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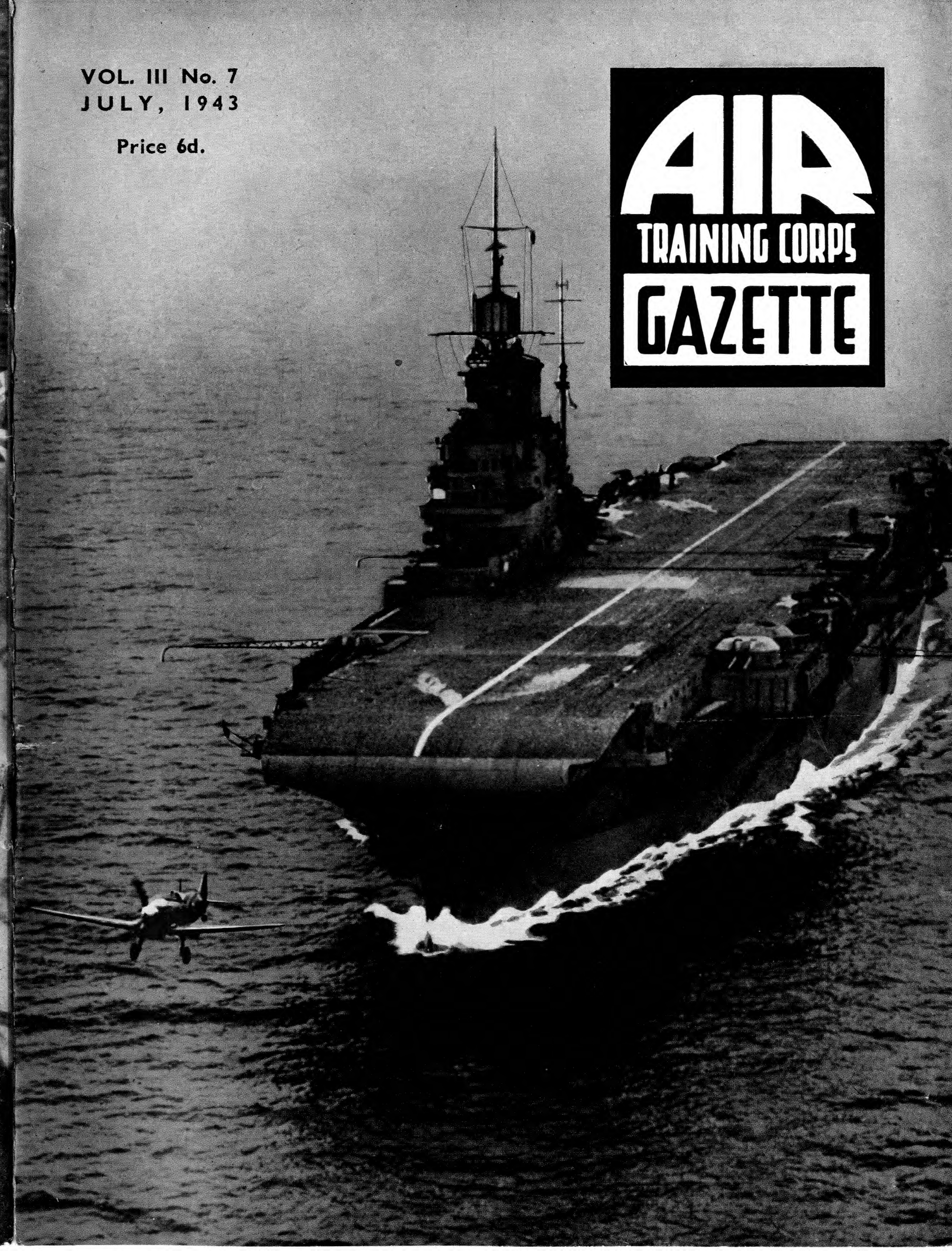
AIR TRAINING CORPS GAZETTE



The Halifax Bomb Rack

A close-up of the Halifax with its bomb doors open, revealing bomb racks fitted with bombs of varying functions, types and weights.

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Edited by Leonard Taylor

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Speed and Snap

TOO often when I go into the classrooms and to the instructional parades of the A.T.C. I find myself saying "How dull!" and I puzzle my head as to how this should be, and yet if I remark on this dullness the C.O. may think that I am asking for more fun and games.

It is true that in the early days of the Corps I asked C.O.s to put the jam of interest on the dry bread of learning; perhaps I did not stress sufficiently that we had first to ensure that the bread was wholesome and palatable before we wasted jam on it.

I think that cadets are seriously determined to do their best; but if they do not feel they are making progress, and if they are not interested, they leave—and small blame to them.

How often is drill instruction a drab period of marching around, with rare words of command interspersed with the still rarer "common" phrase like "Swing those arms further"! How dull! Whereas the drill period might be a dashing time of quick-fire commands, individual checking of faults by name, frequent "As you were!" drill to drum-taps, continuation drill without words of command, drill at the double, unexpected movements—a period when the cadet has no time to be bored and is improving all the while.

Classroom instruction must be real, and not a pretence. Classes must be small enough, or split into sub-classes under N.C.O. instructors — yes! even in calculations—so that each cadet learns and progresses. The teaching must be bright and good-humoured, so that it is palatable and pleasant as well as of value.

I would caution you against too much reliance on that time-waster the blackboard; a foot of rough model is worth ten square feet of blackboard. The land and sky must be freely used to supplement the synthetic maps and star charts on which we spend so much time.

Speed and snap, life and interest—these are the daily needs of young men, and where they are fully catered for we retain our cadets and improve their mental calibre.

The grand work which the Corps has done can be grander still; that day will come when no one seeing any of our classes at work can say "How dull!"

J. A. Chamier

AIR COMMODORE
INSPECTOR, AIR TRAINING CORPS

Height

With the rapid development of aircraft, fifty thousand feet may soon become a fighting level, although not, perhaps, a common one.

by Captain Norman MACMILLAN, M.C., A.F.C.

HEIGHT above the earth's surface can be regarded and measured in a number of different ways. Scientists themselves look upon it differently, according to their point of view. There are the electrical spheres and layers of the radio scientist, which correspond to known phenomena. There is the division of the atmosphere into physical spheres, enveloping one another, associated with aviation in the lowest divisions, the troposphere and the stratosphere, with the tropopause as the boundary layer between these two. There are the measurements above sea-level by true height and by aneroid height. There are measurements above ground-level, below cloud base and above cloud-level. There are measurements by atmospheric pressure and density, both of which have got a "standard" form which represents the theoretically perfect atmosphere, and the actual form which varies from day to day, sometimes from hour to hour.

Height and Flak

The true height of aircraft above ground- or sea-level is of immense importance to anti-aircraft gunners. Yet, amid anti-aircraft shelling, true height above the surface is not of immediate importance to the aircraft pilot, unless he is about to bomb a target. What is more important to the pilot is to put the anti-aircraft gunner off his aim by weaving, or by changing height. The bother with anti-aircraft gunfire, from the pilot's point of view, is that the first salvo is the one he cannot very well anticipate, because he does not know the exact moment when it will come up at him. He cannot be for ever weaving and changing height all the time he is over enemy-held territory, for his range of flight will be seriously reduced thereby, even if he is flying alone; while if he is accompanied by other aircraft flying in formation they will be still worse off.

Range, cruising speed and rate of climb are all reduced when aircraft fly in formation, because all must be adjusted to the capacity of the least efficient aircraft in the formation, and that is usually the one at the rear. The tighter the formation the more does this apply. When climbing to gain height it is more economical in fuel to fly in a loose formation; but circumstances, such as the probable proximity of enemy aircraft, may make it necessary to keep close to secure the advantages of a concentrated attack or a powerful defence.

Aircrews often look upon height in yet another way, and mentally divide the atmosphere into three layers — below oxygen height, oxygen height and above ordinary oxygen height.

The Oxygen Height

We all know from our school chemistry days that oxygen in a free form is required as an agent for combustion. You can take a piece of phosphorus and put it into water and keep it from burning. Expose it to the air and it will burn spontaneously. Water is a compound of hydrogen and oxygen; air is a mixture (mainly) of nitrogen and oxygen. In the compound, water, the oxygen is not free; in the mixture, air, the oxygen is free. Because air is a mixture and its components can readily be separated by suitable means, life is possible for animals, and it was possible for man to make fire, and after long ages to invent and produce the internal combustion engine.

When deprived of all oxygen man quickly dies. When his normal quantity of oxygen—measured by chest capacity multiplied by breathing rate—is reduced his energy is reduced. Bodily warmth is curtailed. One feels cold. Invalids in bed, whose power of breathing is minimised by illness, feel cold. When you take exercise you breathe faster and feel warm.

During a climb in an aeroplane the atmospheric pressure and density fall. But our chest capacity is constant. With each breath we take in a smaller quantity of oxygen, measured by weight, although the volume is the same. The noticeable tendency is then to breathe faster to get more air into the lungs. But there is a limit to the speed at which we can breathe; and faster breathing in itself consumes energy and produces fatigue. So that alone cannot solve the problem.

Acclimatisation

The climbers of Mount Everest, in the last expedition of 1933, decided that it was better to climb without oxygen bottles rather than to carry the extra weight they entailed. By a process of slow and careful atmospheric acclimatisation they succeeded in reaching a height of over 28,000 feet without using oxygen. But the climbers found that they tired quickly and that they could not climb fast. Their final effort had to be compressed into relatively few hours, at the end of which, when they did not succeed, they had of necessity to give in simply because they could not carry on.

Aircrews are in different case from mountain climbers. The aircrews ascend rapidly. There is no time—weeks in the case of the Everest party—to acclimatise; only a few minutes in fighters, an hour or so in bombers.

Oxygen is essential to aircrews who fly above certain levels. The minimum height cannot always be constant, for, as we have seen at the beginning of this article, there are so many variations of height. Variations in atmospheric temperature also make a difference. Warmth is supplied by oxygen, and when the air is colder it may be wise to begin to use the gas at a lower height than is strictly necessary. The duration of flight plays an important part in the use of oxygen. The longer the flight at heights above, say, 10,000 feet, the more necessary it is to use oxygen, because the effect of the deprivation of oxygen increases with time to produce fatigue and sluggish physical and mental responses.

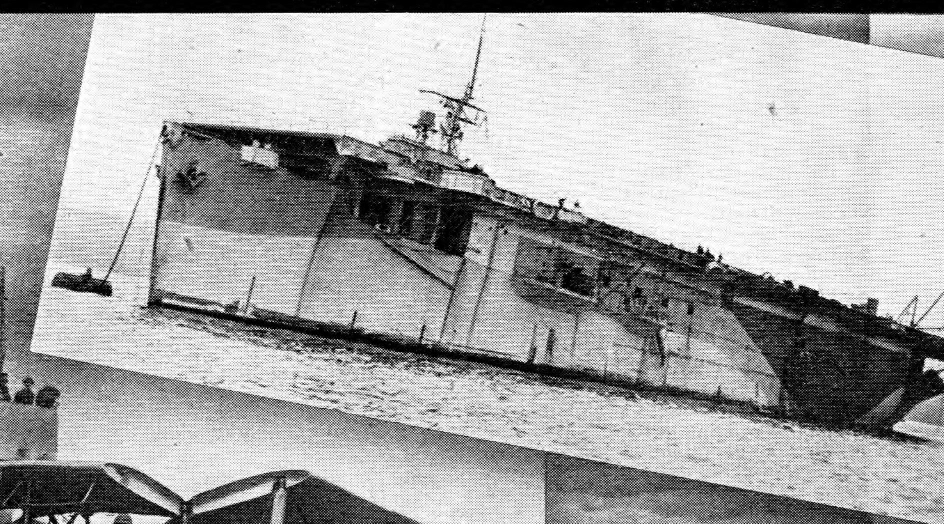
Pressure Suits and Cabins

Over 40,000 feet the breathing of oxygen by the ordinary mask does not suffice, for the atmospheric pressure at these heights has fallen so low as to be insufficient to charge the lungs properly. Artificial pressure is then required. Height record-breaking pilots before the war wore pressure suits with the upper part clipped around the waistline to the body, and a special helmet. The oxygen was fed into the suit, within which it created pressure. This enabled the pilot to breathe normally. His exhalations were exhausted from the suit. The pressure-cabin aeroplane provides a designed minimum pressure within the cabin. If necessary, those in the pressure-cabin can breathe oxygen from a mask or tube.

The ordinary petrol engine is like a man. Its power falls off as it is carried higher, because its cylinder capacity remains the same, and the pressure of the atmosphere falls, so that there is not the same power to push air into the cylinders. And the air pushed in is lighter for the same volume. That means less oxygen. The ratio of petrol gas to air must, however, remain properly proportioned. As the air has been cut down, the petrol flow must be cut down. That is what the mixture (or altitude) control does, whether it is manually operated or automatic. And so the power of the engine is reduced.

The engine power can be maintained by increasing the pressure of the air, and so restoring to the engine at height the conditions found naturally at lower levels. This is done by the supercharger. The limit of the one-stage supercharger has been reached and passed. Some Rolls-Royce Merlin engines are now fitted with two-stage superchargers. This duplicated compression generates heat in the air compressed, and heat causes a gas to expand, so undoing part of the work done. To offset this and provide the maximum airflow to the cylinders, an intercooler is fitted to bring the compressed air back to normal temperature. By this means it is possible to climb faster to higher levels of flight.

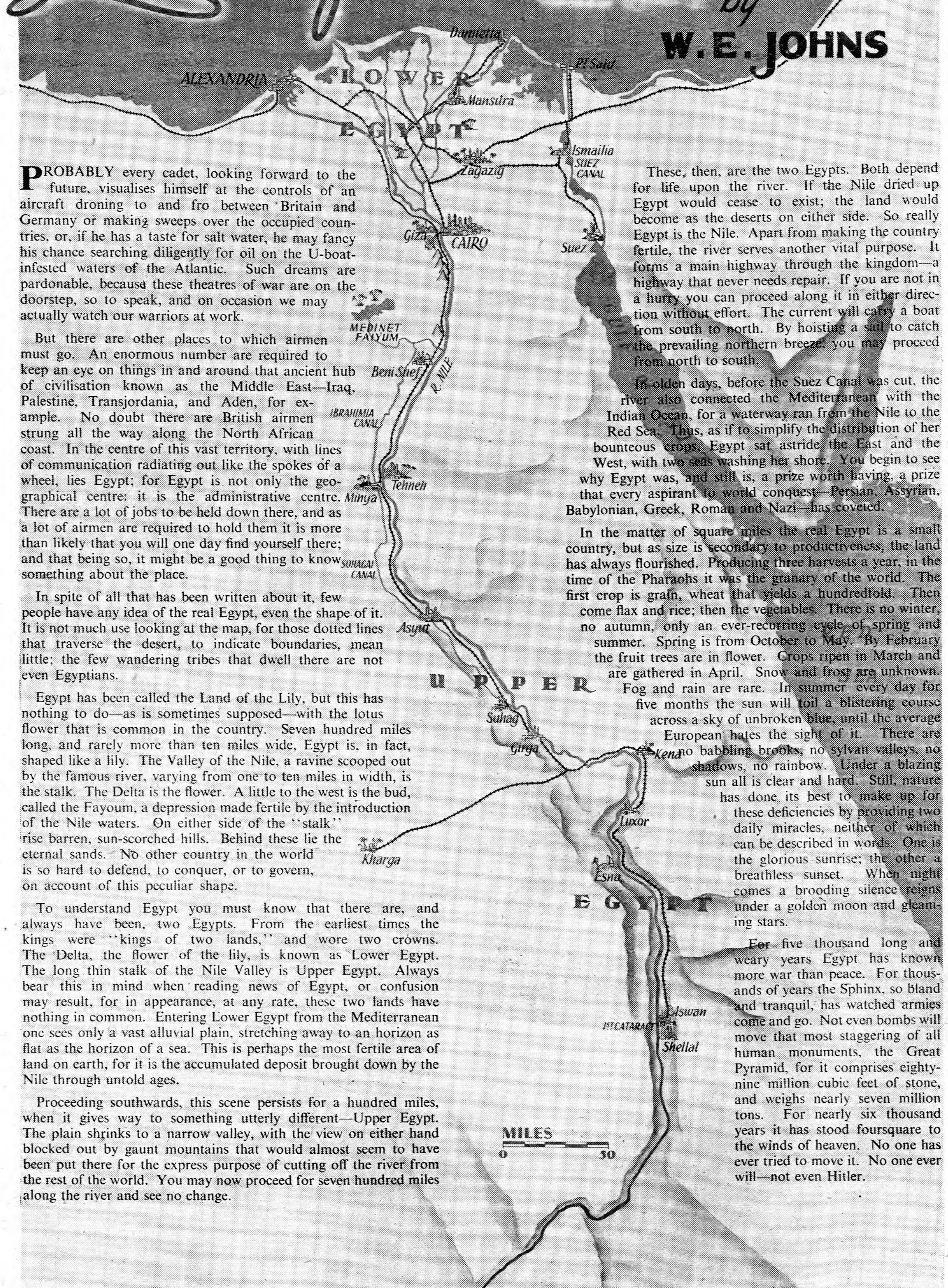
BATTLER



H.M.S. BATTLER, American-built merchantman converted to aircraft carrier by the addition of a flight deck and other essentials. Swordfish aircraft are carried in this one, and armament includes new twin Bofors guns. Crew includes men of the Royal Navy and Royal Marines. Some are wearing American steel helmets. These small carriers will greatly improve our command of the seas.

Land of the LILY

by **W. E. JOHNS**



PROBABLY every cadet, looking forward to the future, visualises himself at the controls of an aircraft droning to and fro between Britain and Germany or making sweeps over the occupied countries, or, if he has a taste for salt water, he may fancy his chance searching diligently for oil on the U-boat-infested waters of the Atlantic. Such dreams are pardonable, because these theatres of war are on the doorstep, so to speak, and on occasion we may actually watch our warriors at work.

But there are other places to which airmen must go. An enormous number are required to keep an eye on things in and around that ancient hub of civilisation known as the Middle East—Iraq, Palestine, Transjordania, and Aden, for example. No doubt there are British airmen strung all the way along the North African coast. In the centre of this vast territory, with lines of communication radiating out like the spokes of a wheel, lies Egypt; for Egypt is not only the geographical centre: it is the administrative centre. There are a lot of jobs to be held down there, and as a lot of airmen are required to hold them it is more than likely that you will one day find yourself there; and that being so, it might be a good thing to know something about the place.

In spite of all that has been written about it, few people have any idea of the real Egypt, even the shape of it. It is not much use looking at the map, for those dotted lines that traverse the desert, to indicate boundaries, mean little; the few wandering tribes that dwell there are not even Egyptians.

Egypt has been called the Land of the Lily, but this has nothing to do—as is sometimes supposed—with the lotus flower that is common in the country. Seven hundred miles long, and rarely more than ten miles wide, Egypt is, in fact, shaped like a lily. The Valley of the Nile, a ravine scooped out by the famous river, varying from one to ten miles in width, is the stalk. The Delta is the flower. A little to the west is the bud, called the Fayoum, a depression made fertile by the introduction of the Nile waters. On either side of the "stalk" rise barren, sun-scorched hills. Behind these lie the eternal sands. No other country in the world is so hard to defend, to conquer, or to govern, on account of this peculiar shape.

To understand Egypt you must know that there are, and always have been, two Egypts. From the earliest times the kings were "kings of two lands," and wore two crowns. The Delta, the flower of the lily, is known as Lower Egypt. The long thin stalk of the Nile Valley is Upper Egypt. Always bear this in mind when reading news of Egypt, or confusion may result, for in appearance, at any rate, these two lands have nothing in common. Entering Lower Egypt from the Mediterranean one sees only a vast alluvial plain, stretching away to an horizon as flat as the horizon of a sea. This is perhaps the most fertile area of land on earth, for it is the accumulated deposit brought down by the Nile through untold ages.

Proceeding southwards, this scene persists for a hundred miles, when it gives way to something utterly different—Upper Egypt. The plain shrinks to a narrow valley, with the view on either hand blocked out by gaunt mountains that would almost seem to have been put there for the express purpose of cutting off the river from the rest of the world. You may now proceed for seven hundred miles along the river and see no change.

These, then, are the two Egypts. Both depend for life upon the river. If the Nile dried up Egypt would cease to exist; the land would become as the deserts on either side. So really Egypt is the Nile. Apart from making the country fertile, the river serves another vital purpose. It forms a main highway through the kingdom—a highway that never needs repair. If you are not in a hurry you can proceed along it in either direction without effort. The current will carry a boat from south to north. By hoisting a sail to catch the prevailing northern breeze, you may proceed from north to south.

In olden days, before the Suez Canal was cut, the river also connected the Mediterranean with the Indian Ocean, for a waterway ran from the Nile to the Red Sea. Thus, as if to simplify the distribution of her bounteous crops, Egypt sat astride the East and the West, with two seas washing her shore. You begin to see why Egypt was, and still is, a prize worth having, a prize that every aspirant to world conquest—Persian, Assyrian, Babylonian, Greek, Roman and Nazi—has coveted.

In the matter of square miles the real Egypt is a small country, but as size is secondary to productiveness, the land has always flourished. Producing three harvests a year, in the time of the Pharaohs it was the granary of the world. The first crop is grain, wheat that yields a hundredfold. Then come flax and rice; then the vegetables. There is no winter, no autumn, only an ever-recurring cycle of spring and summer. Spring is from October to May. By February the fruit trees are in flower. Crops ripen in March and are gathered in April. Snow and frost are unknown. Fog and rain are rare. In summer every day for five months the sun will toil a blistering course across a sky of unbroken blue, until the average European hates the sight of it. There are no babbling brooks, no sylvan valleys, no shadows, no rainbow. Under a blazing sun all is clear and hard. Still, nature has done its best to make up for these deficiencies by providing two daily miracles, neither of which can be described in words. One is the glorious sunrise; the other a breathless sunset. When night comes a brooding silence reigns under a golden moon and gleaming stars.

For five thousand long and weary years Egypt has known more war than peace. For thousands of years the Sphinx, so bland and tranquil, has watched armies come and go. Not even bombs will move that most staggering of all human monuments, the Great Pyramid, for it comprises eighty-nine million cubic feet of stone, and weighs nearly seven million tons. For nearly six thousand years it has stood foursquare to the winds of heaven. No one has ever tried to move it. No one ever will—not even Hitler.

TRIPLE PRESSURE INDICATOR

by Astro

THE importance of brakes on an aircraft was vividly illustrated by an experiment recently carried out with a Mitchell medium bomber. The Mitchell was landed fully loaded on the sands at Salt Lake. The brakes were not applied, and the Mitchell ran for ten miles before coming to a complete stop. With the brakes *on* that distance might have been less than a mile. No modern aeroplane could land and stop within the boundary of an ordinary aerodrome unless the brakes were applied.

Nearly every British aircraft is fitted with pneumatic brakes which are light in weight and rapid in action. Also, as nearly all British guns are cocked by compressed air, both the brakes and the guns are piped out of the same compressed-air storage system. So the pneumatic indicator at Fig. 1 is not only an indicator for the brakes, but it also shows the quantity of air sufficient for operating the guns. The triple pressure indicator is therefore an important instrument, especially on fighter aircraft.

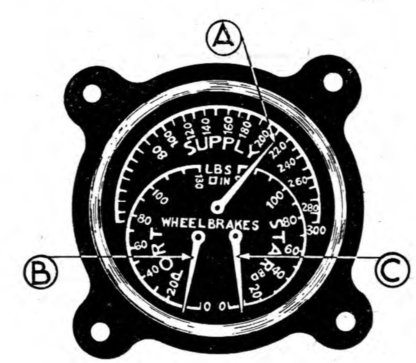


FIG 1 FRONT

Before taking off, the triple pressure indicator readings should be checked to make sure that the pressure on the supply needle (A, Fig. 1) is at least sufficient to cock the guns, i.e. about 190 lb. per square inch. If not, the air pressure may be insufficient for cocking the guns at a critical moment in combat. Therefore, however many units are operated out of the compressed-air system, the pressure at A, Fig. 1, should never be less than 190 lb. per square inch. This also allows a reserve for operating the brakes as well as for operating the guns. In the Beaufighter there are more units operated by compressed air than on any other British aircraft. The supply pressure in the "Beau" is 450 lb. per square inch, while the minimum air pressure should not be less than 200 lb. per square inch for complete safety. This also applies to the Spitfire, another aircraft with a fairly extensive compressed-air system.

The fact that the compressed-air system is pumped up by an engine-driven compressor should not alter the fact that no aeroplane should take off with less than 190 lb. per square inch reading on the supply pointer just in case the compressor does not boost it up after take-off.

Operation

Compressed-air brakes are very simple in operation. The air pressure which operates them is released by a relay-brake motor, which is connected by a cable to the brake lever on the control column. When the brake lever is applied compressed air is passed through a spring-loaded valve from the supply system into the brake units on each wheel. The air pressure there inflates a strong rubber tube, around which are placed several brake segments with braking material riveted to them. The brake segments are pressed outward against the revolving wheel lining by the compressed air expanding the rubber tube, thus slowing up the wheel and reducing the landing run of the aircraft. The brake pressures are automatically regulated by the spring-loaded valve to suit any hand pressure put on the brake lever by the pilot. These pressures are read off on the brake pointers B and C, Fig. 1, which move up when the brakes are put *on*. The pilot should always test his brakes for adequate and equal brake pressure in both wheels before taking off. This, of course, forms part of the Drill of Vital Actions.

Differential Action

If the brake pointers show more than a 5 lb. per square inch difference between port and starboard wheels, then the brakes must be adjusted until they are equal. All aircraft brakes can be used for directional control on the ground by means of a rudder-bar connection to the brake relay motor which becomes operative only when the brakes are applied by the hand lever. For instance, to do a right turn on the ground, the rudder bar would be pushed by the right foot and the brake applied by pressing the hand lever. This would put on the *right brake* only, so allowing the aircraft to swing round on the braked right wheel, using it as a pivot, with the left wheel free. To put both brakes *on* the rudder bar would have to be centralised. For a left turn, the above sequence would be reversed. This differential braking action is done mechanically by cams operated by the rudder bar. When the brake lever is off, the cams are out of action, so allowing unrestricted rudder-bar movement for directional control in the air. To test the triple indicator for this with rudder bar central, put on the brakes, then push the rudder bar over to the left, then the right, and watch the brake pointers closely to see if each brake goes completely *off* and fully *on*.

The operation of the triple pressure indicator is the same as for all pressure gauges, whether for compressed air, oil, water, or steam. The principle is shown diagrammatically at Fig. 2.

The basis of all pressure gauges is the hollow curved tube (Fig. 2 at E) called the Bourdon Tube. This tube is sealed at one end and open to the pressure at the other end. It is oval in cross-section.

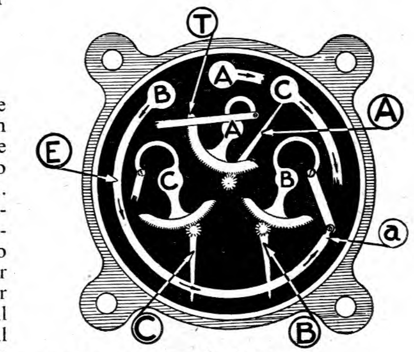


FIG 2 REAR

As the pressure builds up in the system to which the gauge is attached, this curved tube is distended by the air pressure. In other words, it tends to uncurl or unroll at its free tip (a). This small movement is carried to the pointer by the toothed quadrant T meshing with the teeth on the pointer stem. This "gearing" magnifies the movement of the Bourdon tube and causes the pointer to move quite a considerable distance for only a small movement of the Bourdon tube.

In the triple pressure indicator there are three gauges in one, making this instrument a fine example of modern instrument design, a branch of aviation which is progressing constantly.

3,000,000 + = A.T.C. in R.A.F.

CADETS of the Air Training Corps who enter the Royal Air Force are to be distinguished by a special number, starting from 3,000,000.

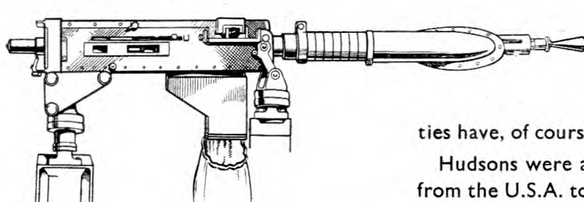
Previously all A.T.C. cadets when they entered the ranks of the R.A.F. were given the usual rotation number.

From now on A.T.C. entrants will be numbered from 3,000,000, which means that all personnel above that number will be identified as having been in the A.T.C. This special block of official numbers will ensure that ex-A.T.C. cadets are readily known as such.

The LOCKHEED HUDSON

By ROY CROSS

Mention of Coastal Command brings immediately to mind the outstanding record of the Lockheed Hudson since it joined the R.A.F. in early 1939. The success of this aircraft is even more amazing when it is considered that the Hudson was not designed specifically as a military machine, but was a development of the Model 14 commercial monoplane, also immensely successful, in a different sphere. Certainly the Hudson closed a very wide breach in the strength of Coastal Command. Before 1939 we relied mainly on a small number of now obsolete Avro Ansons for coastal patrol and reconnaissance. Ordered originally



by the British Air Mission in mid-1938 as a navigational trainer, the Hudson I was pressed into service as a reconnaissance machine, supplementing, and subsequently replacing, the Anson, which was then earmarked for training and communication duties. Later versions of the Hudson are now flying embodying certain detail modifications dictated by service requirements, an example of which is the added armament provided on the Hudson III, IV and V, and with more powerful motors.

Interior Comfort.

Crew positions in the Hudson are extremely comfortable, a decided advantage when long and tedious patrols form a large part of operations, while no less important is the generous stowage for large numbers of thermos flasks and lunch boxes. The navigator, for example, is installed in a roomy compartment in the nose, his instruments distributed around him within easy reach, and pencils, paper, books and maps ready to hand. A large chart-table is provided, and lighting is excellent through the splinter-proof nose windows. Well-upholstered seats, and a rest-couch in the rear cabin, curtained windows and sun-blinds, together with an extensive heating and ventilation system and good lighting throughout, all make the machine very popular with its crews. Handling and general flying qualities have, of course, been doubly proven.

Hudsons were among the first aircraft from the U.S.A. to be delivered direct by air to Great Britain, and for this and other purposes long-range tanks may be fitted in the bomb-bay (272 U.S. gallons) and fuselage (134 U.S. gallons).

Following is most of the available data on the various types of Hudson.

HUDSON I.—Two 1,100 h.p. Wright Cyclone GR-1820-G102A radial motors. Max. speed, 246 m.p.h. at 6,500 ft. Range, 1,700 miles at 170 m.p.h. Initial climb, 1,450 ft. per min. Service ceiling, 22,000 ft. Weight empty, 11,400 lbs., loaded, 17,500 lbs.

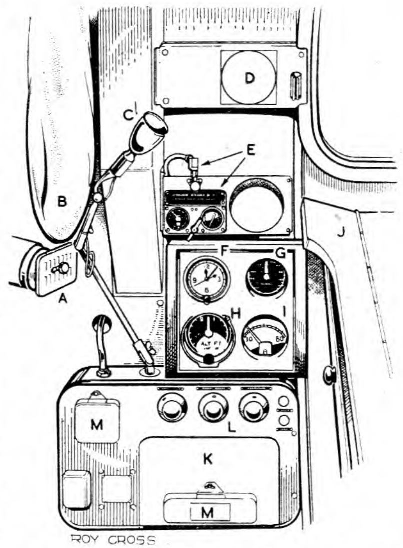
Data for G102A motor: Take-off, 1,100 h.p. at 2,350 r.p.m. Rated, 900 h.p. at 2,300 r.p.m. at 6,700 ft. on 91 octane fuel. Dry weight, no hub or starter, 1,275 lbs. Bore and stroke, 6⅛ ins. x 6⅞ ins. Height over all, 55.1 ins. Length, minus starter, 48⅛ ins.

HUDSON III.—See opposite page.

HUDSON V.—Two 1,200 h.p. Wright Cyclone GR-1820-G205A radial motors. Max. speed, 284 m.p.h. at 15,000 ft. Cruising speed, 255 m.p.h. at 19,000 ft. Service ceiling, 22,000 ft. Range, 2,160 miles at cruising speed. Max. loaded weight, 19,500 lbs. Disposable load, 5,694 lbs. Armament, two fixed .303 Brownings; Boulton Paul turret with two .303 Brownings; two manually-operated Vickers "K" guns for beam positions; one .303 Browning for floor position.

A still later version of the Hudson is powered by Pratt and Whitney Twin-Wasp motors.

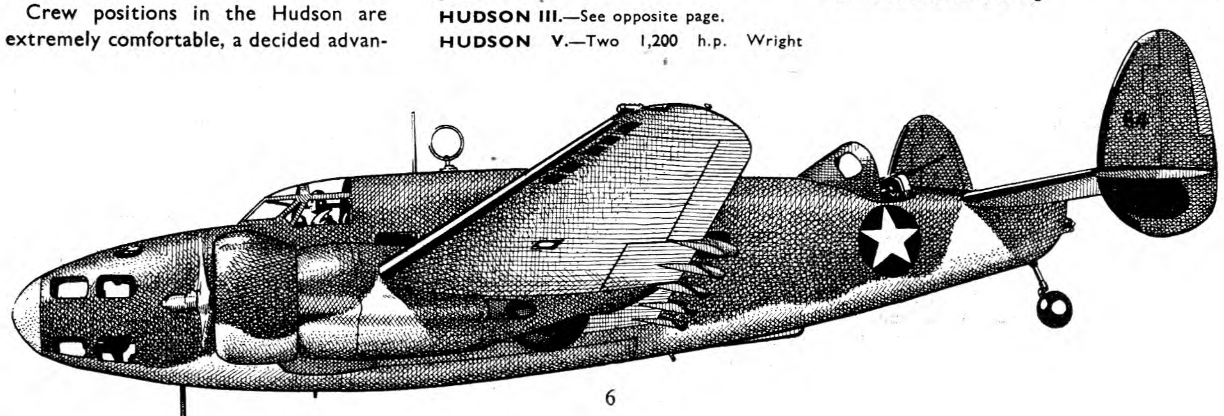
Makers: Lockheed Aircraft Corporation, Burbank, California.



The navigator's equipment on the port side of the nose compartment showing A, hot air control; B, bag for empty cartridge cases from port Browning gun; C, cockpit floodlight on universal arm bearer; D, compass card; E, oxygen bayonet and regulator; F, clock; G, air speed indicator; H, altimeter; I, air temperature thermometer; J, chart-table with drawer for maps, etc.; K, position of bomb switches (removed on transport aircraft); L, three light switches (drift sight, floodlight, and instruments), and warning lamps for bomb doors; M, spare fuses.

Hudsons are also in use as attack bombers with the U.S. Army Air Forces. Below is a U.S.A.A.F. A-29 (maker's number 414-56-01), which is similar to the R.A.F. Hudson III. Either the 0.5 manual rear-gun position shown, or a Boulton Paul turret may be fitted. A crew of five is normally carried.

The sketch of the port fixed nose gun shows the two-point fixing, blast tube, and the spent ammunition chute and bag.



THE LOCKHEED HUDSON III (Two 1,200-h.p. Wright Cyclone GR-1820-G205A Motors)

ENGINE DATA
(Wright Cyclone GR-1820-G205A)

Nine-cylinder, air-cooled, one-row radial motor. Take-off, 1,200 h.p. at 2,500 r.p.m. Rated, 900-1,000 h.p. at 2,300 r.p.m. at 15,200 ft.-16,900 ft. (rated h.p. on 91 octane fuel). Dry weight without hub or starter, 1,320 lbs. Bore and stroke, 6⅛ in. x 6⅞ in. Overall diameter, 55⅛ in. Length, 50.04 in. Reduction gear, 3 : 2.

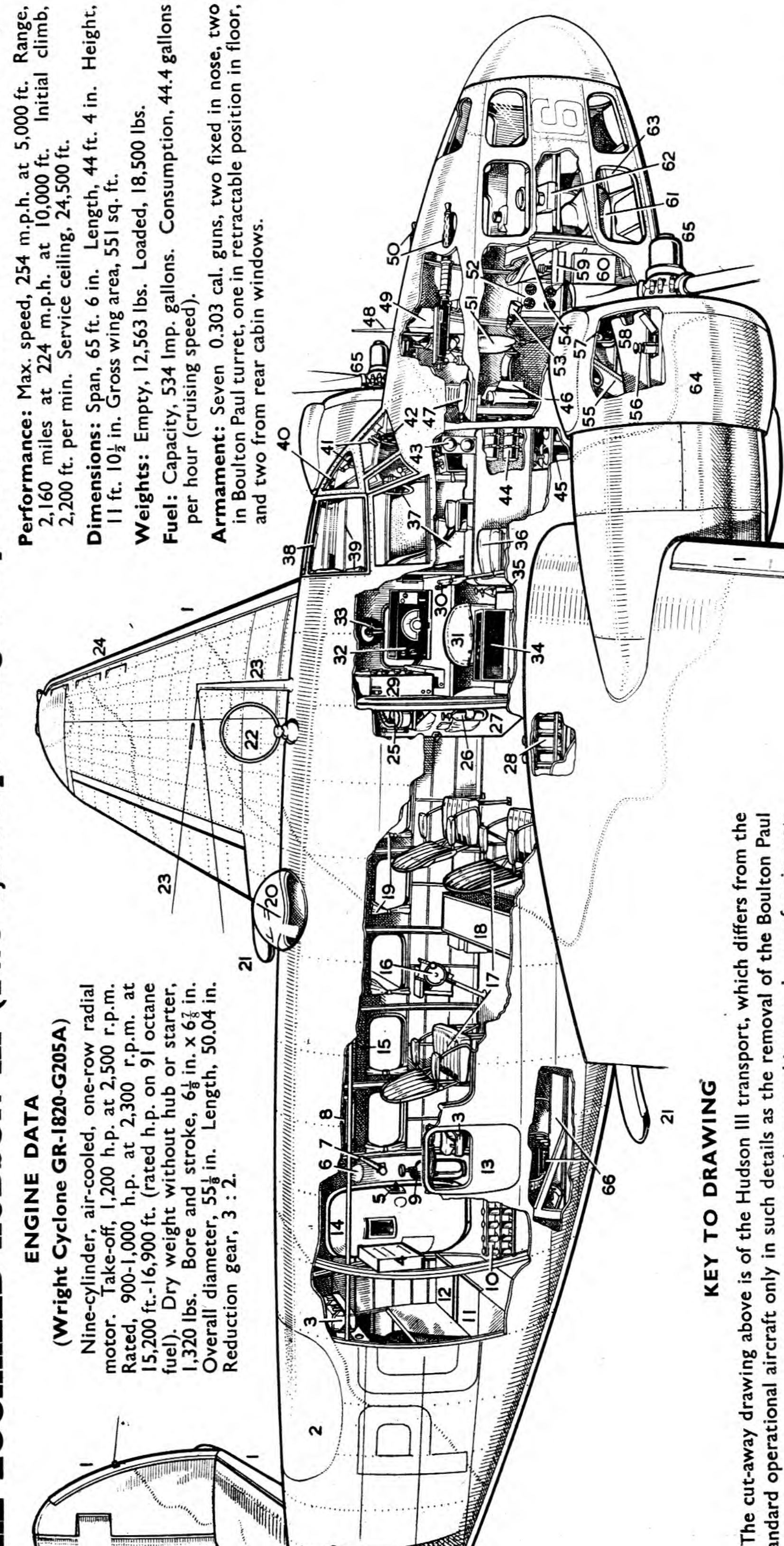
Performance: Max. speed, 254 m.p.h. at 5,000 ft. Range, 2,160 miles at 224 m.p.h. at 10,000 ft. Initial climb, 2,200 ft. per min. Service ceiling, 24,500 ft.

Dimensions: Span, 65 ft. 6 in. Length, 44 ft. 4 in. Height, 11 ft. 10½ in. Gross wing area, 551 sq. ft.

Weights: Empty, 12,563 lbs. Loaded, 18,500 lbs.

Fuel: Capacity, 534 Imp. gallons. Consumption, 44.4 gallons per hour (cruising speed).

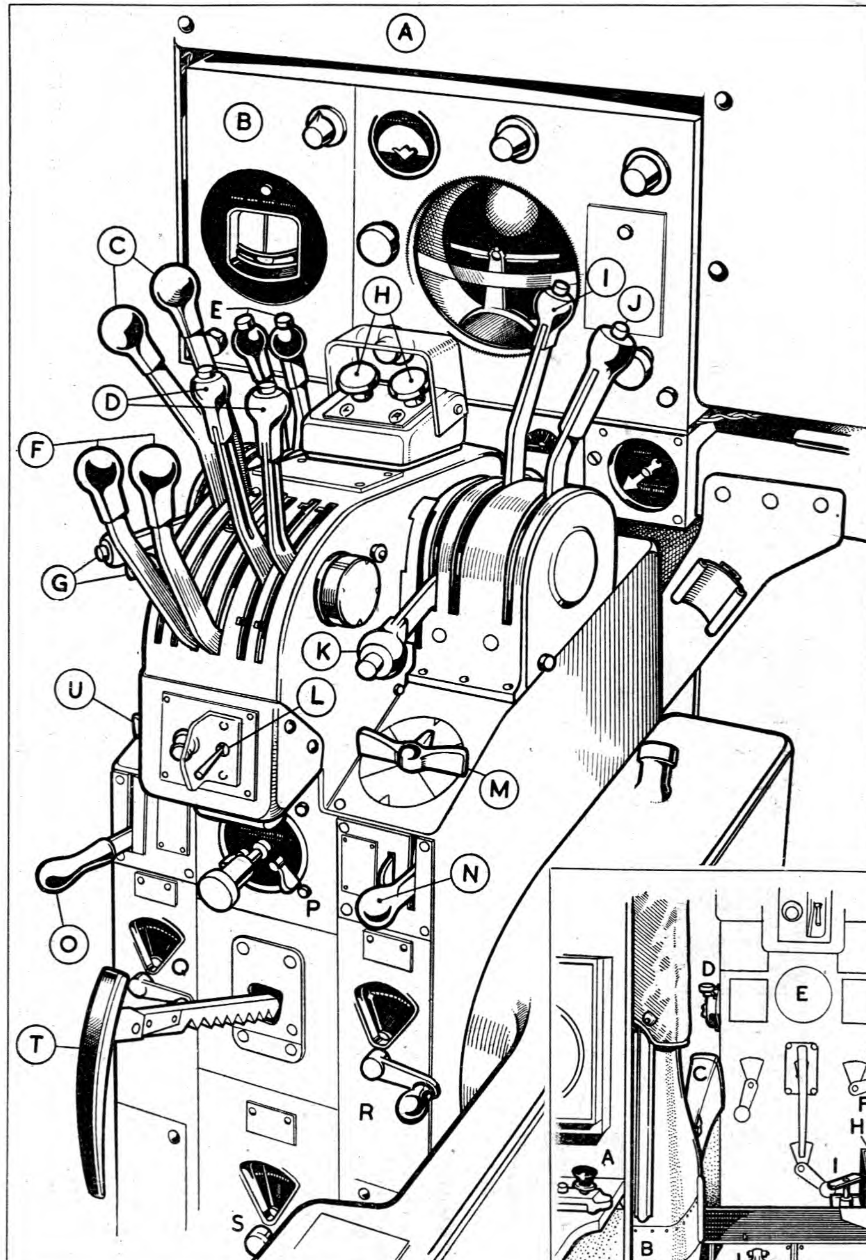
Armament: Seven 0.303 cal. guns, two fixed in nose, two in Boulton Paul turret, one in retractable position in floor, and two from rear cabin windows.



KEY TO DRAWING

The cut-away drawing above is of the Hudson III transport, which differs from the standard operational aircraft only in such details as the removal of the Boulton Paul two-gun turret, and of certain equipment in the rear cabin to make way for six seats (see 17). A wide variety of equipment is carried on the various models of the Hudson in service with the R.A.F., but the layout of the drawing above is common to most, except for the above-mentioned modifications to the transport version.

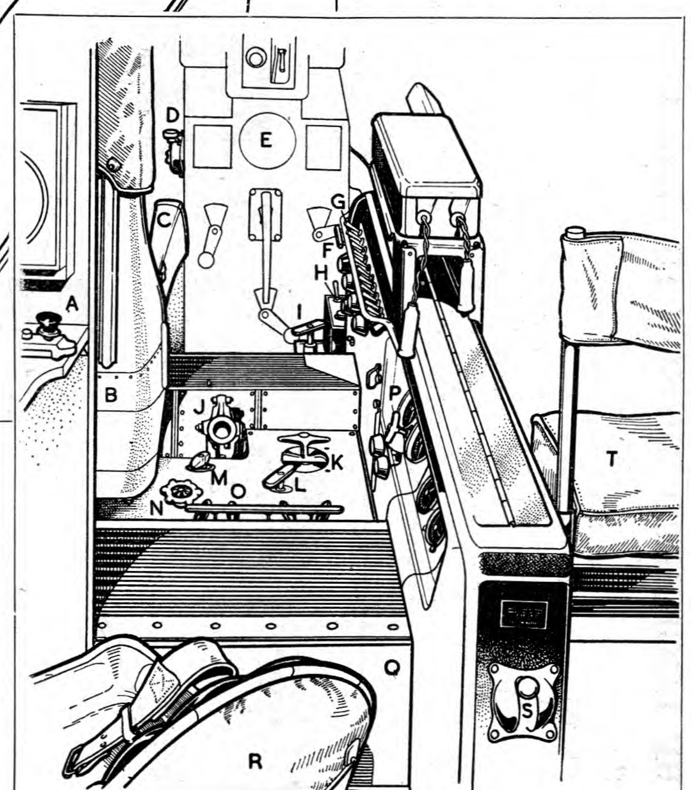
Key to the drawing is as follows: 1, rubber anti-icing boot; 2, Boulton Paul turret position; 3, first aid bags; 4, ammunition box for floor position gun; 5, dinghy release; 6, pocket for door keys; 7, door jettison lever; 8, parachute stowage (eight stowed in rear cabin above windows); 9, fire extinguisher; 10, Very cartridge racks; 11, Elsan lavatory; 12, stowage; 13, parachute exit; 14, cabin door containing dinghy; 15, knock-out window (side gun, hand camera, etc.); 16, trailing aerial; 17, six seats in rear cabin (three removed to show cabin detail); 18, spar; 19, curtains over windows; 20, astro-dome; 21, flap rail extensions; 22, D/F loop; 23, wireless mast and aerials; 24, fixed wing-tip slots; 25, Aldis lamp; 26, hand extinguisher bottle; 27, door to rear cabin; 28, oxygen bottles; 29, T.1154 transmitter; 30, w/op's morse tapper; 31, w/op's seat; 32, R.1155 receiver; 33, switch unit; 34, T.1119 transmitter; 35, hand extinguisher bottle; 36, navigator's occasional seat; 37, pilot's seat and control wheel; 38, cockpit roof jettison (emergency exit); 39, sun-blind and rails; 40, compass wedge plate; 41, cockpit floodlight; 42, dashboard; 43, carburettor temperature gauges; 44, flares; 45, three oxygen bottles; 46, drift sight, navigation instruments and book stowage; 47, hand extinguisher bottle; 48, bead gun-sight; 49, ammunition boxes for front guns (50); 51, bag for spent cartridge cases; 52, navigator's flying instrument panel; 53, floodlight; 54, chart table; 55, flare tube; 56, drift sight; 57, bomb switch panel; 58, bomb-aimer's prone position; 59, drift recorder; 60, map case; 61, navigator's sliding seat; 62, compass; 63, optically flat bomb-aimer's window; 64, Wright Cyclone engine; 65, three-bladed, hydromatic airscrews; 66, retractable floor-gun position.



The LOCKHEED HUDSON

Layout of PILOT'S CONTROLS

Left: The pilot's controls as seen from the navigator's occasional seat. A, instrument panel; B, gyro-pilot switch panel; C, airscrew pitch controls; D, mixture levers; E, supercharger selectors; F, throttles; G, carburettor heat controls; H, feathering switches (hydromatic airscrews); I, tail wheel lock; J, bomb door operating lever; K, gyro pilot master control; L, auxiliary fuel pump switch and warning light; M, engine selector (ground starting); N, flap lever; O, undercarriage lever; P, ignition switches; Q, R and S, elevator, rudder and aileron trims and indicators; T, brake handle; U, fuel tank selector.

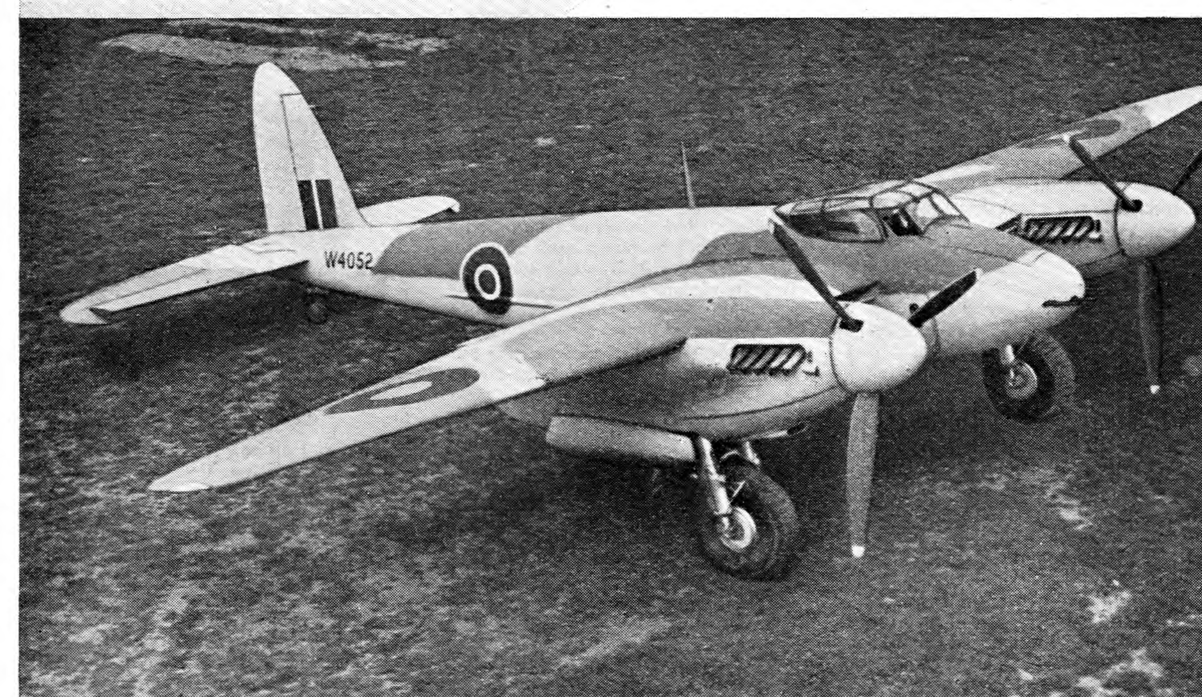


A view looking forward from the wireless operator's seat showing: A, w/op.'s morse tapper; B, pilot's seat and (C) adjustable arm-rest; D, indentification switch-box and tapper; E, engine and flying control bias; F, starter; G, switches (landing, formation, navigation, cabin and switchpanel lights, and pitot heating); H, carburettor de-icer; I, bomb jettison; J, socket for emergency hydraulic hand pump; K, fire extinguisher control (engines); L, de-icer control; M, engine primer; N, hydraulic emergency by-pass; O, fuel jettison; P, oxygen regulator; Q, step; R, w/op.'s seat; S, master switch; T, navigator's occasional seat with removable backrest to allow access to forward compartment.

AS STRONG AS . . .

MANY people ask if the safety factor on the Mosquito wing (here illustrated) would have been higher than it is if the wing had been made of metal. The simple answer is that the designer states in advance what factor he requires, and gets it, whether the aircraft is made of wood or metal. As wood is not so strong as metal, a wooden spar or other member has to be bulkier in order to provide the strength factor specified. Thus there is less air space within the wing or fuselage of a Mosquito than there would be had it been made of metal, but in practice scarcely any difference is noticed—there is ample space for the crew, tanks and equipment.

The fact that wooden members are bulkier has an advantage in action, because a hole made by a piece of shell or bullet represents a smaller proportion of the mass of the material it pierces, and so weakens the member to a less degree. This is especially so when the structure is of the stressed-skin kind, as it is in the Mosquito wing and fuselage. There have been innumerable instances. In one case a 40-mm. shell burst inside a Mosquito fuselage near the tail and the fragments made a ring of small holes around the fuselage, without weakening it very much. If it had been a fuselage made with four strong longerons, then whether the shell had fatal effects would be a matter of chance, depending upon whether one or more of the longerons was badly hit by the fragments. And if those longerons were of metal they would be smaller, so that the effect of a fragment hole would be more serious.

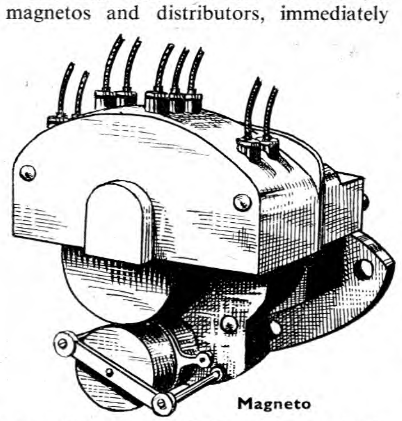


Aero Engine LAYOUTS

by Flight-Lieut. K. R. MIDMER

EACH design of aero-engine necessitates a different positioning of components. The drives for most of these emanate from the wheelcase, which may be mounted at the front *or* rear end of the crankshaft. From this distribution centre the camshafts or sleeves are driven.

The first items on our list are the magnetos and distributors, immediately



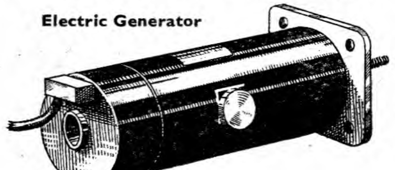
Magneto

recognised by the H.T. cables or leads dispersing through the harness to the sparking plugs. Two main magnetos are mounted on each engine, port and starboard, one supplying the exhaust plugs (or the plugs on the exhaust-valve side of the cylinders), and the other the inlet plugs (or those on the opposite side of the cylinders, adjacent to the inlet valves). The magnetos are driven at 1½ times the speed of the crankshaft.

The Electric Generator

(Driven usually at approximately twice the speed of the crankshaft) is easy to

Electric Generator

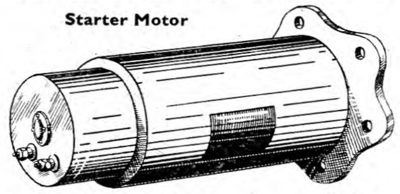


recognise. It is invariably driven from the wheelcase, but should not be confused with the starter motor, or, if cartridge-started, the starter unit, both of which it partially resembles. If the drive to the generator is not encased, it will be immediately obvious that this unit is engine-driven, since so thin a shaft from a starter motor would readily fracture before turning a cold engine. The generator is usually finished in black enamel in contrast to

The Starter Motor

This is smaller than the generator and finished in a high-polish plating, aluminium or an aluminium paint. The electric starter-motor drive has a ratio in the

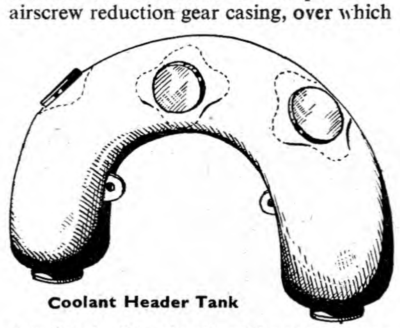
Starter Motor



order of 100:1 to the crankshaft. Frequently it is fitted vertically at the rear and below the engine, driving the crankshaft through its own reduction gear and starter dog in the wheelcase. Cartridge-operated starters are more readily recognisable, as the starter unit will have the cartridge-breech unit near at hand, the two components interconnected by the starter intake pipe, approximately one inch in external diameter.

The Coolant Header Tank

Necessary on all liquid-cooled engines, is made to conform to the shape of the airscrew reduction gear casing, over which

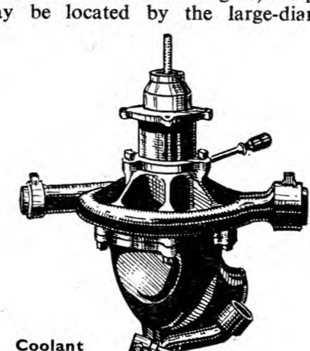


Coolant Header Tank

it is fitted. The details of its connections with the coolant pump and system are given later on. This saddle-tank has a silver aluminium finish.

The Coolant Pump

Mounted beneath the engine, the pump may be located by the large-diameter

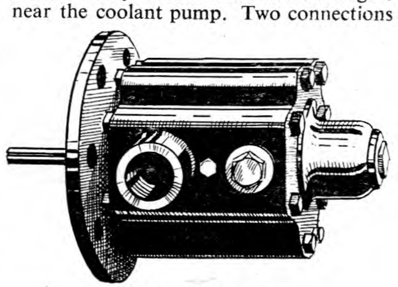


Coolant Pump

coolant pipes leading to and from it. The pump, driven normally at about 1½ times the crankshaft speed, is finished in black and has the appearance of a small, horizontally mounted supercharger (being of the centrifugal type). It has a volute-shaped housing from which coolant is delivered to the outlets, there being one outlet per block of cylinders; or, in other cases, two pumps are mounted beneath the engine, each serving port or starboard cylinder blocks.

The Hydraulic Pump

A small, compact pump (usually driven between half and three-quarter crankshaft speed). The pump is normally found on top of the engine, near or at the rear end of the cylinder blocks. On some installations it may be found beneath the engine near the coolant pump. Two connections

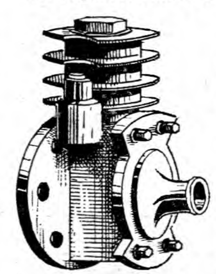


Hydraulic Pump

on the pump—delivery and return—of half-inch external diameter pipes will be found leading to adjacent unions. Several designs of hydraulic pumps are in service.

The Air Compressor

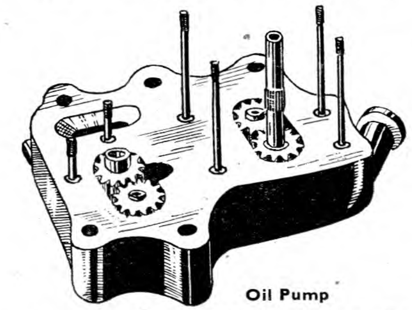
Perhaps the most easily identified pump. Air-cooling fins surround the compression chamber at the top of the pump on all designs of this unit. Mounted usually at the top of the engine, more frequently at the rear of one of the camshafts. The air compressor is usually driven at approximately three - quarters camshaft speed.



Air Compressor. Usually there are more rings than are shown here.

The Oil Pumps

All engines employ two oil pumps, known as "pressure" pump and "scavenge" pump, usually built together in one unit, though, of course, both operating independently on their separate jobs. As the scavenge pump is employed in retrieving the accumulation of drained "splash" lubrication in the sump, these units will naturally be found beneath the engine. Their drive comes from the wheelcase, the pumps running at about three-quarters crankshaft speed. The pumps are not visible externally, being fitted on the floor of the pump. Their position is indicated by the oil-pipe connection from the tank to the inlet of the

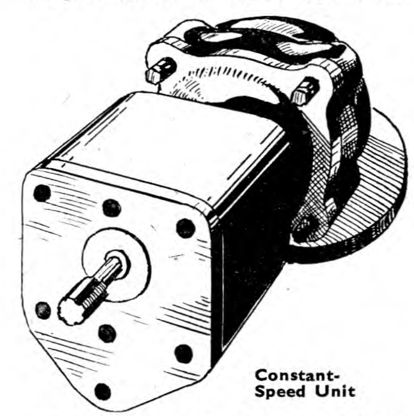


Oil Pump

pressure pump and from the outlet to the relief-valve unit.

The Constant-Speed Unit

This governor unit used in conjunction with constant-speed propellers is invariably fitted on the lower part of the reduction gear cover. It will be found on the port side of the engine opposite the

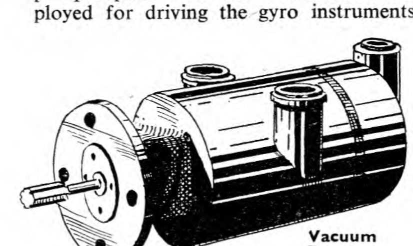


Constant-Speed Unit

vacuum pump, both of which are driven from the front end of the crankshaft. It can be recognised by both the oil return and delivery pipes to the propeller hub connections, and the manual control device on the side of the unit to which a teleflex tube from the cockpit is attached. The constant-speed unit is driven at just over three-quarters crankshaft speed.

The Vacuum Pump

Mounted on the starboard side of the engine opposite the constant-speed unit, in the position given above, the vacuum pump replaces the old venturi tube employed for driving the gyro instruments

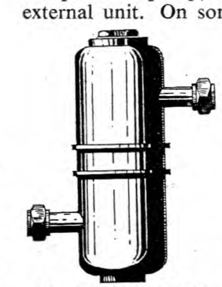


Vacuum Pump

on the cockpit instrument panel. This suction pump, in appearance not unlike a small motor, has two pipe connections: one to the instrument panel on the suction side, and a second on the discharge side for the provision of air pressure for other purposes; e.g. de-icing equipment. The vacuum pump is driven at the same speed as the constant-speed unit.

Main Pressure Filter

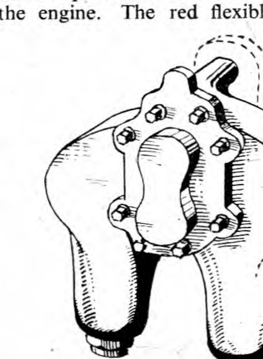
This large filter in the oil pressure circuit is situated on the suction side of the pressure pump, and is therefore an external unit. On some installations this main pressure filter is mounted on the side of the engine, but more frequently than not fitted on the on the engine main bulkhead or bearer. In all cases, however, it will be found on the port side of the engine. It is a large black cylindrical unit with large oil-pipe connections from the oil tank and to the engine. (Small filters also exist in the scavenging system, but are not readily visible, being fitted inside the sump, adjacent to the scavenge pump.) The cap on this main filter will have a special locking device to ensure that the unit is absolutely airtight. Loss of pressure in the oil system will result if loose, and active aerated oil will be in circulation.



Main Pressure Filter

The Fuel Pump

Fitted in front of the carburettor, either on the port side or below the sump of the engine. The red flexible fuel pipes



Fuel Pump

from the main fuel cocks and to the carburettor readily show its position. This pump is also driven from the wheelcase at slightly over half crankshaft speed.

The Coolant System

Pipes in the coolant system are large, being in the order of two inches or three inches in external diameter, and thus easily recognised. The layout is simple, as shown below. A thermostat is introduced to divert the coolant through the radiator when temperature comes up within the normal running range. If this was not incorporated it would naturally take some time in cold weather to warm up an engine if the warmth of the coolant was removed by the cooler. The coolant radiator is several times larger than the oil radiator and can, therefore, be quickly identified. You will find it interesting to note the different methods of joining pipes in various systems.

The Oil System

The internal or engine circuit which links with the airframe is as follows:

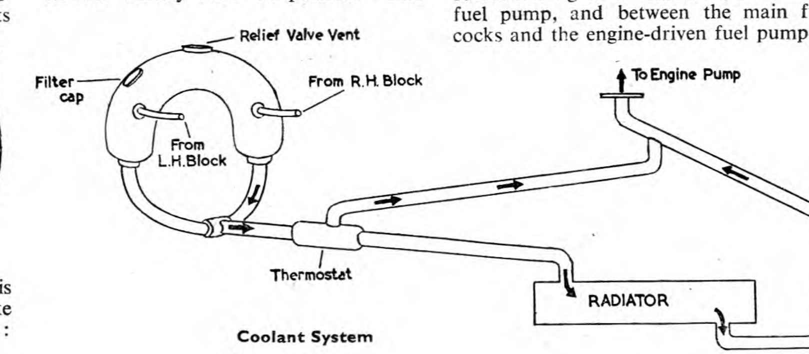
From the main oil-pressure filter, oil is drawn up by the pressure pump. From the pump the high oil pressure is delivered to a relief-valve unit, from which high, main and low oil pressures are distributed throughout the engine. On completion of lubrication of bearing surfaces, gear wheels, camshafts or sleeves, cylinder walls, etc., the oil returns to the pump, flows to the scavenge filters, passes to the scavenge pump (or pumps), from which it is returned, through the radiator, to the tank. Oil pipe-lines are much smaller than coolant pipes, and can be traced to the airframe units from the engine-pump connections beneath the sump.

General

Of other pipe-lines that exist, those connected with the hydraulic system, pneumatic system, vacuum pump, etc., may each be identified by a colour code in the form of coloured bands painted on the pipes. The main identifications are as follows:

1. Fuel - - - - - Red
2. Oil - - - - - Black
3. Coolant - - - - - Blue
4. Compressed Air - - Yellow
5. Hydraulics - - - White
6. Automatic Controls - - Brown
7. Engine Starting - - Green

Fuel is conveyed through special flexible pipes red in colour (in addition to the red bands), surrounded by a coiled protective wire between the pipe unions. Easiest evidence of these pipes will be found leading to the carburettor from the fuel pump, and between the main fuel cocks and the engine-driven fuel pump.



Coolant System

Aerobiographies 12—by C. G. GREY

Marshal of the Royal Air Force SIR JOHN SALMOND

MARSHAL of the R.A.F. Sir John Salmond, G.C.B., C.M.G., C.V.O., D.S.O., succeeded Lord Trenchard as Chief of the Air Staff in 1930, and so carried on the rebuilding of the Royal Air Force which had begun in 1923, after the war-time R.A.F. of 330,000 officers and men had been cut down to 33,000 or less of all ranks.

He is in fact one of the pioneers of military aviation. Although he did not "take his ticket" as a pilot — at the Grahame-White School at Hendon — until August 1912, he had been studying the possibilities of the Air Arm long before that. Certain of his views, written when he was a young captain in the Army in 1910, showed foresight and imagination which, if they had been taken up by the War Office at the time, might have made quite a difference to our air effort in the war of 1914-18.

Captain John Salmond joined the Royal Flying Corps on its formation in 1912, and, although he had become a pilot only a few weeks before, he was appointed an instructor at the historic Central Flying School at Upavon—the real cradle of our Air Power. And he soon became not only an excellent instructor, but one of the finest pilots in the country. Which was why he flew an experimental S.E. biplane built at the Royal Aircraft Factory (now the R.A.E.) and put up, unofficially, a British height record at a figure which I forget. He also set a British height record of 14,000 ft. in a B.E.2c at Upavon, which was passed almost immediately after. It was said of him that he had never broken a single undercarriage wire during his service.

When war began in August 1914 Major Salmond took over No. 3 Squadron R.F.C. from Major Brooke-Popham and went with it to France. There he commanded it till he became a lieutenant-colonel and was given a wing in 1915. He was brought back from France in 1917 to become Director-General of Military Aeronautics and a Member of the Army Council, as a major-general, at the early age of 36.

In 1918, when Major-General Sir Hugh Trenchard came home to the new Air Ministry to be the first Chief of the Air Staff, Major-General Salmond took command of the R.A.F. in France, and held that post until the troops began to come home after the fighting stopped. I have vivid memories of staying with him at his advanced H.Q. near Velu Wood about a week before the Armistice and admiring his knowledge of apparently everything that was going on in the R.A.F. with men and machines alike.

As a commander in the field he won the respect and affection of his officers and men alike. The pilots knew that he had been in his day as good as the best of them, and understood their troubles. The men knew that he looked after their welfare and interests. So the R.A.F. was what the Navy calls "a happy ship."

After the war 1914-18 he commanded the Inland Area from 1920 to 1922, which meant Home Defence, and then he went to 'Iraq, to put into operation that great scheme which Sir Samuel Hoare, our Air Minister, called "control without occupation." Under Air Marshal Sir John Salmond, as he had then become, our forces in 'Iraq were reduced from many tens of thousands of British and Indian troops to three or four battalions, as guards for aerodromes and official premises, plus a few thousand Assyrian levies, plus four or five squadrons of the R.A.F. and some armoured cars. And thus he saved the British taxpayers many millions of pounds a year.

Marshal of the Royal Air Force Sir John Maitland Salmond, G.C.B., C.M.G., C.V.O., D.S.O.; born 17 July 1881; son of late Maj.-Gen. Sir W. Salmond, K.C.B.; Educ.: Wellington, Sandhurst. Entered Army 1901; Captain 1910; Bt. Major 1914; Major 1916; Lieut.-Col. 1915; Bt. Col. 1917; Maj.-Gen. 1917; Air Marshal, 1923; Air Chief Marshal 1929; Marshal of the Royal Air Force 1933; Royal Flying Corps 1912; Instructor, Central Flying School, 1912; Director-General of Military Aeronautics and on Army Council, 1917; Commanded R.F.C. and R.A.F. in the Field, 1918-19; Air Officer Commanding Inland Area, 1920-22; Air Officer Commanding British Forces in 'Iraq, 1922-24; Air Officer Commanding-in-Chief, Air Defence of Great Britain, 1925-29; Air Member for Personnel on Air Council 1929-30; Principal Air A.D.C. to the King, 1925-30; Chief of the Air Staff, 1930-33.

He came home in 1925 to become A.O.C.-in-C. Air Defences of Great Britain; in those days our Government people had not grasped the idea that defence is the first stage of defeat. Sir John made a fine job of our air defences, and the schemes for interception of enemy bombers were sound. But he warned us then that "some of the bombers will always get through"; and we took many years to learn that the only way to stop bombing is to bomb the other fellow so hard that he cannot hit back.

In 1928 Sir John went to New Zealand and Australia to advise those Governments on air defence. And if Australia had taken his advice that Commonwealth would have been much better able to tackle the Japs in 1942. But in 1939 and 1940 they were still arguing about adopting certain recommendations of the "Salmond Report."

When he came home in 1929 Sir John became Air Member for Personnel on the Air Council; and there his vast experience of men in war and peace, and of the British Empire as a whole, was of the greatest value, for by then youngsters from Australia, New Zealand, Canada and the Colonies were joining the R.A.F. and making it a truly Imperial Air Force.

From 1930 to 1933 Sir John, as Air Chief Marshal, was Chief of the Air Staff. He retired as Marshal of the R.A.F., ranking with but after an Admiral of the Fleet or Field Marshal in the Army. And since then he has been a Government Director of Imperial Airways, Ltd.—incidentally, he was badly injured in a crash in an Empire flying-boat in Taranto harbour some years ago.

Before he had fully recovered from that crash, Sir John Salmond, in collaboration with Air Commodore Chamier, had started on another big job—the formation of the Air Defence Cadet Corps in 1938. He was chairman of the Executive Committee, which he attended regularly, and gave his personal attention to every detail of the organisation. When the first squadron headquarters was opened—in Watford High Street in 1938—Sir John Salmond performed the opening ceremony and took the salute. Although no longer directly connected with the A.T.C., he is still a member of the Committee of the Air League, which publishes the *A.T.C. Gazette*.

When this war broke out he naturally offered his services, and he has done much valuable work which must not be specified in detail. I may be allowed to mention that he has interested himself in the armament of aircraft, as is natural in one who was a single-seater pilot in his day, and that more recently he has done important work in developing the air-sea rescue service, which has saved the lives of so many aircrews. Its unadvertised efficiency seems to reflect Sir John's methods in the old R.F.C. and the R.A.F.

Thunderbolt

An outsize in fighter aircraft, the Republic Thunderbolt (P-47) has a span of 40 ft. 9 in., is 12 ft. 4 in. high and 35 ft. 3 in. long. Its eight .5 machine-guns mounted in echelon formation in the wings each have a rate of fire of 750 rounds a minute, and produce a weight of fire of about the same number of pounds a minute. It is hauled by a turbo-supercharged Pratt & Whitney Double Wasp radial of 2,000 h.p. Speed secret but said to be over 400 m.p.h. U.S.A.A.F. pilots like them and are doing good work with them.

SOME of the BEST

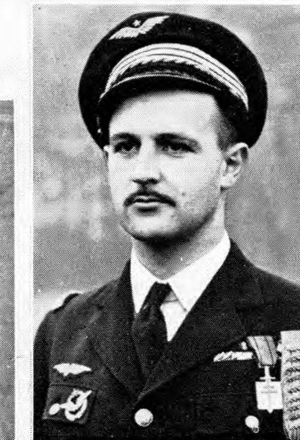

A.V.M. Sir Keith Park, K.B.E., M.C., D.F.C.


W/Cdr. J. Gillan, D.F.C. A.F.C.

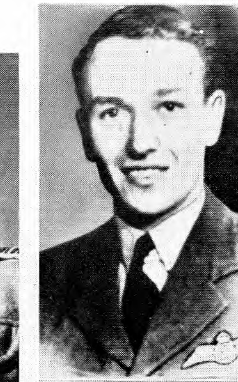

Brig.-Gen. R. C. Candee, U.S.A.A.F


W/Cdr. G. P. Gibson, V.C., D.S.O., D.F.C.

Air Com. G. A. Walker, D.S.O., D.F.C.


Capt. Morlaix, Fighting French


A.V.M. H. Broadhurst, D.S.O., D.F.C., A.F.C.


W/Cdr. H. G. Malcolm V.C.


F/O. G. F. Beurling, D.S.O., D.F.C., D.F.M.


Lt.-Col. Boris Savonov, twice "Hero of the Soviet Union" and D.F.C


A.V.M. Sir Keith Park, K.B.E. M.C., D.F.C.

A.V.M. Sir Arthur Coningham, K.C.B., D.S.O., M.C., D.F.C., A.F.C.

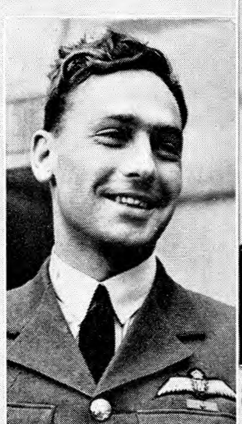
Men of the Royal Air Force and other flying services who have achieved distinction. Most of the photographs have appeared in the Press, and they should be familiar to nearly every reader. The photographs have been displayed at hazard, and include commander-in-chief, junior officers, pilots of other services, and a civil air-line pilot.


W/Cdr. H. G. Ramsbottom-Isherwood, Order of Lenin, D.F.C., A.F.C.

S/Ldr. A. H. Rook, Order of Lenin, D.F.C.


Major John Pun Yung Hwang, Chinese fighter ace


W/Cdr. A. Warner D.F.C., A.F.C.


S/Ldr. J. D. Nettleton, V.C.


A.V.M. H. W. L. Saunders, C.B., C.B.E., M.C., D.F.C., M.M.


Capt. L. A. Walters, British Overseas Airways

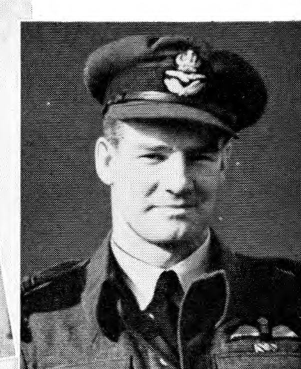

A Link with the Past. Major J. McCudden, V.C., D.S.O., M.C., D.F.C.

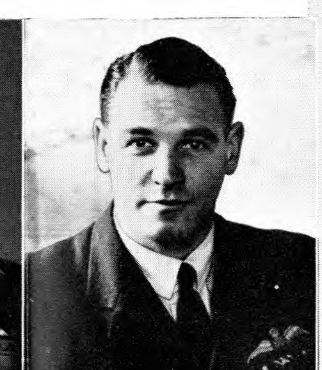

P/O C. Hodgkinson legless pilot.


A.V.M. C. R. Carr, C.B., C.B.E., D.F.C., A.F.C.

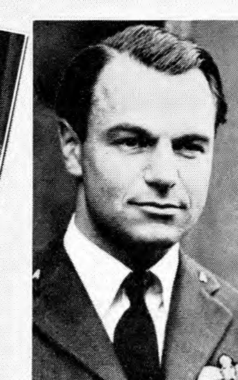

Group Capt. L. F. Sinclair G.C. C.B.E. D.S.O.


Major Levi R. Chase, U.S.A.A.F.


W/Cdr. A. C. Deere, D.S.O., D.F.C.


Group Capt. A. G. Malan, D.S.O., D.F.C.


Air Marshal H. Edwards, C.B., R.C.A.F.


W/Cdr. Max Aitken, D.S.O., D.F.C., Czech War Cross


S/Ldr. J. E. Walker, D.F.C., R.C.A.F.


F/Sergt. A. B. Downing, D.F.M.

The Truth about the TURRET

By CAPTAIN W. E. JOHNS

TALKING to some cadets the other evening after a lecture on guns and gunners, one remarked: "They say the air gunner's job is pretty dangerous. Is that a fact?"

This struck me as being a somewhat fatuous question, particularly as the lad looked as though he expected a denial. My answer was something like this: "Yes, of course it's a dangerous job. So is a pilot's job dangerous; so in this war is every other man-sized job; and that goes right back to the chaps who forge the steel for the guns and the girls who tip high-explosive into bomb cases. After a 2,000-mile trip across a desert stiff with land-mines, the troops of the Eighth Army would probably dispute it if you said their job was a picnic; and life on the ocean wave—as you may have heard—has its moments of anxiety. Big ship or little ship, from skipper to stoker, they are all equally liable to get wet if they happen to collide with something travelling at high speed in a different direction. That goes for an aircraft, too, of course. And at home there are safer occupations than tip-toeing under toppling masonry to douse explosive incendiaries while objectionable people overhead continue to jettison unwanted freight.

Why They Volunteer

All these jobs are quite dangerous, which is probably why men and women (don't forget the women) volunteer for them. Don't ask me why. Look at them and work it out for yourself. A famous war correspondent, who has been in the thick of it from Dunkirk to Tunis (and there are cushier jobs than his), told me that the most astonishing sight he ever saw was a little W.A.A.F. in a big lorry, in Tobruk, powdering her nose in the reflector while the truck barn-danced in a considerable draught of air occasioned by a number of Stukas who were busy with their bombing. She, too, had quite a dangerous job—only she didn't appear to notice it. After all, if there were no risks hanging to air gunnery there would be fewer awards for gallantry. As you may have noticed, air gunners are collecting their share of decorations—which is a good indication of how the Higher Command feels about them.

If you follow this line of country to the end, skipping the details, you will find that nearly everyone, everyone with good, red, high-octane fuel boosting his arteries, is taking a chance with his (or her) life; and few would have it otherwise, because unless you take a risk you can't enjoy that feeling of exhilaration which is the very essence of adventure. Admittedly, some jobs are more dangerous than others, and as a general rule the "kick," the satisfaction of success, is proportionate with the risk.

Teamwork

In point of fact—and never forget this—in the R.A.F., among those who fly in aircraft, there is no comparison of risk; which is as it should be among comrades, for true *camaraderie* takes no more account of danger than it does of badges of rank or rates of pay when there is a job to be done, and the success of the sortie depends on sound, efficient, honest-to-God teamwork. If one man can let a side down at any game—and he most certainly can—think how vital this factor must be in an aircraft over hostile country. The responsibility for the safety of all is *equal*, regardless of personal considerations, regardless of social or financial position, regardless of anything. The fate of not only the individual, but of the whole team, is in the hands of each member of the crew.

As we have remarked, the question of comparative risk does not arise, but if you asked my opinion, I should say that in a crack-up (we are talking of big machines), if anyone has a better chance than the others it is the tail gunner. I believe this is confirmed by records; at any rate it has often been the privilege of the tail gunner to rescue comrades trapped in the fuselage. Anyway, I've never seen a machine crash on its tail.

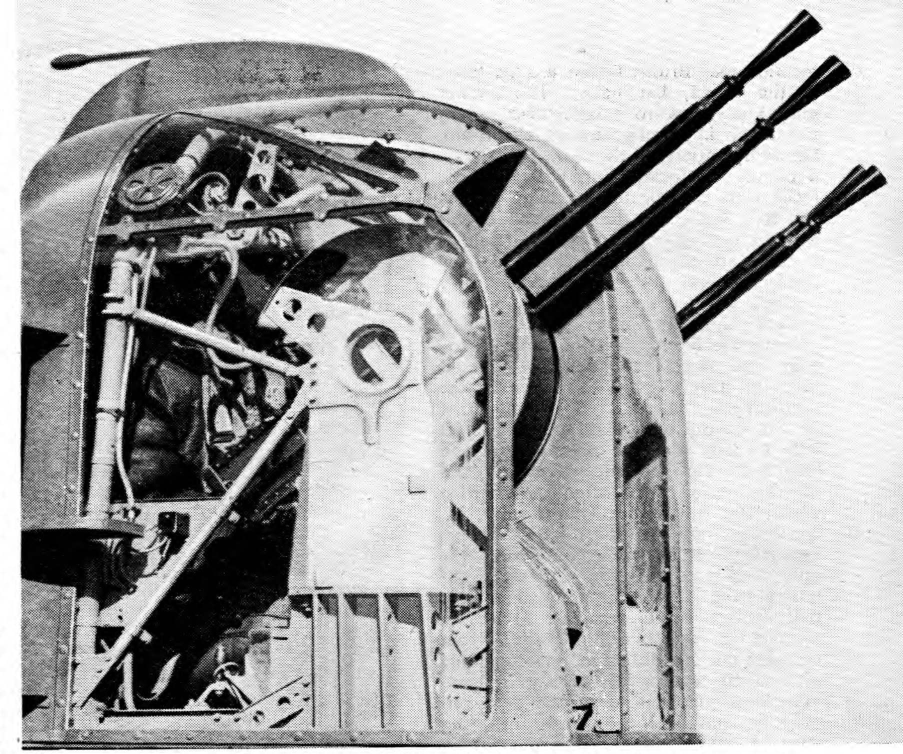
Greater Importance

The qualified air gunner is becoming quite a lad, you know, and the reason is not hard to find. The science of air gunnery has kept pace with the development of the aeroplane and its motive power, and the gunner is now just as much a specialist as any member of the crew; he knows it, and that is why there is an increasing tendency—presumably on the old principle of birds of a feather—for air gunners to get together, as pilots did in the last war, and as specialists will in any walk of life.

Actually, there are several reasons for this, reasons which make the gunner feel, justifiably, that he can stick his chin up on the tarmac. In the first place, training has vastly improved, even since the beginning of the war. He has a lot to learn—a dickens of a lot to learn. An air gunner is no longer any odd erk who knows how to jerk a cocking handle or trip a trigger—not by a long shot.

He must be able to recognise instantly all types of aircraft, and to be able to judge their speed, direction, angle and distance. That in itself is quite a business. He must have a thorough knowledge of guns, gunsights and turrets—how they work and how to keep them working. These instruments have to be handled like second nature, with speed, precision and no ordinary skill. Remember, the gun is a high-efficiency weapon; it doesn't start in low gear and work up into its revs.; the instant you press the trigger it develops full power, so it is a good thing to have it pointing in the right direction.

The turret itself is quite a piece of mechanism, too, and in passing we may



A Frazer Nash rear gun turret of a Whitley, with four .303 Browning machine-guns.

The mid upper gun turret of a Lancaster. It is a Frazer-Nash 50 with two .303 calibre Browning machine-guns. Below the gun can be seen an "interrupter" which prevents the gunner from hitting his own tail.

mention that British turrets are the finest in the world, bar none. The gunner must know how to handle these things, not merely in a demonstration classroom, but on operations, in the dark, perhaps on a bumpy platform, cluttered up (as he feels) with complicated clothing, oxygen and R/T leads, and the like—and all this without getting hot and bothered.

There are other factors that make the efficient gunner feel that he is no mere cog in a war machine so vast that nobody notices him. In heavy bombers, air gunners are briefed just the same as the men who handle the controls. He is likely to have a grandstand view of the performance; indeed, it is probable that he will be the only man in the aircraft who actually sees the bombs burst (no easy matter for the pilot, by the way), and for this reason he is often the chap to whom the Intelligence Officer turns for eye-witness information. And—this is important—the air gunner is definitely the only man who has the satisfaction of hitting back at swastika-branded aircraft that may resort to desperate devices to prevent the captain of the aircraft from carrying out his duties, or getting home after their successful accomplishment. When this happens, even the pilot can only sit and take it—a most irritating state of affairs, as I know from experience. At this stage of the proceedings the gunner certainly has the best of it.

The air gunner can now go a long way, don't forget. Gunnery leaders are appointed on merit, and a gunnery leader can command a squadron. Naturally, operational experience is a necessary qualification.

Coming back to the risk angle on which we started, it is safe to say that an air gunner's destiny is largely, and literally, in his own hands. Efficiency is very much its own reward. There is, of course, an element of luck, as there is in everything; much depends on the theatre of war in which the gunner finds himself; some places are less healthy than others—although the healthiest places can also be very dull. If you examine the records of those veterans who have made scores of sorties over enemy territory, you will find that these are the chaps who know their stuff.

Turret practice on the ground at an R.A.F. training school.

These are the lads who kept awake after sighting the coast on the run home; who flew with their eyes on the sky —not on a book which they happened to have in their pocket; the lads who cleaned their own guns, and remembered to test them, and confirmed that the sights were harmonised; the lads who practised quick repairs in the dark with gloves on; the lads who took full advantage of their training, and thereby developed an infinite capacity for taking pains; who learned their dinghy drill; who kept their flying-boots dry—in short, the men who know all those little things which collectively go far to bringing 'em back alive. For in war, with all its changes, one factor remains constant. The skilful fighter is the winner.

This blister gun position on a Catalina of Coastal Command houses a .5 Browning hand-operated machine-gun.

U.S. Coastguards

by A.M. COLBRIDGE

IN 1911 the United States Naval Flying Corps was established, purchasing on May 20th of that year—

1 Curtiss airplane -	-	$5,500
1 Wright airplane -	-	$4,201
1 Curtiss airplane -	-	$2,750

However, it was not until 1916 that the United States Congress authorised the establishment of aeroplane bases for the Coast Guards. Plans and estimates for this were then proceeded with, but the entry of America into the first Great War interfered with the programme before it got under way, and the project was temporarily abandoned.

Many Coast Guard personnel had learnt to fly and gained much valuable experience with the U.S. Navy during the 1918 war. Thus when the interest of the authorities was aroused by the first successful trans-Atlantic flight, made by an NC-4 (Navy-Curtiss) flying-boat in 1919, there were men to handle any aircraft allocated for Coast Guard duties, and a fresh start was made.

The First Station

The first station was established at Morehead, North Carolina, in 1920, with a canvas hangar and a few near-obsolescent aircraft transferred from the Navy. But in spite of the hard work put in by the men concerned and the many successful flights, the experiment was abandoned in 1921 owing to lack of funds, which Congress did not see fit to supplement by a further grant.

A fresh start was made in 1926, this time with an initial grant of $152,000, and two air stations were established. These were at Gloucester, Massachusetts, and Cape May, New Jersey. Between them they shared five small aircraft.

From this point development was natural, but not rapid until the years immediately preceding the present war. Eight modern air stations had been established by early 1940, followed by two more opened the same year. Records show that at the end of that year 50 machines of some twelve different types were in service.

Varied Duties

All machines are fitted with wireless transmitting and receiving apparatus, both for direct communication with their base and for "homing" on any transmitting station, such as an aircraft or ship in distress.

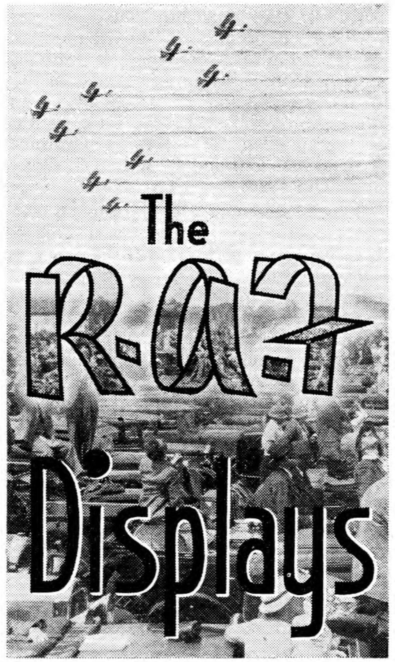
Their duties are extremely varied, amongst the most important being a general aid to shipping, one particular feature being the dropping of messages to small fishing-boats and other craft not fitted with wireless to warn them of coming storms or gales in time to reach shelter. Charting and wreck-plotting is another duty. During 1939 over one thousand wrecks and other obstructions to navigation were found and reported.

In all they perform the duties of a super policeman-cum-guardian-angel, varying from such extremes as notifying fishermen of the locality of shoals of fish to the suppression of smuggling. An interesting corollary of the latter is the location of illicit stills—over one thousand of these being found by the U.S. Coast Guards in 1939.

Before becoming eligible for an aviator's commission in the Coast Guards three years' experience of sea duty is essential. Each year ten selected candidates are sent to the Naval Air Station at Pensacola, Florida, for a one-year course, which includes 300 hours' flying. At the successful conclusion of this course they are then posted to one of the Coast Guard stations. The total personnel of the force in 1940 was given at 42 commissioned officers, 22 warrant officers, and 399 other ranks, but upon the entry of America into the war the Coast Guards became an integral part of the U.S. Navy and thus now operate directly under naval command.

Photograph taken from a low-flying U.S. Navy Blimp showing a U.S. Coast Guard aircraft rescuing survivors of a torpedoed merchantman off the east coast of the United States.

July Memories



EVERY time a bombing raid on the enemy is organised the R.A.F. put into the timetable the lessons learned at the R.A.F. Displays which, between 1920 and 1937, enthralled hundreds of thousands of spectators at Hendon. At a time when the R.A.F. had only a small amount of fighting on its hands, these displays provided opportunities for exercising in peace the organising abilities and flying skill that are required in war.

The main programme lasted about three hours, from three o'clock to six o'clock, and, in order to provide continuous action for the entertainment of the spectators and to avoid accidents, the timing of every flying event had to be meticulously accurate.

All phases of R.A.F. work appeared in the programme: the picking up of messages by Army Co-operation aeroplanes; dropping troops and supplies by parachute; shooting down balloons; and bombing (though for the sake of the spectators and surrounding villas, not bombing from very high levels). Formation flying, of course, took up a great part of the programme. But it was the fighters more than anything else which provided the greatest thrills for the spectators.

A favourite item in the programme in later years was formation flying by three fighters tied together by light cords, which remained unbroken from take-off through a series of evolutions that would be considered good by one aircraft flying alone, right down to the landing. Some of the pilots who took part in this feature — Air Vice-Marshal Broadhurst, for example—put their practice to good use in the Battle of Britain.

The R.A.F. Display was started in July 1920 by a group of officers of the old Inland Area, primarily to raise money for the R.A.F. Benevolent Fund. It was successful beyond all the hopes of its originators. The roads to Hendon aerodrome, then narrow country lanes, became jammed in the first year with a mass of traffic. In later years this was remedied. Routes were carefully prepared and everything possible done to arrange for the comfort and convenience of spectators.

The Air Staff, headed by Lord Trenchard, quickly saw the value of the Display more than a mere public spectacle. The name "Pageant," by which it was known in the early years, was changed to "Display," and it was regarded as the culminating point of R.A.F. training, an opportunity for the British public and the representatives of foreign Powers to see what the R.A.F. could do in the way of flying and ground organisation.

The squadrons selected to take part in the display regarded it as an honour, and trained assiduously for many months. Owing to the careful organisation and selections of personnel, accidents were rare, and the crowd generally went away happy in the knowledge that they had seen a good show and that nothing had occurred to spoil an enjoyable afternoon.

Another feature of the Display was its value as a reunion day for all ranks of of the R.A.F., past and present. Wandering about the enclosure, one could be certain of meeting many old friends. Practically everyone connected with flying managed to turn up, if not one year then the next.

In 1938 it was found that the comparatively small aerodrome at Hendon, surrounded on most sides by villa-sprinkled hills, was not really large enough to permit a safe showing of the qualities of our fastest aircraft, and it was decided to drop the Display and to replace it by displays at aerodromes all over the country on Empire Air Day, which, started in 1934 by the Air League, had developed into another popular annual Air Force event.

It is hardly likely that Hendon will be suitable for large displays after this war, but possibly Empire Air Day will continue, and perhaps one of the larger new aerodromes not too far from London could be organised for a grand national display.

Whatever may happen, the R.A.F. Displays at Hendon will always be remembered with pleasure. They stimulated flying training throughout the R.A.F., gave the public the opportunities to see the work of the R.A.F., and maintained the links of comradeship between all ranks and ages.

The Royal Air Force in July

IN July 1935 King George V, as part of his Jubilee celebrations, reviewed the Royal Air Force at Mildenhall and Duxford, inspecting all types of units. Air Chief Marshal Sir Robert Brooke-Popham was in command of the review, which included a fly-past of 350 aircraft, then considered a large number. In the same month the Government announced the proposed expansion of the R.A.F. by 71 new squadrons. In July 1936 the formation of the Royal Air Force Volunteer Reserve was announced, and in July 1938 the Air Ministry approved the rather less effectual Civil Air Guard Scheme.

The first July of this war—1940—saw the preliminaries of the Battle of Britain, and during that month at least 240 German aircraft were shot down over and around this country. The Victoria Cross was earned on 7th July, 1940, by Sergeant J. A. Ward, who climbed out on the wing of his aircraft to extinguish a fire. A daylight sweep over Bremen brought the V.C. in July 1941 to Group Captain Hughie Idwal Edwards, whose photograph appeared on last month's cover of the *Gazette*. By July 1942 our raids were longer and heavier. Lancaster bombers flew to Flensburg and Danzig, and heavy night raids were made on the Ruhr towns. July 1943 finds the Royal Air Force mightier than ever, its course set for victory.

July Record Flights

THE month of July in aviation history is rich with record flights, the first and most memorable being that of Louis Bleriot, who made the first Channel crossing by aeroplane, in 1909. Ten years later, in July 1919, the British dirigible R34, commanded by Major G. H. Scott, made the first lighter-than-air non-stop transatlantic flight, from Edinburgh to New York, a distance of 3,120 miles. Other notable flights were made in subsequent years, one of the most spectacular being that of 24 Italian seaplanes led by General Balbo, which flew, in seven hops, from Italy to Chicago, between July 2nd and 15th, 1933. In July of the same year Wiley Post, one-eyed American flyer, circled the globe alone in 7 days, 19 hours, 49 minutes, covering 15,596 miles. That time was beaten in July 1938 by Howard Hughes, who with four companions flew round the world in 3 days, 19 hours, 8 minutes.

In July 1934 Major W. E. Kepner, Captain A. W. Stevens and Captain O. A. Anderson made a record balloon ascent to 60,613 feet in America. In July 1937 the Soviet airmen, M. Gromov, A. Yumachev and S. Danilin, flew from Moskva over the North Pole to San Jacinto, California, a non-stop record of 6,296 miles.

The King of Air Fighters

Major Edward Mannock, V.C., D.S.O., M.C.

IN July 1919 the Victoria Cross was awarded posthumously to Major Edward Mannock, who, to quote the official citation, "was an outstanding example of fearless courage, remarkable skill, devotion to duty and self-sacrifice which has never been surpassed."

The son of poor parents (his father was a corporal in the Regular Army), Mannock was educated at an elementary school, and at the age of 12 started working ten hours a day as an errand boy, for half a crown a week. Later he became a clerk, and then an engineer in a telegraph company. He continued to read, to study, to take part in organised sport and to train with the Territorials. At the outbreak of war in 1914 he was interned in Turkey, where he was working, but was repatriated on the grounds of age, apparent bad health and defective eyesight. On arrival in England he joined the transport section of the R.A.M.C., then transferred to the Royal Engineers to become a tunnelling officer, and later again transferred to the R.F.C., learning to fly when he was over 30. He joined an active-service squadron in April 1917, when there was not much time left to win his spurs.

By July 1918 he had risen to the rank of major, earned the D.S.O. thrice and the M.C. twice, and had been officially credited with 50 victories, and unofficially with many more which he modestly attributed to his comrades and subordinates. And by that time he had earned also the respect and admiration of men of all ranks and of all social and educational levels in a world that was more class-conscious than that of to-day.

He was shot down in July 1918, without knowing he had won the highest decoration. His comrades continued to press his claims to the V.C., until Mr. Winston Churchill, then Air Minister, caused an investigation to be made which resulted in the award of the Victoria Cross, twelve months after his death.

Mannock was not only a great fighter. He was a great leader. At a time when fighter pilots were inclined to play the lone wolf, he showed them how to secure better results by inspired team-work.

His story is well told by Group Captain Ira Jones, in *King of Air Fighters*, a book to be read by all. There is inspiration in it for all, and hope for those who may feel oppressed by poverty, lack of education, social inferiority, ill-health or lost years.

Faced with all these obstacles, nearly overwhelmed by them for 30 years, Mannock undespairingly prepared himself. Seizing the chance his wings gave him, he surmounted them all. Many men, confronted with similar difficulties, have risen to victory, but none more swiftly or more gallantly than Mannock, the King of Air Fighters.

In the last war the R.A.F.'s range of operations were small. Today they cover large portions of the globe, as indicated in this picture of Coastal Command's Control Room.

FREE BALLOONING

By Flight-Lieutenant LORD VENTRY

Lord Ventry here explains that ballooning is more than floating like an air bladder on water, and is an interesting art that has to be learnt.

ONE overcast day in the year 1912 the crew of the Army non-rigid airship Delta were in a predicament. They were unable to land without a great danger of the ship breaking up in the air. That would end with the car detaching itself from the envelope and hurling them to earth without parachutes.

The pressure inside the envelope had fallen, and the pilot, Captain Waterlow, attempted to remedy this by blowing in air to the ballonets, or small air-inflated balloons in the envelope, so that it would keep its shape. The air blower failed to do this, and the envelope began to buckle, the bow and the stern rising.

The only way to restore the shape and pressure was to rise, so that the gas would expand with the decreasing atmospheric pressure. This was done, and all was well, at least for the time being. But they knew that when descending to land the gas would contract again, because of the increased atmospheric pressure near the ground.

But when near their base the sky began to clear, and the sun came out. They waited until the sun's heat expanded the gas, and then they were able to come down slowly and in fairly good condition.

A knowledge of free ballooning had saved the ship and probably the lives of its crew as well. To-day the American Navy is making ever-increasing use of airships hunting the U-boat. All the pilots of these first have to go through a course of free ballooning. Let us go into the matter a little.

Throw out small pieces of tissue paper.

How Ballast Works

Before starting a flight the balloon is ballasted up with sand; the more ballast that can be carried the longer the time in the air. Ballast is of fine sand, made up in 30-pound bags. It is assumed that the sky is overcast, that the balloon is nearly full of gas at the start, and that the temperature of the air and the gas are approximately the same. As the balloon rises the gas will expand at exactly the same rate as the pressure or weight of the atmosphere decreases. The lift of the gas is the difference between the weight of the air displaced and the weight of the gas, so the balloon will go on rising until the envelope is fully distended, and the weight of the balloon and air displaced becomes the same.

Equilibrium

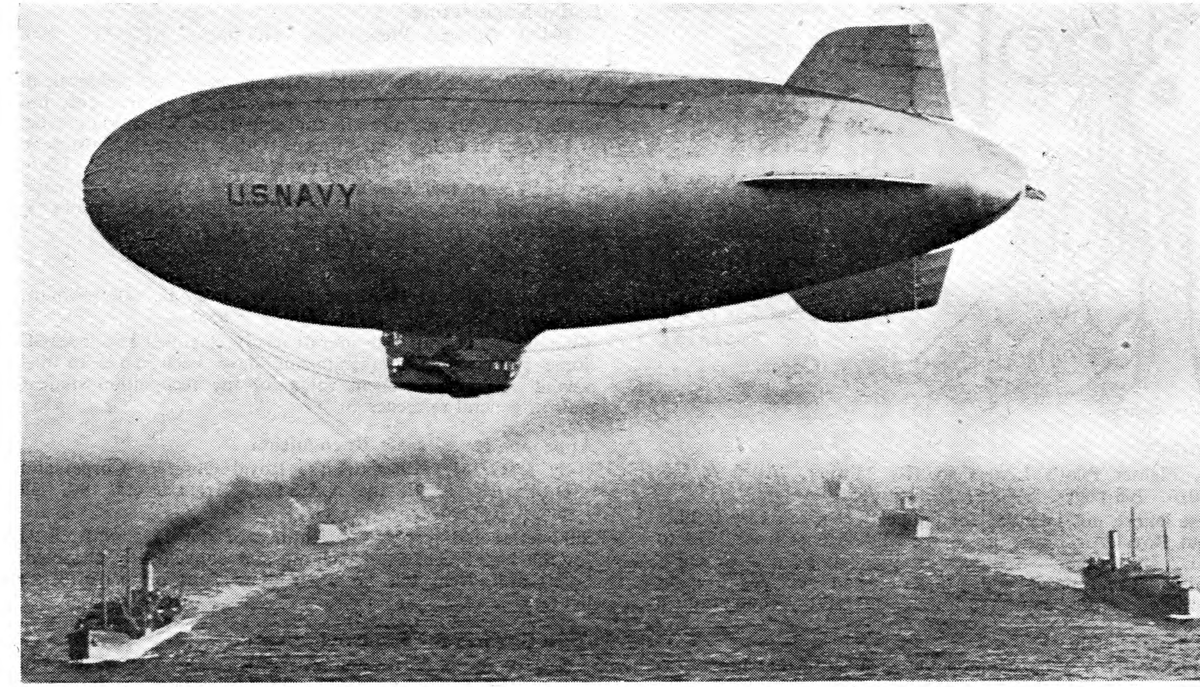
If the lift could be adjusted so finely that the rise were extremely slow, she would then stop rising and remain in equilibrium. Usually, however, as she rises she has enough momentum to overshoot the equilibrium point. The pilot will know from the smell of the coal-gas that she has overshot. As the gas escapes from the open neck she will lose lift and start to fall. So he gets ready to let go a little ballast, watching his rate of rise and fall indicator or statoscope carefully for the first sign of a descent. He can also, if he likes, throw out small pieces of tissue paper, and use these as a guide, for if they appear to float alongside the basket he knows for certain he has started to fall. If this is the case, he lets go a little ballast, and if he is quick enough the balloon will stop falling, and remain more or less in equilibrium, with a very small expenditure of sand. In fact, if he knows the weight of his balloon and crew, the weight of the gas and the height of the barometer and the temperature, he can even work out beforehand the approximate amount of ballast he will have to throw out and also what the balloon's pressure height would be, that is, when it is full of gas and about to valve. He can also decide on the best height at which to fly, and the ceiling of the balloon. This will depend on the ballast.

Having stabilised his balloon, he must watch for all small variations, not being afraid to valve or to ballast and check any undesired rises or falls. This requires practice. The chances are, to begin with, at any rate, too much ballast will be expended and the balloon will rise perhaps through the clouds and into the sunlight. The sun's rays beating on the envelope will cause the gas temperature to rise much quicker than the surrounding air, and if the envelope is full the expanding gas will overflow through the neck, and the balloon will continue to rise, the envelope remaining full all the time and the gas overflowing. Unless the valve is used the balloon may rise to a great height. If there is plenty of ballast and there is no danger of being carried out to sea, this may be allowed to happen.

No ballast left to check the fall.

Gas Losses

The reason plenty of ballast is needed is that the balloon, if full, is losing approximately one-thirtieth of its volume for each 1,000-feet rise, plus one-five-hundredth of its volume for each degree Fahrenheit the gas superheats above the surrounding air temperature. This is all right when ascending. It is when the balloon descends that the trouble starts.



Lighter-than-air craft are still being used in this war, where they can operate out of the range of enemy aircraft. This picture shows a U.S. Navy blimp on patrol over a convoy in the western Atlantic. The blimp crews go through a course of free ballooning before going on to the powered ships.

To take an extreme case, unless there is plenty of spare lift, there will come a time when the balloon is still descending, with no ballast left to check the fall.

Losing Lift

Let us assume the balloon has been in the sunshine perhaps for some hours. As the sun wanes the gas will start to cool and contract. Then less weight of air will be displaced, and the balloon will start to descend. As it enters the clouds it will lose all superheat, and the gas will contract still further, so that it displaces less air. In addition, its weight will increase by moisture settling on the envelope. A further loss of lift will occur because the air in the clouds, being damp, will be lighter.

If, for example, the balloon reached 10,000 feet, approximately one-third of the lift will have vanished by the time it reaches the earth. If the barometer has fallen in the meantime, the difference between the weight of the air and gas will be less still, which means a still faster descent.

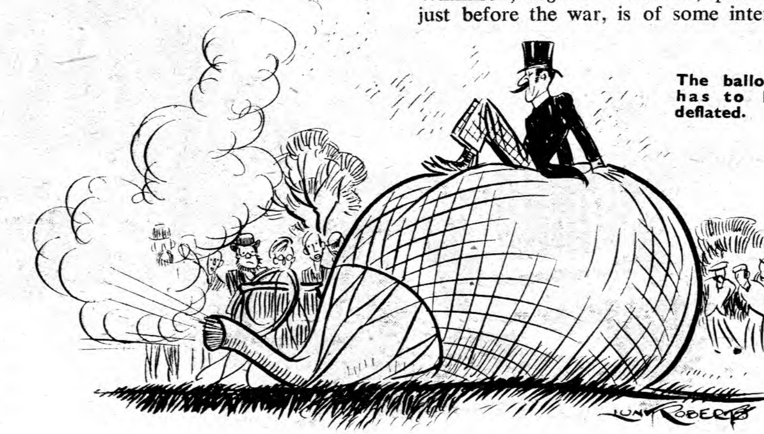
The golden rule is by careful piloting to keep the balloon always as near its equilibrium as possible, and to try to land with ballast still in the basket.

The Descent

Before the final descent the pilot will ballast his balloon and keep it at a height of 500 feet or even less, for some little time, while looking around for a suitable place to land. Having made up his mind, he can valve hard, and it is quite easy to bring the balloon down in the right place. Here the tissue paper comes in handy, for if he keeps on a level with it as it falls he knows he is falling at a reasonable speed. If high grass, water or woods have to be crossed he will find the balloon will descend more rapidly. On the other hand, if a stubble field or rocks or sand, for example, have to be passed over, the balloon will tend to rise; but by watching carefully and using the trail rope it is not too difficult with practice to make a soft landing. If it is windy he can tie the neck of his balloon down to keep it from forming a parachute, and rip at a height according to the strength of the wind. Ripping is more rapid than valving. It tears a panel off the envelope and empties the balloon quickly, thus preventing a drag. A trail rope will be a great help then. This is lowered when there are no high-tension cables. As it touches the ground, naturally it relieves the balloon of its weight, so acting as automatic ballast and also as a brake. Having landed, the balloon has to be deflated and packed up, and brought back by road, like the soaring pilot's glider. But it is all good fun.

BOOKS ON BALLOONING

ALTHOUGH ballooning has been well written about, most of the books on the subject are now out of print, though still sometimes to be found in libraries. Most historical books contain some references to it, and some books of reminiscences, such as Major C. C. Turner's *The Old Flying Days,* go into more detail. Mr. Griffith Brewer's book, *Ballooning and Its Application to Kite Balloons,* was reprinted by the Air League at the beginning of the war, and a book by Stephen Wilkinson, *Lighter Than Air,* published just before the war, is of some interest.



The balloon has to be deflated.

Reviewed by THE EDITOR

The opinions expressed are those of the Editor and do not have official approval or otherwise of the Air Training Corps.

"Imshi"

A Fighter Pilot's Letters to His Mother. Allen & Co. 10/6. 168 pages. 8½"×5½". Illustrated.

These letters, not intended for publication, speak very frankly about Royal Air Force life in the Middle East from 1938 to 1941. The author, an officer on fighters, seemed to enjoy himself during peace and war, and had achieved a great reputation before being shot down in 1941. Very good reading.

Bombers' Battle

(1943.) By a Wing Commander. Duckworth. 10/6. 220 pages. 8½"×5⅜". 16 illustrations.

A survey of Bomber Command's activities, introducing intimate accounts of aircrews' personal experiences, yet maintaining in its consideration of the larger issues the more detached viewpoint of Bomber Command headquarters. A free, vigorous style and a detailed knowledge of the subject have enabled the author to produce a useful book.

Radio Engineering

(1943.) Odhams Press. 6/6. 512 pages. 8¼"×5¼". 600 diagrams.

A most comprehensive book. Without being too technical, it covers wireless in most of its present-day applications, including chapters on aircraft and ship radio which should be of interest to cadets and airmen. Other interesting chapters deal with television and the newer field of electronics. Illustrated by good line drawings and containing a useful reference section and index, it is a very good example of war-time book production.

Basic Aircraft Recognition

(Second Edition, February 1943.) By C. H. Gibbs-Smith. Country Life. 5/-. 130 pages. 9½"×6¼".

Silhouettes of about 300 aircraft neatly classified and indexed. Some additions and amendments have been made to this second edition. Excellent value for the recognition student and for general reference.

Approach to Aircraft Recognition

By J. G. M. Miller (of the Royal Observer Corps) and D. M. Harris (of the N.A.S.C.). Argus Press. 9d. 38 pages. 7⅞"×4¾".

Silhouettes and recognition features of the 64 aircraft listed for the N.A.S.C. Test. Accurate and conveniently classified. Spans are given, but no other dimensions or performance figures.

Aero-Engines for Students

(1943.) By R. A. Beaumont, A.F.R.Ae.S. Allen & Unwin. 5/-. 168 pages. 6½"×4⅜". Well illustrated with photographs and diagrams.

A dull cover disguises an understandable and accurate book which, assuming an elementary knowledge of petrol engines, describes and compares in detail various types of modern aero-engines.

(Continued on page 26)

A Jeep being backed into a transport glider of U.S. Air Support Command.

Books—*(continued from page 24)*

Britain and World Air Transport

By B. J. Hurren. John Crowther Ltd. 2/6. 56 pages. 7″×4½″.

Combining vision with practical knowledge, the author outlines in a well-written pamphlet some interesting suggestions for the development of air transport.

Aircraft Navigation

(1943.) By H. Stewart, A.I.N.A., A. Nicholls, A.I.N.A., S. A. Walling, Senior Master, and J. C. Hill, B.A. Cambridge University Press. 3/6. 146 pages. 7¼″×5″. Diagrams.

Produced by four experts, this book appears to cover the subject adequately, and although cadets are advised to use only R.A.F. navigational textbooks, others not enjoying their advantages but wishing to make some study of the subject will find this useful. With the book goes a circular slide rule and a plotting chart.

How to Write and Interpret Orders, Reports, Letters, Memoranda, etc.

Harrap. 2/6. 64 pages. 8″×5¼″. Line drawings.

A gallant attempt to make English attractive by linking it with aeronautical subjects. The author, an English master, no doubt realises that a good knowledge of general English literature is the only true foundation of good technical English, but the reader should also be told that these exercises are a stimulus rather than a short-cut to mastery of our language.

Complete Air Training Course

No. 1—General Science. (June 1943.) By I. R. Vesselo, B.Sc. Hutchinson. 2/6. 79 pages. 6½″×4⅜″. 72 line diagrams.

Not so complete as its cover at first sight suggests, this volume is merely a compressed textbook on general science subjects—mechanics, sound, heat, electricity, etc.—which might serve as a refresher to those already having a good knowledge of the subject.

Astronomical Air Navigation

By Squadron Leader R. Hadingham. Technical Press. 10/6. 132 pages. 6½″×8½″. Diagrams and Charts.

A most comprehensive and up-to-date book on practical astronomical navigation. The author is proven competent not only in the theory and teaching of navigation, but also in its practice.

Its contents cover all the theory and application the practical air navigator needs to know, but it is, of course, beyond the scope of A.T.C. cadets.

START THINKING NOW!

A competition is being arranged for new names for British bombers and civil air liners. Details will be announced later. In the meantime you can start thinking now. Names suggestive of hitting power are required for the bombers and names suggesting peace and prosperity for the air liners.

KEY TO "AS YOU SEE THEM"

1, Grumman Martlet I; 2, North American Mustang I; 3, Curtiss Tomahawk I; 4, de Havilland Flamingo; 5, North American Mitchell Is; 6, de Havilland Mosquito IV; 7, Fairey Albacore; 8, Blackburn Skua II; 9, Supermarine Spitfire Vb; 10, Bristol Beaufort I; 11, Republic Thunderbolt I; 12, Fairey Swordfish; 13, Gloster Gladiator; 14, Westland Whirlwind I; 15, Douglas Dauntless I; 16, Douglas Boston III; 17, Short Stirling I; 18, Hawker Hurricane I; 19, Douglas C-53 Dakota II; 20, Consolidated Catalina I; 21, Boeing Fortress II; 22, Supermarine Spitfire Vb; 23, Bell Airacobra I.

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

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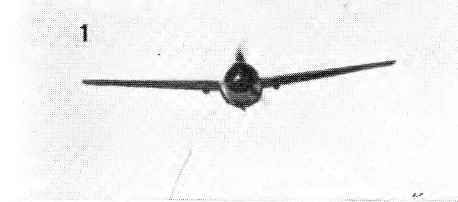

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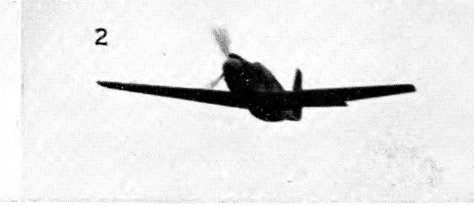

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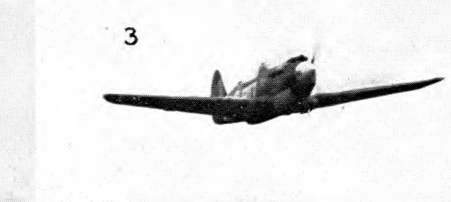

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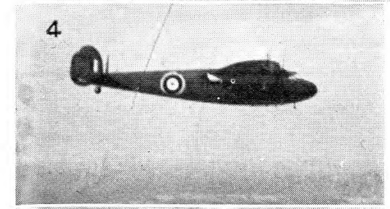

AS YOU SEE THEM

Old and new photographs reproduced to make a test for expert or novice.

Key on page 26

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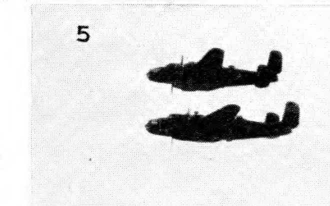

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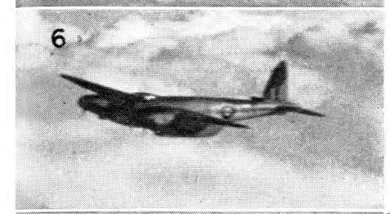

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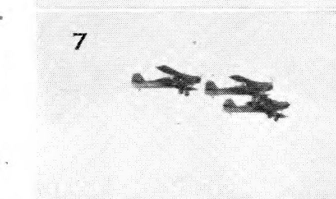

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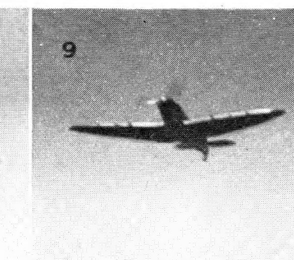

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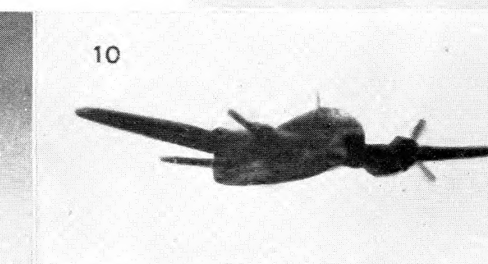

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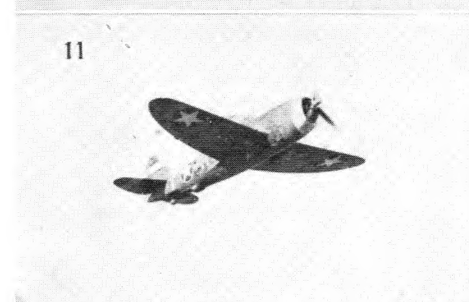

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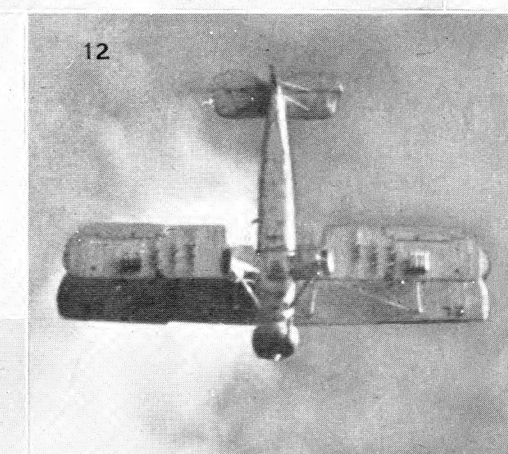

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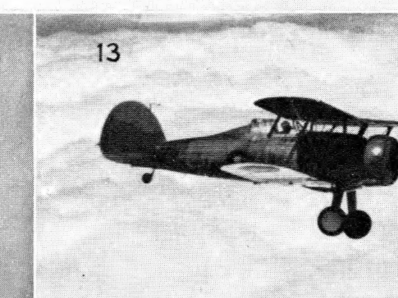

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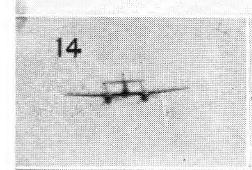

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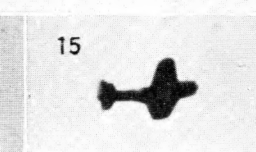

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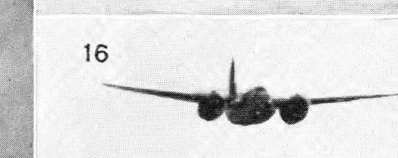

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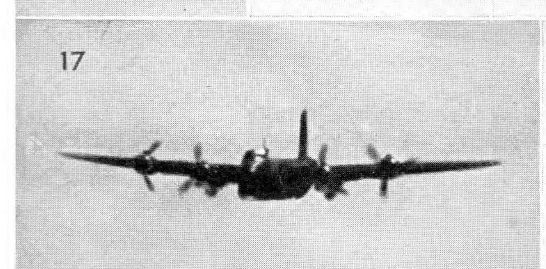

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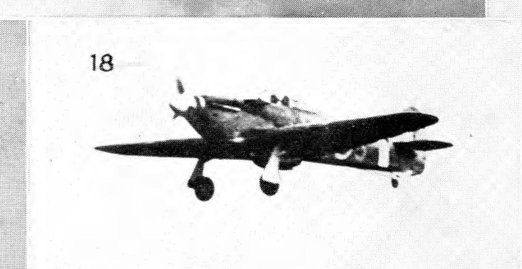

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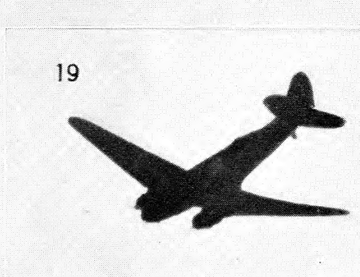

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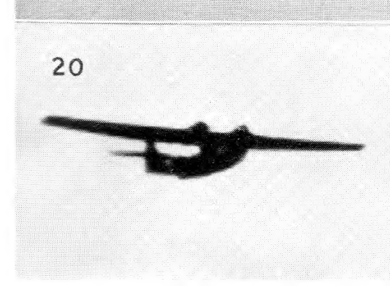

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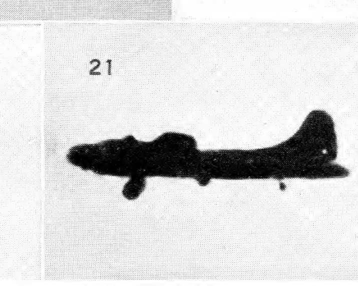

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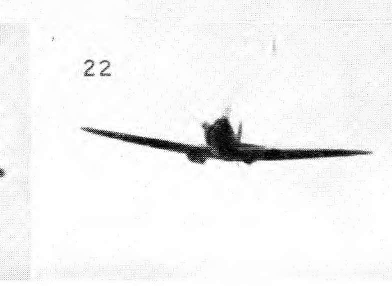

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