Three American Naval Kingfisher observation scouts on Atlantic patrol.

AIR TRAINING CORPS GAZETTE

VOL. II No. 11 NOVEMBER, 1942 Price 6d.

Hawker Hurricanes of the United Provinces Squadron on patrol.

MANY INVENTIONS

The Stourport and Bewdley squadron has its own cinema, illustrated here. You may want to know how we photographed the Hurricane and Spitfires appearing on the screen. We didn't; our artist superimposed a photograph on the white of the screen. The silhouettes below are part of the wall decoration of the Halifax squadron's recognition room. The large photograph on the right is of Wood Green's bomber trainer, designed by Flying Officer Carter.

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AIR TRAINING CORPS GAZETTE

Edited by Leonard Taylor

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Air Marshal William Avery Bishop, V.C., D.S.O., M.C., D.F.C., who brought down 72 enemy aircraft in the 1914-1918 war, inspecting a parade of East London cadets.

At the Rush

THE other day I was presented with a copy of a local magazine, and I was very interested in some of the articles. In particular there was one which was described by the editors as a slanderous account of the start of a new unit, which read as follows:

"It was one chilly afternoon in March, '41, when a small and varied band gathered together in ——'s sacred precincts and eyed each other dispassionately. This momentous occasion marked the beginning of thousands, nay, scores, of successful parades held by what is now the most famous squadron of ——'s Air Cadets. Action was the keynote. Plans were proposed and rejected, resolutions made and forgotten, difficulties foreseen and forestalled and uniforms promised for the end of May.

"Morse, mathematics and drill were the basic subjects of the first few weeks. Enthusiastic but handicapped Morse instructors scrounged, begged, borrowed, hired or stole masses of material with which to construct Morse buzzers. Rubber bands, chewing gum, brass strip, yards of wire of many colours and doubtful integrity, string, nuts, bolts and even whole telephones composed that weird apparatus which looked so efficient but never worked.

"Mathematics brought a look of fear into many eyes, but soon, as the idle brains began to function perfectly, as they had done years before, intrepid youths started pitting their skill and cunning against the answers at the back of the book.

"It is said that drill was a continual source of amusement to the onlooker and of despair to those concerned. The instructor's bull-like roar would subside, and in its place there rose the shrill, timid piping of a prospective N.C.O. drilling the scarecrow squad. Dressed in slacks, shorts, Sunday suits and boiler suits, with collars adrift and buttonless coats, they made a fine display of colour, with no claim to uniformity. Even the direction of their motion was varied, depending upon which direction they took to be left or right.

"In addition to these fantastic attractions, classes were started in physical training, navigation, wireless and engineering. Unaccustomed movements of limbs brought forth vile and obscene threats with regard to P.T. instructors in general and one in particular, though fortunately few cadets were left in a fit condition to carry them out. Navigation was introduced with the aid of ancient maps which had obviously, from their condition, flown hundreds of thousands of miles in Wapitis or some such. Oily thumb-marks, presumably of the home aerodromes, indicated that they had also seen most of the corners of this little earth. Engineering, of which aero engines was the chief component, introduced an assortment of junk—cross-sectioned motor bikes, bits and pieces taken from Bulldogs and early Avros, all unquestionably explained by large, small, poor, detailed or indifferent drawings on the blackboard. Wireless, too, brought its proportionate share of unprecedented mechanisms, none of which han any bearing on the subject in hand. Cadets soon became proficient in capturing dilapidated electrons, and found, when tamed, that they were quite docile creatures. 'Ah, the good old days. I well remember the time when——' 'Shut up, will you, and get on with this dictation. This is the A.T.C., not the Chelsea Pensioners.' "

Although this account professes to be slanderous, there is much truth in it, and it sometimes pays squadrons, perhaps, to look back occasionally to those earlier days so that they can recognise in themselves how much progress they have made. We are indeed a different Corps from what we were in February or March, '41.

But one other thing stands out from this review, and that is the impression of speed and hustle which it gives. The Navy have a good word for it: "At the rush." It is a very good expression; it is more than at the double, and it is something which they are very good at in the Navy: "Aye, aye, sir, at the rush."

That is the spirit which the Corps must maintain among all the difficulties which war-time conditions impose upon us. Let us do everything at the rush, and I am sure we shall hear little of falling attendances.

Young men like speed, and it is good for them; and speed keeps us older men young.

AIR COMMODORE,
INSPECTOR, AIR TRAINING CORPS.

The Right Kind of Instruction

THE main purpose of the Air Training Corps is to ensure that, however long the war may last, the aircrew requirements of the three Services will be filled from the ranks of the Corps with material of the necessary mental and physical standards. This is a very great responsibility.

As each day passes it becomes more and more evident that the winning of this war depends upon absolute superiority in the air. Ships cannot operate successfully at séa, especially within range of enemy land-based aircraft, without air protection. If the Army is to roll back the German Panzer divisions and assume the offensive, then the first preliminary is the smashing up of the Luftwaffe. Finally, if the enemy is to be "softened up" and his means and will to make war weakened, continual raids of the heaviest kind must be made night and day over Europe and in particular on Germany.

Instruction for the Huns. A Russian airman loading up.

The Air Training Corps, therefore, has a very real job of work to do if it is to provide the quantity and quality of young men now required.

I have seen it suggested recently that there is too much classroom work in the Air Training Corps of a dull and uninteresting kind. There can never be too much classroom work for those who desire to become aircrew—and what better ambition for any young man to have?

Unfortunately, at present there are still too many young men unable to achieve their ambition of becoming aircrew because they have not reached the educational standards. I am sure that none desires the standards to be lowered: it is up to us to ensure that every keen young man is given the opportunity to reach the standard required by the right kind of instruction. That this can be done I have ample evidence in those squadrons where the classroom work is made interesting, objective and practical.

When I see on a blackboard, as I still too frequently do, the words Mathematics, Algebra, Transposition, Vulgar Fractions, and Xs, Ys and Zs, I do not wonder at cadets finding their work dull and uninteresting. But when I see set out on the blackboard this kind of problem: "Your main tank has 50 gallons and is half full, your auxiliary tank has 20 gallons and is seven-eighths full, and your gravity tank holds 10 gallons and is four-fifths full—how many gallons have you left?" then I know that those men are learning what they want to know, and that in a very short time they will have covered all that ground described by those names mentioned above, which are enough to frighten anybody.

The Corps has made wonderful progress; standards of instruction and training are steadily improving; but there is a long way yet to go before we adequately bridge the gap between demand and supply: that is one of the reasons why the age of entry into the Corps has recently been lowered.

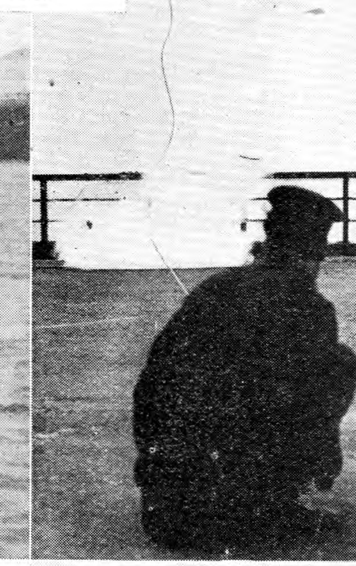
We must not let the Services down—nor will we, if the same spirit which has so far animated the Corps continues steadily to develop, as I am sure it will.

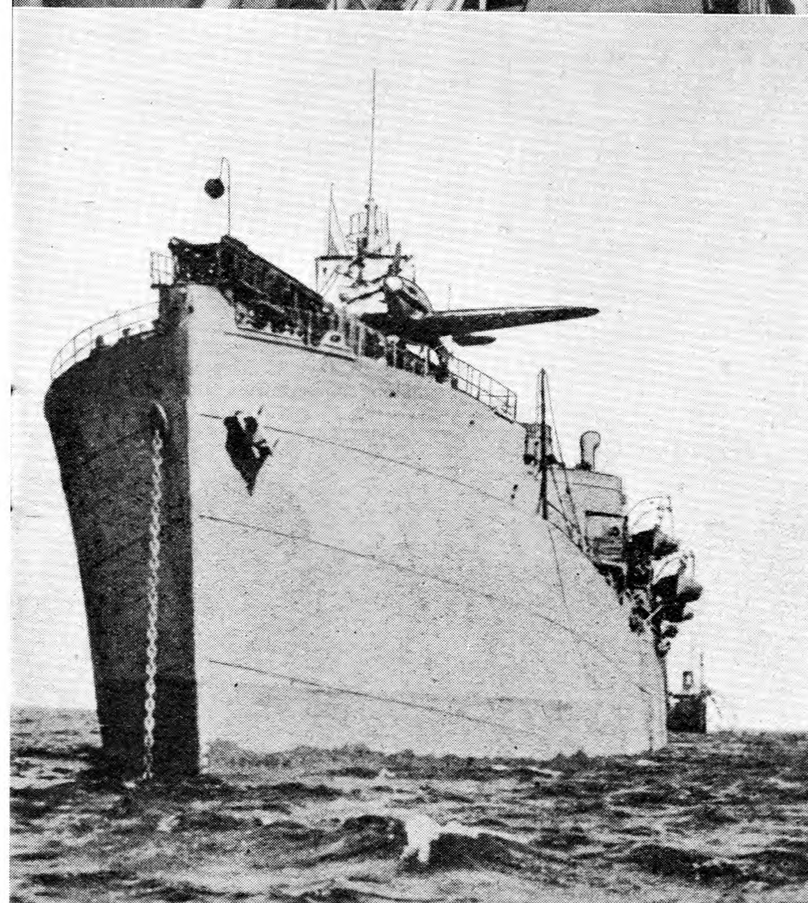
W W Wakefield

DIRECTOR, AIR TRAINING CORPS

PROTECTION FOR SHIPS

(Left) A Hurricane on the catapult of s.s. *Empire Tide*. The aircraft is catapulted off the ship. On conclusion of flight the pilot bales out and is picked up by one of the vessels in the convoy. The aircraft is lost, unless within reach of the shore, but the convoy is protected. Photographs on right show a rocket apparatus which sends up parachutes with long wires attached which become entangled with the attacking aircraft.

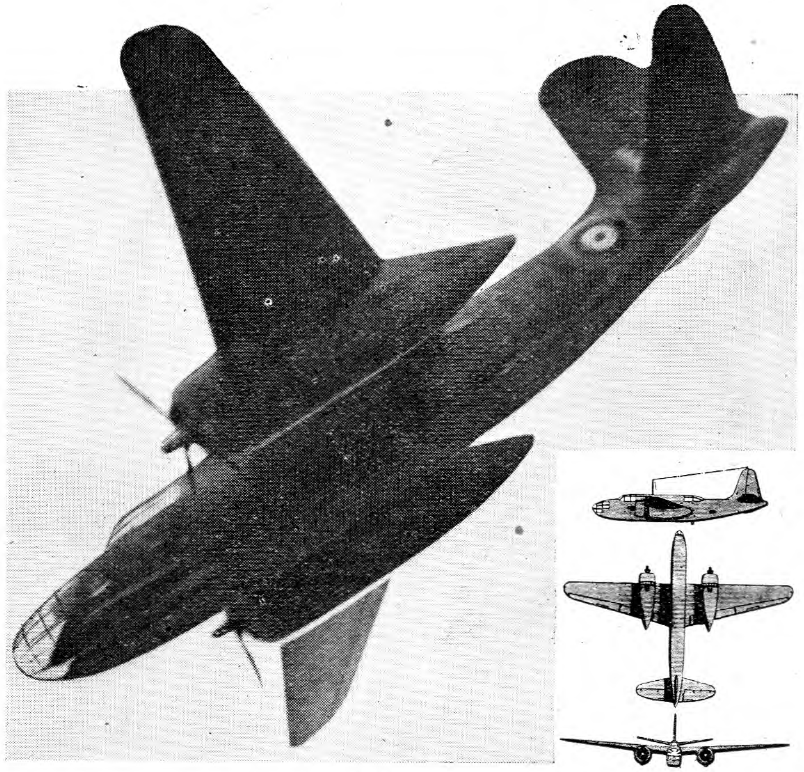




The DOUGLAS BOSTON

Some points about an outstanding American aircraft

by **David Vine**



WE shall hear more of the Douglas Boston. It is in every way a remarkable aeroplane. Some of its constructional features are often very original and show not only much thought and ingenuity, but much experience. Its performance is high. Externally (that is, aerodynamically) it has several distinguishable features which, though not in themselves highly original, are daringly so when incorporated into one aeroplane. These features are being extensively copied, and it looks as if the Boston has set a fashion.

Tail-Plane Dihedral

For instance, the ten-degree dihedral on the tail plane must give a greater degree of stability, especially in very gusty weather with a full load. The underslung engines also reduce the disturbances set up by a centrally placed radial engine, and maintain an unbroken upper surface on the main planes, thus increasing the effective lift of the wings.

Nose Wheel

The nose wheel was both a daring and original development when fitted to the Boston in its present retractable and semi- or fully-castering form. The "snubber" to prevent violent oscillation of the nose wheel is ingenious, too. The chief advantages of a nose wheel are better distribution of the weight of the aircraft around the centre of gravity—which is further forward than is usual in the tail-down aircraft—and better taxying control and ground manœuvring generally. In the tail-up position the aircraft can take off quicker owing to the aerofoils being at optimum angle from the start. (The optimum angle is the angle of an aerofoil where the lift-drag ratio is most efficient.)

A big advantage of the nose wheel from a mechanic's viewpoint is that the aircraft is always in rigging position. This saves a lot of labour and time trestling up for minor rigging checks. Also, an aircraft fitted with a nose wheel can be "flown in" right to the touchdown, and need not be stalled for landing, as is usual with a tail-wheel landing. This makes higher wing loadings possible. When the technique of a nose-wheel landing is mastered, structural damage due to heavy landings is considerably reduced.

The Douglas Boston III

Two 1,600-h.p. Wright Double-Row Cyclone GR-2600 motors. Crew: 3. Armament: Four .303-in. machine-guns fixed in nose, one .303-in. free machine-gun through floor, and two free .303-in. machine-guns in rear. Span 61 ft. 4 in., length 47 ft. 3 in., height 15 ft. 10 in. Wing area 464.8 sq. ft. Bomb load about 1 ton. Top speed 320 m.p.h. at 6,700 ft. Range 1,000 miles at 250 m.p.h. Three-view drawing above is of Boston II; photograph is of Boston III. Note the difference in length of engine nacelles.

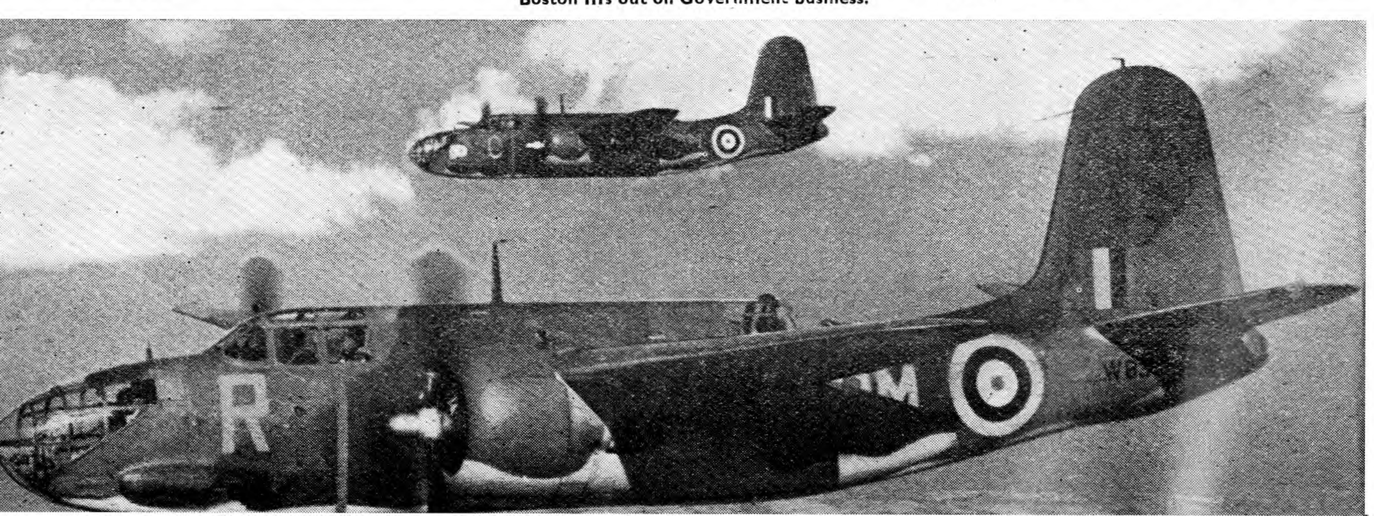
Pitot Head

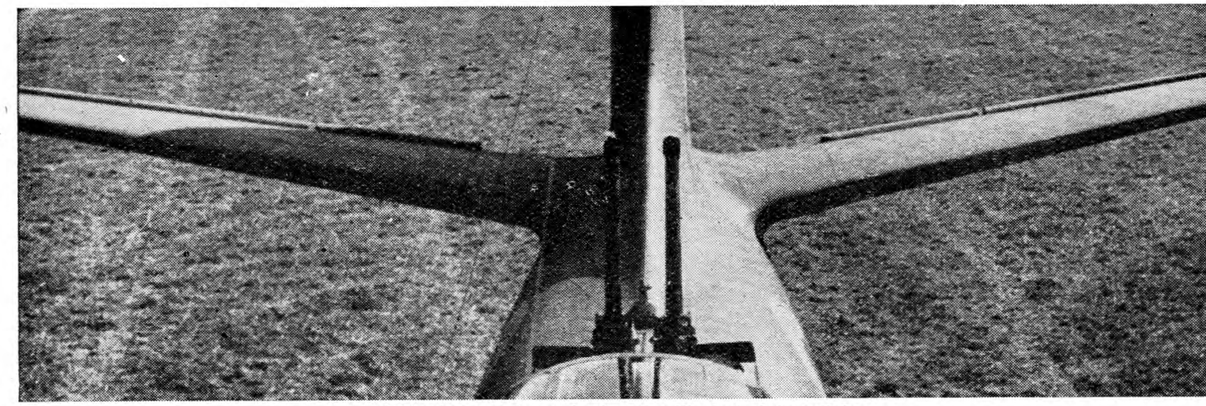
The problem of position-error due to air disturbances round the pitot tube has been minimised by placing the pressure head on top of the fin. Like the Wellington, the Boston fin is tall, giving a high degree of directional stability. The slotted trailing-edge wing flaps are built in two sections—inboard and outboard of the engine nacelle fairings. This ingenious compromise makes an effective air brake.

The Fuselage

Structurally the Boston has many innovations, chiefly in the stiffening of the fuselage structure. For carrying a big load of bombs at high speed, rigidity of the fuselage is vital. This is difficult if the bomb compartments are big. The four built-up keelsons, or longitudinal spars, around which the Boston fuselage is built are mainly responsible for the surprisingly commodious bomb compartments and the good bomb load of the Boston.

Boston IIIs out on Government business.





This photograph emphasises the dihedral of the tailplane.

Wings

The main planes have only a single main spar, and are built in two sections called "panels." The inboard panel carries the engine, inner flap-sections and petrol tanks, and the outboard panel carries the ailerons and outer flap-sections. Internally the arrangement of the pipe lines is extremely neat. The deep wing spars are reinforced with armour plate, behind which all the vulnerable pipes and cables are situated.

Brakes

Owing to the high landing-speed of a Boston powerful braking is necessary. This has been effectively met by two brake drums on each main wheel. The Boston III is fitted with the new Goodyear plate or disc brake, which is a series of discs moving inside stationary discs. When the brake pedal is pressed, hydraulic pressure forces these discs together to create a powerful braking action.

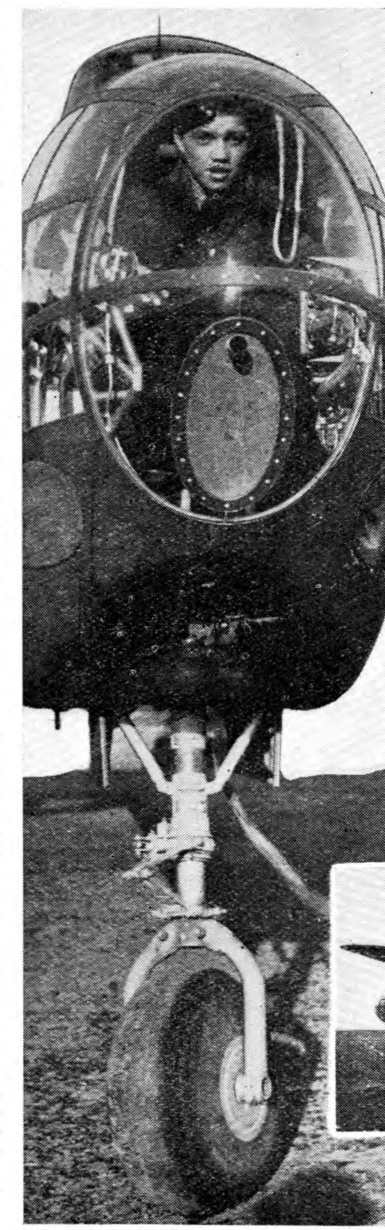
Hydraulic System

The hydraulic system is well designed. It makes full use of an accumulator, or pressure storage container, which provides constant hydraulic power for raising and lowering the three landing-wheels, the flaps, the cowl gills, the landing-lights (only in the early Bostons), the bomb doors and the brakes for parking.

The minor details of construction have not been overlooked. The locking of the landing-wheels is ingenious and effective. The layout of the wobble pumps in the bomb compartments and the accessibility of all working parts makes the Boston ideal both for pilot and mechanic.

Handling

A few words about the landing technique of the Boston. In the approach the Boston can come in with the engines either on or off. When off, the approach speed is from 120 m.p.h. to 115 m.p.h. With the engines on, the approach speed is reduced to 110 m.p.h. These speeds allow the aircraft to be "held off" right to the final touchdown. This should be done in a slightly tail-down attitude, so that when the main landing-wheels touch the ground the aircraft will pitch forward lightly on to its nose wheel. The brakes are then applied. It is not advisable to touch down with the brakes on, as this causes the aircraft to pitch hard on to the nose wheel.



Emergency Controls

Another interesting feature is the control column and rudder bar fitted in the rear-gunner's compartment. Should the pilot be disabled, it would be possible for the rear gunner to reach base. The touchdown would be difficult owing to the very poor forward and downward view from the rear cockpit. But the fitment does give the crew a chance.

The Boston carries a crew of three—the bomb aimer in the nose, the pilot above and behind him, the rear gunner/radio operator in the rear cockpit. They are all separated from each other, which would be a disadvantage in a long-distance bomber but is not noticed on the short sorties which the Bostons are doing these days. Both the bomb aimer and rear gunner have two emergency escape hatches, one above and one below them. The pilot escapes by raising the hooding. In the Boston III the four Browning machine-guns in the nose are faired into the fuselage by blisters, somewhat marring the excellent lines of the fuselage, but no doubt reducing the drag of the guns.

Notice that the Boston at rest has the same attitude as the Boston in level flight.

Left: The nose wheel of the Boston.

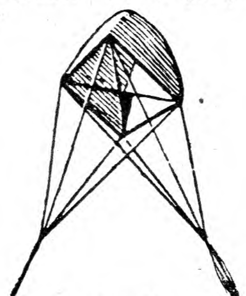
Flying on a String

By Captain W. E. Johns

The pilot who calls his plane a "kite"—whether he knows it or not—is merely doing justice to the true ancestor of the modern aeroplane. To-day kites rarely come into the news, and we were reminded of it recently when it was reported that a boy had been electrocuted near Manchester when his kite touched an overhead cable.

SEVERAL thousands of years ago a Chinese army sat down and refused to fight. "We must have an omen," said they. The general retired to his tent. That night, at the darkest hour, a light rose into the sky and remained poised for several hours. At dawn the army rose as one man and put the enemy to flight—inspired by a Chinese lantern suspended from a kite.

If there is any truth in this legend, it would appear to be the first occasion when a heavier-than-air craft was used in war. If there is no truth in it—well, it doesn't matter. It's a pretty story, anyway.

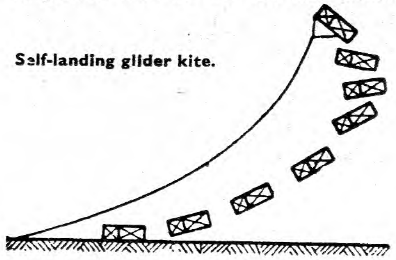


Parachute kite.

Certain it is that kites were used in the Far East long before the Christian era, not only for sport, but for religious and ceremonial occasions. One example of this was the Chinese musical kite, which was so constructed of hollow reeds that when in the air it emitted a clear, ringing tone, audible at a great distance. This was supposed to cause evil spirits to brown off.

Kite Day

Until the present war kite-flying was a national pastime throughout the East, the ninth day of the ninth month, known as "Kite Day," being given over entirely to this sport. An element of competition was introduced by treating the upper part of the kite lines with a mixture of glue and powdered glass, the object being for a flyer to draw his string across that of a neighbour and so cut his kite adrift.

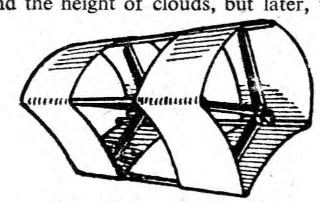


Self-landing glider kite.

Through generations of practice this was developed into a fine art, both in the actual flying and the construction of the kites. The materials used were split bamboo and rice paper. Here we see the first glimmering of the barrage-balloon-cable idea, calculated to keep undesirable "kites" at a distance.

Kites were known in Europe in the seventeenth century, but there is no record of their having been put to any practical purpose until 1749, when Dr. Wilson of Glasgow applied them to meteorological research. The kites, from four to seven feet high, were fastened one behind the other, each taking up as much line as it could support, and thus allowing the one previously attached to rise proportionately higher. Thermometers were suspended from the kites and contrived to drop at regular intervals by means of slow-burning fuses. The thermometers had parachutes fitted to them.

In 1752 Dr. Franklin, of Philadelphia, carried out his famous experiment of sending a kite into thunderclouds, thus proving that they were electrically charged. Here we see the kite playing an important part in the rudiments of meteorology. Indeed, in this respect they became of the greatest importance. At first they were used mainly for determining the direction of upper-air currents and the height of clouds, but later, when



Collapsible observation kite.

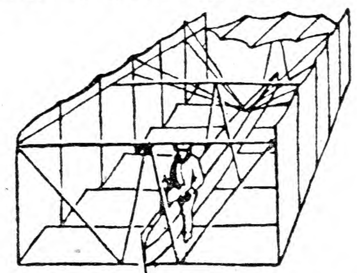
self-recording instruments were perfected, they played an ever more important part. The kite had a great advantage over the balloon, because as a balloon drifts the air around it remains stagnant.

Few people realise how much important work was done by the kite in the nineteenth century, when regulating bridles were invented and steam winches introduced for controlling purposes. Steel piano wire was used instead of string, and some astonishing records were set up. By the turn of the century altitudes of 12,000 feet had been reached. The kites used for this purpose were adaptions of Hargrave's box-kite, nine feet in height and weighing eleven pounds. On record flights these kites carried up to five miles of wire, or a dead weight of 112 pounds. It is interesting to note that at very high altitudes the lower end of the kite wire became strongly charged with electricity and emitted blue sparks—much to the inconvenience of the kite crew.

A new world-record was established in 1905, when the Prussian Aeronautical Observatory sent up a train of six kites to a height of four miles. The sail area was 300 square feet, and lifted nine miles of piano wire!

Military Kites

Apart from oriental legend there seems to be no record of kites being used for military purposes until the Russian Army employed them in its campaign of 1898. In 1905 Captain Baden-Powell read a paper entitled "Kites, and Their Uses in War." In this he emphasised the lightness, cheapness and portability of kites, and set out the uses to which they could be put. These included signalling, photography, torpedo projecting, the carrying of despatches, and the raising of a man for observation purposes. Most of these had already been accomplished. In 1887 successful photographs were taken from kites, and in 1894 Hargrave, the inventor of the box-kite, was raised 16 feet by four kites flown in tandem.

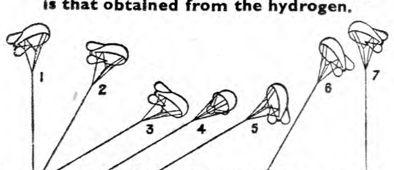


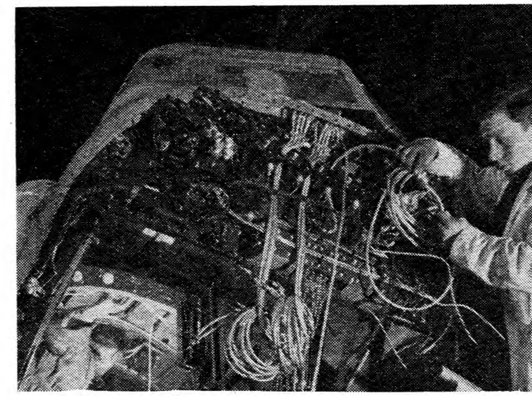
A glider kite. Modern gliders are in effect kites, when being winch launched or towed.

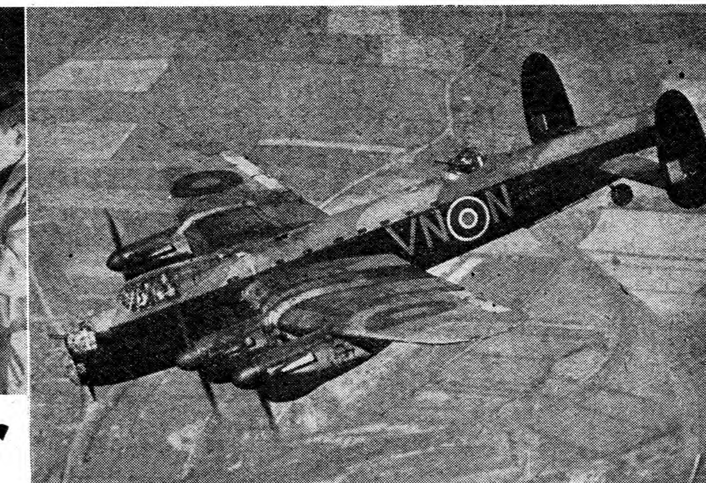
To prove the practicability of his suggestion, Captain Baden-Powell constructed, at Pirbright Camp, a man-lifting kite capable of carrying him to a height of 100 feet. The apparatus weighed one hundredweight. The kite was towed by a waggon.

In 1905 Mr. S. F. Cody was lifted 1,600 feet by a kite, but this record was broken soon afterwards by a sapper of the Royal Engineers, who attained the astonishing altitude of 2,000 feet. He sat in this alarming position for over an hour. As a result of this flight one or two newspapers prophesied that *steam-driven kites* would be the vehicles of the future. That was less than forty years ago. Every time we look up we can see how nearly right they were.

Kite balloons. Barrage balloons are also kites. Some of the lift, the amount varying with the strength of the wind, is obtained by the kiting effect on the fins. This is known as dynamic lift. Static lift is that obtained from the hydrogen.

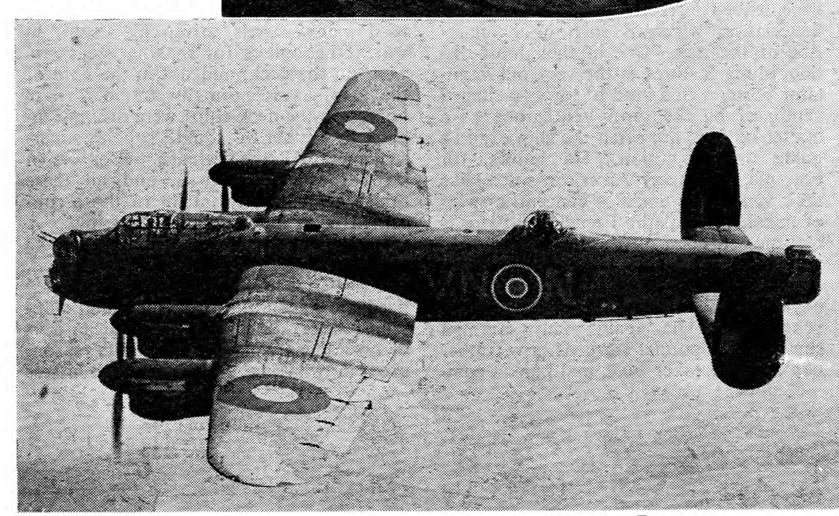






The Lancaster

Production of the four-engined Lancaster heavy bomber is proceeding so rapidly that fresh squadrons are being equipped with it each week. Hailed by many as the best operational bomber in the world, the Lancaster carries a heavy load of bombs at high speed to its target. Men and girls work in the factories building the Lancaster, and some of them are seen here at work, assembling, wiring, riveting and inspecting. The girl in the centre picture is inspecting the fittings in the bomb-aimer's compartment. She is not part of the aircraft's equipment.



Lancasters first came into the news when they raided the M.A.N. Diesel engine works at Augsburg. There are two versions being built here and in Canada, the Lancaster I with Rolls-Royce Merlin motors and the Lancaster II with Bristol Hercules radial motors. The latter has an even better performance.

RECOGNISING MERCHANT SHIPS

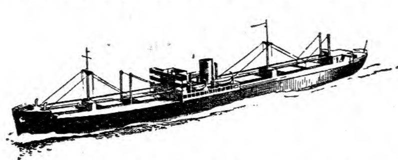
by A. C. HARDY, B.Sc., A.M. INST. N.A.

A Fleet Air Arm Albacore patrolling over a convoy.

THE first thing one wants to know about a ship that one sights is her size and that is the most difficult thing to distinguish. How is she to be reported—by her length or by her tonnage?

Now, when you speak of a ship of 5,000 tons, there are various categories of tonnage which you can mean. There is gross tonnage, based upon the original tun of wine, which is merely 100 cubic feet. There is deadweight tonnage, which is a kind of measure of the carrying capacity of the ship, and that's a ton of 2,240 lb. And there is displacement tonnage, which is the weight of the ship in water—35 cubic feet of water weigh one ton. Then there is net tonnage, upon which the dock dues are based, and under-deck tonnage. So that when you speak of a 5,000-tonner, it is essential to know what it means, or at least to agree on a common yardstick of measurement.

In shipping circles it is customary to talk of cargo-carrying vessels in terms of deadweight tonnage, or deadweight carrying capacity; thus a vessel of 9,000



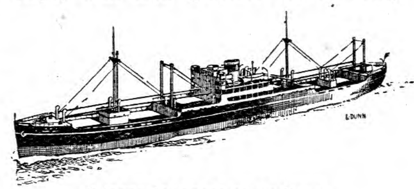
A modern 10,000-ton capacity tramp.

"D.W.C." would mean a vessel capable of carrying 9,000 tons (1 ton = 2,240 lb.) of cargo. Such a ship might have a gross tonnage (1 ton = 100 cubic feet) of 5,000 tons. On the other hand, a big passenger liner with a gross tonnage of 23,000 tons might have a deadweight carrying capacity of only 4,000 tons. That's just one thing that people who've got anything to do with the recognition of ship types in war-time have got to learn.

Now, when, with a common yardstick of gros stone, that has been determined, how does a man distinguish between an Allied vessel and an enemy vessel, bearing in mind the varying disguises which a modern ship can take on herself. The real answer here is subtle national characteristics which the expert appreciates. It is a fact that every nation imbues the design of its merchant ships with certain national characteristics. Thus Netherlands ships, to the expert, are invariably stolid, rather lumpy vessels. This is not said in any unkind sense, but the Dutch ship does reflect something of the stolidity of the race.

French ships have always been fussy. We can remember, for example, certain ships built for trading to the Far East which actually had square funnels with a sort of curve over the top. German ships have tended in recent years to that stark materialism which is such a characteristic of the race. One of their most distinguishing features is the very tall ventilator posts, with a kind of torpedo-shaped ventilator on the top. Ventilators, as a matter of fact, are often the ship expert's guide to recognition. He knows, for example, that many American ships have their ventilators made of concentric strips of metal, whereas the French ventilator is a truncated cone on the top of an ordinary steel structure. The German ventilator has a front which slopes at a greater angle to the vertical than the British ventilator. Then again many German ships have a special form of bow, rather like an ice-breaker bow, and known commercially as the Maierform. With this may go a special type of stern.

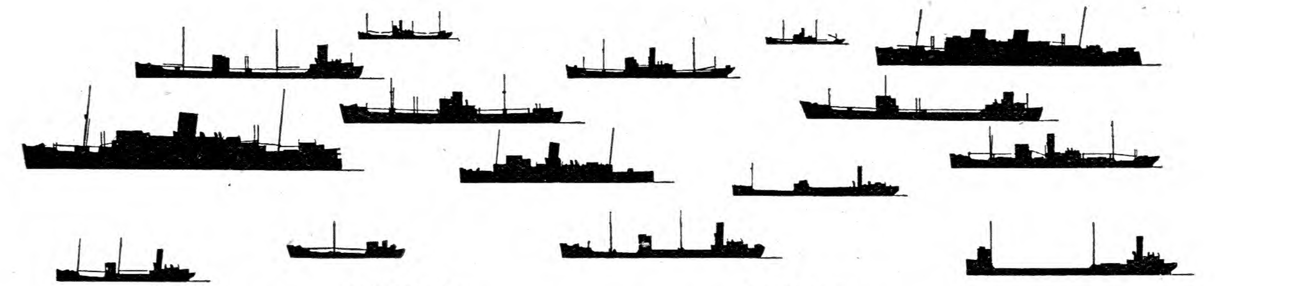
Our Norwegian allies before the war developed a special ship for carrying fruit. People's breakfast grapefruit was brought from the Pacific north-west coast to Glasgow in handsome little ships carrying about 180,000 cubic feet, about the capacity of a small warehouse. These ships, with their graceful curved hulls,



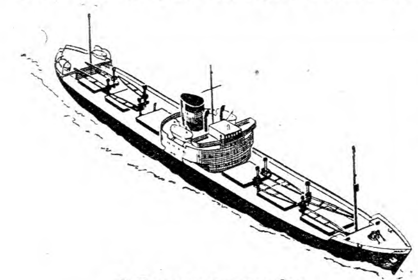
A large Japanese cargo liner.

not too big, their streamlined superstructure and little funnels were known in the trade as commercial yachts. Even disguised in their ugly war-paint, it is impossible to miss these little commercial yachts to-day. The Swedes in peace-time used many vessels driven by steam, in which the boilers for making the steam were on the deck, and not in the hold of the ship, as is normally found. These boilers-on-the-deck ships were distinguishable by rather a squat, square superstructure. All these things the expert in ship-identification knows, and all these things are naturally taught to those concerned in as much detail as possible.

But to have a real appreciation of the art—for it is an art—of ship-recognition, you have got to have in your mind firmly fixed the background for ships and shipping. After all, a ship is in a given port or on a given route for a definite reason, even in war-time. This helps to assess



the type, and once the type is determined the size is fairly well known; and in many cases it's possible to get the length by comparing the total length with that of a fixed known object on board, for example, a lifeboat. There are two sides to this ship-identification: one the purely naval one where the ship is viewed relatively leisurely from the bridge of a surface craft, and the other one that of the pilot of an aircraft, where, as I have said, conditions are frequently very bad. How does the pilot of, say, a Hudson of



A German ore carrier.

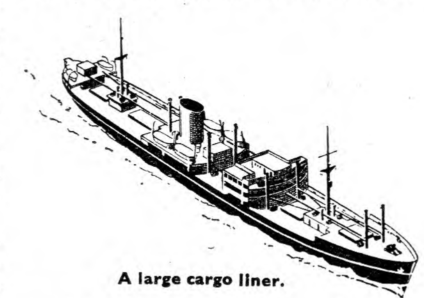
Coastal Command identify the spot on the ocean which may well turn out to be a raider of most virulent type? He has got to be as smart with his eyes as he is with his gun, and as handy with his trained imagination as he is with the stick.

As I have tried to explain, the Navy, if anything, has rather the advantage in this respect, not only because of the extra time in which to identify, but also because the technique of ship-identification is not new to the Service, and ways and means do exist which obviously can't be talked about here whereby everyone on board who matters has the necessary machinery for deciding whether the ship's a raider, a harmless neutral, or any of the other surprises with which modern sea warfare is concerned.

The identification of warships, as between navy and navy may, I presume, be considered a fairly exact science, because it's taught very thoroughly in peace-time; but it would be giving away no secrets to suggest that the whole question is one of real expert knowledge; and that's where the expert in ship-identification is so useful in war-time, because he can impart his technique to those possessed of less knowledge than he.

The importance attached to the Merchant Navy in war-time has certainly placed a premium on all such information at the present time, and a merchant navy is made up of the following main types: *Liners, Tramps, Tankers, Coasters, Tugs* and *Fishing Craft*. Liners may be divided into three main groups—passenger, meat-carrying and fruit-carrying. The first-named is usually self-evident because of its big superstructure, number of funnels and number of boats. The *meat ship* is a big streamlined vessel, usually with one funnel and sometimes with one mast. The *fruit ship* is smaller and even more streamlined; fast (speed about 15½-16 knots), and sometimes known as a commercial yacht.

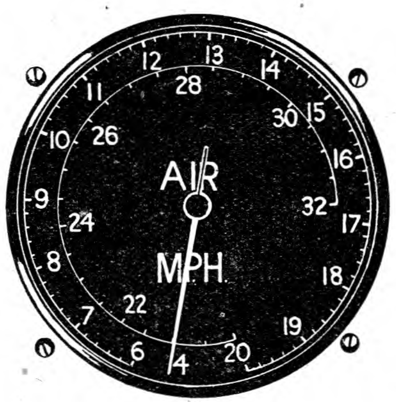
The *Tramp*, a maid-of-all-work, is more difficult to identify, because she varies in shape. Old tramps have a straight stem and counter-stern. Newer ships look very much like cargo liners. Tramps specialising in coal-carrying usually have larger hatches than those built for grain or timber and lumber. Numerically, tramps are still the backbone of many merchant navies. The Axis has less than the United Nations. *Tankers* are vital from the point of view of the prosecution of an aerial war; each carries about 10,000 tons of aviation spirit. Tankers have machinery aft, and the funnel is here, too. So also is the machinery of a coaster. As the former carries 10,000 tons and the latter 1,000 tons, a mistake is easy. There are *two kinds of coaster* (their function is, as the name indicates, coasting and short-sea trading)—the British type, which is usually coal-fired with bridge forward of amidships, and the Dutch type, with machinery and bridge aft; capacity for capacity, the Dutch-built coaster is shorter than the British coaster, because she is not coal-fired. *Tugs* are also of two kinds—big ocean-going salvage ships of the same size as a coaster, with a 16-knot running-free speed, built for long-distance salvage work, and small harbour-tugs between 80 feet and 100 feet long for towing ships. There is a similarity in size and in char-



A large cargo liner.

acteristics between tugs and *Trawlers*, the biggest of fishing craft. Tugs tow ships: trawlers tow nets for the fish. Another, rather smaller fishing craft is the *Drifter*, which, as the name indicates, drifts to her nets. A third fishing type, which completes our family, is the *Seine Netter*. Each type in the family has its own distinct characteristics.

A group of colliers, large coasters and short-sea-route traders in convoy. Average gross tonnage about 3,500.



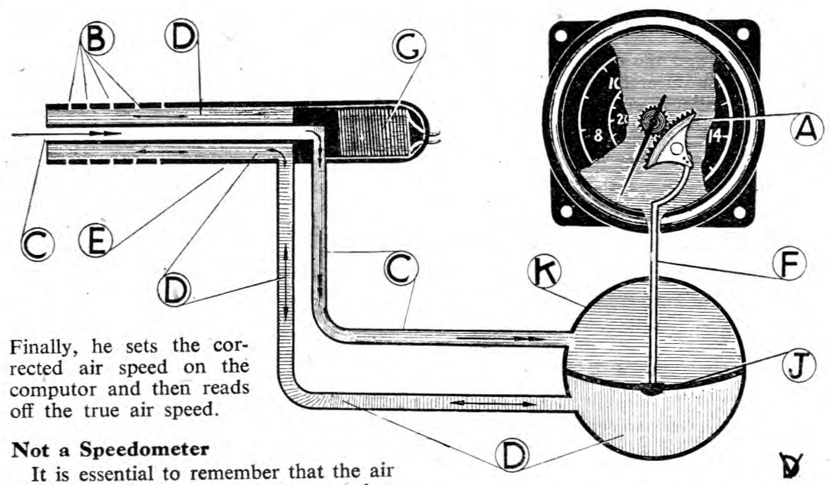
Air Speed Indicator

By Astro

ONE of the most important instruments for navigator and pilot is the Air Speed Indicator, abbreviated A.S.I. This instrument is subject to errors. Without any corrections for these errors, its reading is called the *Air Speed Indicator Reading*, abbreviated I.A.S. The air speed indicator is subject to error due to the position of the pressure head (E) on the outside of the aircraft. This is minimised as much as possible by placing the pressure head in a position where air eddies disturb it least. The error due to the position of the pressure head is called "position error." Corrections for position error are tabulated on a card and placed in the cockpit for the pilot to apply where necessary. When these corrections have been applied, airspeed indicator reading (I.A.S.) becomes *Rectified Air Speed*, abbreviated R.A.S. Position error varies with speed and in different types of aircraft.

Other Errors

There are other errors which must be corrected, and these are due to the temperature and pressure (density) changes of the air at varying altitudes differing from those for which the air speed indicator is calibrated. Factors for these variations are known, and can be applied by the pilot by using the *Height and Air Speed Computor*, marks 1 and 2, or by using an air speed correction chart. But as this works on assumed conditions, it is not strictly accurate. For strict accuracy the height and temperature conditions prevailing at the time must be accurately known, then true air speed can be found by "computing." This is a term which will become very familiar to you in the R.A.F. For speed and accuracy in the air, a mechanical computor is generally used which eliminates the need for elaborate calculations. When all corrections have been made to the I.A.S., namely, position error and air density variations due to changes in temperature and height, the result is called *True Air Speed*, abbreviated T.A.S.; and T.A.S. is essential for accurate navigation. When using the computor to obtain T.A.S., the navigator first ascertains the temperature, and puts this on the computor; then the correct height, with the altimeter set to the aerodrome-level pressure at take-off. Finally, he sets the corrected air speed on the computor and then reads off the true air speed.



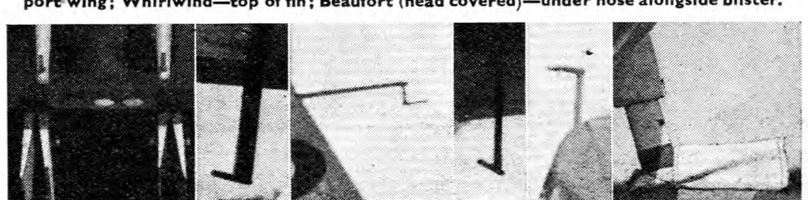
Not a Speedometer

It is essential to remember that the air speed indicator is not a speedometer, but a pressure gauge; and the readings on the A.S.I. cannot be converted to ground speed unless wind speed and direction is known. The air speed registered by the A.S.I. is nearly always different from the ground speed, owing to the wind velocity. Therefore, unless wind velocity is known, it is impossible to find ground speed from the air speed by the A.S.I. reading, and ground speed must be known for calculating estimated time of arrival (E.T.A.), range and fuel consumption, etc. For instance, a pilot flying a crippled aircraft 300 miles from land calculated that he had sufficient fuel left for two hours' flying. A wind of 40 m.p.h. was blowing from the land, which he underestimated in strength, and though his A.S.I. registered 160 m.p.h. the whole two hours, he crashed 60 miles from land.

Types of A.S.I.

There are, broadly, two types of air speed indicator in general use—the capsule type, similar in principle to the familiar barometer, and the diaphragm type. The principle of the diaphragm type is shown in the diagram in a simplified form. Actually, the airtight box (K) is fitted behind the instrument and not below it, as shown here. The pressure head (E) contains a tube (C) which has an open end called the pitot tube. This tube faces the way the aircraft will fly and is situated somewhere outside the aircraft. The pitot tube (C) is piped to one side of the diaphragm (J). The other side of the diaphragm is piped to the static tube (D), which is at zero pressure. The holes (B) in the casing of the pressure head (E) keep the pressure constant at zero in the static tube. When the pressure in the pitot tube (C) rises as the aircraft moves faster, the diaphragm (J) is pressed further down, carrying the connecting-rod (F) with it. This moves the small toothed lever (A) engaging with the gearwheel on the pointer. As the diaphragm moves with varying air-speed pressures, the toothed lever (A) turns the gear and moves the pointer to the appropriate figure on the dial. So the difference between the pressure on the static side (D) of the diaphragm and the air-speed pressure side (C) is recorded on the dial of the air speed indicator in miles per hour or knots. (G) in the diagram is the electrical heating coil which prevents ice from forming in the pitot tube and closing the opening. The heater element is usually coiled round the pitot tube.

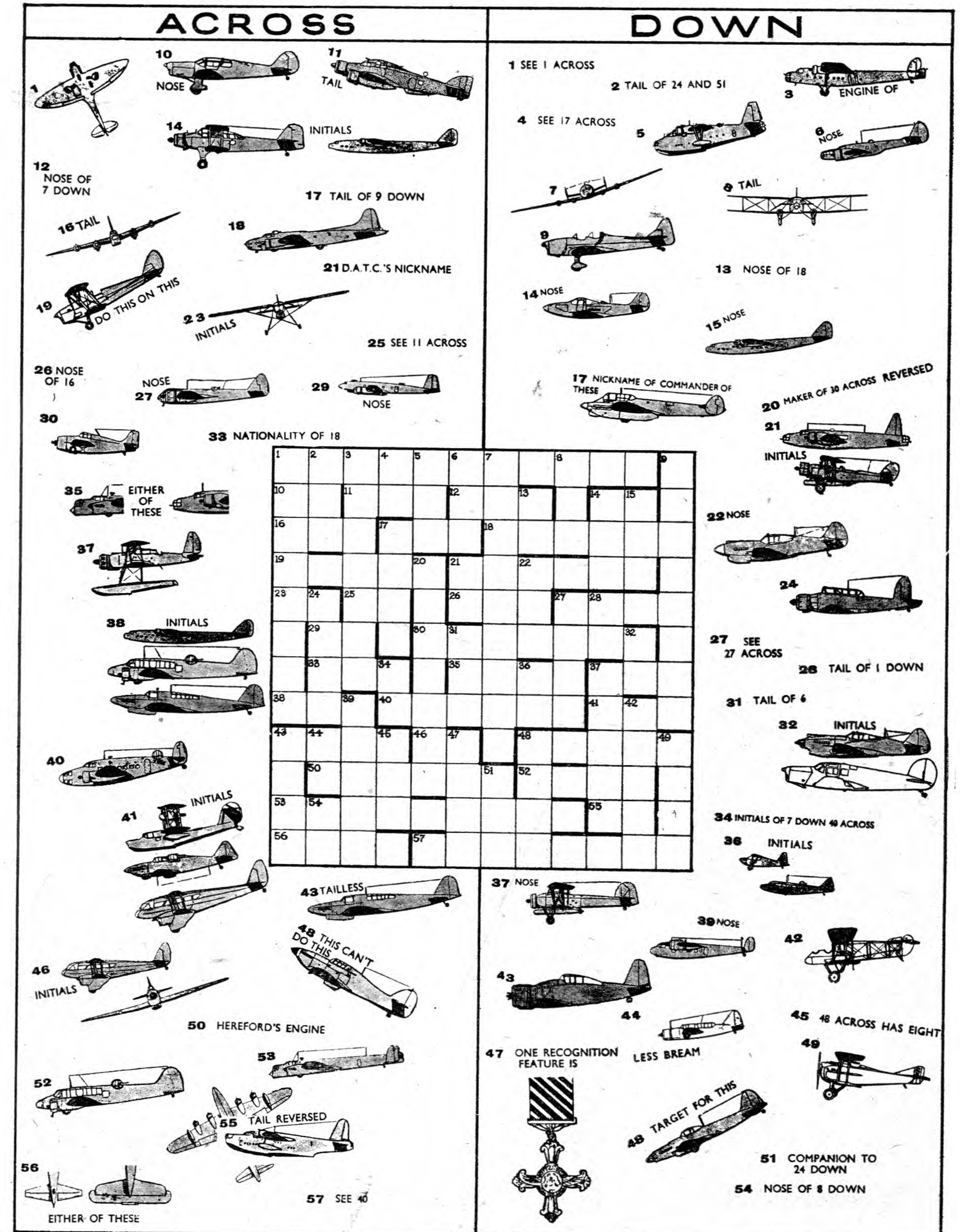
Many and varied are the places in which designers are inspired to place the pitot head. These photographs show (left to right): Stirling—under the nose (in duplicate); Battle—under starboard wing; Harvard—leading edge of starboard wing tip; Hurricane—under port wing; Whirlwind—top of fin; Beaufort (head covered)—under nose alongside blister.



PICTORIAL CROSSWORD

(Solution on page 26).

Note. Solution may be maker's or type name of aircraft. The words "nose" and "tail" indicate that solution is first or last parts of makers' or type name.



Do You Know Them?

Here are news photographs (not arranged in order of precedence) of 37 well-known men whose photographs have frequently appeared in this and other journals in connection with air activities. They include some distinguished junior officers, high-ranking commanders, A.T.C. officials, etc. See how many you can recognise. Names on page 25.

If you would learn to be a successful fighter pilot learn to

CONCENTRATE

says **Captain Norman Macmillan**

VICTORIES are won by utter determination. So, when a pilot decides to attack, he must do so full out, with one object, to destroy his target, whether it is in the air, on the ground, or on the water. That quality is the common characteristic found in all great fighting-men.

There must be no hesitation once the decision to attack is made. In one of the Field Service booklets for air fighters issued by the Air Council in the Great War it was written that " a moderately good pilot who is really determined is better than and will bring down every time the undecided pilot, no matter how good the undecided pilot may be." That is still true.

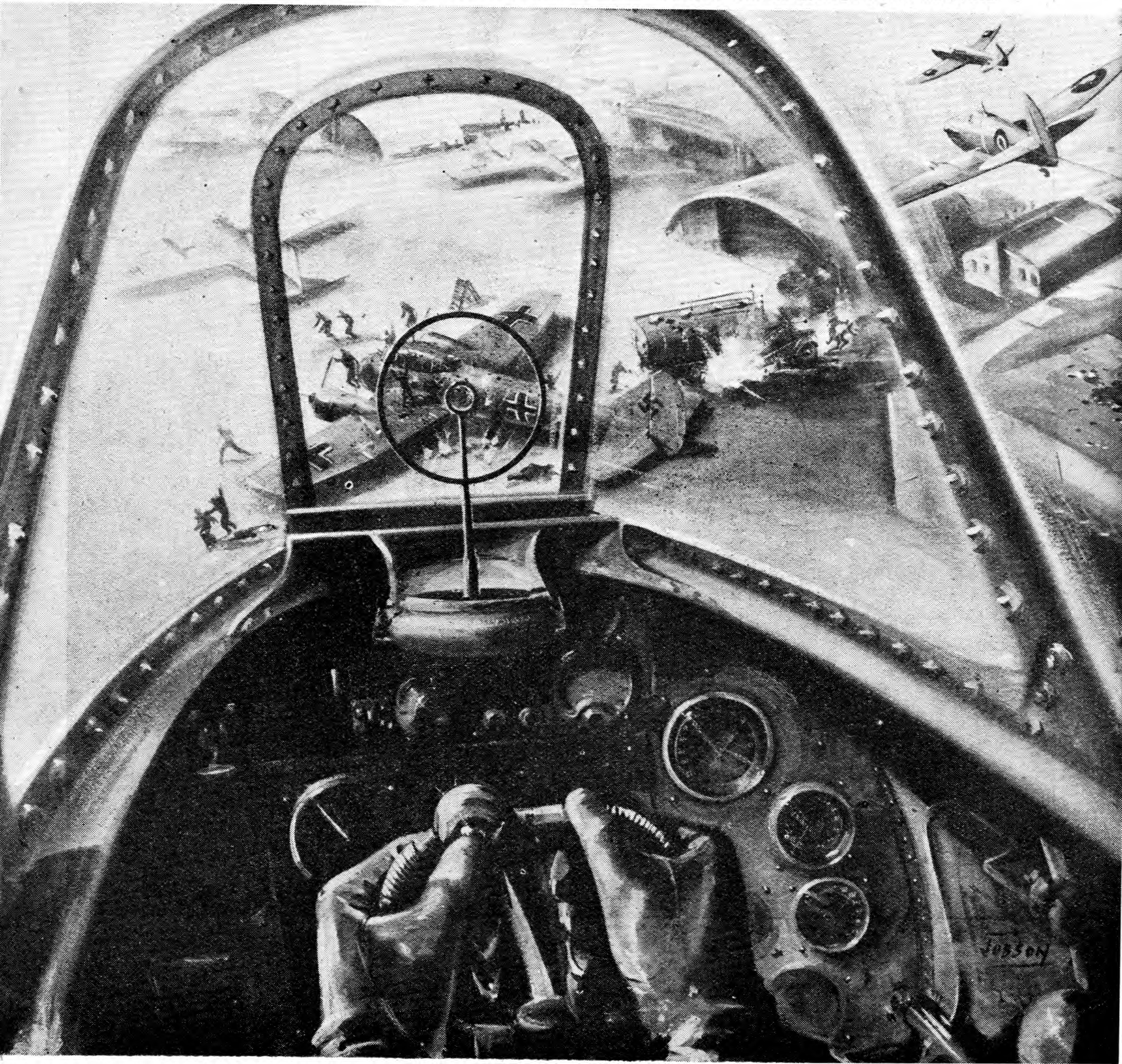
Training

But before any pilot is ever called upon to make the decision to attack, he passes through a long period of training; during his training period the intelligent pupil will study in his free hours the art of air fighting for himself, so that he can apply what he has been taught, automatically, subconsciously, when the moment first comes for him to make the initial momentous (to him) decision to attack.

(It is a good plan to read every book ever written by a fighter pilot, no matter how old it is. They all contain hints of use to their successors.)

It may be suggested that the individual pilot no longer makes the decision to attack; that, instead, the decision is made for him by those in authority on the ground, and communicated by means of R/T, or, when operating outside R/T distance from base, by the formation leader. But a moment's reflection will demonstrate that the final decision must still be made by the individual. For the following reasons: (1) Every military formation is constructed theoretically in a vertical direction; (2) the commander, at the apex, must make the first decision to attack; (3) a hesitant commander will lose the battle almost every time to a determined enemy commander; (4) therefore the commander must have done with theories before he makes the decision; (5) the commander's subordinates carry out the commander's decision by a series of subsequent decisions, each involving a lesser number of units of men and machines; (6) a hesitant subsequent decision will cause a weakness in a part of the supreme commander's force, the extent of this weakness depending upon the rank and authority of the hesitant individual; (7) finally, in its simplest form, the order reaches the actual fighting-man, and if he shows hesitation in assaulting the enemy face to face, the virility of the supreme commander and his subordinate commanders becomes valueless; (8) that is why a military force possesses a code of discipline which ensures as far as possible that an order once given will be obeyed automatically, so that the leader's will is paramount; (9) nevertheless, discipline cannot make the fighter decide to go full out in the final act of executing orders: just to obey is not enough—the personal effort must be 100 per cent; (10) cumulative courage is sometimes called morale, a word adopted from the French, and this is in reality the aggregate of the courage of the individuals who comprise a squadron, wing, force or nation.

An artist's impression of a Malta Spitfire concentrating on a Sicilian aerodrome. The old-type sight has been depicted.

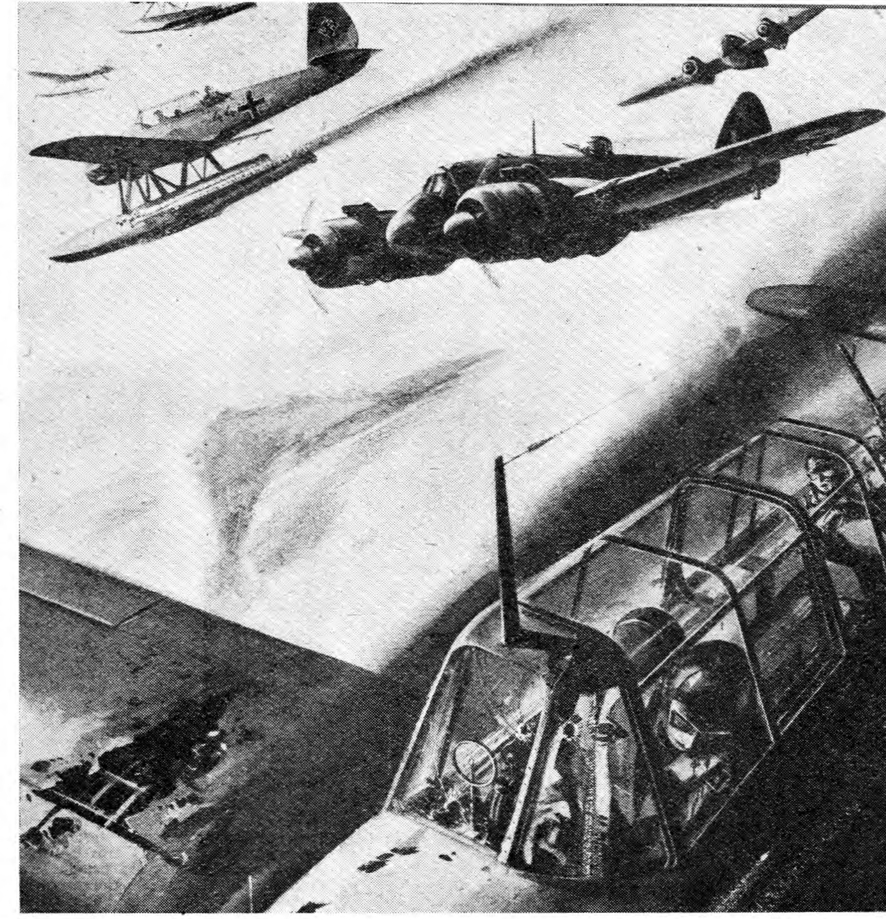


The courageous, determined action of the actual fighting-men during a combat is the basic quality which tells in the end; it is the first and last source of power to a commander, and if it fails nothing can prevail.

Now personal courage is subject to outside influence. When fighting-men know that their equipment is of the best quality, as good as or better than that of the enemy, their spirits are accordingly elated. But the individual can triumph even against superior enemy equipment. General Wavell's men did so against Graziani's more numerous and well-equipped Italian army in North Africa. The tiny air garrison of Malta under Sir Hugh Lloyd did so against Kesselring's overwhelming air odds. That is the British spirit. Way back in 1365 our light mobile archers in the battle of Auray faced heavily armoured knights (the original one-man tanks); their arrows glanced off the heavy armour. The British threw down their bows, seized the enemy's battle-axes out of the knights' hands, and hit them on their casques with their own weapons. The same spirit won the Battle of Britain.

Use the Subconscious Mind

But modern air-fighting, although apparently simple during the actual combat, is simple only because the individual fighter pilot is so highly trained and so skilled at his job of flying that he can fly without conscious thought, thus leaving his brain clear for action in the stereoscopically vivid moment of encounter in the air. I found—and a similar impression has been recorded by many pilots, that once battle has been joined all sense of time is lost. That explains the apparent slowness to the individual of some of the most hectic moments of his flying life; from it arises the impression almost of boredom that fighting pilots have noticed during combat.



Beaufighters concentrating on Arados in the Bay of Biscay. (*Drawing by Jobson.*)

Most surely it is wise to anticipate this condition during the training period. Ordinarily we all live in relation to time. We measure our flying-speed in miles an hour, break the 100-yards sprint in so many seconds, have so much time off for meals, turn out at reveille at a certain hour, and so on.

But in an air-fight the fourth dimension, time, is shut out of our lives. A few seconds may seem as many minutes, or even hours. The explanation is that extreme concentration upon the immediate object can be gained only by the absolute exclusion of everything else, including time. This is a condition which brings its own natural reaction, expressed in the almost uncontrollable desire for sleep. You remember how some of the fighting pilots fell asleep in their cockpits after landing during the Battle of France.

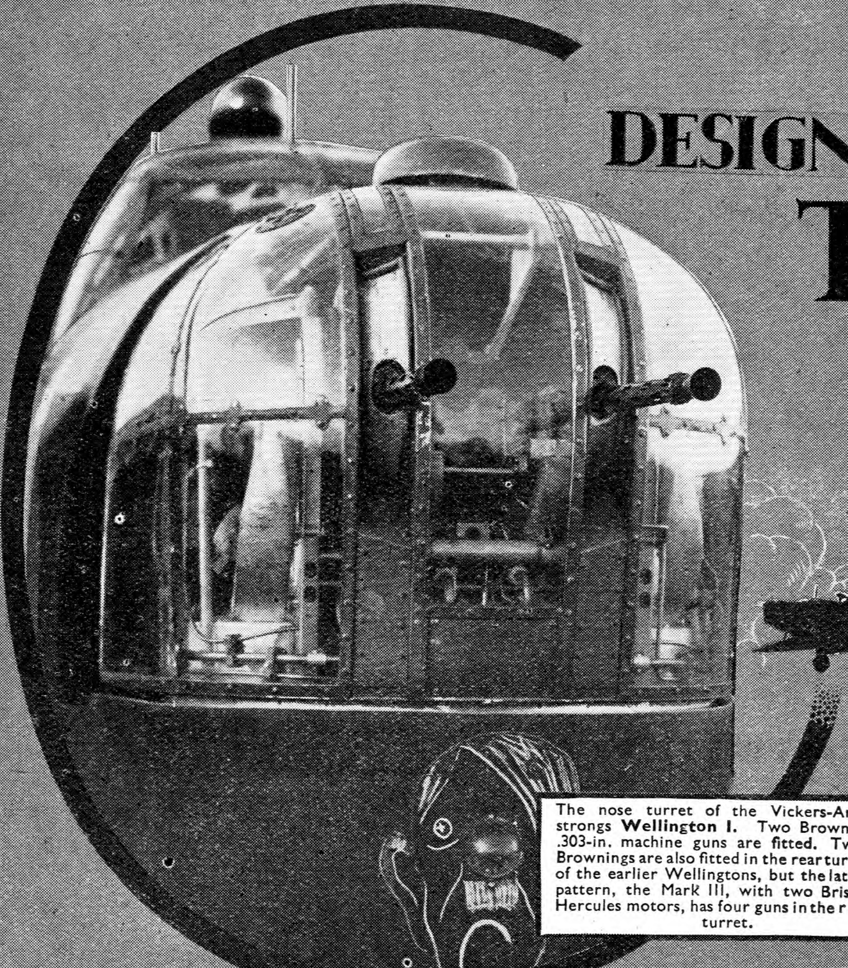
If you are going to fight in the air, you will encounter this condition. So prepare to train yourself to master it. This you can do only for yourself. No one can help you. When it comes upon you in the air, it comes upon you alone, beginning at the instant you have made the decision to attack.

Practise Concentration

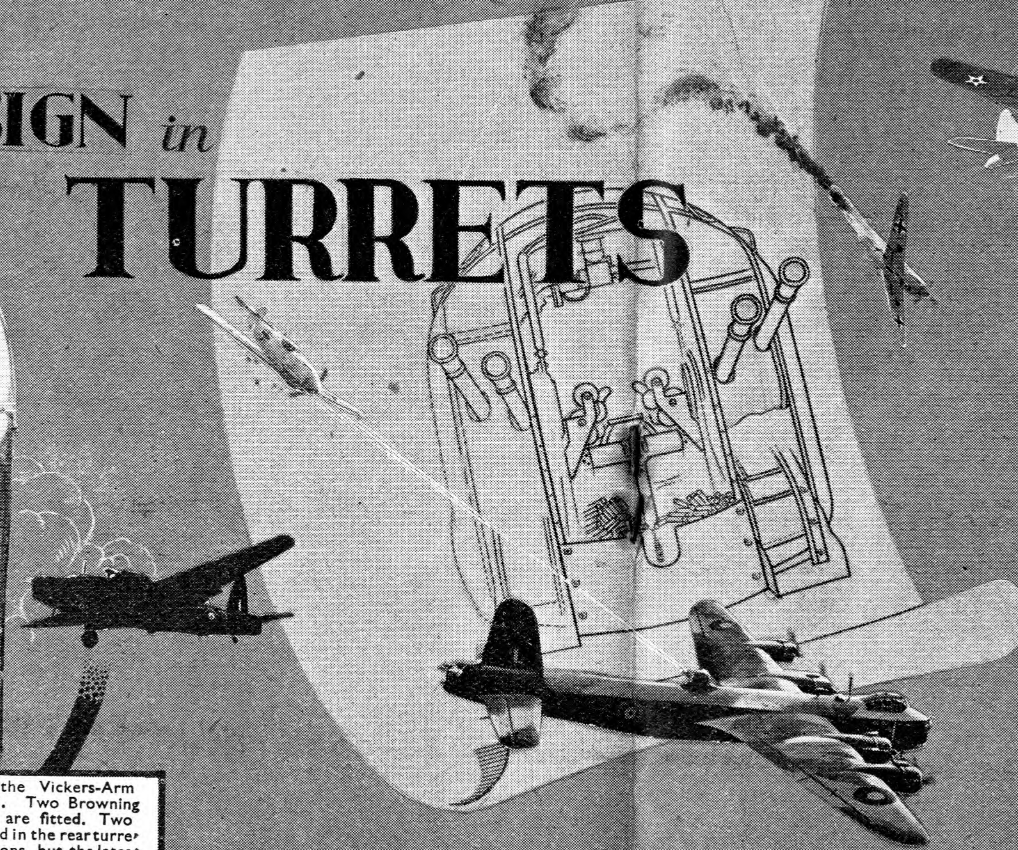
How can you train yourself to meet this physiological phenomenon? Thus: It does not matter what your present task is. Try concentrating upon it to the exclusion of everything. Concentrate on the ground, in the air. At first you will find it difficult to do so intentionally. You will not be able to keep it up for long. But gradually your power to concentrate will improve. Persevere, and you will undoubtedly find, when your turn comes, that the strain of concentration in air-fighting will be less severe; its subsequent reaction, in consequence, will be less powerful.

The advantage of such pre-training is that you will tire your opponent before you tire; and by doing so you will gain victory more swiftly and decisively. It will compensate combat inexperience during your first few fights if you are unlucky enough at that stage of your career to meet a veteran foeman. It will enable you to put forth your very best from the moment you give yourself the word "Go," to charge full throttle to the attack, with the power to concentrate already acquired, instead of having the strain of it thrust upon you unawares at the last moment.

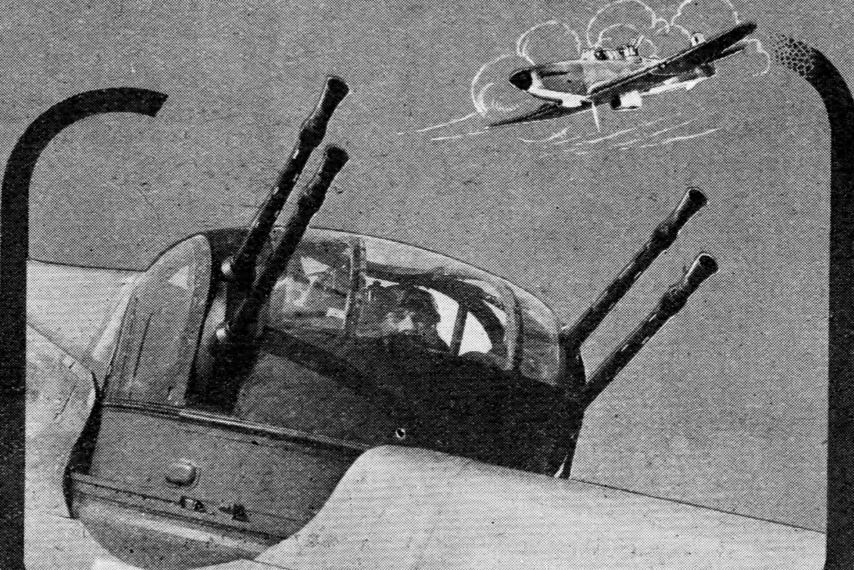
DESIGN *in* TURRETS



The nose turret of the Vickers-Armstrongs **Wellington I.** Two Browning .303-in. machine guns are fitted. Two Brownings are also fitted in the rear turret of the earlier Wellingtons, but the latest pattern, the Mark III, with two Bristol Hercules motors, has four guns in the rear turret.

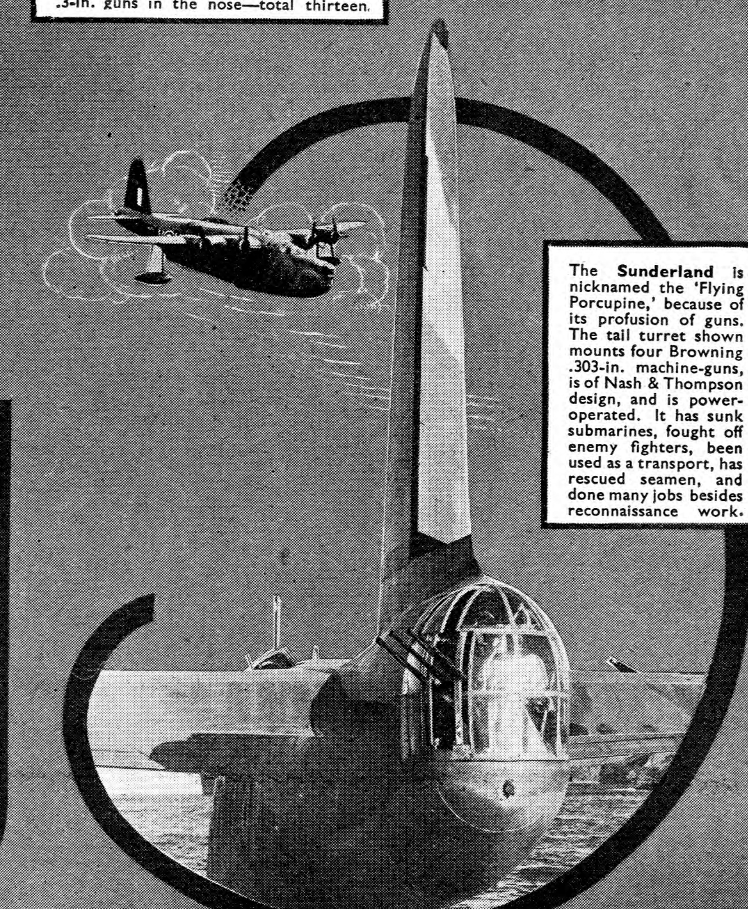


The later versions of the **Fortress,** or B-17, in use by the U.S. Army Air Force, have a greater fire-power than earlier models. In under turret shown here, two .5-in. guns are fitted. There are two similar guns in the upper turret, two in the tail, one in the top decking, one each side of the fuselage, and three .5-in. and one .3-in. guns in the nose—total thirteen.



The Boulton Paul **Defiant** has its armament in the four-gun turret behind the pilot. Scoring a smashing success at Dunkirk, a formation were attacked by enemy aircraft, who treated them as if they were single-seaters, probably mistaking them for Hurricanes. There is no fixed forward armament.

The Bristol **Blenheim,** one of the great machines of the earlier part of the war, has carried out many varied duties successfully. The partially retractable dorsal turret of the Mark IV has two Brownings; of Bristol design, it is hydraulically operated. There is one fixed gun firing forward from port wing, and a rearward-firing, remotely controlled gun in a blister under the nose.



The **Sunderland** is nicknamed the 'Flying Porcupine,' because of its profusion of guns. The tail turret shown mounts four Browning .303-in. machine-guns, is of Nash & Thompson design, and is power-operated. It has sunk submarines, fought off enemy fighters, been used as a transport, has rescued seamen, and done many jobs besides reconnaissance work.

YOUR FIRST NAVIGATIONAL TRIP

Some Practical Considerations

By **DONALD W. SEAGER**

NOW that cadets are being given the opportunity of flying as navigators in non-operational Service aircraft, many of you may soon be able to put into actual practice the knowledge you have gained during the past months.

Although it is an advantage to be well up in the theoretical side of navigation, you will find that your apprenticeship does not begin until you attempt the job in the air. There is a vast difference between leisurely working out courses and ground speeds in the comfort of the classroom and trying to do the same thing while being bounced about inside an aircraft travelling at 200 m.p.h. or more. The following hints may help to make your initiation easier.

If possible, get to the crew room half an hour before the scheduled time of your flight and ask your pilot for the maps you are going to use—"quarter-inch" are the most helpful for map-reading on short trips. He will probably remember how he felt himself before his first flight, and will no doubt be only too pleased to help you.

If you are given a proper plotting map as well, based, of course, on Mercator's projection, the measurement of your track angles will be simple. However, for a short cross-country flight you may be expected to make do with an international 1/1,000,000 or 1/500,000 aviation map. The meridians on this projection converge slightly, and therefore if you are laying off tracks take care to measure the track angles against the meridian lying most nearly midway along their length.

As the straight lines you have drawn on your map are approximately great circle arcs, and you will actually be flying rhumb-line tracks, they will not represent exactly your intended path over the ground. For short trips, however, the difference is slight.

Make a note of the track angle (True) and distance for each leg of the trip, and, if you can obtain a navigator's log sheet, enter up this information. If a meteorological forecast is available, study it closely. Ask your pilot at what height he intends to fly, and refer to the forecast for the estimated wind at that height. With the aid of a C.S.C., or, if you prefer, by the use of scale drawings, you can then work out provisional courses to steer (True). The appropriate variation to be applied will be found from the isogonals on the map and the courses converted to Magnetic. When you get into the aircraft you can then give the pilot his first course, taking care to mention that it is a Magnetic one. He will probably be pleasantly surprised at your keenness.

Careful preparation before flight will make your work in the air infinitely easier, and before getting into the aircraft you should make sure you have the following: two pencils (each sharpened at both ends), a rubber, Douglas protractor, parallel rules and a pair of compasses. As soon as you get aboard ensure that the navigation clock is functioning, and, if you can, get the pilot to synchronise his watch with it. Then, if you feel bold enough to give him a few E.T.A.s during the flight, they will at least stand a reasonable chance of being accurate according to his watch. Have your maps folded conveniently for use in the air, and stack them in the order they will be needed.

If you have transferred the track lines to your "quarter-inch" maps you should not find it too difficult to check your position by noting the main landmarks en route and identifying them on your map. Unless the forecast wind is seriously out, you should not find yourself more than a few miles off your desired track at any time, and your main difficulty will be to estimate how far along this track line you should be at any given time. Here again a little preparation before flight can help a great deal. By dividing up your track line into lengths equal to, say, five minutes' estimated ground speed to the scale of your map, you will have a predetermined though rough and ready check on your position at various intervals during flight. An example may help to fix this in your mind:

Suppose the first leg of your flight were from Oxford to Cambridge. Your log entries might appear something like this:

ROUTE: From Oxford to Cambridge.
FORECAST WIND: 30 m.p.h. from 360° (T) at 3,000 feet.

TRUE AIR SPEED	TRUE TRACK	DIS-TANCE	HEIGHT	TRUE COURSE	VAR.	MAG. COURSE	GROUND SPEED	TIME
200 mph	060°	68 mls	3000′	053°	11°W	064°	185mph	22 mins

The estimated ground speed is 185 m.p.h., and you can therefore expect to travel five-sixtieths of 185 miles (approximately 15½ miles) in five minutes. It is a simple matter to set your compasses to an arc of this length on the graduated scale line of your map, and to mark off your track line with these intervals, as in Fig. 1, in which the appropriate vector drawing is also shown.

The sensation of flying in itself will be enough to occupy your complete attention during the first few minutes after you are airborne, but as soon as you have got your "air-legs" you will find that the trip will become much more interesting if you take up your map and try to pick out the main ground features. Here your pilot can be helpful. He will be familiar with many of the landmarks, and by pointing them out to you can give you that initial feeling of confidence so necessary for successful map-reading.

Provided you have swotted up your map symbols, you will soon get the hang of it, and the only thing likely to trick you is that the heights of ground objects do not show up very clearly from the air.

Rivers and railway lines will strike you immediately as being the most obvious aids, but as soon as you have checked your position by reference to them try to locate some of the lesser landmarks shown on your map. The fact that you are aware of your position will make the task a lot easier. It is a good idea to spread out your map so that your track line is running directly away from you. By doing this you will find that features such as railway lines and roads will come up to meet you at the same angle as they appear on your map. This greatly assists identification.

Instead of having height and airspeed given you by a classroom instructor you will, of course, have to get this information for yourself. If you have no separate instrument panel it is as well to get the pilot to point out the altimeter and A.S.I. on his. They take a bit of finding amongst the maze of other dials.

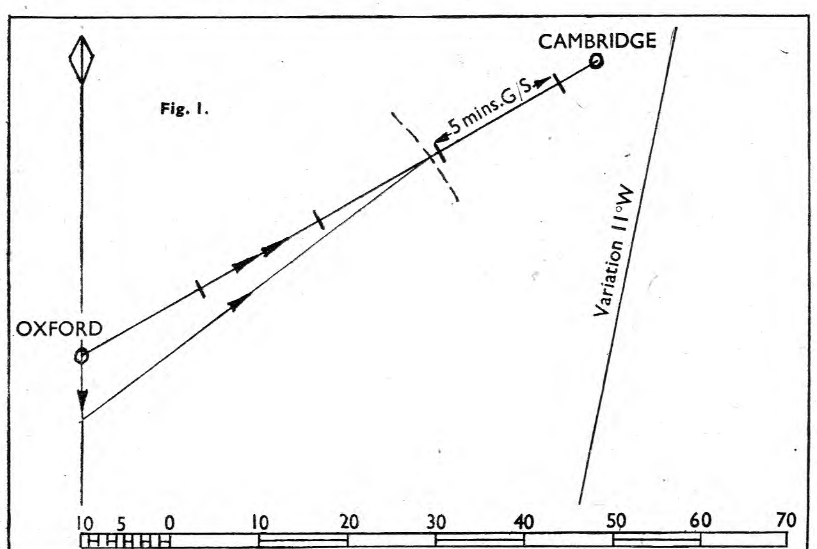
If you find that the aircraft is not following the required track exactly there is no need to calculate a new wind. When you are about half-way along the leg you can join up your known position to your departure point, and, by doubling the angle that it makes with your required track, the necessary correction to apply is automatically found. It should be noted that the angle between your required track and actual track is *not* the angle of drift. Drift is the angle between your track made good (T.M.G.) and the course steered.

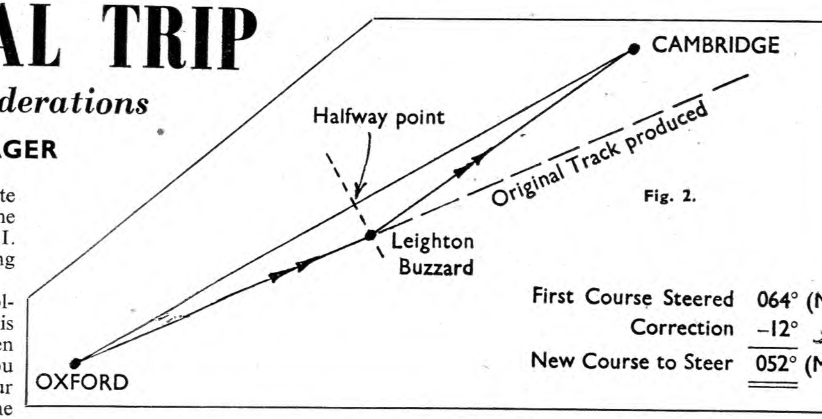
Assume, for example, that when flying from Oxford to Cambridge you pass over Leighton Buzzard, instead of, as you should, leaving it about two miles to your starboard. This error may not sound serious, but, if uncorrected, means that you would miss Cambridge by no less than five miles. By drawing a line at right angles to your required track, at a point half-way along it, and noting where this line cuts your actual track produced, you can easily estimate where you should be at "half-time." If you double the angular error between your required track and T.M.G., and give this as a correction to the pilot, this should bring the aircraft directly over Cambridge (assuming, of course, that the wind remains constant). Fig. 2 illustrates the example given above.

When you find yourself to the starboard of your required track, this correction should be subtracted from the course steered, and if you are to the port it should be added.

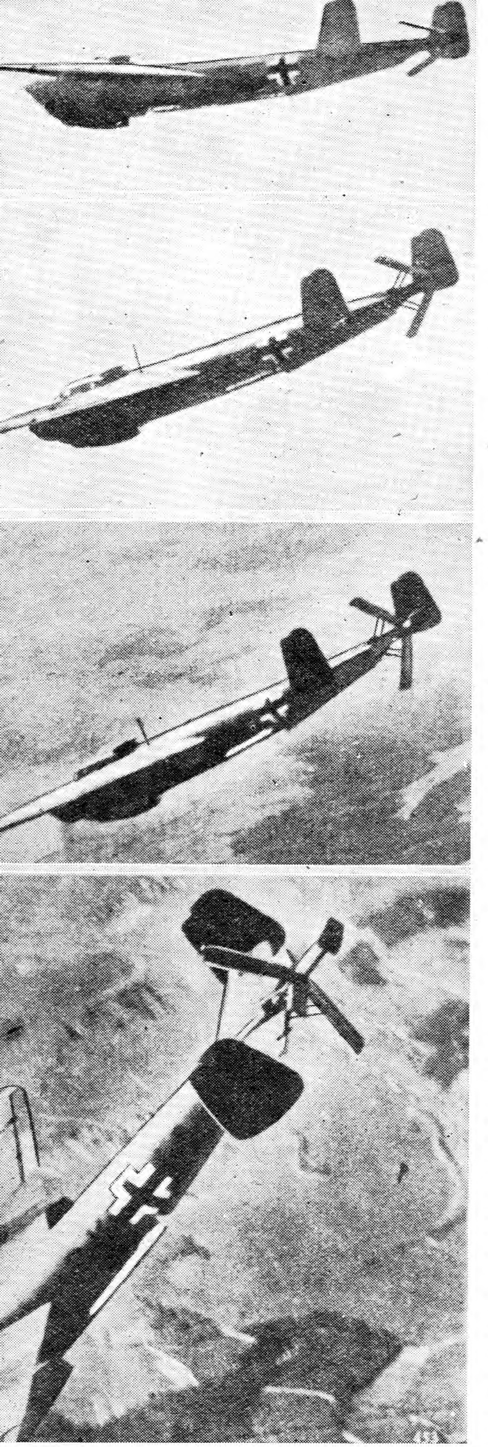
I hope that these few notes may help you a little during your first flight as navigator; but just in case you should happen to get lost I would like to close with these few words of consolation:

"Don't worry; the pilot will be far more worried than you are."





The navigator of a Whitley takes a little coffee to help him over his problems.



THE DORNIER DIVE BRAKE

A series of pictures showing the Dornier 217-E2 dive brake in action. The brake is controllable in flight, the extent to which it is opened depending upon the angle of the dive. The brake has four vanes, though two of them are not very clear in the pictures above. When not in use the brake folds as indicated in the drawing on the next page.

BOOKS

Practical Mathematics

By C. V. Durell. With answers. 176 pages. 7″×5″. Bell & Co. 3/3.

This is an excellent little book. There is no unnecessary padding; the author comes straight to the point, gives his proofs and explanations very tersely and is clever in selecting methods easily understood by novices. A good example of this is his proof of Pythagoras' Theorem on page 90.

The book covers practically all mathematical knowledge that can reasonably be expected of candidates for pilot or observer.

Man's Conquest of the Air

(August 1942.) By Harry Harper. John Gifford Ltd. 2/6. 206 pages. 5¼″×7½″.

Sparsely illustrated survey of the history of aviation, by one of the oldest aeronautical journalists.

The Greatest People in the World

(1942.) By Flying Officer "X." Jonathan Cape. 2/-. 79 pages. 4½″×7″.

Nine short stories about Air Force flying men by an R.A.F. flying officer.

Weather

(1942.) By W. G. Kendrew, M.A. Oxford University Press. 2/-. 96 pages. 4½″×7″. Diagrams.

A well-written and accurate book which forms an excellent introduction to meteorology.

A First Course in Wireless

(Second edition, 1942.) By "Decibel." Pitman. 5/-. 221 pages. 4½″×7¼″. Diagrams.

A reprint in book form of a series of articles which appeared in *World Radio* under the title of "Radio Circle." A useful and accurate introduction to the subject.

Fundamentals of Flight

(1942.) By R. Abbot, M.Sc.(Lond.). J. M. Dent. 2/3. 64 pages. 6¼″×8½″. Diagrams.

A good introduction to elementary aerodynamics.

We Rendezvous at Ten

(1942.) By "Blake." Victor Gollancz. 8/6. 160 pages. 5″×7¼″. 16 photographs.

An interesting story by the author of *Readiness at Dawn*, who is a Control Officer. Deals largely with events subsequent to the Battle of Britain, and describes life on a Fighter Station, and particularly the workings of operations and control, forming a useful complement to the books by fighter pilots on their actual experiences in the air.

Aircraft Carriers of Great Britain, U.S.A. and Axis Nations

Real Photographs. 1/6. 27 pages.

Details and pictures of the aircraft carriers of the warring nations.

Fleet Air Arm—"Y" Scheme Entries

The Editor, *A.T.C. Gazette*.

Sir,

I have been concerned lately with a number of cases in which Commanding Officers of A.T.C. units have apparently been under the impression that the possession of a School Certificate, or its equivalent, was an essential qualification for entry into the Fleet Air Arm through the " Y " Scheme. This impression is entirely incorrect.

The "Y" Scheme pamphlet (C.W. 40906/41) lays down as an alternative qualification "a recommendation and certificate from his Commanding Officer stating that the candidate is of outstanding personality and a good education and has been for at least a year before his application an efficient member of one of the following Corps:—(*a*) The Air Training Corps . . ."

Under the existing regulations Fleet Air Arm pilots and observers are required to qualify as officers in addition to their flying duties. It is therefore essential that they should possess the qualities of responsibility and leadership required of an officer; it is equally essential that they should have a sufficient knowledge of such subjects as Mathematics and English to enable them to cope with their duties as pilot or observer, but this does not mean that a School Certificate, or even a secondary school education, is essential for entry. On the contrary, one of the great values of the Air Training Corps is its ability to take a boy who has only had the benefit of an elementary school education and to train him, if he possesses the right type of character and the will to learn, up to the required standards both of education and of leadership.

I apologise for trespassing on your space, but as the number of A.T.C. cadets who have expressed a preference for the Fleet Air Arm now runs well into five figures, it seems desirable that both they and their Commanding officers should be correctly informed as to the qualifications required.

I should add in conclusion that a candidate who just fails to make the grade for pilot or observer before the Selection Board may be offered the alternative of entry for training as an air gunner, and many promising air gunners have entered the Service in this way.

Yours faithfully,

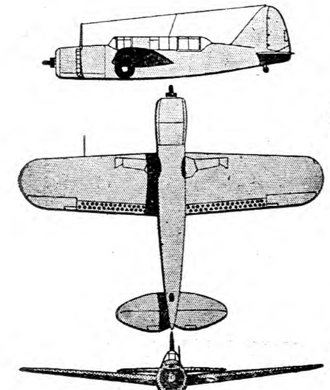
A. Goodfellow,
Commander (A) R.N.V.R.,
A.T.C. Liaison Officer.

(Series 12)

Drawn by James Hay Stevens for the Air Training Corps Gazette.

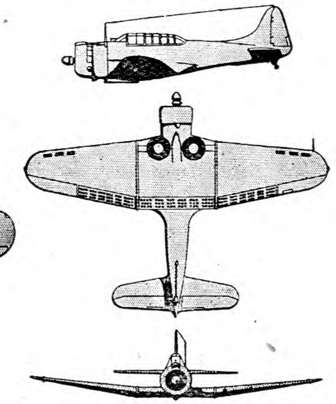
Aeroplanes You Should Know

BREWSTER 340 BERMUDA
(U.S. Navy SB2A-2, Buccaneer)



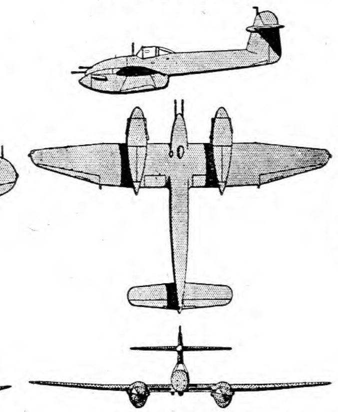
Reconnaissance dive bomber.
Single-engined mid-wing monoplane.
Wright Double-Row Cyclone air-cooled radial engine.
Span 47 ft. 0 in. Length 39 ft. 6 in.
Maximum speed about 300 m.p.h.
Note deep, tubby fuselage, long nose, large fin and low aspect-ratio wing (U.S. Navy version differs in detail and is fitted with turret).

DOUGLAS SBD DAUNTLESS



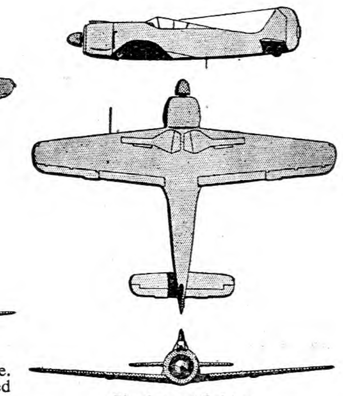
Dive bomber ship plane.
Single-engined low wing monoplane.
Wright Cyclone air-cooled radial engine.
Span 41 ft. 6 in. Length 31 ft. 8 in.
Maximum speed 261 m.p.h. to 275 m.p.h.
Massive wing and "cocked-up" slender tail very distinctive, three versions, SBD-1, 2 and 3, all very similar, but with varying powers and performances.

WESTLAND WHIRLWIND



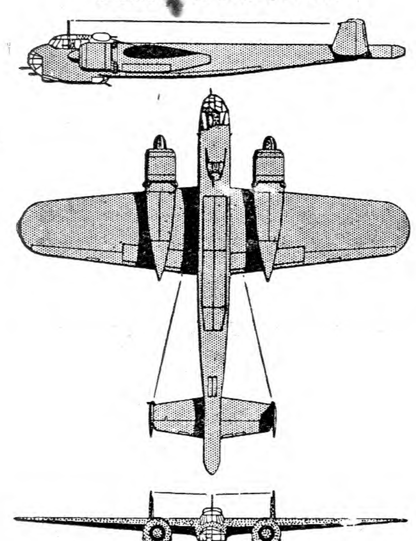
Single-seat fighter.
Twin-engined low-wing monoplane.
Rolls-Royce Peregrine liquid-cooled vee engines.
Span 45 ft. 0 in. Length 31 ft. 6 in.
Maximum speed over 350 m.p.h.
High tail plane, tall rudder, straight fuselage and underslung nacelles unmistakeable. Pulsating engine note sounds like German bomber.

FOCKE-WULF Fw. 190



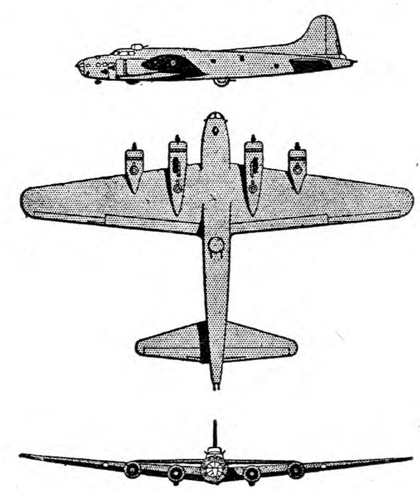
Single-seat fighter.
Single-engined low-wing monoplane.
B.M.W. 801 air-cooled radial engine.
Span 37 ft. 0 in. Length 28 ft. 11 in.
Maximum speed about 370 m.p.h.
Low cockpit cover and compact shape with large rudder and "squared-up" wing-tips distinctive.

DORNIER Do. 217-E2



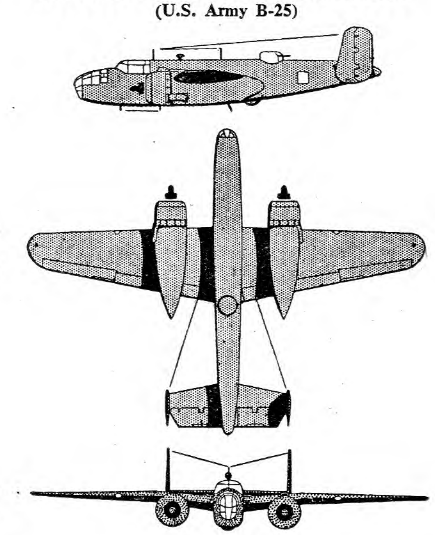
Medium bomber.
Twin-engined high-wing monoplane.
B.M.W. 801 air-cooled radial engines.
Span 62 ft. 5 in. Maximum speed 309 m.p.h.*
Very like earlier Dornier designs. Long nacelles projecting aft and complete absence of wing root fillets are points to note. Do. 217-E1 is similar, but has no projecting dive brake at tail and no power-driven top turret.
*British estimate.

BOEING FORTRESS II
(U.S. Army B-17E)

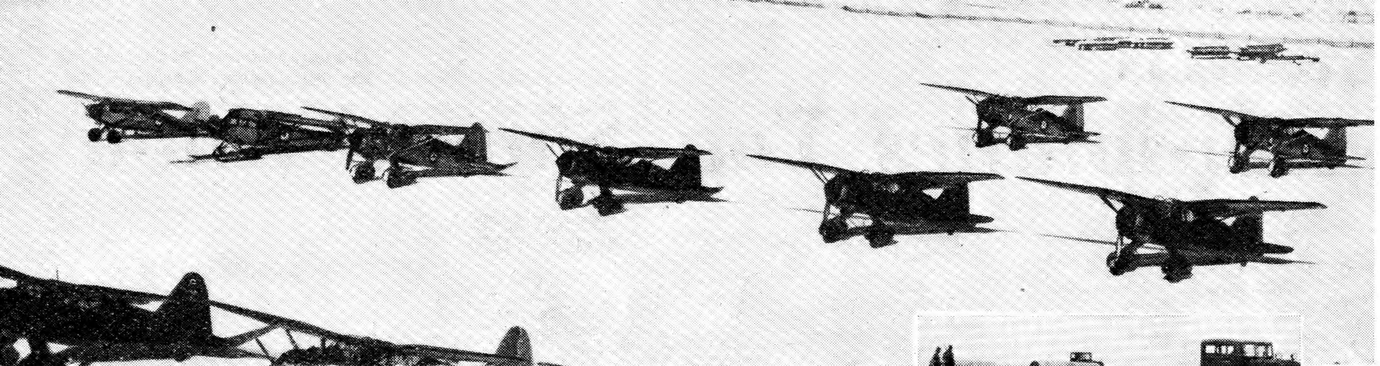


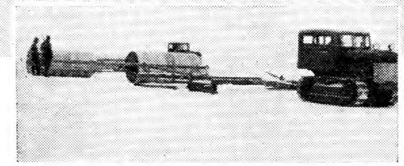
Long-range bomber.
Four-engined low-wing monoplane. Wright Cyclone air-cooled radial engines.
Span 103 ft. 9 in. Length 73 ft. 9 in.
Maximum speed over 300 m.p.h.
Engines more inboard than British types. Large fin very characteristic in the air.

NORTH AMERICAN MITCHELL
(U.S. Army B-25)



Medium Bomber.
Twin-engined mid-wing monoplane
Wright Double Row Cyclone air-cooled radial engines.
Span 67 ft. 7 in. Length 51 ft. 5 in.
Maximum speed 308 m.p.h.
General appearance is a cross between the Boston and the Hudson. The cranked wing (only noticeable at certain angles), angular rudder and fins, and the turrets are distinguishable features.





Lysanders and other aircraft on a Canadian snow-clad aerodrome. Inset: the snow roller.

FLYING IN CANADA

By a Pilot

THE first morning at camp we were given a pair of thick stockings, rubber overboots, a Yukon hat with ear-muffs and some thick underwear. We were free for the rest of the morning, and I went to have a look at the landing-ground. The neat yellow planes were powerful, single-engine types, with a cockpit for two; dozens of them were buzzing around the circuit and taking off and landing on the smooth snow. The snow on the airfield was rolled smooth every day, and it made a very good landing-surface, though difficult to judge when landing in the strong sunlight.

The following morning my instructor took me up for a familiarisation flight. The outside air was 25 degrees below freezing, and it took about a quarter of an hour to warm up the oil. He let me taxi out to the end of the aerodrome, and I found it surprisingly easy, because the machine had brakes, unlike the Tiger Moth, which is a difficult machine to manœuvre on the ground, especially in a strong wind. We went through the long cockpit drill together; eighteen points to remember to prevent mistakes such as taking off with hardly any petrol, or with the flaps down, or the trimming gear set wrongly. Then the take-off. The powerful engine forced me against the back-rest and there was a glorious surge of energy. We seemed to be off the deck in no time and climbing at a terrific angle. What a change from the Tiger Moth! I looked around me and saw the ground as a huge expanse of white, divided into the sections of land with the boundaries running due north and south and east and west. It seemed as if the earth's lines of latitude and longitude had been marked out for us. The towns appeared as black masses in the intense white, and the only other landmarks were railways.

Landing was more difficult than on the Tiger Moth, because there were more things to remember, besides the added difficulty of high wing-loading and greater landing-speed.

Soon circuits and bumps were finished, and I started aerobatics. I found it much easier to do a slow roll and much harder to loop than the Tiger. It was so much faster that it rolled over without losing much height, but the extra speed increased the centrifugal force in a loop, and it was quite a common occurrence to black-out.

The solo cross-countries were interesting. The longest one was about 300 miles, and the route lay over mountains, frozen rivers and lakes. When I was about 50 miles from base, on the return journey I got caught in a snowstorm; I had to come down to about 50 feet in order to see anything of the ground; the machine bumped and rocked. I wondered how I could land from that height, even if I could ever find the aerodrome. Luckily it was only a local storm, and after about five minutes I came through the other side of it.

There were a few tests, including a navigation test. The navigation instructor took me up, asked me the names of several villages, told me to set a course and then steer it, put me under the hood and, after he had flown around on various courses, he would make me come out and find my way back to the aerodrome.

The "Wings" test consisted of a three-legged cross-country. On the first leg I had to fly on course to a certain point; when we arrived at that point the flight commander took over while I put the hood over my cockpit, and then I set course for the second point, and I had to hold that course until I told the flight commander that E.T.A. was up; I then had to pinpoint myself, hand my map over to him, and find my own way back to the aerodrome from a distance of about 100 miles.

I had several "pleasure" trips. I remember going up with another pupil, and we thought we would like to go above a layer of cloud which was about 1,000 feet thick with a base of 2,000 feet. We climbed up into it, and I think we were both a little nervous, because we wondered when we were going to get through it, and whether we should be able to find ourselves when we came down again. We were flying blind in the cloud; as we came nearer the top it became brighter and brighter, until we suddenly burst through into blinding sunlight. When we first broke through it was like being in a boat with waves of cloud washing round us. It seemed that we had that whole space to ourselves and that we were living in a different world. There was nothing but the blue sky and sun above and a layer of wavy cloud below. We seemed completely cut off from the world. The cloud below looked so solid that we wondered if we would break anything when we wanted to go back to earth. It was eerie in that deserted place, but most interesting in spite of its emptiness.

We decided to come down again, and I held my breath as we approached the cloud; I was still not quite sure what was going to happen when we hit that solid-looking mass. We came nearer, and the waves started washing by. Then we plunged right into it, and all we could see was the cockpit, that seemed to have opaque glass. It became darker and darker, and we appeared to be just hanging and not moving. At last we broke through, and there was the earth 2,000 feet below. It was like going through the earth and finding a dingy underworld beneath.

At last the great day arrived, the day on which we were to be given our wings. We put on our best blue, with buttons shining and boots polished. The station commander presented each pilot with his wings and a pair of sergeant's stripes. He shook hands and gave each one of us some words of congratulation.

Although it was still cold, and summer had not yet arrived, not one of us wore a greatcoat in the town that night.

Aerobiographies V—by C. G. Grey

Sir Frederick Handley Page

WHEN I first met Sir Frederick Handley Page, early in 1909, he had quite a good-sized workshop and a very small office, made of wood and corrugated iron, on a wind-blasted plateau near Barking. The plateau had in fact been built up of the earth, clay and rocks which were excavated in building the London Tube Railways, taken down the river in barges and dumped on the north bank, so ground rents were cheap.

At that time he was not building aeroplanes of his own: he was building aeroplanes for anybody who liked to pay for having the work done. Among his customers were several later distinguished members of the Aeronautical Society, not yet Royal, who had a neighbouring part of the dump on which they hoped to aviate, and a rough shed to house their curious apparatuses.

He did so well at that job that he decided to build an aeroplane of his own, and he acquired a piece of ground at Fairlop, close to the modern arterial road to Southend, and, in the end, it looked like an aerodrome. There he built two curious machines which, because of their colours, were known as the "Yellow Peril" and the "Antiseptic." He did so well that, with extreme financial care, he was able to rent a shed at Hendon, which by 1913 had become a popular and fashionable week-end show place, where people went by tens of thousands to watch the air racing and stunt flying. And during all this time he was lecturing on Aerodynamics at the Northampton Institute in Clerkenwell.

He had acquired quite a big reputation by the time war broke out in 1914. Then, being a wise man, he started building aeroplanes of official design for the Royal Naval Air Service, instead of for the Royal Flying Corps, which was the Army.

At that time people were beginning to talk about twin-engine bombers. So H. P. produced a design for one. It was submitted to Captain Sueter at the Admiralty. He sent for young Mr. H. P., and to use his own words: "As soon as I saw him, I said to myself, here is a man who can deliver the goods." And from that day Handley Page's future was assured.

He built the twin-engine Handley Page bombers which did so well for the R.N.A.S. in France, and later with General Trenchard's Independent Air Force in Eastern France, bombing the German Rhineland cities. He also built, towards the end of the war, the great four-engine Handley Pages which were going to bomb Berlin.

In 1920 the Handley Page Slot was patented. H. P. never claimed that he invented it himself: he has always said that it was evolved rather than discovered by his experimental staff. At the same time Doctor Lachmann developed the same thing in Germany and patented it. So Mr. Handley Page, instead of spending money on litigation, wisely bought Doctor Lachmann, who had quite a big hand in designing the famous Hampden bomber along with Mr. Volkert, the firm's chief designer, and Mr. Jamie Hamilton, the firm's chief engineer. Dr. Lachmann was interned when war broke out, but the still more famous Halifax was then already going into production, so he probably had a hand in that too.

There is nobody in the aircraft industry—and I know most of them—who could catch H. P. out on a technical point, or defeat him in a scientific argument, or get past him with a bad piece of design. His idea of running an aircraft factory, which he does most successfully, is that the boss should be like the editor of a paper. He should be able to pick the best possible assistants, and he should know enough to see whether their work is right or not. And that is the secret of the success of Handley Page Ltd.

Apart from all that, H. P. is one of the most brilliant speakers in the country, and one of the greatest humorists. He can be guaranteed to make an interesting and informative and entertaining speech on any subject, whether he knows anything about it or not. And one can always be sure that he will work in a thoroughly appropriate reference to the Handley Page slot and to the Handley Page bombers, generally with a fitting Scriptural quotation to drive the argument home.

AIRCRAFT RIGGING CHECKS

By **P. W. BLANDFORD**

DURING the last 30 years or so of aviation history there have been big changes in the methods of construction of aircraft. Early aeroplanes were braced by wires and adjustable struts, internally and externally. Most modern aircraft have rigid, non-adjustable structures.

The adjustments on early machines enabled experiments to be made in the flying angles—incidence and dihedral. Flying faults of individually produced machines could also be corrected by adjusting wires and struts. The angles of wings, etc., of modern quantity-produced machines are fixed, the best positions being found by tests with models and experimental aircraft before production is started, and then accuracy is maintained by building in jigs.

The men who worked on the airframes of early machines were known as "riggers," as distinct from the "fitters" who worked on the engines. The riggers' duties were then very similar to those of the old-time sailing-ship riggers', so the name was very appropriate. As aeroplane construction changed, and the rigger was called upon to attend to such things as hydraulic systems, oleo legs, retractable undercarriages, etc., instead of much of the original rigging, which was disappearing, his name was changed; and he is now known in the R.A.F. as a "Flight Mechanic (Airframe)" or "Fitter II (Airframe)," and in civil Aviation as a "Ground Engineer."

There are a few modern biplanes, including the popular Moth types, which have adjustable mainplane bracings; but the only work which might be called rigging that can be done on most monoplanes is the testing of angles and measurements after assembly, repair, modification, etc.

Tools

The few tools needed for this work are straight-edges, adjustable level, chalk-line and plumb-line. I described the construction of an adjustable level, which is sufficiently accurate for work on mock-ups, ground trainers and models in the *Gazette* for April, 1942. Aircraft manufacturers supply rigging boards which take the place of straight-edges and adjustable levels; but the work can be done as well, if not so easily and quickly, without them.

Angles

If you are not familiar with the names of the many angles on an aeroplane, Fig. 1 will explain them to you. The angles on a tailplane have the same names as their counterparts on the mainplane.

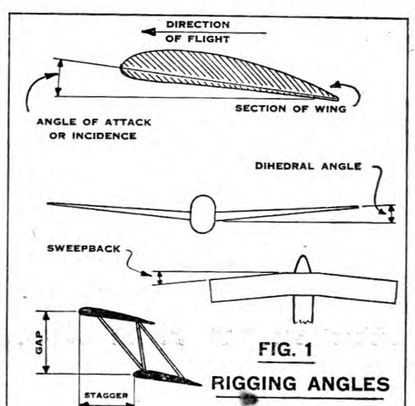


FIG. 1 RIGGING ANGLES

Rigging Position

Before the angles of mainplanes and tailplanes can be tested, the machine has to be supported in "rigging position." Inside the fuselage, generally in the cockpit, are "datum points" on which a wooden straight-edge can be rested. These points are arranged so that, when resting on them, in one position the straight-edge would be horizontal lengthways, or "longitudinally" (if the machine were flying normally), and horizontal crossways, or "laterally" in the other position (Fig. 2, A).

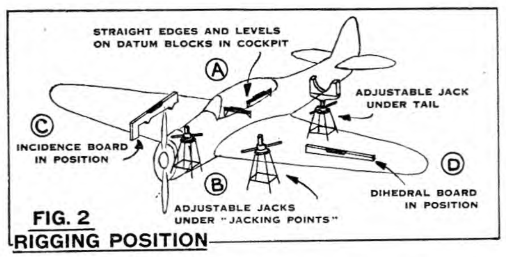


FIG. 2 RIGGING POSITION

Certain parts of the aircraft are strengthened so that jacks can be placed under them and the machine raised off the ground. As explained by Harold P. Lees in last month's *Gazette*, there are generally three "jacking-points" arranged, one at the tail and one each side of the fuselage under the root-ends of the mainplanes.

By lifting the machine on these jacks and adjusting them to get a level reading on both sets of datum points, the aircraft can be put into rigging position (Fig. 2, B). Once it is in correct position, care must be taken that its level is not disturbed by people climbing or leaning on it when tests are being made.

For every aeroplane type there is a descriptive handbook published. Particulars of the angles and check measurements for a certain machine can be found in its handbook, together with limits. As there are limits to the degrees of accuracy that are needed, or possible to obtain, in rigging, the permissible limits are stated, e.g. aileron movements: up 25°±15′, down 12°±15′, which means that if the settings obtained are within 15′ of the correct reading they can be regarded as accurate.

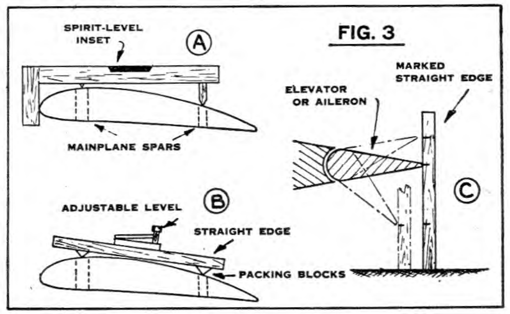


FIG. 3

Testing Angles

The positions for testing are specified in the handbook, and often also marked as "datum points" on the machine. If the makers' rigging boards are used, testing becomes merely a matter of trying them in the correct positions. The "incidence board" is held on the datum points, with its forward end hooked over the leading-edge of the plane (Figs. 2, C; 3, A). Then the spirit-level is examined to see if the bubble in it is central.

Some mainplanes have "wash-in" or "wash-out," meaning that their angle of incidence increases or decreases from root-end to wing-tip respectively. In that case two incidence boards are needed—one applied on datum points near the root-end and the other used near the wing-tip.

A makers' dihedral board is used in a similar way, but it has to lie on a lateral line, generally over the front spar (Fig. 2, D).

If a straight-edge is used in conjunction with an adjustable level, instead of makers' rigging boards, the procedure is slightly different. To allow for the curve of the top of the mainplane, when testing incidence, small packing blocks of equal thickness are placed over the datum points and the straight-edge rested on them. The adjustable level is rested on the straight-edge, and adjusted until the bubble is central, when the actual angle can be read off (Fig. 3, B). When resting on the straight-edge to measure an angle, the hinged end of the level should be towards the higher end.

Control Movements

Movements of control surfaces are specified in angles and distances. It is the latter which the rigger generally uses, unless he has an adjustable level or clinometer with a sufficiently large range of movement.

As an example, the movement of the elevator on one machine is given as: up, 15° or 4.55″±0.15′; down, 25° or 7.55″±0.25″. This means that from the neutral position the elevator should move through these angles or its trailing edge should rise and fall the distances given when operated by the control column. The distances are measured by supporting a vertical rod against the trailing edge of the surface, and marking the distance moved (Fig. 3, C). Control of movement is generally made by adjustable stops somewhere in the system.

Movement of ailerons, elevators and trimming tabs can be tested in this way.

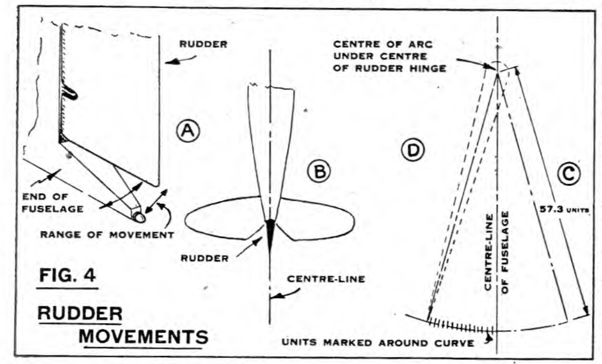


FIG. 4 RUDDER MOVEMENTS

The rudder requires different treatment. If the end of the fuselage projects below the rudder, its maximum movement may be given as a distance each side of this (Fig. 4, A).

On machines where this test is impossible, the angle of rudder movement can be measured in the following way:

With a plumb-line and bob locate a mark on the ground exactly under a central point of the fuselage near the nose. Do the same under the rudder post at the tail. Through these points draw a line on the ground, projecting past the tail (Fig. 4, B). With the point under the rudder post as centre, draw an arc with a radius of 57.3 units. The units can be any convenient amount, and the compass can be a piece of string and chalk. Measure around the curve the same number of units each side of the centre line as the number of degrees in the angles. Lines drawn through these points to the centre will be at the correct angles (Fig. 4, C). To test the rudder movement, hang a plumb-line from its trailing edge and see if it hangs over the marked-out lines when the rudder is moved to the limits of its travel (Fig. 4, D).

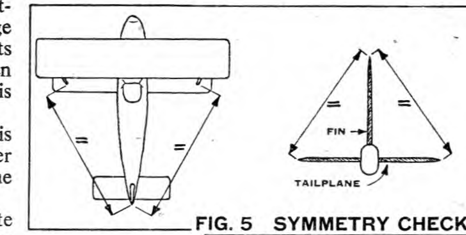


FIG. 5 SYMMETRY CHECKS

Even if the various angles are correct, an aeroplane may not fly correctly if some part of it is twisted. To test for twist, a rigger carries out symmetrical checks. To do this he takes some point on the centre line of the fuselage, and measures to appropriate points on each side, e.g. wing tips to fin, or top of fin to tailplane tips (Fig. 5). If the machine is symmetrical, each pair of measurements should be equal.

Answers to

DO YOU KNOW THEM?

(*see pages* 12 *and* 13)

(READING in rows from left to right.) Page 12, *Top row*—(1) Sergeant John Hannah, V.C., who extinguished a fire in a blazing Hampden returning from Germany; (2) Squadron Leader Keith (Bluey) Truscott, D.F.C., Australian fighter pilot.

Second row—(1) Air Chief Marshal Sir Hugh T. C. Dowding, G.C.B., G.C.V.O., K.C.B., Commander - in - Chief Fighter Command during the Battle of Britain; (2) The Prime Minister (in Air Commodore's uniform); (3) H.M. The King; (4) Wing Commander Max Aitken, D.S.O., D.F.C., British fighter pilot; (5) Captain A. G. C. Talbot, R.N., D.S.O., in command of aircraft carrier *Illustrious*, 1941.

Third row—(1) Air Marshal A. G. R. Garrod, C.B., O.B.E., M.C., D.F.C., Air Member for Training; (2) The Rt. Hon. Sir Archibald Sinclair, Bt., K.T., C.M.G., M.P., Secretary of State for Air; (3) The late R. J. Mitchell, C.B.E., designer of the Spitfire.

Fourth row—(1) Rear Admiral A. St. G. Lyster, C.B., C.V.O., D.S.O., Chief of Naval Air Services, who directed Taranto operation; (2) Wing Commander G. H. Keat, Administrative Officer Air Training Corps; (3) Brig.-General J. Doolittle, famous American pilot, Schneider Trophy winner and leader of first daylight raid on Tokio; (4) Wing Commander R. A. B. Learoyd, V.C., awarded V.C. for raid on Dortmund-Ems Canal, August, 1940.

Fifth row—(1) Air Chief Marshal Sir R. E. C. Pierse, K.C.B., D.S.O., A.F.C., former A.O.C.-in-C. Bomber Command, now commanding R.A.F. in India; (2) The late Flight Lieut. Eric Lock, D.S.O., D.F.C., fighter pilot; (3) Mr. W. W. Wakefield, M.P., Director of the A.T.C.; (4) Wing Commander Hughie Edwards, V.C., who led daylight raid on Bremen, July, 1942.

Page 13. *Top row*—(1) Air Commodore J. A. Chamier, C.B., C.M.G., D.S.O., O.B.E., Inspector of the A.T.C.; (2) Major-General George Brett, G.O.C. Allied Air Force, Anzac Area; (3) Sir Bertram Jones, K.B.E., Chairman of Chairmen's Advisory Board, A.T.C.; (4) Flight Lieut. Charles Kuttelwascher, D.F.C., famous Czech fighter pilot; (5) Lieut.-General H. H. Arnold, Chief of U.S. Army Air Forces.

Second row — (1) Wing Commander A. G. Malan, D.S.O., D.F.C., famous South African fighter pilot; (2) The late Flight Lieut. Brendon Finucane, D.S.O., D.F.C., Irish fighter pilot; (3) Air Chief Marshal Sir A. W. Tedder, K.C.B., A.O.C.-in-C. Middle East.

Third row—(1) Air Chief Marshal Sir Charles Portal, K.C.B., D.S.O., M.C., Chief of Air Staff; (2) Squadron Leader John Nettleton, V.C., who led Augsburg raid, March, 1942; (3) Wing Commander R. Ramsbottom - Isherwood, D.F.C., A.F.C., leader of the R.A.F. Wing in Russia, 1941; (4) Captain J. C. Kelly Rogers, transport pilot, who flew the Prime Minister across Atlantic, 1942.

Fourth row—(1) Air Chief Marshal Sir Sholto Douglas, K.C.B., M.C., D.F.C., A.O.C.-in-C. Fighter Command; (2) Captain H. H. Balfour, M.C., M.P., Under-Secretary of State for Air; (3) Wing Commander John Cunningham, D.S.O., D.F.C., night-fighter pilot.

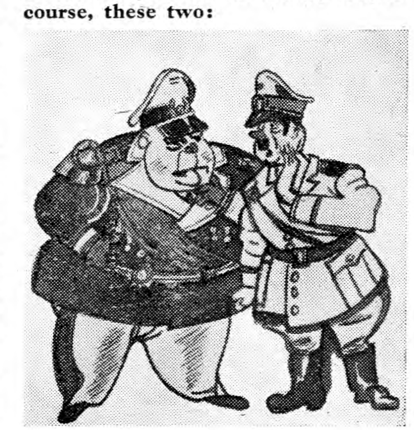
Fifth row — Flying Officer Kenneth Campbell, V.C., who attacked enemy cruisers at Brest, 1941; (2) Air Chief Marshal Sir Philip B. Joubert, K.C.B., C.M.G., D.S.O., A.O.C.-in-C. Coastal Command; (3) Air Chief Marshal Sir Arthur T. Harris, K.C.B., O.B.E., A.F.C., A.O.C.-in-C. Bomber Command; (4) Air Chief Marshal Sir Frederick Bowhill, G.B.E., K.C.B., C.M.G., A.O.C.-in-C. Ferry Command.

SECRET BROADCAST

If you told two men a secret at nine o'clock this morning, and they and everyone who subsequently heard it repeated it half an hour after hearing it to two others who had not previously heard it,

2,147,483,647

people, including yourself, would know it before midnight. That includes everyone in the world, and, of course, these two:



AIR TESTS ON WHEELS

by Michael Lorant

LIKE a football substitute who warms up along the sideline but is never sent into the game, there's a solitary aircraft engine at the Boeing Aircraft Company's, Seattle, U.S.A., plant that roars and roars but never leaves the ground. Yet this engine is more useful than those that test fly. It is one of the most valuable items in the large storehouse of aeronautical research developments.

It's a real engine, mounted on a real section of wing, but in place of fuselage and tail section the wing is attached to a house. The southern exposure of this winged house is unusual, too, for it is as changeable as the wind.

The whole works is mounted on wheels and runs on a rail, but it doesn't go anywhere. It just runs around in circles.

The "go-round" house was built to test the engine installation of new-type aircraft without flying them, and under conditions that will take into consideration the direction the wind is blowing. Since the engineers couldn't control the wind and wouldn't wait for it to change direction, they set the lab. on a turntable. If the engine is to be tested heading into the wind, as on a normal take-off, the laboratory can be trundled around to face the proper compass point.

The problem of wind is a big one, because it is important in the cooling of a motor. Consequently the power plant is set right out in the open, where the breeze can hit it.

An important reason for testing the engine on the ground is that an aircraft engine is put to its greatest strain, normally, during the warm-up and the take-off. The way it operates and the way it cools can be judged to considerable extent, therefore, before the engine is installed in an aeroplane.

Another reason for ground testing is that you can save a great amount of money and weeks of testing-time if you have completed the warm-up and taxying tests while you are still building the rest of the aircraft. When the machine is completed, then you can concentrate on testing the parts and the factors that must be proved by actual flight.

With time the all-important factor that it is in to-day's war, the pre-flight testing of a new model has become vital. Months may be cut from the time normally taken to get the type into production, since the engine requires more test time than any other part.

Some of the things that can be checked in the revolving laboratory are oil cooling, fuel flow, exhaust back pressures, vibration of the engine and the propeller, "prop" clearances and how well the heat generated in the cylinders is dispelled. More than showing only how the engine will operate on the ground, the results are a good indication of what may be expected in the air.

The largest cooling problem is apt to be encountered at ground-level. In the air, for instance, an aircraft usually cruises at from 60 per cent to 70 per cent of its engine capacity. But on the ground, during the warm-up and take-off, the engines are speeded to full horse-power. In flight the aircraft sets up its own headwind; on the ground there may be no wind, and the temperature may be 100 degrees or more.

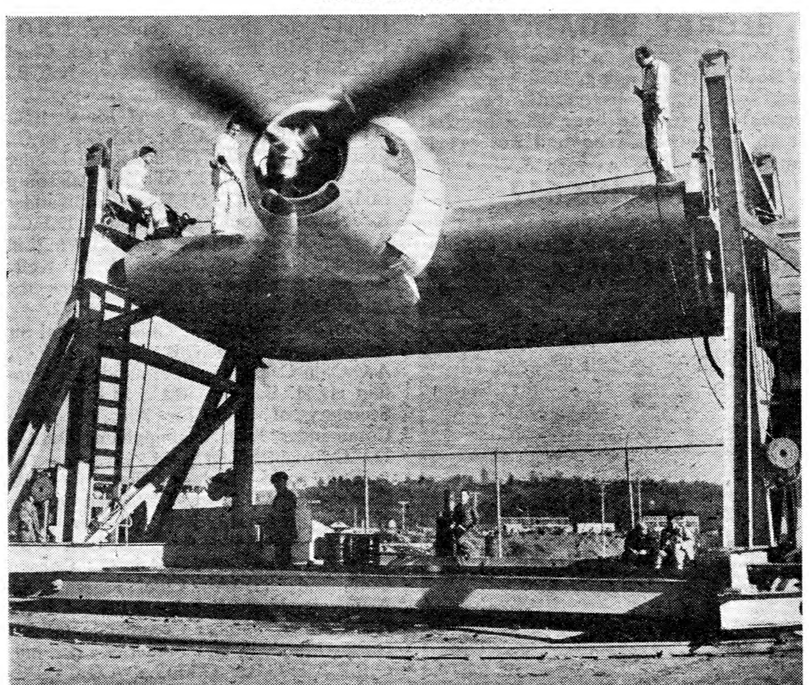
Usually, of course, engineers test the engine as it is headed into wind, simulating take-off conditions. But there are times when they want to run crosswind. Sometimes aircraft have to warm up, taxi and take off in cross-currents, and here the engine and its cooling system are up against a different set of factors. For one thing, the wind blowing across a radial engine will cause a difference in pressure between the windward and the lee sides of the motor, with the result that some cylinders will get hotter than others.

The tests are conducted by the "flight" crew inside the merry-go-round lab. The cabin is soundproof and equipped with instruments just like an aeroplane cabin, as well as with manimeter boards to measure pressure at many points, cameras for recording the whole board readings at the same instant, and other gadgets for getting the desired information about what's going on inside the running engine.

In all respects but one, the men at the instrument panel are a regular test-flight crew. They just don't leave the earth. The fact that they don't have to completes a major stride in speeding up research and the gathering of aeronautical knowledge.

The power-plant laboratory is only one among several research labs. at Boeing which foretell and foretest what will happen to aircraft and equipment under virtually any condition or combination of conditions that may be encountered in actual flight. The rarefied air of the stratosphere—where the famed Flying Fortresses operate—is supplied by the strato-chamber. The intense cold of the upper regions can be produced in the "cold room," or Polar-Lab., and the wind and icing conditions will be encountered in the projecting icing tunnel.

The movable test bed.



Crossword Solution

(*see page* 11)

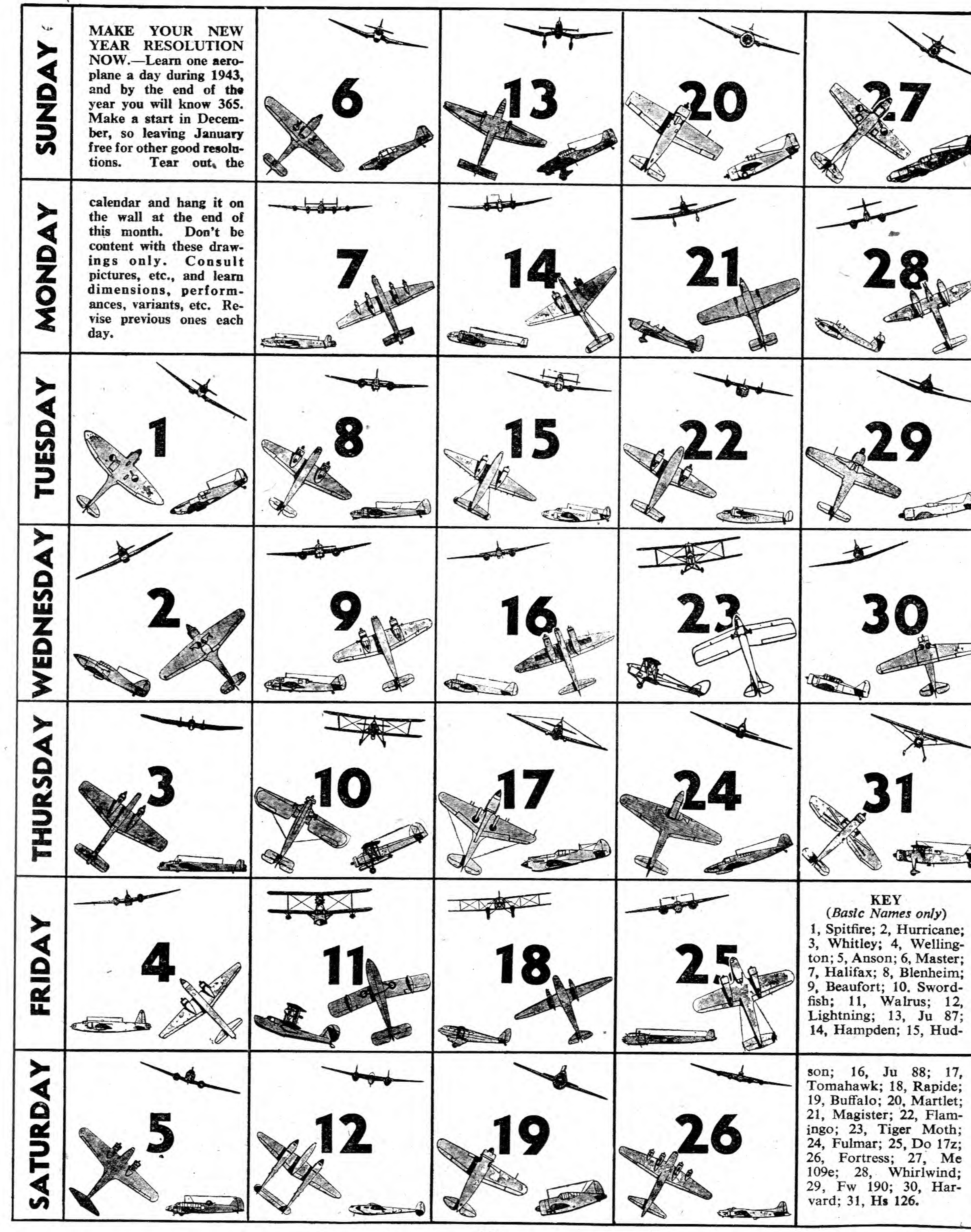
ACROSS.—1, Supermarine; 10, Pr (Proctor); 11, Ero (Sparviero); 12, Alb (Albatross); 14, Ae (Albacore & Ensign); 16, Ing (Stirling); 17, Ter (Magister); 18, Boeing; 19, Train; 21, Wakers; 23, Fs (Fieseler Storch); 25, Sm (Savoia-Marchetti); 26, Sti (Stirling); 27, Bris (Bristol); 29, Ku (Kurier); 30, Martlet; 33, U.S.A.; 35, Nose; 37, See (Arado Ar 95 See); 38, Eaf (Ensign, Anson & Fulmar); 40, Hudson; 41, Wdr (Walrus, Defiant & Rapide); 43, Fulm (Fulmar); 46, Rh (Rapide & Hurricane); 48, Toohs (Shoot backwards); 50, Dagger; 52, Avro; 53, Armstrong; 55, Dn (Sunderland); 56, Tail; 57, Lockheed.

DOWN.—1, Spitfire; 2, Urn (Blackburn); 3, Pegasus; 4, Er (Magister); 5, Roe; 6, Mar (Maryland); 7, Albatross; 8, Ide (Rapide); 9, Magister; 13, Bo (Boeing); 14, Air (Airacobra); 15, Ens (Ensign); 17, Timo (Timoshenko); 20, Nammurg (Grumman); 21, Ws (Wellington & Shark); 22, Kit (Kittyhawk); 24, Skua; 27, Blen (Blenheim); 28, Re (Spitfire); 31, And (Maryland); 32, Te (Tomahawk and Eagle); 34, Ah (Albatross & Hudson); 36, So (Stinson & Oxford); 37, Sword (Swordfish); 39, Flami (Flamingo); 42, D.H. One; 43, Fiat; 44, Ud (Bermuda); 45, M.G.s (machine-guns); 47, Hero; 48 Tank; 49, Spad; 51, Roc; 54, Ra (Rapide).

AIR TRAINING CORPS GAZETTE

RECOGNITION CALENDAR

DECEMBER 1942



MAKE YOUR NEW YEAR RESOLUTION NOW.—Learn one aeroplane a day during 1943, and by the end of the year you will know 365. Make a start in December, so leaving January free for other good resolutions. Tear out the calendar and hang it on the wall at the end of this month. Don't be content with these drawings only. Consult pictures, etc., and learn dimensions, performances, variants, etc. Revise previous ones each day.

KEY
(*Basic Names only*)
1, Spitfire; 2, Hurricane; 3, Whitley; 4, Wellington; 5, Anson; 6, Master; 7, Halifax; 8, Blenheim; 9, Beaufort; 10. Swordfish; 11, Walrus; 12, Lightning; 13, Ju 87; 14, Hampden; 15, Hudson; 16, Ju 88; 17, Tomahawk; 18, Rapide; 19, Buffalo; 20, Martlet; 21, Magister; 22, Flamingo; 23, Tiger Moth; 24, Fulmar; 25, Do 17z; 26, Fortress; 27, Me 109e; 28, Whirlwind; 29, Fw 190; 30, Harvard; 31, Hs 126.

PREPARING TO-DAY

FOR TO-MORROW

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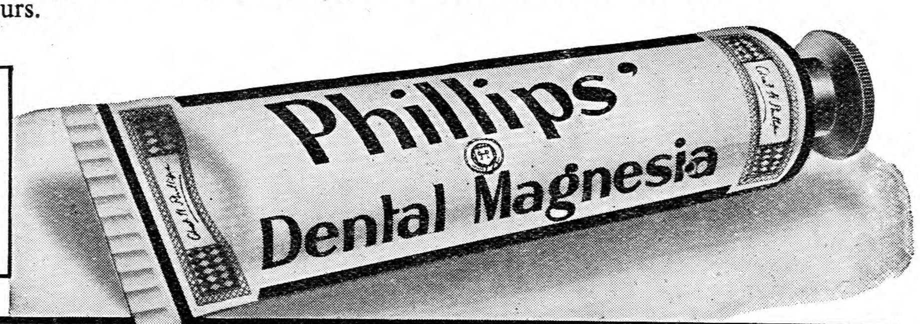

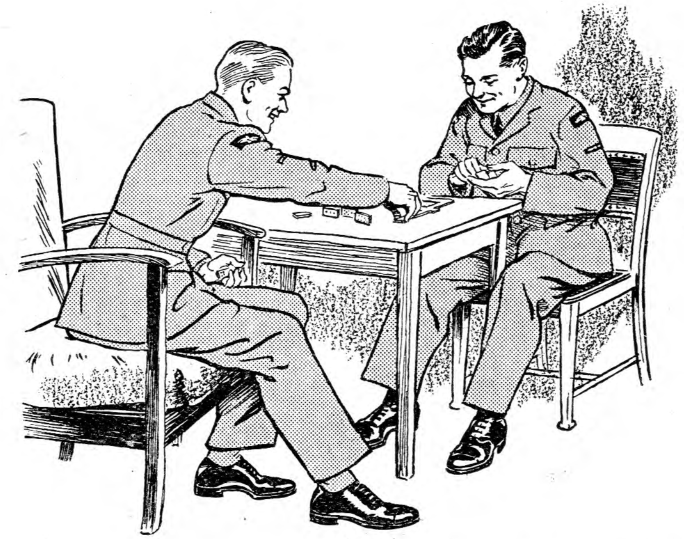

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RANDOLPH FIELD

Some views of the U.S. Air Corps Primary Flying School, Texas, where U.S. Army Air Corps cadets receive their first flying training. The aircraft below is a North American trainer. A portrait of the Commandant is at the foot of the page.