AIR TRAINING CORPS GAZETTE

VOL. III No. 11
NOVEMBER, 1943
Price 6d.

Liberators flying in formation over Britain.

AIR TRAINING CORPS GAZETTE

VOL. III NO. 11 NOVEMBER 1943

Edited by Leonard Taylor

Published for the Air League of the British Empire, 1A Pall Mall East, S.W.1 (Telephone Abbey 5041), by the Rolls House Publishing Co. Ltd., Rolls House, Breams Buildings, London, E.C.4.

"Venture Adventure"– Officers' Pattern

"VENTURE ADVENTURE" is the motto of the Air Training Corps, but we older people who handle cadets as officers or instructors may sometimes think that the adventure is only on the side of the cadets—they are preparing themselves for a life of aviation, and of aviation in war-time, and they are on the threshold of the great adventure of life.

By comparison our job must at times seem terribly dull and full of routine, with very little adventure at all about it. But I would like to put before officers and instructors the thought that it is a very big venture to have the handling of young men in a Corps of this kind and size, and that there are adventures too to be tried in our everyday work.

There are well-tried—one might almost call them stereotyped—methods of training which have been employed for many years; I would not attempt to say whether these have been successful in all ways or not, but in this Corps we have to approach training and education in quite a different spirit, because we are dealing with volunteers who work hard during the day-time and give up some of their leisure to us; and the well-trodden paths are not always pleasant to such young men.

I would like the officers and instructors to venture adventure in the sense of trying new methods and getting away from the stereotyped routine. Perhaps I had better give some examples of what I mean. If a young man comes to us very defective in his mathematical attainments, the standard method might be to tell him that he must work tremendously hard at his calculations, and even study at home, when perhaps his mind is not in a position to digest such studies. Now that we take recruits mainly at the earliest age we have time to approach the problem in a different manner, and it might be better to awaken his mental processes by the more interesting forms of study—aircraft recognition, lively P.T., etc.—and only gradually introduce him to education. That would certainly be an experiment worth trying.

Again, Morse can be taught in hour after hour of listening to and writing down letter and figure groups. Teaching in this way we do not get nearly so quickly to proficiency in this subject as we would if we made it much more variegated from the very start. There are a number of competitive games which could be played at Morse, and I should be happy to send to any C.O. or instructor hints on this.

The general point I am trying to make, however, is that this training of young men is not static; it is not a routine; and there is scope for immense adventure to see whether any unorthodox methods will not achieve the results we need. If only every officer and instructor would look upon his task from this point of view we might all get much greater satisfaction from our work and still more interest in it, and this would in turn reflect itself in the greater progress and greater satisfaction of our excellent cadet material.

J. M. Chamier

AIR COMMODORE
INSPECTOR, A.T.C.

The Republic P-47B Thunderbolt, the latest fighter in full service with the U.S. Army Air Force.

Transatlantic FLIGHT

A Royal Air Force Navigator trained in Canada tells how, at the conclusion of his training, he acted as a navigator on a transatlantic ferry flight.

Fully prepared for the intense cold . . .

To the other two members of the crew this was their fourth transatlantic briefing. For me it was the first. The briefing was terse, but to the point. After a description of the weather likely to be encountered we were told our take-off times, then the navigators made themselves scarce to prepare the flight-plan for the trip.

First a word to any would-be observers about the navigational pre-flight preparations. The flight-plan was simplicity itself. The flight, approximately 1,760 miles, was divided into rhumb-line legs of two hundred miles each, roughly eight legs in all. The general scheme was to climb for the first hour and a half, until a height of thirty thousand feet had been reached; to maintain this height for 1,200 miles in order to clear the top of a vast frontal system, and finally at the end of seven and a half hours' flying to descend at the rate of three hundred feet a minute. By tea-time the flight-plan was complete, the aircraft had been re-checked; all that remained was to wait for take-off time, which was nine o'clock in the evening.

At 21.00 hours zone time (22.00 hours G.M.T.) we clambered into our aircraft, gave the final adjustment to our flying clothing, completed the check-over—petrol, oxygen, sextant, charts, radio, etc.—and taxied in to the perimeter track to take our place with the line of departing aircraft. At 21.22 hours L for London flashed down the runway, and as the wheels left the ground I realised that when I next stepped on terra firma I should be in the old country, after many months' absence.

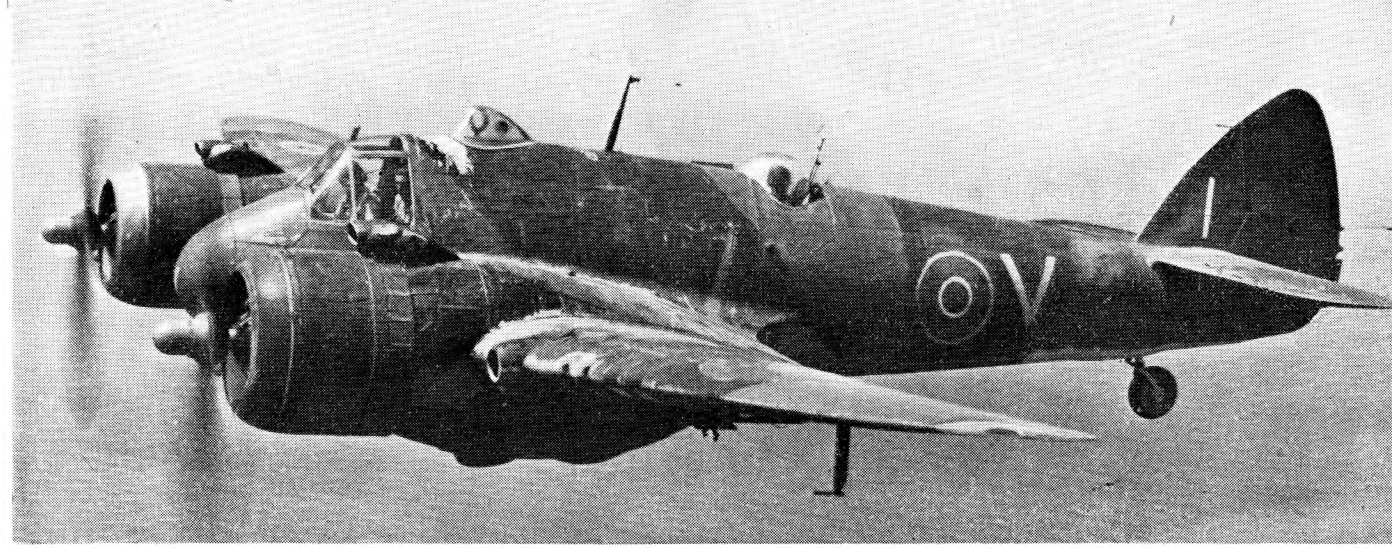
When we had circled the aerodrome I gave my pilot the initial course, and we began the long climb to thirty thousand feet. I had heeded the warning of my two companions and was warmly clothed, fully prepared for the intense cold we expected at such an altitude. Some twenty-five minutes later, when the altimeter read 7,800 feet, my wireless operator handed me a radio bearing obtained from Newfoundland. This enabled me to check our ground speed. The difference between our D.R. ground speed and our actual ground speed was infinitesimal. So far, so good. I breathed a sigh of relief.

When we reached ten thousand feet we put on our oxygen masks. Outside our cabin the world was an inky blackness. Only the stars and the dim shape of clouds were visible. Having inspected my sextant, I retired to the rear of the aircraft, pushed back the escape hatch and, standing on a small platform, began to "shoot" the stars. I had been given a comprehensive astro-navigation course when in Canada, and had done a fair amount of night flying, but this was the real thing. Fifteen thousand feet above the Atlantic Ocean with nothing but the stars to rely on, one just had to concentrate. A "fix" I obtained and plotted some fifteen minutes later from Polaris and Rigel showed us to be some eight miles to port of track. I altered course to allow for the additional drift. At thirty thousand feet we levelled out, and started our seven-hour dash across the clouds. Conversation was difficult, as our masks could not be removed for more than five seconds at a time. Every forty minutes I retired to my perch at the rear of the aircraft, and by a two-star fix confirmed our position. We were maintaining track, and so, barring any technical failures, we should sight our destination approximately on estimated time of arrival. Frequent bites at sandwiches plus occasional sips of coffee kept us all fully awake, despite the intense cold—27° C.

When the sun rose in the east at six a.m. the whole of the cloudbank became alive, as if on fire, giving the impression of orange cotton-wool. As we touched the towering cumulo-nimbus tops the vapour broke against our aircraft like waves on on the bows of a ship.

Time never stands still, and it certainly made no exception for us. After what seemed like three hours I glanced at my watch, and found to my amazement that it was five minutes past six. We then started to descend at about three hundred feet per minute. A peculiar sensation, this, hemmed in by a wall of white cloud and only the instruments to watch, until at eight thousand feet we reached cloud base, and dipped out of the white wall. Stretching below us as far as the eye could see was the mighty Atlantic. When I removed my mask my face was quite stiff and numb. My pilot grinned as he saw me rubbing my cheekbones, gave the "thumbs up" sign, and asked: "Everything okay?" "Quite okay," I shouted back. I could smell those eggs and bacon already.

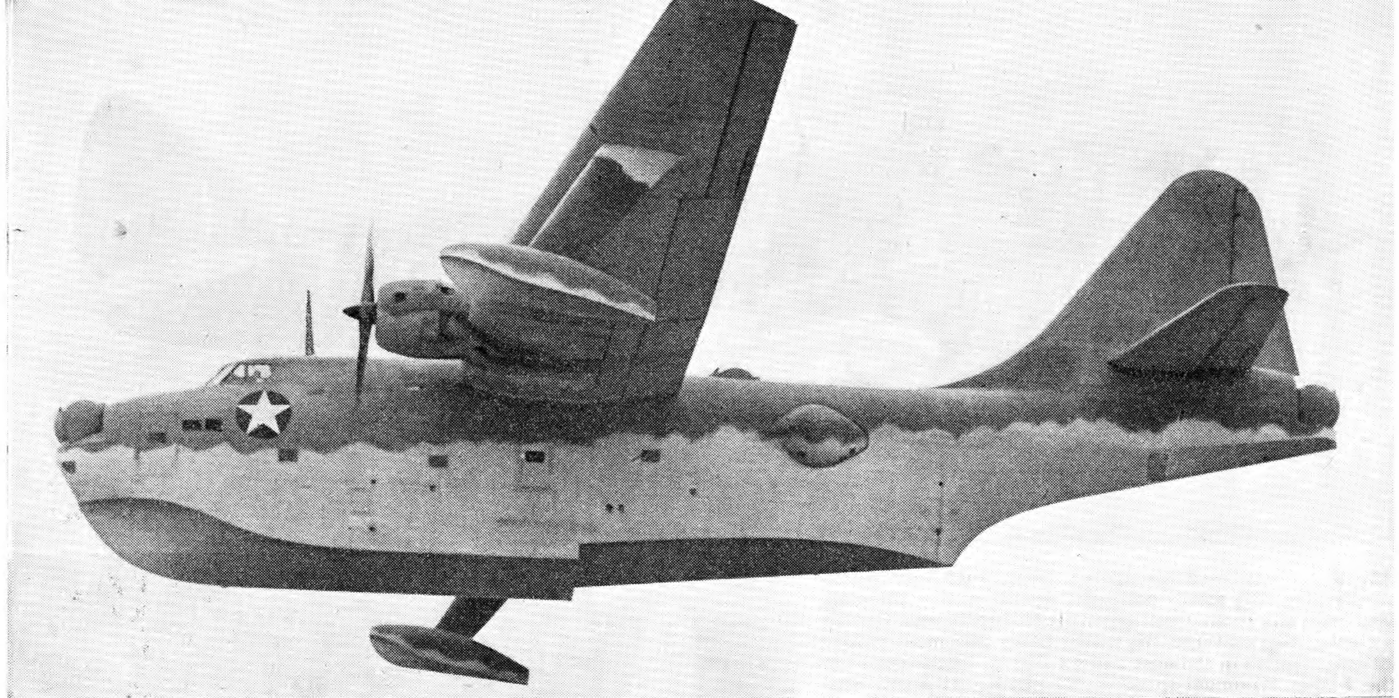
Some forty minutes later we sighted the coast, altered course slightly, and sighted our destination, having completed the flight in nine hours, eight minutes—exactly twelve minutes ahead of our E.T.A. Not a record by any means, but a good average time and, what was more important, a safe arrival for L for London and its crew.



Above: A Malta-based Beaufighter. Long-range Beaufighters are keeping up a steady onslaught against enemy shipping, land bases and communications in the Mediterranean. Carries a crew of two or three, has a very heavy armament of four 20 mm. cannon in the nose and six .303 in. machine-guns in the wings. Maximum speed is 330 m.p.h., its operational range is 1,500 miles, and cruising speed is 200 m.p.h.

Right: The Vought-Sikorsky Vindicator (R.A.F. name Chesapeake) naval dive-bomber. Armament consists of five machine-guns, two in each wing and one movable in the rear cockpit. Range 700 miles at 227 m.p.h.

Below: The Northrop N-3PB U.S. Patrol Bomber seaplane. This aircraft is designed for operation against surface craft, and is said to be the fastest float seaplane in the world. It carries a crew of three, has four fixed .5 calibre machine-guns in the wings and one .5 covering the rear, and one .3 firing aft out of the bottom of the fuselage. Maximum speed is 257 m.p.h. Maximum range 1,200 miles at 172 m.p.h.



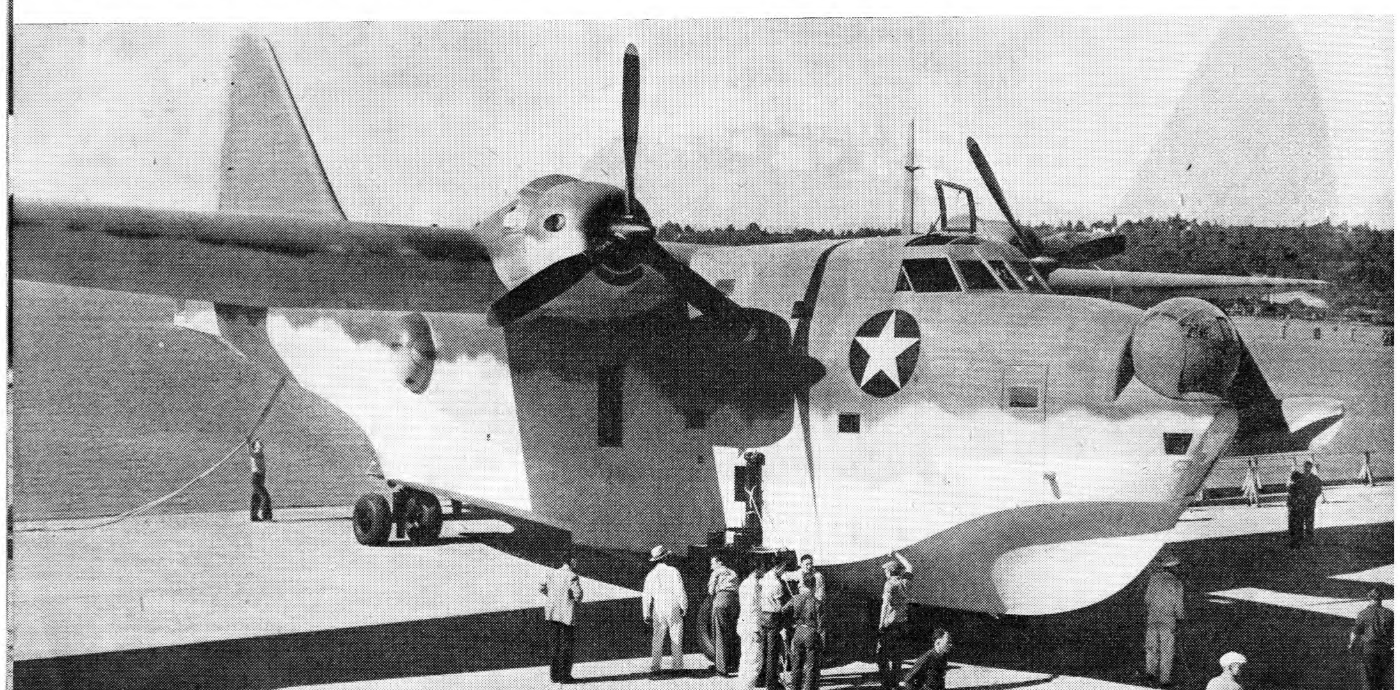
THE SEA RANGER

WHEN the Boeing Sea Ranger, a brand-new experimental flying-boat built for the U.S. Navy flew from Lake Washington, Seattle, U.S.A., its maiden flight was not the gala event of first flights in the past. War had dropped a curtain of censorship over the 'plane, and the entire proceeding was carried out quietly.

The Sea Ranger's performance figures were shrouded, too, but it was no secret that the giant patrol bomber is expected to fly farther and to carry a larger bomb load than any naval 'plane now in service.

Designated by the U.S. Navy as the XPBB-1 — X for experimental — the Sea Ranger is in the weight class of four-engined aircraft. It has just two engines, but they are believed to be the most powerful aircraft engines in production anywhere in the world.

The Sea Ranger is designed as a long-range scouting and bombing 'plane, capable of hunting out and destroying enemy submarines and surface vessels. It is heavily armed and within its all-metal structure is complete living accommodation for its ten-men crew while on extended operational flights far from shore bases. Behind the Sea Ranger lies the experience and the tradition of the large fleet of transoceanic Clippers that have brought Boeing a world-wide reputation as the builder of flying-boats.



AEROPLANE SKINS

by **P. W. BLANDFORD**

AEROPLANES have to have a covering of some sort, and in the early days aircraft builders made their machines in skeleton form, and then covered them with the lightest material they could find—usually a linen fabric. The shape of the wings, fuselage, etc., was formed by ribs and stringers, and the fabric was strained and sewn around them, then treated with a "dope" to tighten it.

This form of skin is still used for many aeroplane parts, but there are few modern aeroplanes completely fabric-covered. With the development of plywood, wooden skins came into use, although as the glue used in the construction of plywood was not perfectly waterproof, the wood was covered with a thin fabric called "Malapolam" to protect it from the weather. The Airspeed Oxford is a good example of an aeroplane completely covered with this type of skin. The most modern plywood is built up with a completely waterproof plastic cement, and aircraft have been built with this kind of plywood as skin, uncovered by any fabric.

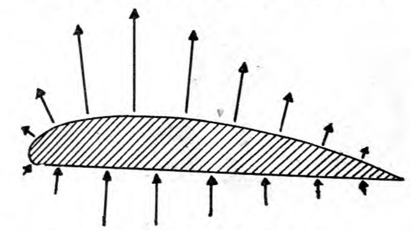
As fabric and wood are very inflammable, an entirely metal construction seems very attractive. Early aeroplane builders were handicapped by the fact that no really light and strong sheet-metal was available. Steel tubes and sections were ideal for constructional work, but sheet steel was too heavy and corrodible for covering aeroplanes.

Pure aluminium has been used; but it is the aluminium alloys, particularly duralumin, which are used for the metal skins of modern aeroplanes.

Choice of Materials

In modern practice, fabric is mainly favoured for covering control surfaces of all sizes of aeroplanes, for the rear fuselages of many aeroplanes and for the complete covering of light machines.

Wooden covering is, of course, coupled with wooden constructional work, and is favoured for trainer planes in particular,



Loads on the skin of a main plane.

There is one other advantage besides those mentioned which wood and metal have over fabric as a covering. They are rigid materials and can provide some of the strength of the wings and fuselage of which they form a part, so that the internal structure can be reduced. Whereas a structure which is to be fabric-covered must be strong enough in itself before the fabric skin is fixed, a wooden or metal-covered part may be almost or completely devoid of internal structure. Where there is no internal structure, or it is reduced to a few light frames or formers, and all of the loads are taken by the skin, the construction is called "monocoque."

The main use of an aeroplane's skin is to provide "shape," and to do this as smoothly as possible, so that there is the minimum of friction or "drag" between the airflow and the surface. On the wings it must also take the load caused by the "lift" in flight and transfer it to the ribs. On the fuselage the air pressure inside is mostly the same as outside, so that there is very little tendency for the skin to be pressed in or out; but on the main planes the pressure is different at every point. From your study of theory of flight you will know that the pressure on a wing in flight is increased underneath and decreased on top, the pressures varying across the section roughly in the proportions of the lengths of the arrows in the sketch.

The skin on the underside of the wing is pressed tightly against the ribs, but the skin on top tends to be sucked away, and needs to be securely fastened down. In actual practice the normal constructional methods of glue and nails in the case of wood, and rivets in the case of metals, is sufficient to hold down the top skin; but fabric has to be secured by a system of "stringing," which is a combination of sewing and knotting, done with a special braided cord.

A Sea Hurricane lands on the deck of H.M. Aircraft Carrier Argus. This aircraft's covering is partly stressed and partly fabric.

P for Pursuit

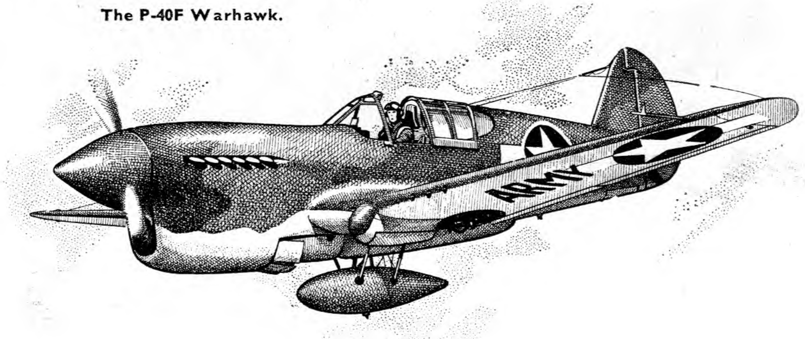
***ROY CROSS** comments on some of the older American fighters.*

AMERICAN fighter design has, until recent years, been influenced by the non-existence of a high-performance liquid-cooled in-line motor of home design (though Rolls-Royce Merlins are now being made in America). The radial air-cooled motor was looked upon with favour by the Army and Navy, and has now reached an enviable state of development and reliability in the U.S.A.

In 1930 the Allison Division of General Motors Corporation started design work on the V-1710, a 12-cylinder upright V aero-engine. The first Allison, the GV-1710-A, of 650 h.p., was ready in mid-1931. A long period of experiment and modification preceded the first installation of the motor in a single-seat fighter, the Curtiss XP-37, with a turbo-supercharger, and some months later, in September 1937, the Bell Airacuda first flew, with two "D"-type turbo pusher Allisons and five-feet shaft drives.

After trials with these types it was decided to drop the turbo-supercharger for the time being, and to concentrate on the mechanical blower. A C-15 motor with its own supercharger was fitted in a Curtiss XP-40. The successful flying trials, coupled with the simplicity of the motor itself, influenced the decision to put the C-15 into full production in 1939. This model, and the later F3 and E4, had single-stage, single-speed blowers only, and in the case of the C-15 power output fell to a little over 800 h.p. at 20,000 ft. The Allison Company has recently been trying to remedy this defect, and a two-stage, two-speed supercharger is now fitted to current models in full production. Output is reported to have been increased by 40 per cent over the C-15, which seems to indicate that latest V-1710s will be rated at around 1,500 h.p.

At the time of Pearl Harbour the Army fighters in most extensive use were the P-39 Airacobra and the P-40 series; upon these types, and the Navy Wildcat, fell the brunt of the early fighting.



The P-40F Warhawk.

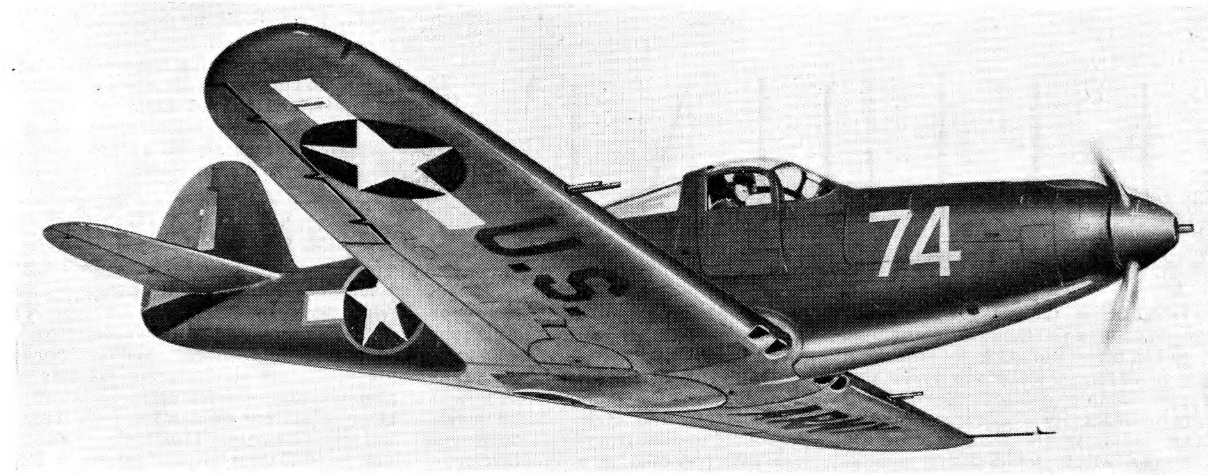
Bell P-39 Airacobra

The Bell Aircraft Corporation, Buffalo, New York, deserves much credit for the successful development of the Airacobra, an aircraft which seems to have caught the eye of both the public and the critics. Its design certainly includes some most interesting departures from common single-seat pursuit practice, including the positioning of the motor amidships, the tricycle landing-gear and the novel methods of construction used. It has not had the operational success for which its makers had hoped, but it is in service in very large numbers with the Americans and is doing a most useful job in all quarters of the globe.

A more powerful Allison motor of 1,325 h.p. seems to have been installed in recent models of the Airacobra, as well as other Allison-powered fighters. The new motor may be the F-5 model, which in May 1941 completed tests at 1,325 h.p. for take-off.

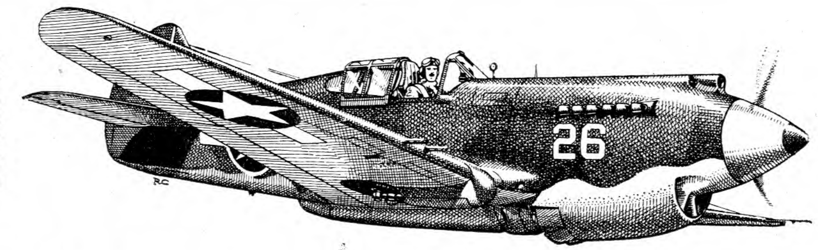
Curtiss P-40 A, B and C

A war veteran, the P-40 has seen more active service than any other American fighter. Original French orders were transferred to Britain, and the first arrivals were equipped according to the French specification; the dials were numbered metrically and all stencilled instructions—in the cockpit, for instance—were in French. Rapid modification at R.A.F. stations produced the Tomahawk I, numbers of which were despatched to the Middle East, where they first earned their battle honours. P-40s are operating also

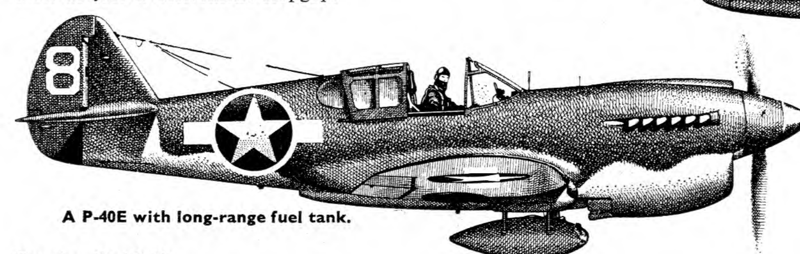


The Bell P-39 Airacobra.

with the Red Air Fleet and the Chinese Air Force, have seen action over France and the Pacific, Burma and Iceland. Although it has been criticised in the American Truman Report, the P-40 was at hand when and where the need was greatest, and it achieved greater fame than as just a convenient stopgap.



The Curtiss P-40C.

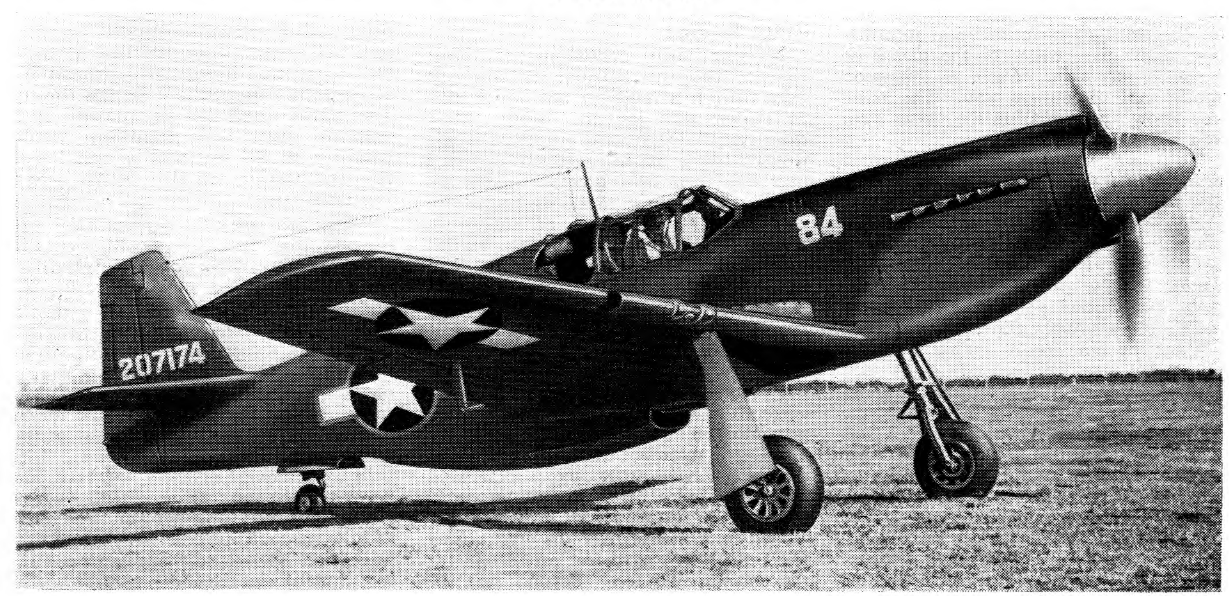


A P-40E with long-range fuel tank.

Curtiss P-40 D

Known in the R.A.F. as the Kittyhawk I, the P-40D is similar to the Tomahawk, except for the following changes. An Allison F3R motor with external spur reduction gear and casing replaces the longer C-15, resulting in a slightly shorter nose. The air intake for glycol and oil coolers has been enlarged and moved forward to coincide with the rise in power. Nose armament is removed to the wings, and a cleaner cowling designed. The cockpit is reduced in height.

A picture of a North American Mustang on which our artist has painted the new American markings.



GLIDING

by a NAVAL PILOT

LONG before the war I was a glider pilot. Then enthusiasm carried me a step further—I learned to fly an aircraft with an engine. Finally war broke out, and after a brief course I found myself flying a Shark for the Fleet Air Arm with an all-up weight of about five tons.

The part which gliding played in helping me to become a qualified Service pilot is possibly of special interest to those A.T.C. cadets who have already started their glider training, or hope to do so. Right at the beginning, let it be stressed that a first-class sailplane pilot who subsequently becomes a Service pilot will always have something that the other fellow hasn't got. He will have a highly developed sense of judgment should he ever have to make a forced landing, an uncanny instinct for weather—which plays a far bigger part in flying than is generally realised—and, finally, his lightness of touch should enable him to win the reputation of possessing a first-class pair of hands. A sailplane pilot is most unlikely to kill himself by the otherwise popular method of stalling his aircraft through a sudden engine failure. Moreover, he will possess an invaluable understanding of when the weather is dangerous and when it is merely unpleasant.

Meteorological Training

The A.T.C. gliding schools can never hope to turn you into soaring pilots of sufficient experience to short-cut your Service training. But they can put you on the track of meteorological information which may easily be the means of saving your skin. Such a limitation should not discourage you. The more you know about soaring the better pilot you will eventually make.

You are learning to-day, in your elementary training gliders, to use a stick and rudder, common to any type of aircraft. You may get so far as finding yourself at 400 feet looking down between your knees at the faces of your companions on the ground, and unless something goes wrong you will return safely to earth in a straight glide.

Your machine has a sinking speed of about ten feet per second at its best gliding angle. A high-efficiency glider such as the Minimoa, which holds the British distance record of 209 miles, has a sinking speed of only 2½ feet per second. If these aircraft are to maintain height after their launch they must, therefore fly in air currents rising vertically at not less than 10 and 2½ feet per second, irrespective of any horizontal velocity. From this obvious statement it will be appreciated that all soaring depends upon the vertical velocity of the air through which it is done.

Most winds over the land, and nearly all winds over the sea, blow on a horizontal plane. But under certain conditions they deviate from the straight and level path and even, as in thunderclouds, blow directly up and down. Many of these vertical currents achieve a great velocity. The greatest of all are to be found among those majestic masses of cloud which pile up into Himalayan-like ridges, whose undersides are a deep purple and whose flanks bear the stain of livid yellows. Vertical air speeds up to 60 feet per second may be found within such masses, velocities which will tear the wings from the strongest aircraft. A sailplane pilot has survived to tell the tale of how he found himself sitting in mid-air while pieces of his aircraft descended in a shower of splinters around him. He had been torn from the fuselage, and saved himself by parachute.

An American glider taking off by means of a power winch. A parachute lowers the towing rope slowly to the ground to prevent knotting.

Ridge Soaring

Between such conditions of great violence and the quietude of complete calm there is a range of airs which may be ridden with joy and safety. Most elementary of all are the gentle winds which strike a hill-face and are deflected over it as they flow onwards across the countryside. Along the sides and above the crests of such hills an upflow is created which might support the burden of a sailplane. The vertical speed acquired by a wind which strikes the face of a hill may be anything from three to fifteen feet per second.

Assuming that an intermediate type of sailplane, with a natural sinking speed of five feet per second, is flying in a rising current of twelve feet per second, its rate of climb will be seven feet per second, or 420 feet a minute. At two soaring sites of which I have experience, a west wind of twenty miles per hour will probably produce an up-current of eight feet per second immediately over the crest, rising to as much as twelve feet per second for the ensuing 300 feet. Beyond that the wind will begin to flatten out again, until at 600 feet the pilot is neither climbing nor sinking, but suspended in an up-current which exactly matches his natural rate of sink.

Ridge soaring is not always, however, quite so simple as I have suggested. A second element enters the problem. The lapse-rate, which is the temperature by which the air falls for every thousand feet of height, has a profound influence. When cumulus clouds are in the sky—the towering galleons of a summer day—the temperature may drop as much as four degrees for every thousand feet of height. Thus if the temperature is 60 degrees in your garden, it will be only 40 degrees 5,000 feet up, and freezing 7,000 feet up.

On the other hand, when a roof of flat grey cloud covers the sky, the fall in temperature may be only one degree per thousand feet, or it may even be warmer than at ground-level. This is known as an inversion.

Translate these conditions into terms of a 15-m.p.h. wind striking the face of a slope, and see what happens. A body of air is forced up the face for, say, 500 feet and enters a colder layer. If the lapse-rate is 4, the layer on top of the hill will be two degrees colder, while if the lapse-rate is only 1, the upper layer will be only half a degree colder. In the first case the rising stream will be accelerated, because, as is well known, warm air rises; while in the second case it will have virtually no acceleration imparted to it for this reason. The height which can be attained by a sailplane under these conditions would probably be 600 feet with a high lapse-rate, and possibly less than 50 feet with a low lapse-rate.

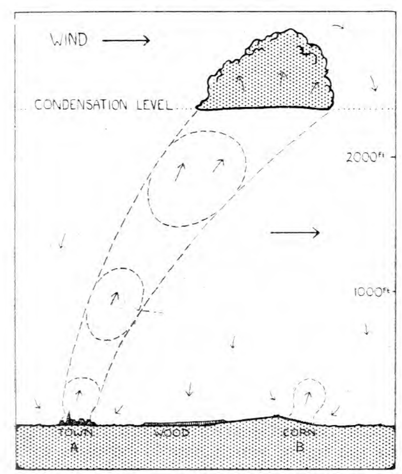
When you cross the soaring ridge for the first time there is no doubt about the conditions in which you are flying. A tremendous upward surge will strike the underside of your wings, necessitating violent movements of the stick. The ground will recede, and you will ride as though on a fractious horse to the ceiling of the up-current. Here you may remain for as long as the wind blows and for as long as you remain over the crest of the hill.

In a subsequent article I will take you beyond elementary ridge soaring, which I have described, and tell you something of how thermal lift, cold fronts, standing waves and inter-cloud flying can open up the whole sky to the glider pilot.

CLOUD Readings FOR PILOTS

by 'STRINGBAG'

I WAS once returning from a trip over the North Sea when the engine coughed, spluttered, and threatened to stop. For a few bad moments I had visions of making the rest of the journey in a rubber dinghy. A few minutes later, when the motor seemed to have settled down to its original rhythm, I tried to open up the throttle with a view to checking the magneto switches. It was jammed. There was something seriously wrong. But I happened to have in my head the details of the weather report that morning, and these, combined with visual evidence of the raw, grey conditions in which I was flying, made it obvious that the trouble was icing. The butterflies of the carburettor had probably become jammed by chunks of ice, while the engine itself had, no doubt, been momentarily choked. Knowledge of these circumstances made it easy to get rid of the ice by a change in altitude.



The formation of a Thermal Bubble and the cloud resulting at condensation level.

This trifling experience will help to illustrate the value of a book (*Cloud Reading for Pilots*, A. C. Douglas; published by Murray, 10/-) which has just been produced with the idea of helping pilots to interpret the weather, particularly the dangerous weather through which they may have to fly.

Whether the destiny of its readers is to be the F.A.A. or the R.A.F., it will help to keep them out of trouble. Those who fly our "heavies" into the depths of Europe do not need to be reminded that an electric storm is as big a menace as flak, while the fighter pilot who has to descend through an unbroken cloud layer after a dogfight, and perhaps with his wireless shot away, knows well the risks he runs in breaking cloud which may be close to the ground.

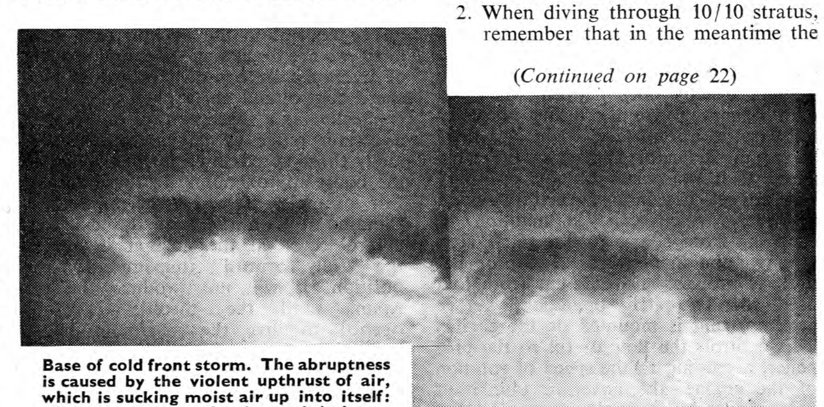
Every youngster who is going to be a pilot takes out a life insurance policy by learning all there is to know about the clouds. He knows, because he has been warned, that three or four inches of solid ice can form on the leading edges of his wings in as many minutes. That he should recognise instantly the type of weather in which this will happen is important. The ragged-edge crown of a cumulus nimbus will cease to be a beautiful diadem upon the castellated summits of a cloud castle, but will become an icy menace to be avoided at all costs. The ice crystals which filter into his cockpit to form a shimmering Christmas scene as he flies through a wisp of cirrus will not, however, do anything but delight his æsthetic senses. It will be lowering mammatus, low-lying stratus and the towering cumulus nimbus which he will avoid.

An appreciation of the meaning of temperatures and the sequence of clouds which follow each other across the sky will provide him with the priceless information as to the advisability of continuing his journey or turning back. While directional wireless and other navigational aids will keep him out of trouble nine times out of ten, there will come the tenth occasion, when only his own intimate knowledge will stand between him and a too-sudden return to earth.

This book, *Cloud Reading for Pilots,* is by Mrs. A. C. Douglas (who is, incidentally, an expert glider pilot and one of the original Ferry pilots in the A.T.A.) and is concluded by a list of tips which every flier should learn by heart. They include these golden rules:

1. Don't fly in cumulo-nimbus unless it is unavoidable. These clouds are far more attractive from outside.
2. When diving through 10/10 stratus, remember that in the meantime the

(*Continued on page* 22)



Base of cold front storm. The abruptness is caused by the violent upthrust of air, which is sucking moist air up into itself: this forms into cloudy wisps as it is drawn up and cooled beyond its dew point. The dark colour of the cloud and the violent turbulence are the most noticeable features and show that it extends up to great heights.

J. A. KYD explains Constant-Speed PROPELLERS

THE need for the variable-pitch propeller first became evident when pilots found that they could not keep their engine speed up to the desired revolutions per minute on take-off and at the same time keep the engine speed down to a safe figure in full-throttle level flight with the same propeller.

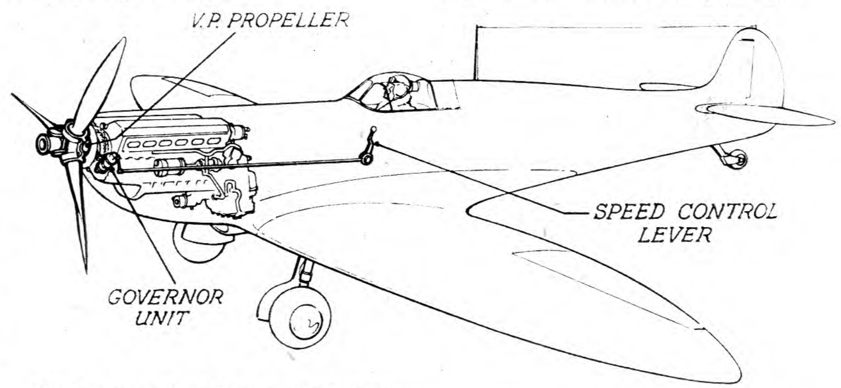
What they wanted were two separate propellers of different pitch, the one to be able to take off safely and the other to enable the use of full power in flight without overspeeding.

The First Stage

The obvious development, which had been occupying designers' minds since shortly after the last war, was to produce a propeller which could alter its pitch in flight at the will of the pilot. Although one or two designs were more or less perfected in the nineteen-twenties, is was not until the early 'thirties that the power of engines and the increasing speed-range of aircraft warranted putting such a weight as the V.P. propeller right on the nose of the aircraft. These propellers were of the two-pitch type, and some of them are still in use on the older and more sedate aircraft of the Royal Air Force. The pilot merely had a control in the cockpit which he pulled out for fine pitch and pushed in for coarse pitch; he could not go far wrong, for even if he pulled the control and got fine pitch when he was flying level and at full throttle the overspeeding was not very great, since the change in angle between coarse and fine pitch was not more than five or ten degrees; similarly, if he forgot himself and attempted to take off in coarse pitch (as he sometimes did), he usually managed to scrape over the airfield boundary with a few feet to spare.

Constant Speed

What exactly does happen when the pilot opens up from cruising boost to full throttle during level flight and finds his r.p.m. indicator at exactly the same figure as it was when he was cruising? The answer lies in a normal two-pitch propeller, which can, in addition to changing from coarse to fine pitch, stop at any point in between. The propeller itself is probably no different from that used for two-pitch operation, but a governor unit is mounted on the engine. This controls the flow of oil to the propeller, according to the speed of rotation of the engine—the governor unit itself being driven by the engine (assuming that the propeller blades are operated by oil pressure). The governor unit consists of an oil pump which raises the pressure of the oil which it takes from the engine. The amount which it delivers to the propeller is graduated by a control valve actuated by governor weights. The higher the engine speed the less oil the valve allows to go into the propeller. Since the propeller blades are always trying to go into coarse pitch (low r.p.m.)—for different reasons in different designs of propellers—it follows that when the engine speed goes up slightly it is at once checked by less oil being delivered to the propeller with a consequent coarsening of pitch and lowering of r.p.m., the designers having so arranged it that the r.p.m. are brought back to their original value. The exact opposite occurs when the engine speed drops.



Modern propellers have a great many refinements and complications in their design. The foregoing description has been reduced to the simplest form possible.

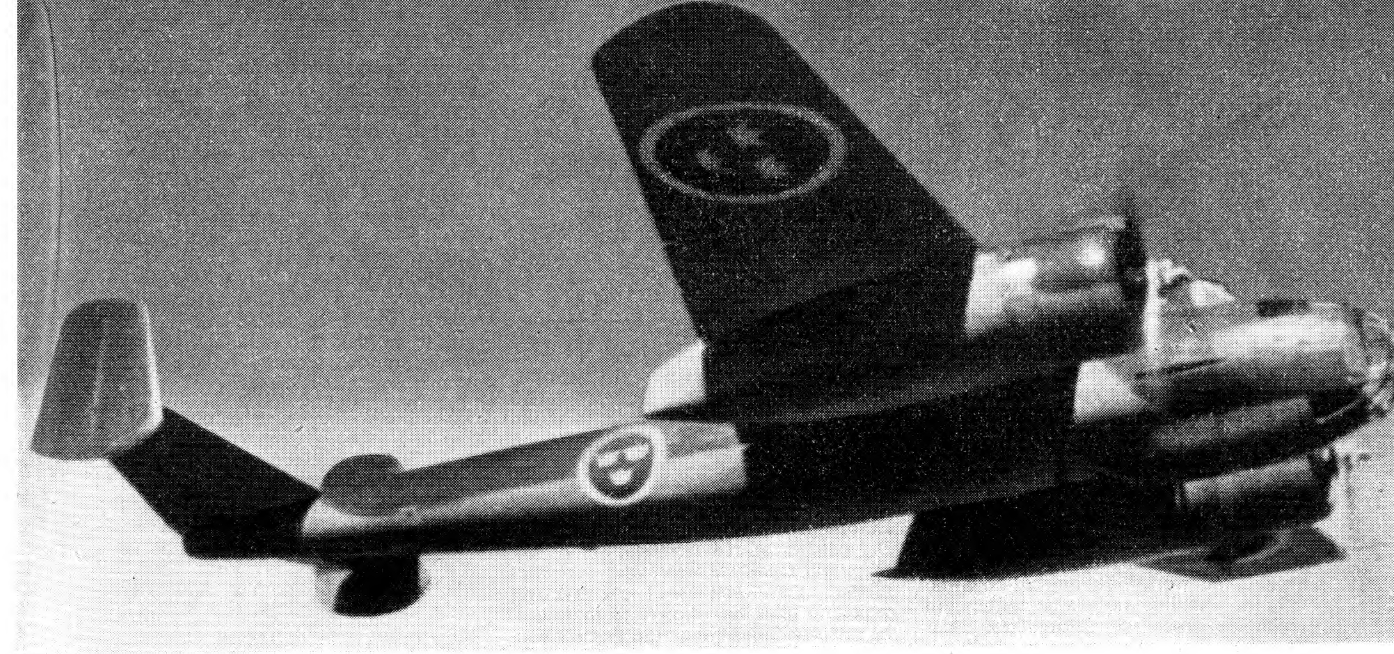
Speed Control

The control in the cockpit (and here again we are discussing the simplest form of hydraulically operated propeller) is a speed control and not a pitch control. It is effective as a speed control only within a certain range of engine speeds—normally those speeds used in flight—and at the boost approximating to those speeds. For example, if when the aircraft is standing still on the ground the speed-control lever in the cockpit is put to the "fully forward" (maximum r.p.m.) position, it will not produce the full r.p.m. until the throttle is fully opened to give the maximum boost, but while flying the maximum r.p.m. can be obtained with quite a low boost, that is, with the engine throttled back. The reason for this is that the propeller blades are restricted to a certain pitch range, and to get the full r.p.m. at low boost, at rest on the ground (a situation that would never be required), would entail having to allow the propeller blades to go to a very fine pitch. Then, with the limited pitch range available, the other end of the pitch range would have to suffer. To get the full operation out of a V.P. propeller with constant-speed control the aircraft must either be flying or the engine must be running at full throttle on the ground, the latter being undesirable for any length of time.

When the aircraft is ready to take off, the speed-control lever is moved to the maximum r.p.m. position (fully forward) and the throttle is opened; the r.p.m. immediately rises to the maximum permissible and stays there. With a fixed or two-pitch propeller the r.p.m. would immediately begin to rise as the forward speed of the aircraft increased and reduced the load on the engine. With the V.P. propeller, the governor unit, as explained earlier, immediately counteracts this tendency by closing its valve a little and allowing the propeller blades to coarsen, thus keeping the engine speed down to the maximum permissible. It will actually be a gradual coarsening of the blade pitch proportional to the aircraft's increase in speed. When the aircraft is well clear of the ground and climbing safely, the pilot throttles back to a lower boost to take the load off the engine. The r.p.m. will not drop, however, although there is less power coming from the engine, since immediately the engine speed tries to fall with the reduction in power the governor unit admits more oil to the propeller and the blades go into a finer pitch. The pilot will reduce the r.p.m. by moving the speed control rearwards until they drop to the figure which should be used with the boost at which the engine is running.

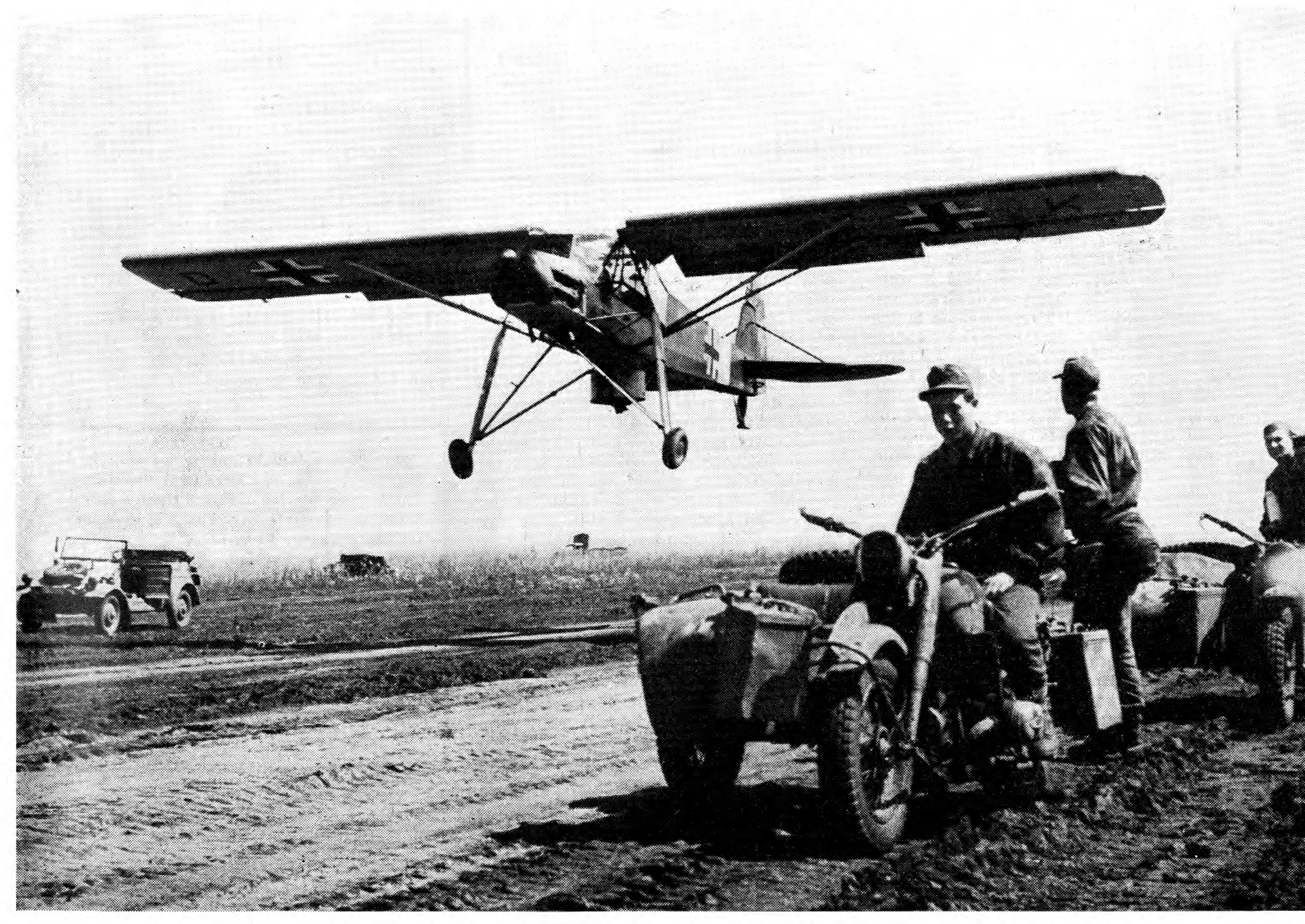
The aircraft can be climbed, dived or manœuvred in any manner, and while the speed-control lever remains at the position set by the pilot the r.p.m. will not alter—hence the term "Constant-Speed."

When the pilot wants to land he will move the speed-control lever to the maximum r.p.m. position, not because he wants maximum r.p.m. when he is landing, even if he could get it with his throttle almost closed, but so that he would immediately get his maximum permissible engine speed should he have to open his throttle in a hurry to take off again because he had misjudged his landing.



Above: A fairly new Swedish bomber, the Svenska B-18.

Below: A not-so-new German aircraft, the Fieseler 156 Storch, about to land on a road in Russia. This aircraft has a top speed of 109 m.p.h., landing speed of 31 m.p.h., take-off run of 71 yards and a landing run of 27 yards.



Flying through RED TAPE

by CAPTAIN W. E. JOHNS

OVERHEARING some cadets talking about post-war private flying, it struck me that the war has been going on for so long that, to fellows of fourteen or fifteen, pre-war conditions may be little more than a hazy memory. Anyway, it was clear from the conversation that these cadets had some sort of quaint notion that in the good old days a pilot could step into an aircraft and cruise around the world just any-old-how—no flak, no bandits, no stationmasters, to make life miserable. It was also clear that they hoped these halcyon conditions would return when the guns are unloaded, the cookies put into store, and the flicks dowsed for the last time.

It is a shame to have to prang these illusions, but it must be done. To start with, it is by no means certain that there will be any private flying after the war. From the way things are going it seems more likely that the sky will be cut into sections and handed over to one or two big corporations. If the private owner is allowed into the air at all, he will have to conform to so many regulations that war flying, in comparison, will look like a slice of cake. This was, in fact, the case before the war, so those who are anticipating a return to those conditions, without having the gen, are likely to have a shock if their hopes materialise.

The Early Freedom

I remember the days when you could put your passport in your pocket, step into an aircraft, and head for any point of the compass. This delightful state of affairs did not last long. Governments have always made a point of making people pay for their pleasures, so it was not long before officialdom stepped in with a load of forms which had to be filled in before you were allowed to run up your engine. By 1938 it would be no exaggeration to say that every possible obstacle was put in the way of a pilot who wanted to fly anywhere except round and round his own airfield.

Prohibited Areas

One of the worst snags arose through Europe getting a bad dose of spy jitters. Big patches of red were slapped on the map, and these, we were told, were prohibited areas—sections of country over which no pilot was allowed to fly in case he saw something which the country concerned was anxious to keep under the hat. These prohibited areas became so large and so numerous that a flight across Europe meant creeping through a number of narrow aerial corridors. If you slipped out of your corridor you were liable to be shot at. And pilots *were* shot at. Some, forced to land, were thrown into prison or fined. A camera on board was quite enough to convict the pilot as a spy. In point of fact, one was allowed to carry a camera, but it was carefully sealed up by officials before the flight.

There was another set of prohibited areas on the pilot's map. These, which appeared as a number of lines forming a complicated geometrical pattern, were the routes of the regular air-liners. To cross one of these in cloudy weather was to risk collision with a winged pantechnicon; and as all other traffic had to give way to these transport machines it was a common thing for a solo pilot to be grounded for hours before the control officer would give him permission to proceed on his way.

Paper Work

Let us snatch a quick glance at the owner of, say, a Moth, contemplating a flip in the good old days. To start with, he had to leave the ground at a licensed airport, where certain documents had to be produced; among others, the pilot's licence, log-book, aircraft and engine logs, certificates of airworthiness and registration, and other licences if special equipment, such as radio, was carried. If the course lay overseas a passport was necessary, and a permit to fly over each of the several countries on the course. There was also a document called a Customs Carnet, which enabled the pilot to take his aircraft across these countries without having to pay an enormous sum in customs dues. Of course, all these things had to be paid for—one had to pay a deposit to each country of at least £10 even if you had a carnet.

Yet another document, to obtain which one had to be a member of the Royal Aero Club, was a tourist's identity card, issued by the International Aeronautical Federation. This saved a lot of expenses in aerodrome fees and hangar charges, although, of course, one had to put one's hand in one's pocket every time the wheels touched down. Yet another document was the petrol carnet. Admittedly, this was not compulsory, but it was highly convenient. A cash deposit was made at one of the petrol companies' offices before the start, and this enabled one to get petrol from the company's agents abroad, otherwise it would be necessary to carry a stock of money of every country in which it might be necessary to land. All kinds of maps were needed, and these, too, cost money. On a long flight one started with a whole parcel of them.

There were other documents, but enough has been said to show that private flying was a sport which even millionaires found expensive; apart from which so much time was taken up in collecting all these papers that if one was in a hurry it was usually quicker to go by train.

Another little worry was this: every country had its own regulations, and as ignorance of the law is no defence, it was necessary for a pilot to swot up the regulations in force all along his line of flight. So you see, with one thing and another, private flying, even in the good old days, was not just a matter of saying where shall we go—and going.

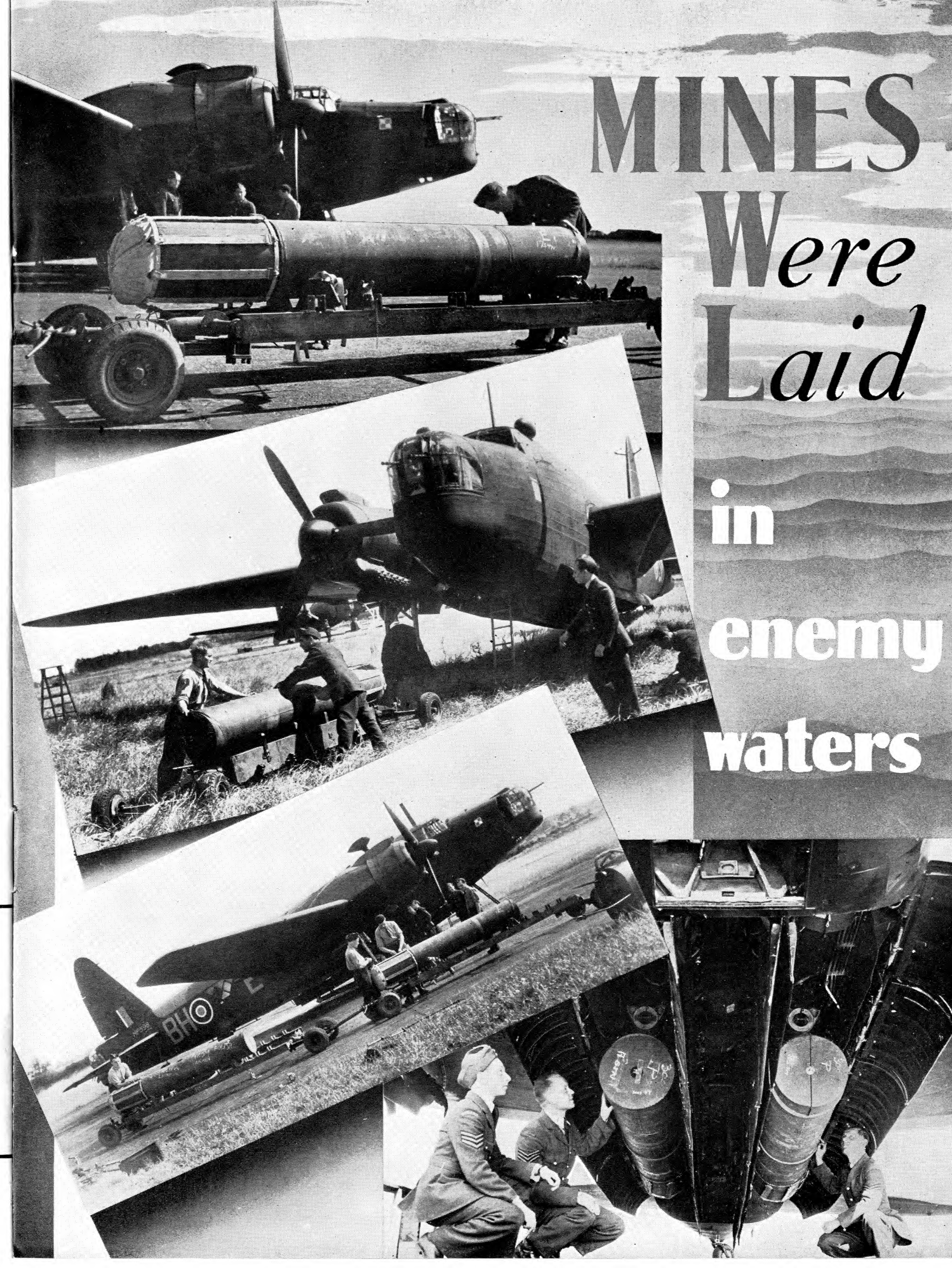
[26 GEO. 5. & 1 EDW. 8.] *Air Navigation.*

fails to comply with any provision of the Order such penalties (not exceeding a fine of twenty pounds and a further fine of five pounds for every day on which the contravention or non-compliance continues) as may be specified in the Order.

A.D. 1936 — PART I. —*cont.*

An ominous extract from Air Navigation directions.

MINES Were Laid in enemy waters



"Mines were laid in enemy waters" is a familiar phrase, and here it is illustrated. The bomber station at which these pictures were taken is made up of Polish airmen, and on the right are pictures of them loading "Wimpeys" with mines. At the top of the page is a close-up of a mine. Although the camera makes this mine seem appear practically as big as the aircraft, the third picture does give an accurate impression of the real size of the mines. The last picture shows Polish N.C.O.s making sure that everything is correct before the aircraft take off to sow the mines that are such a death-trap to enemy shipping.

THE CONSOLIDATED LIBERATOR

In production for the R.A.F., U.S.A.A.F., and Ferry Command, this long-range heavy bomber is one of the best aircraft the United States has produced. It is powered by four 1,200 h.p. Pratt & Whitney "Twin-Wasp" radial engines, has a maximum speed of 335 m.p.h. at 17,000 ft., and a cruising speed of 230 m.p.h. Service ceiling is 36,000 ft., and the maximum range is approximately 3,000 miles.

The top picture shows a Catalina fitted with wing-tip floats, which made such a good impression on the U.S. Navy. In the middle is one of the earliest of the PY series of flying-boats, the P2Y-3 with a parasol wing. At the bottom a Catalina moored in the shadow of the "Rock" being fuelled and prepared for a Mediterranean patrol.

The Catalina

by David Vine

LIKE all successful aircraft, the Catalina flying-boat is the result of gradual modification and development from an original basic design. It began fifteen years ago with the first flying-boat of the series, known as the PYI. This boat began a long succession of sucessful naval flying-boats, culminating in what is probably the most remarkable of them all, the Catalina. No other aeroplane has a better claim to be classed as one of the outstanding operational aircraft of this war than the flying-boat which shadowed the *Bismarck* and indirectly brought about its destruction. The work of the "Cat" in anti-submarine patrol and convoy defence is outstanding. It has also the greatest mileage of any operational type still in regular use. The full story of the famous Catalina, when told, will make fascinating reading.

Development

The Catalina in many ways resembles the first of the series, the PYI of 1928. It has the same parasol high monoplane wing of thick section and wide chord, and twin radial engines. The hull with its two steps has always had excellent hydrodynamic qualities. For a flying-boat must not only be easy to fly, but it must be without vices on the water, especially on choppy surfaces. Floats were fitted to all the earlier types, but fixed by complicated triangular bracings to the hull and wings. For extra lift, two intermediate types in the series, the P2Y 1 and 2, were fitted with a small wing about a third of the main wing span. This wing was attached to the hull between the wing and the fixed floats. So for a short time the PY series became a sesquiplane. This was in 1932, and was the first radical modification to the PYI. In 1933 a formation of these flying-boats made a non-stop flight of 2,040 miles in 25 hours, a remarkable performance for ten years ago. This set up a new record for seaplanes. The small wings, however, did not stay long.

But it was not until 1935 that the PY series really began to look like the Catalina of to-day. The earlier twin fins and rudders were now replaced by a single fin and rudder. The wing was supported by the faired-in structure which now houses the flight engineer. The present wing-tip floats were also fitted to this 1935 model, called the XP3Y-1. This new series made such remarkable long-distance flights that the U.S. Navy ordered a further batch with a wider specification, chiefly with a greater range and a war load of 2,000 lb.

THE CONSOLIDATED CATALINA

Power plant: Two 1,200-h.p. Pratt & Whitney "Twin-Wasp" R-1830-S3C4-G radial air-cooled engines driving Curtiss electrically-operated constant-speed reversible-pitch airscrews.

Dimensions: Span 104ft., length 65ft. 1in., height 18ft. 6ins.

Weights and Loadings: Weight empty 17,561 lbs., weight loaded 26,651 lbs., wing loading 19.11 lbs./sq.ft., power loading 12.7 lbs./h.p.

Performance: Max. speed at 10,500 ft., 190 m.p.h.; stalling speed at sea-level, 70 m.p.h. Climb to 5,000 ft., 4.5 mins.; climb to 15,000 ft., 16 mins. Service ceiling 21,900 ft. Max. range (1,750 U.S. gallons of fuel) at critical altitude 4,000 miles.

Figures from *Jane's All the World's Aircraft*, 1942.

Thus began the famous series known as the PBY series. A formation of XPBYI flying-boats of 1935 flew, non-stop, a distance of 3,443 miles, setting up a new seaplane record as well as an international distance record for all types.

Civil Version

A civil version of the PBY series, called the Guba, acted as aerial transport for the Archbold Scientific Expedition to New Guinea. After a year of survey and oceanographic work the Guba flew back to the U.S.A. via Australia, India, Africa and the South Atlantic. A glance at an Atlas will show the magnitude of this flight. The 1938 XPBY 3 and 4 flying-boats had the new 1,200 Pratt & Whitney twin-row Wasp engines and the familiar gun-blisters. In the film "Wings over the Navy" XPBY boats were used almost exclusively. Then, as a result of the British Government purchase and tests of an earlier PBY boat, the same model as the Guba, the Model 28, an order was placed in 1939 for a large number of XPBY5s for the R.A.F. This boat was later called the "Catalina," or just the "Cat." Later, the U.S. Navy also called their XPBY5s Catalinas.

Accommodation

Constructionally, the "Cat" is interesting. The long, graceful, tapering hull weds exceptional hydrodynamic with aerodynamic qualities, as can be expected from such a gradual evolution. Forward of the gun compartment, where the blisters are, is a rest-room fitted with two bunks. The 4,000-miles range of the Catalina makes these bunks essential. Forward of the rest-room is the cook's galley. Here also is a rest-bunk fitted on the port side. On the starboard side is an electric hot-plate for cooking and lockers for food and crockery. Immediately above the galley is the flight-engineer's compartment, which is inside the faired wing-support pylon. Above this compartment, in the long, wide-chord, high-lift wing of 104 feet span, are the petrol tanks, which give the Catalina its extreme range. These tanks form part of the inner cellular structure of the wing, and are called integral tanks. They are situated between the engines in the wide untapered centre section. Just ahead of the galley, and separated, as are all the other compartments, by a bulkhead, is the navigator's compartment. A large navigator's chart table is fitted, with plenty of elbow room, a necessary item on long ocean flights, which are very trying if the navigator is cramped for table space. Ahead, and a little below the cockpit, and separated from it by a roll-up canvas door, is the front-gunner/bomb-aimer's compartment. Here all the sea gear is stowed away as neatly as on a private yacht. There is also a bomb-aimer's window, shuttered to prevent damage by salt-water.

An even later version of the series is the amphibian Catalina, with a nose-wheel and main landing-wheels retracting into the hull. So now the series is fifteen years old, with almost unbelievably vast mileages to its credit, and a reputation unsurpassed on every ocean from the Arctic to the Antarctic. The debt we in Britain owe to the "Cat" will never be fully realised, but it is so vast we should never forget it.

Test Pilot

By Capt. Norman Macmillan M.C. A.F.C.

THERE are several different kinds of test pilot; all must be able to fly superlatively well, but after that the additional knowledge they need varies with the type of test flying they are called upon to carry out.

The most highly skilled test flying is undoubtedly prototype testing. The prototype test pilot has to fly new experimental aeroplanes on their first flight. He has to act as technical pilot-adviser to the designer of the aircraft during all the stages of its creation from an idea or specification until the aircraft is ready to make its first flight. Then the test pilot becomes even more important than the designer.

Specialisation

The life of most British military aeroplanes begins when an official Air Ministry specification is issued, usually to a number of aircraft firms who are accustomed to build aircraft of the type which is wanted. For example, it is customary to ask firms who make big bombers to deal with the specifications of proposed new types of big bombers. The same procedure is usually adopted with fighter and flying-boat specifications. Of course, the ideas of firms change from time to time. For instance, Supermarines were once famous for their flying-boats, but now everyone thinks of Supermarine as synonymous for Spitfire. Avros were one regarded as the specialists in training machines; now they are the parent firm of the Lancaster bomber. But such changes come slowly over a period of years, and as a rule most firms continue to make the types of aircraft for which they are famous. And as the prototype test pilots are all on the staffs of the manufacturers, these pilots become accustomed to testing a long succession of similar types of aircraft, and thus become specialists in a particular class of aircraft test work. Their long experience of experimental development is invaluable. And when they take a new aircraft into the air on its first flight they are accustomed to the finicky vagaries of new aircraft and are ready to deal with any peculiarities their new mount may display.

Engine Testing

Next on the list of aircraft test pilots are those who test prototype engines and airscrews. Theirs is not quite the same kind of job, for they do not ordinarily have to take prototype aircraft on their first flight, simply because, for engine flight research, new types of engine are usually fitted into established types of aircraft. The aeroplane is then a flying engine test room, in which the pilot is seldom troubled with the aerodynamics of the aircraft except in so far as its flying qualities may be affected by the change of power unit. But these two branches of flight research are usually separated into (1) the purely aerodynamic side and (2) the purely engine development side. The aircraft designer most wants to know the results of one set of tests; the aero-engine designer is more interested in the other; although each has a practical interest in both branches because of the dual effect upon his own endeavours.

Modification Testing

Then we come to the test pilot who is engaged upon research tests after modifications in aircraft, engines and airscrews. This is extremely important work, for upon the skill of the pilot in flying and recording accurately the results of his tests is built up the basis upon which improvements in aeroplanes become possible. All kinds of tests may be called for: ailerons with different gear ratios to be tried one against another, changes in wing design, modified windshields, new gun positions, different flaps, elevators or rudders, changes in undercarriage, variations in load and centre of gravity—all these and many other details may require to be tested in flight before an aeroplane which has been modified can be released for general flying by all pilots.

Production Testing

A fourth class of test pilot is employed in the testing of regular production aircraft. The duty of these test pilots is to fly standard aircraft coming from the factories—whether the aircraft are new, reconditioned or repaired—and by carrying out a number of prescribed tests make sure that each aircraft handles satisfactorily and that its performance is up to the required standard. In some respects the acceptance test (as it is called) is the most elementary kind of test flying, for it demands recording the flight results against a known standard performance, whereas the prototype and modification research tests are made to find out something which is not established. Nevertheless, production aircraft testing is a responsible task calling for exceptional flying ability, self-discipline for an exacting routine, and, on aerobatic types of aircraft, a steadfast quality which has the will to make the test-spin and the power-dive in cold blood in an aeroplane which has never spun or dived before.

Seaplane Testing

In a class by himself is the seaplane test pilot. The seaplane test pilot must carry out important tests on the water, for the water-borne characteristics of a seaplane are as important as its air-borne characteristics. Seaplane test pilots require considerable experience of seaplane operational flying. No landplane pilot makes a good seaplane pilot until he has had time to acquire a knowledge of the special conditions of water-borne aviation. In the air seaplanes require the same classes of testing as landplanes.

In Britain, both in peace-time and to-day in war-time, the testing of aircraft, engines and airscrews is carried out both by civil and Service test pilots. The civil pilots are mostly members of the staff of the aircraft manufacturers. Many are in the R.A.F. Reserve of Officers, but have not been called up because of the importance of their civilian test work. Several of these pilots have been killed since the war began, evidence, despite their skill, of the hazards of the work upon which they were engaged. Upon the leaders among the civil test pilots falls almost all the testing of prototype aircraft. They and their assistant test pilots carry out modification research flight tests, and schedule tests of production aircraft rolling out of the factories. Senior airline pilots carry out transport operational tests of new types of commercial aircraft.

Service test pilots are concerned with the special tests that fully equipped Service aircraft are required to pass: tests of aircraft under exact Service conditions instead of manufacturers' conditions, tests of Service equipment in the air, armament tests, trials made to find out not just that the aeroplane is all that it should be, but that it can fulfil the specific duties which it will be called upon to execute during its field service with the R.A.F., or, in the case of the R.N., with the Fleet Air Arm. To become a Service test pilot is a step in the career of the keen pilot who wants to find out all about flying, for it is an Open Sesame to the acquisition of the very specialised knowledge of analytical technical flying.

Aircraft DINGHIES

by DONALD W. SEAGER

THERE seems to be no limit to the increasing ingenuity shown in the development of aids to the rescue of airmen "down in the drink." The latest addition to the equipment already available is the parachute-lifeboat, details of which have recently been released.

The crew to whom it was dropped for the first time under emergency conditions were themselves amazed at its effectiveness.

"I've never been so frightened in my life as when this great boat came sailing down towards us in our rubber dinghy," said Flight-Sergeant James Bowman, captain of a ditched Halifax, when the crew reached land in safety.

Parachute Boats

This successful demonstration of a lifeboat dropped by parachute is likely to have far-reaching effects, not only where ditched airmen are concerned, but throughout the sphere of life-saving at sea in general. The lifeboat is carried underneath the fuselage of the rescuing aircraft, and contains two specially converted motors, dry clothing, medical supplies, food, pyrotechnics and sufficient petrol to enable a considerable distance to be covered. A portable wireless set, sails and oars are also included in the equipment of this amazing boat, and it can carry several persons in comfort.

Uncapsizable

It is necessary to take into account the speed and direction of the wind, so that the lifeboat may be dropped as near the required position as possible. The parachute attached to it opens automatically upon release, and regulates the speed of descent to that of a man descending by parachute, and, when the boat strikes the water, owing to the incorporation of special buoyancy tanks, it unerringly rights itself and remains uncapsizable.

Bearing in mind the efficiency of this device, it is interesting to consider some of the earlier lifesaving appliances whose behaviour under emergency conditions has provided so much valuable information.

Inflatable rubber boats were in existence as long ago as 1851, but they seem to have been used mainly for fishing and pleasure purposes, although there is record of their having been taken on various expeditions.

The problem of providing a separate means of escape for airmen forced to descend in the sea does not appear to have received serious attention until about 1930, when the loss of several aircraft on practice torpedo-carrying flights at a time when rigid national economy kept the R.A.F. short of aircraft focused official attention on the matter.

Inflatable dinghies had been used as tenders between flying-boats and the shore some years prior to this, but these were not intended for use in an emergency. They were triangular in shape, as this was found to give the greatest seaworthiness, weighed about 70 pounds and were equipped with rowlocks and wooden oars. A pair of foot-operated bellows was carried in the flying-boat to inflate the dinghy, which itself carried a small mouth-operated pump so that it could be topped up if necessary. It could carry a crew of five and was found most useful in transporting passengers and stores to and from the shore.

Inflation Difficulties

Trials were carried out with a dinghy of this type installed in the part of the wing immediately above the fuselage. It should be borne in mind that nearly all the aircraft at this time were biplanes. The problem of inflation presented some difficulty, particularly as the ditching of aircraft with fixed undercarriages was by no means easy and often meant that the crew were not in a fit condition to carry out the inflation themselves. Automatic inflation was made possible by a hydrostatically operated valve attached to one of the undercarriage legs and connected to a CO_2 bottle. The dinghy was covered by a special wooden panel which burst out when the dinghy commenced to inflate. The diaphragm, which was operated by the pressure of the sea-water, was so sensitive, however, that accidents occurred due to the dinghy inflating whilst the aircraft was in flight. When this setback was eventually overcome it was found that the aircraft dinghy was a definite success, and although it is true that ditchings nearly always took place within the sight of would-be rescuers, many lives were saved by its use.

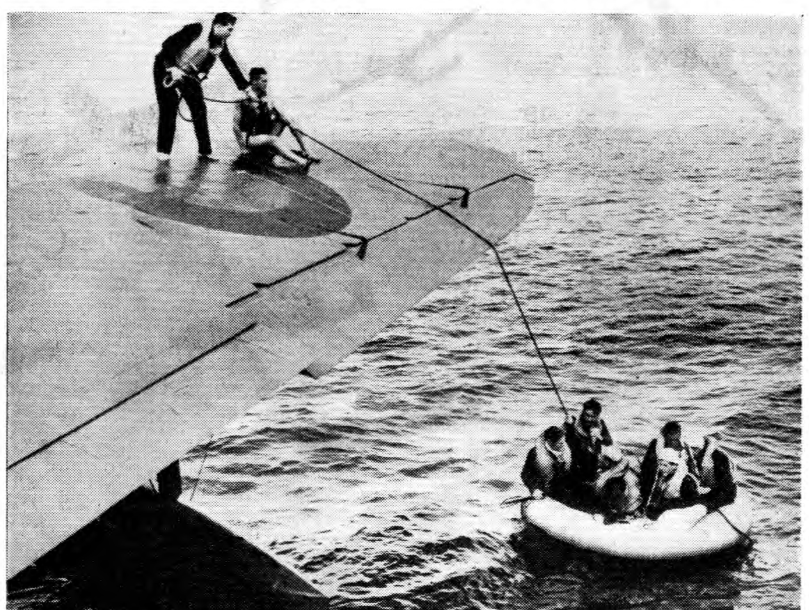
Saving the Aircraft

Attention was again directed to saving the aircraft itself. This had previously been attempted with moderate success by means of flotation bags installed in the wings. It was now argued that if the dinghy could save the crew, why could it not also support the aircraft below the surface of the water until help arrived.

The introduction of the dinghy in this new role led to a radical change in design. The shape was altered from triangular to circular, and ten shroud wires were attached at equal intervals around its circumference. These were connected to a quick release union from which a single cable led to the aircraft itself. After a successful ditching the crew took to the dinghy, which, incidentally, could be used either way up, and when the aircraft became waterlogged and sank it took up a position some ten feet below the surface. If its presence began to jeopardise the

(*Continued on page* 24)

A Coastal Command Whitley developed engine trouble and was forced down into the sea. Another Whitley sighted the crew, who had climbed into their dinghy, and reported their position. A short time later a Sunderland arrived and picked up the men.



Testing Candidates for Aircrew Duties

by **Group Captain G. R. Oliver**

WHEN candidates are being tested for flying duties the human element cannot be entirely relied upon, and certain tests have been introduced in order to aid the Selection Boards in their assessment. Failure in any of the tests does not in itself mean the rejection of a candidate.

Various tests.

The tests have been designed to indicate a candidate's general capabilities and characteristics in various directions. As will be seen, the results are of great assistance to the Selection Boards, not only in deciding whether or not a candidate is potentially good aircrew material,

Not an easy matter.

but in recommending, within broad limits, the particular category of aircrew for which he appears to be best suited. You may be interested to have a brief description of them.

What card?

In addition to the medical examination, the navigator (radio) tests—which are secret—and, of course, the interview by the Aviation Candidates' Selection Board, the tests which every candidate for aircrew duties has to undertake are as follows:

(1) General Intelligence.
(2) Mathematical Knowledge.
(3) English and General Knowledge.
(4) Pilot Aptitude.
(5) Wireless Tests.

Probe into candidate's inclinations

General Intelligence

This is a paper test, and there are several alternative papers in order to prevent "cribbing." There are alternative papers also in the mathematics and general-knowledge tests.

Each general-intelligence paper consists of twenty questions. There is nothing to write. For each question a number of answers are printed, and all the candidate has to do is to underline which he considers is the correct one. The time allowed is 15 minutes, and one mark is allowed for each correct answer. The questions are not difficult, and provided a candidate uses his common sense and does not get flurried (in itself perhaps a useful test for suitability for aircrew), he should have little difficulty with this paper.

Past history in business.

Mathematical Knowledge

This is really more a matter of calculation than mathematics, and consists of a paper of seven questions. Fifteen minutes are allowed. The maximum marks are 16, and 10 marks are regarded as satisfactory, so it will be seen that even those who have left school for some time, or are not "maths-minded," have a very good chance of scraping through. An even lower standard is accepted in certain categories.

An even lower standard is accepted.

English and General Knowledge

This is a short written test consisting of only two questions, designed to test the candidate's general knowledge and his ability to write the King's English and express himself intelligibly. The board also pays attention to handwriting. Only ten minutes are allowed for this paper, so that one might be tempted to be exceedingly brief, if it were not for the official instructions which warn candidates on this point: "Do not make your answers read like telegrams." For example, if one question was: "What do you know about King Alfred?", the answer "Cakes—Danes" would *not* score many marks. But if you give the answer, "Alfred was a ninth-century King of England who fought the invading Danes with varying success," you would get credit for knowing certain facts about him, and you would also get credit for giving the facts in a sentence of correct English.

Don't be too despondent.

Pilot Aptitude

This is a physical and mental test, and is more commonly known as the S.M.A.3 Selection Test. The cryptic initials are alleged to stand for Sensory Motor Apparatus, Mark III.

This test has been introduced to indicate a candidate's ability to co-ordinate the movements of his hands, feet and eyes. Incidentally, it has been found that such co-ordination does not necessarily depend upon intelligence. It may be lacking in persons who are otherwise entirely suitable for aircrew. So don't be *too* despondent if you do badly in this test. It may also be a comfort to know that an eminent organist whom one might suppose would be reasonably well "co-ordinated," and even reasonably intelligent, did badly in this test.

Keen to fly.

I cannot, of course, go into great descriptive detail of the apparatus, otherwise you would be making a mock-up in the back garden, and become so proficient as to spoil the delight of the medical officers, whose toy this is. It is sufficient to say that one sits very uncomfortably in a very rough replica of a pilot's seat and, by cunning manipulation of joystick and rudder-bar, frantically endeavours to keep a will-o'-the-wisp-like spot of light in the centre of a disc. To add to the fun, coloured lights keep popping up at unexpected times and places, and these have to be extinguished without delay by juggling with a lever.

Incidentally, the powers-that-be have decreed that all candidates for every type of aircrew duty must take this test; don't ask me why, unless it is that the attributes revealed, or lack of them, are valuable guides in respect of aircrew qualifications in general, and not only as regards potential pilots. Bad luck! You can't get out of this test by saying you want to be a wireless-operator/air-gunner or a flight engineer.

Wireless Tests

All candidates must take these tests also. There are three separate tests involved, consisting of: (*a*) The Morse Aptitude test, which entails candidates listening to gramophone records on which are recorded Morse-like dots and dashes; the sounds are given in pairs, and candidates have to determine which pairs are alike and which are different—by no means as simple as would appear at first. (*b*) A Directions test, which consists of a paper displaying diagrams, groups of words and other devices of an elementary nature. Instructions are then read out slowly and clearly, and what seems like a few seconds, but is probably a few minutes are given for the solution of each problem. It is all really very easy when viewed in cold blood, but one has to possess good powers of concentration and a cool head to score high marks. (*c*) A Tapping test, in which the candidates sit with headphones on their ears and a Morse transmitting key in their hands, and endeavour to follow the rhythm demonstrated by an instructor and a metronome.

"The next man asking for Bing Crosby is on a charge!"

So there you are, and don't say you haven't been warned. But remember what I said at the beginning of this article. These tests are designed purely to assist the Selection Board in arriving at a decision in each individual case. No candidate is rejected solely on the results of the tests, and they are only part of the Selection Board's means of assessing suitability (*a*) for aircrew duties at all, and (*b*) the category of aircrew for which the candidate appears most suitable.

The board, composed of human beings (and they are very human, so don't be nervous), remains very definitely the deciding factor. You *may* be such an obviously desirable type that they will pass you after quite a brief summing-up (that's what comes of being so attractive, as the old lady said when she was struck by lightning), but for the majority there will be a fairly long but sympathetic interview.

Finally, *Nil desperandum*, and up cadets and at 'em!

Risk of personal injury in games played.

Air Training Manual

(1943.) Odhams Press Ltd. 7/6. 320 pages. $8\frac{1}{2}'' \times 5\frac{1}{2}''$. Illustrated with line drawings.

Chapters by various authors on mathematics, engines, instruments, wireless, airframes, gliding and navigation, and some general information. The mathematics chapter is on refresher lines and is rather hard going for the novice. Other chapters good, but gliding chapter is rather generalised and does not deal specifically with A.T.C. methods of training.

CLOUD READINGS

(*Continued from page 9*)

cloud may have gone down to the ground, or the ground come up to the cloud.

3. When smothered in ice, don't let your first thought be to get down. You certainly will if you do.

The storm cloud seen from above at 5,000 feet. Note the little turreted heads which never seem to be visible from the ground.

4. When icing up, try to make for drier conditions; it does not matter if they are colder.
5. The smoother the sea the harder to see.
6. Snow-covered mountainsides in dull weather can look very like just another bit of sky.
7. Never try a valley in poor weather unless you are absolutely certain that you will be able to get out of it. Usually you can't be.

MORE BOOKS

Aircraft Fitters' Handbook

By A. C. Robinson. George Newnes Ltd. 124 pages. $8\frac{7}{8}'' \times 6''$. Price 7/6. (*Reviewed by Laurence Fletcher.*)

This is Vol. 28 of the Aeroplane Maintenance and Operation Series. Hydraulic equipment and exactor control are dealt with at some length, and these chapters are illustrated with some excellent line drawings.

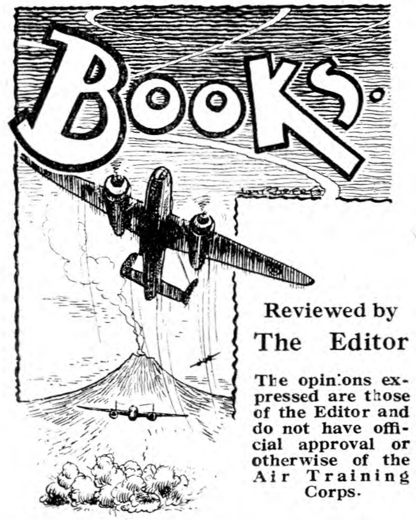
There are useful sections on the riveting of aluminium alloys and the use of rigging instruments, and a somewhat brief outline of the heat treatment of duralumin and steels.

One feels that more space should have been given to actual fitting and workshop methods than to Aircraft Terms and the glossary of same in Appendix 4, which to some extent duplicate each other, especially as the author points out in his preface that much of this latter information is of no direct concern to the fitter.

Glossary of Flying

A DICTIONARY OF AERONAUTICAL TERMS. Reprinted from *The Aeroplane Spotter*. 1/6. 128 pages. $5\frac{1}{4}'' \times 3\frac{3}{4}''$.

One hundred and twenty-eight closely packed pages of terse definitions. Well worth having.



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.

How to Become an Airman Tomorrow

(September 1943). By Alfred Kerr and Clarence Winchester. Crosby Lockwood. 3/6. 135 pages. $7\frac{1}{4}'' \times 4\frac{3}{4}''$. Illustrated.

The newcomer to the A.T.C. may find this useful. The proficient cadet will have left it behind. Contains silhouettes of 44 aircraft, chapters on aero-engines, navigation, aerodynamics, signalling and gliding, with a glossary of aeronautical terms. The statement on page 9 that a grant of one pound a year is paid to each efficient cadet may cause some complaints. It is not true. The grants are made to squadron funds, not to the individual, and are provided for the upkeep of the squadron.

Forces Pocket Book

FACTS FOR FIGHTING MEN AND WOMEN. (1943.) By P. V. Harris and D. E. Marshall. Allen & Unwin. 3/6. 103 pages. $6\frac{5}{8}'' \times 4''$. A few illustrations.

There is nothing about the Marines in this miscellaneous collection of war information, but statements like this should be told to them: "The Japanese also initiate new ideas, as witness the detachable petrol tanks on the Mitsubishi 0 fighter." The book does, however, give many useful war facts in concise form.

Worked Radio Calculations

GRADED PRACTICAL EXAMPLES. (September 1943.) By Alfred T. Witts, A.M.I.E.E. Pitman. 6/6. 126 pages. $7\frac{1}{4}'' \times 4\frac{3}{4}''$.

Assuming the reader to have some knowledge of mathematics and of radio, the author provides 302 mathematical problems likely to be met with in radio work. He provides answers and an index.

Mathematics for Pilots (5/-; 157 pages) and Physics Manual for Pilots (6/-; 229 pages).

Published by McGraw-Hill Book Co. Pages $7\frac{3}{8}'' \times 4\frac{1}{2}''$. Illustrated.

These two volumes, part of a flight preparation training series, are neatly but strongly bound to stand up to hard wear. They are carefully compiled and the explanations are clear and concise.

Air Transport and Civil Aviation Year Book 1943

Todd Publishing Co. 10/6. 159 pages. $8\frac{3}{4}'' \times 5\frac{5}{8}''$. Illustrated.

An article by Major R. H. Thornton on the future of Air Commerce and a reprint from *The Times* on Sea and Air Transport are about the best things here. There are some other reprints, an article by Lord Londonderry with 125 "I"s and some out-of-date information regarding air lines. The paper is good and could have been put to better use.

Applied D.R. Navigation

(July 1943.) By J. H. Clough-Smith, B.Sc.(Lond.). Pitmans. 6/-. 113 pages. $8\frac{3}{4}'' \times 5\frac{5}{8}''$. Diagrams.

Captain Kelly Rogers, the well-known air-line pilot, says in a foreword to this book that the author "has dealt with his subject thoroughly. . . . I recommend this book to all navigators who would improve the standard of their D.R. . . . It is among the best of its kind." The book assumes an elementary knowledge of D.R.

Manual of Gliding

By W. R. Scott. Bernards. 2/-. 48 pages. $7'' \times 4\frac{3}{8}''$. Illustrated.

Printed in small type on poor paper and written in English that is good in parts, this book is nevertheless attractive to glider enthusiasts, for in it the author, a practical designer, constructor and flier, deals thoroughly with the secrets of his craft.

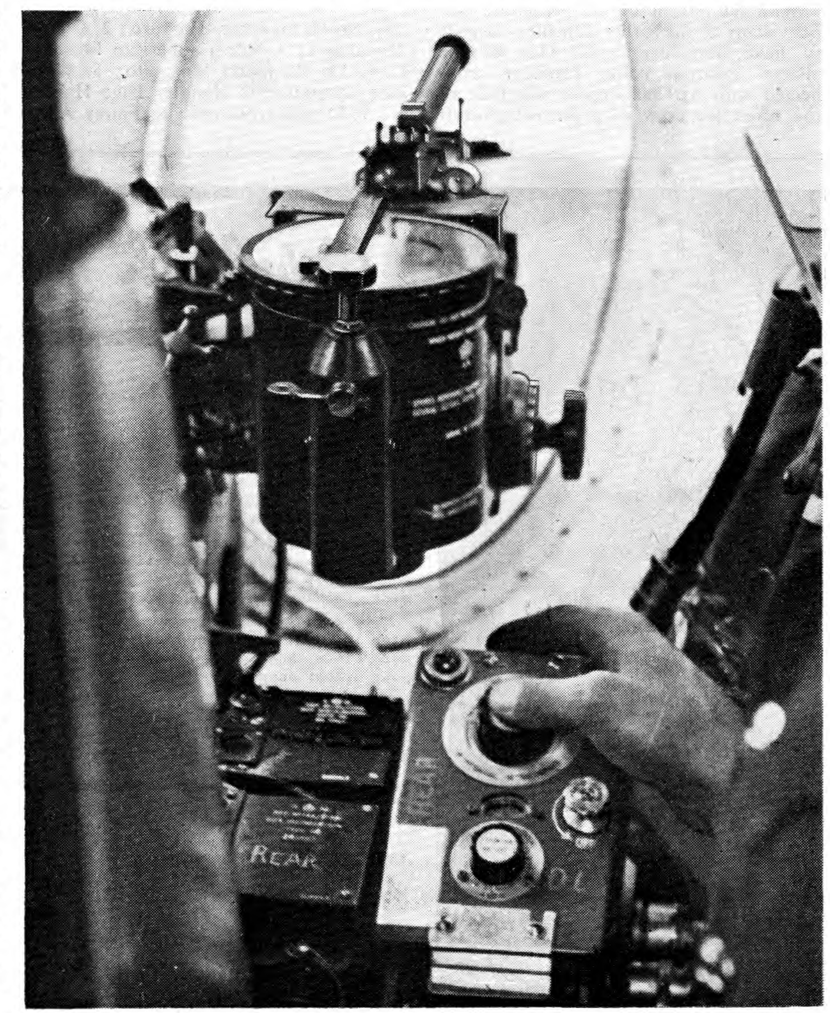
The Air Cadet's Astronome Spherical Stellar Chart

By C. J. Grimwood. Allen & Unwin. 1/6.

A "cut-out" sheet from which can be made a paper replica of the Celestial Sphere some five inches in diameter.

Provides a truer picture of the hemispherical heavenly dome than the ordinary planisphere. Rather too many stars are shown. Horizon ring is calibrated in the style of the mariner's compass.—L. R. GLEGG.

A camera of an R.A.F. Reconnaissance Unit. Photographs are taken of the target before the proposed operation and from these the details of the raid are planned. After the attack the R.A.F.'s cameramen go out again to obtain photographic evidence of the results.



Aircraft Dinghies

(*Continued from page* 20)

safety of the crew, it could readily be released by operating the quick-release gear from the dinghy.

This ingenious device, although successful, was subsequently abandoned, as it was found that after a thorough immersion in salt-water the salvaged aircraft was hardly worth the trouble of saving.

The circular shape was, however, retained, and persisted until the outbreak of war, although what little new development has been made public since then indicates that the shape of an actual boat represents the ideal.

Limited Space

Although many articles of equipment have been added to portable dinghies, there is an obvious limit to the extra space available. In the words of a well-known designer, the modern dinghy looks like a Christmas-tree, with weather covers, wireless mast, compass, rescue lines, knives and leak-stoppers included among the elaborate gear.

With the advent of the parachute lifeboat many of the earlier difficulties appear to have been overcome. One of the almost insurmountable problems connected with Air/Sea Rescue was that all too often the crew of a ditched aircraft had been well immersed in the water before they could clamber into the dinghy. This naturally increased their discomfort and added considerably to the danger of exposure.

It would seem now that the function of the aircraft dinghy in future will be to provide a temporary sanctuary until the more comfortable and roomy parachute-lifeboat can be dropped to the distressed crew.

Goldfish Club

No article on aircraft dinghies would seem complete without reference to the Goldfish Club, sponsored by a well-known firm of dinghy manufacturers, which was inaugurated this year and offers recognition in the shape of a badge and illustrated membership card to all who have been ditched and got away with it.

Membership is increasing almost daily, thanks to the high degree of efficiency to which aircraft dinghies have at last been brought.

What Goes There?

(*See page* 19)

1, North American Harvard; 2, Curtiss Tomahawk; 3, North American Mustang I; 4, De Havilland Mosquito; 5, Westland Lysander; 6, Handley Page Halifax Is; 7, Douglas Bostons; 8, Fairey Albacores; 9, Grumman Martlets; 10, Supermarine Spitfire V-B; 11, Hawker Typhoon I-B; 12, Bristol Beaufighter I; 13, Hawker Hurricane I; 14, Martin Maryland; 15, Short Sunderland; 16, Curtiss Tomahawks; 17, Lockheed Hudson.

18, Martin Mariner; 19, Consolidated Liberator; 20, Vought Sikorsky Chesapeake; 21, Fairey Fulmar; 22, Supermarine Seafire; 23, North American Mustang; 24, North American Mitchells; 25, Martin Maryland; 26, Avro Manchester; 27, Armstrong Whitworth Whitley; 28, Bristol Beaufort; 29, Airspeed Oxford I; 30, Avro Lancaster.

Camera Cuts

(*See Inside Back Cover*)

1, Republic Thunderbolt; 2, Westland Whirlwind; 3, Shirt Stirling; 4, Lockheed Hudson; 5, Consolidated Catalina; 6, De Havilland Mosquito IV; 7, Curtiss Tomahawk; 8, Miles Master I; 9, Supermarine Spitfire V-B; 10, Messerschmitt Jaguar; 11, Martin Marauder; 12, Lockheed Lightning; 13, Handley Page Halifax I; 14, North American Mitchell; 15, Hawker Typhoon I-B; 16, Boeing Fortress II; 17, Fairey Albacore; 18, Douglas Boston.

In the answers to "Goodness Only Knowses" in last month's issue, No. 4 in some copies was given as a Mosquito II instead of as a Mosquito IV.

To all Squadron Officers

Pitman's have issued many textbooks which are used and recommended by A.T.C. units, and, when some of the new books are issued, offer inspection copies to officers. If your Squadron has not seen the books, please send a note of the Squadron number and the Headquarters address. Inspection copies can then be sent.

PITMAN'S "SIMPLY EXPLAINED" SERIES

This series is universally popular! Time and again issues have been sold out almost before printing. Have you tried these easy-to-handle, cheaply-priced handbooks? There are plenty to choose from. Prices are sixpence or ninepence. Titles in the Series are:

9d.

- Air Training Mathematics
- Aero Engine Practice Simply Explained
- Aero Engine Theory Simply Explained
- Aerobatics Simply Explained
- Wireless Operating Simply Explained
- Radio Simply Explained
- The Aeroplane Simply Explained
- Your Motor Car Simply Explained
- English Simply Explained

6d.

- Air Navigation Simply Explained
- Flying Simply Explained
- Gliding and Soaring Simply Explained
- Ground Gen for Airmen and Airwomen
- Camouflage Simply Explained

PITMAN'S POCKET HANDBOOKS

R.A.F. men, A.T.C. Cadets, Ground Engineers—everybody who has come into contact with Pitman's "Simply Explained" Series will hail this series with enthusiasm. Each book is written with the minimum of technicality by the most authoritative specialists. Perhaps you have tried—and recommended—them? May we remind you of a few titles?

Practical Morse. By John Clarricoats. Presents a scientific method of learning the Morse Code. **1s. 3d.** net.

Workshop Practice Simplified. By P. W. Blandford. Of special appeal to apprentices and trainees. **1s. 3d.** net.

Basic Electricity and Magnetism. By W. C. Frid, B.Sc.(Hons.), M.R.S.T. Specially prepared for Service and pre-Service trainees. **1s. 6d.** net

Meteorology Simplified. By J. I. Fell, B.Sc. (Hons.), M.R.S.T. Covers the A.T.C. and I.T.W. syllabuses in as simple and concise a form as possible. **1s.** net.

FREE!

Please send me your free catalogue of Aeronautical Books (100 titles).

Name ....

Address ....

....

SEND THIS AT ONCE TO
PITMAN'S 39 PARKER STREET KINGSWAY, W.C.2

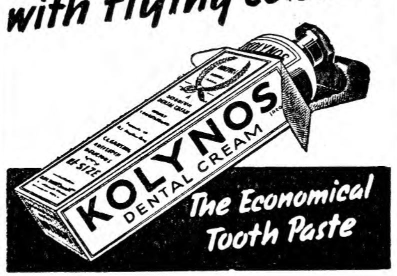
11/43

by KOLYNOS! of course

Months ago when the Flight-Lieutenant's 'wings' were only just beginning to sprout he started using Kolynos. "Amazing stuff," he tells his friends, "It doesn't just clean your teeth, it's got a real 'kick' in it and bucks you up no end when you're feeling all-in." That, of course, is due to the wonderful refreshing properties of Kolynos, the tooth paste which is quite different from any you've ever used. Try it and prove it for yourself.

From Chemists, Stores and N.A.A.F.I. in standard sizes.

Sound Teeth will help you to pass your 'medicals' with flying colours!



M·O·R·S·E

Complete Practice Unit for A·T·C· Cadets etc.

As supplied to other branches of H.M. Services

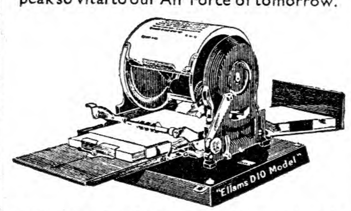
No. 1261. Complete Key and Buzzer Unit, ready for immediate operation. Heavy commercial key with nickel silver contacts and sensitive triple adjustment. High-tone Buzzer with silver contacts, mounted on bakelite base with cover. Battery Holder, complete with 4.5 Ever Ready battery. All metal parts heavily nickel plated. Polished Mahogany Base, 6¾" x 6¼" **29/6** Post free

Send 1d. stamp for Illustrated List

SIGNALLING EQUIPMENT LTD
Specialists in Morse Equipment
(Dept. 6) Merit Hse., Southgate Rd., Potters Bar

Training Cadets -

involves a colossal amount of work, a large proportion of which, has to be duplicated. An Ellams Duplicator is an absolute necessity if time, labour and money are to be saved and efficiency kept at the high peak so vital to our Air Force of tomorrow.



From one hand or typewritten original an Ellams duplicator will run off perfect copies of any Form, Letter, Document, etc., and can be relied upon to give long service and satisfaction.
WRITE FOR FULL PARTICULARS

Ellams British Duplicators

ELLAMS DUPLICATOR CO., LTD.
Astor House, Aldwych, W.C.2 (Holborn 5365)
Bushey Hall Rd., Bushey, Herts (Wat. 4221/4)
Makers of British Duplicating Equipment 50 years

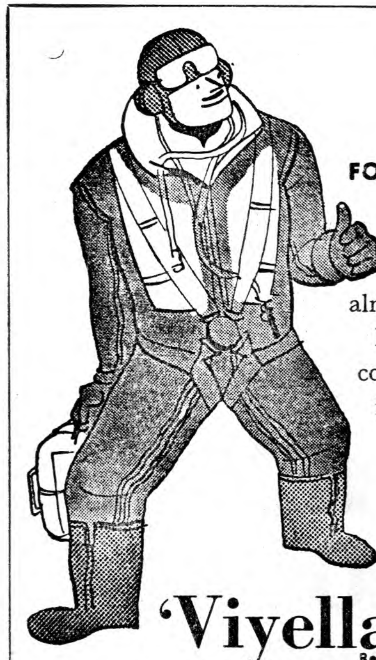
"R.P. PUBLICATIONS"

We have a comprehensive range of publications of interest to A.T.C. Cadets, particularly in regard to the identification of aircraft as shown in our **"Warplanes"** series in which there are now seven different booklets (price 1/3 and 1/6).

Owing to restriction of advertising space, we are not able to give a full list of our publications, but a folder describing them will be sent on request.

We also list over 2,500 photographs of Aeroplanes. Send 1/- for a copy of our new List 18W and specimen aeroplane photo.

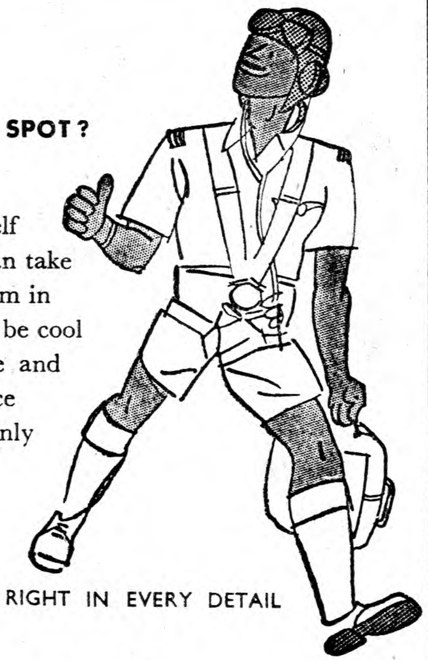
REAL PHOTOGRAPHS CO., LTD.,
Victoria House, Southport, Lancs.



DETAILED

FOR A COLD SPOT—OR A HOT SPOT?

An airman suddenly finds himself almost anywhere, nowadays! He can take his 'Viyella' Service shirts with him in comfortable certainly that they will be cool in heat, warm in cold, washable and hard-wearing under all Service conditions. These goods can only be supplied to members of H.M. Services.



'Viyella' Regd. SERVICE SHIRTS RIGHT IN EVERY DETAIL

REGISTERED — WILLIAM HOLLINS & CO. LTD. DAY & NIGHT WEAR VIYELLA HOUSE, NOTTINGHAM — TRADE MARK

A.12a

Victor Silvester

and his Ballroom Orchestra

Take it from There; The 'Request' Waltz	FB 2961
In the blue of Evening; With all my Heart	FB 2962

Victor Silvester's Strings for Dancing

Valse des Fleurs; La Cumparsita	FB 2959

CARROLL GIBBONS
and the Savoy Hotel Orpheans

If you Please; I don't want anybody at All	FB 2958

FELIX MENDELSSOHN
and his Hawaiian Serenaders

Roses of Picardy / Chez Moi	FB 2957

ALBERT SANDLER TRIO

On wings of Song. *Mendelssohn* / Demande et Reponse. *Coleridge-Taylor*	DB 2122

FODEN'S MOTOR WORKS BAND
Conducted by Fred Mortimer

Lohengrin — Prelude (Act 3). *Wagner* / Military Polonaise. *Chopin*	FB 2956

ROBB WILTON

The Home Guard — Comedy Sketch	FB 2960

BING CROSBY

You're beautiful tonight, my Dear / You're still in my Heart	DB 2123

FUTURE SUPPLIES! Your future record supplies depend upon *you*. Take your old records *now* to your Record Dealer.

The Finest Name on Record

THE COLUMBIA GRAPHOPHONE COMPANY LIMITED, HAYES, MIDDLESEX

COLUMBIA

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.

Camera Cuts

For KEY *see* PAGE 24