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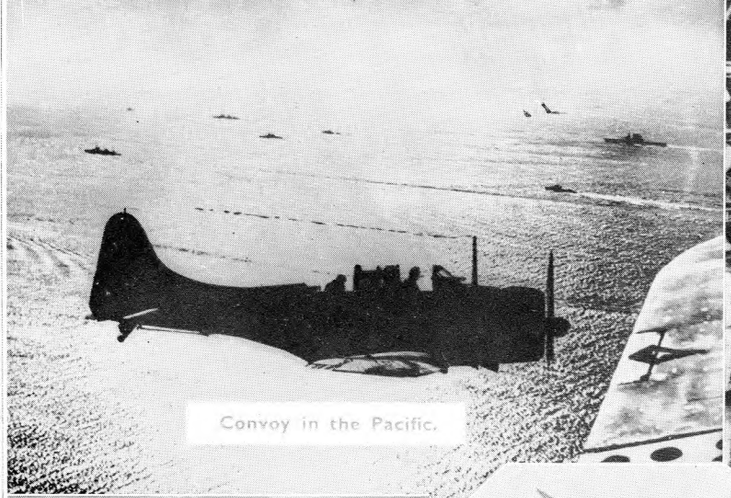
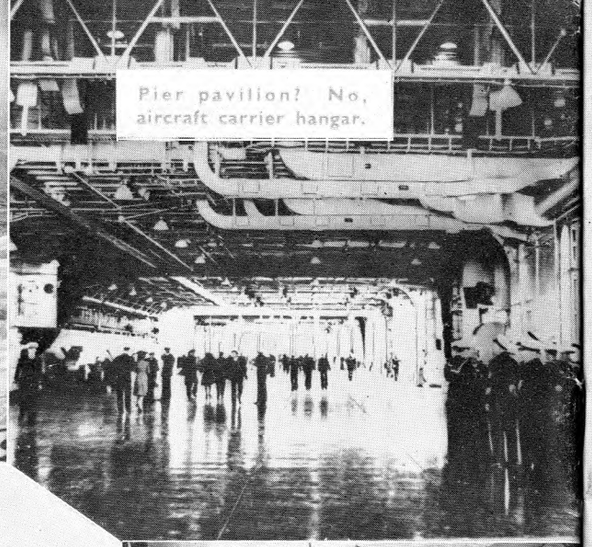
It is my hope that you find the file of use to you personally – I know that I would have liked to have found some of these files years ago – they would have saved me a lot of time !

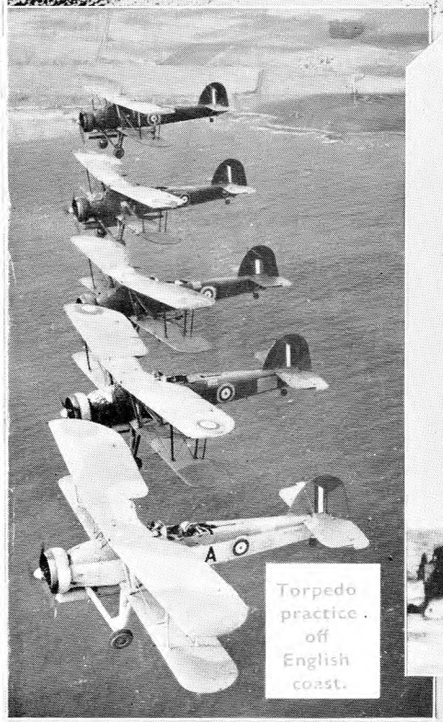
Colin Hinson
In the village of Blunham, Bedfordshire.



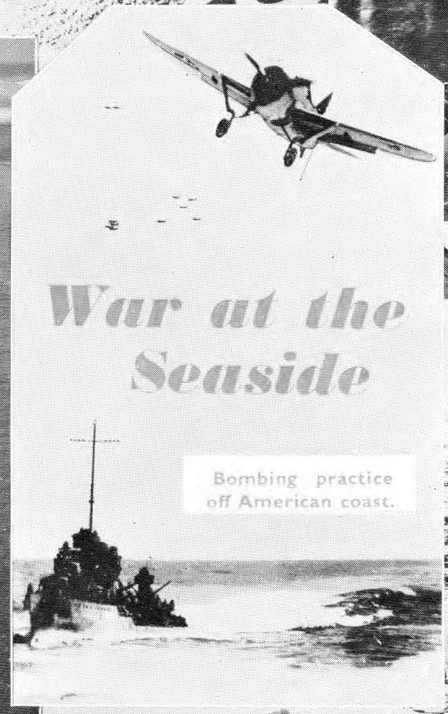
Convoy in the Pacific.



Pier pavilion? No, aircraft carrier hangar.



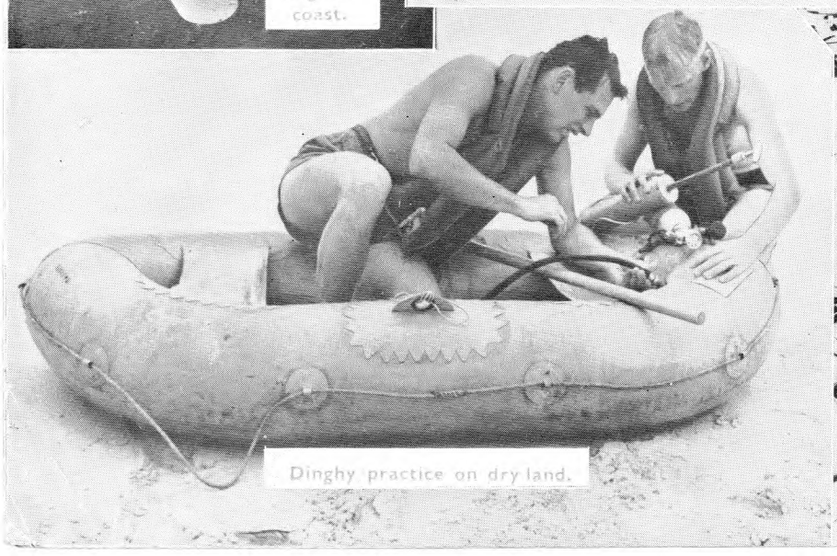
Torpedo practice off English coast.



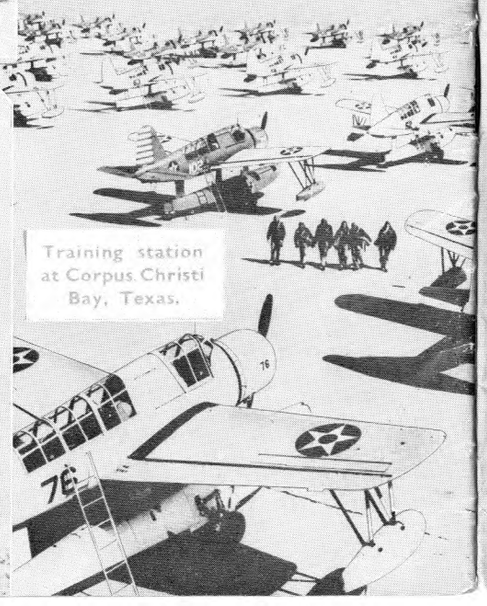
War at the Seaside

Bombing practice off American coast.

Catalina houseboat.



Dinghy practice on dry land.



Training station at Corpus Christi Bay, Texas.

AIR TRAINING CORPS GAZETTE

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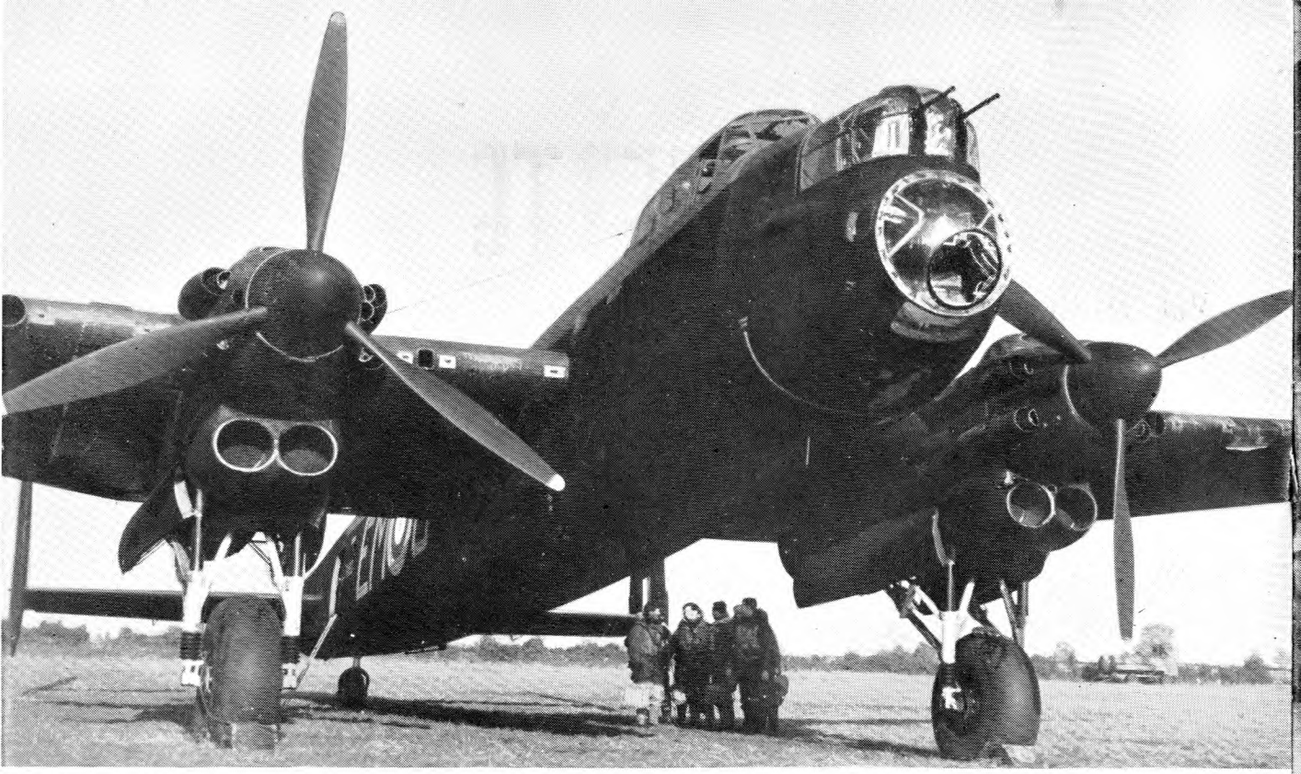


The Avro Manchester scales 25 tons all-up and the 1,845-h.p. or 1,950-h.p. Rolls Royce Vulture motors give it a top speed of 280 m.p.h.

The Short Stirling below is fitted with four Bristol Hercules motors, giving a top speed of 280 m.p.h. It is reputed to be able to carry a bomb load of eight tons for over 2,000 miles.

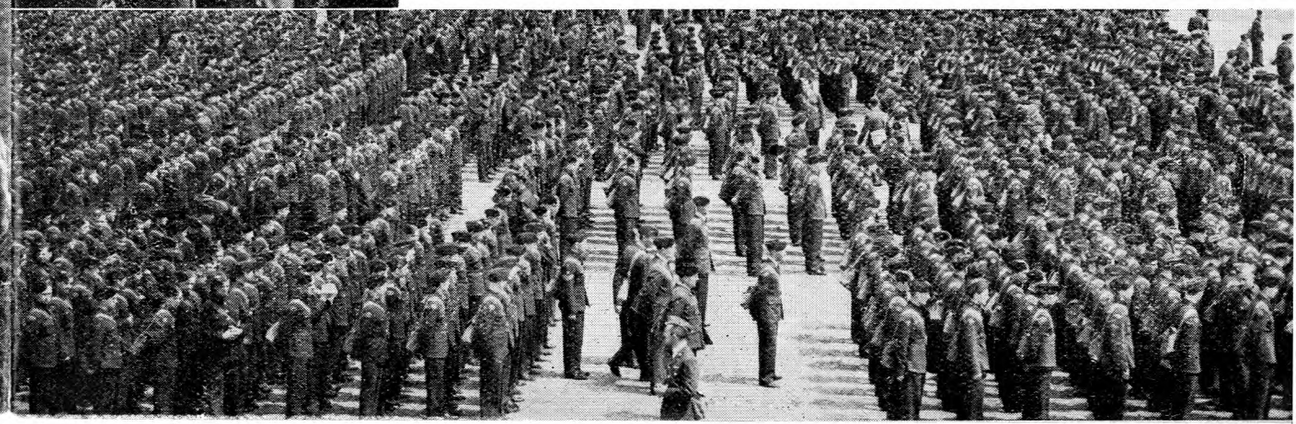
The King inspected Cadets at Buckingham Palace on the 4th July. Parades were held all over the country on the 5th July. The other pictures show Windsor cadets marching past the Castle, Air Chief-Marshal Sir Charles Portal, Chief of the Air Staff, inspecting Cadets in Hyde Park, and a section of the parade in the park.

Salute to the A.T.C.

AS Commandant of the Air Training Corps during the first eighteen months of its existence, I have led a violent but most interesting life, which I and all the staff at Stanmore have thoroughly enjoyed.

I am sure that the understanding, confidence and loyalty that have made the heavy work so pleasant will continue to be shown in full measure by all of you to the Regional Commandants and to the Director and his staff at the Air Ministry. I hope that the spirit of service will continue to animate the Corps. As the war goes on, our tempers get shorter and our purses shallower, but we must still not forget the high motives that inspired us to give our services to the State. I am sure that if we lose that spirit and think too much of what people in other spheres make out of their service, we shall lose something which has made the Corps the great body it has become.

It is a happy coincidence that the last days of Headquarters at Stanmore have been marked by so great an event as the general



parade of the Corps on July 5th. All over the country, I am sure, the squadrons of the Corps, attending in a common service, have won golden opinions for their smartness. I only wish that the whole Corps could have been included in the great parade we held in London of over 10,000 officers and cadets from 83 different squadrons. The packed mass of blue was a most inspiring sight, and it was impressive to see this large body moving accurately and smoothly to the commands of a single voice.

The credit for the success of this great parade must be shared by Wing Commander Keat, his staff and the D.I.O.s of the London Area, who were responsible for the organisation, and the officers, warrant officers and cadets of all the squadrons participating, who responded so magnificently.

On the previous day 100 of our cadets, drawn from 16 squadrons and under the command of Flight Lieut. Huxley, had, with 100 of their brothers from the Royal Navy and from the Army, paraded at Buckingham Palace for inspection by His Majesty the King. I can assure you that, if you could have seen the representatives of the A.T.C. in that picked gathering, you would have been as proud as we who were privileged to attend were of the bearing of our contingent. The best of regulars could not have done better as regards smartness of turnout and accuracy of movement.

These were two good and heartening displays to live in our memory.

Although Headquarters at Stanmore has now ceased to exist, most of the officers and many of the airmen and airwomen and civilian staff who have worked so hard in your interests will continue to serve them from within the Air Ministry.

I myself look forward, as Inspector of the Air Training Corps, to seeing—and I hope that I may say helping to guide—all of you in your further progress and to continue by the kindness of the Editor of the *A.T.C. Gazette* to contact you on this page from month to month.

J. A. Chamier

AIR COMMODORE
INSPECTOR, AIR TRAINING CORPS

A Strong Team

The Royal Inspection

HIS MAJESTY THE KING recently at Buckingham Palace honoured the three Cadet Corps by inspecting 100 cadets from each Service. I wish the whole Corps could have been with me and seen the fine bearing of our cadets on parade. I feel sure the Air Training Corps will be glad to know how well they were represented on that important occasion.

A.T.C. Sunday

A.T.C. Sunday belongs to history. The world now knows that church parades and public worship are part of the preparation and training to fit us for service in the air or at sea. By taking the service at the great parade in Hyde Park, the Bishop of London, assisted by representatives of other denominations and the Chaplain-in-Chief of the Royal Air Force, gave us the support, guidance and inspiration we require for the proper fulfilment of our work. The same may be said of all those other services held throughout the country on that great day.

A.T.C. Sunday also gave us the opportunity to show to the Royal Air Force what we had achieved during the eighteen months of our existence. That the Royal Air Force appreciates the importance of our work may be judged by the fact that at Hyde Park the Secretary of State for Air took the salute, supported by both the Under-Secretaries, the Chief of the Air Staff, and seven Air Marshals, including Marshal of the Royal Air Force Lord Trenchard. Throughout the country, too, senior officers of the Royal Air Force showed by their presence the value they attach to the work we are doing. It is up to us to endeavour to achieve in every way we can the high standards set us by the Royal Air Force. Their example and their interest in us we can but best repay by making ourselves ever more efficient.

The Reorganisation

We must go forward. Nothing is static except that which perishes. It is in that spirit that the Air Council recently decided to simplify the organisation, accelerate administration and strengthen the central direction of the Corps by giving to the Commands some of the duties hitherto undertaken by the Headquarters of the A.T.C. at Stanmore and transferring the rest to the Air Ministry.

The services and experience of those who have done so much for the development of the Corps at Stanmore will not be lost. The staff at Headquarters has been transferred to the Air Ministry, where they will continue to give of their best to the Corps as in the past.

The change in the organisation has relieved Air Commodore Chamier of much of the heavy burden of administration. Relieved of this burden, his great experience in the working of the Corps will be able to be used to better advantage by helping us in the forming of policy at the centre, and by giving him more time to travel around than hitherto, and thus see units at their work and learn firsthand of their problems.

The Corps is extremely fortunate, as within the last few days Air Commodore Warrington-Morris, formerly Commandant of the Royal Observer Corps, has joined us in the post of Deputy Director. He will undertake a substantial part of the work of administration at the Air Ministry.

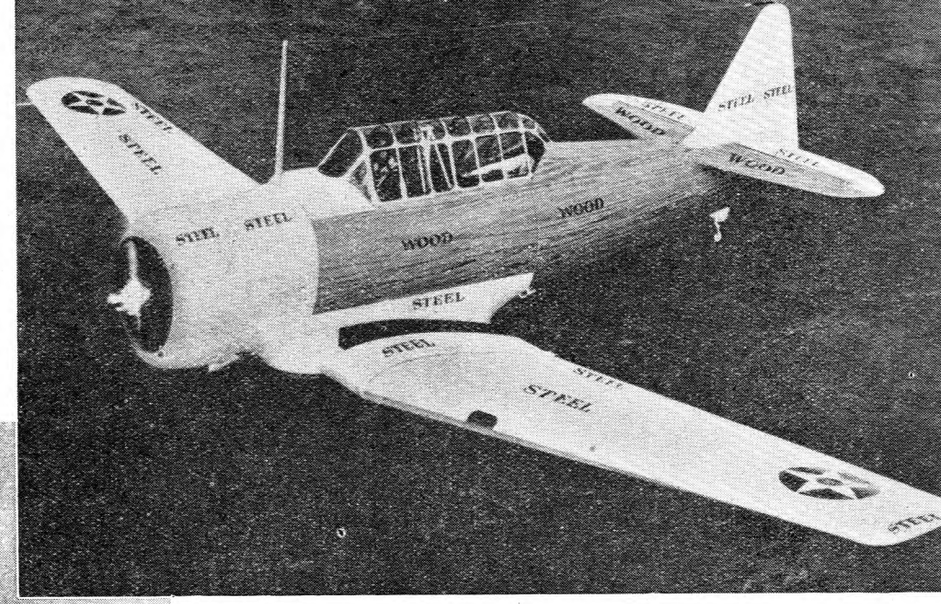
I have also recently appointed a Chairmen's Advisory Committee, with Sir Bertram Jones, Chairman of the Purley and Coulsdon Squadron, as Chairman of the Committee. This Committee is composed of a number of active Chairmen drawn from various parts of the country, and I feel will be most helpful in giving me advice on problems of administration. In this way I hope that we are building up a strong team at the centre to give all help possible to the Commandants responsible for carrying out policy in the field. I know that they, for their part, will do all they can to help committees, officers, instructors and cadets in furthering the work and efficiency of the Corps.

W. W. Wakefield

DIRECTOR OF THE A.T.C.

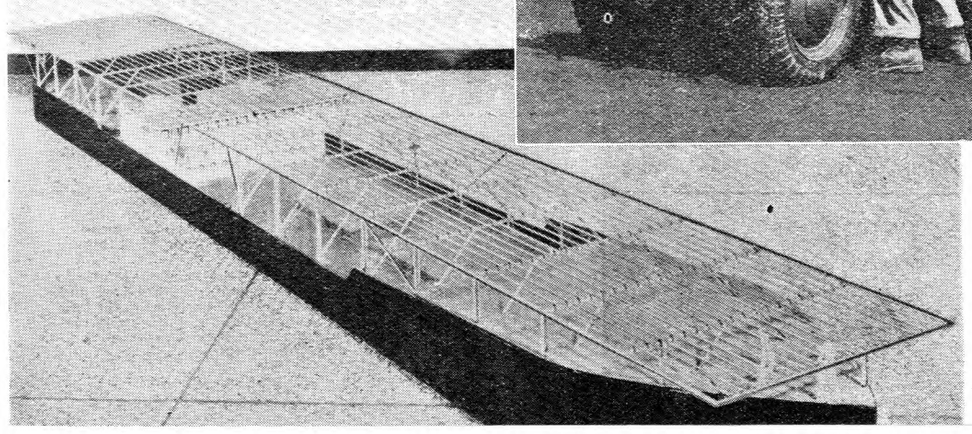
AMERICA JUMPS TO IT

Men and women of the U.S.A. have jumped feet first into this war with vigour and new ideas. On the right is a suggestion for saving 75% of the aluminium now used in the construction of a North American AT-6A advanced trainer. According to reports, in each machine of this type, over half a ton of aluminium will be saved for other vital uses, the aluminium being replaced as shown in the picture.



A seaman jumping from an American Naval trainer at Corpus Christi (Texas) Naval Training School. America has paratroops in the Army, Navy and Marines.

"Marine Air Raiders," some wearing the new-type steel helmet, unloading one of the Jeep light cars from a Douglas DC-3 modified for military use. This aircraft also carries the anti-tank gun, which is hitched to the Jeep.



A novel suggestion put forward by an American is this grid for converting a tanker or freighter to an aircraft carrier. It is claimed by the designer, J. B. Quinn, that the grid, composed of eight-inch pipes and supported by steel girders, would only weigh 300 tons when fitted to a 400-foot ship. To use it, the aircraft would have to use a special form of wheel or roller.

TRAINING IN AMERICA

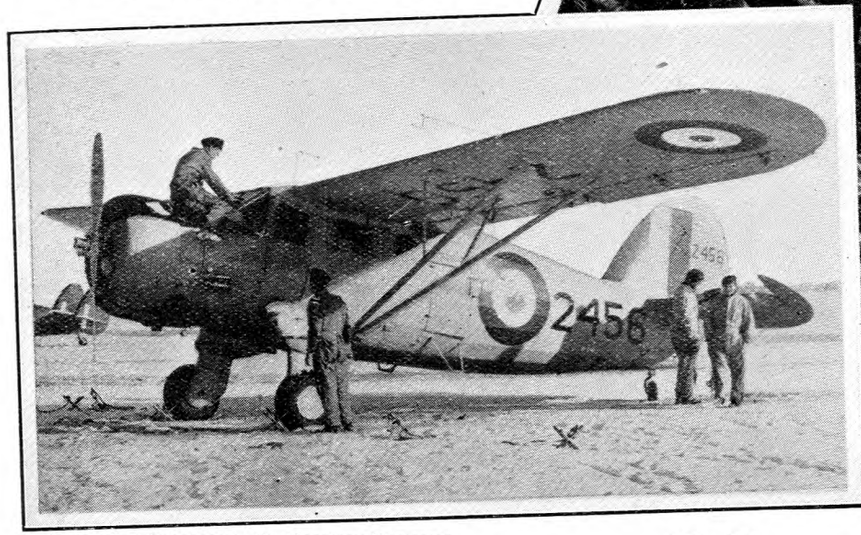
With British and American aircraft production accelerating quickly, the R. A. F. must speed up training to keep pace with the influx of new machines. The U.S. Army Air Forces are training 8,000 pilots a year for the R.A.F., the cadets being under the supervision of U.S. Army Air Corps officers and receiving the same training as American pilots.

Everywhere the R.A.F. boys are welcomed with the typical hospitality of the Americans, and all who go to America for their training have the time of their lives.

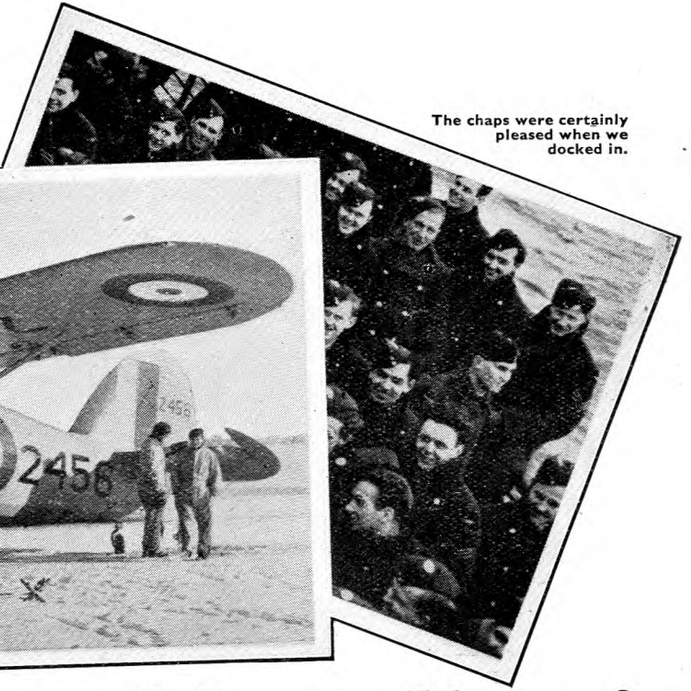
At the top of the page an R.A.F. cadet, in the back cockpit of a Stearman PT-17 primary trainer, is receiving last minute advice from his instructor before taking off, and in the middle picture the instructor watches the cadet on his first solo. The horsepower of the Stearman PT-17 is 220 h.p., while that of the Tiger Moth, our own biplane trainer, is 130 h.p.

American cadets at the Bombardier Training School in Midland, Texas, are seen going through ground drill with the new and very secret American bomb-sight, which is covered from the lens of the camera. Very little has been said about this new bomb-sight, save that it is highly accurate and will be a great asset to the destructive power of American bombers.

Canada is Marvellous!



A spot of maintenance on the Noorduyn Norseman. The motor is a 550-h.p. Pratt and Whitney Wasp, giving it a top speed of about 170 m.p.h.



The chaps were certainly pleased when we docked in.

Read this letter written by an R.A.F. cadet in Canada to his mother in England. Whether you are likely to go to Canada or not, you will enjoy it. A few lines have been omitted where indicated by a row of dots, otherwise the letter is unaltered.

Dear Mum,

Well, here I am safe and sound and bang in front as usual. By the time you get this letter Dorothy will have got my cablegram and you will have ceased to worry. . . .

We were put on the train at the dock immediately upon leaving the ship, after having handed in our respirators (we don't wear them over here, thank God) and receiving our ten dollars, or "sawbuck," which is our allowance for the train journey.

Stepping from the ship on to the train was like stepping from Hell to Heaven.

Canada is absolutely marvellous. I can't even attempt to describe it, and anyway no words of mine could ever be adequate enough to do full justice to this wonderful country. My heart is so overflowing with happiness and wonder that I just don't know where to begin.

We docked at 4 p.m., but were not disembarked until 10.30. We leaned over the rail and cheered, sang and went gloriously mad from the time that land was sighted until the time we docked. We then went, very reluctantly, below and had tea at 5.30 and then came up again at about 6.30. By that time it had grown dark, and the first thing that met our astounded eyes when we came up on deck again were the lights. Oh, those lights! I think it was the greatest thrill of my life. There were big lights, small lights, bright lights, dim lights, red lights, green lights, blue lights, yellow lights, moving lights, stationary lights—the whole world was ablaze with light. After groping around in the dark for over two years the whole thing seemed incredibly unreal. You've absolutely no idea what it looked like; I can't describe it. I can't describe anything about this place properly—it's just too good to be true; it just defies description.

Anyway we said a thankful good-bye to that lousy troop-ship and boarded the train. This train is absolutely the last word in twentieth-century comfort and convenience. Great wide carriages, marvellously centrally heated, BUNKS, *wash-places, everything. We were woken at 7.00 a.m. by a* STEWARD, *and shown the way to the dining-car. And the food! Oh boy, the food!! I could go into raptures for pages and pages about the quantity and quality of the food, but knowing as I do what rationing is like I'll spare you the agony and just give a brief description.*

The dining-car was large and airy, and the tables in there were ready laid complete with snowy-white table-cloths, beautiful cutlery, a butter dish containing half a pound of fresh Canadian butter, another dish full of thick strawberry jam, another full to the brim with sugar and yet another containing cream. Just imagine our feelings after eating putrid stew for 14 days out of a mess tin!

We all sat down two at a table, and as soon as we were all in, in came waiters carrying bowls of steaming hot porridge, which we ate with lashings of cream and sugar.

When that was cleared away they brought in plates containing two eggs, three sausages and two rashers of bacon. This was washed down with unlimited cups of real Canadian coffee and piles of the most delicious bread and butter I have ever tasted.

With that safely tucked away we staggered back to our luxurious upholstered seats, and no sooner had we sat down when a fellow came along with two baskets laden with chocolate popcorn, sweets, huge red, shiny apples, great juicy oranges, tins of tomato juice, cigarettes, cigars, books and magazines. He went down in the ensuing rush and so far has not been found. . . .

We arrived at the receiving centre on Tuesday night, and what a place it is too! We are billeted on the site of the Exhibition Grounds, in a building which is approximately seven times as big as Wembley Stadium, and comprises, in addition to eating and sleeping accommodation, a sports arena which will seat an audience of 10,000, a cinema, a milk bar, a café, a Y.M.C.A., a barber's shop (ten chairs), a tailor's shop, a cleaning and pressing while-you-wait service, a Mothers' Corner Service staffed by Canadian mothers who repair tears and sew on buttons, etc., a boxing-ring, swimming-pool, a library, and finally a huge lounge full of deep armchairs and little writing-tables with specially shaded lights for reading and writing; on the walls are expensive pictures and in the middle is a large ultra-modern radiogram.

We, as R.A.F. u/t pilots are treated

as gods, no less. In the eyes of the Toronto people we can do no wrong. We have all had so many invitations out we cannot possibly accept them all. We have been interviewed and our names and photographs have appeared in the Toronto papers. We are, I believe, going to broadcast to Canadian listeners on the C.B.C. network soon. We are stopped in the street and in the street cars by the Canadian people and asked how we are getting on and how England is faring. We can't walk more than a few yards down the street without people picking us up in their cars and inviting us out to dinner. . . .

I'll never forget what happened on our first parade. . . .

At I.T.W. for four months we had nothing but drill, drill, drill, so when we fell in it looked pretty smart; we received our instructions, and, lo and behold, when we marched off we made our exit to a storm of cheering from all the other R.C.A.F. fellows waiting to come on parade! I'll never forget it; it made us feel really proud to belong to the R.A.F.

Since we've been here we've been swimming at the Central Y.M.C.A., dancing at a huge hotel, ice and roller skating; we've played skittles in one of those skittle alleys; we've seen a spectacular ice festival at the Maple Leaf Gardens, where the famous Toronto Maple Leafs plays; and if you tune in next Sunday to the ice hockey which is always broadcast by the B.B.C. every Sunday you'll know that I shall be actually there watching it. . . .

Now here comes the high-spot of this letter. Last night the R.C.A.F. staged a military and sports festival to a crowd of 10,000, and the guests of honour were headed by AIR MARSHAL "BILLY" BISHOP, *Commander-in-Chief of the R.C.A.F.! . . .*

We were the last on the programme and lined up rather nervously in the pit, until we heard the band strike up the R.A.F. march, and then with our R.A.F. drill sergeant at our head we marched on.

Well, I've honestly never heard such cheers before as those that greeted us. They were so deafening that the sergeant had to wait a full five minutes before he could make himself heard. Everything we did—halts, turnings on the march, saluting, slow marching—were all greeted with absolutely deafening cheers; we were undoubtedly the turn of the evening. There were reporters and photographers there, and we were all photographed and some fellows were interviewed, but unfortunately I was not around when they were. Some of us were even asked for our AUTOGRAPHS!

When we marched past Billy Bishop and gave eyes right while he took the salute, the crowd went absolutely crazy and threw confetti, streamers and what-not. We were all of us invited out to about twenty different places by various people and were given an over-night pass by the C.O. It was undoubtedly the most memorable day of my life. . . .

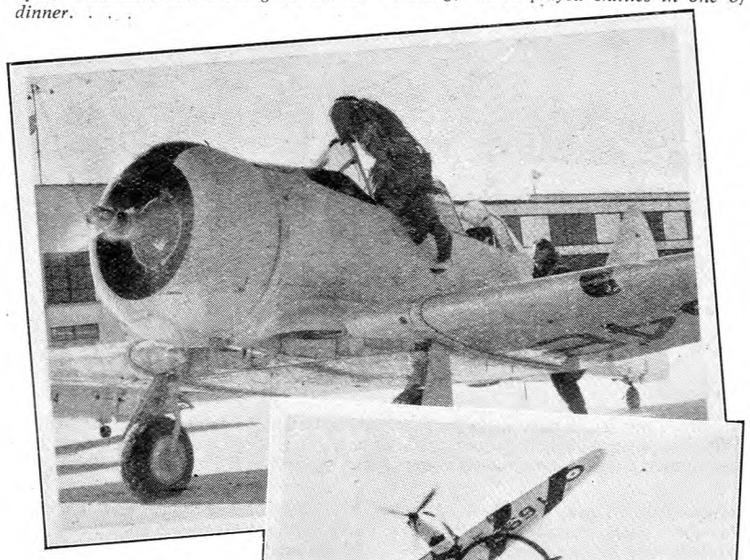
We're really having a most marvellous time here, Mum, and I only wish that you could all be here and see the lights, full shops, crowded streets and luxury. After two and a half years of war this place is sheer paradise, and one is apt to forget that lives are being lost and people are living in misery and worry back home. We blamed America for her Isolationist policy, but after only a week here the war seems a long way to me, so you can imagine what it seems like to people who have never known what war is.

Nevertheless, however marvellous a time I have here, I shall always be looking towards the time when I can get my training done and come back home again to do my bit towards getting the lights on and the shops full in England just as they are here. (There will now be a fanfare of trumpets and the band will play "Rule Britannia" and anybody heard singing "He wants to be a pilot, bless his heart" will be publicly squashed.)

Well, that really is all for now, Mum; give my love to all at home and write soon, won't you?

Bye-bye,
All my love,
Don.

PS.—Would you send all my available photographs, please? My public, you know.



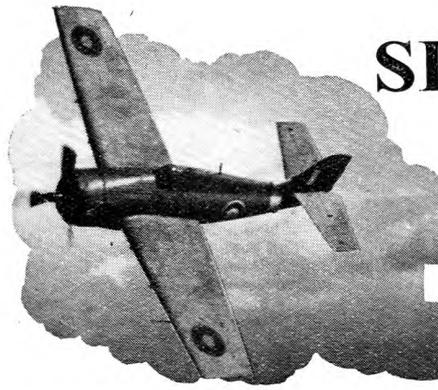
Two of our men climbing into a Harvard advanced trainer which is the main type of machine used for this purpose out here.

The right view to get on aerial gunnery practice. The target machine used is a Fairey Battle.

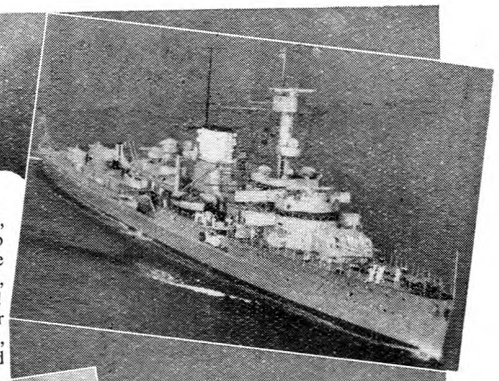
We have no picture of Canadian hospitality but this of American hospitality is typical of both.

SHIP RECOGNITION

A naval officer here discusses ship recognition. Silhouettes drawn by the author to scale of ½-inch equals 100 feet.

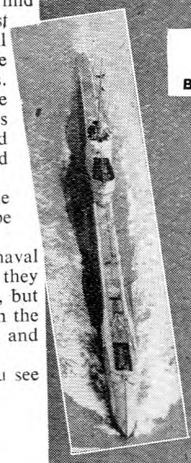


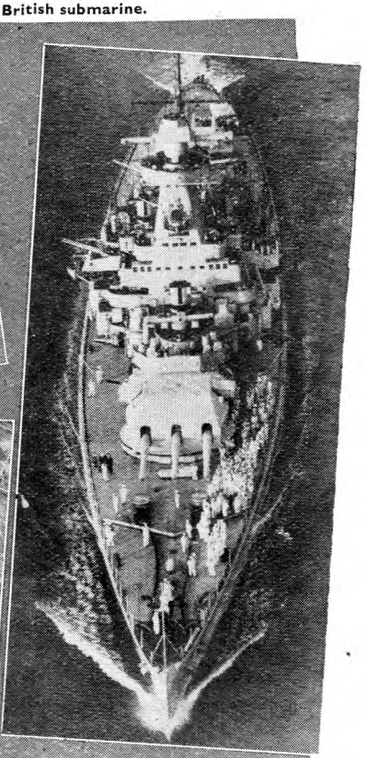
Grumman Martlet fleet fighter.



German light cruiser.

British submarine.





IT is obvious that we should we able to recognise aircraft from the ground, sea or air. Has it struck you that it is equally important to be able to recognise ships from the air? If we had two thousand million of the Observer Corps suspended in balloons all over the world watching ships, how easy it would make our problem—and how pleasant for the R.O.C.!

For the Naval Air Service such knowledge is vital, but it is equally so for the Royal Air Force. Not only Coastal Command, but Bomber Command, play a vital part in our sea operations, and even fighter aircraft may find themselves in a position to give enemy naval information of the greatest importance. Our own and our Allies' surface forces are strung out all round the globe, and rely increasingly on good aircraft reports of the enemy. The effect of bad and uninformed reports may be disastrous.

We can't be overwhelmingly strong everywhere, and economy of force is necessary. If aircraft reconnaissance is reliable we can put our ships in the right place. If we get bad reports, we may send our ships and aircraft out on wild-goose chases, wasting fuel, time and effort—and weakening our strategic position.

The man in the aeroplane making enemy reports must be no prune. He has got to be able to tell (*a*) where a ship is when he sees it, (*b*) what type of ship it is, (*c*) what class of ship, and so on.

The Commanders-in-Chief of our Naval Forces, with their lifelong naval experience and sea sense, must rely on young airmen to tell them what they can see, clearly and briefly. The air crews are responding magnificently, but we want even better results. If the Admiral can rely on you to give him the right stuff, he may be able to release surface scouting ships, cruisers and destroyers for operations elsewhere.

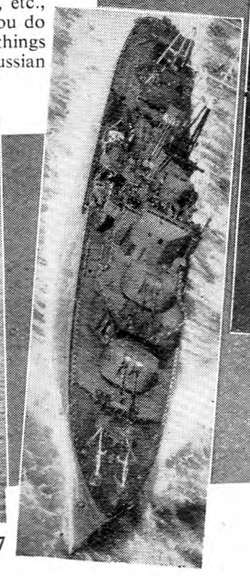
A good report from an intelligent air crew may win a battle, so you see the necessity for a good knowledge of ships.

Type Characteristics

Now how to set about it. . . .

When you see an aircraft you look at the wings, engines, tail, etc., and you look for national characteristics or family likenesses. You do the same with ships. Certain nations reflect their ideas in the things they make and do—an American car, a British locomotive, a Prussian

Aircraft carrier H.M.S Illustrious.



German battleship.

British destroyer.

haircut and so on. This applies in the same degree to warships. I'll point out some of these in a later article, but first of all let us take a look at the general characteristics of each type of ship which are common to all nationalities. By type, of course, I mean battleship, cruiser, destroyer, and so on. Classes are subdivisions within the types, i.e. a British battleship may belong either to the King George V, Nelson, Queen Elizabeth or Revenge classes. To distinguish between them is simply a matter of experience, and is outside the scope of this article. Some enthusiasts go even further, and can tell the individual ships of a class from each other, but this requires an intimate personal knowledge of the ships themselves, which, moreover, change their appearance in minor details after every refit. Such knowledge is chiefly of academic interest, but has its uses on occasions. (The identity of the Littorio-class battleship damaged in the Battle of Matapan is a case in point.) For the present we may leave this kind of thing to the experts, and make a start by learning to recognise the different types by their most outstanding points. Here are the chief ones:

Battleship.

Battleships (including battle-cruisers, which are virtually obsolete as a distinct type).—One or two funnels, which, together with the masts, are always vertical. High superstructures and bridges, and, in the older classes, heavy tripod masts fitted with prominent control tops. In single-funnelled ships this gives them a triangular silhouette in the distance.

Destroyer.

Sloop.

Aircraft Carrier.

When seen from above, the proportion of "beam" (i.e. breadth) to length is noticeably greater than in other types, and this is enhanced in some cases by external "bulges" for protection against torpedoes. To sum up, they have a heavy, sometimes almost clumsy appearance when compared with other ships. If you think of the Navy's term: "battle-wagons," and "the top-'eavy battleship" in which the four jolly sailormen in the song "rolled their way 'ome," it may help.

Cruisers may have one, two or three funnels, often "raking" (i.e. sloping aft). Their bridges and superstructures are much lower than those of battleships, and their figures slimmer. An altogether more rakish appearance.

Destroyers.—One to four funnels. (Generally speaking, the fewer the funnels the more modern the ship.) These and the masts almost always have a pronounced rake, and the funnel-tops are cut off square with their sides instead of being horizontal as in the majority of cruisers. Destroyers have grown so much in size during recent years that it is not always easy to distinguish them from small cruisers in the distance.

A fairly close aerial view will reveal steel decks instead of the usual teak planking found in other types. The shape of the stern, too, spells "destroyer." Instead of tapering away to a point, the sides run almost parallel until the round of the stern is reached.

Sloops and escort vessels, etc.—The larger of these might possibly be mistaken for destroyers at a distance, but most of them have only one funnel and an altogether less powerful and speedy appearance. Corvettes are not unlike large trawlers.

Cruiser.

Trawlers differ but little, whatever country they hail from, and are familiar to most people who have spent a holiday by the sea in the days of peace. They have a single tall funnel nearly amidships and a very pronounced "sheer" (i.e. upward slope) in the bow. Except for a coat of grey paint and a gun on the fo'c'sle, they do not convey the impression of warships.

Aircraft Carriers.—In the distance and broadside-on these might be mistaken for battleships. A closer view, however, shows the funnel and the bridge on one side of the ship, to give a clear run for the machines along the flight deck, which extends from bow to stern. Some carriers, particularly the Japanese and one or two of our own, have no visible funnel or superstructure at all, which makes the task of recognition easier still. All have a much higher freeboard than any other type of ship.

Submarine.

Submarines are quite unmistakable. They have no funnels. A conning-tower of oval section and a gun are the only objects on the long turtle-backed hull.

M.T.B.s, M.L.s, etc., are of varying types, but generally speaking look like overgrown motor-boats — which in fact they are. Those with funnels can generally be spotted by the intermittent exhaust from their internal combustion engines.

In addition to all these, there is a host of other types such as depot ships, mine-layers, netlayers, boom-defence vessels, fleet auxiliaries, etc., but to deal with these individually would require a whole volume, and the reader has probably already had as much as he can digest at one meal.

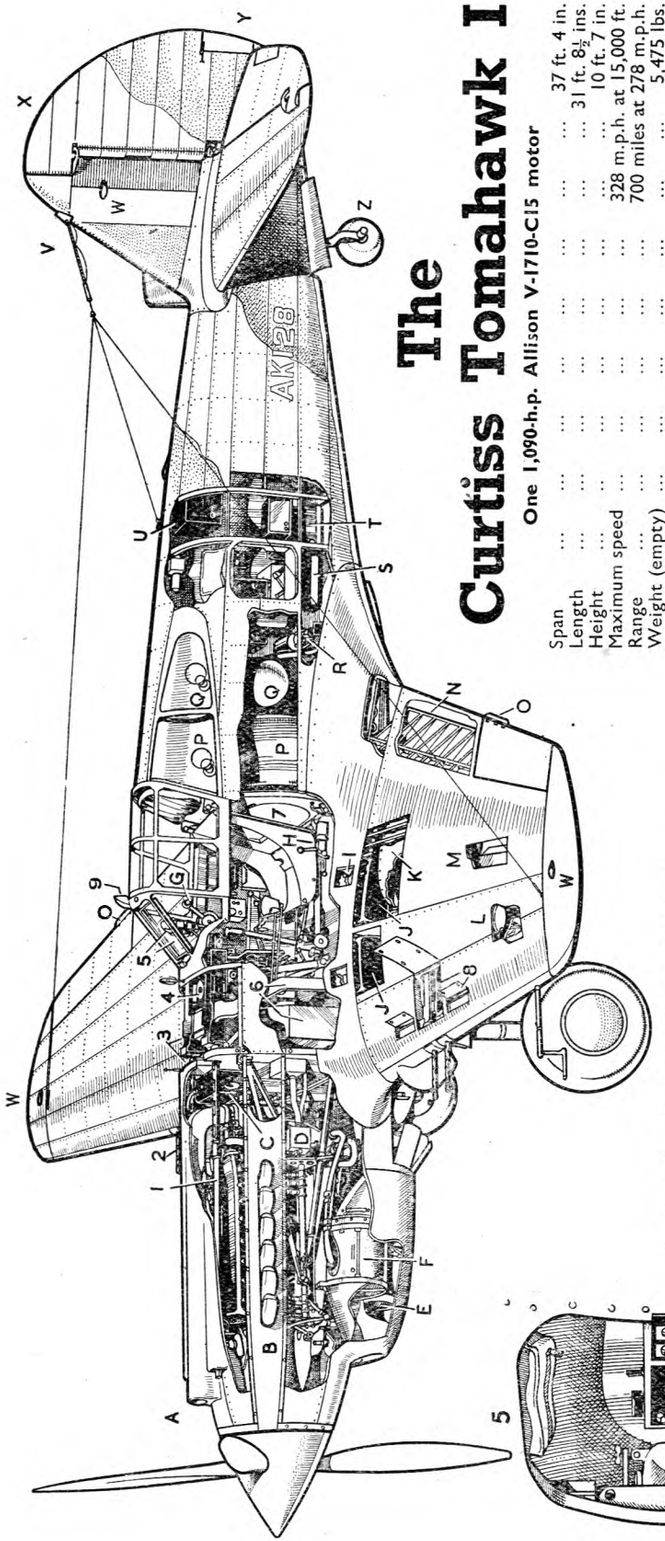
Trawler.

(A further article on ship recognition will appear in next month's issue of the "Gazette.")

The Curtiss Tomahawk I

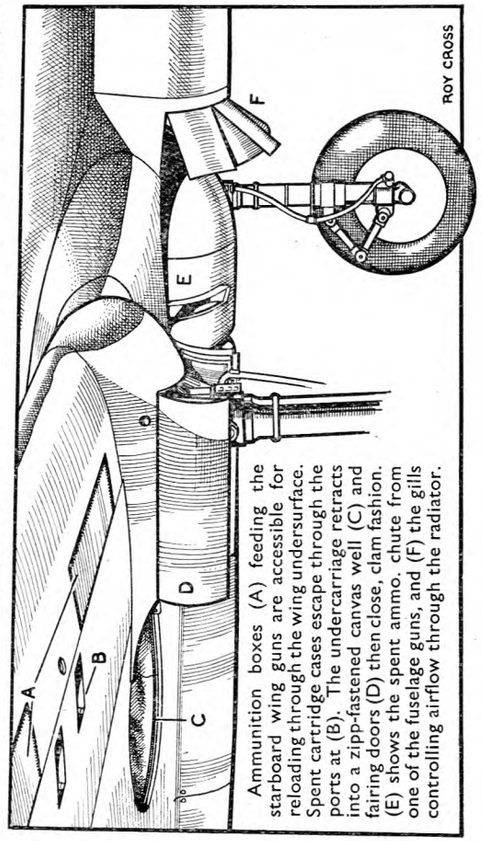
One 1,090-h.p. Allison V-1710-C15 motor

Span	37 ft. 4 in.
Length	31 ft. 8½ ins.
Height	10 ft. 7 in.
Maximum speed	328 m.p.h. at 15,000 ft.
Range	700 miles at 278 m.p.h.
Weight (empty)	5,475 lbs.
Weight (loaded)	6,978 lbs.



A, Supercharger air intake; B, detachable panels for access to engine; C, glycol header tank; D, Starter switch; E, oil radiator; F, glycol radiator (two); G, handle for opening cockpit cover; H, flaps and undercarriage selector control; I, filler caps to wing tanks, J; K, canvas wheel well; L, retractable landing light; M, flare stowage in either wing; N, split trailing edge flap; O, trim tabs (not adjustable in flight); P, fuselage fuel tank and filler cap; Q, oil tank; R, electric motor operating hydraulic system; S, oxygen bottle; T, battery; U, radio; V, aerial; W, navigation and formation-keeping lights; X, balanced and fabric-covered rudder; Y, rudder and elevator trimming tabs (adjustable in flight); Z, retractable tail wheel.

I, Blast tubes for two 0.5 fuselage guns; 2, one of the two starboard wing guns; 3, armoured and fireproof bulkhead protecting fuselage guns; 4, windscreen spray container; 5, bullet-proof glass and reflector sight; 6, ammunition box and chute; 7, armour protecting pilot; 8, port wing guns and ammunition boxes; 9, rear view mirror.



Ammunition boxes (A) feeding the starboard wing guns are accessible for reloading through the wing undersurface. Spent cartridge cases escape through the ports at (B). The undercarriage retracts into a zipp-fastened canvas well (C) and fairing doors (D) then close, clam fashion. (E) shows the spent ammo. chute from one of the fuselage guns, and (F) the gills controlling airflow through the radiator.

Access to the radio in the rear fuselage of the Tomahawk is through a small hatch on the port side. This is covered either by a door, or by a quickly detachable panel. Through the hatch can be seen (1) hydraulic reservoir for flaps and undercarriage system, (2) Morse key for ground testing, (3) plug connection for ground starting battery, (4) part of the radio, (5) first aid satchel.

FORMATION

THERE are two kinds of formation flying—the one practised in peace-time for display purposes, and the one required for war. They are not the same.

Before this war began it was customary for British aircraft to formate so tightly that the wing-tip of one machine was flown inside the span of the machine in front—between its wing and tail-plane. It looked grand to the spectators on the ground, and it gave a thrill of power to the pilots who flew that way. It was amazing how skilfully manœuvres were made. Three machines in arrow formation looping together, rolling together, creating an aerial Prince of Wales' feathers in the sky. Sometimes four machines in diamond formation, packed so close that they looked like spots on a dice.

Drill Justified

That kind of spectacular formation flying calls for great skill, exact judgment, and a cool head allied with sure hands and feet. Although the manœuvres made when flying in such formations must be made too slowly to be practical in war, they have the same character for training purposes as basic drill for ground troops. The star exponents of peace-time acrobatic formation flying have made good in this war. H. Broadhurst and E. M. Donaldson were probably the star leaders of the arrow and diamond formations at the time of the last R.A.F. Displays. Then they were both Flight Lieutenants. They are now Group Captains; Broadhurst has the D.S.O., the D.F.C. and the A.F.C., while Donaldson has the D.S.O. and the A.F.C. Their careers justify the flying drill of the fighter squadrons of the years before 1939.

But when the fighter squadrons of the R.A.F. became involved in actual combat with the fighters of the Luftwaffe, the pilots quickly learned that the peace-time form of formation flying was of little use in war. In peace, every pilot in the formation could concentrate upon the leader's moves. It was eyes front all the time. In war, danger came from behind on most occasions. Pilots needed eyes like those insects whose vision encompasses a complete hemisphere. The only way to make up for the blind spots in the human field of vision was to change the type of formation.

Protecting the Rear

The French pilots appear to have realised this first, or, perhaps one should say, they had not forgotten. The fighter squadrons with the Advanced Air Striking Force, Nos. 1 and 73, who were first to engage the German Messerschmitts, copied the French and guarded the rear of their formations with a machine detailed to act as Tail-end Charlie. The job of this pilot was to weave his way, essing behind the Vic, so that he could see what was going on behind. When he spotted Huns to the rear he called out the warning by radio telephone.

CAN YOU RECOGNISE THEM?

On the right, Blackburn Rocs. Notice the different positions of the guns. Below: Lightnings in tight formation. Continuing round the clock we see Bostons, six Spitfires of the Eagle Squadron, four Hurricane IIcs, and five Fairey Fulmars of the Royal Navy.

FLYING *by* Captain Norman Macmillan

This method was devised in the last war to give protection to the vulnerable rear of a formation of fighters. Then there was no radio telephone. The chap at the rear had to fire a Very light, or dive down in front of the leader by way of signal of danger. But all the machines of the last war were less blind to the rear than to-day's fighters because they had open cockpits and the pilot's head stuck out above the deck-line. Their pilots developed rubber-necks and could turn their heads almost as well as a ventriloquist's doll. Their collar sizes increased from about 14 to 16 after a few weeks' fighter formation flying through the exercise their neck muscles got.

Fighters are the most manœuvrable aircraft in formation flying. This is understandable because they have the highest power-to-weight ratio, and generally the lowest total weight; the first quality increases their acceleration in response to throttle movement, and the second permits turning with a smaller radius of curve. They are thus naturally easier to fly in formation; but their powers of manœuvre when formating demand greater skill because the risk of collision in the air is a condition of their very qualities. A sure hand and eye and a quick brain are essential in the fighter pilot who would excel in formation flying.

War Requirements

The necessity for different qualities of manœuvre in war have altered the formation arrangement. Aircraft are more widely spaced than they were in peace-time, so that each has its own little bit of sky to wriggle in safely. With fighters the consideration that applies to relative positions in the formation is the need for room for separate movement in emergency. With multi-seaters it is the need to keep an open field of fire for the trainable guns; companion aircraft should blank the field as little as possible.

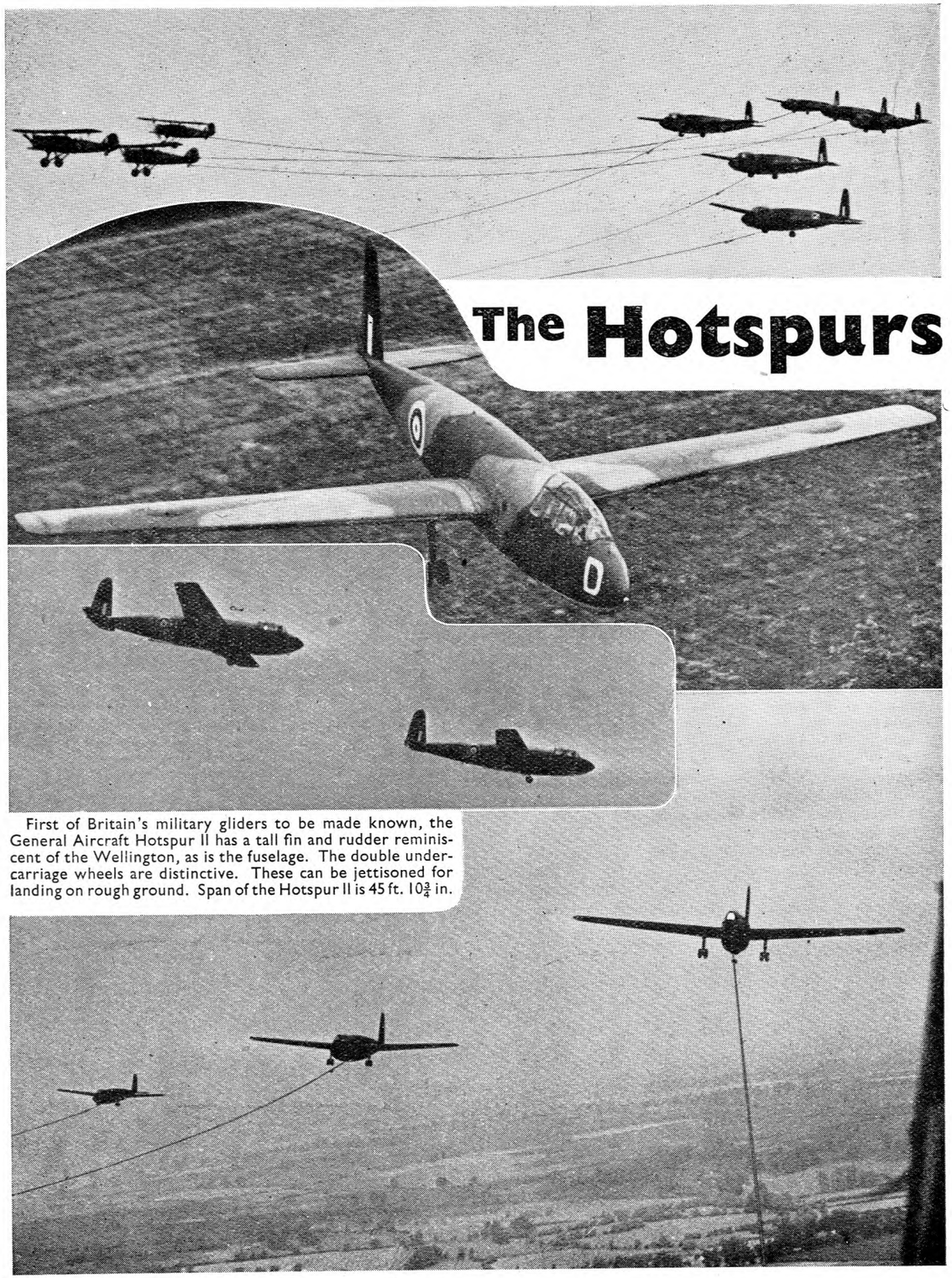
Disadvantages

For all formation flying certain principles apply. Here are some of them:

No formation can fly or climb as fast as a single aircraft, of the same kind.

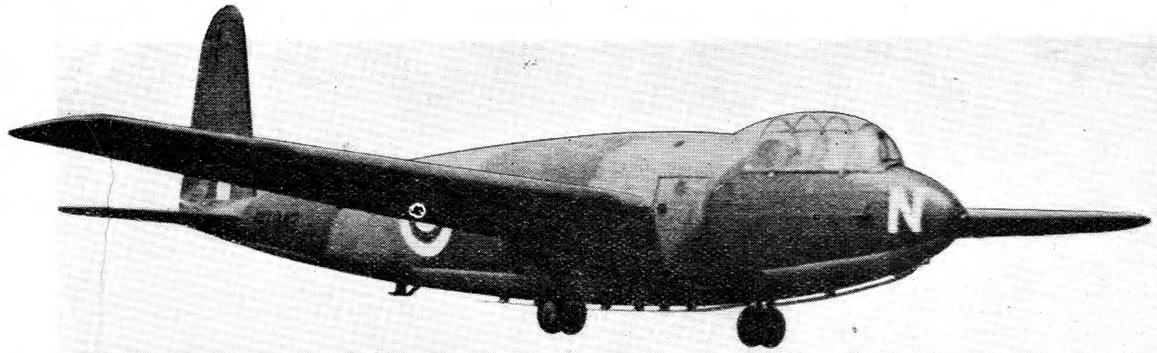
The best cruising speed for maximum range when flying solo is not necessarily the best cruising speed for maximum range

(*continued on page* 17)



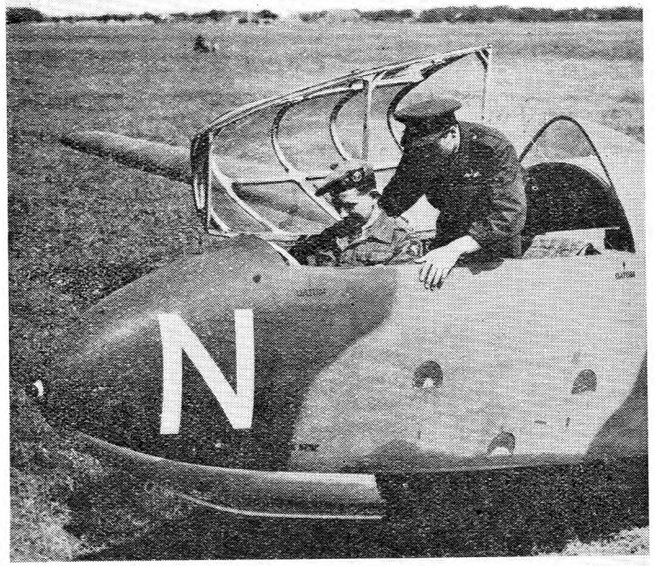
The Hotspurs

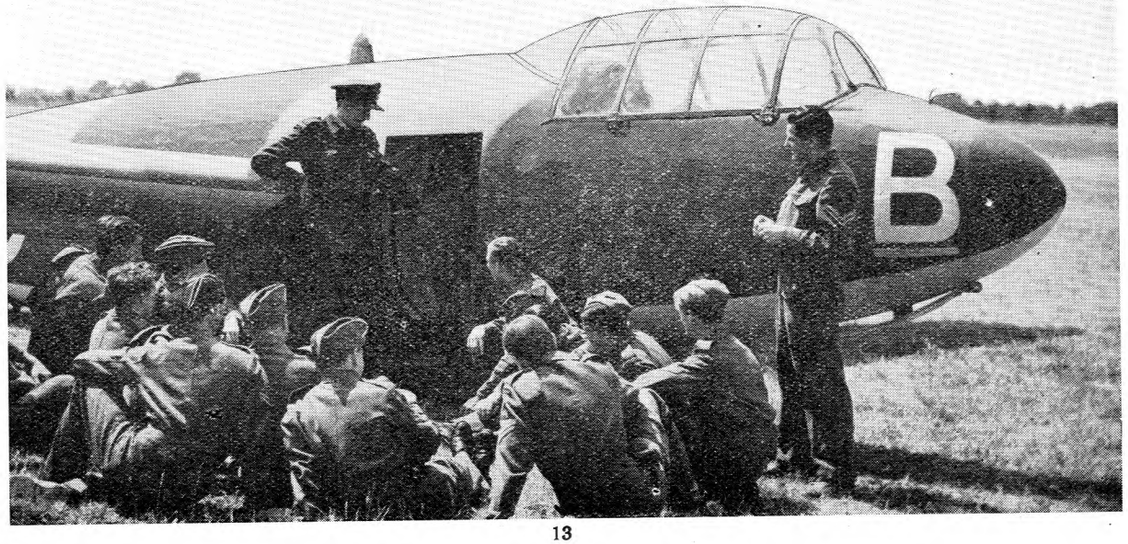
First of Britain's military gliders to be made known, the General Aircraft Hotspur II has a tall fin and rudder reminiscent of the Wellington, as is the fuselage. The double undercarriage wheels are distinctive. These can be jettisoned for landing on rough ground. Span of the Hotspur II is 45 ft. 10¾ in.



Gliders are flown by Army pilots trained by the R.A.F., first at a ground school, then at an R.A.F. Elementary Flying Training School on powered aircraft. The third stage is dual control on gliders, a reversal of the procedure adopted before the war by the gliding clubs. Soldiers of any branch of the Army may volunteer, usually entering as corporals and after the award of their wings (a special pattern incorporating a golden lion) being promoted to sergeant.

Towing is done by R.A.F. pilots in Hawker Hectors The glider on tow keeps just above the slip-stream of the towing aircraft. In casting off the rope the glider pilot releases his end first. The tug then drops the cable on a pre-arranged spot to be picked up by a trailer. The speed of glide after casting off is about 60 m.p.h. To reduce speed after landing, the nose is held down so that the skid rubs along the ground.





A Ground Trainer constructed by No. 172 (Mid-Sussex) Squadron is here described

AMONG the many headquarters of A.T.C. squadrons there are probably more than one located in a cowshed, but few cowsheds could be in so pleasant a setting as that of the Mid-Sussex Squadron.

What makes it still more interesting is that the squadron has made itself a ground trainer which has many of the virtues of the Link trainer. The chief designer is an electrical engineer, the commanding officer of the squadron is an amateur carpenter, and between them they have contrived a machine which, though it may not have the handling qualities of the Spitfire, does respond in a general way to the controls as a real aeroplane might, and which in its construction and operation has provided the combination of interest and instruction that goes with good teaching.

A view of the trainer which shows the supporting frame on the left. Notice the ailerons and roomy cockpit. Seated at the controls is Flight Lieutenant Whittington, the Commanding Officer.

Performance

The fuselage is made to bank, dive and climb, and rotate, the design permitting, if headroom is available, of looping and rolling.

The fuselage is pivoted in a horizontal frame, and the "banking" is operated by a motor driving through gearing on to the spindle. This horizontal frame (horizontal only when the fuselage is on a level keel) is pivoted in a vertical frame, and the "diving" and "climbing" is performed by a motor geared on to its spindle.

The vertical frame is suspended from the ceiling on one-half of a car back axle, the propeller shaft of which is driven by a further motor mounted on the ceiling, which can cause the rotation of the vertical frame.

Controls

Rotation is controlled in the fuselage by means of a rudder bar, and the motors for "diving" and "climbing" and "banking" are governed by a control column.

To give realism, a rudder and ailerons are operated at the same time by the rudder bar and stick.

The movements of the controls vary the speed of the motors. If the machine is put into a bank or dive, and the stick is brought to its neutral position, the machine automatically comes back to an even keel. When a certain angle of "bank" is reached the stick and rudder-bar controls are interchanged, that is, operation of the rudder bar causes "dive or climb" and operation of the stick "dive and climb" causes rotation.

The instructor is able to take over control from the pupil and cause the machine to move in any direction, after which the control is given back to the pupil so that he can recover as instructed.

Power Plant

All the gear is operated on 100 volts D.C., the supply being by a motor-driven generator, originally installed for demonstration purposes.

The motors are compound-wound and run at a speed of 1,750 r.p.m. The gearing gives a speed reduction down to 1 r.p.m. or thereabouts.

The motors being compound-wound, it was necessary to provide contactor control to give reversing operations. Limit switches are provided on both "bank" and "dive and climb," so that when a prearranged angle is reached the motor is cut out.

Construction

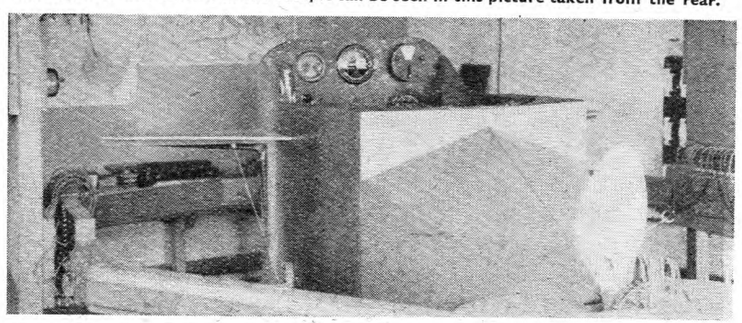
Many makeshift arrangements have had to be employed. The general construction of the fuselage is of heavy timbers to form the keel, with plywood casing. The horizontal and vertical frames are of wood, strengthened with iron. A counter-balance is provided beneath the machine consisting of a sand-filled box mounted on runners for adjustment.

The motors and parts of the gearing were originally constructed for operation of cinema projectors. Parts of the gears consist of bicycle chains, chain wheels and sprockets taken off the scrapheap, and the back axle was taken out of an ancient 7-h.p. Austin car, which also provided the bearings for the frames. The contactors had to be bought.

Current is conveyed from the generator to the motors and controls on the fuselage through fixed brushes bearing on slip rings which are mounted on the top of the vertical frame.

(*Continued on page* 22)

Some of the instruments in the cockpit can be seen in this picture taken from the rear.



CAPTAIN W. E. JOHNS offers an idea for discussion

THE other evening, talking to some cadets of my old school someone asked the question, What became of all the Flying Fleas? This was rather like "Where do the flies go in wintertime?" And, frankly, I did not know the answer.* All I could say about the Flea was that I considered it an interesting experiment because it revealed—if nothing else—the extent of the interest in flying when it could be brought within the financial embrace of the man, or boy, in the street.

From the Flea the conversation passed on to similar experiments, and I was asked what, if anything, had been done towards the production of an aero-bicycle—or, as we might say, a pedal-glider. I had almost forgotten that such a vehicle once existed, although as far as I know it never got beyond the experimental stage. I came away feeling that here readers might find scope for their inventive genius, or, at any rate, a subject for debate, so here are the known facts to form a basis for discussion.

Let us start from the pessimistic standpoint. Some scientists have said that such a vehicle is impossible. But scientists are not always right. Not so long ago they said flying was impossible. If pedal-plane flights have been short, let us also remember that the first aeroplane flights were not only short, but it was necessary to lie down to make sure that the machine was airborne. Gliding started with hops of a few seconds' duration. Hops of a few seconds have been made by pedal-planes, so if we take sail-planing and power flight as a precedent, there seems to be no reason why pedal-planing should not pass beyond the stage already reached. The fact that most of the experimental work was done in Germany need not deter us.

Experiments

In the years before the war Germany, for reasons which are now apparent, explored every possible form of flight, and she devoted so much research to the aero-bicycle that she created a special name for it—*Muskelkraftflugzeug;* that is, a muscle-worked flying machine. For some time nothing practical was done, so in 1933, to stimulate interest, a useful money prize was offered for a plane, operated by human muscles, capable of flying for 500 yards. This set inventors to work, but the prize was never claimed, so the German Air Ministry increased it. This served its purpose, for it did at least produce on aero-bicycle of promise. This was the invention of a chap named Dunnebeil, who was an expert glider pilot, and could thus appreciate the difficulties confronting him. I may say that at this period I was myself associated with a fellow who after two years of experimental work built an aero-bicycle. We tested the machine one day at dawn on Epsom Downs, but we did not get off the ground, simply because we could never get up flying speed.

Dunnebeil did better, although his experience was much the same as ours. On August 29, 1935, he had his first official shot at the prize. His best effort that day was a flight of 125 yards at a maximum height of three feet. He was in the air for 17 seconds, and then had a minor crash. On the following day he put up the best performance ever made with such an aircraft, covering 250 yards in 24 seconds, when he again dived into the ground. He once got as high as 15 feet. His machine, I may say, weighed just over 100 lb. Ours was much heavier.

Dunnebeil did not get the prize, but these experiments served a useful purpose in that some interesting data was produced. They proved, first of all, that in order to get a machine off the ground by human muscles alone, tremendous strength and endurance are required, even to cover a short distance. At least one-half horse power (estimated) is necessary, and this can only be produced by a strong, expert pedal-cyclist making a terrific spurt.

A point arises here. It must be understood that in this aircraft the leg muscles alone were used, in the manner of pedalling a cycle. Much more power could have been obtained had it been possible to bring the arm muscles into play at the same time, but, as Dunnebeil pointed out, he had only one pair of hands, and these he needed for the control of the machine. His problem was how to use both arms and legs and still maintain control. It might be possible to hold a control column with the teeth, but such a device was hardly practical.

One pilot who has given a lot of thought to the aero-bicycle is convinced that such flight is possible. He took the view that Dunnebeil's machine was too heavy, and as a result it began to sink the instant the pilot relaxed his efforts. When war broke out he was building an aircraft very much like Dunnebeil's, having managed to reduce the weight to 75 lb., which he thought would make all the difference.

The last experiments that came to my notice were carried out in Germany just before the war, when, on an unofficial test, a pilot flew a muscle-powered aircraft for 500 yards, but he used a rubber cable—as a glider is launched—to give him a start. It was estimated that this elastic launching apparatus gave him a flying start of 120 yards, but, even so, the rest of the distance was made under his own steam.

Well, there it is. Courage and enterprise have made the aeroplane what it is to-day. The same qualities applied to the aero-bicycle might produce a successful machine. If such a vehicle could be produced it would certainly be popular with enthusiasts—if not with the general public.

*EDITOR'S NOTE.—Some of the Flying Fleas were docile, but many made a sudden downward last jump which proved fatal to their owners and discouraging to the rest. Governments hated the Flea, experienced pilots despised it, insurance companies snubbed it, and finally the inventor, Henri Mignet, made an ordinary aeroplane of it. The original Flea departed from convention in having no elevator, the whole main wing being moved to make the machine go up or down. There were no ailerons, the machine banking automatically when the rudder was used. As there were no ailerons, the rudder was connected to the control column, thus eliminating the rudder bar. It was claimed that the Flea would cost only about £100, but funeral expenses, etc., which made the cost somewhat higher were not included in the estimate.

What is the Air League?

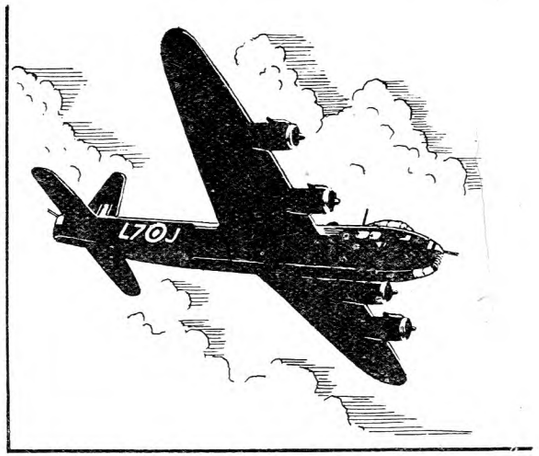
THOSE who read the *Gazette* from cover to cover and have noticed the superscription on the last page reads "Published by the Air League of the British Empire . . ." may have wondered what the Air League is.

The answer is that it is an association of private citizens formed in 1909 to foster interest in aviation and to advocate proper air defence of this country and Empire. Since then the Air League has done quite a lot of useful work. Under the direction of Air Commodore Chamier, its Secretary-General before the war, it inaugurated Empire Air Day, when aerodromes all over the country were for one day thrown open to the public. It founded a Young Pilots' Fund, which gave many distinguished pilots now in the R.A.F. their first chance to fly as civilians. The Air Defence Cadet Corps, on which the A.T.C. was based, was founded and administered by the Air League until 1941. Before the war the Air League sent lecturers up and down the country to draw attention to our lack of strength in the air (in 1933 the R.A.F. consisted of about 3,000 officers and 30,000 airmen—roughly one-sixth of the strength of the A.T.C.). Its efforts resulted in arousing public opinion to the extent that the first steps in the expansion of the Air Force were taken just in time.

The Air League makes no profit from the publication of the *Gazette*. Any surplus of income over expenditure is handed over to the A.T.C. Welfare Fund. So far about £1,000 has been paid over. Thus readers of the *Gazette* and the Air League have between them produced a popular magazine and at the same time have provided a useful contribution to the Air Training Corps Welfare Fund.

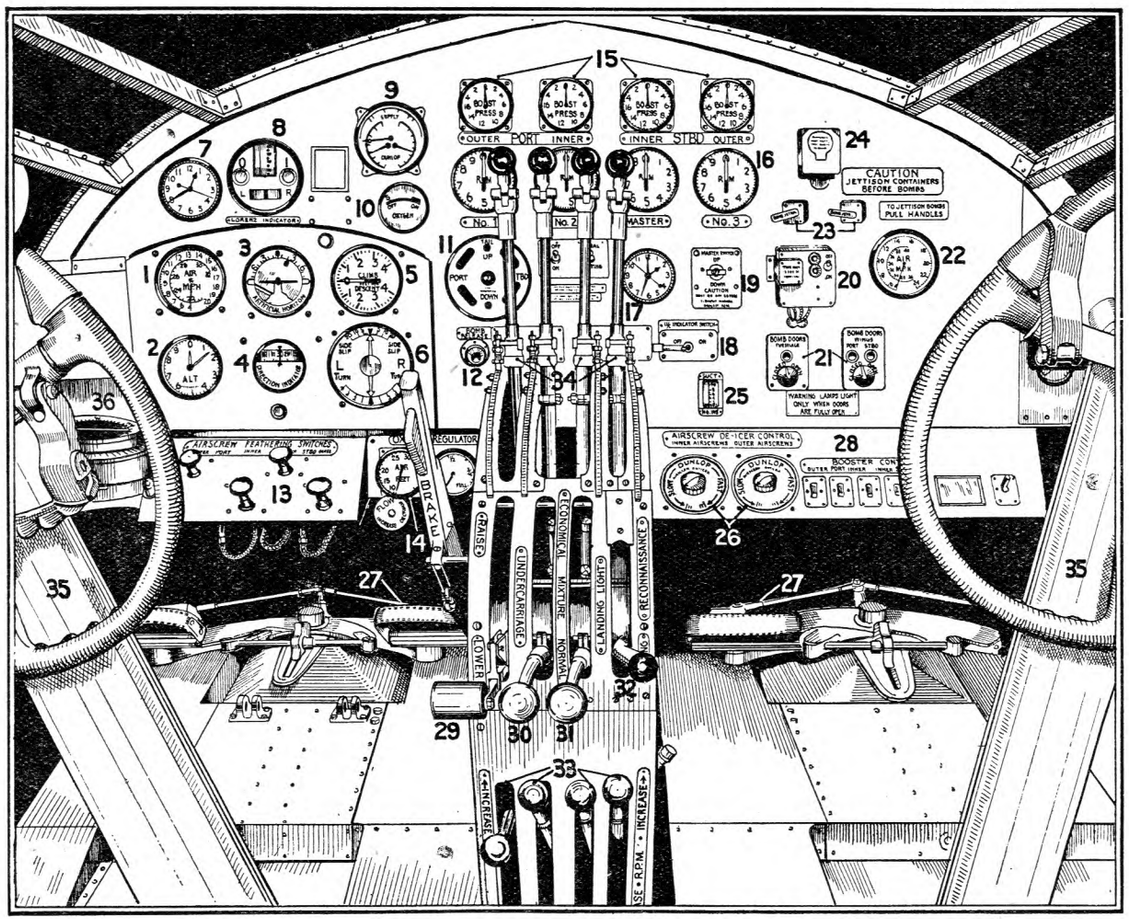
INSTRUMENTS OF THE SHORT STIRLING

by **G. HOWARD**



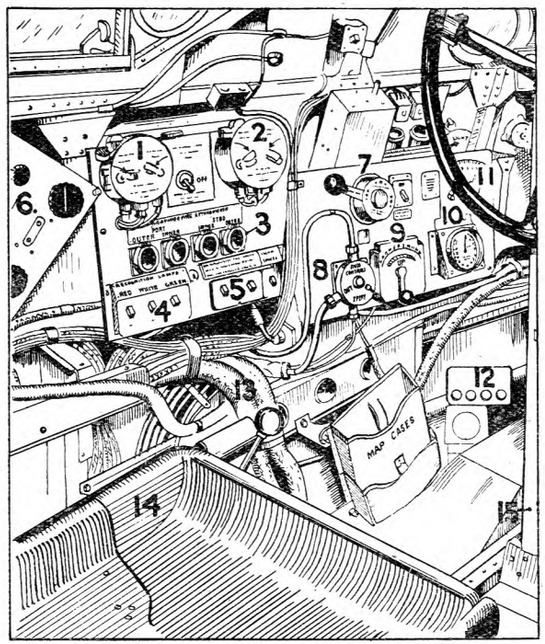
Blind flying panel (Nos. 1-6): 1, air speed indicator; 2, altimeter; 3, artificial horizon; 4, directional gyro; 5, rate of climb indicator; 6, bank and turn indicator.

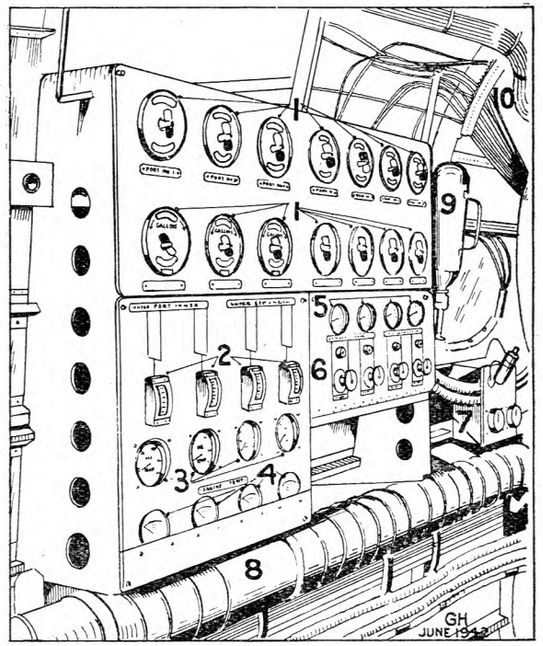
7, clock; 8, Lorenz blind approach indicator; 9, triple indicator brake pressure gauge; 10, oxygen flow meter; 11, undercarriage and tail wheel position indicator; 12, bomb release switch; 13, airscrew feathering switches; 14, oxygen flow control and pressure gauge. 15, boost gauges; 16, electrical revolution counters; 17, 'time of flight' clock; 18, undercarriage indicator switch; 19, undercarriage master switch; 20, bomb release main switch; 21, bomb doors control and warning lights; 22, air speed indicator; 23, bomb jettison handles; 24, bomb container jettison switch; 25, suction gauge; 26, airscrew de-icer controls; 27, rudder bars; 28, booster control switches; 29, undercarriage selector lever; 30, mixture control; 31, mixture control; 32, landing light control; 33, V.P. airscrew controls; 34, throttle levers; 35, control columns; 36, compass.



PORT SIDE OF COCKPIT

1, Identification lamps signalling switch box; 2, formation lamps signalling switch box; 3, Engine fire extinguisher buttons; 4, recognition lamp switches; 5, pitot head heating switches; 6, blind approach panel; 7, clutch control for automatic pilot; 8, automatic controls control cock; 9, attitude control; 10, automatic controls pressure gauge; 11, automatic steering control; 12, fuel pressure indicator lights; 13, electrical services—main cables; 14, bucket seat; 15, part of control column.





ENGINEER'S PANEL

1, fuel gauges; 2, oil pressure gauges; 3, oil temperature gauges; 4, cylinder temperature gauges; 5, cowling gill indicators; 6, cowling gill control knobs; 7, oxygen regulator and gauges; 8, internal heating tube; 9, hand fire extinguisher; 10, Bowden control leads.

(These drawings are from one of the early Stirlings).

Formation Flying

(*continued from page* 11)

when flying in formation. The formation speed is usually slower.

The petrol consumption of aircraft flying in formation varies with the position occupied in the formation. The leader, for example, maintains a steady engine speed. The next machines to his right and left rear, if they are to keep station, must alter their throttle from time to time to counter disturbances in the airflow which affect their positions relative to the leading aircraft. The machines behind them have their stations affected by the same conditions plus the power variations of the machines in front.

The closer machines fly in formation, the more fuel is used by the aircraft in the rear of the leader, because more engine adjustments are demanded to keep station. Therefore the more is their range of flight reduced.

The range of a formation is that of the shortest-range aircraft.

Not all aircraft possess the same characteristics. Some are more stable in flight than others. A few exhibit a tendency to fly in phugoid curves; this causes them to develop a slow oscillation in flight which, although hardly noticeable when flying solo, is a nuisance when flying in formation, for it causes machines to rise and fall, and vary in speed, relative to one another, and so requires throttle and stick corrections to be made by the pilot.

When a formation turns the leader makes a true turn, as in normal flight, but the pilots flying behind him cannot make a true turn or they will lose their stations in the formation. Those on the inside of the formation must make a curve of less radius than is natural for their speed, and those on the outside of the leader a curve of greater radius than is natural for their speed. Both conditions use up more petrol, but the outer machines fare the worse.

Responsibilities of Pilots

When flying in formation it is sometimes difficult for those who follow the leader to keep check of their track over the ground. The leader is responsible for navigation. But it is incumbent upon those who follow him to do all they can to keep check on their line of flight so that at a moment's notice each can navigate accurately should the formation be broken up by a dogfight or a running fight with bombers.

"The Way of a Pilot"
and other new books

The Way of a Pilot
By Barry Sutton. 117 pages. 7½″×5″. Macmillan. 5s.
Squadron-Leader Barry Sutton was a reporter before the war, and gives us a simple report of his pre-war training and of the part he played as a fighter pilot in the Battle of France and the Battle of Britain. He writes just as though he were telling you all about it and answering your unspoken questions, revealing an inspiring and unshakable determination to get on with the job in hand, conveying much information that will be of value to the future pilot.

The Last Enemy
By Richard Hillary. 221 pages. 7½″×5″. Macmillan. 7/6.
Either because he went to Oxford or because he has literary talent—probably the latter—Mr. Hillary writes well, though many readers may wish he had given them more flying and less philosophy. Yet we have to think sometimes, and Mr. Hillary gives us something to think about. A member of the Oxford University Air Squadron, he finished his flying training during the war and fought in the Battle of Britain, and was shot down, spending many months in hospital. He relates these events freely and frankly, giving us revealing glimpses of his own thoughts and feelings and those of his comrades. He assumes a quaint, old-fashioned Oxonian superciliousness in describing his first contact with such things as seaside boarding-houses, country cottages and tough sergeants, but in doing so reveals them in a new light to the reader who has taken such things for granted. A book well worth reading.

Aircraft Instruments
By J. Riley. 74 pages. 7″×5″. 50 diagrams. N.A.G. Press Ltd. 1/6.
A first-class little book which deals adequately and accurately with instruments construction and maintenance.

Air Navigation for Cadets
By D. E. Webster, M.Ed. 87 pages. 6¾″×8¼″. Dent. 2/6.
A textbook on navigation with exercises and answers and a chapter on weather. Clearly written and attractively produced.

Problems in Radio Engineering
Fifth edition. By E. T. A. Rapson, M.Sc. 150 pages. 5″×7″. Pitman. 5/-.
A good technical book for the advanced student. Answers are given at the end.

Wireless Terms Explained
By "Decibel." 74 pages. 5″×7½″. Pitman. 2/6.
An accurate glossary with many diagrams. Useful to technicians and non-technicians.

How Aeroplanes Fly
By W. O. Manning. 64 pages. 4½″×7″. Oxford University Press. 2/-.
Mr. Manning has the gift of writing very simply for the non-technical reader (although he knows his subject well enough to write highly technical treatises), and in this booklet he uses that gift to explain aerodynamics in a way which anyone can understand. Recommended to new cadets.

Aircraft Identification
German Monoplanes. Second Edition. Four photos and three-view drawings of 32 types. British Monoplanes. Second Edition.
The new editions of these two books are produced on much the same lines as the first edition, but a number of additions have been made which will make them valuable to the aircraft identifier. The books maintain the accurate standard already set by *The Aeroplane*.

Wings in Motion
By E. T. Jagger, B.Sc. 123 pages. 8½″×5½″. Many diagrams and photos. Pitman. 7/6.
Apparatus for demonstrating the theory of flight is more valuable if the apparatus is made by cadets. This book tells how such models can be made from scrap materials, and explains in a most lucid way the various phenomena of flight which can be demonstrated. It is much more than a mere constructional book, Mr. Jagger's writing and diagrams being so clear that a reader with little mathematical knowledge may learn from it quite well without the aid of the apparatus. The book is right up to date.

Attack!
By Leland Jamieson. Harrap. 2/6. 94 pages. 7¼″×4¾″.
A story of imaginary war but based very closely on a real one, dealing with the adventures of two brothers in an American aircraft carrier. Quite exciting in a "filmy" sort of way.

Examples and Exercises in Elementary Air Navigation
1942. By M. J. Hearley, B.Sc. Longmans. 1/-. 32 pages. 7¼″×4¾″.
Designed for the A.T.C. and I.T.W. syllabus. Over 100 exercises in ten sections, with answers. Good value.

Air Navigation for Beginners
1942. By A. W. Siddons, M.A. Edward Arnold. 1/-. 32 pages. 7¼″×4¾″.
A brief outline for those who have already some knowledge of associated subjects. Exercises, but no answers.

Planisphere of Air Navigation Stars
By Flight Lieut. Francis Chichester, R.A.F.V.R. Allen & Unwin. 2/6. 8″×8¼″.
Designed by a first-class navigator to show the air navigation stars visible at any time of night or year to observers in latitude 50° N. and latitude 35° S. Recommended to all studying navigation.

Elementary Meteorology for Aviators
PART I. 1942. Longmans Green. 1/-. 48 pages. 7¼″×4¼″. A few photographs and line drawings.
A good shillingsworth of elementary meteorology. Designed to cover the A.T.C. and I.T.W. syllabus.

R.A.F.—The Second Year
Published by Adam & Charles Black. 7/6. 9½″×7″. 111 photographs by S. E. Veale.
The photographs in this book are remarkably good and well presented, and the short commentary is excellent.

Aerobatics Simply Explained
1942. By Wing Commander R. Cravell. Pitman. 6d. 40 pages. 7¼″×4¾″.
You will have to learn to fly before you can do these aerobatics, but Wing Commander Cravell's book, if you read it carefully, will enable you to name and have some understanding of the evolutions that you see.

Aero Engines
1942. By O. Caudwell. Pitman. 5/-. 111 pages. 7″×4¾″. A few line drawings.
A reliable book on the overhaul, testing and installation of aero engines. Recommended to advanced students.

Aero-Engine Practice Simply Explained *and* **Aero-Engine Theory Simply Explained**
1942. Both by Group Captain Coats. Pitman. 6d. each. 38 pages. 7¼″×4¾″.
Group Captain Coats has the knack of being able to write simply and lucidly about aero engines; and from these two booklets the beginner, even though he has never seen an aero engine, should be able to get a good idea of how the things work.

Navigation and Meteorology
April, 1942. By D. Hay Surgeonor. Longmans. 3/6. 108 pages. 7¼″×4¾″. Line drawings.
Mr. Surgeonor has tried to put so much into this book that the meteorology has had to be compressed into one chapter at the end, and can hardly be regarded as a complete exposition of the subject. The navigation has been more adequately treated and will be found useful.

Practical Navigation for the A.T.C.
1942. By R. W. Brooker, M.A. Harrap. 2/6. 112 pages. 8½″×5½″. Line drawings.
An up-to-date elementary book with exercises and answers. Good value.

Aerobiographies II—MOORE-BRABAZON
by C. G. Grey

THE next victim in this series of Aerobiographies, after Constructor No. 1, must necessarily be Pilot No. 1 in the list of licensed pilots of the Royal Aero Club of Great Britain—J. T. C. Moore-Brabazon, now Lieut.-Colonel The Rt. Hon. the Lord Brabazon of Tara in Eire (Privy Councillor, Military Cross).

"Ticket" No. 1 is dated March 8, 1910, which was when tickets were invented, long after he first flew, and he did his qualifying test—which in those days consisted of three circuits of no particular length or diameter accomplished without allowing the wheels of the aeroplane to touch the ground—on a Short biplane with a Green water-cooled engine.

Before flying began "Brab" had already made a name for himself as one of the very few first-class motor-racing drivers we had in this country. He won the Circuit des Ardennes in 1907 against the best of the French, German and Italian drivers. He took to flying as soon as flying began.

He learned to fly at the Voisin School at Mourmelon, near Rheims, in 1909, and brought a Voisin box-kite biplane to this country. On it he made the first flight in Great Britain by a British subject—that the flight was made by an Irishman on a French machine is typical of our ways. His certificate flight, as stated, was made on an all-British Short with a Green engine. By this he won the *Daily Mail* prize of £1,000, presented by Lord Northcliffe, for the first all-British flight in England round a closed circuit.

Shortly thereafter, being a humorist as well as a sportsman, he put a small pig in a basket in the passenger seat of the machine, and took it up just to prove the old saying that pigs may fly.

After that "Brab" went on flying for fun. He never took part in public competitions or exhibitions. But when war broke out in 1914 he promptly joined the Royal Flying Corps, and there he specialised in aerial photography. In the course of his job he won the Military Cross. The high standard of photography in the R.F.C. and the R.A.F. during that war owed a lot to "Brab."

After 1918 he took to business and politics, but he never lost touch with flying or with engineering. He has been at one time or another Chairman of the Royal Aero Club and President of the Royal Aeronautical Society, which is the oldest organisation of its kind in the world.

In the House of Commons he continually made witty and incisive speeches all in favour of a big Air Force and a solid aircraft industry. If successive Governments had listened to him we should not have been in the hole that we were in 1938-39.

In 1941 he was appointed Minister of Aircraft Production in succession to Lord Beaverbrook. His quiet driving methods and his intimate knowledge of the technical side of his subject produced excellent results, and helped to get us out of the hole we had been in.

His remark that "we make the biggest and best bombers and the fastest and fiercest fighters" is not only a statement of fact, but a compliment which the British aircraft industry thoroughly deserves and seldom gets.

His elevation to the peerage in March 1942 is a deserved reward for services rendered not only as a pioneer, but as a producer, and it assures that his high intelligence will be available to the nation irrespective of the whims of the electorate.

RECOGNITION CROSSWORD

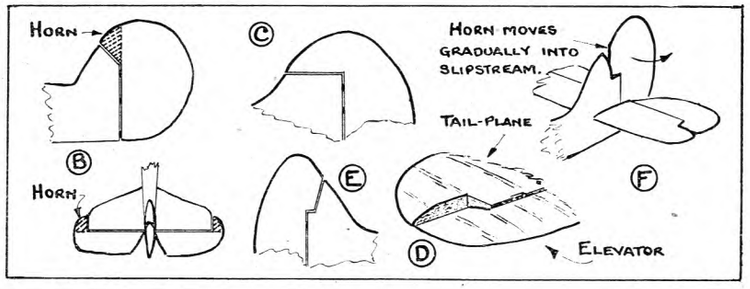
(Compiled by Fl.-Lieut. S. C. Nunn, No. 272 (Wisbech) Squadron). (Solution on page 22).

ACROSS
1. Radial-engined forerunners of the P-40 series (7).
8. Give this a black nose and call it a Havoc (6).
9. This machine is known in the U.S. Navy as the Wild-cat (7).
10. Heaviest machine in Bomber Command to date (8).
11. This biplane will always be associated with the Norwegian campaign (9).
13. Tint (3).
14. "Luft——," German counterpart of B.O.A. (5).
16. To get off the subject (7).
18. Blohm und -os- (2).
19. Decapitated ant (2).
20. Inverted-gull wing advanced trainer (6).
22. A decoration worth having (3).
23. Officer Commanding (2).
25. A small town in East Prussia (5).
26. American twin-engined night-fighter (5).
31. Fire Service (2).
32. Makers of the 95 See (5).
33. Does it for a living (3).
34. In action outside Britain for the first time over Malta (8).
36. More of these have been flown across the Atlantic than any other machine (7).
37. The naval version of the Fury (6).
38. Builders of the Wal and the 217 (7).

DOWN
2. An American trainer with a raucous engine noise (7).
3. A modern Iron Duke with radial or in-line motors (10).
4. The Boeing B-299T (8).
5. Its duties are many but do not include carrying babies (6).
6. Flags or four-engined transports? (7).
7. American radial-engined fighter reported to have ten machine guns (8).
9. With or without spats, an R.A.F. monoplane trainer (8).
10. Of "Stars and Stripes" fame (5).
12. The other people (4).
15. Comes before Manchester (4).
17. To dwell on (6).
21. Pressed on by the feet (4).
22. Two-seat turret fighter (7).
24. Constructors of the Libeccio (7).
26. Once the cream of Bomber Command, now used as a flying pantechnicon (6).
27. A twisted era (3).
28. Virginia (abb.) (2).
29. A civil Kurier (6).
30. Radial-engined two-seat fleet fighters (4).
34. A dive-bomber, but no great weight carrier (4).
35. Renown (4).

HELPING the PILOT

by **P. W. Blandford**



WHEN the driver of a car turns his steering wheel the movement is transmitted from the steering column by a worm and pinion reduction gear to a link system connected to the front wheels. When the helmsman of a ship turns the wheel on the bridge his efforts are transmitted to the controls of an engine which moves the rudder.

In the first case the driver is said to have a "mechanical advantage," i.e. he can produce a strong turning effect at the wheels by a comparatively small effort on the steering wheel, which, however, has to be turned a considerable way. In the second case, the helmsman uses heavy machinery to work the rudder.

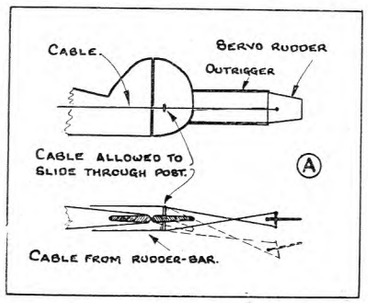
On an aeroplane neither of these methods of helping the pilot is really practicable. Yet the large control surfaces of a big machine might be too stiff for a pilot to work unaided. An aeroplane has also to be controlled about three axes compared with the one of the car or ship.

If the pilot were given the mechanical advantage of the car driver, he would be faced with three wheels in the cockpit, each of which would have to be revolved several times when he wished to turn, bank or dive—an impossible arrangement. He can, however, be given a slight mechanical advantage through his controls, and the designer usually provides this.

The aeroplane designer makes the easy movement of the pilot's controls possible by making the airflow assist in moving the control surfaces. This is done in a number of ways which may be used separately or combined.

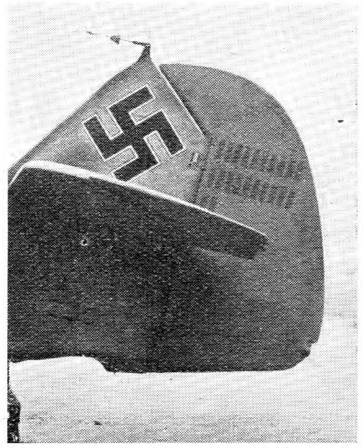
The Servo Rudder

An early method of assisting the pilot to move a large rudder was by the fitting of a "servo rudder." This is now obsolete, but it is interesting to compare it with the other methods now in use. A servo rudder consisted of a small auxiliary rudder supported on outriggers, several feet behind the main rudder (A). The control cables were crossed and connected to this rudder, so that when the pilot moved the rudder bar to turn one way the servo rudder went the other way. The airflow, striking this small rudder, tried to blow it back straight; but as the pilot was holding it at this angle the main rudder was forced to move over in the desired direction. The Boulton-Paul Overstrand had a servo rudder.



Horn Balance

Nearly all rudders on modern machines are balanced by "horn balance" (B). This is arranged by having a part of the rudder in advance of the hinge-line. This part is often at the top, but it may be at the bottom or part way up. Horn balance is also applied to elevators. The



A close-up of the tail of an Me. 109F showing the tapered and shielded horn on the rudder and elevator.

shape and size of the horn varies considerably between different machines (see photographs of Airacobra and tail of a Messerschmitt Me. 109F).

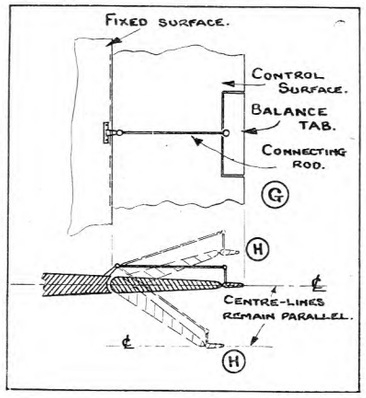
The working of a simple horn (C) is quite straightforward. As the pilot puts the rudder over the horn moves into the slipstream and the air pressure on it reduces the effort needed from the pilot. The help of a horn is not found to be needed when only a slight rudder movement is desired. A plain horn balance, also, tends to "snatch," i.e. as the horn comes into the airflow, the sudden action of the air pressure tends to pull the rudder round farther than the pilot wishes.

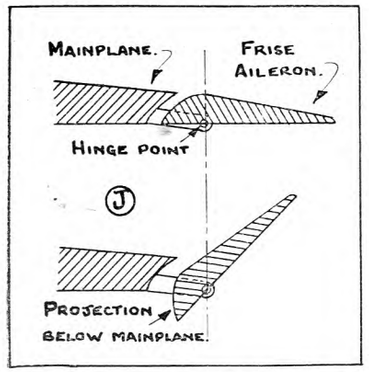
So that the first action of the horn is minimised and the tendency to snatch removed, shielded and graduated horns are used (D and E). The horn is arranged to be behind a part of the fin, in the case of the rudder, or a part of the tail plane on an elevator. By its shape and the shape of the surface in front of it, it is only allowed to project gradually into the airflow. Thus it is not effective at small angles, and comes into action without snatch as further rudder movement is made (F).

Balance Tab

Another fitting of help to the pilot, and applicable to any of the control surfaces, is the "balance tab" (G). This at first glance might be mistaken for a trimming tab inset in the trailing edge of a surface. It can be distinguished by its having either a single rod or a pair of cables connected to a point level with the control-surface hinge-line. Being in this way rigidly connected to a fixed part of the plane, it remains parallel to the fixed part of the machine when the control surface is moved (H).

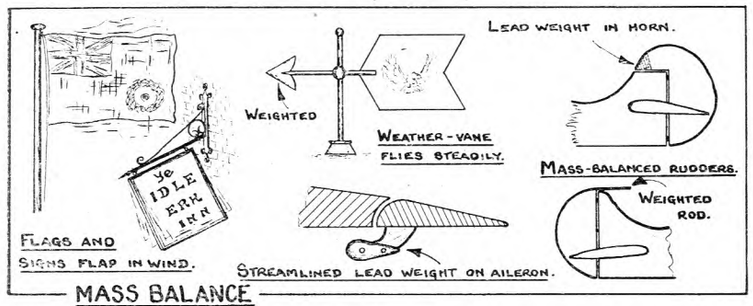
The further the surface, e.g. rudder, is moved, the greater the angle between the tab and rudder. The airflow over the rudder, striking the tab, tries to force it back in line with the larger surface, and consequently helps to turn the rudder.





Balance tabs have been called "servo tabs," but this is incorrect. A servo rudder moves before the main rudder, but a balance tab does not move until the main rudder is operated.

Ailerons do not often carry any tab or horn (a Lysander's ailerons, with balance tabs, are exceptions), but the majority are what are known as "Frise ailerons" (J).



This is an arrangement for improving flying qualities by getting a smoother and intensified airflow over the upgoing aileron. The hinge-line is inset, and the leading edge of the upgoing aileron projects below the wing. Although this is done primarily to improve performance, it also has an effect like horn balance in reducing the effort needed by the pilot.

Rudder bias gear and adjustable trimming tabs (which I mentioned last month) also help the pilot by reducing strain on his arms and legs.

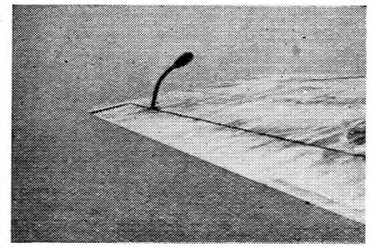
Mass Balance

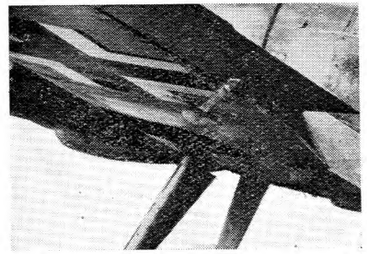
Closely allied to the devices so far mentioned, although not serving quite the same purpose, is the use of mass balance. This arrangement of added weight to a structure which is otherwise kept as light as possible is best understood if you consider the following:

A flag blowing in the breeze does not blow straight out and stop there: it whips about—the stronger the wind the faster and harder it shakes. The end or "fly" of the flag gets the worst of it, and soon tears to ribbons. A hanging sign does not blow out at an angle and stop there, even if the breeze is steady. Instead, it bangs and shakes about. Yet a weather-vane points straight into the wind and stays there.

What is the difference between the weather-vane and a flag or sign? Why does the vane remain steady and the other two flutter? What, you may ask, has this got to do with aeroplanes?

You can find the answer to the first question if you notice that in the case of the flag or sign everything is on one side of the hinge-line; whilst on the weather-vane, although most of the area is on one side of the hinge-line, there is a compact weight forward of the hinge. Why this makes the vane fly steadily is too complicated a problem for me to explain, but the fact remains that the weight forward of the hinge does have this damping effect on flutter.



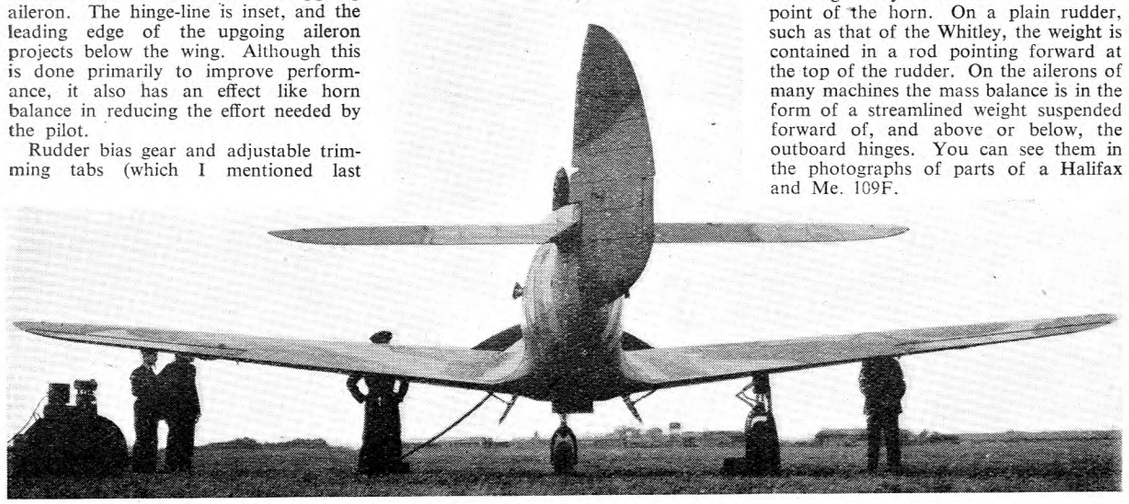


Two examples of mass balances. Above: the balance on the aileron of a Handley Page Halifax, and below, that of the Messerschmitt 109F.

On an aeroplane the control surfaces—rudder, elevator and ailerons—are very much in the position of flags or hanging signs when the machine is flying. It has been known for a control surface on a fast-moving machine to vibrate so much that it has broken off. This vibration is known as "flutter." To prevent flutter the weather-vane idea is used, and a weight called mass-balance fixed forward of the hinge-line on a control surface.

On a rudder fitted with a horn-balance the weight may be a mass of lead in the point of the horn. On a plain rudder, such as that of the Whitley, the weight is contained in a rod pointing forward at the top of the rudder. On the ailerons of many machines the mass balance is in the form of a streamlined weight suspended forward of, and above or below, the outboard hinges. You can see them in the photographs of parts of a Halifax and Me. 109F.

On the Bell Airacobra, the horn balance is placed some distance from the top of the rudder.



"Handsomely . . . "

ALL AT SEA

By **V. C. BATLEY**

Sketches by LUNT ROBERTS

AS a naval recruit you are all at sea as soon as you approach the gates that guard the shore station where you receive your preliminary training. Although you are going to enter, you do not enter the place at all. You go aboard. Your most vivid impression is that of a strange country of new words. You live as if actually aboard a ship, and ordinary things acquire new and nautical names.

The floor of your hut becomes a "deck," and you eat in the "mess deck," the food being served from the "galley."

Your early job of sweeping the floor becomes "cleaning ship," and everything is on either the port or starboard side. You also find that your part of the "ship" is the "forecastle" or "maintop," etc.

"Liberty man "

When you get your night off you don't just walk out of the main gates. Oh no! You become a "liberty man" and catch a "liberty boat," and go "ashore" and come "aboard" again when you return.

You are left in no doubt by those who have been there longer than yourself that you are a "rooky" or a "jeep."

Soon you find that life is largely run by "Killicks" (leading seamen), "Jaunties" (masters-at-arms), "Body-snatchers" or "crushers" (regulating petty officers), and, if you incur punishment, you will probably get "jankers."

After you make your first visit to the "Pay-bob," or accountant-officer, you will have an all-consuming urge to become "tiddly"—in other words, very smart for going ashore, including a work of art in making the silk bow on your cap, which becomes only really "tiddly" when brought as much to the front as one dares.

Maybe you will do your "dhobeying," or washing, before you go ashore, but see that you don't leave things around, or they will disappear into the "scran bag," which — before soap rationing — used to need the surrender of a piece of same to recover the articles.

On board ship—your time is kept by so many "bells" and certain sea duties are called "tricks"—you never refer to "tackle"; "taicle" is the correct pronunciation; and forget what you used to connect with the words "handsomely" and "marry," for the former means that you must haul or ease "slowly and with care," and when you pull on two ropes brought together you "marry" them.

Of course, the English language is full of seafaring words and expressions that have become commonly used by landlubbers—as befits an island race, but it is curious how much the seaman borrows from animals for his definitions.

Without stopping to explain each, a few terms at random include bull, camel, catspaw and cathead, claw, dog, horse, lizard, goosewing, sheepshank, fox and mouse, etc.

If there is a "buzz," or rumour, don't "drip," or grumble about the extra work it may bring you—in fact, I'll leave you by hoping that when you are working at "three bells" in the "last dog" under the "killick," don't act like a "jeep" and "drip" about having to "mouse" a hook to hold the "lizard," or the "crusher" might have to stop your "liberty," for which you "dhobeyed" so hard to make yourself "tiddly"!

Recognition Crossword Solution

(*see page* 19)

ACROSS.—1, Mohawks; 8, Boston; 9, Martlet; 10, Stirling; 11, Gladiator; 13, Hue; 14, Hansa; 16, Digress; 18, V-s; 19, Nt; 20, Master; 22, D.S.O.; 23, O.C.; 25, Rhein; 26, Havoc; 31, F.S.; 32, Arado; 33, Pro; 34, Spitfire; 36, Hudsons; 37, Nimrod; 38, Dornier.

DOWN.—2, Harvard; 3, Wellington; 4, Fortress; 5, Storch; 6, Ensigns; 7, Vanguard; 9, Magister; 10, Sousa; 12, Them; 15, Avro; 17, Insist; 21, Trod; 22, Defiant; 24, Caproni; 26, Harrow; 27, Are; 28, Va.; 29, Condor; 30, Rocs; 34, Skua; 35, Fame.

Flight in a Cowshed

(*continued from page* 14)

Equipment

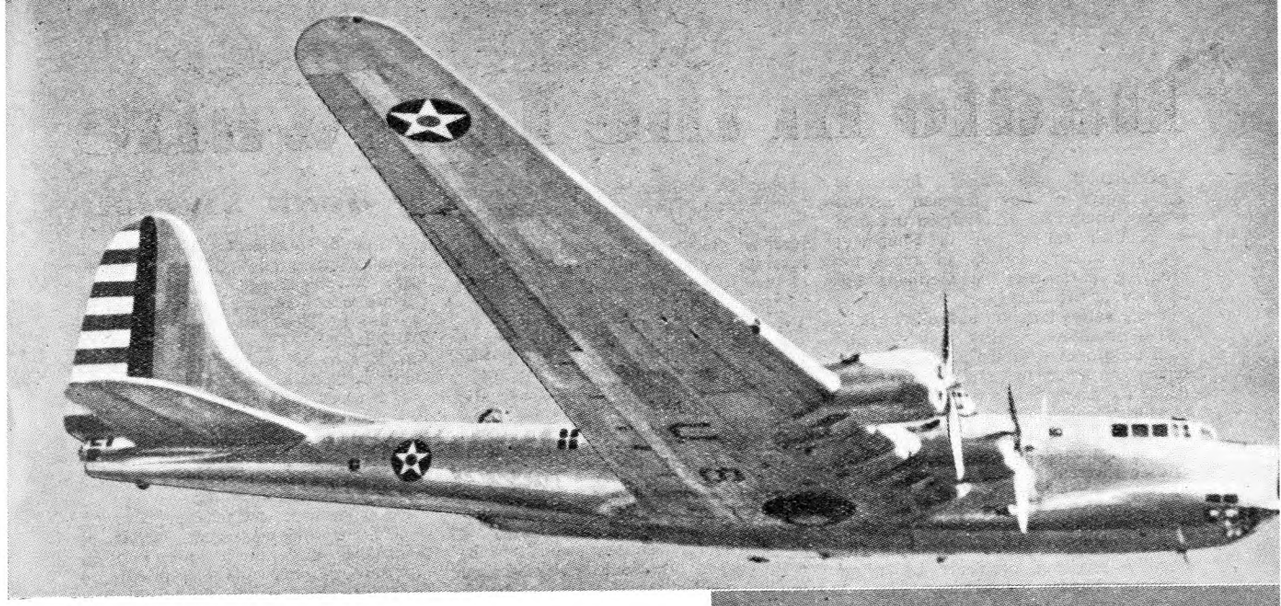
In the fuselage there is a fairly fully equipped instrument board, comprising a turn indicator, a revolution counter, an artificial horizon, an airspeed indicator, an altitude gauge and a compass.

A fourth motor mounted on the fuselage drives fan blades—also taken from the Austin Seven—and a sound effect is provided on the pulley. Speed control of this motor is by means of a throttle, and interlocked with it is an airspeed indicator, which is also governed by movements of the controls. The fan blows air on to the pupil, and this with the sound of the motor gives a certain amount of realism. A crab to record the course steered by the pupil is now being developed.

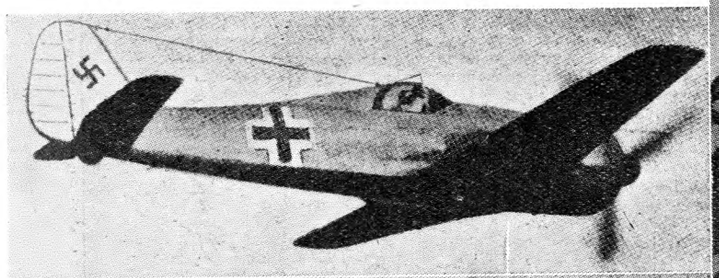
Cost

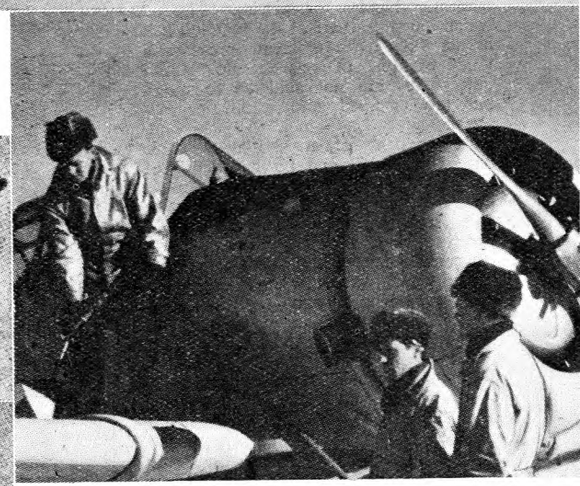
This trainer is more complicated and expensive than the Carthom trainer described in the April *A.T.C. Gazette*, its construction demanding the services of at least a good carpenter and an expert electrical engineer. The cost could hardly be less than £50, and might be considerably more, the amount depending on how much mechanical and electrical equipment can be picked up for nothing or next to nothing for incorporation in the machine.

The constructors would be pleased to answer enquiries and to arrange for A.T.C. officers to inspect the trainer. Applications should be addressed to the Officer Commanding, No. 172 Squadron, c/o *A.T.C. Gazette*, 1a Pall Mall East, London, S.W.1.



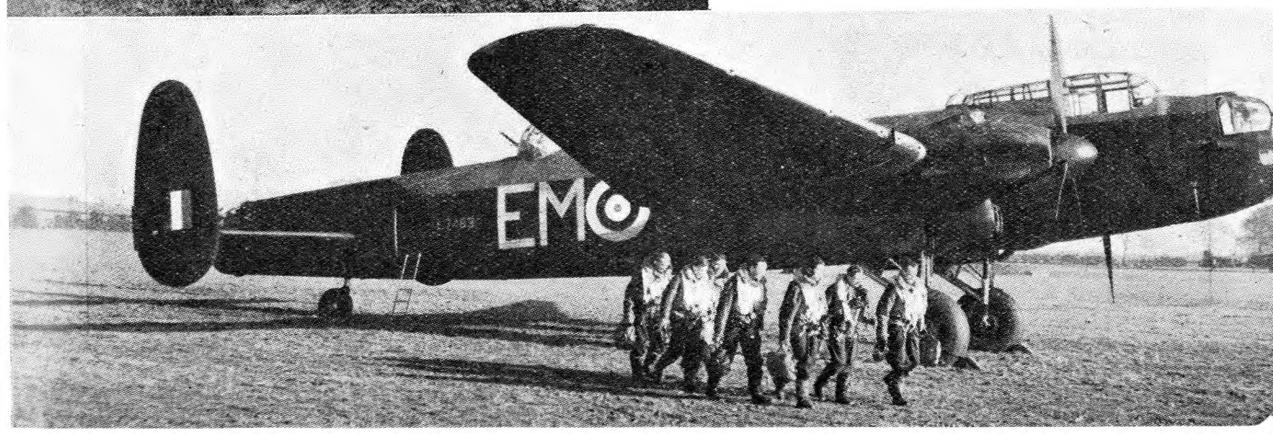
Questionnaire





What do you know about the four aircraft illustrated here? Answer the questions below and turn to page 27 to see how right you are.

1, What are their names or designations? 2, Name the engines fitted to them? 3, What are their top speeds? 4, What duties or functions do they perform? 5, How many men are there in the normal crews? 6, Give the number of guns, cannon and/or machine-guns fitted to each? 7, What is the normal range? 8, What is the loaded weight, in tons?



Radio in the Luftwaffe

by ***John Sinclair***

POSSIBLY the most interesting example of how German aircraft wireless equipment differs from our own is in their valves. British equipment employs a wide variety of types for receiving purposes; the Germans use only one or two class types.

These valves function basically as R.F. pentodes, although they can also be used as triodes with the suppressor and screen connected to anode. The RV12 P2000 for example is a real midget valve measuring only about 2 in. in height by ½ in. in diameter. It has side contacts and is rather like a British "acorn" valve. Inverted holders with built-in sockets are employed for these valves.

Simplification

The Germans have attempted to simplify servicing problems by using terminal blocks extensively Fig. 2 which illustrates part of the junction box of an F.U.G.7 equipment, provides a good example of this feature. Inter-unit cables are not soldered to plugs, but are clamped under nuts or set-screws.

Replacement of a shot-away cable requires no skill and no knowledge of the circuit. Replacement of a defective unit is a matter of seconds. Complex units, such as transmitters and receivers, which at first sight appear completely inaccessible are split up into a number of units plugged together. In this way every component may be easily replaced. Fig. 5 shows the Receiver unit of an F.U.G.10 equipment.

The construction of the units follows a standard formula, all units being built up on a light-alloy casting which is very thin and clean. All radio parts are moulded and no component appears to need any special fitting in the unit. Gear wheels are a precision job and are machined from solid material.

The construction and workmanship is undoubtedly of the first order, but it cannot be considered as good *aircraft* construction. The gears used in the "click dials" of certain transmitters and receivers are an example of heavy, costly precision workmanship. Here are details of two types of equipment.

Type F.U.G. 16 Equipment

An advanced type used on the Junkers Ju. 88, consisting of a short-wave transmitter and receiver operating on frequencies between 42.2 Mc/s and 38.6 Mc/s (7.1 to 7.7 metres). The actual frequency used in flight is predetermined before the machine takes off.

Construction follows the usual German technique, except that (owing presumably to the low wavelength used) the transmitter, receiver and associated circuits are in one unit. The ganged variable condensers are much smaller than those used in other German aircraft radio equipment. The attendant economy in space probably permits increased compactness.

Nine valves are used in the receiver. All are of the same type—Telefunken RV12 B/2000. This is an R.F. pentode, but it can be connected as pentode, triode or diode as the occasion demands.

The transmitter employs two RL12/P35 pentode valves, which are used as master-oscillator/frequency-doubler and power amplifier respectively. A modulation amplifier (RV12/P/2000) is used for telephony transmissions.

Fig. 1 illustrates the front-panel layout of this interesting equipment. No details of range are given, but it can be assumed that under normal conditions this would be a little beyond the optical horizon distance.

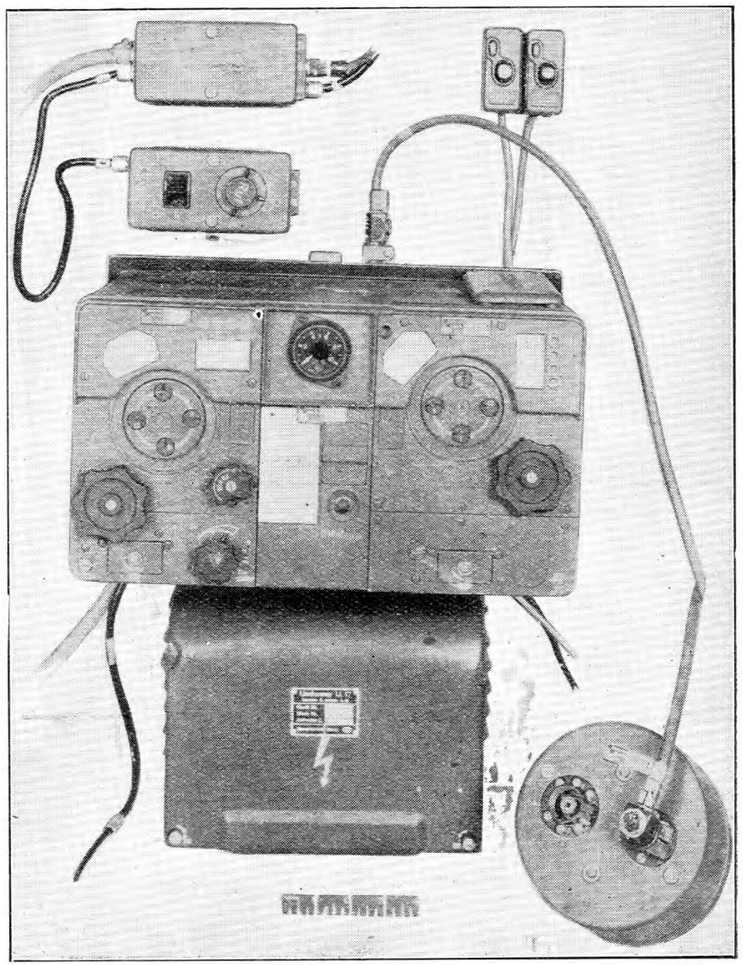
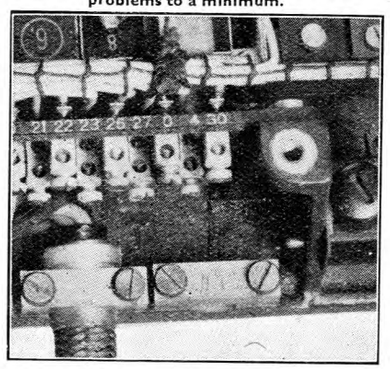


Fig. 1 (*right*). **General view of the F.U.G. 16 ultra short wave equipment used in Junkers Ju. 88 aircraft.**
Fig. 2 (*below*). **A good example of the German method of reducing servicing problems to a minimum.**



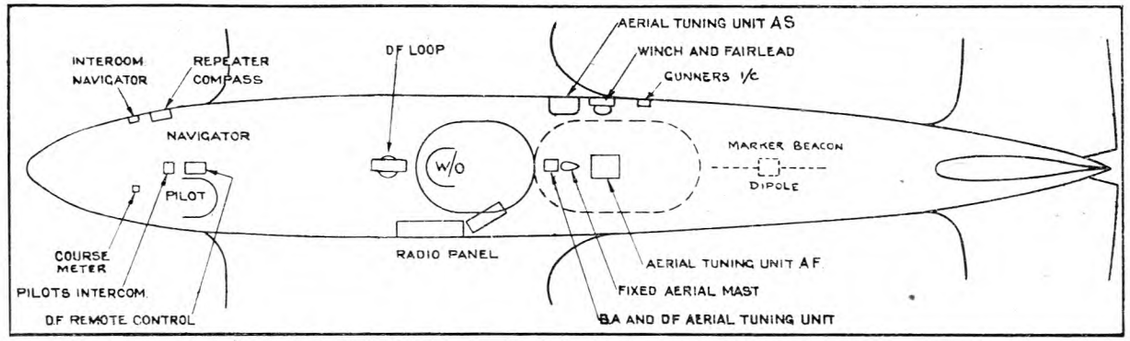


Fig. 3. Layout of the radio equipment installed in the Heinkel He. 111H.

Type F.U.G. 10 Equipment

This is the most recent standardised equipment and is installed in all the latest bombers (such as the He. 111H) and reconnaissance machines. It provides all the facilities generally agreed as necessary in machines of this type. Technically the design is good, but not advanced, and, in common with other equipments, the mechanical design and workmanship is good, but expensive and heavy. Its complete weight is 358 lb. The majority of the apparatus is fitted on the instrument dash, although bulky items such as the H.T. motor generator, the D.F. receiver and its loop and the blind-landing approach equipment keep "Tail-end Hans" company.

Very well made and ingeniously designed metal castings are used as chassis for the various components, and these are approximately cubical in form, with partitions for coils, valves, etc.

The condensers have die-cast vanes, which is in accordance with pre-war practice, when many German-made die-cast condensers were imported to Great Britain for precision equipment.

The F.U.G. 10 covers two frequency bands: (a) 300-600 kc/s (1000-500 metres), (b) 3-6 Mc/s (100-50 metres).

Continuous tuning is possible, but there is provision for the rapid selection of four-spot frequencies on each band which can be preset before or after the machine leaves the ground.

The transmitters are designed for telegraphic operation, but telephony may be used. Fig. 3 illustrates the layout of the radio equipment in the He. 111H.

Aircraft Navigational Facilities

The F.U.G. 10 equipment includes a separate D.F. receiving unit which is carried under the control of the navigator. The loop control is combined with a compass repeater, and aural signals are provided for both pilot and navigator. A course meter for homing is provided on the dash, and this also gives a rough indication of distances.

Blind-approach equipment operating on two-spot frequencies is carried, and is extended to the pilot on the same course meter as is used for D.F.

The long-wave transmitter is capable of emitting pulse transmissions enabling bearings from the aircraft to be obtained on the ground free from night errors.

Inter-Aircraft Links

Bombers such as the Ju. 88 (apart from reconnaissance machines) carry a radio-telephony set for inter-aircraft communication, operating off the aircraft battery.

Loop Aerial

The loop aerial (Fig. 4) used with the F.U.G.10 equipment shows unusual features differing entirely from the two-turn commercial loops which are used on the Dornier 17 aircraft. It is intended for mounting under a perspex housing, and is wound on a hollow bakelised fabric former 13 inches in length and of oval section. Through the centre runs a dust-iron core built up of ring sections. The windings consist of eight turns of heavy Litz wire wound symmetrically over the length of the former.

The iron-core loop has been compared with the more usual type, and results show it to be considerably more efficient. It is, however, much heavier than a standard loop; in fact, its actual weight is about three pounds greater than the receiver with which it is associated.

From the information now available, it seems clear that British aircraft radio equipment is considerably more advanced than the German.

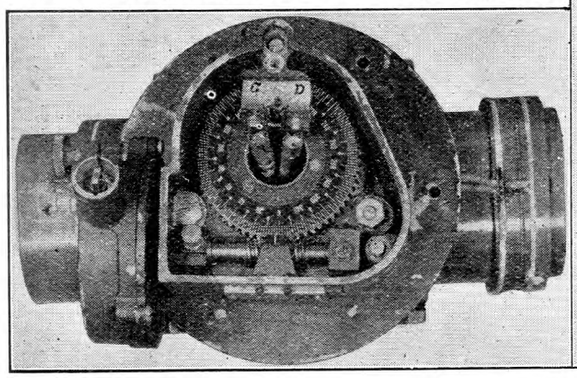
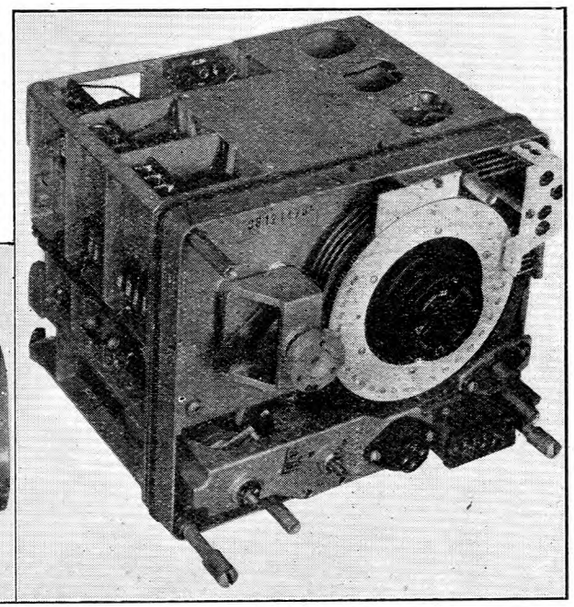


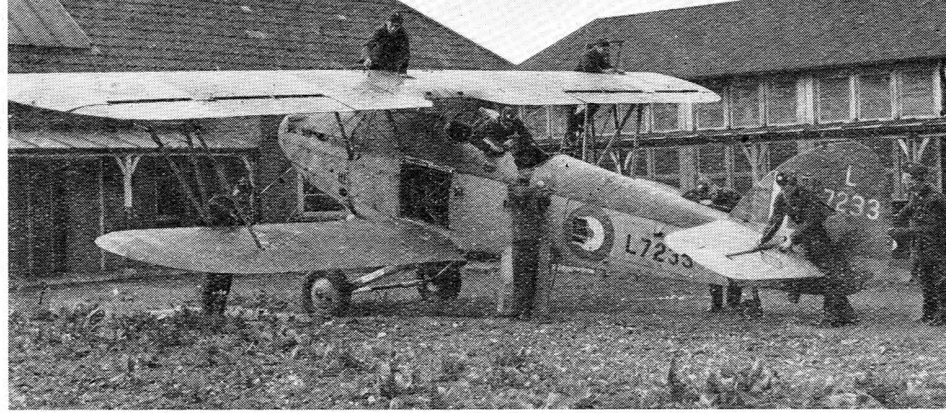
Fig. 4 (*below*). **The ingenious dust iron core D.F. loop used with the F.U.G. 10 equipment fitted to bombers.**

Fig. 5 (*right*). **The unit principle is illustrated in this photograph of the F.U.G. 10 receiver with covers removed.**



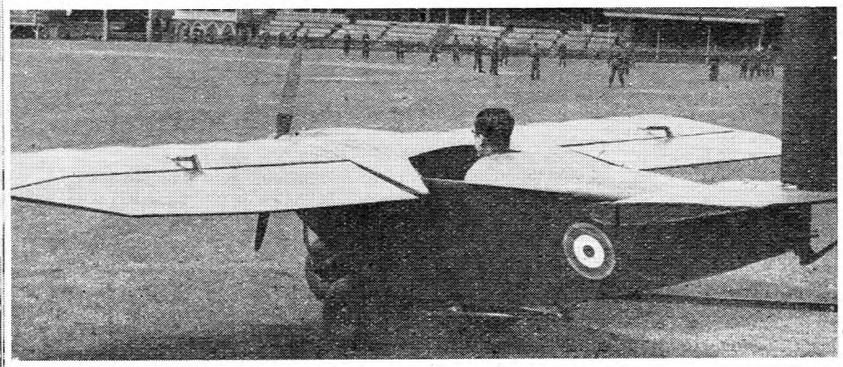
AIR TRAINING NEWS

A cadet of No. 204 Squadron being prepared for a flight during a visit by the squadron to an R.A.F. station.



FLYING BEDSTEAD. Cadets of No. 1051 (Dartford) Squadron have just repaired this Hawker Hind with parts manufactured from scrap, including pieces of an old bedstead.

"THE HOPPITY." This little machine, built entirely by two Flying Officers of the 1440 Squadron of the Hove and District A.T.C., and nicknamed "The Hoppity" or the "Hopalong-Scooter," is used to train cadets in engine control, and starting drill. It is capable of all the movements of a flying machine, but has not the power to leave the ground. The engine is a Douglas flat twin-cylinder motor-cycle engine, and the wings were taken from a glider. They have exceptionally large ailerons, whilst a tricycle-undercarriage enables the "Hoppity" to taxi under engine power on an even keel. Photo (by Hamlin of Brighton) taken on Hove County Ground, where the trainer was being demonstrated.



THE A.T.C. VISITS THE ROYAL NAVY.

The aircraft which the cadets are entering is a Fox Moth, a type well-known for its joy-ride trips at Croydon before the war. The pilot's cockpit is aft of the passengers' cabin. A Walrus is in the background.

In the Limelight

SINCE our last issue the A.T.C. has been put prominently in the public eye by several events. There was the A.T.C. *Star* Boxing Tournaments at the Albert Hall, which drew a large and enthusiastic crowd. No. 416 (Bethnal Green) Squadron and No. 343 (Camberwell) Squadron distinguished themselves by taking two championships.

A more private but nevertheless important event was the inspection by H.M. The King on Saturday, July 4th, of a contingent of A.T.C. cadets in company with cadets of other Services. A photograph of this appears on page 1. The King gave an inspiring address to all the cadets.

A.T.C. Sunday on July 5th was marked by parades all over the country. To describe them all in detail would be impossible. The most important among them was that in Hyde Park, where 10,000 cadets were inspected by the Secretary of State for Air, the Under-Secretary of State for Air, the Chief of the Air Staff and members of the Air Council, together with other distinguished visitors including Marshal of the Royal Air Force Viscount Trenchard. This is said to be the largest parade that has ever been held of any Air Force personnel, and, except for the Hendon Displays in pre-war days, it is about the only occasion at which so many Members of the Air Council have attended together. That fact indicates that the Air Council is fully alive to the importance of the A.T.C. and to keeping itself informed of the progress that is being made.

Thousands of visitors attended this ceremony, as they did similar ceremonies held in other parts of the country.

A.T.C. Record

At an R.A.F. initial training wing, a flight composed almost entirely of ex-A.T.C. cadets created a record of getting through their examinations with 100 per cent. passes.

For Example

No. 30 (Cardiff) Squadron has a club containing two full-sized billiard tables, two full-sized tennis tables, a dance floor and a gym.; two radio-grams, a wireless set and a piano; an officers' room and an N.C.O.s' room. All has been provided by local supporters.

Co-Operation

A shield has been presented by an R.A.F. station to the Southend Wing, which enjoys very close co-operation with its parent squadron.

Visual Signalling

The Worksop College Squadron has livened up indoor signalling by installing 3.5-volt bulbs behind landscape pictures.

Morse Machine

Cadet C. Cooper of Ilfracombe has invented and constructed an ingenious Morse machine. A perforated strip is drawn over a metal plate at various speeds by a motor. The perforations, being made in the form of dots and dashes, allow electrical contact to be made. It provides accurate receiving practice at precise speeds.

A photographic rating instructs cadets in the use of an oblique camera.

Open Day

The Cheadle Squadron had an Open Day, and parents were taken round to see cadets at work. The programme was most attractively drawn up.

Spotters' Clubs

A pilot officer in the Colwyn Bay Squadron has designed an attractive pictorial certificate for A.T.C. Spotters' Clubs by reproducing several photographs on one negative. Prints can be made for 7/6 for thirty.

Good Start

First issue of the *Mercury*, magazine of No. 1352 (Putney) Squadron, sold right out. A photographic cover and contributions from all ranks are included in the next issue, which is being eagerly awaited.

The Stars This Month

August 12th, 10.30 p.m.

The Plough is working round towards the NW. Northern Cross, with Vega and Altair, is almost overhead. Pegasus is rising in the east, but is still close to the horizon and can be observed better later in the year.

Learn this month: Ras Alhague.

A leading seaman supervises dinghy practice for cadets visiting a naval station.

Answers to Questionnaire

(*See page* 23)

1. The four machines are: (*top*) the Douglas B-19; (*right centre*) the nose of a North American Harvard 1; (*left centre*) two pictures of the Focke-Wulf Fw. 190H; (*bottom*) the Avro Manchester.

2. Power plants: Douglas B-19, four 2,000-h.p. Wright Duplex Cyclones; North American Harvard, one 600-h.p. Pratt & Whitney Wasp; Focke-Wulf Fw. 190H, one 1,600-h.p. B.M.W. 801; Manchester, two 1,845-h.p. Rolls-Royce Vulture or 1,950-h.p. Vulture IIs.

3. Top speeds: B-19, 210 m.p.h.; Harvard, 209 m.p.h.; Fw. 190, 370 m.p.h.; Manchester, 280 m.p.h.

4. Duties: B-19, experimental and research; Harvard, advanced trainer; Fw. 190, fighter; Manchester, heavy bomber.

5. Crews: B-19 (normal), 10; Harvard, 2; Fw. 190, 1; Manchester, 7.

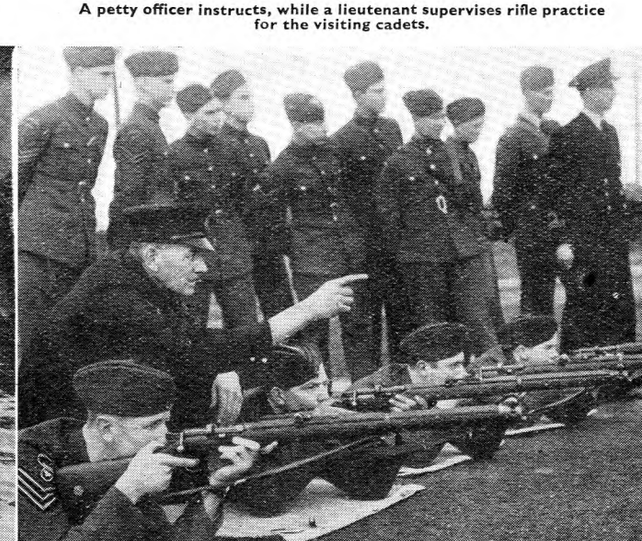
6. Armament: B-19, details secret, but guns are fitted in nose and tail, in two dorsal turrets and in the underside; Harvard, one fixed machine-gun in the port wing; Fw. 190, two cannon and four fixed machine-guns; Manchester, two-gun nose turret, two-gun dorsal turret and four-gun tail turret. (N.B.—Fw. 190 armament doubtful.)

7. Ranges: B-19, 7,750 miles; Harvard, 735 miles; Fw. 190, 525 miles; Manchester, not disclosed.

8. Loaded weight, in tons: B-19, over 71 tons; Harvard, over two tons; Fw. 190, over three tons; Manchester, about 25 tons.

Stationary driving practice. Its training value as a rehearsal for Spitfires is no doubt small, but it seems to be interesting.

A petty officer instructs, while a lieutenant supervises rifle practice for the visiting cadets.



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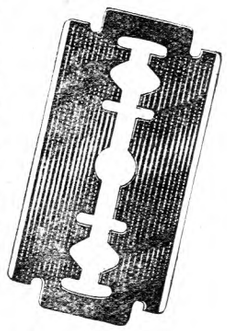

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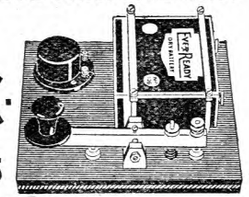

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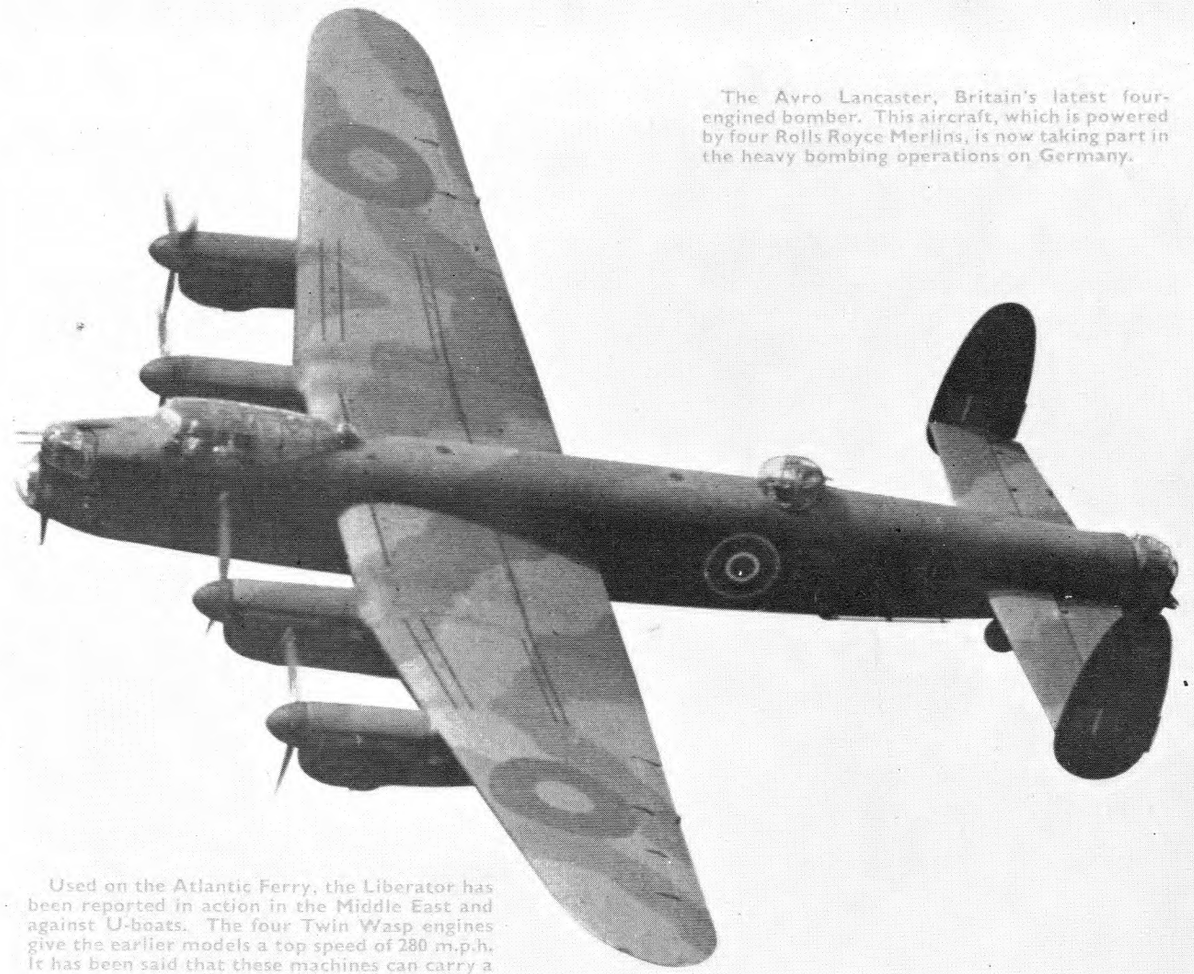

The Avro Lancaster, Britain's latest four-engined bomber. This aircraft, which is powered by four Rolls Royce Merlins, is now taking part in the heavy bombing operations on Germany.

Used on the Atlantic Ferry, the Liberator has been reported in action in the Middle East and against U-boats. The four Twin Wasp engines give the earlier models a top speed of 280 m.p.h. It has been said that these machines can carry a bomb load of about two tons for a distance of over 3,000 miles.