AIR TRAINING CORPS GAZETTE

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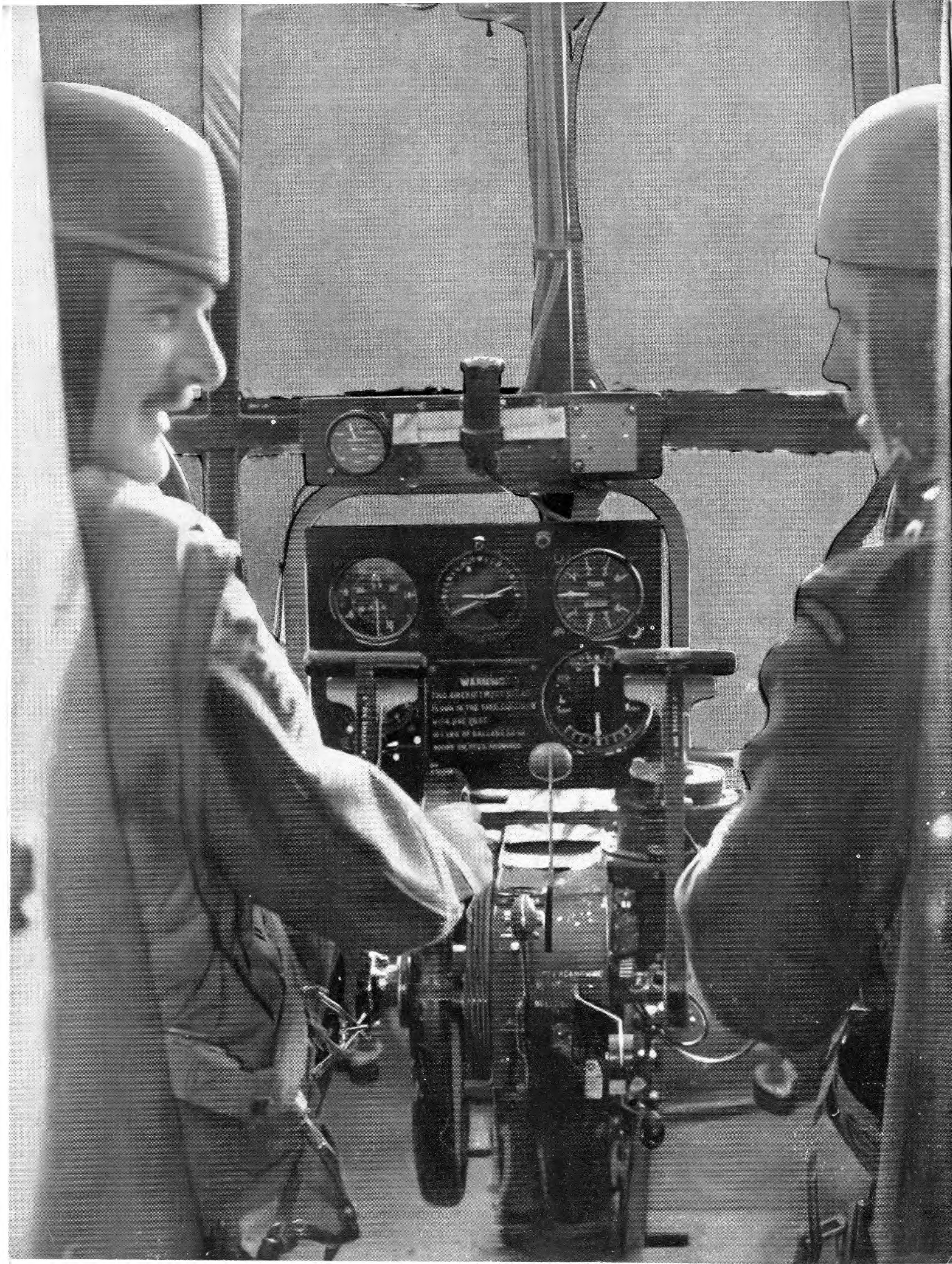

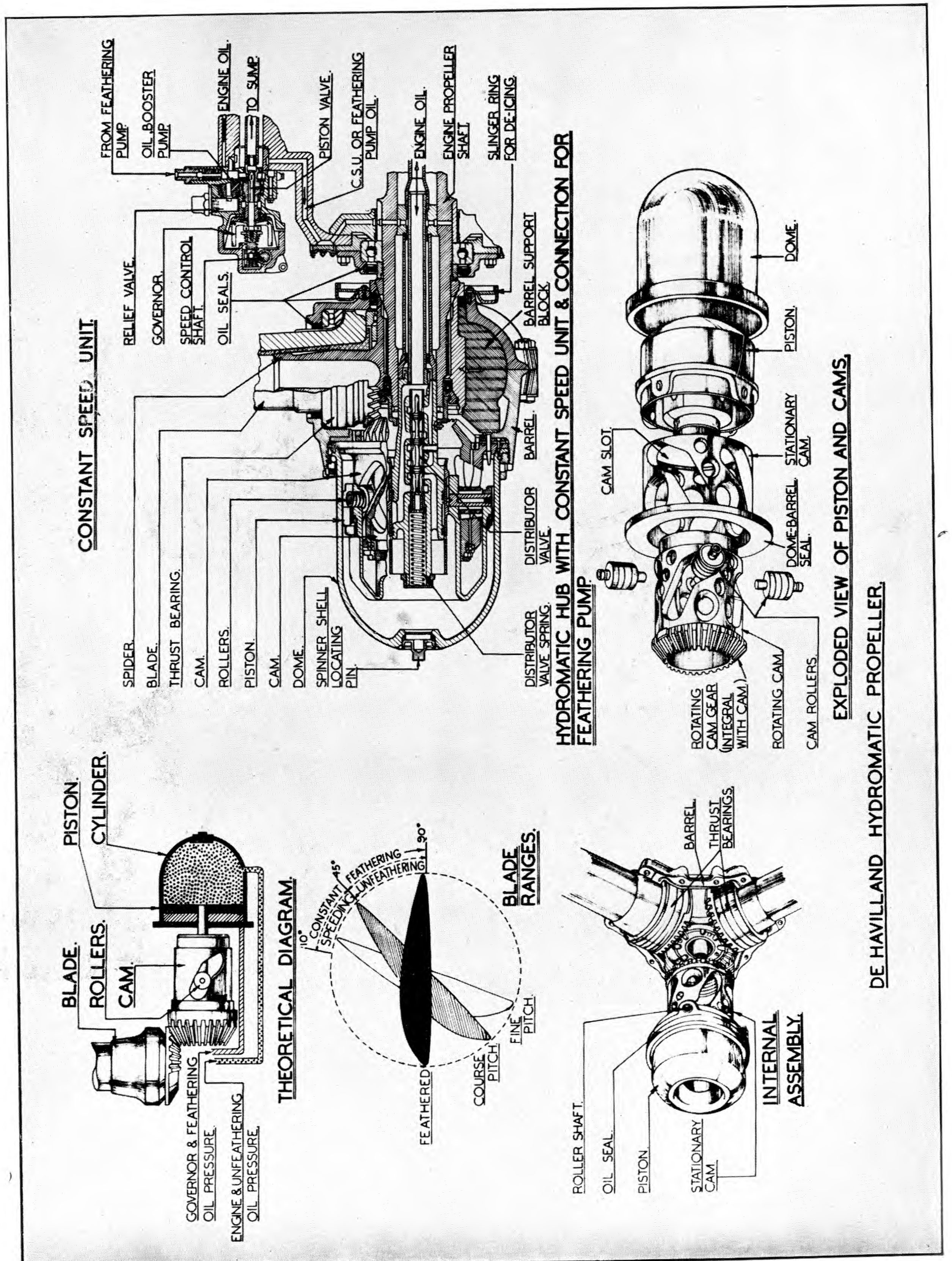

AIR TRAINING CORPS GAZETTE

VOL. III NO. 12 **DECEMBER 1943**

Edited by Leonard Taylor

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The A.T.C. in Peace

IN recent months I have received many suggestions from various quarters about the future of the Air Training Corps. I think, therefore, that it might be of interest if I summarised these proposals, so that you can see the lines upon which many people in various parts of the country interested in A.T.C. activities are thinking.

Thanks to the Royal Air Force

During 1943 the Air Training Corps have, in ever-increasing numbers, been the guests of the Royal Air Force. Thousands of cadets have spent happy and instructive weeks at R.A.F. stations, and officers and airmen have in the midst of their arduous war duties, found time to entertain and instruct cadets during their week-end visits to R.A.F. stations. The officers and Cadets of the Air Training Corps wish to express their gratitude for all the assistance given to them. The inspiration and instruction derived from these visits will be repaid in a renewed effort by the Corps to be of service to the Royal Air Force.

Every one considers that the Air Training Corps should continue after the war. The great majority also consider that the Corps should be a separate entity, having its own local headquarters and closely identified with the Royal Air Force. It is thought that machinery should remain in existence as at present for close co-operation with other voluntary youth organisations, and in view of the new Bill on education that there should be the closest possible co-operation with the Board of Education and local education authorities.

It is pointed out that the Royal Air Force was formed in the last war to meet the needs of modern war. Its formation and continuance have been a decisive factor in our still being in existence as a nation. Now that the air age is with us the same position, it is suggested to me, might equally apply in the future to the Air Training Corps, which, like the Royal Air Force in the last war, was formed in this war to meet special war-time needs.

It is pointed out, however, that the development of the Air Training Corps on a nation-wide scale and the increasingly important contribution it is making to the national war effort clearly indicate that such an organisation is necessary in the post-war world. For just as in war the Corps brought up to the required standards for air service many young men who would otherwise have failed to reach those standards, so will the same requirement be necessary if Britain is to play her part in the air age which is now with us.

It is stressed to me that an organisation is required to provide young men fit and worthy to enter the flying services. There will be full-time employment of various kinds in civil and military flying for young men with enthusiasm for the air.

The post-war Training Corps is just the kind of organisation to provide an appropriate channel of entry for those Services.

Many also point out to me that besides giving preliminary training to young men intending to make the air their profession, the Air Training Corps can provide valuable help to those who, whilst intending to follow other callings, desire to fit themselves for service with the reserve Air Forces, where after further training they will be ready and available in case of any national emergency.

Many industrialists have pointed out to me how valuable the Air Training Corps is in developing the mental and physical fitness of its members and in fostering in them individual qualities such as self-reliance, a sense of duty and personal service which are just as essential in peace as in war in the various activities which make up our national life.

Many have expressed the hope that the Air Training Corps will provide that opportunity for our young men to carry out some of their training in various parts of the Empire and that Air Cadets in our Dominions and Colonies may make similar visits over here. In this way it is hoped the Air Training Corps may be able to play an important part in furthering the unity of Empire.

W. W. Wakefield

DIRECTOR, AIR TRAINING CORPS

ADVANCED SOARING

by "Stringbag"

ABOVE Dunstable Downs, on an early-summer day, thirteen sailplanes beat along the ridge from Whipsnade Zoo to Totternhoe. They were like yachts jockeying for position at the start of a race.

But now and again one of the sailplanes would fly out from the crest of the down, pass over the hamlet of Totternhoe, crab sideways over the ploughed fields behind the hangar, and then make a quick rush back to the crest of the hill. It would clear this by the barest of margins, and then laboriously climb aloft again on the wings of the ridge currents. If you watched this particular sailplane you would see that it would make another exploratory voyage over the valley as soon as it had won back six or seven hundred feet. The next time, perhaps, it would stop suddenly in its circuit, and begin to make tight turns as it drifted with the wind. Instead of sinking steadily it would begin to climb away and the wind would bring it gradually back over the ridge. But now the ridge had no interest for it. The circles continued and the wind carried it back and back over the down, over Kensworth, across the London Road, and on towards Luton. And climbing all the time, it would gradually become a speck, to be absorbed in the folds of one of the great cumulus clouds which were continually drifting across the sky. Another pilot had said good-bye to Dunstable.

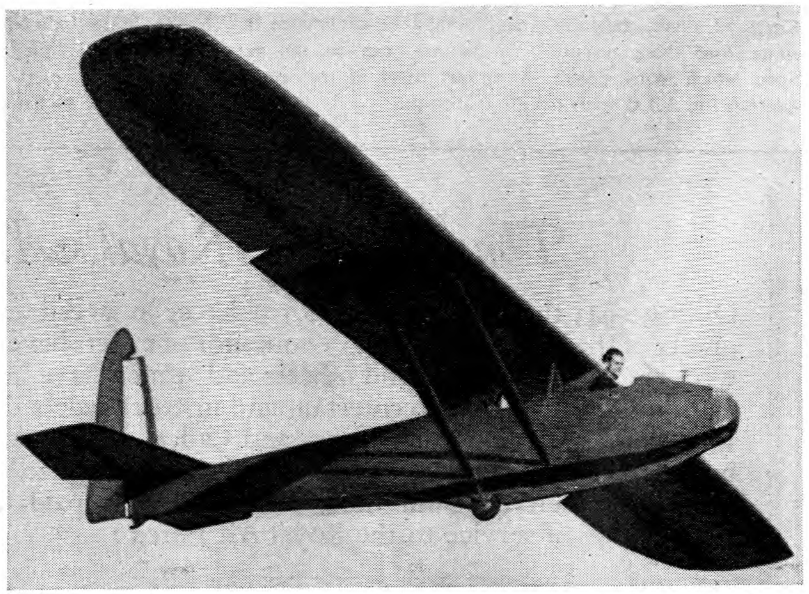
What had happened? Somewhere down below a bubble of warm air had broken away from the ground. It had been detected by the pilot, first of all by passing from smooth to rough air, and then by his variometer, a super-sensitive instrument recording the rate of climb or descent from six inches per second. At the moment when the thermal was picked up it was probably not more than two hundred yards in diameter, and to keep inside it the tightest possible turns had been necessary. At this stage the bubble was probably rising at five feet a second, leaving him with a net gain of two feet per second after deducting his natural rate of sink of three feet per second. Another 1,000 feet higher up the sailplane was climbing much faster. The thermal had accelerated to 15 feet per second, and the aircraft was therefore gaining height at 12 feet per second, or more than 700 feet per minute.

The use of such thermals is the first lesson in advanced soaring which the pilot must learn. To him they are the links between his home ridge and the clouds.

The hunting down of a thermal is a matter of experience coupled with a correct interpretation of a weather report. Generally speaking, the thermals are stronger in summer than in winter. A patch of ploughed ground, a wood, or the roofs of a village will warm up in the morning sunshine more rapidly than the surrounding country. As soon as the hot air accumulates in sufficient quantities it will break away like a great soap bubble, and rising heavenwards will eventually form a little cumulus cloud at its dew point. I have climbed from 200 feet over a ploughed field to 4,000 feet circling continuously inside such a bubble. The pilot of a service aircraft crashing through a thermal at 300 miles an hour will feel it only as a savage bump. The sailplane pilot will find it to consist of a patch of restless, unstable air, with nothing which is violent about it.

In July 1939 a friend of mine was waiting 800 feet above the Dunstable ridge for the approach of a great cumulus cloud in which he hoped to break the British height record. Between him and the cloud front was a gap of five or six miles which it was first necessary to bridge. The feat was accomplished by means of a gentle thermal, such as one of those I have described. It took him up at three feet per second to 3,500 feet, and with this height in hand he set off for the big stuff.

As the wall of cloud ahead got nearer, it grew in size and blackness, and he battered his way through an area of down-current into a gloom enhanced by contrast with the brilliant sunshine he had left. Flying under the blackest patch of all, he struck lift at eight feet per second, and then as he entered the dark folds of the front the needle of the climb indicator moved right across the dial and jammed at 20 feet per second. Still circling, flying on his instruments, he was now climbing at more than 2,000 feet per minute—a rate of climb which would have done credit to a Hurricane. In seven and a half minutes the altimeter was reading 10,000 feet. The cloud was still as thick as ever, turbulent and dark. There was risk of the sailplane being caught in the fountain of air which is believed to turn outwards and downwards with extreme violence at the head of such a thunder-type of cloud. It was, however, not until he had reached 15,000 feet that increasing roughness of the air warned him of the danger point. Centralising all controls, he thereupon flew on a steady course, and struggling through torrents of wild air shot out of the side of the cloud into dazzling sunshine. Ribbons of ice festooned the leading edge of his wings. Every little protuberance was encrusted like a Christmas-tree. He had, however, broken the height record and had made one of the finest flights ever recorded by a sailplane.



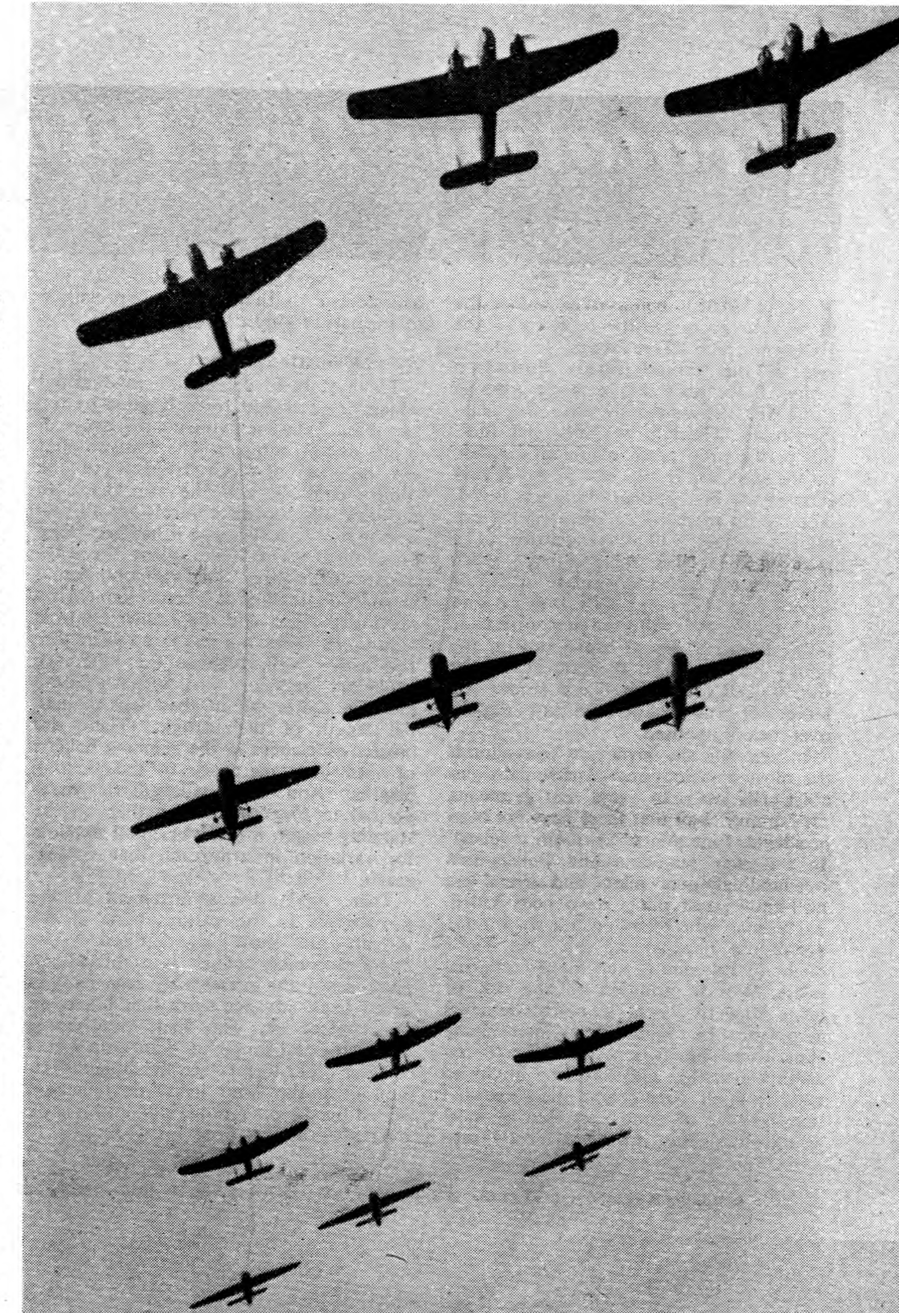
A home-made glider built by Flight-Sergt. Jack Munn, R.A.A.F., of Wagga Wagga, New South Wales, on a trial flight at Matraville, Sydney, Australia.

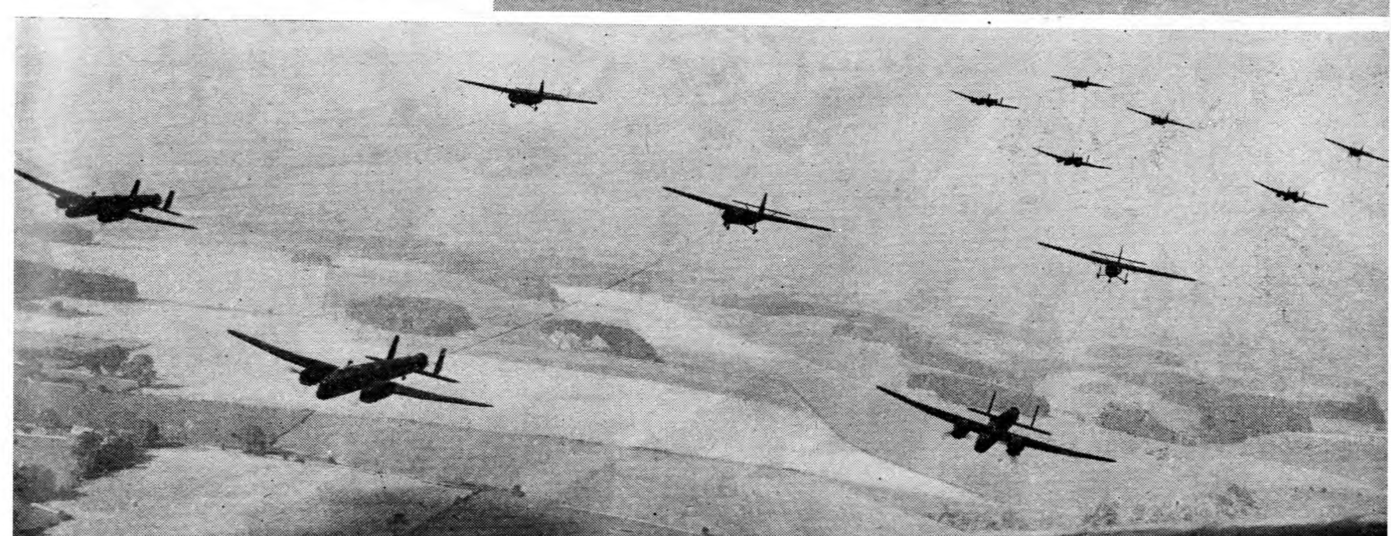
Military Gliding

Gliding as practised in the Army has little resemblance to free gliding or soaring. It is, in fact, a form of power flying, except for the brief period when the tow-rope is released preparatory to the landing of the glider, though the power is supplied by tow-rope instead of directly by engine. Pilots are first trained in powered aircraft and then go on to the lighter types of glider before operating the Horsas shown in these pictures. Whitley Vs and other large aircraft are used for towing. Most of the pilots come from the ranks of the Army. These two pictures show Whitley Vs towing Horsa gliders. The front-cover picture is a Horsa coming in to land. The picture on the back cover gives an idea of the layout of the controls of a Horsa.

Glider and tug are both equipped with radio, and the cable can be released by either.

Towed gliding is thought by some experts to have commercial possibilities after the war, especially for freight, rather as strings of barges are towed in inland and coastal waters. It is possible that passengers will prefer powered aircraft. Towed gliding might have some attractions as a sport. A string of soaring planes could be towed to a fairly good height and then released, the glider pilots competing to remain airborne for the longest possible time or to cover the greatest distance in a straight line.





Prototype Test Pilots

By CAPTAIN NORMAN MACMILLAN, M.C. A.F.C.

I REMEMBER being asked before the war to go to see the *première* of the Hollywood film "Test Pilot." It featured one of the earliest Flying Fortresses, which have since made a resounding name for themselves by their fine daylight raids. The film was very well done, but perhaps too much emphasis was laid on the risks run by the test pilot. A shot showed the first Fort crashing—as it did. A build-up in the story pictured the test pilot wrestling with the controls at a great altitude when the sandbags which had been put into the fuselage in lieu of service load began to shift forward and send the aircraft into an uncontrollable dive. Glycerine sweat broke out on the pilot's forehead. To the critical eye the shot looked too much like a studio setpiece. It was a fine film just slightly over-melodramatised.

In real life the prototype test pilot is the most unmelodramatic person imaginable. His job is to avoid, not to create, melodrama. Not that there have not been accidents. Fine pilots have been involved. In this war Staniland and Baker, two outstandingly good pilots, and several less well-known test pilots have been killed.

The man who takes on test work must accept the risks of the job. He is—or ought to be—one of the highest salaried pilots. For in addition to the risk of being first to fly in a newly designed aeroplane, he must have long flying experience, should be a technician of no small knowledge, and have the ability to make himself coherent to the somewhat unusual type of mind possessed by most aircraft designers, who are mostly men accustomed to thinking in a specialised mathematical kind of way.

Standardisation

To-day lots of details are standardised which formerly had to be decided by the test pilot. Take the flying-control arrangements as an example. The seat the pilot sits in, the leg-reach from it to the rudder controls, and the arm reach to the stick and throttle controls are all predetermined now, because it has been long established what the best average measurements are. The variation found in individual pilots is accommodated by making the seat and the rudder controls adjustable. Why not the arm-reach, too, you ask? Well, because the difference in height between most men is found more in the length of their legs than in the length of their trunk. There are greater differences in the standing heights of men than there are in their sitting heights. And as arm-length is more normal to the trunk-length than to the standing height, it is less essential to allow for variation in arm-reach than in leg-reach.

Then, again, the arrangement of the instruments in the various parts of the aircraft are more standardised. The flying-instrument panel is standardised. Here again the present-day test pilot is saved from advance work that fell upon his predecessor, who had to discover what the all-round best arrangements were in order to produce the standardisation of to-day, and have his judgment vetted by the operational pilots who took over after he had done his work.

The prototype test pilot has to think not merely of himself and of his personal preferences in aircraft (for every pilot and every designer does express his individuality in an aeroplane). The prototype pilot has to think of the aircraft as a flying vehicle for the average pilot. Are the controls right for the average individual? Is the aircraft stable enough for the average kind of work the aircraft will be called upon to do? Are the controls too heavy or too light to operate? Are they over-sensitive or sluggish in response? Do the controls harmonise? Are the engine and airscrew controls conveniently placed in relation to the air controls?

How does the aeroplane itself handle? Is the view the best that can be obtained? How does it react to movements of the air controls—of the stick fore and aft, of the stick sideways, of the rudder? Does it pitch, yaw, or hang in the wing-dip? Is there any vibration anywhere?—if so, does it come from the engines and airscrews, or from the air controls? The test pilot must find its source of origin. Is there any suggestion of aileron flutter or of wing-tip torsion? Does the elevator freeze too solid at high speed? Is the rudder powerful enough at slow speed? Is there aileron control at the stall? Is the response of the engine to movement of the throttle control smooth and progressive, or does it all occur in a short movement of the control, with a dead patch of movement where nothing happens?

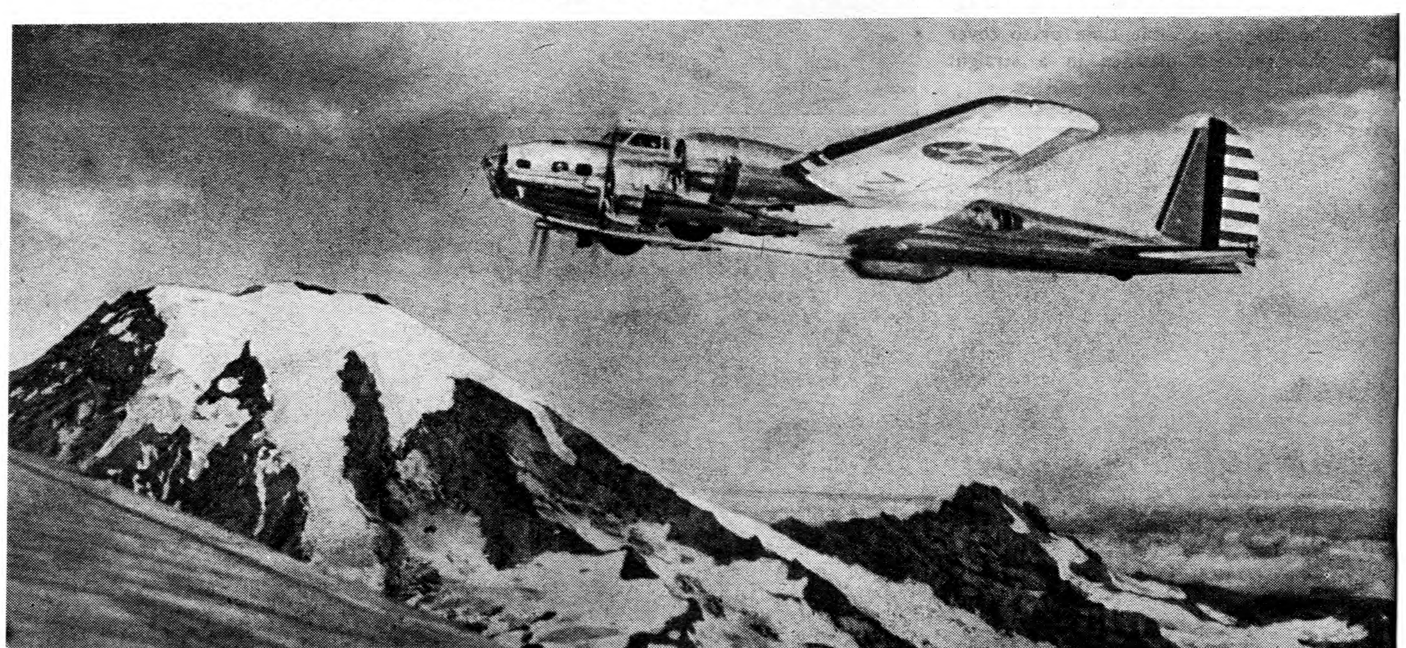
These are all handling tests which the prototype test pilot must conduct and to which his own flying knowledge and sensitivity must react as a barometer.

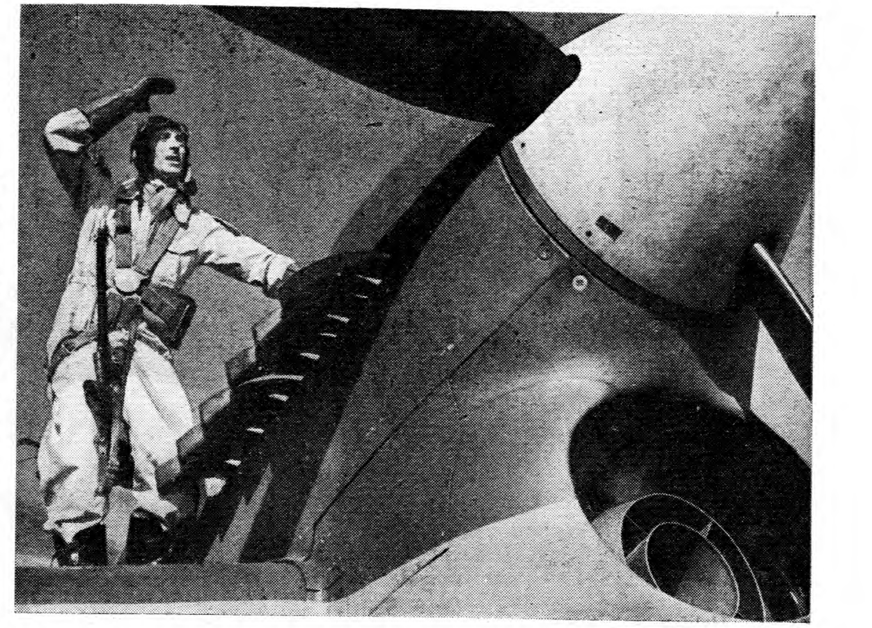
Ground Test

To reach this stage of his work he does not just get into the cockpit and take the aircraft up straight away, as you would take up your accustomed fighter or bomber or flying-boat that you are flying every day. The process of establishing that the aeroplane is as it should be, or of finding out that something is wrong is carried out with meticulous care. There are specialist inspectors who must pass the aircraft before the test pilot takes over. And then the pilot must satisfy himself that everything is as he wants it to be. He must assure himself that the aircraft handles satisfactorily on the ground before it takes the air. The undercarriage must function smoothly while taxying, the tail or nose wheel must be stable. The view from the cockpit for taxying is important, and must be checked and reported on. The smooth functioning of throttle controls is as important while taxying as in flight. The effect of the air controls can be "felt" while taxying at high speed. Any abnormal tendency of the aircraft to ground-loop or ground-spin must be sought and cured. The efficiency of the brakes must be tested. The aircraft must be loaded correctly for normal centre of gravity, and the effect of this—or alternative settings—on the handling of the elevator noted while accelerating over the surface.

All these details must be tested before the aircraft takes the air. Indeed, the initial stages of an aircraft's life, before she makes her first flight, are among the most onerous in the work of a test pilot. Through them his experience should enable him to outwit by anticipation the risk of catastrophe in the air.

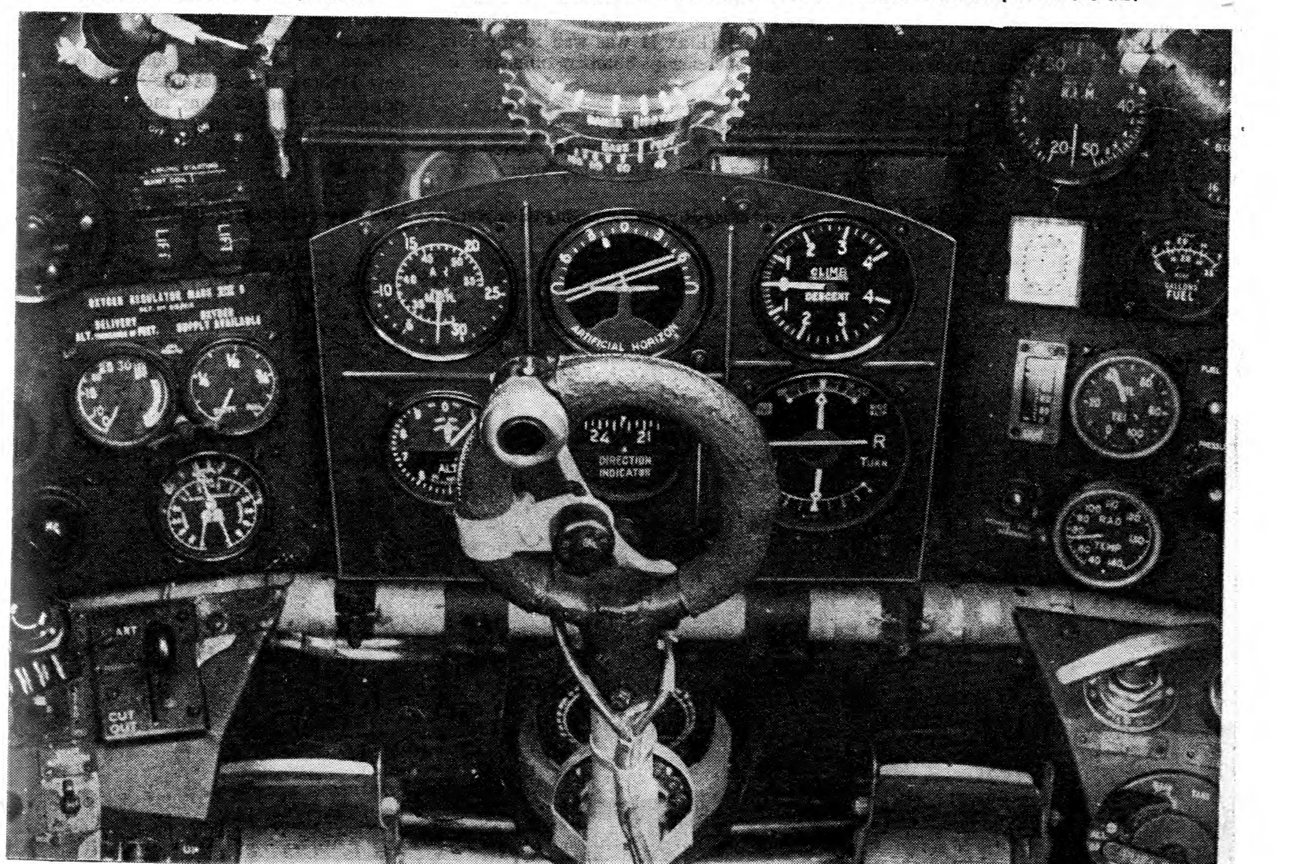
A Boeing B-17C Fortress I of the U.S. Army Air Corps flying over 14,408-ft. Mt. Rainier in the State of Washington, U.S.A.





Ralph Munday, who with Philip Lucas, Hawker's chief test pilot, flew numerous modification tests of the Typhoon, before it went into full production for the R.A.F.

Instrument panel of the Typhoon.



The Halifax

by DAVID VINE

THE Halifax was first used against the enemy in the spring of 1941. It was christened by Lady Halifax in September of that year. Since then it has undergone many changes, though the basic design has not been altered. War conditions demand many contradictory things: altitude and bomb load; a big fuel load and heavy defensive armament; many gadgets and yet a streamlined exterior. The changes that have taken place in the Halifax illustrate this perfectly.

The Halifax I of 1941 was an excellent aircraft with a good range, bomb load, speed and altitude. But as the enemy defences improved so the heavy bomber became more vulnerable, especially to nightfighters. So in 1942 we find a two-gun turret fitted on top of the Halifax II. It could be expected that such a change would have an adverse effect on the performance of the Halifax: extra drag from the turret might reduce its speed; extra weight of turret, guns and ammunition would affect altitude and range (fuel) or bomb load. Despite these handicaps the Halifax II was well to the fore of our increasing bomber offensive of 1942.

Four-Gun Armament

But the enemy's defences were ever improving and demanding more from our aircraft, so the big upper turret had to go, and with it went the front turret, and for a time the Halifax II, series I, went about the German night skies with a faired nose and no front or upper armament and only four guns in the rear. But the gain in all-round performance was evidently worth this temporary vulnerability. Speed and altitude were improved, and they are as vital to defence as guns.

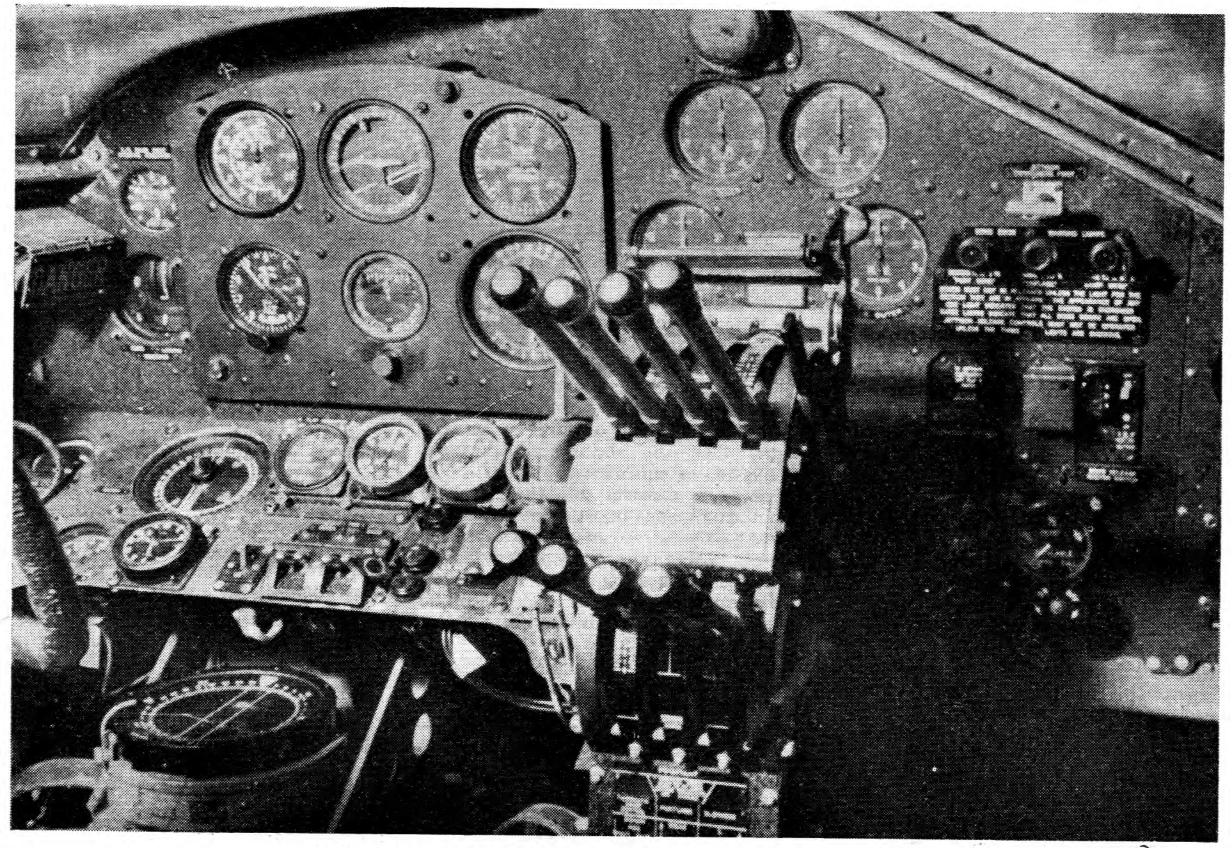
Then, a few months ago, came the new Halifax II—series IA—with a nose not unlike those of many modern medium bombers; the Marauder and the Boston, for instance. Other changes were more powerful engines (Merlin 22s), with a cleaner cowling and exhausts; a lowered astro dome; no wireless masts; and extended nacelles for the inboard engines. The latest Halifax is without the extended nacelles. The fuel-jettison pipes were removed and a new four-gun upper turret was fitted. There was more effective sealing of all spaces between bomb doors, cowlings and hatches. The tail wheel, too, was partly retracted. The drastic alteration of the nose probably increased the "keel" surface and changed the original longitudinal trim, so demanding an increased fin area to offset it.

Merlin Improvement

Such modifications are the technical growth of aviation and are not a criticism, but a proof of the excellence of any basic design. All the finest aeroplanes to-day are the result of constant modification. The most notable of all is the engine which powers the Halifax, the Merlin. Who would dare criticise that masterpiece, and yet who could keep pace with its endless modifications and improvements?

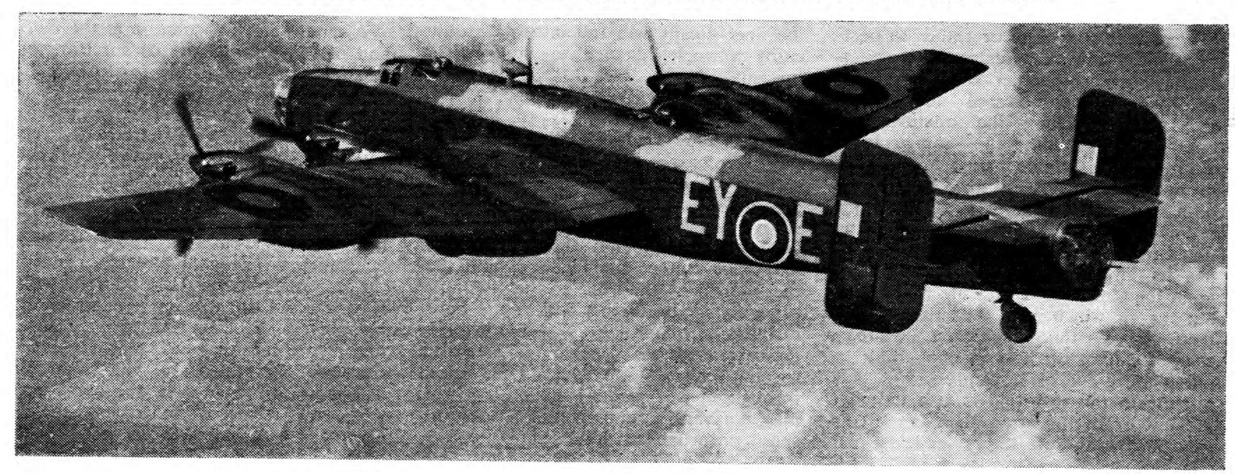
So the Halifax I, modified to the Halifax II, series IA, now carries our bomber offensive safer, surer and deeper into Germany—a tribute to the excellence of its basic design.

A Halifax II, series I, with a streamlined and cleaned-up nose, having its engines run over after returning from a raid.



Halifax display. The instruments and controls in the Halifax cockpit.

Halifax II, series IA in flight. Note the re-designed nose, dorsal gun-turret and increased fin area.



Automatic Boost Controls

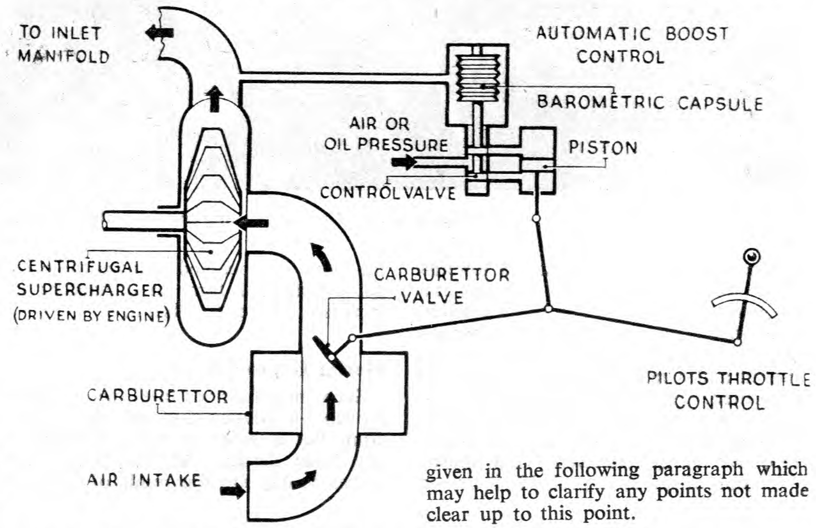
by J. A. KYD

BEFORE embarking upon a description of the function and operation of the automatic boost control, it may be wise to have a brief word on what boost really is and how it affects the running of the engine.

On a normal unsupercharged internal combustion engine, such as one might find in a motor-cycle, a motor-car or a light aircraft, the mixture which causes the explosion and pushes the piston down the cylinder is "sucked," as air, in at the air intake and through the carburettor, where the petrol is added, thus making a combustible mixture which enters the induction manifold; it is then sucked into whichever cylinder has its inlet valve open. This sucking effect is, of course, caused by the downward stroke of the piston in the cylinder. Now, as is well known, what really takes place is that the atmosphere outside *pushes* the air in at the intake, through the carburettor and into the induction manifold as soon as the pressure in the cylinder is decreased below atmospheric by the downward movement of the piston, but to get it quite clear in one's mind it is a good idea to look upon the mixture as being "sucked" into an unsupercharged (or normally aspirated) engine.

Atmospheric Pressure

Unsupercharged engines are, therefore, dependent upon the atmospheric pressure to get the mixture into the cylinders, and, since the atmospheric pressure drops with increase in height, there comes a time when the atmosphere has not enough pressure to push sufficient mixture into the cylinders; the aircraft cannot then climb any higher for want of power. To overcome this trouble, or rather to postpone it until a greater altitude is reached, a supercharger is usually fitted to modern high-powered aero-engines that keeps pushing the mixture into the cylinders with the same force although the atmospheric pressure is dropping. Therefore it may be possible on a supercharged engine to get the same power output at 15,000 feet as was being obtained at sea-level (a supercharger, too, has its limitations, for it is dependent upon the atmospheric pressure for supplying the air which is in the mixture, and there comes a time when even the supercharger cannot get hold of enough air to pump up to the sea-level pressure). This mixture in the manifold is at a different pressure from the atmosphere almost as soon as the aircraft leaves sea-level, and the difference will increase as height is gained—not through the pressure in the manifold increasing, but due to the atmospheric pressure decreasing. On modern high-powered aero-engines the pressure in the manifold at sea-level is actually higher than the atmospheric pressure, thanks to the supercharger, but it is not necessary to consider this when thinking about automatic boost controls, as it would only serve to complicate the matter. There are many other factors which have a bearing on the subject, but if the foregoing notes on boost are borne in mind and the following facts about automatic boost controls are understood the finer details will fall into place quite easily when a chance to study them presents itself.



Maintaining Boost

It was shown earlier in this article how the supercharger keeps constant, up to a certain height, the pressure of the explosive mixture in the inlet manifold. Above this height there is just not sufficient air to maintain the pressure. It may have crossed the reader's mind that the more air there is to go into the supercharger the higher will be the boost in the inlet manifolds. This is obviously the case, since the supercharger is driven by the engine, and the engine speed throughout a climb to, say, 15,000 feet, may not vary, assuming that a constant-speed propeller is being used. Therefore, if the supercharger is going to deliver the same boost at 15,000 feet as it did at 1,000 feet, where it had much more air to call upon, some means of control must be used to keep the pressure in the inlet manifold down to safe limits at low altitudes. This is where the automatic boost control appears. It is called a boost control because, for any setting of the throttle lever in the cockpit, it keeps the boost constant up to that height at which the supercharger cannot get enough air; that is, if the pilot opens his throttle wide and takes off at +4 lbs./sq. in. boost (4 lbs./sq. in. above normal atmospheric pressure) he could maintain that boost up to 15,000 feet, or to whatever height the supercharger is capable of maintaining the boost constant. Naturally this example would never occur in practice, since for a prolonged climb the pilot would throttle back to a lower boost to relieve the strain which a high boost imposes on the engine.

The boost control is given the prefix "automatic," since once the pilot sets his throttle the boost obtained will not alter whatever the aircraft is doing.

A brief description of how it works is given in the following paragraph which may help to clarify any points not made clear up to this point.

Carburettor Control

After the air has come in at the intake and passed through the carburettor, thus becoming a combustible mixture, it has to pass through the carburettor valve before entering the supercharger to have its pressure raised; this carburettor valve will allow only that amount of mixture to pass into the supercharger which will give the correct boost at the other side of the supercharger, that is, in the inlet manifold. The carburettor valve is being constantly adjusted to give this result by the automatic boost control unit, which is connected to the inlet manifold and operates in the following way. It has a barometric capsule which is in an airtight chamber connected to the manifold. Therefore any change in the boost pressure will create a movement of the capsule. Attached to one end of the capsule is a control valve which directs either oil or air under pressure to one or the other side of a piston, depending upon whether the boost in the manifold is too low or too high. The resultant movement of this piston is transmitted to the carburettor valve mentioned earlier, which at once opens or closes to counteract the incorrect boost in the induction manifold.

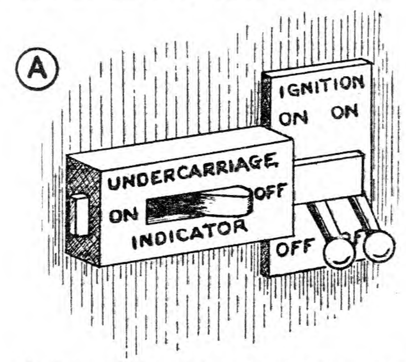
The accompanying sketch, which is purely diagrammatic and not intended to illustrate any particular installation, shows the action in pictorial form.

The linkage between the oil- or air-control valve, in the automatic-boost-control unit, and the carburettor valve is not direct, but is interconnected with the linkage between the pilot's throttle lever in the cockpit and the carburettor in such a way that the boost-control-unit piston can override the pilot's setting of the carburettor-control valve if the boost is too high or too low. This adjustment of the carburettor-control valve by the automatic boost control does not alter the setting of the throttle lever in the cockpit.

IS YOUR UNDERCARRIAGE DOWN?

by **P. W. Blandford**

BESIDES the complicated mechanism required to work it, the fitting of a retractable undercarriage to an aeroplane calls for devices to take care of the human element. Something has to be done to make sure that, as far as possible, the pilot cannot forget to lower his undercarriage when attempting to land normally. Of course, under some circumstances he has to land deliberately with his wheels up, so it is no use merely arranging things so that he cannot make his other preparations for landing without first lowering his wheels.



It is usual on British aircraft to fit a warning horn in a position near the pilot's head. This sounds when the pilot throttles back in readiness for landing, if the undercarriage is not locked down. Some American aircraft have horns, while others have a red lamp on the instrument panel which flashes under the same circumstances.

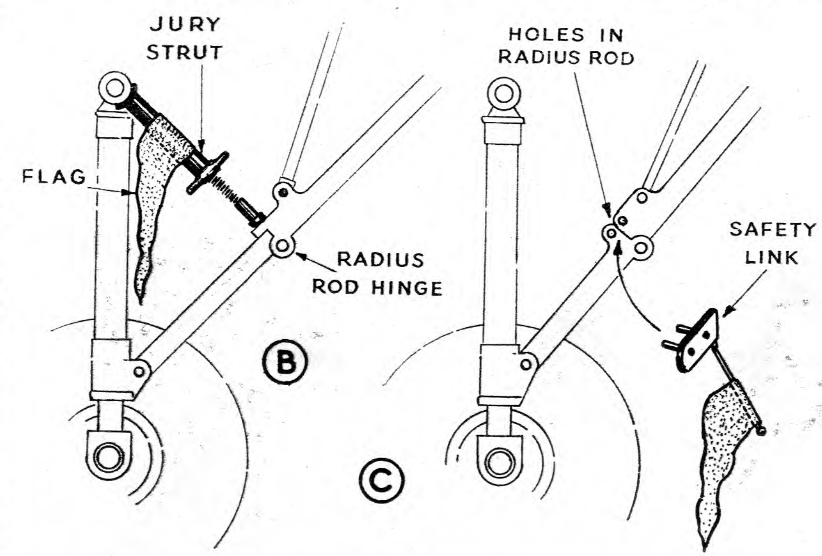
Besides the locking provided by the fluid pressure in a hydraulic system, a positive mechanical lock is provided in the "down" position. In most cases the last movement of the undercarriage jack in lowering closes a latch. Connected to this latch is a micro-switch which operates an indicator on the pilot's instrument panel. There have been many types of indicators, but on most modern aircraft coloured lamps are used.

To prevent an engine being started before the pilot has checked that his wheels are locked down, a switch for the undercarriage indicator is interconnected with the ignition switches in such a way that they cannot be moved until the indicator has been switched on (A).

In a typical indicator there is a green and red lamp for each wheel, and a duplicate set which can be brought into circuit by a changeover switch if a failure in the main set is suspected. When the indicator is switched on the green lamps light if the wheels are locked down, the red lamps light if the wheels are not locked (in transit), and no lamps light if the wheels are locked up. On some aircraft the meanings of "no lights" and "red lights" is reversed. The arrangement on a particular aeroplane can be checked from its "Pilot's Notes."

Another type of indicator, used on Bristol aircraft, shows the word "Up" on a red background when a wheel is locked up, "Down" on a green background when it is locked down, and black and white stripes when it is in transit.

As a further precaution against accidental retraction, on some aircraft the undercarriage selector lever is automatically locked in the down position so long as the weight of the machine is on the wheels. In other aeroplanes the lever can only be moved to the up position after a safety catch has been pushed aside.



Separate undercarriage locking devices are provided for most aircraft. They are fitted whenever the machine has to stand on the ground for a long time, and their purpose is to provide a definite lock which relieves the aircraft lowering and locking mechanism of strain. One commonly used device on aircraft such as Oxfords and Lancasters, in which the wheels retract backwards, is an adjustable jury strut which fits between the top of the undercarriage leg and the knuckle of the radius rod, preventing the latter folding. Another device serving the same purpose is a two-pronged link which fits into holes at each side of the radius-rod hinge.

To attract attention to these locking devices, and so make it unlikely that an aeroplane would be taken off before they were removed, they are coloured red and generally have long red flags or streamers attached.

Early Parachutes

by REX RANSLEY

TO-DAY, when large-scale air battles have made the forced parachute jump an almost commonplace experience, it is surprising to reflect that in the last war not a single Allied aeroplane pilot's life was saved by the use of the parachute.

Yet the idea goes back hundreds of years. The ancient Chinese are believed to have tried out a crude form of umbrella-parachute two thousand years ago. Leonardo da Vinci, who died in 1519, left behind a complete description of a practical parachute, complete with sketches showing how it should be constructed—"a tent-shaped pyramid of linen, 36 feet broad." And a French writer, Simonde la Loubere, in his book *A History of Siam*, written in 1700, tells of a court jester who entertained the king and his courtiers by making spectacular leaps from the roofs of high buildings while holding an umbrella in each hand.

Probably it was from this book that Sebastien Lenormand, a French doctor, found inspiration. Lenormand, real father of the parachute, was the first man in history to make an authenticated parachute jump.

One afternoon in January 1783, grasping an umbrella in each hand, he jumped from his bedroom window and landed unhurt in a flower-bed below. Encouraged by his success, he built a parachute to his own design. It was of oiled silk, 14 feet in diameter, mounted on a rigid bamboo framework. Using this 'chute, Dr. Lenormand jumped from the main tower of Montpellier Observatory, again landing successfully.

All the pioneer aeronauts were enthusiastic parachutists: balloonists like the Montgolfier brothers, Garnerin and Jean Blanchard devoted their skill and daring to evolving the idea of the parachute.

It was Garnerin who made the first parachute descent over Britain, jumping from a height of 7,000 feet over the Marble Arch and landing 15 minutes later near St. Pancras.

Then as the novelty of ballooning wore off interest in parachutes waned. It was not until about 60 years ago that parachuting was revived as a sport by exhibition jumpers. The craze began in America, and soon daring parachutists, women as well as men, were making vast sums risking their lives in stunt "drops" at fairgrounds and circuses.

Some of these exhibitions were so foolhardy that the tragic fate of their participants is hardly surprising. A man named Berg, for example, used to jump with the parachute supported by a strip of leather gripped in his teeth. On his last jump he bit through the leather and fell 4,000 feet to his death.

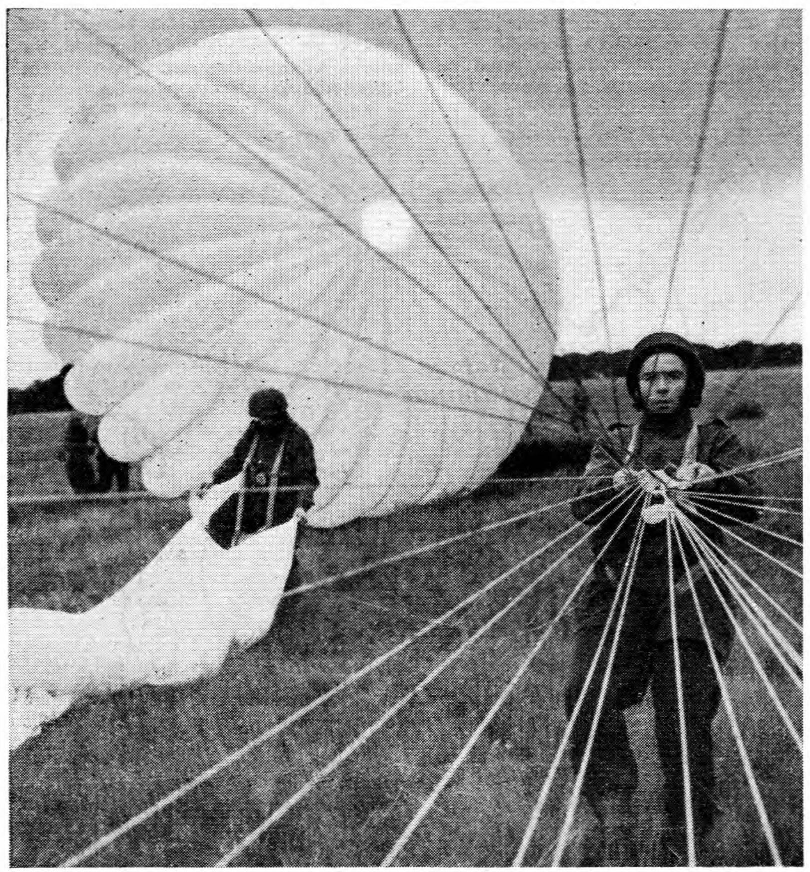
Until 1880 parachutes had always been built on a rigid framework. Revival of interest in parachuting led to the invention of the loose-canopy 'chute, so that, with the birth of the aeroplane, a suitable parachute was ready to be developed.

The first recorded parachute descent from a 'plane was made in 1912, when the pilot of a Wright biplane jumped from a height of 4,000 feet and landed safely two and a half minutes later.

The German Air Force introduced parachutes for its airmen in 1917, but the idea was not adopted by the Allies, mainly because it was held that the parachutes of those days were hardly more reliable than the planes then in use.

Parachutes were later issued to observers who went up in observation balloons as "artillery spotters," and saved many lives.

A photograph taken from inside a parachute showing a Paratroop bringing his 'chute under control before releasing himself from the harness.



Fuel Contents Gauge

by 'ASTRO'

Fig. I.

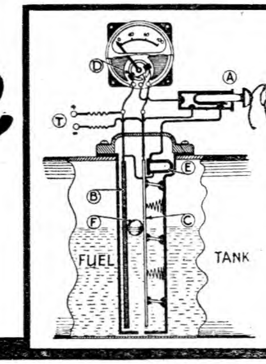


Fig. 3.

THE problem of refuelling aircraft increases with their size. Refuelling a Spitfire is hardly more difficult than refuelling a car; but with big twin- and four-engined types, where sometimes 15 to 20 big tanks have to be filled, refuelling becomes a complicated and long process. If accurate fuel contents gauges are not available the dip-stick check-up makes the process all the more complicated.

The Rotating Type

The modern electrical variable-resistance instruments are a logical development of the simple rotating-float type shown at Fig. 1. The float moves in a tube which has a helical slot. As the float rises or falls it is twisted round by the two pins which move in the slot. This rotating motion is translated by a pointer to a dial, and records the position of the float, which is the fuel level. This type is usually embedded in the wings in such a position that the pilot can see it from the cockpit.

The Electrical Type

The electrical variable-resistance type of instrument shown at Figs. 2 and 3 is a development of Fig. 1. In big aircraft a separate instrument is used for each fuel tank, and all the instrument dials are grouped on a big panel somewhere in the cabin. A single switch actuates them all. When the pilot wishes to know his fuel quantities he presses the switch A and all the needles record their various quantities. What happens when the switch is pressed on is this: The first movement of the switch (A) makes a circuit with the electro-magnet (E). This pulls the clamping-bar (C) away from the metal float (F), causing the float to drop to the fuel level. By this time the switch has been pressed in farther. This breaks the first circuit with the magnet and brings in the second circuit connecting up with the instrument. Current then passes through the resistor bar (B), the metal float (F) and along the clamping-bar (B) to the actuating coils (D) in the instrument. A resistor bar and float are immersed in each tank. The two terminals (T) are from a 24-volt accumulator.

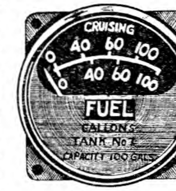


Fig. 2.

The amount of current passing to the actuating coils of the instrument is dependent on the position of the float on the resistor bar, which is also the fuel level. The resistor bar descends the full depth of the fuel tank. As the switch (A) is released, the magnet (E) is again momentarily energised, the float (F) is once more released and clamped up again in readiness for the next reading. When the instrument circuit is broken the needles drop back to zero. In effect, this type of instrument is a simple ohm meter recording variable resistance. For ground reading (tail down) the lower numbers on the dial are used. In flight (tail up) the top numbers are used. This is a valuable innovation, and makes this type more useful than others to ground crews.

The Taylorcraft Auster III. This aircraft is used for artillery spotting and communications. Its ability to land in small spaces, by the use of split trailing-edge flaps, makes it particularly valuable for this work. Fitted with a Gipsy Major engine of 132 h.p., its maximum speed is 118 m.p.h.

A Former A.T.C. Cadet wins V.C.

Flight Sergeant Arthur Louis Aaron, V.C., D.F.M., who belonged to the Leeds University Air Squadron, which in February 1941 was incorporated in the Air Training Corps.

On the night of 12th August, 1943, Flight Sergeant Aaron was captain and pilot of a Stirling aircraft detailed to attack Turin. When approaching to attack, the bomber received devastating bursts of fire from an enemy fighter. Three engines were hit, the windscreen shattered, the front and rear turrets put out of action and the elevator control damaged, causing the aircraft to become unstable and difficult to control. The navigator was killed and other members of the crew were wounded.

A bullet struck Flight Sergeant Aaron in the face, breaking his jaw and tearing away part of his face. He was also wounded in the lung, and his right arm was rendered useless. As he fell forward over the control column the aircraft dived several thousand feet. Control was regained by the flight engineer at 3,000 feet. Unable to speak, Flight Sergeant Aaron urged the bomb aimer by signs to take over the controls. Course was then set southwards in an endeavour to fly the crippled bomber, with one engine out of action, to Sicily or North Africa.

Flight Sergeant Aaron was assisted to the rear of the aircraft and treated with morphia. After resting for some time he rallied, and, mindful of his responsibility as captain of aircraft, insisted on returning to the pilot's cockpit, where he was lifted into his seat and had his feet placed on the rudder bar. Twice he made determined attempts to take control and hold the aircraft to its course, but his weakness was evident, and with difficulty he was persuaded to desist. Though in great pain and suffering from exhaustion, he continued to help by writing directions with his left hand.

Five hours after leaving the target the petrol began to run low, but soon afterwards the flarepath at Bone airfield was sighted. Flight Sergeant Aaron summoned his failing strength to direct the bomb aimer in the hazardous task of landing the damaged aircraft in the darkness with undercarriage retracted. Four attempts were made under his direction; at the fifth Flight Sergeant Aaron was so near to collapsing that he had to be restrained by the crew, and the landing was completed by the bomb aimer.

Nine hours after landing, Flight Sergeant Aaron died from exhaustion. Had he been content, when grievously wounded, to lie still and conserve his failing strength, he would probably have recovered, but he saw it as his duty to exert himself to the utmost, if necessary with his last breath, to ensure that his aircraft and crew did not fall into enemy hands.

In appalling conditions he showed the greatest qualities of courage, determination and leadership, and, though wounded and dying, he set an example of devotion to duty which has seldom been equalled and never surpassed.

MORE OF THE BEST

1. Wing Commander J. H. Player, D.S.O., D.F.C.
During December 1942 Wing Commander Player was in charge of an advanced detachment in North Africa. Under his leadership the detachment destroyed 16 enemy aircraft in 15 days and made numerous intruder patrols over Sardinia.

2. Wing Commander R. F. H. Clerke, D.F.C.
Has shot down four enemy aircraft, two at night, and shared in three others.

3. Wing Commander B. R. O'B. Hoare, D.S.O., D.F.C. and Bar.
One of the pioneers of night intruding over enemy airfields. Has shot down at least six enemy aircraft.

4. Squadron Leader G. Barwell, D.F.C.
The only R.A.F. officer to fly in the Rome and Ploesti raids made by the U.S.A.A.F.

5. Squadron Leader E. K. Sinclair, D.F.C.
This Australian officer of the R.A.F. received his D.F.C. for the part he played in a very heavy raid on Friedrichschafen.

6. Squadron Leader J. F. McLachlan, D.S.O., D.F.C. and two Bars.
With Flight Lieutenant A. G. Page, has shot down six enemy aircraft in ten minutes. Squadron Leader McLachlan lost an arm in an accident, but was on intruder operations a few weeks later.

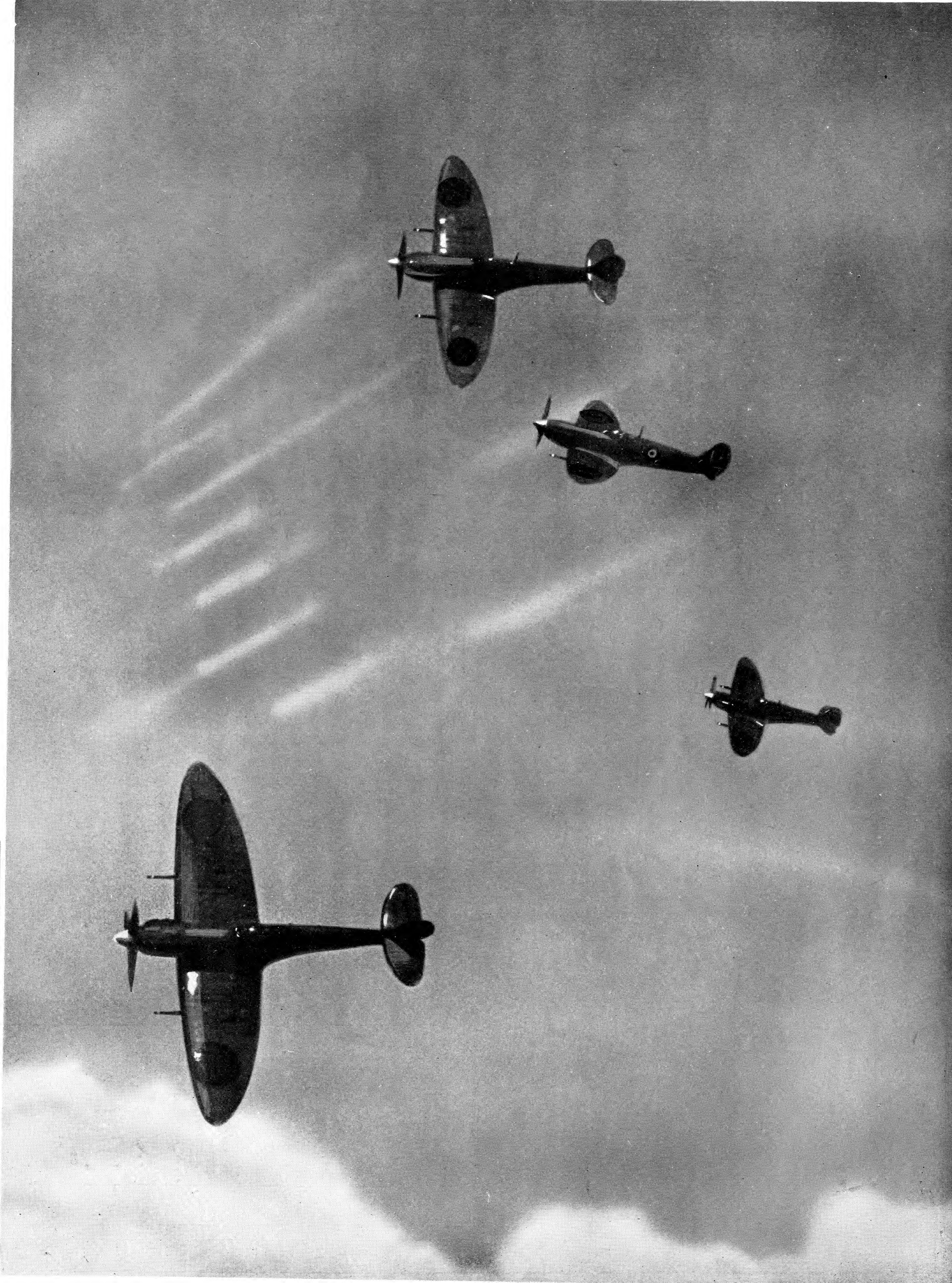
7. Squadron Leader M. Stephens, D.S.O., D.F.C. and two Bars.
Has shot down 21 aircraft over Malta G.C.

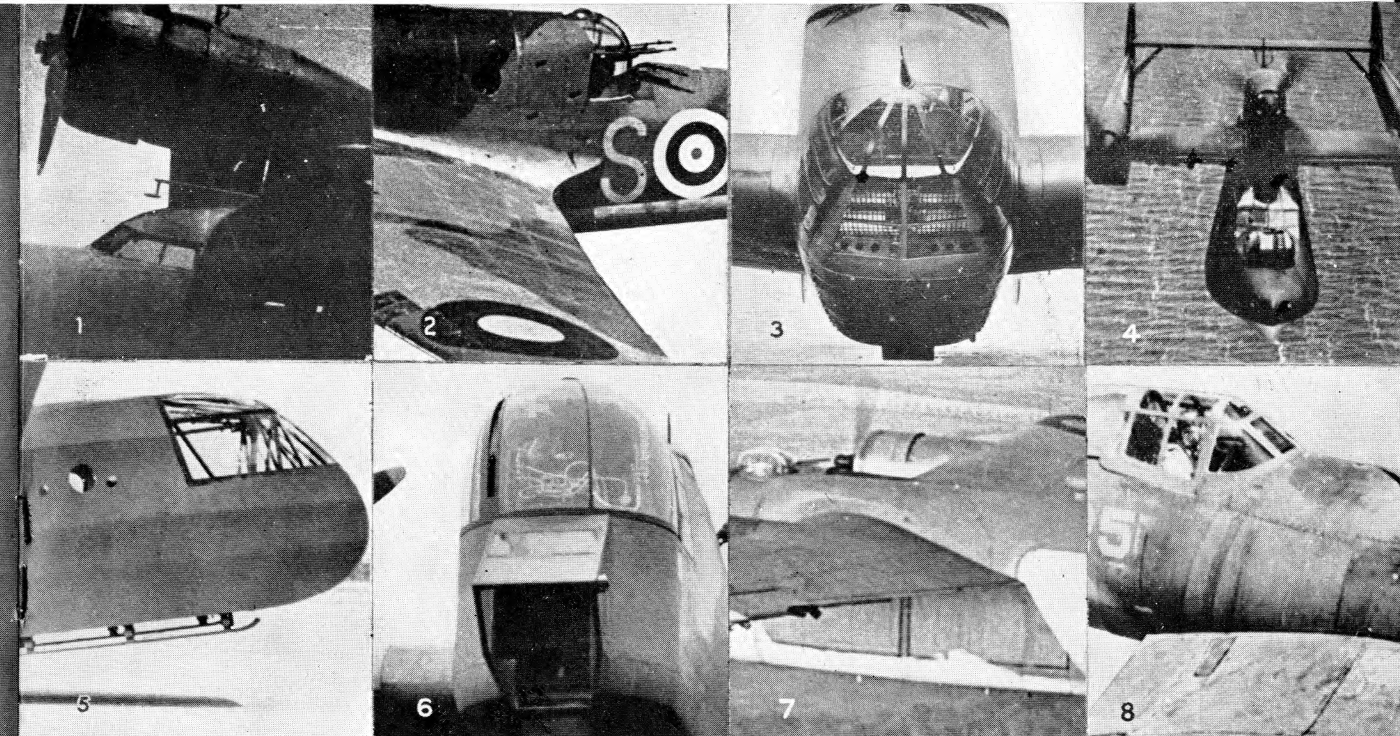
8. Flight Lieutenant W. B. Oliver, D.F.C. and Bar.
Has taken part in attacks on a large assortment of targets, including Gdynia, Essen, Berlin, and daylight attacks on Le Creusot and Milan.

9. Flight Lieutenant J. H. Kenny, D.F.C.
Has been on numerous sorties both from this country and North Africa.

10. Flying Officer P. S. Kendall, D.F.C. and Bar.
Displayed great initiative and daring while on intruder patrols in the Mediterranean theatre of war, and has destroyed at least six enemy aircraft.

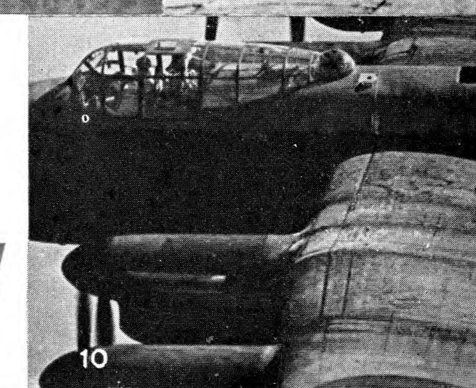
11. Pilot Officer F. Hill, M.B.E., D.F.C.
Won his M.B.E. by helping to rescue the crew of a blazing bomber which had crashed near his aircraft, and the D.F.C. for courage and devotion to duty when raiding Kassel.



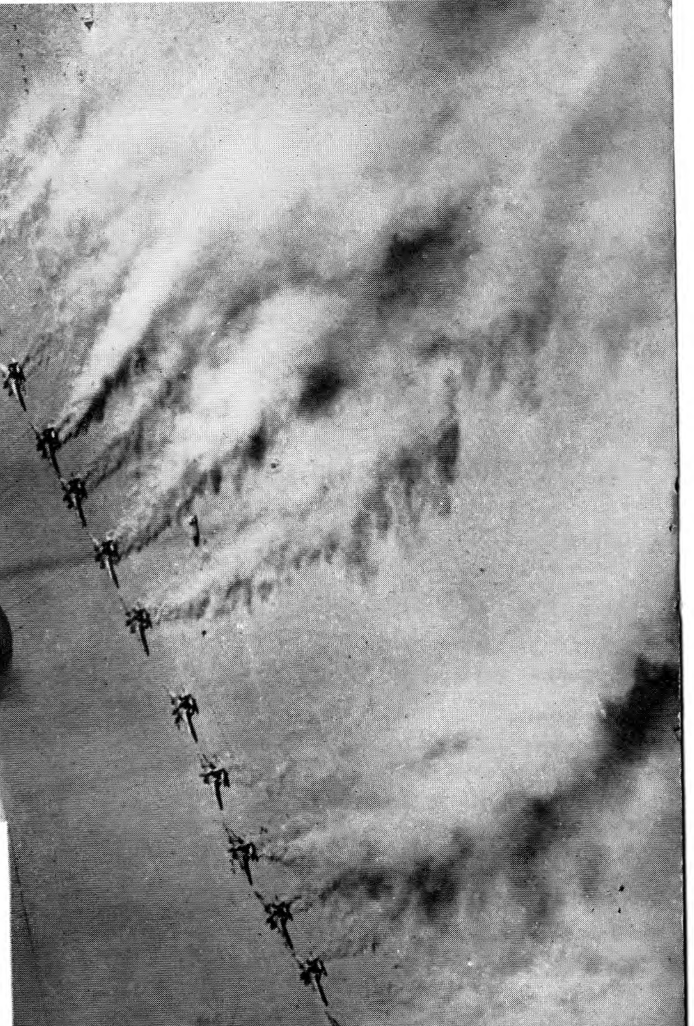


Points of VIEW

For Key see page 24.



AIR CHIEF MARSHAL SIR ARTHUR TEDDER



The upper picture is of a formation of Bostons taking off from a desert airfield, and below are some derelict Me 110s battered by Sir Arthur Tedder's bombers.

SIR ARTHUR TEDDER

by **C. G. GREY**

AIR CHIEF MARSHAL SIR ARTHUR WILLIAM TEDDER, G.C.B., is looked upon by many people, in the R.A.F. and out, as one of the great discoveries of this war. To have come out of the last war as an acting Lieut.-Colonel R.A.F., without any decorations, and to become Air Officer Commanding-in-Chief all the Allied Air Forces in the Mediterranean as an Air Chief Marshal, which ranks with but after a full Admiral in the Navy or a General in the Army is remarkable. But to those who have known him for more than 20 years, as I have, this all seems a logical development.

Arthur Tedder was born at Stirling (Scotland) in July 1890. He was at Whitgift School from 1903 to 1909, and at Magdalene College, Cambridge, from 1909 to 1913. He was commissioned as 2nd Lieut. in the Dorset Regiment in September 1913, nearly a year before that war, and was a captain in his regiment in March 1916, just after he began to fly.

From the beginning his air career has been remarkable. He went to No. 1 School of Aeronautics in January 1916, to a Reserve Squadron in March, to 35 Squadron in April, and graduated at the Central Flying School in June. And, mark you, the C.F.S. passed out only pilots who were fit to be instructors. He was then 26 years of age, not a harum-scarum youngster as were so many crack pilots.

A few days later he joined No. 35 Squadron in France. And on January 1st, 1917, he was appointed to command No. 70 Squadron, as Temporary Major. With it he served in Italy, when General Plumer went to save the Italian Army and took with him a brigade of the R.F.C. under Brig.-General Tom Webb-Bowen. And there Major Tedder acquired the Italian Silver Medal.

In June 1917 he was brought home to command No. 67 Training Squadron, and in October he took command of No. 29 Training Wing. In March 1918 he did a course at No. 1 School of Navigation and Bomb Dropping. And on April 1st, 1918, when the R.A.F. came into being, he resigned his Army commission and became a permanent Major "A" (for Aviator) R.A.F. The new rank titles were not invented till 1919.

By May 1918 he was in the Middle East commanding No. 3 School of Navigation and Bomb Dropping, as Acting Lieut.-Colonel, at the age of 28, and barely two years after learning to fly. Which was pretty good going.

He came home in March 1919, and was appointed in April to No. 33 Training Depot Station, but in May was put in command of No. 274 Squadron, which later became No. 207. In August that year he was given a Permanent Commission as Squadron Leader R.A.F., "on reduction of establishment"—when the Government cut down the R.A.F. from 30,000 officers and 300,000 men to 3,000 officers and 30,000 men.

That was about when I first met Arthur Tedder. He was commanding at Bircham Newton, and I went to call on him with friends who lived at Hillington near by. We were told that we should find the C.O. up at the flight sheds. We did. The first I saw of him was his boots and breeches. The rest of him was head down in the cockpit of a single-engined bomber —a D.H.9a, I think. What impressed me was that the C.O. should bother to see for himself just what piece of mechanism was wrong, or had been put right, inside. He has been like that ever since. He always wants to see for himself instead of trusting to reports from others. And that is half the reason for his success.

In September 1922 No. 207 went to Constantinople (Istanbul as it is and used to be) for that queer near-war with Mustafa Kemal (later Atatürk) over the Chanak business. Nobody has ever written the comic or any other history of that affair which it deserves. But by September 1923 Sq. Ldr. Tedder was home again to do a Staff Course at the Royal Naval College at Greenwich. One can see now how useful what he learned on that course must have been in dealing with the Navy in the Mediterranean.

Just a year later, as a Wing Commander, he took over No. 2 Flying Training School, and he stayed there more than two years, till January 1927, when he went to the Air Ministry, to the Directorate of Training. In December 1927 he began another course of 12 months at the Imperial Defence College. You see how all these courses fit a man for higher and higher command. And from there he went in January 1929 to the R.A.F. Staff College as an instructor. While there he became a Group Captain.

Three years later, in January 1932, he was appointed to command the Air Armament School—another useful new experience, remembering that he always insisted on knowing all about the technical side of his job. And from there he went, in April 1934, to be Director of Training at the Air Ministry, and was promoted Air Commodore.

Then, in October 1936, came another complete change: he was sent to command at Singapore, where he was promoted to Air Vice-Marshal in July 1937. But he was there only a year and three-quarters, for in July 1938 he flew back to England to become Director-General of Research and Development. Many people thought that this was an odd appointment, for all Air Marshal Tedder's courses had been for staff work, and there was nothing scientific or technical in his training. But somebody in authority evidently knew of his natural ability to grasp engineering problems.

In August 1940 he was transferred to the Ministry of Aircraft Production as Deputy Air Member (of the Air Council) for Development and Production, at Harrogate in those days. I spent an evening with him there, and was impressed with the extent to which his grasp of affairs, technical, operational and international, had developed. He put everything so clearly. The most complicated affairs seemed simple as he set them forth. And in spite of all the strain of his work he talked just as amusingly and cheerfully as he used to when a Squadron Leader at Bircham.

His great chance came in November 1940, when he was sent to Cairo as Deputy A.O.C.-in-C. Middle East to Air Chief Marshal Sir Arthur Longmore, to replace Air Vice-Marshal Boyd, who had been forced down in Sicily while flying out to take over the job. Seven months later he was made A.O.C.-in-C. Middle East, to succeed Sir Arthur Longmore, and promoted to Air Marshal. Also, he was created a K.C.B. in the New Year's Honours of January 1942.

In the Middle East, during all the defeats and victories, he won the admiration and affection of everybody. As I have said of his Bircham days, he insisted on seeing everything for himself. He was out and about all the time. One of his staff told me that he did not think there was a unit in the Middle East which the A.O.C.-in-C. had not visited. Out in the desert, up in Palestine or Iraq, fighters, bombers, coastal units, training stations, repair depots, British, Dominions, U.S.A., French, Poles, Czechs, Greeks, Dutch and all, he saw them, and he judged their worth in an uncanny way that he has.

But all that running about gave Sir Arthur Tedder a knowledge of what his men and material could do which he would never have got in any other way. After the drive through to Tripoli and the Allied landing in Algiers, he was brought home to be Vice-Chief of the Air Staff. A few months later, in February 1942, he was sent out to be A.O.C.-in-C. the whole Mediterranean Air Command of all the Allied Air Forces. And that is the biggest command yet held by any Air Officer. But many of us believe and hope that there are still bigger things coming to him.

The Avro York

THE Avro York comes of a good family, and if distinguished parentage can guarantee success it should do well. Unless this bearer of the White Rose can maintain the tradition of the Red Rose, the immediate, and probably ultimate, status of Britain's civil air transport system is going to be seriously jeopardised. Conversions of military types there will be, but nothing can take the place of the transport aircraft designed as such, and if the York does not come up to scratch the immediate prospects of an understudy are lacking.

First impressions of the York are heartening. It has a comfortable air of quiet efficiency about it and appears to be more of a gentle giant than its American contemporaries, which tend to give one the impression of aggressiveness. The distinctive Lancaster fins and rudders are somewhat spoilt by the central fin. The square fuselage is more portly than the Lancaster's, and the front end is reminiscent of the Avro 642. Apart from the centre section, the wings are those of the Lancaster, and the four two-speed supercharged Merlin engines should ensure that the York need have no fears of being over-publicised and underpowered like some aircraft of pre-war years.

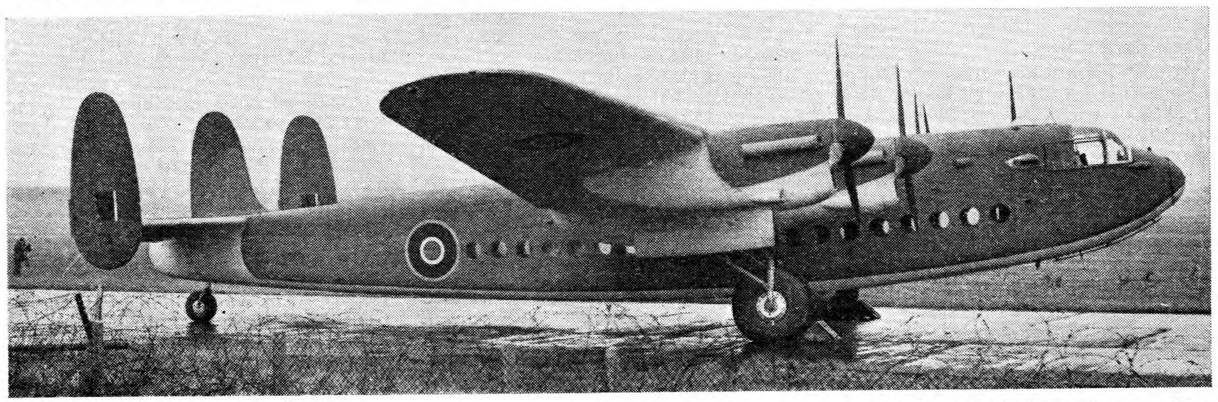
A cruising speed of 170 m.p.h. should be within its reach. The operating range is probably under 2,000 miles, and although this is satisfactory judging by pre-war standards, the aim of designers must be higher in future if we are to have safe and efficient long-distance air transport. It is to be hoped that stations on our Empire routes are by now all provided with runways, for a flat-tyre landing made on a rough airfield in a loaded York might have ill-effects.

The York is a peace-time aircraft, and its crew, apart from the stewards, is consequently small. It consists of the captain, whose seat, when he is at the controls, is of course at the port side of the control cabin; the flight engineer, who sits alongside the pilot behind dual controls; the wireless operator, who sits just behind the pilot, but on a lower deck; the navigator, who sits just behind the flight engineer, but on a higher deck where he is handy for the astral dome. There is a rest station below the navigator for the unoccupied pilot. The flight engineer is becoming less of an air mechanic and more of a technical adviser to the pilot, and now that he is found right on the bridge in the York one wonders who, in a few years time, will be the most important member of the crew.

To the rear of the crew's quarters the layout of the interior can be of several kinds, depending upon the function of the aircraft. These range from short-distance passenger work, when about 50 passengers can be carried, through all conceivable applications to freight carrying. One point which has been taken great care of in the design of the York is the ability to effect a conversion of the aircraft from one role to another in a few hours The main passengers' entrance is up a short ladder to a door of reasonable size under the port wing.

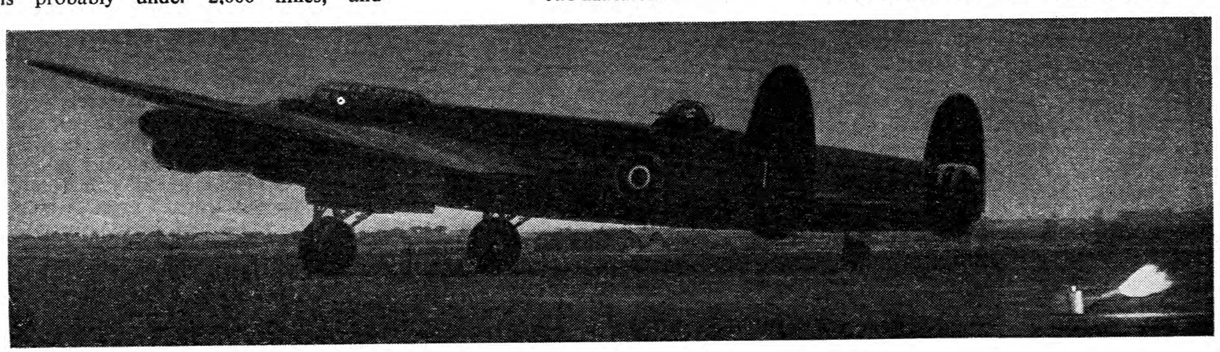
The four Merlin engines should be able to lift the aircraft to a height where oxygen becomes a necessity, and since this ability is likely to be used on long-distance work it is probable that some cabin-pressurising system will be introduced. Although this is not an easy proposition on an aircraft of this size, it would be necessary, since the wearing of oxygen masks would detract somewhat from the pleasure and convenience of flying for the air traveller.

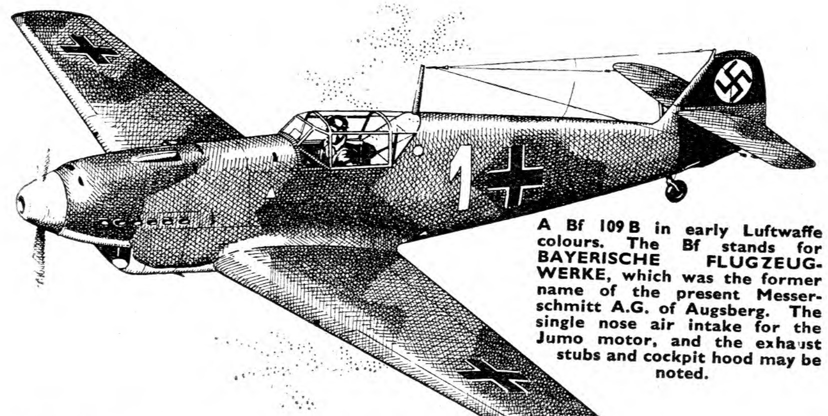
It appears that the York is a pleasant enough aircraft to fly without any vices, and under light load it can be flown without difficulty with both engines on one side stopped. The fact that hydromatic feathering propellers are fitted is probably one of the main factors which help to give such fine controllability.



The York.

The Lancaster.





A Bf 109 B in early Luftwaffe colours. The Bf stands for BAYERISCHE FLUGZEUG-WERKE, which was the former name of the present Messerschmitt A.G. of Augsberg. The single nose air intake for the Jumo motor, and the exhaust stubs and cockpit hood may be noted.

The Me 109 Fighters

by Roy Cross

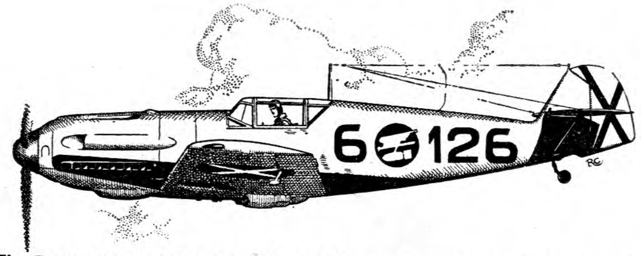
GERMANY'S war plan called for many thousands of aircraft in several fixed-duty categories. To obtain the numbers required necessitated a "freezing" on certain designs, and the application of full mass-production methods to the building of the selected types. Such a programme called for the utmost simplicity of equipment and construction, while interfering as little as possible with the efficient functioning of the aircraft under rigorous war-time conditions. The Germans "froze" on the Me 109 as their standard fighter.

In an attempt to keep position in the race for superiority in technical equipment the Me 109 has been progressively developed, but although performance has been improved, and the latest versions are formidable fighting types, the initial design seems to have lacked that little something which is the hallmark of the thoroughbred.

The Me 109 made its first public appearance at the Zurich International Meeting in July 1937, where it won several of the events for military aircraft, one of them being the Circuit of the Alps, in which the machine was flown by Major Seidemann at an average speed of 240.9 m.p.h. This early version was powered by a Daimler-Benz DB 600 inverted Vee motor of 910 h.p., and saw extensive battle service in the Spanish Civil War with General Franco and the Insurgents. Seidemann, promoted to Lieut.-Colonel, became Chief of Staff to General von Richthofen, the last commander of the Condor Legion in Spain.

The DB 600 version mounted two machine-guns over the engine, firing through the airscrew, and a similar gun in each wing. The top speed was about 323 m.p.h.

In 1939 appeared the Me 109E, with the more powerful DB 601A motor of 1,150 h.p. for take-off, two shell-firing cannon in place of the wing machine-guns, and, after a time, a redesigned cockpit cover. Later, also, armour and bomb racks were fitted, the latter to enable the aircraft to undertake the duty of fighter-bomber for raids on the British Isles after the defeat of the German heavy-bomber forces during the early phase of the Battle of Britain. Efforts to further improve the fighting qualities of the machine resulted in the appearance in 1940 of the Me 109F series, and quite recently of the Me 109G. The F model is the latest for which detailed information is available, and is dealt with at greater length below. A table is also printed on these pages showing in chronological order the various types introduced since the prototype Me 109 first flew in 1935.



The German Condor Legion in Spain had several squadrons of Me fighters. The 109C here has the Condor Legion emblem on the fuselage, and the Franco insignia on the tail and wings.

THE MESSERSCHMITT ME 109E

Early machines of this type shot down over this country were entirely lacking in armour protection or leakproof tanks. The unhappy results, to Mes, of engagements with British eight-gun fighters, however, caused the Germans to refit their fighters (and, incidentally, their bombers) to include a measure of protection. On more recent Me 109Es this includes 8-mm. head and back armour, 5-mm. seat armour, and a thick laminated bulkhead to the rear of the main tank, which is behind and extends beneath the pilot. A 2¼-in. thick transparent panel is let into the windscreen of some Mes, but this appears to be of plate-glass and therefore of a doubtful bullet-resisting quality. The entire transparent hooding, by the way, may be flung clear by the operation of a jettison lever in the cockpit, with the exception of the windscreen, which serves as an effective windbreak. The cockpit is rather small, and when strapped in and in flying kit the pilot has difficulty in looking to the rear (no rear-view mirror is fitted). The seat is adjustable for height, and on the port side of the cockpit is the oxygen gear, electrical push-button switch-panel, a map case and a radio control panel. The radio itself is composed of a fixed-frequency transmitter and receiver with a very limited range of operation. Also housed in the radio compartment is a first-aid kit.

In addition to the standard 7.9-mm. guns mounted on the engine there are

Type	Motor	Horse-Power	Speed (m.p.h.)	Armament	Year
Bf 109	Jumo 210	610	294 at 13,100 ft.	2 m.g.	1935
Bf 109B	Jumo 210	640 at 14,800 ft.	285 at 13,100 ft.	2 m.g., 1 cannon	1937
Bf109C	DB600	910 at sea level	323 at 13,100 ft.	4 m.g.	1938
Bf 109D	DB600	910 at 13,100 ft.	—	4 m.g.	1938
Me 109E	DB601A	1,150 at take-off	354 at 14,760 ft.	2 m.g., 2 cannon	1939
Me 109E7	DB601N	1,270 at 16,250 ft.	—	2 m.g., 2 cannon	1940
Me 109F	DB601N1	1,270 at 16,250 ft.	371 at 22,000 ft.	2 m.g., 1 cannon	1940
Me 109F	DB601E	1,300 at 18,000 ft.	395 at 22,000 ft.	2 m.g., 1 cannon	1941
Me 109G	DB605A1	1,350 at 18,500 ft.	400 at 22,000 ft.	2 m.g., 1-3 cannon	1942

Nine years of Messerschmitt development are summarized in the table above. A point is that early 109Es had four machine-guns in place of the installation indicated here.

two 20-mm. Oerlikon shell-guns, one in each wing, which may be fired singly by manipulating a selector switch in the cockpit. A rack and electrical release mechanism for a 550-lb. bomb may be installed with ease, while on the E7, at least, there is provision for an external long-range fuel tank. Maximum permissible diving speed of the machine is 446 m.p.h. The dive is usually executed at 45 degrees, indicated by a red-paint line over the cockpit cover at this angle. The pilot adjusts this red line to correspond with the horizon by pushing the stick forward, and sights his target through the gunsight. Many of our civilian population, particularly around the South Coast, became at one time very familiar with the Me in this role of dive-fighter-bomber.

The Messerschmitt Me 109E was never a great success in any role, however, and in an endeavour to "make a silk purse" the whole design was drastically "cleaned up" aerodynamically.

THE ME 109F

The new machine is a much better all-round fighter, and differs from the E in the following main respects:

(1) The Mercedes-Benz DB 601A is replaced by the more powerful **DB 601N**. The supercharger air intake has been pushed farther out into the air-stream to ensure an adequate air supply to the new blower.

(2) The plan form of the wing has been slightly altered and now incorporates rounded wing-tips.

(3) The airscrew spinner is much larger.

(4) The tailplane is no longer strut-braced and the tailwheel partially retracts.

(2), (3) and (4) may be particularly noticed from the spotting point of view; they are common to both the F and the G versions.

(5) The armament is revised to include one Mauser shell-gun firing through the airscrew spinner.

The key to the cut-away of the ME 109F1 is as follows:

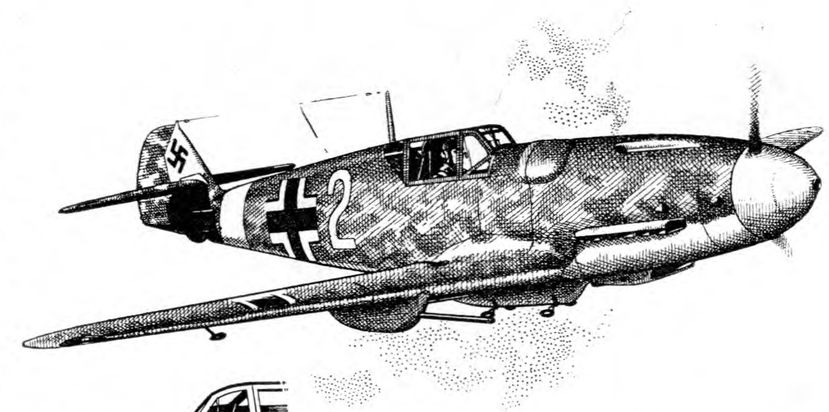
1, 20-mm. MG 151 cannon blast tube; 2, V.D.M. airscrew, diameter 9 ft. 8½ ins.; 3, oil tank. Coolant pumped through the cylinder blocks flows into the external vapour separating swirl chambers (4), the vapour returning to the coolant header tanks (5), on eeach side of motor; 6, anti-vibration pad on forged magnesium alloy engine-bearer (7); 8, two synchronised 7.9 mm. MG 17 guns; 9, gun interrupter gear; 10, supercharger; 11, MG 17 ammunition box; 12, instrument panel; 13, rudder pedal; 14, MG 151 cannon lies between cylinder blocks and fires through airscrew hub; 15, throttle; 16, engine-priming fuel tank and hand pump for starting; 17, flap and tail trim control wheels; 18, armour plate behind pilot; 19, hinged direct-vision panel for bad-weather flying; 20, sliding glass panel in hooding; 21, seat, adjustable for height; 22, head and neck armour protection for pilot; 23, locker; 24, hand-hold; 25, radio mast and aerial; 26, plate on top of tank carrying centrifugal immersed pump, fuel contents gauge, dipstick and vent pipe fittings; 27, self-sealing rubber fuel tank (88 gallons) supported by plywood box; 28, three oxygen bottles; 29, Handley-Page automatic slat (open); 30, wing-tip lights (navigation and recognition); 31, Frise-type aileron; 32, ejector exhaust stubs; 33, oil cooler; 34, air intake for supercharger; 35, port leading-edge slat shown closed; 36 pitot head; 37, aileron hinge and (38) mass balance; 39, outer flap section; 40, main air flow through wing radiator; 41, air flow exit flaps; 42, boundary layer air flow; 43, reinforced tank base; 44, foot-step; 45, radio hatch and installation; 46, master compass; 47, semi-retractable tail wheel; 48, elevator with small trimming tab adjustable on the ground; 49, horn-balanced rudder.

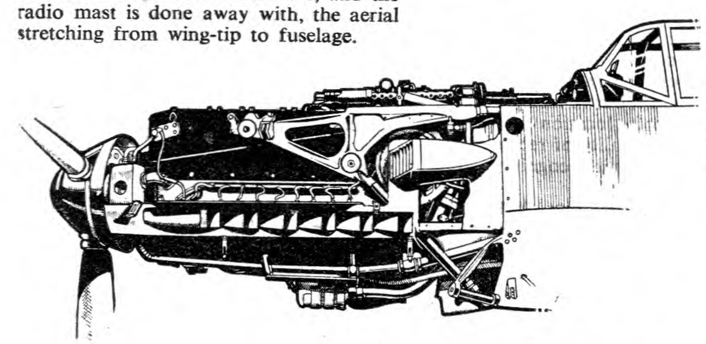
The DB Motor

The DB 601N1 motor, a liquid-cooled inverted Vee unit, has direct fuel injection into the cylinders and a variable speed supercharger, both excellent features. Horse-power for take-off is 1,200, and 1,270 h.p. is developed at 16,270 ft. The engine control in the cockpit is of the simplest kind, there being only a throttle lever; mixture, engine coolant temperature, supercharger speed and airscrew pitch are controlled automatically.

Another feature is the installation of a 20-mm. Mauser MG 151/20 shell-gun in the cockpit floor and firing between the cylinder banks of the DB motor out through the airscrew hub. The rate of fire is remarkable, 800 rounds per minute as compared with the 550 r.p.m. of the Rheinmetall/Oerlikon FF 20-mm. guns on the 109E. A box in the port wing contains 200 rounds of ammunition, enough for a duration of just over 13 seconds' fire. Two Rheinmetall-Borsig MG 17 rifle-calibre guns are mounted on the engine.

Mention has so far been made of the Me 109F1 only; the F2 is very similar but mounts a 15-mm. cannon in place of the 20-mm model on the F1, and the radio mast is done away with, the aerial stretching from wing-tip to fuselage.





(Above) The Me 109G6. This particular type has 20-mm. wing cannon, a bomb carrier beneath the fuselage, and bulges on the cowling to take the 13-mm. MG 131s. (Left) The DB 601A installation on a 109E. The larger spinner of the F has resulted in a much cleaner nose. The 87 octane fuel used in the 601A is replaced by 93 octane fuel in the 601N.

THE ME 109G

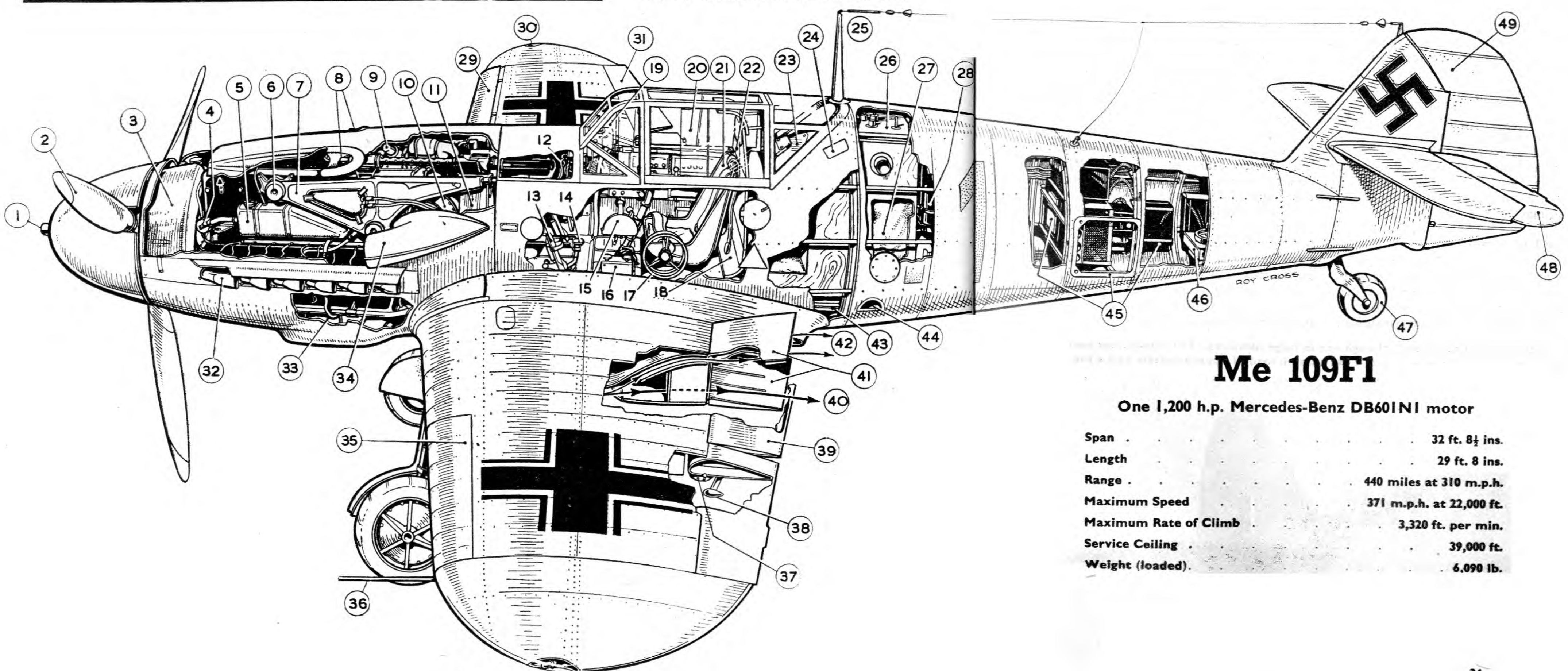
The latest of the 109 series has seen action first on the Russian front and lately in the Mediterranean area. Produced in several sub-types, from high-altitude fighters to ground-assault machines. In all cases a Mercedes-Benz DB 605 motor is fitted with provision for a 20-mm. MG 151/20 cannon.

High-flying Gs can operate at 41,000 ft., while the use of a pressure cabin gives a still greater ceiling. These types have identical armament to the 109F.

More information is available on a ground-assault version, the G6, since numbers have been captured intact on Italian and Tunisian airfields. The motor is a DB 605A1, giving 1,350 h.p. at 18,500 ft. and a maximum speed of 387 m.p.h. at 18,500 ft.

Armament is heavy and consists of a 20-mm. Mauser cannon firing through the airscrew hub, two similar weapons slung one under each wing in blister fairings, and two 13-mm. MG 131 machine-guns mounted on the engine in place of the 7.9-mm. MG 17s. The MG 131 is a comparatively new gun of just over half-inch calibre firing 900 rounds per minute, and the installing of it in the Me 109 has necessitated large bulges on the engine cowling to accommodate the feed arrangements. The wing cannon may be removed or the fuselage cannon dispensed with according to tactical requirements. Streamlined bomb-carriers under the fuselage or wings can take the following alternative loads—one 550-pounder, four 110-lb. bombs, or containers for anti-personnel bombs.

Head and neck armour protection is attached direct to the cockpit cover, which on all 109s hinges to the starboard side, and three pieces of 5-8-mm. armour protect the pilot's back as in the F. The 88-gallon fuel tank is protected from the rear by a bullet-proof bulkhead. Cruising range is 400 miles, and the all-up weight is 6,820 lb.



Me 109F1

One 1,200 h.p. Mercedes-Benz DB601N1 motor

Span	**32 ft. 8½ ins.**
Length	**29 ft. 8 ins.**
Range	**440 miles at 310 m.p.h.**
Maximum Speed	**371 m.p.h. at 22,000 ft.**
Maximum Rate of Climb	**3,320 ft. per min.**
Service Ceiling	**39,000 ft.**
Weight (loaded)	**6,090 lb.**

"Over to you—Over"

by NAVIATOR

SINCE the start of the war four years ago there have been many startling changes and improvements in the instruments of war, but perhaps in no one direction has the improvement been so great as in that of radio-telephonic communication.

Before the war there was a great fight in progress as to which was the better for general communication between aircraft—R/T (radio telephone) with speech transmission, or W/T (wireless telegraphy) using the Morse code. That there was in fact such an argument is in itself sufficient indication of just how bad speech transmission and reception were; and it was bad, too. The sets were unreliable, their range was exceedingly small and interference was appalling. It was therefore argued, and not without considerable justification, that W/T using the Morse code was in the end the better medium of communication.

The rapid improvement in R/T was hastened by the introduction of the single-seat fighter. It was fairly simple for a trained observer or air gunner to operate a Morse key in the back seat, but it was most impracticable to expect a pilot to fly the aircraft in action with one hand and use a key with the other.

Reception Improved

One of the great objections to R/T was that it could be more easily picked up by D/F (direction finding), and in addition a greater separation was required between wavelengths in order to prevent interference from adjacent stations. Both these difficulties have now been overcome by the introduction of very high frequency, which has not only greatly increased the range of transmission and reception, but renders it exceedingly difficult of location by D/F. Furthermore, the quality of reception has been improved beyond recognition. (We hope not.—ED.).

I remember on my first flight using R/T when flying behind my instructor for formation practice. I found to my horror that I could not understand a word he was saying; moreover, from the general intonation of the noises that did penetrate that background of crackling, roaring sound I gathered that my repeated bleats of "Say again, please" were meeting with equally little success at his end. I was therefore delighted to find that when we once more conversed in normal tones on the tarmac after the flight I was not cursed up and down hill as I had expected, but was quietly told not to worry, it was always like that the first time, I'd get used to it. It seemed unbelievable that one would ever make anything out of that awful confusion of sound, but one did, and when it became my unhappy lot to instruct others I found myself constantly giving the same glib assurance.

Cut Your Conversation

You have probably often listened in to messages and conversations between aircraft in the air, but I wonder if it has ever struck you how much those conversations differ from normal conversation. Each phrase is concise and clear-cut; there are not, or, I should say, should not, be any "umms" and "errs," no unnecessary words, the voice is pitched high, and each word is carefully pronounced without slurring and without that outstanding British habit of dropping the voice at the end of a sentence.

All aircrews are, of course, trained in this particular and strange art. A form of code is employed in addition, the object throughout being to increase the reliability of reception and at the same time to save time.

Have you ever stood in a draughty hall with a telephone in one hand, listening for what seems like hours on end to the interminable ramblings of a fond relative, only to replace the receiver, straighten your aching back and ask yourself just what she had said? In the end it all boiled down to about three sentences. The two extremes are a telegram and a "thank-you" letter to the same fond relative. All you really want to say is "Thank you," but how awfully rude it would be if you simply said: "Aunt Emma, thank you—Freddie."

Try It Out

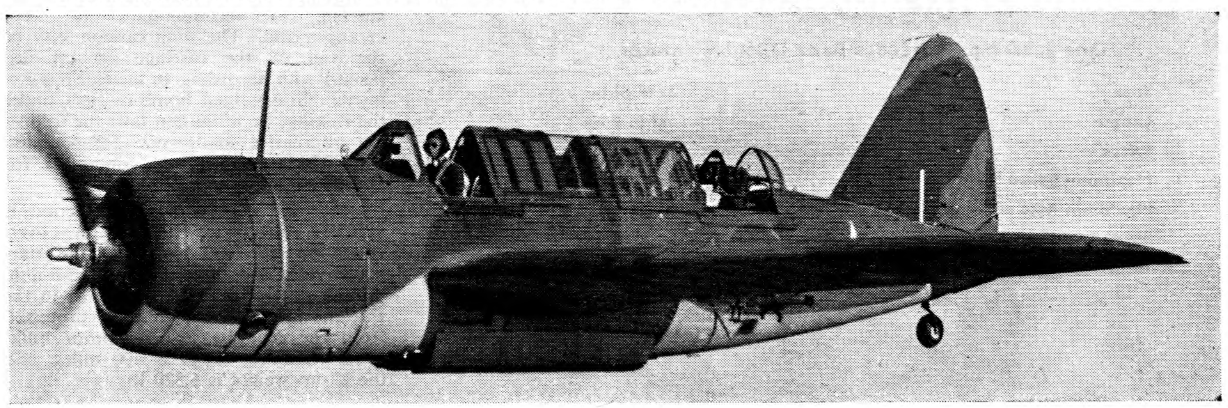
Listen in to some R/T conversations, and then go home and try it on your friends—you will soon find they'll cool off. Ask your girl friend to the cinema; pick up the telephone and call her number, think carefully what you are going to say beforehand—this latter very important, or you will find yourself dithering all over the place—wait for her reply, take a breath and go ahead:

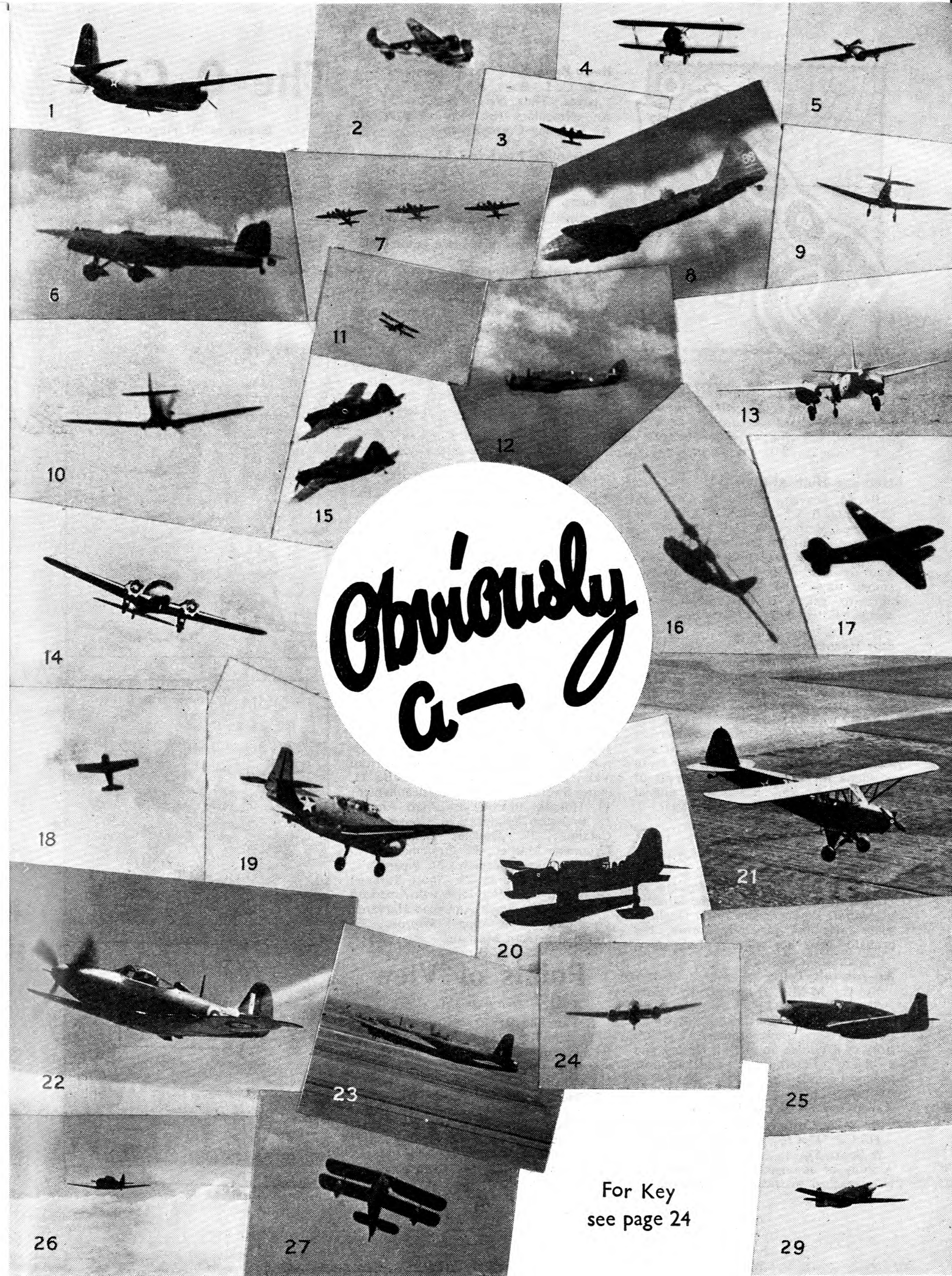
"Hullo Clara, hullo Clara. Bill calling. Rendezvous oak-tree eighteen thirty. Come prepared. Over."

She'll love it. Try it and see; but don't blame me if she doesn't understand the message, and that if she does she will come prepared to knock your block off.

In short, R/T speech training is a long and difficult business; old habits of conversation must be conquered, accents must be overcome, and, above all, you must learn to think before you speak. Remember that if you are in a tight corner, or the Hun is on your friend's tail, it is the quick, clear and concise message that will save life.

A Brewster Bermuda I. The delivery of this aircraft to the R.A.F. has begun, although not in large numbers. The dimensions are: span 47 ft., length 39 ft. 6 in., height 15 ft. 3 ins. Top speed is about 300 m.p.h. and it has a bomb load of approximately half a ton.





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.

Hell and High Altitude
By M. Seaven. Edited by Capt. M. Ventura, R.A.F. (Retd.). 5"×7½". 184 pages. Methuen & Co., Ltd. 7/6.
Breezy straight-from-the-shoulder extracts from the 1940 diary of a bomber pilot who during the Battle of Britain was among those who started the counter-offensive which is now reaching its climax. Entertaining and revealing.

Star Recognition
By Francis Chichester. Two Charts and Instructions. Allen & Unwin. 7/6.
Two large star charts on Mercator's projection charting 390 stars, one with names and one without; two smaller Polar star charts, together with explanatory booklet which contains a catalogue of first and second magnitude stars with their mean positions for January 1943 in terms of Dec., S.H.A. and R.A., with annual variations for the middle of the year.

The Sky's the Limit
By D. Farrer. 5"×7⅜". 95 pages. Hutchinson & Co. 6/-.
The story, by one of his admirers, of Lord Beaverbrook's work at the Ministry of Aircraft Production in 1940. Discloses some facts not generally known, but probably does not tell the whole story.

An Aircraft Tale
By S. M-M. Drawings by Dora Shackell. 6½"×8¼". 34 pages. Sir Isaac Pitman & Sons. 3/-.
For your very young brother. A child's story of a visit to an aircraft factory and a flight. Entertaining, and accurate technical details.

Aerodynamics of the Aeroplane
By W. L. Cowley, Wh.Sch., A.R.C.Sc., D.I.C. 5¼"×7⅜". 201 pages. Nelson & Sons. 5/-.
A study of aerodynamics for those who have reached matriculation standard.

Basic Radio
By C. L. Boltz, B.Sc. 5⅜"×7⅜". 272 pages. Thos. Nelson & Sons. 5/-.
An elementary text-book covering the Air Training Corps Syllabus.

Automobile Electrical Maintenance
By A. W. Judge, A.R.Sc., Wh.Sc., A.M.I.A.E. 5"×7⅜". 279 pages. Pitmans. 7/6.
A guide for Service men and private motorists to the maintenance of the electrical systems of modern automobiles.

Meteorology Simplified
By J. I. Fell, B.Sc.(Hons.). 4⅞"×7¼". 52 pages. Pitmans. 1/-.
An elementary study of meteorology, covering the A.T.C. syllabus.

Nice Types
By Raff and Anthony Armstrong. 7½"×5". 83 pages. Methuen. 5/-.
The creator of Pilot Officer Prune has some fun at the expense of a few others.

Operation of Aircraft Engines
Published under the supervision of the Training Division, Bureau of Aeronautics, U.S. Navy. 4⅞"×7⅜". 206 pages. McGraw-Hill Book Co. Inc. 6/-.
(*Reviewed by Gordon Freeman.*)
Breezy and instructive. Primarily for Americans. Though some of the subjects dealt with do not apply exactly to British engines, this book can be recommended particularly to all potential pilots.

"Obviously a—"

(*see page* 23)

1, Douglas Boston; 2, Beechcraft AT-11; 3, Handley Page Hampden; 4, Grumman F2F-1; 5, Hawker Hurricane IID; 6, Dornier Do 23; 7, Boeing Fortress IIs; 8, DB-3A; 9, North American Yale; 10, Supermarine Spitfire VB; 11, Fairey Swordfish; 12, Bristol Beaufighter; 13, Douglas Boston; 14, Avro Anson; 15, Brewster Buffaloes; 16, Consolidated Catalina; 17, Douglas Dakota; 18, Grumman Martlet; 19, Grumman Avenger; 20, Curtiss Seamew; 21, Piper Cub; 22, Bell Airacobra; 23, Short Stirling; 24, Bristol Beaufort; 25, North American Mustang; 26, North American Harvard; 27, Vickers-Armstrongs Walrus; 29, North American Mustang.

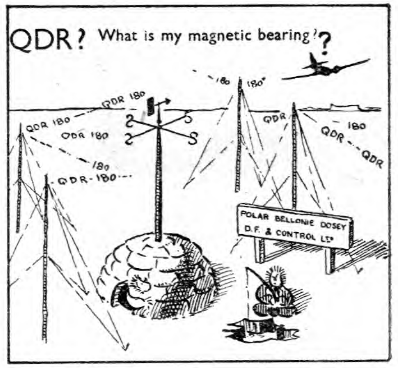
Points of View

(*see page* 15)

1, Fairchild 91; 2, Bristol Beaufort; 3, Caproni Ca 135; 4, Blohm und Voss Bv 138; 5, Waco CG-4 (Hadrian) Glider; 6, Armstrong-Whitworth Whitley; 7, Consolidated Liberator; 8, Vought Sikorsky Corsair; 9, Focke-Wulf 200k Kurier; 10, Avro Lancaster; 11, Blackburn Roc; 12, Vultee Vengeance; 13, Bell Airacobra; 14, Grumman Goose; 15, Junkers Ju 52/3m; 16, Miles Master III; 17, Piper Cub; 18, North American Mustang.

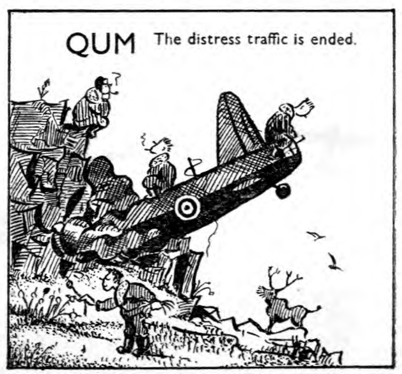
The Q Code

Drawn by W. Megoran



QDR? What is my magnetic bearing?

QCY I am working on a trailing aerial.


QUM The distress traffic is ended.


QCP Your note is bad.

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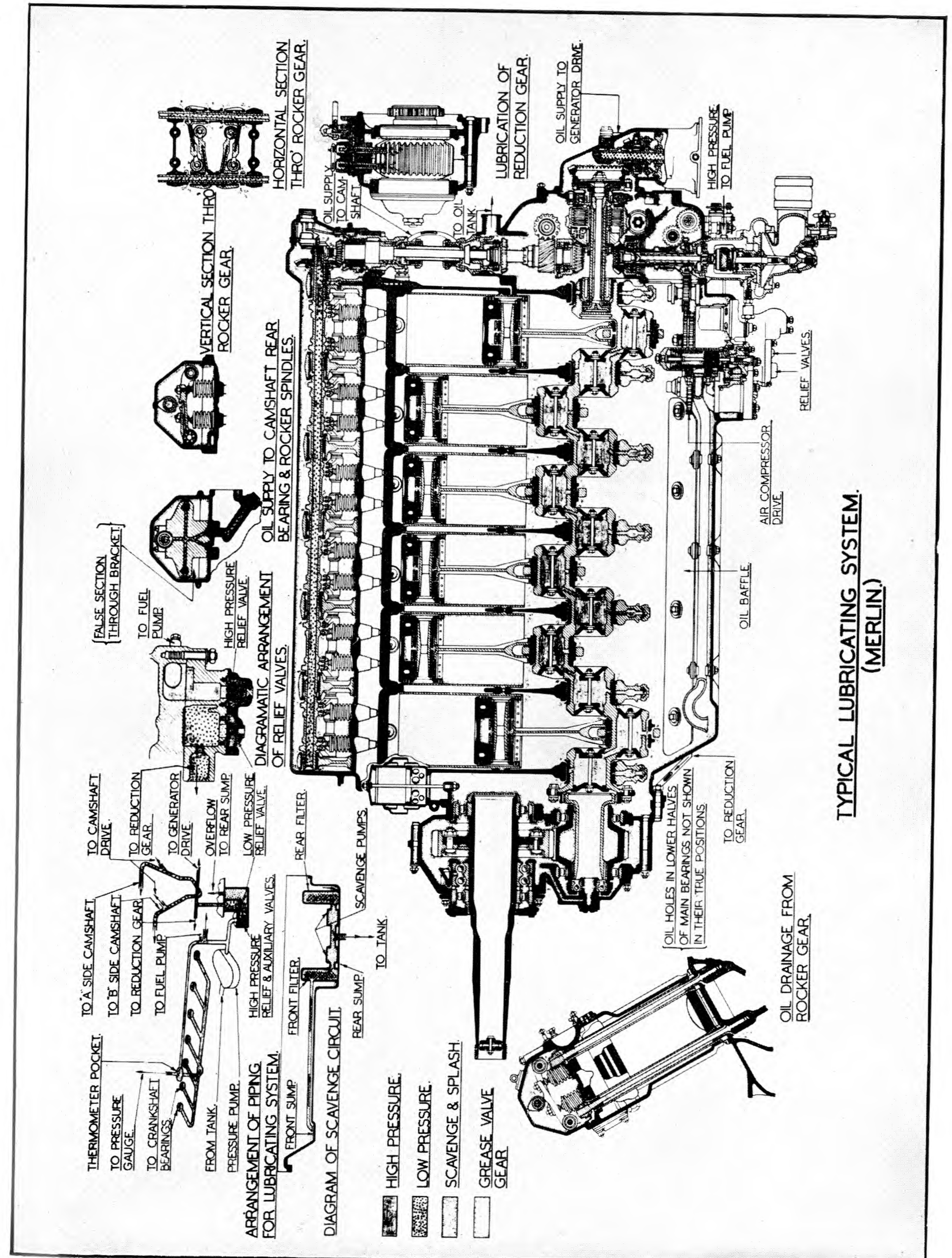

TYPICAL LUBRICATING SYSTEM. (MERLIN)