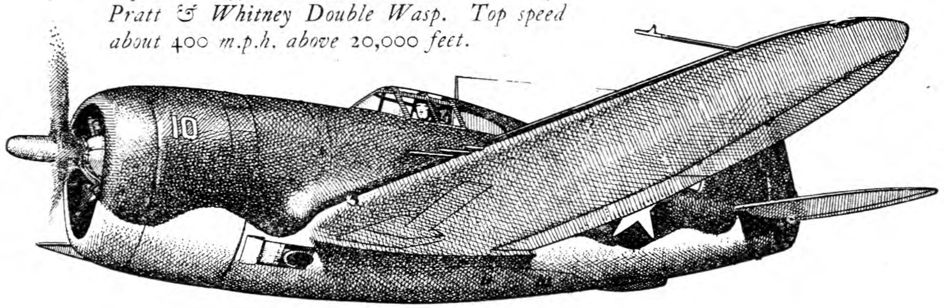
Republic P-43A Lancer.
One Pratt & Whitney Wasp.
Top speed 375 m.p.h. at 23,000 feet.



Douglas A-24. One 950-h.p. Wright Cyclone. Top speed 275 m.p.h. at 7,500 feet.



Curtiss P-40B (Tomahawk IIa). One 1,090-h.p. Allison. Top speed 328 m.p.h. at 15,000 feet.



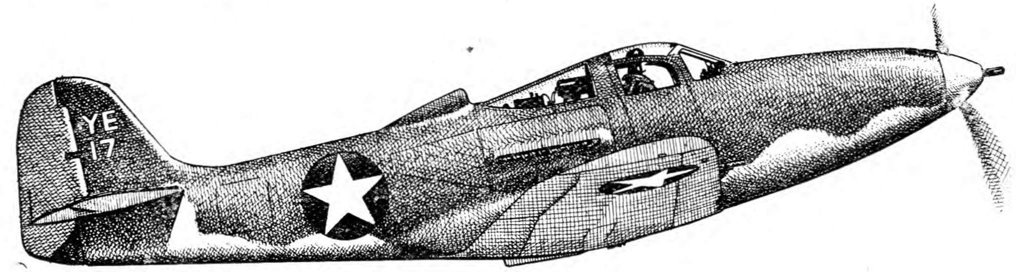
Republic P-47B Thunderbolt. One 2,000-h.p. Pratt & Whitney Double Wasp. Top speed about 400 m.p.h. above 20,000 feet.

Some Single-Motored American Aircraft

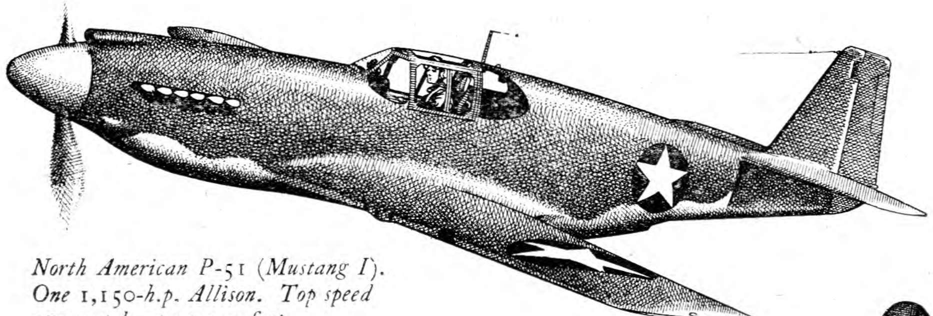
There are few British single-engined operational machines in the R.A.F. with radial motors, but the latest types of American fighters and light bombers use radials extensively. The Thunderbolt has a radial and so has the Lancer, the Wildcat, the Buffalo, the Devastator, the Dauntless, the Kingfisher, the Vindicator, the Helldiver and the Buccaneer, to name the best-known aircraft.

A certain number of machines are fitted with in-line motors and have proved good fighting aircraft. The Tomahawk, Kittyhawk and Mustang have been in service with the R.A.F. for some time and have put up a good show. There is a new Curtiss—the Warhawk—which is fitted with a British Rolls-Royce Merlin, and is reported to be the fastest Hawk yet put into service.

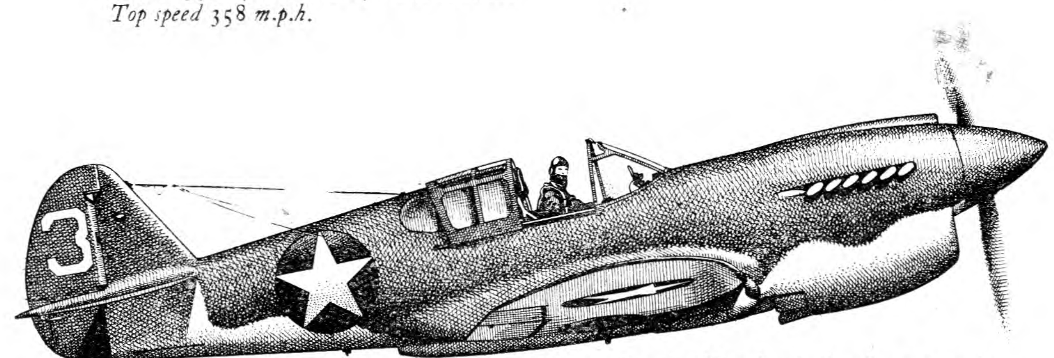
(Drawings by Roy Cross.)



Bell P-39D (Airacobra I). One Allison. Top speed 358 m.p.h.

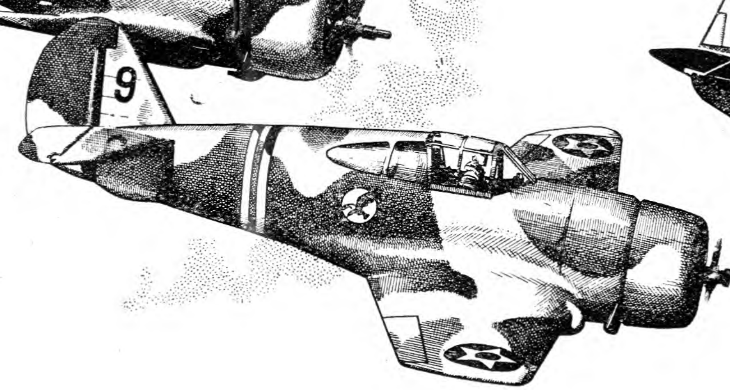


North American P-51 (Mustang I). One 1,150-h.p. Allison. Top speed 370 m.p.h. at 15,000 feet.

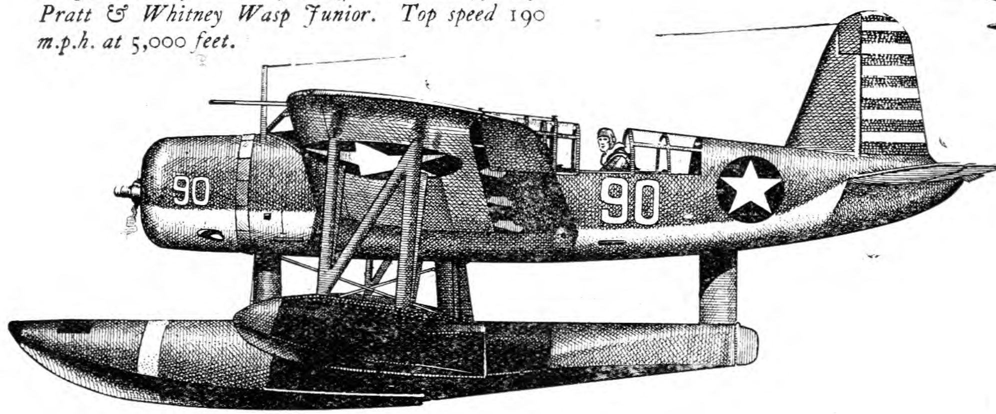


Curtiss P-40E (Kittyhawk I). One 1,150-h.p. Allison. Top speed about 350 m.p.h. at 15,000 feet.

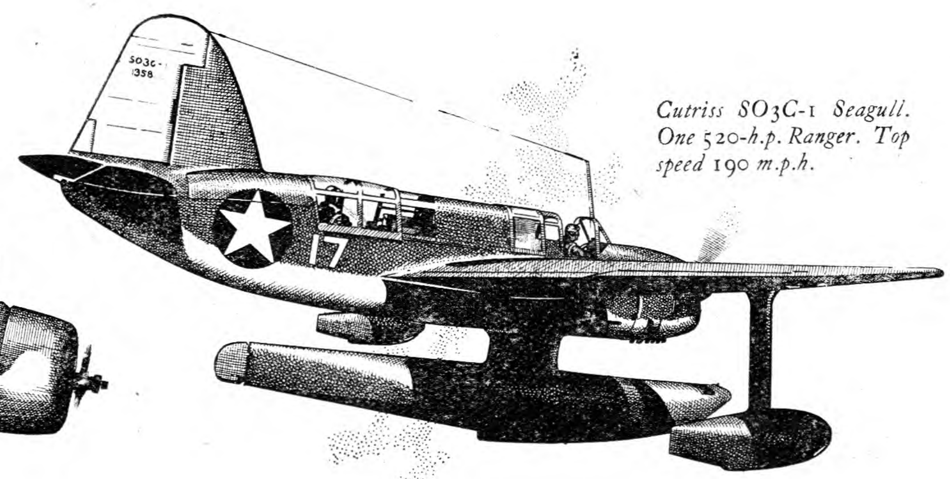
(ABOVE) *Curtiss P-36E. One 1,200-h.p. Wright Cyclone, giving a top speed of 323 m.p.h. at 15,100 feet.* (BELOW) *Curtiss P-36. One 950-h.p. Pratt & Whitney Twin Wasp. Top speed about 300 m.p.h.*



Vought-Sikorsky OS2U-3 Kingfisher. One 450-h.p. Pratt & Whitney Wasp Junior. Top speed 190 m.p.h. at 5,000 feet.



Cutriss SO3C-1 Seagull. One 520-h.p. Ranger. Top speed 190 m.p.h.



OFFICER-LIKE QUALITIES

by Kenelm Bramah (Lieut. (A), R.N.)

A naval officer with considerable flying experience, who was in the Fleet Air Arm before the war and was wounded in the Battle of Britain when attached to the R.A.F., here tells us something about the qualities (apart from technical qualifications) required of an officer. His remarks are equally applicable to the Royal Air Force and the Army. The views evpressed are not "official."

AMONG the qualifications the Admiralty requires in young men who wish to join the Royal Navy for the duration of hostilities under the "Y" Scheme, we find "officer-like qualities". What do we really mean by "officer-like qualities"?

It is easy to roll off a string of answers to this question, but different ranks and appointments demand different qualities; apart from one or two obvious things that every good citizen possesses such as honesty, the qualities required in a young submarine or flying officer are obviously not the same as those expected of an Admiral or the First Sea Lord. I am going to deal with the qualities required in the younger officers—those between 18 and 28.

When I asked one army officer what he thought was wanted, his immediate reply was: "*Guts! Guts!* That's all that matters in wartime—a fellow without guts is no good to me." Well, "guts," let us call it courage, is needed, though many people went through the whole of the last war and never had any opportunity to prove whether they had it or not, and we certainly cannot judge in a half-hour interview if a man has courage, though in nearly all Englishmen there is that latent quality which will show up if needed.

Here is a list of the qualities that we like to find in a prospective officer, not in order of merit, because it is impossible to say that any one is more important than the others: alertness; enthusiasm for the service; cleanliness and smartness of appearance; good manners; ability to speak the English language; some experience of discipline (Cert. A: A.T.C.; Scouts; Sea Cadets; J.T.C.; O.T.C.); up to date general knowledge of affairs; clear-headedness; sense of humour; physical fitness; one or more hobbies; intelligence; bearing; personality; willingness to take responsibility.

Now let us enlarge on each of the above in turn.

By *alertness* we mean both physical and mental alertness and we expect to find both in young men. Many people are capable of moving quickly while their thoughts are in confusion; others who seem half asleep possess a brain that works at lightning speed. What we want is a combination of the two, co-ordination between hand and eye.

Enthusiasm for the Service, in contradistinction to personal considerations, is important. Nobody can be a success unless he is enthusiastic: the cadet who says he has been keen on the Service for years and always taken an interest in it, and then when questioned does not even know the difference between a cruiser and a corvette, or what flag one associates with the Royal Navy, or who has never heard of Admiral Cunningham, is soon bowled out: he is not honest, and all naval officers love candour.

Some people say that *cleanliness* does not matter and it is not necessary to be smart to be a success: they say that appearance is a secondary thing. There is some truth in what they say, but the Royal Navy is regarded as a clean Service, and people prefer to take their orders from, and live with, a clean body rather than a smelly one. From the Selection Board's point of view, if an applicant cannot be bothered to make some effort to appear clean when asking to be considered for a commission, he is really not worth consideration. A nail brush, a white collar and a haircut can make a lot of difference and weigh the scales in one's favour.

Good manners are essential and they are the hallmark of a successful officer. By good manners I do not mean that a young man should be servile. Most people know what we mean by good manners: respectfulness—though not overdone—obedience, the ability to take criticism without being offensive or sulky, the ability to say, "Sir" when it is due. One does not want to be too full of "sirs" and, on the other hand, not too offhand. The sprawling, lounging, hands-in-pockets, open-coat attitude is out of place at an interview, though sometimes we find it is a form of nervousness. The ready smile is not essential but it is pleasant and covers a multitude of defects: roaring jocularity is most unpleasant before a selection board, though all right in small doses in the ward-room.

Speech. The King's English must come in. By the "King's English" I do not mean a B.B.C. accent, but it must not be so conspicuously lacking in grammar as to be looked down upon by the men under one's command: accent does not affect a man's fighting qualities. The most important thing under this heading is that a cadet must have sufficient knowledge of the English language to put his thoughts into clearly understood words so that anybody can translate them into actions in the minimum amount of time. He must be able to express himself briefly and clearly.

Discipline. It is an advantage if an applicant has had some sort of experience of discipline, and learnt to be obedient and to give orders. There is no excuse for a young man not having this experience. Every intelligent cadet should be able to reach at least the rank of cadet-corporal during his service in the A.T.C. These N.C.O. ranks give him experience in exercising his power of command, that is the ability to induce others, both equals and subordinates, to work cheerfully and with zest.

General knowledge of current affairs is a good hallmark of a boy's intelligence. It is surprising how many boys do not know why we are at war. In some, the lack of general knowledge is simply shocking. One applicant told us that Ghandi was the Emperor of India and that Benbow was the name of a public house. Another mistook Madagascar for Ceylon (these were boys with School Certificates). Another, when asked, at the height of the fighting for Stalingrad, where the fighting in Russia was going on, pointed to the middle of Siberia.

Many young men who have motored thousands of miles have not the slightest idea of how a petrol engine works, and one applicant who had driven a Morris 8 for two years thought the 8 stood for the number of cylinders.

We find that many boys do not read the papers intelligently, and few of them know what is going on all around them. They do not realise the importance of the Persian Gulf to Russia, of Malta to our Mediterranean Fleet, the Brazilian Coast to our Allies and—apart from this—few of them can point to Gibraltar on a map, or pick out the Suez or Panama Canals.

Clear-headedness is the ability to understand and see what is at the back of orders received from superior officers and to transmit orders to subordinates, making them realise the reason for such orders.

Sense of humour—the foundation of many an officer's success. I will not attempt to define it. It is most important, and I want to combine it with personality, for it is essentially part of a *charming personality.* Combined with tolerance, and the ability to get on happily with superiors and subordinates.

These are part and parcel of Personality and all help in the smooth running of a successful ship.

Human qualities should be part of the make-up of every naval officer, i.e. the power to show sincere sympathy with others, especially subordinates, in all their affairs, including private affairs. We may include here another useful quality, a broad outlook, the ability to see the ultimate object of any action and *not to* "fail to see the wood for the trees."

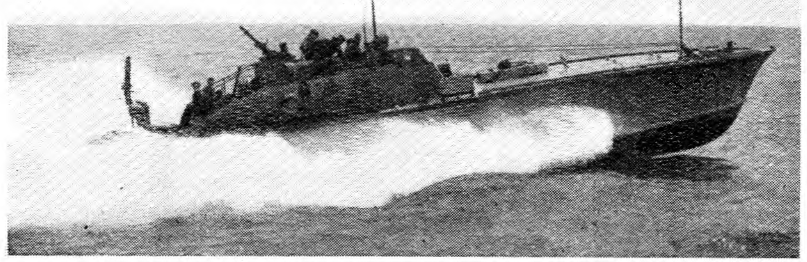
Physical fitness is a matter for the doctors to judge, but it is important that all officers should appear to be fit and set a good example to the men. Bleary-eyed officers suffering from hangovers do not command respect.

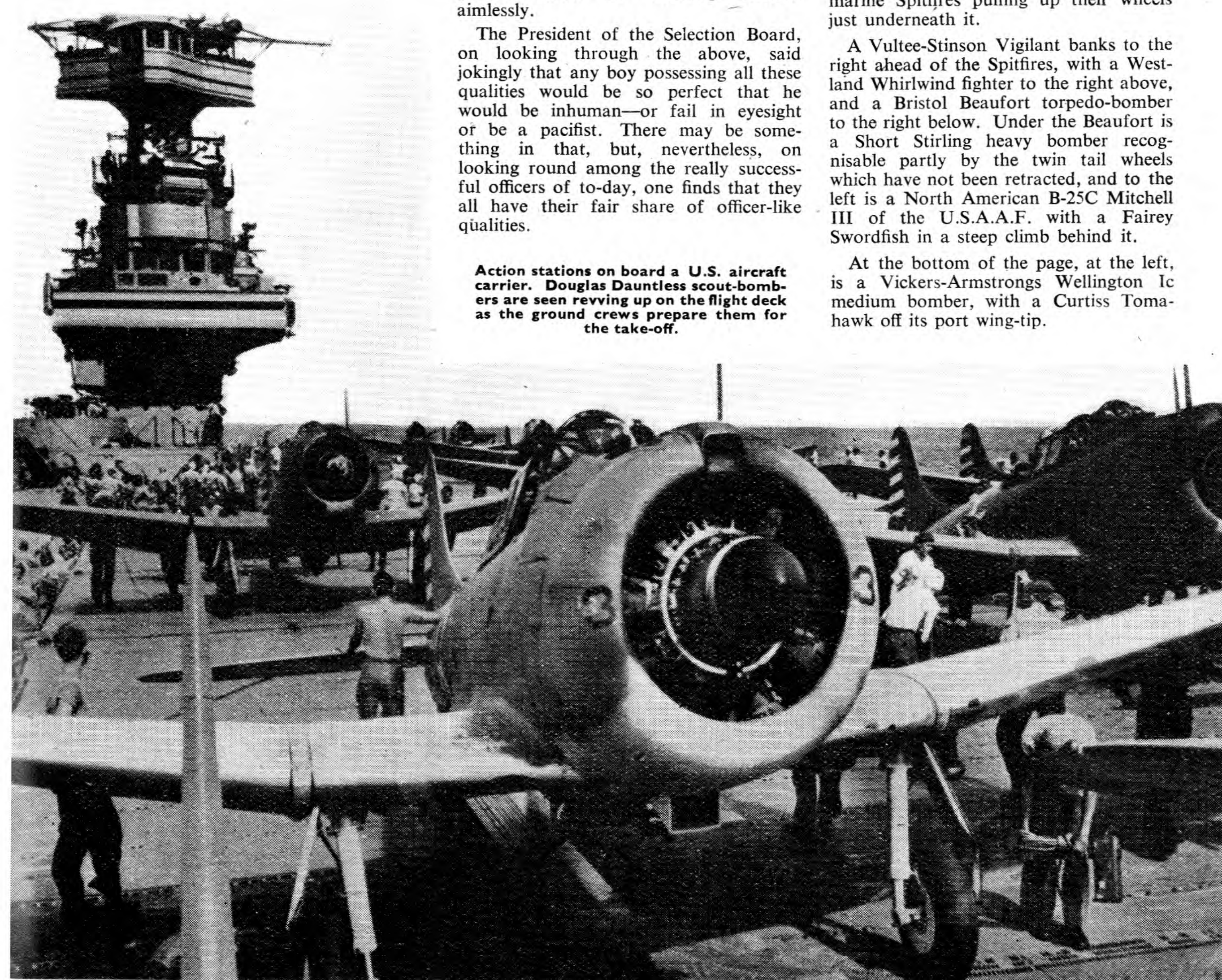
Bearing. This comes to a large degree from previous training in the A.T.C., but I include the ability to look one straight in the eye and hold oneself as if proud to be in uniform. The "General Impression", that is, the impression gained by a Selection Board during half an hour, is most important and it depends largely on bearing.

A young man who has one or two hobbies, we usually find, is an enterprising lad, certainly preferable to the type that spends all his spare time in the picture house or amusing himself aimlessly.

The President of the Selection Board, on looking through the above, said jokingly that any boy possessing all these qualities would be so perfect that he would be inhuman—or fail in eyesight or be a pacifist. There may be something in that, but, nevertheless, on looking round among the really successful officers of to-day, one finds that they all have their fair share of officer-like qualities.

"Many people are capable of moving quickly while their thoughts are in confusion . . . but thoughts must be put into clearly understood words that can be translated into actions in the minimum of time."





Action stations on board a U.S. aircraft carrier. Douglas Dauntless scout-bombers are seen revving up on the flight deck as the ground crews prepare them for the take-off.

Key to As You See Them

(*see inside front cover*)

At the top left of the page is a Douglas Boston III day-bomber; to the right a Lockheed Hudson. Just off the tail of the Hudson is a Curtiss Tomahawk fighter-reconnaissance machine, and in front of that, looking very similar, a Hawker Hurricane I. Underneath is a Hurricane IIB, with a Supermarine Spitfire VA on its starboard quarter, and a Fairey Fulmar I two-seat Fleet fighter ahead.

An Avro Manchester is to the left of the Fulmar, and underneath is a Vought-Sikorsky OS2U-3 Kingfisher. On the other side of the caption is a twin-boom machine, the Lockheed P-38 Lightning, or Atalanta, as the Americans call it. Under the Lockheed, diving away to the right, is a North American Mustang, and to the left is a glider, the General Aircraft Hotspur II. Aft of the glider is a Consolidated Catalina, with two Supermarine Spitfires pulling up their wheels just underneath it.

A Vultee-Stinson Vigilant banks to the right ahead of the Spitfires, with a Westland Whirlwind fighter to the right above, and a Bristol Beaufort torpedo-bomber to the right below. Under the Beaufort is a Short Stirling heavy bomber recognisable partly by the twin tail wheels which have not been retracted, and to the right is a North American B-25C Mitchell III of the U.S.A.A.F. with a Fairey Swordfish in a steep climb behind it.

At the bottom of the page, at the left, is a Vickers-Armstrongs Wellington Ic medium bomber, with a Curtiss Tomahawk off its port wing-tip.

Altimeter Progress

by **C. Farley**

THE early types of altimeters suffered from what is known as "lag"; this is the slowness of the capsule to return to its normal state after being distended by the action due to decreased pressure at altitudes. Sometimes it would never completely return. This was found to be due mostly to the method then adopted for joining the two halves of the capsule together. It was later discovered that by making them with peripheral flanges instead of overlapping edges that this error, which might be anything up to 500 feet after a high climb, could be reduced to 250 feet. Thus encouraged, they set to work to improve still further the performance of the instrument, and they found that by the careful selection and special treatment of the materials employed they could bring the error down to as small a figure as 75 feet.

It does not follow that because these alterations proved necessary to make the aneroid suitable for aviation purposes that it was badly designed in the first place. It served well enough for the purpose it was intended for, which was to measure pressure on the ground. But changes in atmospheric pressure on the ground due to changes in meteorological conditions take place slowly; whereas changes due to the varying height of an aeroplane in flight are rapid, so the behaviour of the capsule in aircraft had to be carefully studied before the defects referred to above could be detected and remedied.

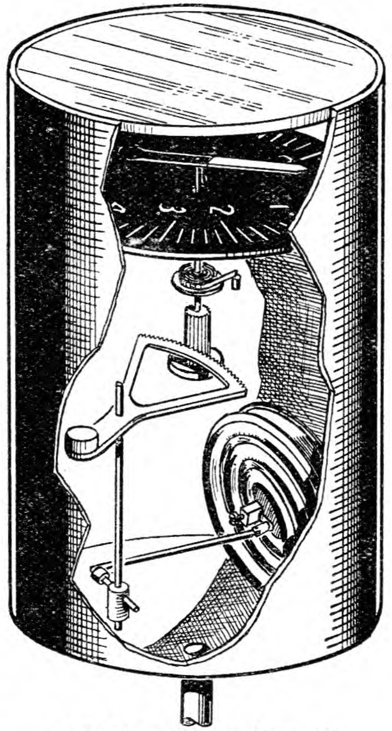
Further Improvements

The design of airframes and engines progressed rapidly, thus giving the machines far greater speed. The question of using the altimeter as an aid to landing began to assume real importance, and research workers were striving for still better results. In these earlier altimeters one side of the capsule was fixed to the base of the instrument. This gave it a certain amount of restriction which was undesirable, so the next step was to suspend the capsule between two knife edges; this gave maximum freedom of movement and had quite astonishing result, for we find now that the margin of error due to mechanical causes has been reduced to 10 feet in 40,000.

None of these improvements made very much difference to the appearance of the instrument, and yet they resulted in reducing an error of 500 feet to the small amount of 10 feet; and when we consider the urgency of landing an aircraft in bad visibility, the magnitude of this achievement can hardly be exaggerated. But this is not all that has been accomplished.

Temperature Compensation

Having overcome the constructional difficulties, the designers soon found themselves face to face with fresh trials. The great variation of temperature encountered with machines of ever-increasing ceiling gave rise to the problem of compensation for the contraction of various parts of the mechanism, and the hardening and therefore stiffening resistance of the capsule under intense cold. A bimetallic strip was first introduced into the magnifying lever, but this led to over-compensation to the extent of over a thousand feet. The error was certainly on the safe side, but was too big. Eventually a solution was found by fixing a bimetallic helix to the spindle of the pointer. This resulted in an error of only plus 85 feet in 40,000.



The Kollsman Simple Altimeter.

High-Speed Compensation

Another snag began to make itself a nuisance with high-speed machines, and that was the difference of pressure in the cockpit from that of the true atmospheric pressure outside. This would amount sometimes to an error of 150 feet. To overcome this they put the instruments into airtight cases, which are then connected up to the static side of the airspeed indicator system.

The altimeter was now beginning to take its place among the other instruments as an indispensable part of the aircraft equipment; but the speeds of modern machines have shown the necessity for still further refinements. Acceleration, deceleration and centrifugal force can all have bad effects on instruments at high speeds, so once again compensating devices had to be introduced.

But with all these improvements the altimeter remains, in a sense, a sham. It does not, and so long as the present principle is adhered to, it never can, really measure the height of the aircraft from the ground: it merely measures the prevailing atmospheric pressure at the height at which the aeroplane happens to be flying. This is not very satisfactory, because the atmospheric pressure is continually changing with changes of temperature and latitude, so that however accurate the instrument may be it will still be necessary for the pilot to juggle with computors and calculations in order to arrive at a true indication of his height, and this is surely undesirable in an emergency.

What is really required is an instrument that will gauge the distance between the aircraft and any object (usually the earth) immediately beneath it, so that warning may be given when unexpectedly approaching high ground, mountains, or even buildings.

There are other methods—electrical, acoustical and optical—but these are not suitable for aircraft. In all probability the ultimate solution will be found in the reflected radio beam system which has been experimented with in America. This instrument possesses truly staggering possibilities; even in the densest fog the presence of a town or village, or even very uneven ground, would be indicated by a fluctuation of the needle.

Pictorial Crosswords Solutions

(*see page* 9)

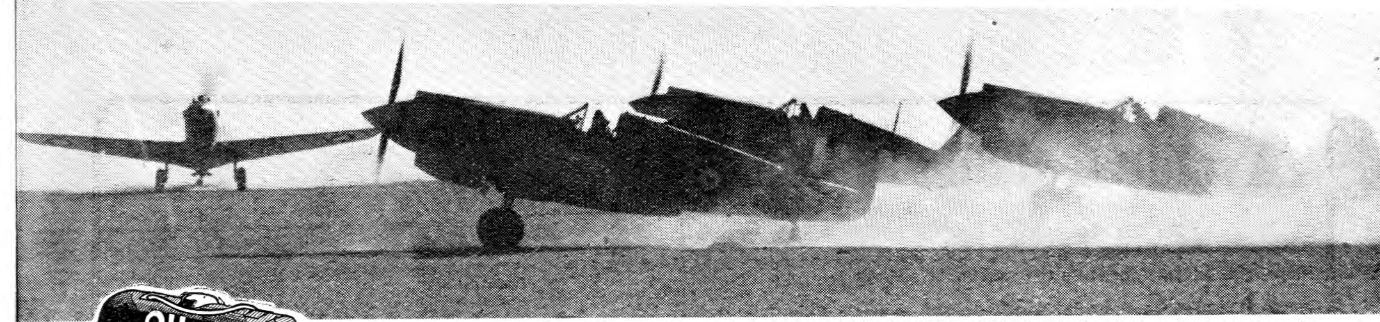
ACROSS.—1, Demon; 5, Buffalo; 9, Ibr; 10, Lib; 11, Ar; 12, Gotha; 15, Goeland; 17, BR; 18, Airone; 19, MCD; 20, CR; 21, Typhoon; 22, Hudsons; 25, I.O.; 27, Ryan; 29, W.O.s; 31, Cleveland; 33, Whitley; 34, Oleo; 35, Gouge; 38, Scion; 41, Freccia; 45, Hereford; 47, Liberators; 48, Ford; 49, XT; 51, Hampden; 52, Stuka.

DOWN.—1, Digby; 2, EBOR; 3, MRT; 4, Simoun; 6, Falcho; 7, Arado; 8, Odd ones do; 13, Hardy; 14, AI; 15, GET; 16, Empire; 20, Curtiss; 23, Saulnier; 24, ON; 26, Hawks; 28, Beauforts; 29, Wal; 30, One; 31, Cygnet; 32, LO; 36, GRRS; 37, EED; 39, Cheap; 40, Orate; 42, Chota; 43, Audax; 44, Pisa; 46, Fox; 50, M.U.

(*see page* 25)

ACROSS.—1, BBB; 3, Moth; 8, Lerwick; 10, Flamingo; 11, RO; 12, Macchi; 13, Airacobra; 17, MAY; 18, RE; 19, Phœnix; 21, Voss; 22, SES; 24, ER; 25, RO; 27, Stinson; 28, RE; 29, ENA; 31, GWR; 33, Jaguar; 35, AD; 36, LY; 37, HRAKS or HKARS; 38, Albacore; 39, PP; 41, Aste; 42, TT; 45, Fieselers; 48, Tomahawk; 49, Seals.

DOWN.—1, Baltimore; 2, Bombays; 3, Mentors; 4, HL; 5, Proctors; 6, Lightning; 7, SKY; 9, ERA; 12, Map; 14, Raso; 15, Bees; 16, Oxford; 20, Henschels; 23, Stormovik; 26, ANG; 28, Reliant; 29, Eagle; 30, Audax; 32, Wasp; 34, Battle; 38, Atom; 40, Puss; 43, Tea; 44, DH; 45, Fw; 46 ES; 47, RL.



These Tomahawks taking off from a Middle East aerodrome indicate how desert heat and sand can complicate the problem of engine lubrication.

LUBRICATION

by **G. D. Duguid, M.A.**

WHEN a shaft or journal is running in a bearing, it may do so under three conditions—dry friction, greasy (or boundary) friction, and fluid friction.

Dry Friction

In the case of dry friction we assume a complete absence of lubrication, so that there is complete metal-to-metal contact. The frictional resistance depends upon the load on the bearing and the type of the metals which are in contact. The friction will produce a large amount of heat, so that it would be impossible to run the bearing under load for long without complete seizure.

Boundary Lubrication

In greasy or boundary lubrication there is some lubricant present in the bearing, but not enough to separate the surfaces completely, the resistance to motion still depending on the load and the nature of the surfaces. It is an advantage to use dissimilar metals in contact with each other. The anti-friction or bearing metals usually used are phosphor bronze, white-metal and lead bronze, the latter two being used for aero-engine big-end and main bearings. In boundary lubrication the film of lubricant is thin, so that the surfaces are intermittently in contact.

The finish of the surfaces is important. Even a ground-steel shaft running in a burnished bearing, if viewed under the microscope, will show an undulating surface. In these boundary conditions a vegetable oil such as castor oil shows up to advantage over a mineral oil, as it has more "oiliness." This means the ability of an oil to maintain a thin film on moving surfaces under severe conditions, the film of oil adhering so powerfully to the surface of the metal that it is sometimes difficult to remove it. The film of oil is said to be "adsorbed" on the surface of the metal, in the same way as poison gas is adsorbed on the surface of the charcoal particles in your gas-mask canister.

New engines are sometimes run in on castor oil, so that the surfaces in contact become thoroughly impregnated with the lubricant before changing over to mineral oil for permanent running. The disadvantage of castor oil for prolonged running is its tendency to oxidisation and gum formation, which make it bad for piston lubrication, owing to rings sticking.

Fluid Lubrication

In fully flooded lubrication the surfaces of the bearing metals are completely separated by means of an oil film.

The resistance to movement now becomes a fluid resistance, as it depends upon the resistance to shearing of the oil film itself. This resistance to shearing depends upon what is called the viscosity of the oil, which can be measured by its resistance to flow; for example, treacle has a high viscosity, which is reduced if you heat it. Heating a lubricating oil will usually decrease its viscosity also, so that one very important function of the lubricating oil is to carry heat away from the bearings as well as to lubricate them.

If the temperature rose greatly, the viscosity of the oil might be so reduced that the oil film could not be maintained, with consequent metallic contact and possible seizure.

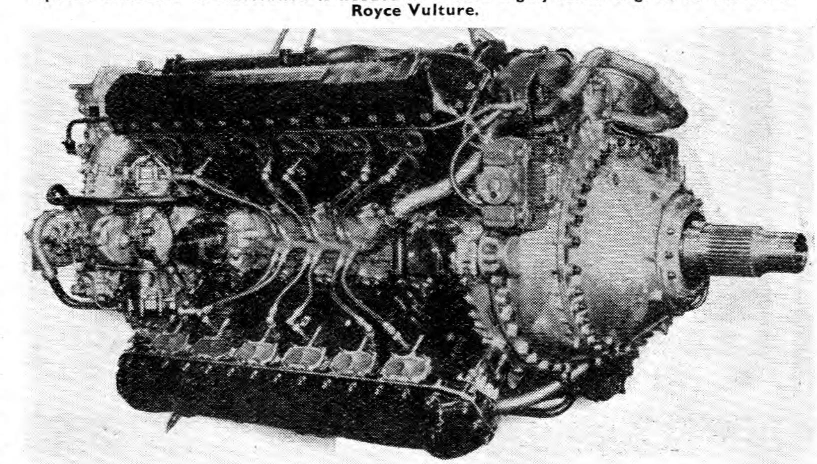
In practice fully flooded lubrication is not always achieved under high-duty conditions, and the lubrication is probably midway between fully flooded and boundary conditions.

Pressure Lubrication

In aero engines, pressure lubrication is used for all important bearings, so ensuring a supply of fresh and cool oil to take away the heat. Most aero engines are lubricated on the dry-sump system, which means that the engine sump does not carry the oil supply. The oil is carried in a tank external to the engine, and from the tank it is drawn through a pressure filter by the pressure pump, and delivered under pressure to the main bearings. By means of drilled oilways in the crankshaft the big-end bearings are fed, and the oil flung from these bearings gives splash lubrication to the cylinder walls and piston rings. Gudgeon pins are splash lubricated. Other moving parts of the engine may be either splash lubricated or have an auxiliary oil supply by separate leads from the main feed. As the oil drains back to the sump, a scavenge pump draws it through the scavenge filter, and passes it through an oil cooler to the tank. The scavenge pump is of larger capacity than the pressure pump, and the pumps are usually of the gear type.

This consists of two gearwheels meshing together and rotating inside a casing in which they are a close fit. Oil entering the pump is picked up by the gear teeth and carried round on the outside between the wheels and the casing, the pressure being limited by means of a pressure-relief valve, which opens and allows the oil to escape if the pressure should rise excessively.

Special attention to lubrication is needed with such highly-tuned engines as the Rolls-Royce Vulture.



Avoid Talking Carelessly

For this slogan, which uses the initials A.T.C., we are indebted to Warrant Officer M. G. K. Byrne, of the Hull Squadron. John Sinclair wrote the article.

FOR the first time thousands and thousands of you cadets are being given the wonderful opportunity of *visiting* R.A.F. stations, but you know, as well as I do, that you are not regarded as visitors in the usual sense of the word. The moment you march into camp you become an integral part of the Royal Air Force. You are taken on to the strength, and receive the confidences of your brother airmen—and, if my eyes did not deceive me at ——, your sister airwomen as well!

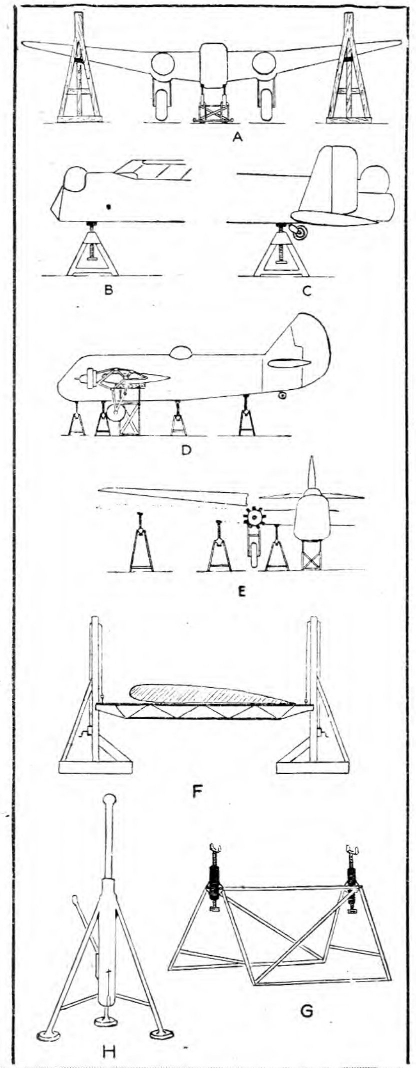
While you are at camp you are given every privilege. You are allowed to fly (providing Service duties are not affected). You are permitted to wander freely (perhaps a little too freely sometimes) around hangars. You may examine aircraft and ask questions. You may, if you are sufficiently wideawake, see many new developments which, for security reasons, have not yet been disclosed to the public. In other words, the R.A.F. takes you into its confidence and treats you as a fully fledged member of the Service.

It is only natural whilst you are in camp that you should "shoot a line" to your pals if, by chance, you click a three hours' "cross-country" with a D.F.C. pilot at the controls. It's also natural that you'll want to boast a bit if you finish the local blitz course in 10 minutes short of bogey. But—and here's the point of this article—keep your "line shooting" to yourself when you leave camp. Additionally, don't disclose—even to your parents or your girl friend—details of any special work which you have noticed being undertaken at the station you visited. Mother may tell the milkman, Father may tell his pal at the club, Mary may tell her sister. The milkman, the clubman and Mary's sister may—I'm not saying they will—pass on the "gen" to someone who is *not* "one of us." An odd scrap of conversation may well provide the trained Secret Service agent with just that little clue which may spell disaster to our cause. So guard your tongue as you guard your life, and don't, *under any circumstances*, yarn in public about the things you've seen and heard at summer camp, or at any R.A.F. station you may visit.

The R.A.F. lets you into its secrets —don't give them away.

JACKING-UP

by Harold P. Lees



EACH different type of aircraft has its own method of jacking and trestling, the positions of the trestles depending on how the weight of the machine is distributed. Fighters, because of their short length and the weight of the engine, are usually heavier at the front than at the rear, and care is taken when lifting the tail on to a trestle to see that the weight is not suddenly thrown forward and the aircraft tipped up. To prevent this, a weight is hung on to some part of the tail.

The jacking and trestling points are clearly marked on the surface of the fuselage or mainplane, with the words "Place trestle here" or "Jacking point" stencilled on. The pads of the main fuselage jack fit into special fittings which are usually enclosed behind removable panels. A jack or trestle is never placed at any other point than that indicated. Designers fix what is probably the only point capable of taking the weight of the machine.

Jacks or trestles may be specially designed for a type of aircraft, or they may be of the universal design with special beams to fit the curvature of the sections which rest on them. To prevent damage to the metal or canvas the beams are padded. The main fuselage jack is strong enough to take the whole forward weight of the aircraft, but it is never used alone. To give full support and to prevent the aircraft from slipping off the main jack, a trestle is placed at the nose and at the tail. In addition, trestles or gantries are placed under the wings to support them and to prevent them from tipping if any weight is thrown on one side. Gantries are used only on the larger aircraft, where the mainplanes are too high for a trestle to reach. The beam of a gantry on which the mainplane rests moves up and down by means of a chain and handle.

The principal jack—the one which is under the fuselage—can be either mechanical or hydraulic. The mechanical ones are raised and lowered by winding a ratchet wheel on which meshes a screwed cylinder. The hydraulic types are pumped up, and lowered by releasing a lever.

Information about the trestling of an aeroplane is always found in volume one of the respective aircraft handbooks. A trestling diagram is shown on this page. Fig. A shows a main fuselage jack taking the weight of the aircraft, and two gantries at each side supporting the wings. A better view of how the gantries work is shown in Fig. F. The jack shown in Fig. A is a mechanical one. An hydraulic jack is shown in Fig. H, the large lever at the side being used to pump it. The small rod at the base of the jack is used when it is desired to lower the aircraft. Figs. B and C show the support given to the nose and tail of the same machine. This jacking diagram represents one which would be used for a fairly large type of aeroplane, such as a Whitley or a Wellington. The fuselage of a smaller type, such as a twin-engined fighter, is supported on universal trestles, as shown in Fig. D, while the undercarriage and engines are being fitted. The wings are assembled as in E. A trestle is shown in G; the beam fits across the two U pieces.

A trestle-type jack supporting a Spitfire during a demonstration of undercarriage retraction. The special bar that fits in the adjustable U pieces can be seen behind the air intake.

A Letter from the Fleet Air Arm

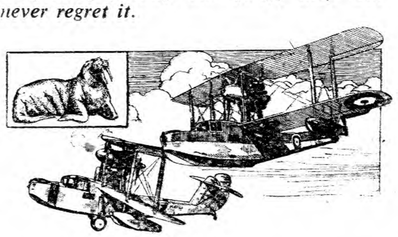
IN the August Gazette we published a letter from a cadet who had gone to Canada for his flying training. Here is another such letter, this one from a cadet who joined the Fleet Air Arm and who has been doing his training at various places round our own coasts. The letter is addressed to the navigation instructor of the cadet's old squadron, and gives a few hints which may be useful to others who hope to join the Navy. Here it is:

Mess E.S., H.M.S. ———

Dear Mr. Price,

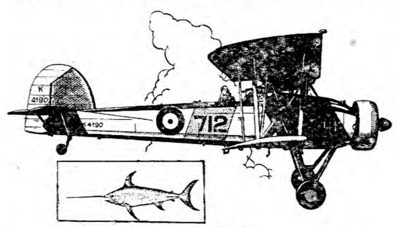
I expect you have almost completely forgotten me by this time, as your long-term Navigation student between September 1941 and April 1942.

I have not written before, but as you can well imagine, I have been very busy indeed. Since joining at ——— on 15th April, I have had two moves. I was sent to ——— after seven weeks, and two weeks later was drafted here. We have to do sea navigation, and extensive field training, which I believe, is additional to the R.A.F. Syllabus. The field training is perhaps the worst of our subjects. It involves convincing a stringent examining officer that you can instruct a squad and carry out various field movements with them. The chief secret is (1) to keep your head and (2) to keep shouting. We are due for exams in two weeks as we have now done six out of eight weeks here. I have not had any leave at all as yet, this being my only complaint so far. Apart from that, the life, food, conditions, etc., are first class. I can honestly assure any of your cadets who are contemplating joining our gang, they will never regret it.



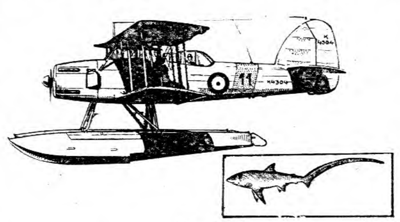
Walrus

The air navigation we do here is not quite as advanced as that which I was doing when I left the A.T.C. So, once again, may I thank you for the care you took with me—it has saved me hours and hours of hard slogging. We do some map reading, also the altimeter, and some elementary meteorology on the Nav. side. Our instructor is a schoolmaster lieutenant (R.N.) and he's very good indeed. We have to keep complete logs for all plotting done, but that does not trouble me. Sea navigation is very similar, but much easier. The D/R is a position determined by use of the course and speed of the ship only—we don't have to bother with currents or winds. They do expect a greater degree of accuracy however. Nav. is of paramount importance here—if you can't do it, they "dip" you straight away. Some of the chaps have great difficulty with it, so I act as a sort of instructor during dog watch hours. They all insist (1) on marking off T.A.Ss. on their tracks, and (2) mixing up the scales (taking distances of long scale), you are no doubt well acquainted with these two failings.



Swordfish

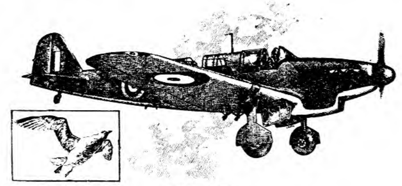
We do not do any buzz here at all, but do flashing up to six w.p.m. and semaphore to six w.p.m. (which is very easy). The observers do buzz up to 20 w.p.m., which I should think is very difficult judging from my experience of four w.p.m. We have to know tonnage, armament and be able to recognise all British warships, this being one of our headaches. The aircraft rec. covers all British and about 70 Italians and Germans (we have to know the wing spans).



Seafox

I had a letter from Healing, the other day. He is at E.F.T.S. at ——— and has already put in 7hrs. 40 mins. on Tiger Moths. He didn't seem to be very pleased with his flying, but that's not unusual is it? He tells me he finished 3rd out of 97 in his I.T.W., another feather in the cap of 210 Squadron. Lockyer, the big dark chap, is still in I.T.W. at ———. He, too, is doing very well and enjoying himself very much. I am afraid I have completely lost touch with the rest of the fellows. Perhaps you know some of their movements.

I trust the A.T.C. is still as strong, numerically and otherwise, as ever. I can do no less than wish you and the A.T.C. every success. I think I have proved for myself the immense value of A.T.C. training prior to entering the forces. This applies just as much to the F.A.A. as to the R.A.F. I didn't expect it to work out that way. Incidentally, the big noises here fully appreciate the value of A.T.C. training, and take the names of all cadets who have had this training.



Fulmar

As for conditions here, they are quite good. Food is rather inconsistent, but on the whole, good. ——— was very cold but also very pleasant. ——— was a perfect haven and like all good things, ended much too soon.

I hope you have not been unduly bored by this somewhat lengthy chronology of my own happenings, but I thought it may be of interest to any cadets who may be considering joining the F.A.A.

Wishing you every success with your potential observers, etc.

Yours sincerely,
G. St. Barton

Pictorial Crossword

HERE is another example of the new idea devised by the *A.T.C. Gazette*. The crossword itself was designed by Flight Lieut. S. C. Nunn. The clues are drawings (by James Hay Stevens and Roy Cross) of various aircraft. The name of the aircraft depicted is usually the solution, but not always. Sometimes it may be the maker's name, though if the manufacturer's name is a compound one only part of the name, such as Blohm, or D.H. may be the answer. The number of letters in the solution will help you in selecting the right word.

Clues with compound names such as Tiger Moth may give the answer "Tiger" or "Moth." The size of the word helps you to decide. Plurals may be indicated by two machines of the same type or by "+S" after the clue number.

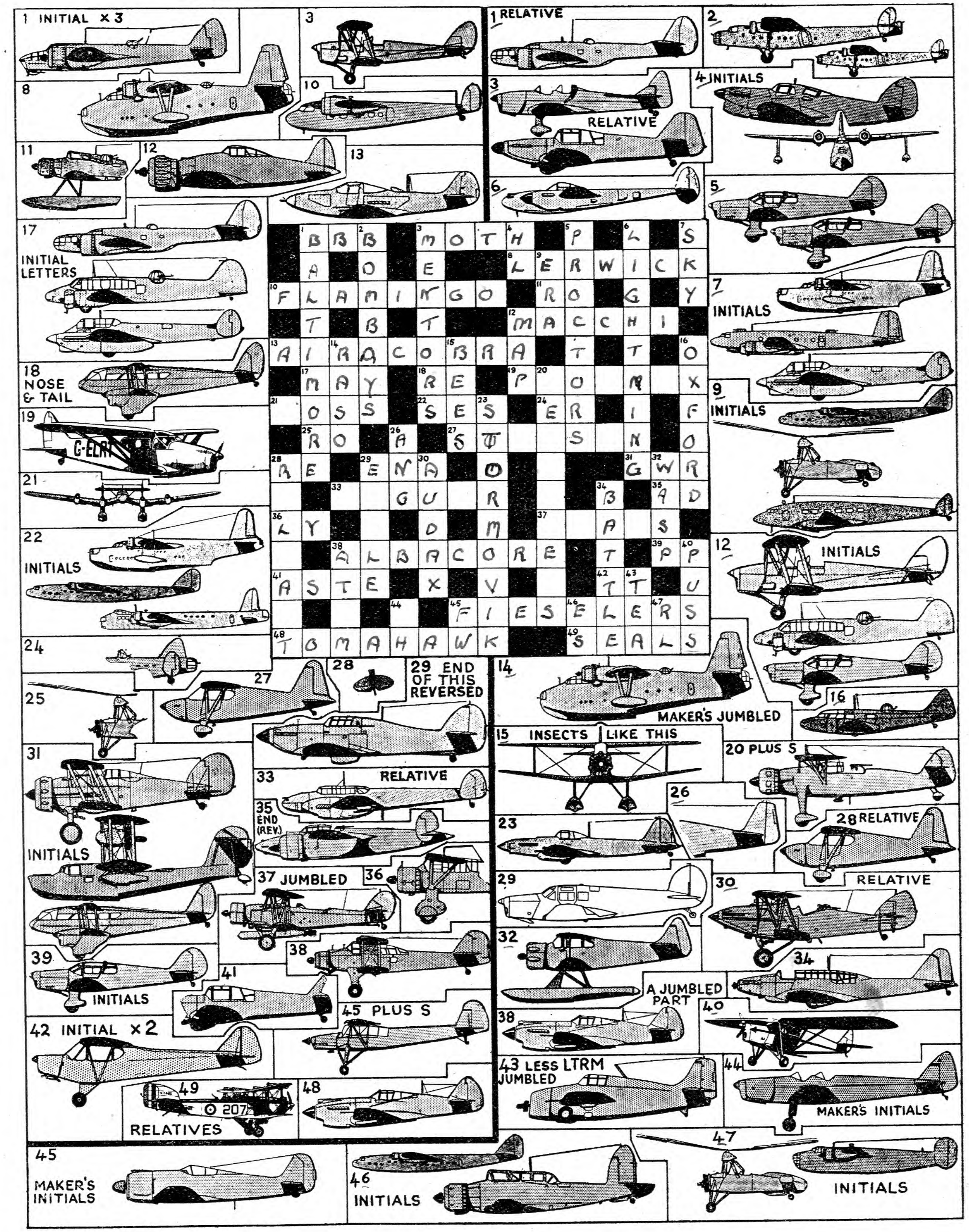
The word "Relative" indicates that the solution is to be found in the name of another aircraft made by the firm that makes the one depicted.

If part of an aircraft is shown, it means that the solution lies in the same part of the word. The nose of the Lysander, for instance, might indicate 'LY', and the Master minus its nose and tail would indicate 'ASTE'.

(*Solution on page 20.*)

PICTORIAL CROSSWORD

ACROSS (see note on page 24) **DOWN**



Engine Terms

by G. D. Duguid, M.A.

INSTRUCTION books, specifications, or descriptions of aero engines very often contain references to certain terms which are in common use, and a brief list of these is given below:

Horse-power (*H.P.*). This is defined as the rate of doing work, that is, the faster a certain amount of work is done the more power must be exerted.

If 33,000 lb. is raised through one foot in one minute, the rate of working is expressed as 33,000 ft.-lb. a minute. and this rate of working is called one horse-power.

Indicated horse-power (*I.H.P.*). The horse-power developed in the cylinders at the piston crown.

Brake horse-power (*B.H.P.*). The useful horse-power available at the propeller shaft.

Lost horse-power (*L.H.P.*). The horse-power which is lost in driving the auxiliaries, in engine friction and pumping loss, i.e. getting the charge into the cylinder and the exhaust gases out.

$$\text{I.H.P.} - \text{B.H.P.} = \text{L.H.P.}$$

Mechanical efficiency. The ratio between the Brake H.P. and Indicated H.P., usually expressed as a percentage. The value is usually about 85 to 90 per cent.

Thermal efficiency. The ratio between the work obtained from the engine expressed in heat units, to the number of heat units supplied to the engine in the fuel. Usually about 30 per cent.

Volumetric efficiency. The amount of mixture drawn in on the suction stroke divided by the amount which would be drawn in if the cylinder was completely full. The latter is known as the swept volume, which is the volume swept out by the piston when travelling through one complete stroke. The comparison is made under standard temperature and pressure conditions. The efficiency is usually from 75 to 80 per cent.

Clearance volume. The volume of the space between the piston crown and cylinder head with the piston at the top of its stroke.

Compression ratio. The ratio between the total volume of the cylinder and cylinder head with the piston at the bottom of the stroke, to the volume of the cylinder head with the piston at the top of the stroke—i.e.

$$\text{Comp. ratio} = \frac{\text{swept vol.} + \text{clearance vol.}}{\text{clearance vol.}}$$

Top dead centre (*T.D.C.*). The position of the piston when exactly at the top of its stroke; in an inverted engine it is usually called the outer dead centre.

Bottom dead centre (*B.D.C.*). The position of the piston when exactly at the bottom of its stroke; on inverted engines it is called the inner dead centre.

Brake mean effective pressure (*B.M.E.P.*). The mean or average pressure which, if it could be applied steadily to the piston on the power stroke, would give the same brake horse-power as is actually produced by the fluctuating pressures. It is chiefly used as a means of calculating the brake horse-power, knowing the bore, stroke and r.p.m. of the engine.

Up on the cowling of a Stirling an airman explains to cadets some details of the engine. To the cadet on the tarmac they seem a long way up.

Specific fuel consumption. The amount of petrol which would have to be used in one hour to produce one B.H.P., expressed as pints per B.H.P. hour; average 0.55 pints.

Valve lead. When a valve opens before the dead-centre positions; e.g. inlet valve opens before T.D.C., exhaust valve opens before B.D.C.

Valve lag. When a valve remains open after the dead-centre positions; e.g. inlet valve closes after B.D.C., exhaust valve closes after T.D.C.

The object in the first case is to take advantage of the momentum of the incoming mixture to help fill the cylinder, and in the latter case to take advantage of the momentum of the outgoing exhaust gases to assist in scavenging the cylinder.

Valve overlap. When the inlet and exhaust valves are open together. This occurs at the end of the exhaust stroke, known as scavenging T.D.C., when the inlet opens before the exhaust has closed. The mixture entering the cylinder helps to scavenge the exhaust gases left in the cylinder head.

Boost. Short for "boost pressure" in boosted or supercharged engines. Is the pressure in the induction system above or below normal atmospheric pressure (14.7 lb. per sq. in.).

Boost gauge. An instrument working on the same principle as the aneroid barometer, or altimeter.

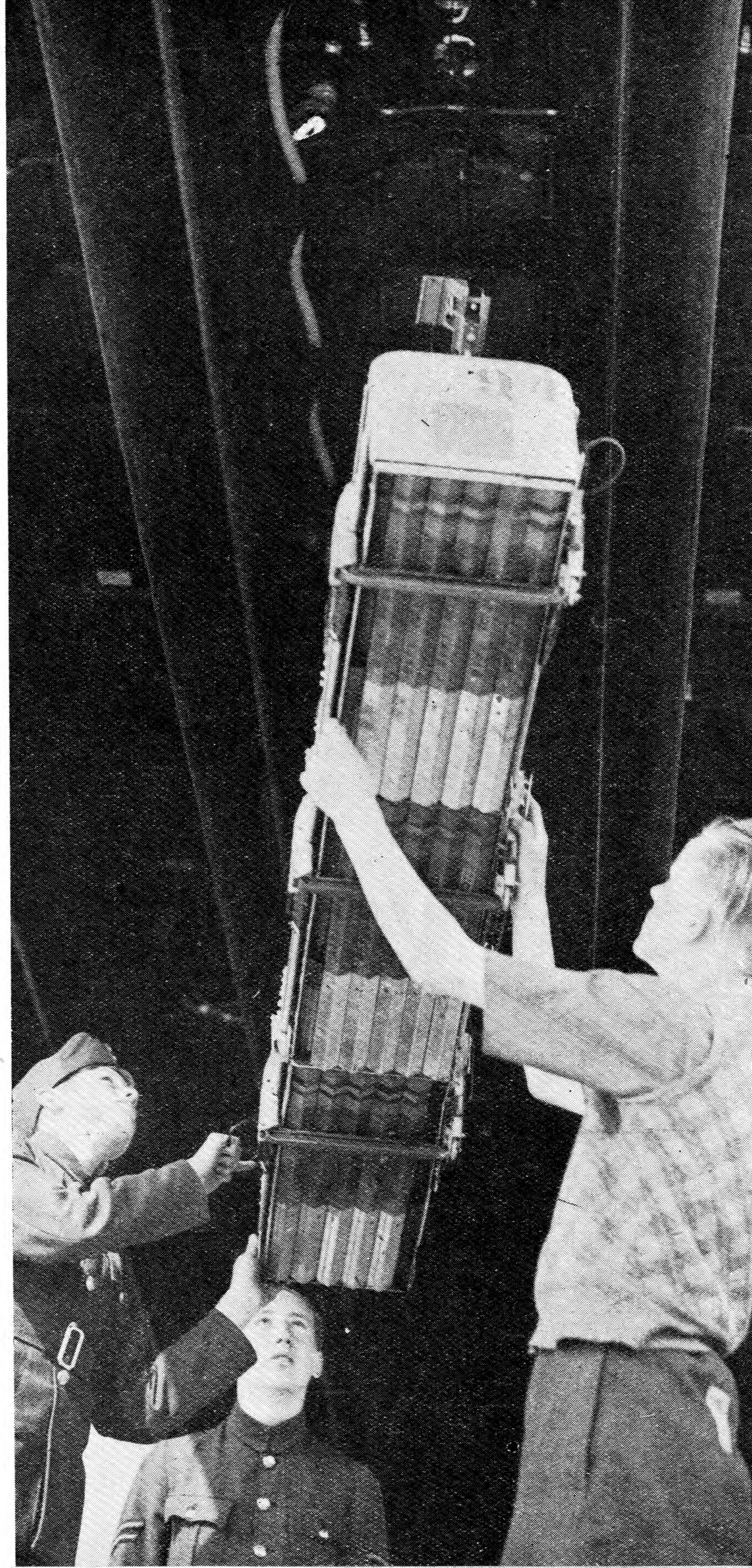
Registers boost pressures above (+) or below (−) atmospheric. American gauges show the total pressure in inches of mercury. 29.92 in. of mercury equal 14.7 lb. per sq. in.; i.e. 2 in. of mercury very nearly equal 1 lb. per sq. in.

Rated altitude. Is the greatest altitude at which the rated boost is possible at normal engine speed.

If this altitude is exceeded the boost falls off and power decreases as in a normally aspirated engine.

Automatic boost control (*A.B.C.*). A device which prevents the normal boost being exceeded. Operated by means of an aneroid capsule with a fairly high vacuum. This is exposed to the boost pressure, and if it rises the capsule is compressed. This moves a balance valve, which admits oil pressure to one side of a servo piston, opening the other side to exhaust, and the movement of the piston closes the throttle.

The real thing. Bombing-up a Stirling with an incendiary bomb container. The winch is in the fuselage above, the cable running through into the bomb bay.



Answers to DO YOU KNOW WHY?

(see back cover)

1. A German BMW 801D 14-cylinder radial engine, it is fitted to the Focke-Wulf (Fw) 190a3 and has a 12-bladed cooling fan just inside the armour plated cowling, so allowing a smaller air inlet and a closer cowling with much better streamlining than the normally air-cooled radial engine.

2. Because it is a Caproni jet-propulsion aircraft which requires no outside propeller. The engine sucks air into the duct in the nose, then forces the air out of a smaller opening in the tail, thus causing a jet effect which propels the aircraft forward. The pressure is created by an engine-driven compressor fan running inside the ducted fuselage.

3. The machine illustrated—a Republic Thunderbolt P-47B, has a radial engine of 2,000-h.p. To grip the air efficiently and translate as much of the 2,000-h.p. as possible requires considerable blade area. With three blades this is difficult, owing to ground clearances, etc., so to obtain sufficient blade area to translate the 2,000-h.p. into thrust four blades are necessary.

4. To prevent glinting, a bomber's propeller is painted dull black and is invisible when rotating at even moderate speeds, so the tips are painted a bright yellow to prevent people walking into them on the ground.

5. They are holding down the tail of a Fairey Battle while the pilot runs up the engine. This prevents the tail coming up and causing the aircraft either to nose down or override the chocks. We cannot hear the din, but the mechanics can!

6. At high speeds the air pressure is enormous, and the smallest hole in the leading edges causes disturbances which affect performances, so all cannon and machine-gun apertures are muzzled. Incidentally it also protects the barrel. When the gun is fired the projectile pierces the muzzle.

7. The pupil is about to undergo blind-flying instruction and is drawing the blind-flying hood over his head. He will then be flying completely blind as at night or in a cloud. The instruments are illuminated.

8. The cadet seated in the trainer is destined for Bomber Command. All bombers are fitted with similar wheels, fighters with control columns.

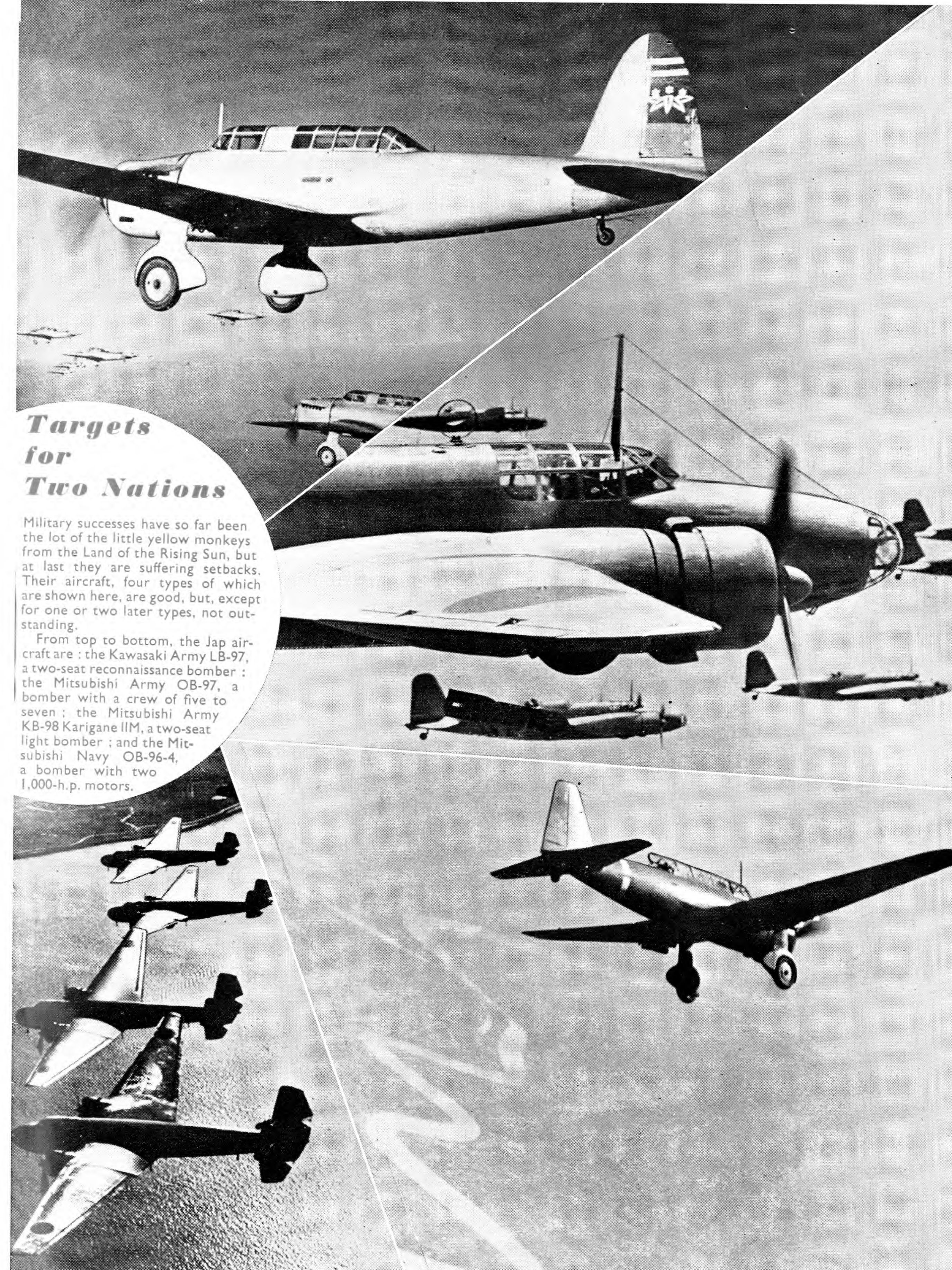
9. There are various explanations. The best known suggest either that, the air at high altitudes is always at or near the dew point, and the passage of the aircraft or the exhaust from the engine touches it off so that a cloud is formed. They are really artificially induced cirrus.

10. Most American airfields have concrete runways. Their aircraft tyres are reinforced not only on the tread, but on the walls, as those of this Lockheed Hudson, to minimise the bursts and blow outs which are more likely on hard concrete than soft grass. Runways are "skiddy," too, when wet.

11. A perforated flap (as it is called) is fitted as a diving brake to this American dive bomber (probably the Douglas Dauntless). Similar brakes are fitted to the Ju.88 in the form of slats, but the principle is the same, namely to allow the flaps to slow up the bombing dive. The perforations are carefully calculated and placed for that purpose. Unperforated flaps would buckle at high diving speeds.

12. Because this Piper Cub is not fitted with brakes, so cannot be turned into the wind for take off very easily on the ground. The tail is very light indeed, so it is not so hard as it looks.

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 Limited, Rochester, Kent.



Targets for Two Nations

Military successes have so far been the lot of the little yellow monkeys from the Land of the Rising Sun, but at last they are suffering setbacks. Their aircraft, four types of which are shown here, are good, but, except for one or two later types, not outstanding.

From top to bottom, the Jap aircraft are: the Kawasaki Army LB-97, a two-seat reconnaissance bomber: the Mitsubishi Army OB-97, a bomber with a crew of five to seven; the Mitsubishi Army KB-98 Karigane IIM, a two-seat light bomber; and the Mitsubishi Navy OB-96-4, a bomber with two 1,000-h.p. motors.