

FLIGHT

and
AIRCRAFT ENGINEER

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The Outlook

Designing for the Customer

A CONTRIBUTOR to our Correspondence columns in this issue raises the question of low-wing passenger aircraft. We have a great deal of sympathy with him. There is nothing more uninteresting in this world than to sit in a mid-chord seat of a low-wing monoplane and stare for hours at acres of tin stretching apparently to the horizon, its monotony broken only by rows upon rows of rivets arranged in orderly lines and squares. After a time the unfortunate passenger either tries to read a book, or he drops off sleep, or, worst of all, he begins to count the rivet heads.

We welcome our contributor's remarks all the more because he puts the layman's point of view, and, as he says, the layman pays his pennies and will, where possible, take his choice. Many years ago we ventured to forecast that ultimately the demands of the travelling public will compel the designer to face the technical problems of pressure cabins and the operator to put up with any consequent loss of payload. The war has postponed the opportunity for the travelling public to feel its demands felt, but we feel sure it will come. In much the same way it seems likely that unless a proportion of passengers is to be bored to death by lack of view, designers may have to adopt the high-wing layout for passenger aircraft.

Our correspondent laments the low wing of the de Havilland Dove and asks "What was the matter with the Flamingo?" The answer is that there was nothing wrong with the Flamingo, but that in the Dove the wing arrangement would have interfered too much with the pilot's lateral view. Thus there are, and must necessarily always be, cases where the low-wing arrangement must be retained because the penalty of the

alternative is too great. In small aircraft at any rate, a pusher installation with buried engines may not be practicable.

From the designer's point of view there is, of course, a good deal to be said for the low-wing layout: the undercarriage is short and can readily be tucked up into the engine nacelles; in many cases the wing spars may pass under the cabin floor and so cause no interference with passenger comfort. But the time will come when "the customer is always right," and the fact is well worth bearing in mind.

What is He Likely to Want?

WHILE on the subject of high-wing layouts, the Miles Aerovan described and illustrated last week represents an arrangement in which an exceptional field of view for the pilot is combined with a high wing and a good outward and downward view for the passengers. We are not suggesting that *all* small passenger aircraft should have this configuration, which is designed for freight and goods rather than for passengers, and which is probably somewhat less efficient aerodynamically than the more orthodox lines to which we have become accustomed. There is, however, much to be said for it where a high cruising speed is of less account than roominess—be it for goods or passengers.

For one thing, access to the cabin is very easy, thanks to the tricycle undercarriage and the small height of the fuselage belly above the ground. A further advantage accruing from the tricycle is the level floor of the cabin. There is none of that uncomfortable scrambling up a slope to reach the seats at the far end. This, of course, is a feature common to all tricycled aircraft and not peculiar to the Miles Aerovan, and may be another convenience demanded by the public in a few years.

Perhaps one might sum up likely demands from air

passengers of the future for such basic design features as a good view from all seats, a pressurised air-conditioned cabin, and a level floor. They are not really unreasonable, and we feel sure they will be important in attracting traffic.

Fastest and Heaviest

WITH the war in Europe finished, the need for secrecy has lessened considerably, and as a result the Ministry of Aircraft Production has released some particulars of four aircraft types. To describe them as "new" would scarcely be correct, since two at least have been mentioned previously. In the case of the de Havilland jet-propelled fighter, for example, the additional information is its name, the Vampire, and the statement that it has a speed "in excess of 500 m.p.h." It is noteworthy that the power unit is also of D.H. manufacture. The existence of the Avro-Lincoln had also been revealed previously. Entirely new so far as publication is concerned are the Supermarine Spiteful and the de Havilland Hornet fighters.

In our issue of March 8th, 1945, we made the first



CREATING A PRECEDENCE: When Her Majesty the Queen flew with the King from Jersey to Guernsey during the recent royal visit to the Channel Islands, it was the first occasion on which a Queen of England has flown.

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mention of the de Havilland jet-propelled aircraft. In the de Havilland series it is the D.H.100, and the official announcement that it exceeds 500 m.p.h. is probably an understatement. The same may be said of America's fastest, the Lockheed P-80A, but it would be idle to speculate as to which is the faster. Progress in turbine jet units is so rapid that increased thrust is registered almost monthly, so that the fastest to-day may be outstripped in performance in the space of a few weeks.

The other new de Havilland, the Hornet, is somewhat misleadingly described by M.A.P. as a scaled-down Mosquito. Apart from size, it differs greatly from that famous type. Designed for very high performance and long range, it fulfils some very ambitious and difficult demands, and its success is due to very close teamwork between de Havillands, Rolls-Royce (whose Merlin power units are fitted) and the de Havilland airscrew division. The Hornet fighter is designated D.H.103. The fact that its speed is disclosed as being more than 470 m.p.h. would appear to indicate that it is probably the fastest airscrew-driven aircraft in the world.

Not far behind the Hornet in speed is the Supermarine Spiteful, whose Rolls-Royce Griffon engine propels it at a speed exceeding 460 m.p.h. The fact that this single-engined machine is nearly as fast as the Hornet is, of course, due to its much smaller size.

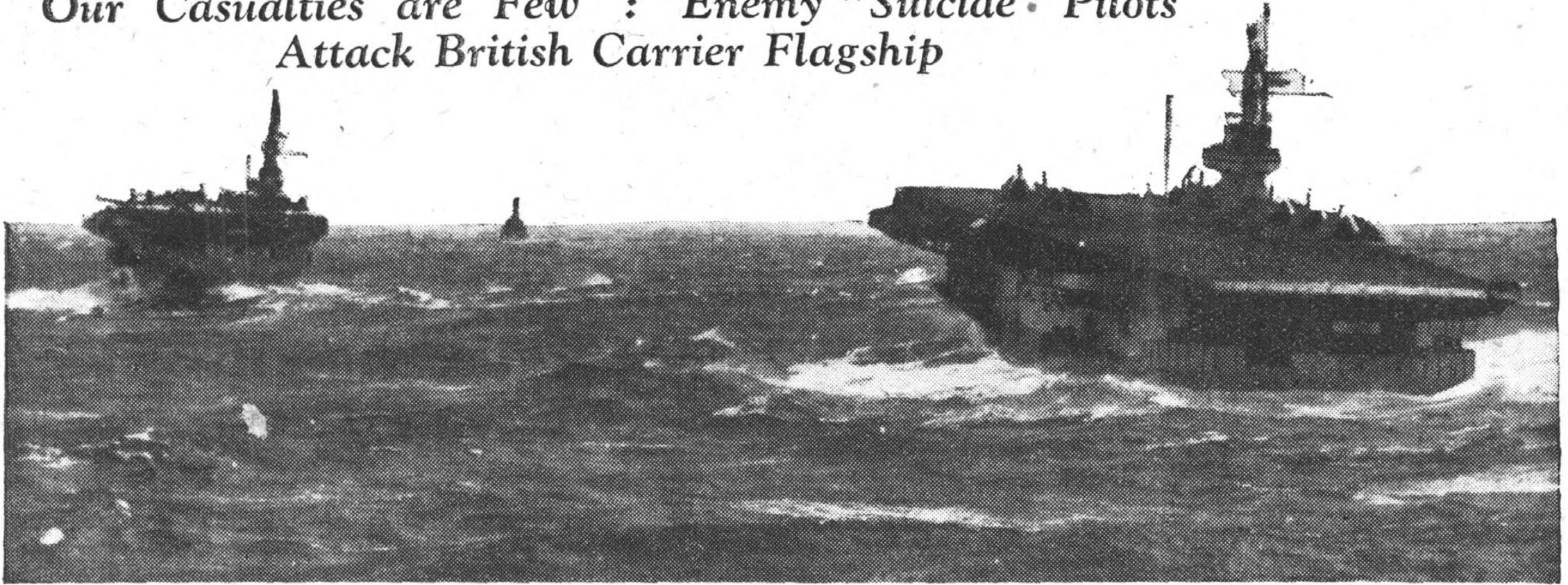
At the other end of the size scale we have the Avro-Lincoln with four Rolls-Royce Merlins. Carrying the heaviest bombs at greater speed than does the Lancaster, the Lincoln may have some unpleasant surprises in store for the Japs. It is also being manufactured in Canada and Australia.

Altogether it is satisfactory to know that development in all types, from the largest to the smallest, is being vigorously pursued.

On the civil side Mr. Perkins, the new Parliamentary Secretary to the Ministry of Civil Aviation, reported rather less satisfactory progress. The Tudor I prototype is probably flying by now, and the Tudor II is, he said, expected to fly next November. The Viking prototype may fly this month, and the Hermes in September. Tests and deliveries are, however, another matter.

WAR in the AIR

**Naha Airfield brings Heavy Bombers nearer Japan :
Our Casualties are Few : Enemy "Suicide" Pilots
Attack British Carrier Flagship**



THE NAVY THAT FLIES: Aircraft carriers of a British naval task force plough their way through rough seas to attack Japanese targets in Sumatra.

COMPLETION of the capture of Naha airfield on Okinawa, which is about the middle of the Ryukyu group and some 425 miles from Kyushu, the most southerly of Japan's main islands, was one of the most important items of news from the Pacific last week. By all accounts it was a gruelling fight, not only on account of enemy opposition, but because of the prevailing weather conditions which made the going extremely tough; but then, the U.S. Marines are tough troops. The value of this airfield as a heavy bomber base within Japan's inner defence ring needs no stressing and the fanaticism of the defenders can well be imagined, both on the ground and in the air. Indeed Tokyo radio openly describes the operations here as the preliminary to invasion of the home islands.

Admiral Nimitz has had the considerable weight of a British Pacific Fleet task force since the attack on the Ryukyus began on March 26th and up to May 31st this force had been in action on 21 days, fortunately with only light casualties. Actual figures issued from Admiral Nimitz' headquarters on Guam were 70 killed or missing and 34 seriously injured; the number of minor injuries is not reported.

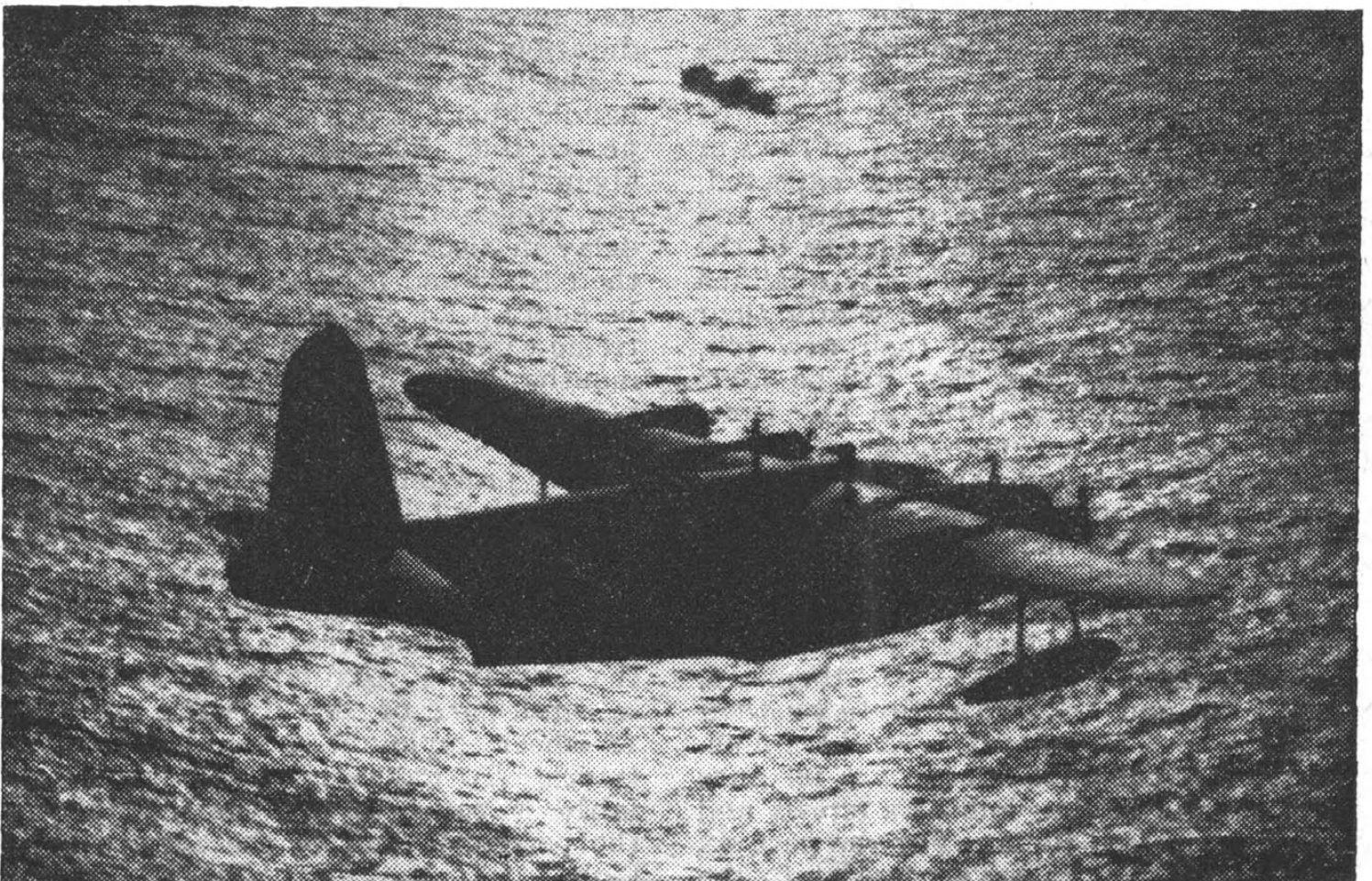
A feature of the defence tactics has been the efforts of the Jap "suicide" pilots to dive their aircraft on to our

ships, and one day last week two of these hari-kari experts tried to hurl themselves at Rear-Adml. Sir Philip Vian's carrier flagship. Diving through a murderous barrage from the carrier's guns after getting through the fighter screen covering this and three other big carriers, they came within an ace of succeeding, actually scraping her deck before plunging into the sea.

Piloted "suicide" rocket-propelled flying bombs, known as Baka bombs, have also been used in attempts to break up formations of Superfortresses, notably during the recent attack on Kobi, an important Japanese industrial centre, and it was reported last week that at least one of the bombers was hit over the target. But another Baka—they are said to

exceed 400 m.p.h.—missed the leading formation of B-29s and the pilot, losing control in what may well have been a high-speed stall, crashed and exploded amid the fires raging below. The pilot of a Jap fighter, however, made no attempt at a suicide crash into any of the raiding bombers when hit by a burst of 0.5in. machine gun fire from one of the Superfortresses, but promptly baled out and parachuted down into the burning city.

Recent pronouncements from Washington stress the fact that although the Japanese Air Force is capable of numerically strong defence of its homeland, it is too small to provide adequate defence at all the critical points of Japan's wide defence area. The present strength of the air force



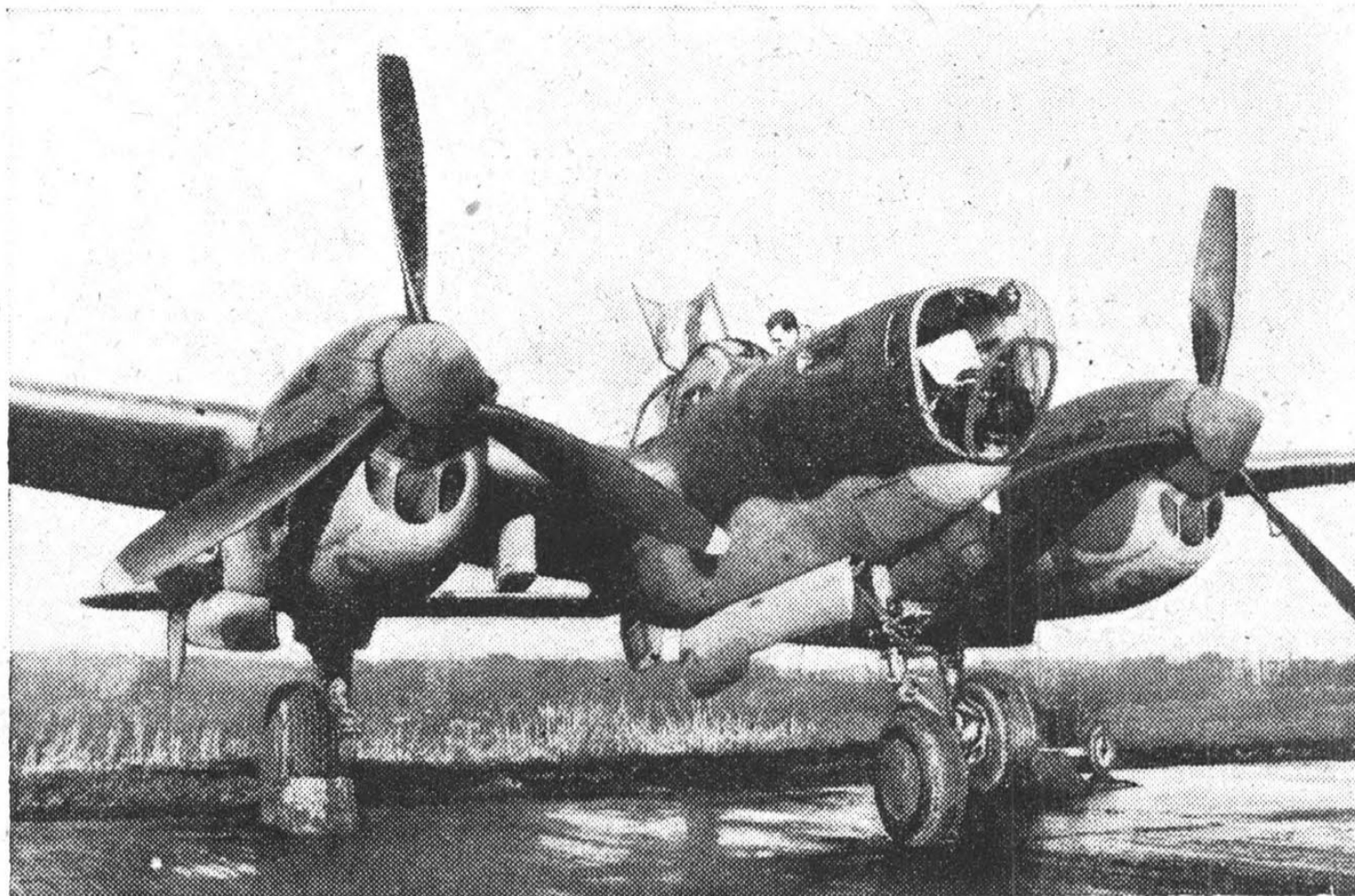
LAST PATROL: Z for Zebra, a Sunderland V flying boat which flew Coastal Command's last convoy escort for the Royal Navy. At 00.01 hours, June 4th, 500 miles south-west of Ireland, the order "Cease Patrol" was received.

WAR IN THE AIR

is estimated at some 4,000 combat aircraft and about 600,000 men including ground personnel, and it is agreed that their fighting aircraft are improving in quality. The enemy's efficiency and co-ordination in night torpedo and bombing attacks against Allied shipping and air bases is also said to have improved of late, while the frequency and, in most cases, the determination of suicide attacks during recent months indicate that a special organisation has been formed and special training given for this fanatical form of defence. The general ability and skill of Japanese pilots, however, is definitely not as good as it used to be.

Of particular interest to all students of air power, incidentally, is the analysis of U-boat sinkings issued by the Admiralty a few days ago. The figures cover the entire period of the war against Germany, and a glance at the tabulated statement at once discloses the fact that 351 U-boats were disposed of by Allied aircraft as compared with 262 by Allied ships and submarines. Nor is this the whole story, for, in addition to the 613 U-boats thus accounted for, there were another 100 under the heading of "other losses, including those due to mining by Bomber Command, etc., precise details of which are not yet available."

The included item of 224½ sinkings



"Droop Snoot": The modified, bomber leader, version of the Lockheed Lightning. The nose armament has been removed and a navigator/bomb aimer position with Norden bombsight installed. One of these led each Lightning formation—each aircraft of which carried two 2,000-lb. bombs externally—and gave the exact dropping signal. Both the 8th and 9th U.S.A.A.F. used these modified Lightnings successfully. With a bomb load of 4,000 lb. the Lightning almost equals the Flying Fortress but the range of the fighter is considerably reduced. The Lightning was originally converted to carry bombs externally for service in the Mediterranean area, where it was used on shipping strikes.

credited to shore-based aircraft out of the total of 351 gives a good idea of the fruitful results of Coastal Command's relentless vigil. Carrier-borne aircraft contributed 50½, joint ship-

shore and ship-carrier based aircraft accounted for 39, and the remaining 37 were destroyed in bombing raids whilst afloat in enemy ports.

Reports from Seac show that the monsoon weather has inevitably restricted air operations in that area, but fighter-bombers have put in some useful work strafing Japanese camps and troops on the Thazi-Siam escape route and elsewhere, and there have also been heavy-bomber attacks farther afield against points on the Bangkok-Singapore railway and targets fringing the Gulf of Siam. In such operations Liberators have been making sorties of well over 2,000 miles under appalling flying conditions. Transport squadrons, too, have kept up their regular supplies to the Army which still has fighting to do in districts inaccessible to other forms of transport, and have carried on the vital task of evacuating sick and wounded.

R.A.F. DEMOBILISATION PROBLEMS

THE Royal Air Force, more than any other Service, is in the throes of what amounts to a complete reorganisation. The whole Service is to be reduced in strength by about one-third, and the ratio of overseas to home personnel has to be completely changed, largely because there is no civil repair and maintenance service available in the Far East. A vast scheme of retraining is now in hand to enable younger persons, not due for immediate discharge, to take over the specialised trades now done by older men who are entitled to their release.

Owing to the early collapse of the *Luftwaffe*, and the termination of the war in Europe sooner than was expected, there is a large surplus of aircrew and from these will come the majority of the retrainees. If they are already qualified aircrew members, they will retain their wings, pay and rank in their new job, but, at the same time, they will be liable for recall to aircrew duties at any time. Unqualified aircrew personnel will have to take the rank and pay of the new job.

All this reshuffling is inconvenient but not unfair. To help the nation in its manpower problems, the R.A.F. took a large proportion of older men, and also those from low medical grades, for work in the sedentary trades. If, therefore, men were now released entirely by their age groups, the Service would immediately become unbalanced. For instance it is no use having lots of aircrews and no cooks to feed them. For the past six months no recruits have passed into the

R.A.F., but a certain number of personnel have been transferred to the Army. No more will go, except for a commitment to supply some men to the Fleet Air Arm for service in the Far East.

Every effort is being made not to send anyone over the No. 26 group abroad, but this cannot be definitely promised in view of the unsettled state of the world in general, and the impossibility of making accurate prophecies regarding the duration or course of any war.

The retraining scheme will have to handle about 100,000 men but it is expected that this work will be finished by about the end of the year. For the men in the groups due for demobilisation the delay in discharge will vary according to their trade and position. Many will only be held up for a month or so and the extreme cases should not be more than six months late. The usual delay is expected to be of about three months' duration.

The problems to be solved in this partial demobilisation are many and complex. In the Royal Air Force there are 19 different aircrew duties, 75 officer employments and 195 ancillary and maintenance trades for airmen. In the Women's Auxiliary Air Force, an integral part of the R.A.F., there are 18 officer employments and 63 airwomen trades. To reduce all these equally and fairly is going to tax the ingenuity of the personnel staff of the Service to its limit.

SIR LEIGH-MALLORY'S AIRCRAFT

INFORMATION has been received by the Air Ministry that the wreckage of the aircraft which was carrying Air Chief Marshal Sir Trafford Leigh-Mallory to South-East Asia has been found in the mountains 30 miles west of Grenoble. The discovery was recently made by a farmer, and an examination of documents found in the wreckage leaves little doubt that the aircraft was that in which Sir Trafford and Lady Leigh-Mallory were travelling.

The aircraft left this country on Nov. 14th last to fly to Italy on the first stage of its journey.

HERE AND THERE

Homeward Bound

THE last Lancasters of the 6th R.C.A.F. Bomber Group, Iroquois Squadron, took off from Croft airfield, Yorkshire, last week bound for home.

They were led by Sqn. Ldr. Joel Aldred, of Toronto, who has 2,800 flying hours to his credit.

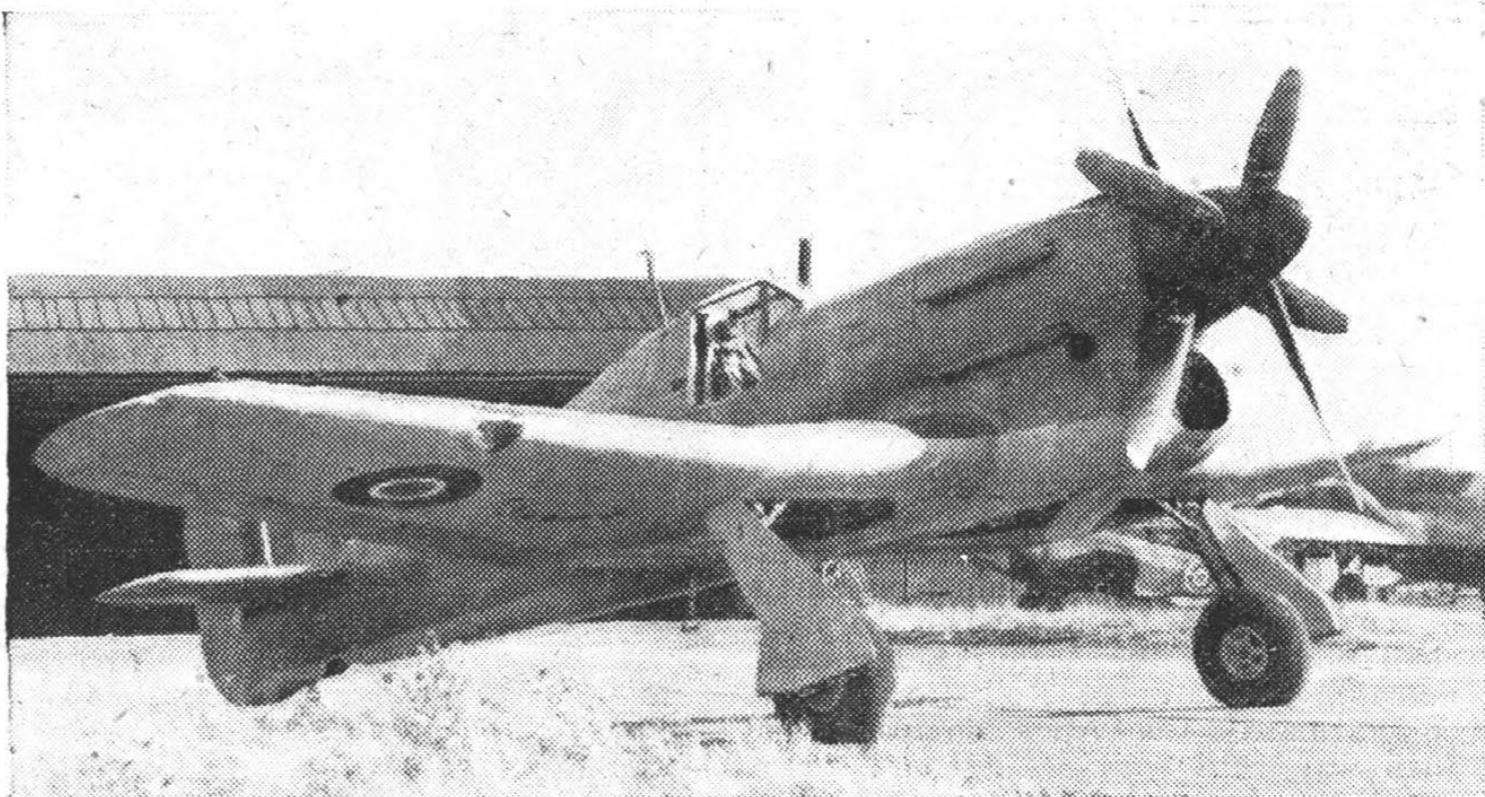
Quick Delivery

A LANCASTRIAN, of the new B.O.A.C. service between this country and Australia, last week flew from Sydney to Britain in three days. It carried newspapers (among other things) and a copy of the *Sydney Morning Herald* dated June 2nd was received in Reuter's London office in Fleet Street on the afternoon of June 5th.

Jets to Boost Business

"THE replacement of outmoded planes (by jet-propelled aircraft) is expected to give United States aircraft manufacturers better business in the next five or six years than if the jet had not been developed," said *The Wall Street Journal* in a recent article headed "Power for Planes."

Saying that jet engines and gas turbines may make vast military fleets obsolete within the next few years, the article added that the gas turbine for long-range military and scheduled com-



NASAL EXPERIMENT. The Hawker Tornado, which differs from the proven-in-battle Typhoon in being powered by a 24-cylinder X-type Rolls-Royce Vulture engine, is here seen in experimental form equipped with a six-bladed Rotol contra-rotating c.s. airscrew.

mercial flights was probably at least five years away and that jet propulsion for small personal aircraft was unlikely in less than that period.

"Aries" Flies to Canada

THE British Lancaster *Aries* of the Empire Air Navigation School last week flew non-stop from this country to Rivers, Manitoba, covering a distance of 4,076 statute miles in 19 hr. 18 min.

The *Aries* is now on a liaison visit to the Canadian Coastal Navigation School, and her pilot is Sqn. Ldr. A. A. Imrie, R.C.A.F., of Toronto. Navigator and Officer in Charge of the mission is Sqn. Ldr. Arnold Potter of Teignmouth, Devon.

Distinguished Visitors

TWO distinguished American visitors to this country last week extended their travels to the Continent. Mr. T. P. Wright, who recently gave the Royal

Aeronautical Society's annual Wilbur Wright Lecture, left this country for a tour of German aircraft factories—or such as is left of them—and Dr. Th. Von Karman, of the Californian Institute of Technology, went on a visit to Switzerland.

Received with Thanks

THE last of five R.A.F. airfields occupied by the U.S.A.A.F. in Northern Ireland was handed back to the R.A.F. last week when Flt. Lt. F. J. Simmonds signed a receipt in the form of a slip of paper bearing the sentence "Received 1 airfield at Greencastle, Co. Down, comprising buildings, machinery, equipment and utility services." Maj. M. L. Shockley acted for the U.S.A.A.F. in this transaction.

Aircraft Engines to Cars

ON his return from a visit to Germany, Sir Roy Fedden is relinquishing his position as technical adviser to the Ministry of Aircraft Production. He is to devote some of his energies to the production of a light car with novel features.

According to *The Autocar* the new vehicle is of 14 h.p. and has a three-cylinder sleeve-valve, air-cooled radial engine mounted over the back axle, and an automatic torque converter. The body will accommodate six people.

Honour for Whittle

PRECEDING the reading of the Wilbur Wright Memorial Lecture by Mr. T. P. Wright was a pleasant little ceremony at which Sir Roy Fedden presented to Air Commodore Whittle the Gold Medal of the Royal Aeronautical Society. This is the highest honour which the Society can bestow, and Sir Roy recalled the long years during which the recipient was struggling for recognition. His tremendous enthusiasm, however, ultimately had carried him to success with his gas turbine and jet power units for aircraft.

Light Metals Control

A RECENT statement (not in *Flight*) that all control of fabrication of light metals is scheduled to end on June 30th this year, is stated by M.A.P. to be misleading and unofficial.

"It is not intended," adds the Ministry, "that all control shall come to



VISUAL CONTROL POINT: Five R.A.F. officers and 13 men with a VHF-equipped jeep accompany each "lift" in airborne operations. They keep Allied aircraft advised of positions taken by our troops in fast-moving fighting.

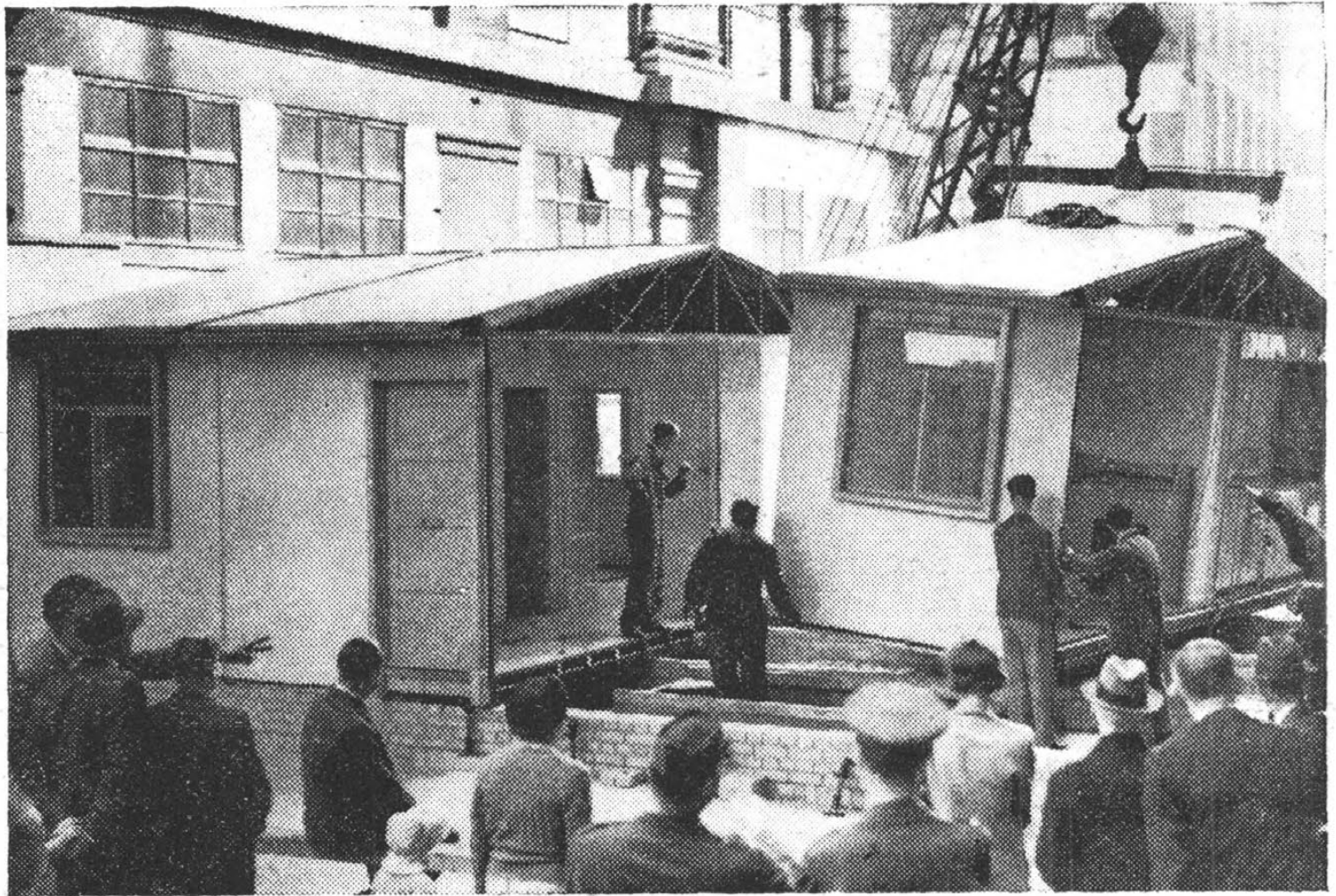
HERE AND THERE

an end on June 30th next." The statement explains that a simplified form of control, of which due notice will be given, will be introduced in the next month or so, and in the meantime the usual control procedure must be followed by consumers and fabricators.

Alvis Celebration

THE completion of 10,000 power units for Rolls-Royce Ltd., was celebrated recently by an informal luncheon party at the main Alvis factory, when the principal guest was Sir Arthur Sidgreaves, managing director of Rolls-Royce who congratulated the Alvis company on their war work and said it had become one of his firm's most valuable sub-contractors.

Mr. R. Rutledge, one of the Alvis directors, thanked Sir Arthur, Capt. G. T. Smith Clarke, their general manager, toasted the visitors, and Mr. Swift, of Rolls-Royce, raised a laugh when he said that his experience of Alvis was that they reacted strongly against "mods," raised many objections, and then made a first-rate job.



BRIS-FIT: A sample of an aluminium prefabricated house produced by the Bristol Aeroplane Co., being fitted together for exhibition at the back of Selfridge's, London. It is assembled in four sections.

News in Brief

AIR VICE-MARSHAL LESLIE O. BROWN, former A.O.C. 2nd T.A.F., is now head of a British Mission to study American methods of air training.

The revoking of another order made under the Defence Regulations in 1941 means that it is no longer necessary for wireless transmitters on aircraft to be made unusable when the aircraft is left unattended.

Air Comdre. Lord Willoughby de Broke, A.F.C., who is Lord-Lieutenant of Warwickshire and for several years commanded No. 605 (County of Warwick) Squadron of the Auxiliary Air Force, has been appointed Director of Public Relations at the Air Ministry in succession to the late Mr. H. A. Jones.

Air Chief Marshal Harris, chief of Bomber Command, was decorated last week with the Grand Cross of Polonia Restituta by the Polish Government in London. The president, M. Raczkiwicz, made the presentation, and referred to the friendly interest Sir Arthur had always shown in the Polish cause.

Mr. H. Warren, who joined the B.T.H. Company in 1911 and was elected to the board in 1938 as director of research, has been appointed managing director of the company. He has been in charge of their technical education and training system for many years.

Cadets of London Command A.T.C. now enjoy gliding facilities at Heston airport, which is managed by the Fairey Aviation Co., Ltd. A Dagling and a Kirby Cadet provide two stages of training.

The Avro Lincoln, successor to the Lancaster, is being built in Australia. Merlin engines are at first being sent out from England, but a Sydney factory is in process of changing over to the production of Merlins from Pratt and Whitney air-cooled radials.

Sir George Edwin Bailey, who was made chairman of the Metropolitan-Vickers Electrical Co., Ltd., in March, 1944, has now been made managing director of Associated Electrical Industries, Ltd.

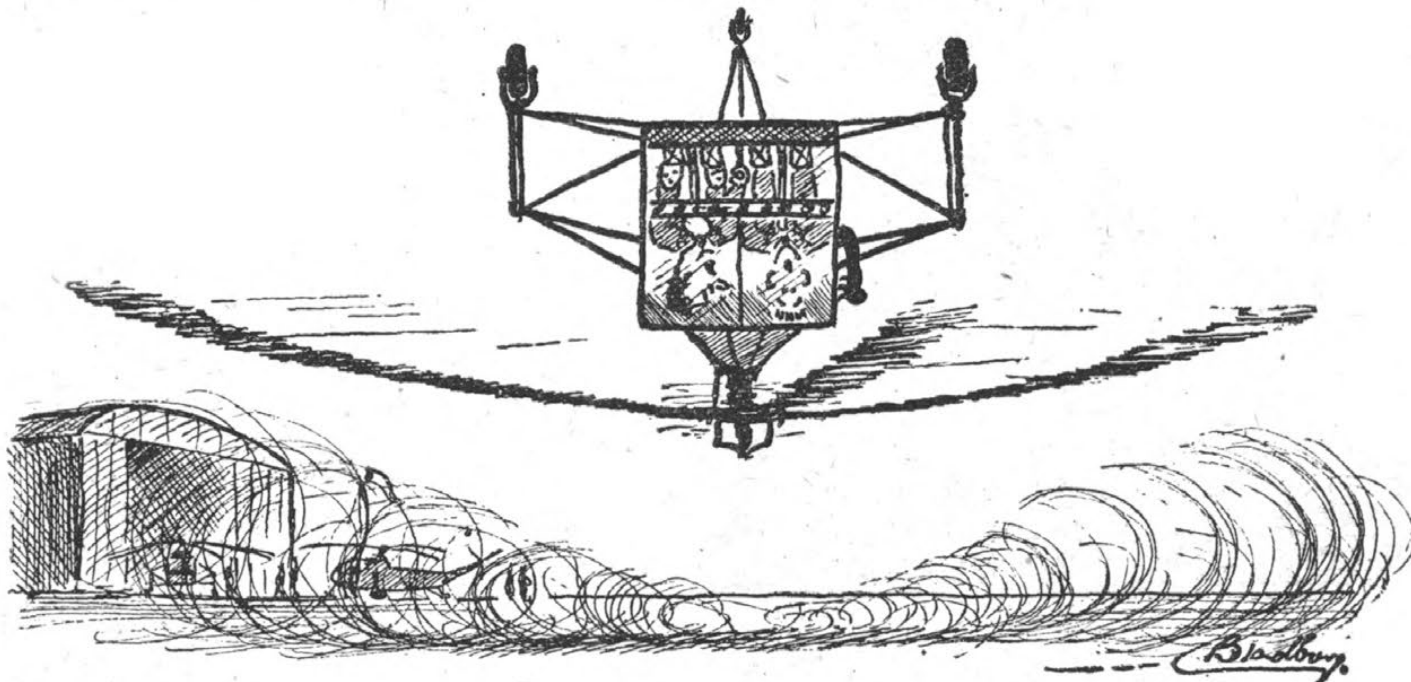
A new type of incendiary bomb containing about 300 pints of petrol and other oils in jellied form is being used by the U.S.A.A.F. in the South-west Pacific with, it is reported, excellent results.

Mr. Leonard Simmonds, who has earned fame as a mess caterer at Staverton and Theale airfields, is to have a complimentary dinner given to him by the Miles Aircraft employees before leaving to take up a new appointment. Mr. Simmonds started his service catering career at the R.A.F. College, Cranwell.

Lord Swinton, the Civil Aviation Minister, recently told a deputation headed by Lord Gorrell, chairman of the R.Ae.C., that it was for the Secretary of State for Air to decide, on grounds of safety, when the ban on private and club flying could be removed. But even if it were lifted at once, petrol for private flying could not be made available.

Some very fast "global" flights were in the news recently; four P.R. Mosquitoes with full equipment and long-range tanks flew from Benson, Oxfordshire, to Karachi in under 13hr. including a stop at Cairo; the fastest clocked 12hr. 25min. and averaged 378 m.p.h. for the 4,700 miles. A B.O.A.C. Lancastrian also flew from England to Sydney, Australia, in 49hr. flying time, carrying passengers and London newspapers.

The first Northern Area Rally of the Society of Model Aeronautical Engineers is being run by the Manchester and District Council of Model Aero Clubs at Springfield Park Municipal Golf Course, Marland, near Manchester, on Sunday, July 1st. All details are obtainable from Mr. W. Titterington, 13 Lakes Road, Dukinfield, Cheshire, or Mr. R. Lawson, 10 Dalton Avenue, Whitefield, near Manchester.

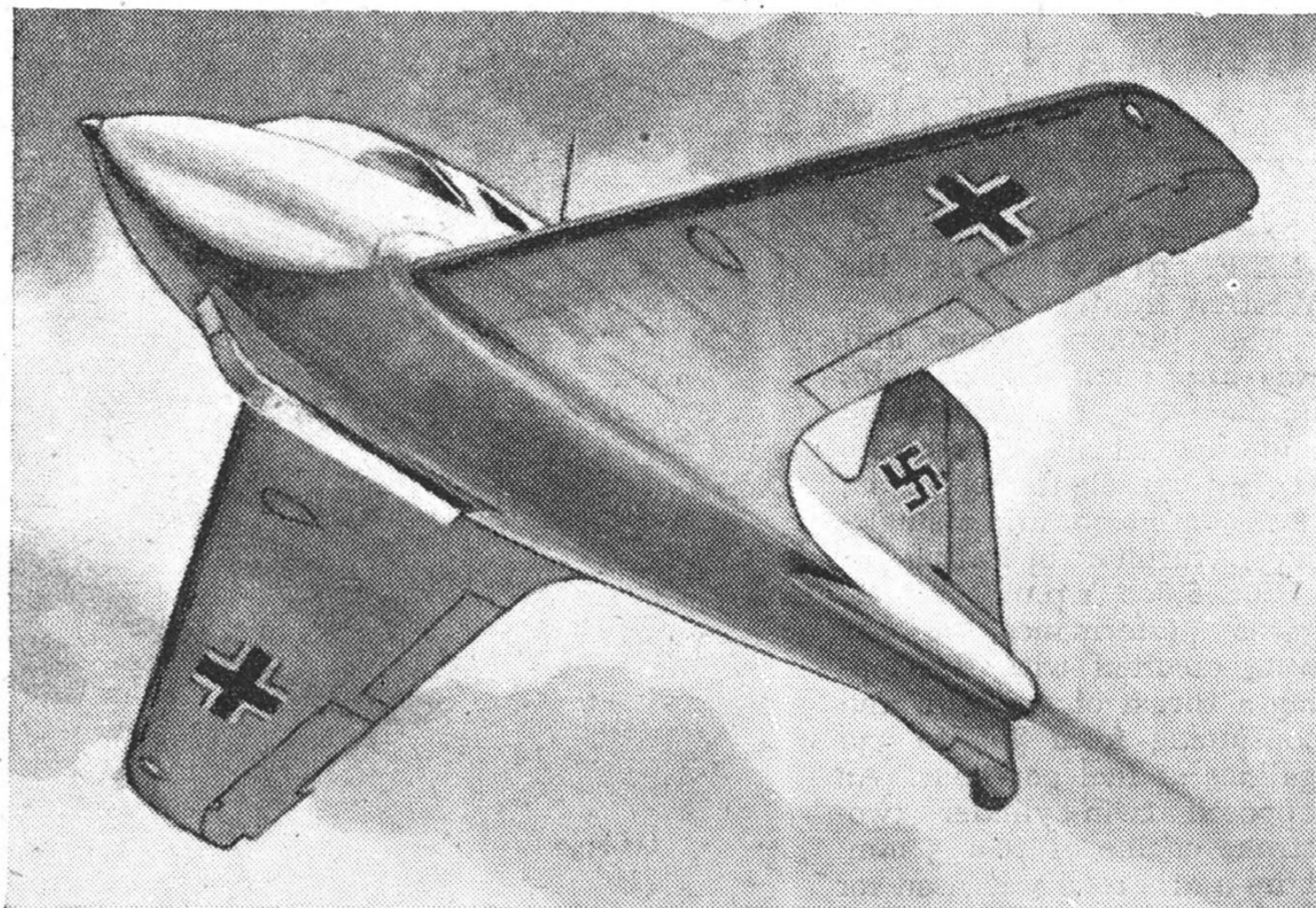


"We always do this first. - - - Gives the pupil confidence you know."

German Jet Aircraft

*Some Observations and
Brief Details of the
Junkers, He-Hirth and
B.M.W. Propulsion
Units*

By G. GEOFFREY SMITH, M.B.E.



Rocket-propelled, the Me 163B is one of the 'tailless' types. Originally it was incorrectly referred to as a flying wing.

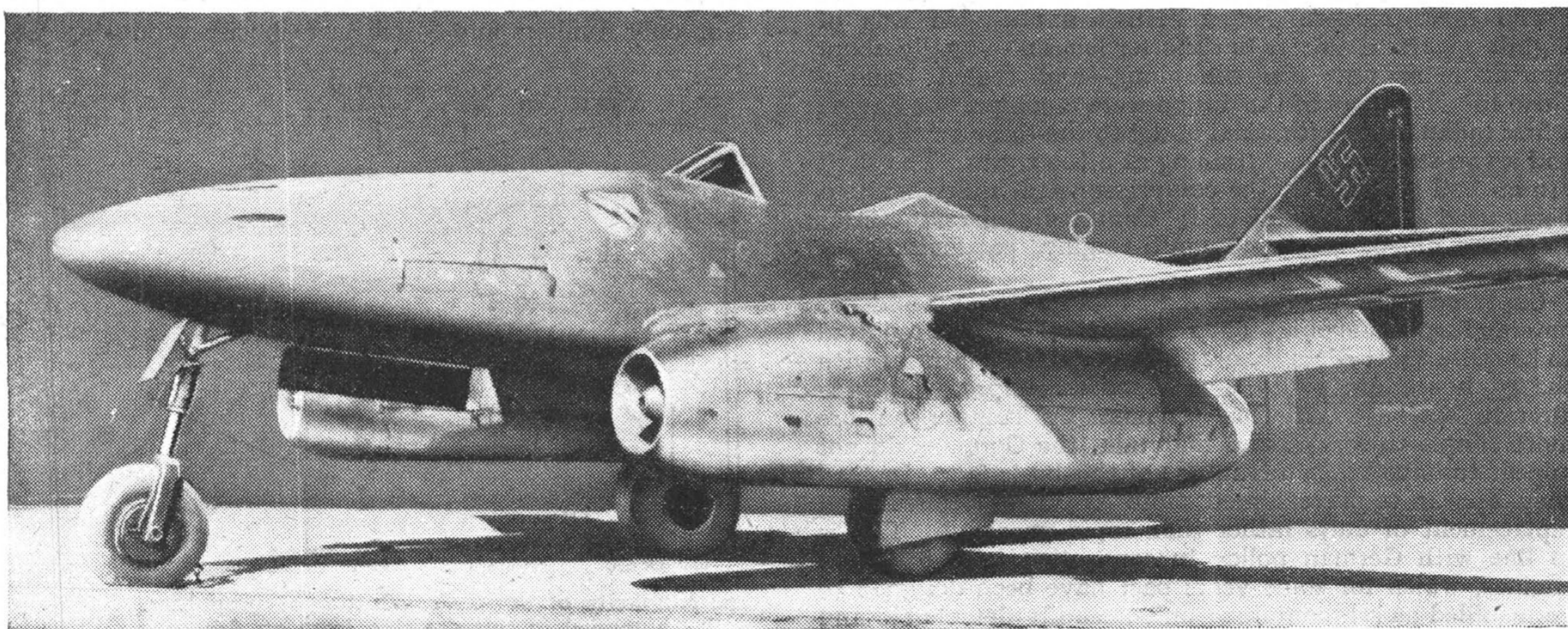
IN previous observations on the progress of jet propulsion it has been made clear, despite a lack of details, that Germany had a marked interest in jet propulsion from the earliest days. Amongst data collated since VE day is evidence that an experimental turbine jet plane of German origin, the He 178, was flown on August 27th, 1939. The Germans were quick to recognise the possibility of speedy production offered by the simple gas turbine and consequently, when they were forced on to the defensive by our bombing attacks, there was concentration upon jet fighters and reconnaissance types. In 1941 and 1942, subsequent to successful development of turbine jet designs by Junkers and the Heinkel and Hirth firms which joined forces, the activities of practically all the recognised aircraft engine manufacturers were switched to the new type of propulsion unit. As we now know, dispersed plants and underground factories were busily occupied in manufacture of jet fighters for the last eighteen months of the war. Many of these plants were captured intact by the Allies.

Apart from turbine-jet planes the Germans also successfully developed a true rocket-propelled plane, the Me 163, which was extremely fast—faster indeed than the turbine-jet planes. This liquid rocket-propelled fighter which had a

vertical fin only and no elevators—virtually a tailless type—was credited to Lippisch, who produced before the war a series of Delta machines of somewhat similar design but fitted with reciprocating engines. The range of the Me 163 was extremely limited, and to eke out the rocket propellant, the pilots would ascend rapidly and then glide for a time, using further rocket propulsion to regain altitude. There were two types, the Me 163A, which was used as a trainer for the 163B fighter which could attain a speed of 550 m.p.h.

First in the Field

In the summer of 1944 German turbine-jet planes went into service on the Western front, notably the Me 262 (Swallow) with two Junkers Jumo 004 units, and later the high-wing bomber-reconnaissance Arado 234, also with two Jumo engines. At their normal ceiling of 28,000ft. the jet planes were 100 k.p.h. (62½ miles) faster than the Me 109 with a piston engine. At that time British Gloster Meteor fighters with two Whittle-type jet units were coming into combat service, after initial successes against the V1 flying bomb over the English Channel. There is no record of jet fighter meeting jet fighter, but a number of German jet



An impression of a captured Me 262—the first German jet plane encountered in combat. It has two Jumo units.

GERMAN JET AIRCRAFT

planes were shot down by R.A.F. pilots over the Western front.

The Junkers Jumo unit was approximately 2ft. 9in. in diameter, 11ft. 9in. long and weighed about 1,600 lb. It had an eight-stage axial flow compressor and a single-stage turbine operating at about 8,800 r.p.m. As regards performance, it has been credited with developing a thrust of 1,980 lb. and consuming from 300 to 330 gallons of fuel per hour. An opposed twin-cylinder two-stroke engine of 70×35 mm. bore and stroke was used for starting. Just why a small two-stroke reciprocating engine was chosen for starting is not clear. On the ground, such an engine would no doubt function perfectly. At high altitudes, the possibility of a pure turbine jet cutting out cannot be ruled out entirely and one would assume that a non-supercharged engine would not be easy to get going to give a new start to the turbine. An electric starter seems altogether preferable. The Jumo replaced the Heinkel unit originally intended for the Me 262. Like-

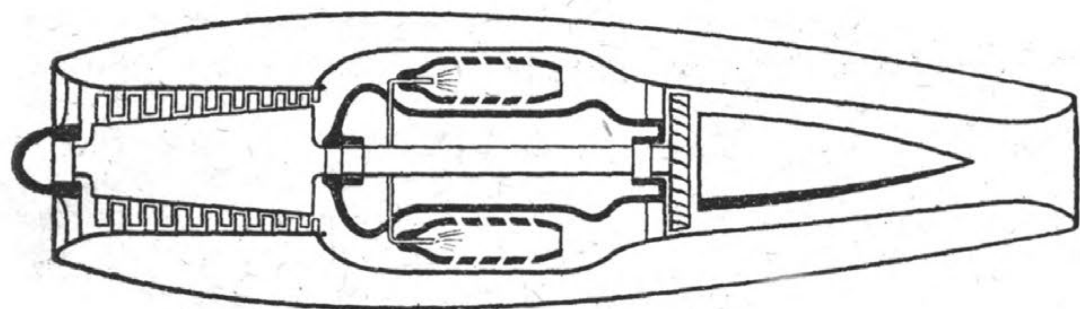


Diagram of a jet propulsion unit employing an eight-stage axial flow compressor in conjunction with a single-stage turbine. Junkers and B.M.W. designs follow this layout.

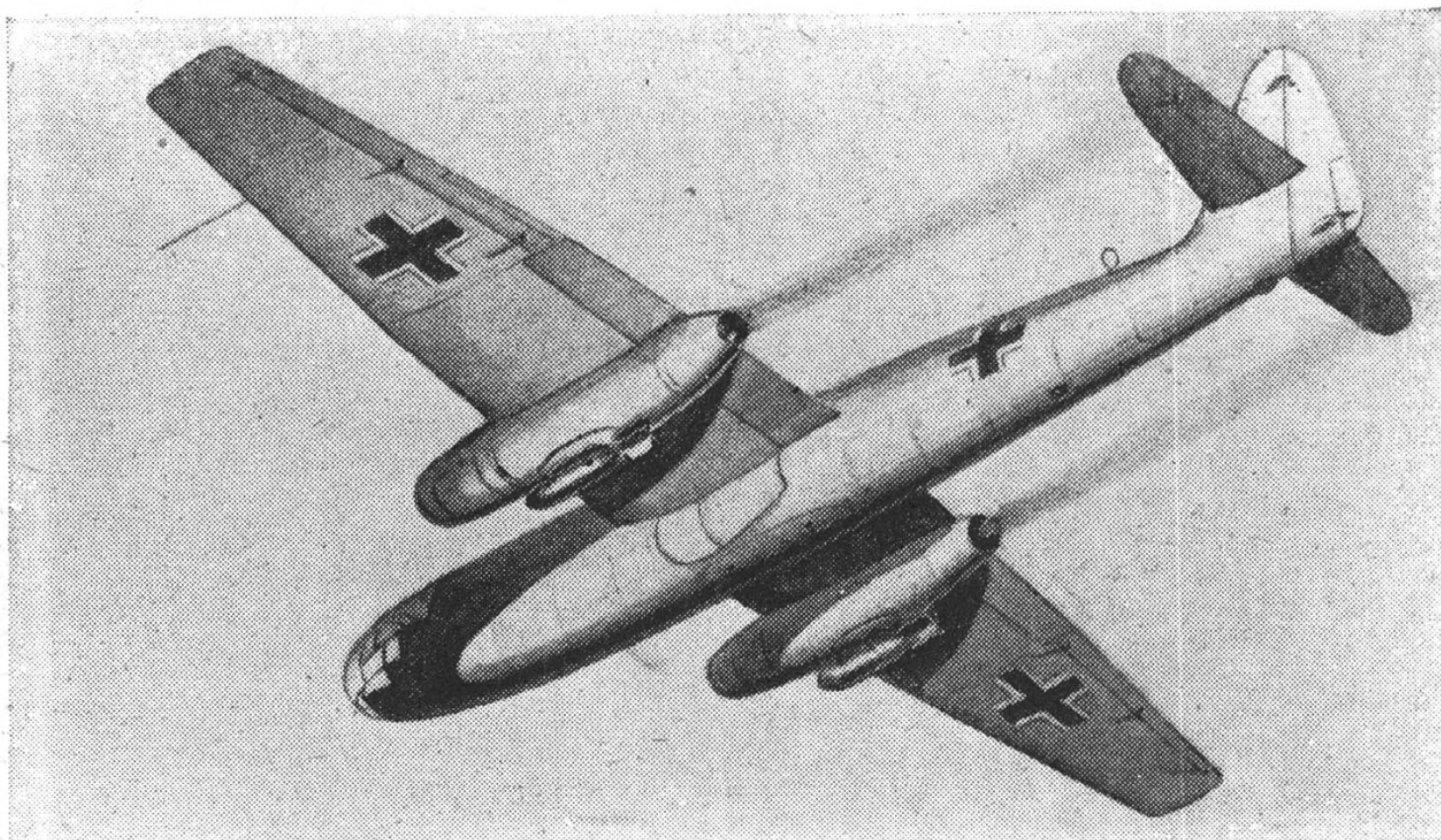
wise the He 280—now obsolete—was originally intended to have two Heinkel jet units but, owing to the slowness of their development, Jumo units were fitted in this case also.

Heinkel-Hirth

The more modern Heinkel-Hirth 011 engine was of slightly greater diameter but shorter length—actually about 3ft. diameter and 8ft. 6in. long—and scaled roughly 1,050 lb. Features of the design were a compressor having a first radial stage with axial outlet to the three axial stages and a two-stage turbine, running at 9,000 r.p.m. The shaft ran on ball bearings at the compressor end, roller bearings being used at the turbine end. Continental manufacturers from the outset employed multi-staging, particularly for compressors.

Captured units were regarded as unduly heavy and not outstandingly efficient. Their "overhaul" life is reported to be quite short—less than 25 hours—which contrasts with the 250 hours' overhaul life of a modern reciprocating type aircraft engine. Whereas turbines by comparison are more simple to service and maintain, the Germans do not appear to have taken advantage of this basic fact. Instead they appear to have aimed more at quick removal and replacement of units rather than rapid overhaul. This is in line with German policy in connection with orthodox engines, which for some years past have been designed to be installed as self-contained units, readily detachable and interchangeable.

As to speed capabilities the Me 262 was reported to have



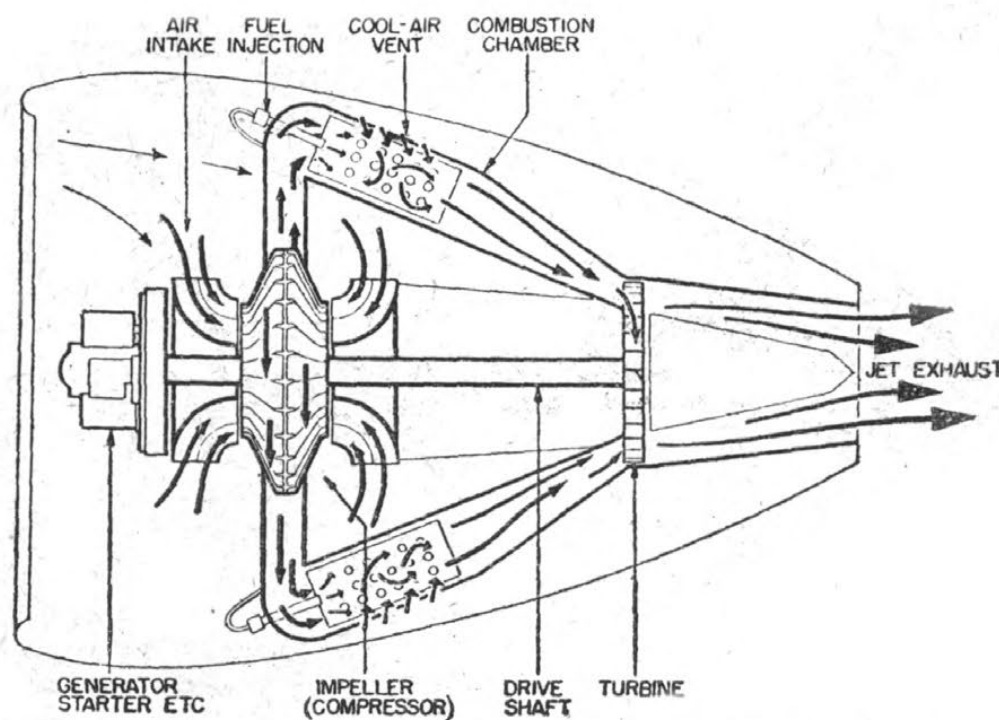
The Arado 234, a high-wing bomber-reconnaissance type with two Jumo turbine jet units.

been timed over a distance of 12 kms. at a velocity of 745 k.p.h. (463 m.p.h.) and the ability to ascend to an altitude of 12 km. (39,000ft.) in 4.5 minutes. It was not operational at that height. The highest *indicated* speed was reported as 880 k.p.h. (546 m.p.h.) "at altitude." A reconnaissance type also with Jumo units carried 3,000 litres (660 gallons) of fuel weighing 5,610 lb.

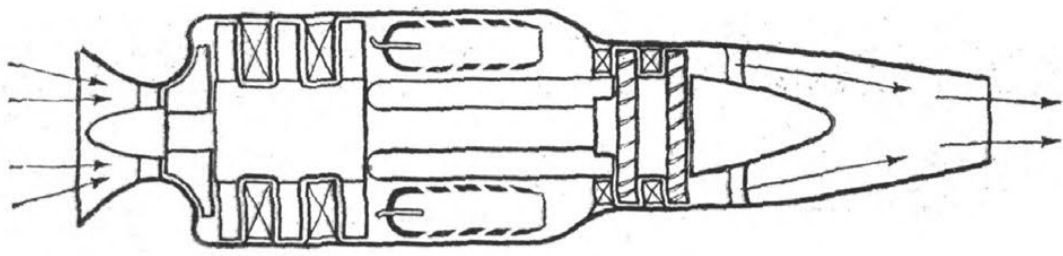
Much of the speed of the Me 262 must be attributed to the improved aerodynamic characteristics of the airframe structure and the absence of tail vibration. The Me 262 had an extremely thin wing to minimise compressibility factors. It is clear that the importance of wing and fuselage design going forward hand in hand with speed attainments with modern turbine units has been well appreciated by the enemy.

The design of the engines is interesting indeed, and if the weight is high, their life short, and performance limited these disadvantages may largely be ascribed to inferior materials and, particularly in the case of the Jumo engines, to the urgent need for getting into production. It must be remembered that Germany was seriously hampered by constant Allied bombing, particularly during the closing stages of the war. As a result production and research were curtailed and the enemy's metallurgical difficulties were great. Thus the lack of high quality heat-resisting steels such as are imperative for efficiency with turbine-compressor units prevented complete development.

Not only Junkers and Hirth were busily producing jet



The simplicity of the basic Whittle jet propulsion unit is well exemplified in this drawing from an American source. The double entry centrifugal compressor is driven by a single-stage turbine.



This diagram indicates the type of turbine unit evolved by Heinkel-Hirth. It has a four-stage compressor and a two-stage turbine.

units. Bussing N.A.G. among others had interesting designs in course of test, but they were more complicated than early British counterparts. The N.A.G. had a free piston-type compressor. The most recent turbine jet engines of enemy origin on which great store was set was a B.M.W. 003 design incorporating a seven-stage compressor in conjunction with a single stage turbine. It developed a static thrust of 1,760 lb. Examples of this engine had been applied to a number of prototype aircraft, including the He 162 Volksjager, an Fw, and a Junkers which were flying before VE-day. It would appear that with the typical Teutonic approach to technical problems, the highest mechanical efficiency, ignoring complexity, was the primary objective of their designers, but the difficulties of the metallurgical situation was the means of minimising much of their aims.

In an attempt to overcome the shortage of heat-resisting metals suitable for the turbine wheel, German engineers experimented with hollow blades to assist cooling. It may be recalled that some years ago the Swiss engineer, Buchi, patented a system of conducting air from the hub through the leading edge of the blades of a turbo-supercharger.

More interesting at the present stage perhaps is the reported statement of a German rocket and jet expert that two specimens of Germany's latest jet-propelled aircraft, twelve turbine engines and also rocket units were forwarded to Japan in three submarines in January, 1945. Twenty-two Messerschmitt engineers and three from a

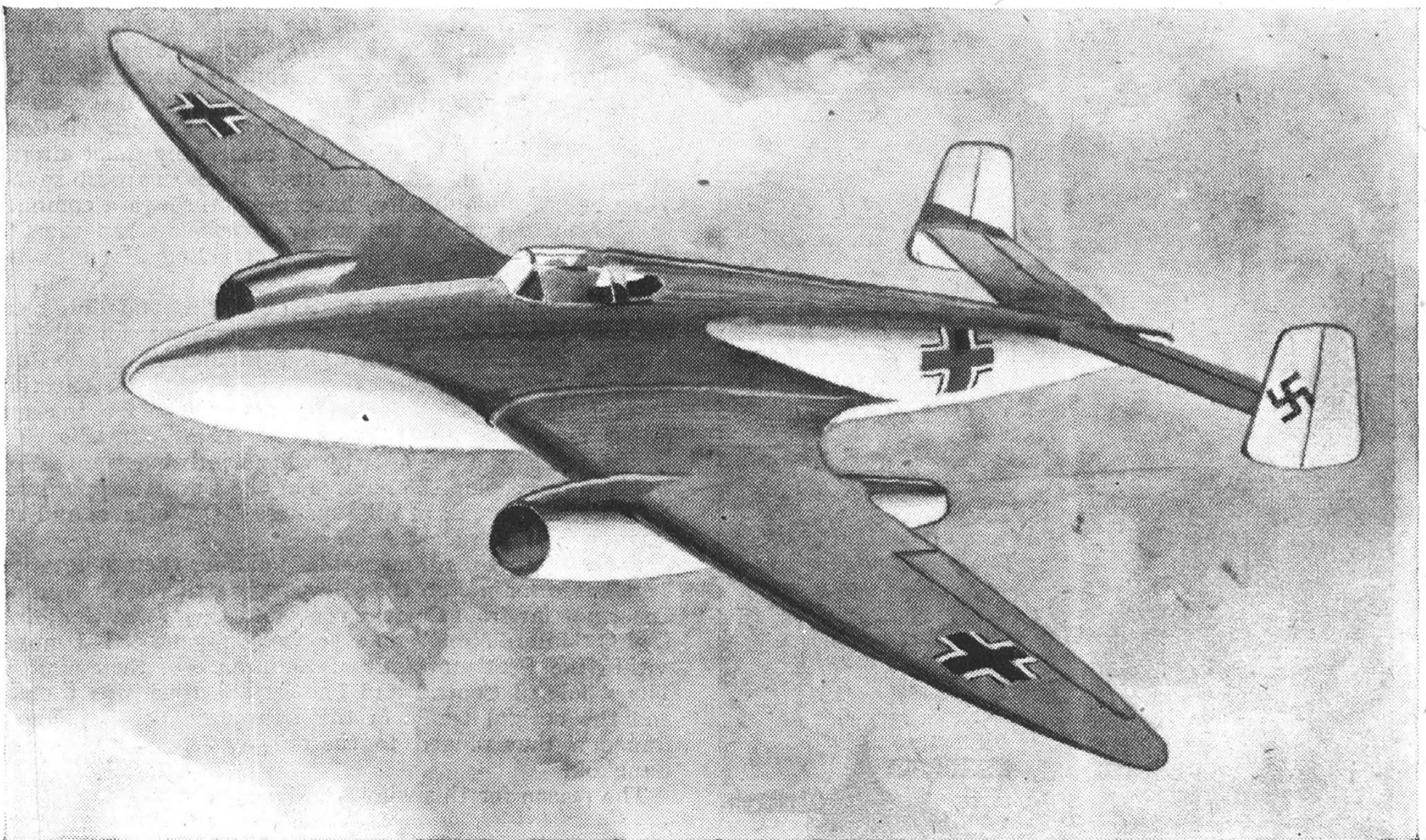
Junkers factory are said to have accompanied the equipment.

From Shaef a correspondent cables that the Germans were on the verge of perfecting a four turbine-jet bomber—the Me 264—intended for high altitude high-speed service. It was anticipated that this big machine would have been ready in three months from VE Day.

It has also been reported that an experimental fighter equipped with an intermittent impulse thermal duct engine similar to that employed on the V1 flying bomb has been discovered. This was probably the Dornier Do 17Z. An impulse engine of this type was in the early stages actually tested on a road lorry. I have seen captured photographs of a lorry under experimental test propelled by one of these engines mounted high up. The driver looked very anxious, as might be imagined from the long flaming exhaust from the tail and the deafening noise of the V1 unit.

From the foregoing brief summary it is clear that there is much to be gleaned from a study of German practice. It is equally true that Continental designers could learn much from the highly developed British units. When the full story of our achievements can be told it will be demonstrated that Britain has made a major contribution to the world's knowledge and successful development of jet-propulsion systems, which present the prospect of new and revolutionary types of aircraft and undoubtedly constitute an important "phase change" in the science of mechanical flight and power production in its wider applications.

The jet-propulsion unit is a heat engine and is designed in conformity with thermal and dynamic laws which are generally known and accepted. Under war conditions, however, the normal technical liaison established by learned societies, the Press and trade channels breaks down between belligerent countries. As a consequence, whilst pursuing the same aim and employing the same principles, the scientists in warring countries may approach a problem and develop a solution upon radically different lines. British and German designers sought efficiency in jet-propulsion units by simplicity and complexity respectively.

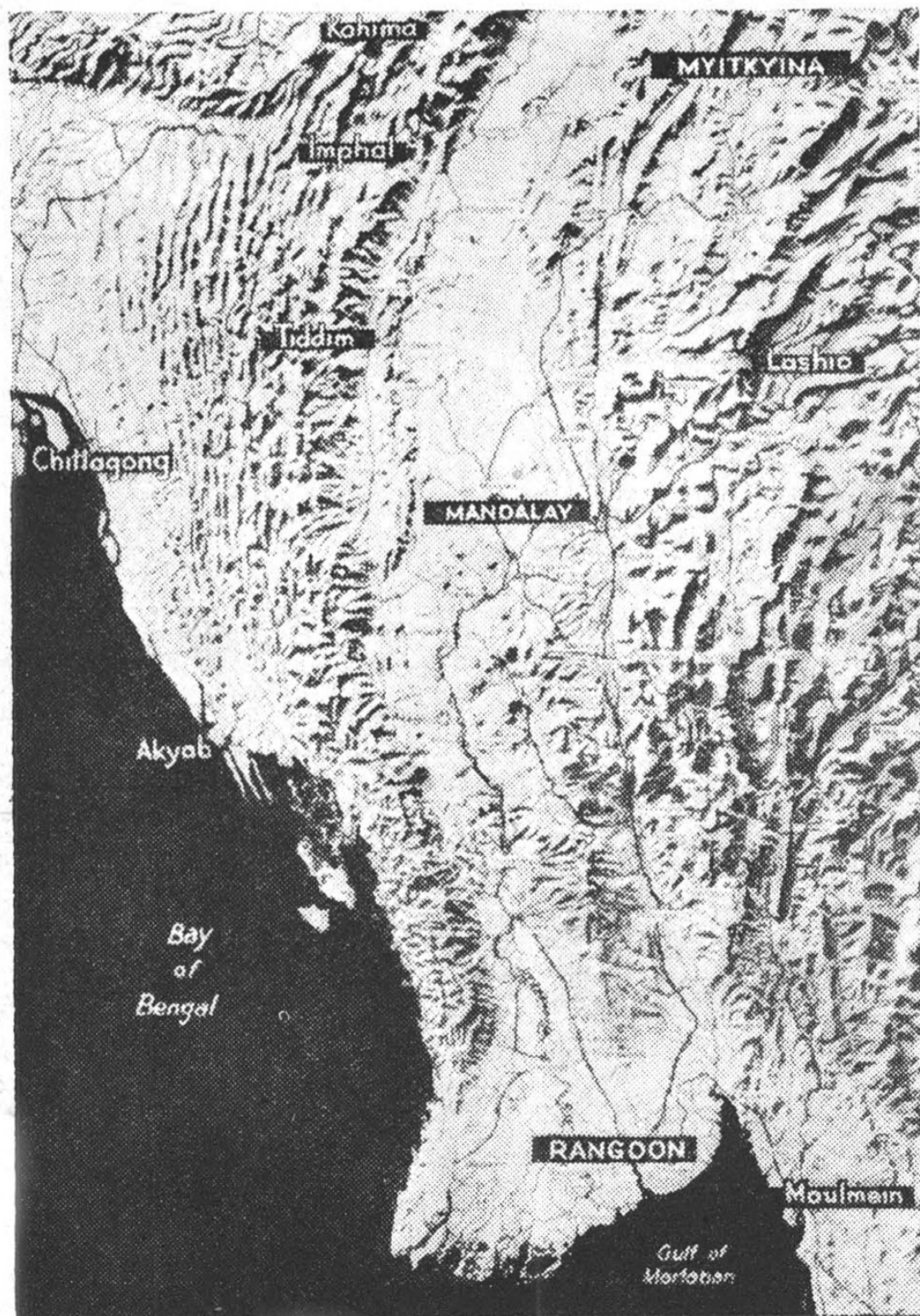


Toward the end of 1944 the He 280 (now obsolete) made an appearance.



The Story of the Beaufighters' Share in the Battle for Burma

By CHARLES GARDNER, Sqn. Ldr., R.A.F.



"WHISPERING DEATH" was not a name chosen by us. We are too prosaic and undramatic to call a Beaufighter anything so sinister—or so poetic. It was the Japanese who did it—and, since they were at the receiving end of the Beau's rockets, cannons and machine-guns, who shall deny them the privilege? It may be, too, that there's something of accuracy in the description though the matter is still argued in the messes of the Beaufighter Wing of 224 Group, Eastern Air Command. The Beau is, after all, a reasonably quiet aircraft and fast low down. Also the jungle tends to absorb sound. There must, undoubtedly, have been, through a combination of these phenomena, many occasions when the first that an enemy garrison knew of approaching disaster was a swoosh over the tree tops and the boomp-boomp of cannon.* That this sort of thing could, and did, often happen was once a disconcerting prospect for all Japs between Myitkyina and the Chindwin, and from Ledo Road to Rangoon. It did our cause no harm that the effectiveness of the aircraft doing the job was given a free and rather charming build-up by the enemy himself. The Beaus, not caring one hoot by what word they were called, went on to become the scourge of the Burma supply lines, and the heartbreak of all Japanese "Q" officers and rail masters in South East Asia.

These Beau squadrons, while building their reputation, were based mainly on the all-weather strips of the Arakan Coast not far from Cox's Bazaar and theirs was the job of L of C "interdiction" on everything Japanese that moved within the Prudent Limit of Endurance of their aircraft. The whole of Central and Southern Burma was theirs—and the coastal traffic of the Irrawaddy delta. Beyond Rangoon they ranged to the railway which ran in from Bangkok.

The reason for this wholesale "interdiction" is obvious.

* From the low level at which the Beaufighters attacked, and at the high speed of approach, the first warning the Japs had might well have been the projectiles, followed by the engine noise. The "whisper" is heard after the aircraft has passed and when most or all of the engine noise has faded.—ED.

WHISPERING DEATH

The Japs were fighting from interior lines of communication based on a good port. The 14th Army was not. As we have seen in the two previous articles, the 14th's difficulties were overcome by the use of air power, and it was also air power which was to deny to the Japs the benefits of the many roads, railways and rivers she controlled between her bases and the front line. The Beaufighters fitted-in as the central piece in the pattern of this offensive air strategy. Far beyond Rangoon, the Liberators pounded the bridges of the prisoner-built Bangkok railway. Close to the line of battle the Hurribombers, the Vengeances, and, later, the Thunderbolts and Mustangs all dropped on the browned-off Japs—but the big area in between—that was Beau-land!

Optimum Height

From the first the sorties were flown in pairs. It was no easy business this interdiction flying. The pilots had to keep a balance between the absolute nought feet which achieved complete surprise, and the minimum height at which they could see far enough to get guns on the target before it flashed underneath. Local tactics, therefore, had to be devised for the various day-to-day targets. The Rangoon-Mandalay railway, for instance, demanded that the Beaus patrolled about half a mile or so from the track itself, sticking to nought feet—with an occasional pull up to 200ft. for a "look-see." This procedure avoided the light machine-gun fire which was plentiful along the railway itself, and gave a good chance of achieving the all-important surprise. Once surprise was gone, and the word was passed along the sector that the Beaus were in the area, trains had a habit of staying in stations which were defended from all angles by light ack-ack. To attack a train under those conditions was "dicey" and not recommended.

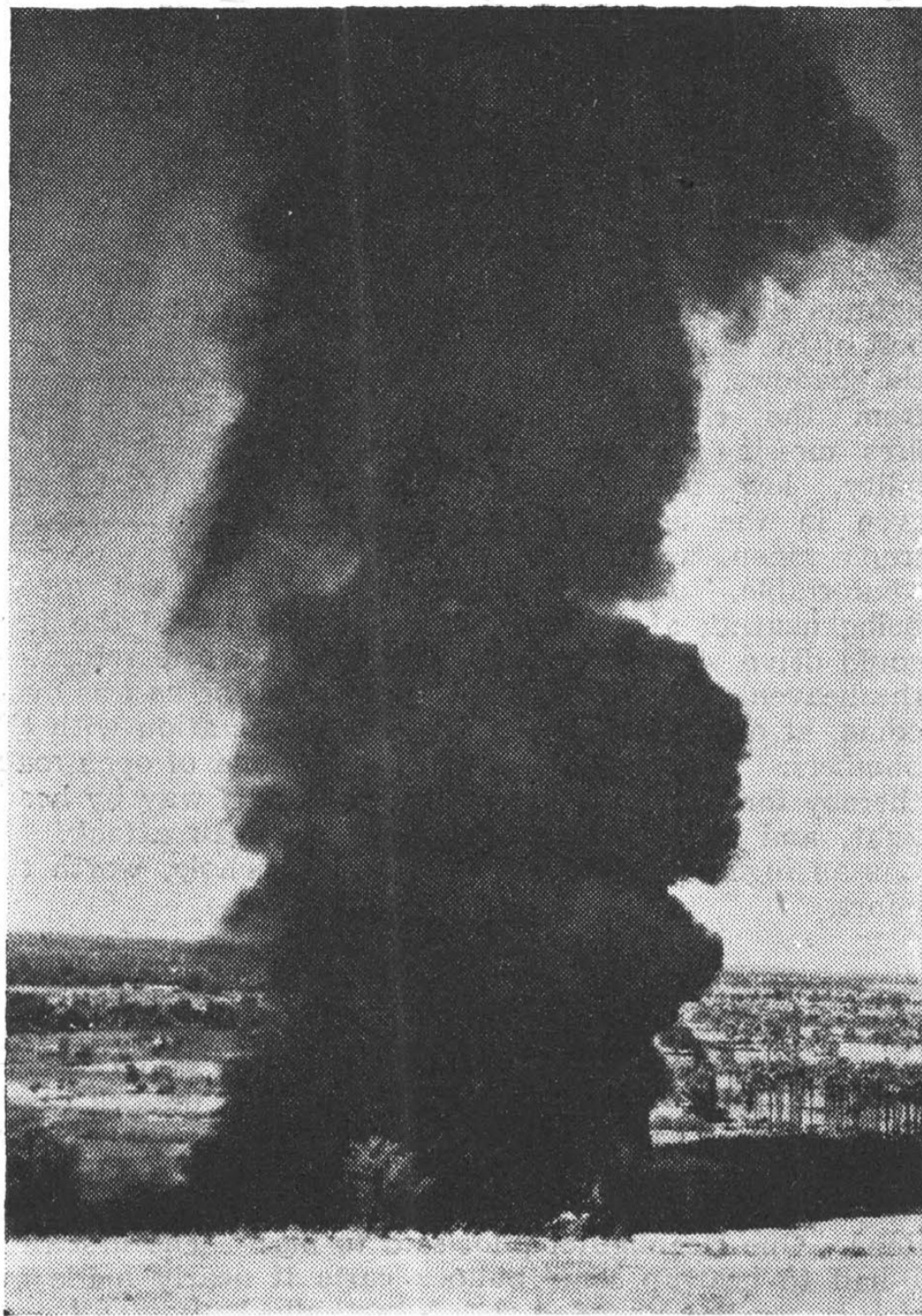
But, caught out in the open, a train was a lovely target, and one which couldn't run away, or hide in the jungle. The usual practice was to stop the engine with a cannon burst, and then deal with the rolling stock at leisure. Two Beaus working together could usually keep light machine-gun fire down and make a thorough job of the strafe. One train of 14 coaches, which was hit by rockets, was blasted right off the rails and rolled down the embankment.

It was not long before the pilots noticed that drivers usually stopped their trains as soon as a Beau appeared, and made a dash for cover. One sees their point. The occupational risk of being train crew in Burma in 1943-45 must have been high. One wonders if they had an "ops-tour" of so many round trips, or if there were many cases of L.M.F.

In the early days train targets were fairly plentiful—there was one pilot who had three on his first sortie—but later the laws of diminishing returns made a "loco" a prize of such rarity as to call for squadron rejoicing.

The battle of the railroads was, as was all the Beau work, a battle of wits between our pilots and the Japs. The enemy didn't take their continual beatings-up quietly and devised several counter measures. Chief among these was the loco-shelter. The Japs built these shelters in a number of places all along the line, and their main use was to provide such a plethora of potential targets that the Beaus wouldn't be able to spare ammunition for them all. This was a good idea, as theoretically it would be impossible to tell which of many shelters held a "prize," and a game of "hunt the loco" among all the shelters would have been wasteful and difficult. In the event our pilots were able to solve the problem in a daring and resourceful way, which I can't reveal in case they have need of it again farther down the line.

Camouflage, too, was abundantly used—but you really can't camouflage a train, and this netted a nil return for the Jap. Their only real defence was the obvious one of light ack-ack, which soon became the major hazard of



OIL FIRED : A huge column of smoke rising from burning oil trucks after a railway attack by Beaufighters near Kyaukpadan.

train busting. A Beau coming down in a dive from 500 or 1,000 quickly gained feet was not a hard target, and our aircraft were frequently hit. Soldiers with rifles also added their quota—but, despite this, it was not often that we lost aircraft or crew. The light machine-gun fire, however, did give a great deal of work to maintenance crews, and several aircraft had to crash-land on return because of failure of hydraulics or electrics due to a lucky bullet. Punctured tyres, with their vicious and sudden influence on an unsuspecting touch-down, were one of the dangers attendant upon every sortie. The light machine-gun fire, incidentally, was mainly placed alongside the railway and seldom on the train itself.

Bridge Fords

The Japs eventually built up quite a good repair organization on their much-attacked rail system—though it was never quite good enough to keep the supplies moving at a rate which repaid the effort. In some cases they left broken trains where they were as permanent monuments to the Beaus, and built loop-lines around the wreckage. With broken bridges (some the work of Beau rockets), many devices were used. In one or two places where the defunct bridges had been over rivers, roads were built which were "forded" through the water—giving a road link between the broken ends of the railway. Traffic was switched from rail to road and back to rail again, but the machinery for doing this was also given adequate attention from the Beaus.

In their attacks on the roads, the Beaufighters had a more difficult job. There 100 per cent. surprise and "snap shooting" were called for. A car or lorry, if not hit on the first run, had time to pull into jungle before the Beau could turn through 180 degrees, and come back again on the target. There was no full answer to that one—so, in

general, the pilots concentrated on those stretches of the central Burma roads which were open and offered little shelter. Again a battle of wits followed. The Japs constructed "good pull-ups for lorry drivers" on the more popular roads—and developed a very rapid camouflage system. Nevertheless the "bag" of staff cars, lorries, and other motor transport steadily grew, until the enemy was forced to do most of his driving at night. The Beaufighters did not normally operate at night except at the best of the moon. But, with the shadows, and the smoke from the chronic jungle fires messing up the visibility, low night flying, even in the light of the tropic moon, was not very comfortable. Another drawback was that the moon, being neutral, also shone for the ungodly—and the Japs could drive without lights. This inconsiderate refusal of the heavens in their courses to fight only for us was overcome, at one or two key times, by co-operation with the bombers. These would crater a chosen spot of open road, thereby forcing the enemy to pick a careful way by headlight, and so lay themselves open to Beau attack. It was an ingenious idea, but not, on the whole, worth the effort.

Unpleasant Work

Beau depredation among Jap motor transport caused a road transport crisis for the enemy by the end of 1944, and, as with the locos, targets became rarer. The enemy, by then, had been forced to use lumbering bullock carts, and these also had to be attacked in certain areas. It was never a job which our pilots performed happily—although they appreciated that it was something which had to be done. One Beaufighter pilot said to me: "The first time I had to beat-up some bullock carts it nearly made me sick to see the wounded and dying bullocks lying all over the road thrashing about. I didn't feel very proud of myself, and it was a job I tried to steer clear of after that." Nevertheless the Japs did use bullock carts—they had to.

The third branch of the daily Beaufighter service was that which looked after the river and coastal steamers. Before the war the Irrawaddy and Chindwin rivers floated a large fleet of picturesque and bulky river steamers. Today that fleet has entirely disappeared. Aesthetically many will regret the passing of those photogenic Burmese paddle-boats, but they were doing the enemy's work. The brown Irrawaddy and the blue Chindwin were relied on by the Japanese to carry much of their supplies and many of their men to the front. As on the railway and the roads, the Beaufighters denied them that advantage.

In creeks, and under camouflage nets by the banks, the Japs hid their boats—but the Beau rockets found them. I saw some beautiful photographs of the destruction of one of the last of the paddle steamers—incidentally the biggest on the Irrawaddy. Five Beaufighters put paid to her—she caught fire after the second pair of rockets, and was subsequently hit by every succeeding salvo. The final picture showed her heeled over and burning.

All the Beau squadrons have shown a very high level of accuracy with rockets. The campaign has not given

them an abundance of rocket targets—but when they have had a chance to let fly they have seldom wasted it.

The halting of river traffic—virtually achieved by the end of 1944—was of supreme importance to the 14th Army. The rivers were a big danger—heavy tonnages might have reached the Jap front by water—and the smaller boats could be fairly easily hidden by day in the creeks and backwaters. But even these smaller boats, together with hundreds—even possibly thousands—of sampans were found and sunk. Sampan and native craft recognition became an extra course for the aircrews. It was ruthless this war of the rivers, and in it damage was undoubtedly done to local

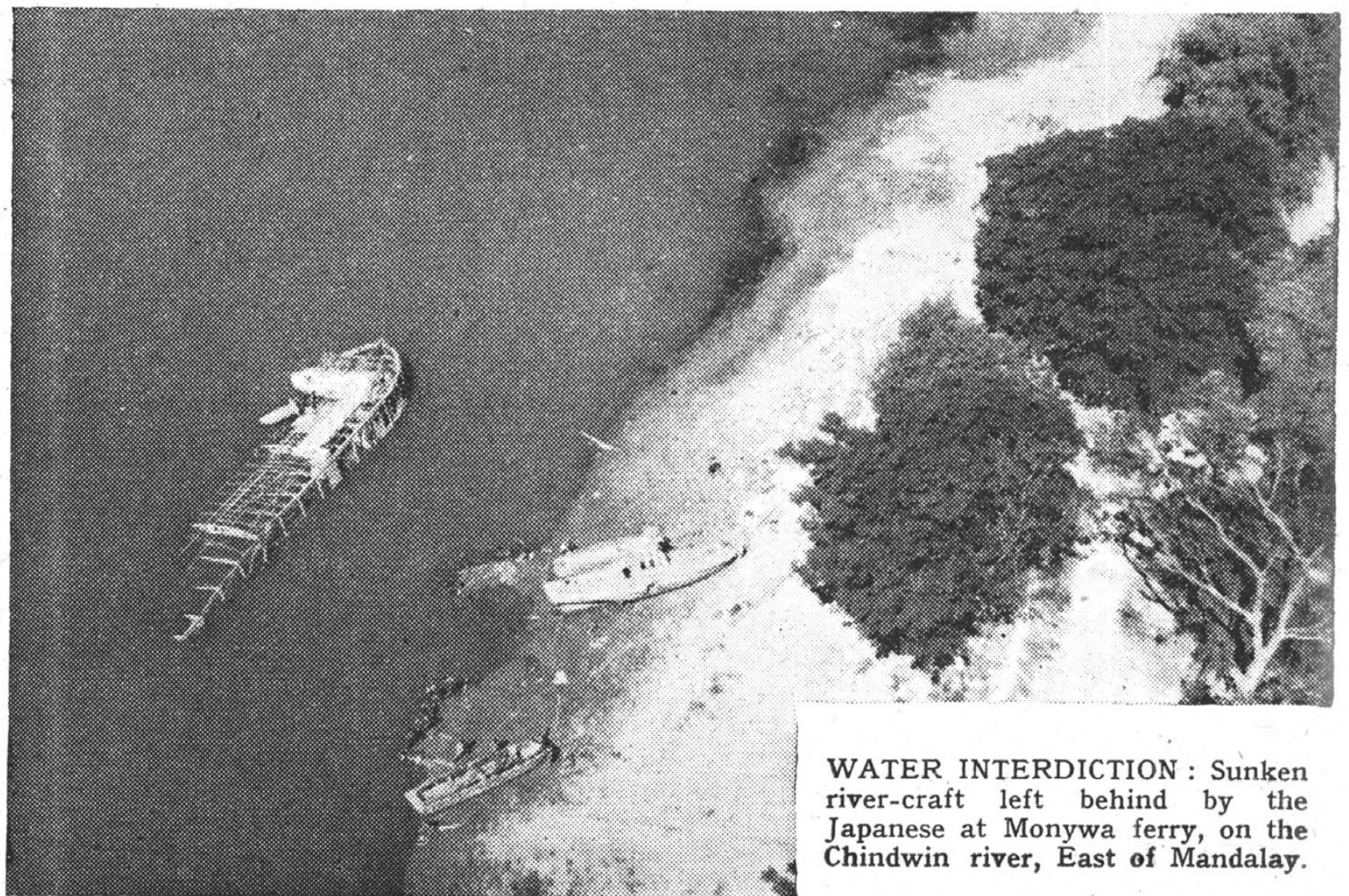
villagers and fishermen. This was regretted by the pilots who liked sampan shooting no more than they liked strafing elephants and bullock carts—but the great waterways of Burma had to be kept clear of enemy boats, and the Jap armies had to be kept short of every supply. That this over-all objective was brilliantly achieved is now known. Our air stronghold on the enemy's ability to maintain his troops in action was a vital factor in the great Burma victory.

Apart from their interdiction of the Jap's interior L. of C., the Beaus also played their part in stopping supplies reaching Burma from the outside. The Gulf of Martaban was a happy hunting ground, and gave the wing one of its biggest victories. In mid-September, 1944, they discovered a convoy of Jap merchant ships—a grand and unexpected target. The Beaus attacked in force using rockets, and for 33 hours they kept at them, the fight running on over hundreds of square miles of ocean. In all 14 merchant ships, two sloops and a gunboat were badly hit, and many were left blazing. It was the biggest air-sea victory in the theatre's history, and remains so today. The Japs never tried to "run a convoy" through to Rangoon again.

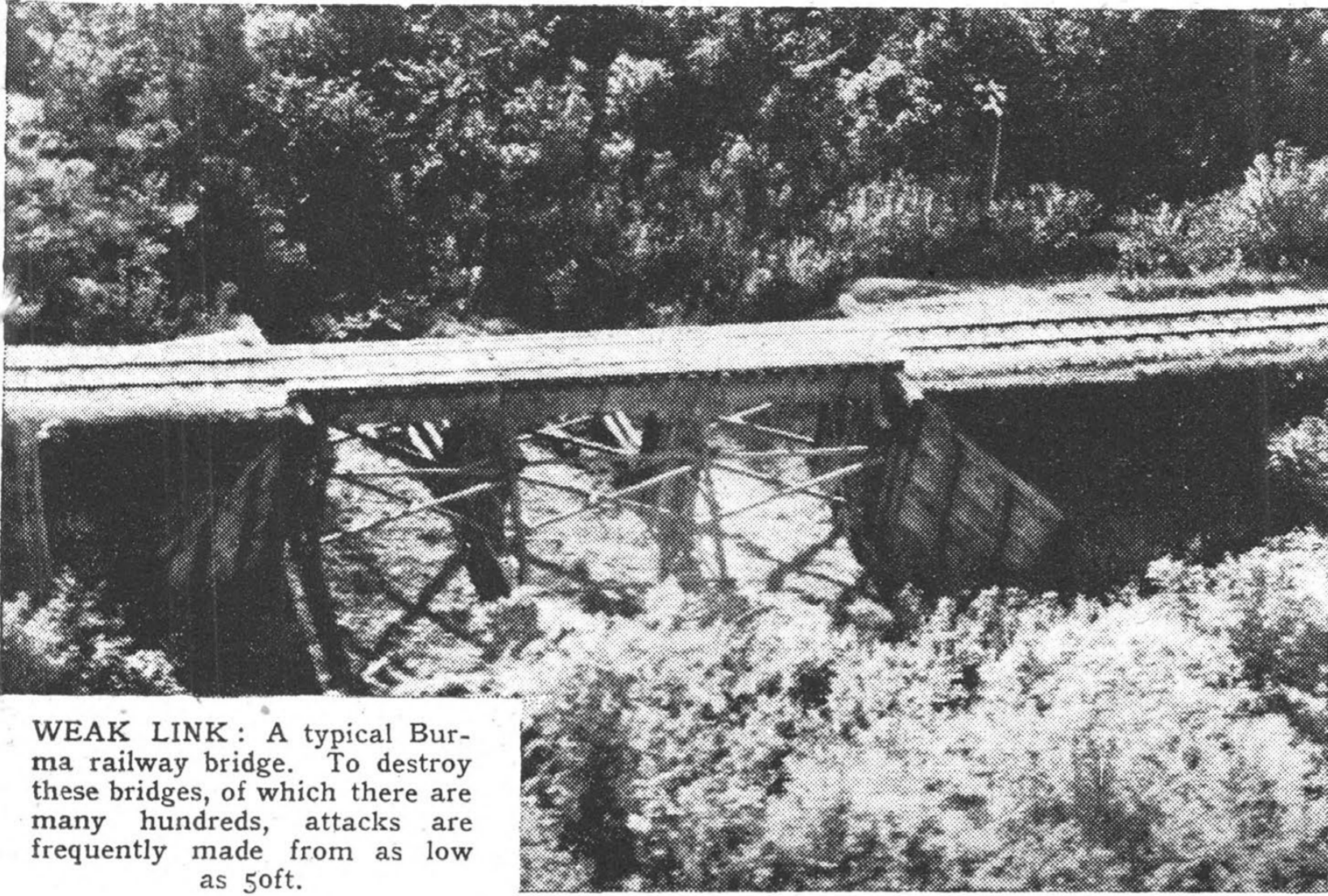
Relativity

Their varied daily work imposed, as I have said, a great strain on the aircrews. The average sortie was one of five hours—but was often much longer. For the whole time there could never be a moment of relaxation for the pilot or his W/OP-A.G. The flying problems involved—setting aside the wretched one of the weather—were unusual. One difficulty was that of perspective. A very experienced Wing Commander, who had been in boats, but who was

WHISPERING DEATH (CONTINUED)



WATER INTERDICTION: Sunken river-craft left behind by the Japanese at Monywa ferry, on the Chindwin river, East of Mandalay.



WEAK LINK: A typical Burma railway bridge. To destroy these bridges, of which there are many hundreds, attacks are frequently made from as low as 50ft.

fairly new to Beaufighter work, said that, after having climbed to 10,000ft. to get over the mountains into the Central Burma plain, he found it very tricky coming quickly down again to low level.

"I find," he said, "that until I see some familiar object whose actual dimensions I know, I cannot gauge comparative size or height. I'm not sure if I'm flying over tall trees or just shrubs—or if the jungle is tall or only undergrowth."

This may be hard for "European" pilots to understand, but nearly every flier in South-East Asia has had that experience at some time. It needs the sight of a house or a man or some such prosaic object to bring everything into scale again after a sudden descent over an unbroken carpet of greenery.

The Gulf of Martaban—a dull dirty brown—proposes just the same height problem. All flying-boat pilots know how difficult it is to judge height over calm water—and in the Gulf the brownness of the sea seems, in some queer way, to accentuate the trouble.

High-speed Stalls

Another thing to be watched is "mushing in." One Squadron C.O. reckoned that at least one-third of his casualties were caused in this way. The Beau does not mush more than any other aircraft of her weight and size when pulled out of a shallow dive—but the Burma pilots have but little margin to play with. It is recognised by even the most experienced men out there that it is all too easy to squash down into the jungle if over-intentness on the target is allowed to obscure all other considerations.

Another thing the Beau pilots have to keep a sharp eye for are trip wires. The Japs put a number of these interesting devices around the Irrawaddy delta—but, I'm told, they can usually be seen in time. I heard of only one instance of a pilot hitting a trip wire—and he brought his aircraft back with yards of the stuff wound round his wing. There does not seem to be any explosive bag hooked up with the wires.

The same pilot tells an amusing story of a strike he went on against a Jap-held village. Among the targets allocated to him was a group of bashas—huts made of palm and bamboo. He came-in on his first run, cannon popping nicely, and watched with interest a group of Japs run for dear life into one of the huts. "I'd just got that basha lined up," he said, "as the last man reached it. This Jap ran inside, but then suddenly popped back and—shut the door!"

There was little specialisation in the Beau squadrons.

All the pairs sent out had an allotted zone each day—and everything in that zone—trains, motor transport, boats and sampans were their affair. Towards the end of an ops. tour all the pilots had flown every zone many times and knew Burma far better than any other Allied airman. One Flight Commander I met just as he was finishing his tour could mark on a map every ack-ack position in the whole of Central and Southern Burma. His observer was no less "clued up"—and expressed his intention of spending his six months of ops. rest with the 14th Army so that he could visit on the ground the places he knew so well from 20ft. up.

It is a tribute to our air superiority in S.E.A.C. that the Beaus were seldom interfered with by Jap fighters

although they operated all round every fighter base. Losses from this cause were surprisingly small. Several Beaus were chased from time to time, but reckoned to be able to out-distance an Oscar low down. Many, in fact, did so.

Future Outlook

Now that the Burma campaign is over, the Beaufighters will have to learn new territory—but their targets are likely to be fewer along the Kra Isthmus than they were north of Rangoon. There are not so many roads—and only two railways. At sea the enemy has almost given up coasting attempts—with one result that the Beaus may well have to range far in their search for prey. If they do they will face long hauls over the inhospitable country with confidence. A return flight of 900 miles on one engine has already been made out there in a Beau, and there have been many others over shorter distances. It is a comforting thought to a man with hundreds of miles of jungle between him and base that his aircraft can "get home on one"—especially if there is a light machine-gun to meet at the target.

Whatever the future employment of the Beaufighters, they have already earned their keep in Eastern Air Command in a big way. They have been helped lately by Mosquitoes both of 224 and 221 Groups, and at all times the S.E. fighters and American Lightnings have joined-in over specific areas—but the main credit for "stopping 'em rolling" in Burma must be given to "The Whispering Death."

As a footnote one wonders what the Japanese name for the Meteor is likely to be.

[In my first article (*Flight*, May 24th) I inadvertently wrote "From the edge of the Imphal Plain and throughout its 1,300-mile advance to Mandalay. . . ." This should, of course, have read "to Rangoon."—C. G.]

JAP BALLOON BOMBS

SUBSTRATOSPHERE west-to-east winds of 125 m.p.h. or more are used by the Japs to drift their bomb-carrying balloons over the Pacific to America. These winds are constant in direction and velocities of over 120 m.p.h. are common.

The balloons, defective examples of which have come to earth in America intact, are reported to be equipped with barometric-pressure switches which automatically release ballast sandbags when loss of gas brings them down to about 25,000ft., allowing them to rise again.

Towards the end of their journey, single bombs are dropped instead of sandbags, thus each balloon drops a series of bombs at intervals across the country, the last one igniting the fuse of a demolition charge which destroys the balloon.

Aircraft Ancillary Services

All-electric and All-hydraulic Systems Not Necessarily the Most Efficient : Each Has Special Advantages : One Produces Rotary Motion, the Other Longitudinal

By S. M. PARKER

(Chief Engineer, Lockheed Hydraulic Brake Co., Ltd.)

AT the outbreak of war the hydraulic specialist firms were in a comparatively early stage of their development and were faced with expansions that were in most cases proportionally greater than the expansions in other parts of the aircraft industry. For this reason, during the war period, technical development has to a great extent been subordinated to production needs, but as these have now been met it is possible to consider those technical developments which have been deliberately held back and which are as a consequence in many cases overdue.

Certain well-defined trends in aircraft design, and the advent of very large aircraft, play a predominating part in determining the course of such developments. In particular the very large electrical installations which are to be expected will bring to the forefront, for consideration and comparison, the relative merits of electric and hydraulic transmission.

There is a tendency to regard electric and hydraulic systems as essentially competitive to a degree which would seriously prejudice balanced judgment on the needs of the aircraft itself. These must without question be the determining factor in any decision that is made.

The purpose of these few notes, therefore, is to put forward the point of view that the ancillary power system in aircraft need not necessarily be all-hydraulic or all-electric to secure maximum efficiency in the widest sense, but that this very policy may well result in the all-electric or all-hydraulic system being appreciably less efficient than a combination of the two.

Current Available

In very large aircraft, and probably in medium-sized aircraft to an appreciable extent also, there will be large electrical systems whose character is such that electrical power will be available in close proximity to any part of the aircraft at which power operation of any kind is required. This has not been the case in the past, and electrical systems have been overloaded and of quite insufficient magnitude to accept the short but heavy overloads of the services that have been operated hydraulically. This has resulted in the free use of hydraulic systems extended often to services that could equally well, or better, be carried out electrically. The view, therefore, might reasonably be held that the pendulum of choice has swung too far in favour of the hydraulic system.

It should not, however, be assumed that this has been to the benefit of, or welcomed by, the hydraulic specialist firms, who are quite aware that it is an unstable condition both for the user and for the specialists themselves who, as

previously stated, are unable to balance development and production.

Neither past practice, nor fashion, nor sales talk will determine ultimately how far hydraulic services will be needed in aircraft of the future. Nothing less than a complete assessment of aircraft needs, and a complete replanning of the electrical and hydraulic system jointly to meet them, will prove either effective or enduring.

The existence of two major power services in an aircraft must at first sight appear incorrect, but first impressions are not always reliable, and aircraft design is so much a matter of compromise that no part of the complete aircraft can escape it.

Individual Power Service

Those who say that two services must lead to increased complication and increased maintenance are only correct if the one service chosen will meet all the requirements without unacceptable sacrifices in other directions. It should never be overlooked that it is the maintenance of the individual power service rather than the maintenance of the power system as a whole which involves the greatest amount of work, and that if a particular form of power is not entirely suitable for a particular type of service, then the means to make the one operate the other are just those which are likely to give rise to trouble. Alternatively, if such trouble can be avoided by design, it may only be by generosity in terms of weight or space which cannot well be afforded.

In this connection, the fact that the electrical system produces fast rotary motion and the hydraulic system longitudinal motion cannot be too greatly emphasised. It is the primary reason why there are grounds for considering the retention of both electric and hydraulic services in the same aircraft.

It is the suitability of the motor mechanism rather than the generator and transmission mechanism which must be assessed. It might, for example, prove more difficult to provide electrical servo-assistance for flying controls on large aircraft, particularly where it was thought desirable to have a small degree of load reaction. This point illustrates the second attribute of the hydraulic system, namely, its application to the problem of sensitive control. It is not suggested that such a problem cannot be solved electrically, but it must be determined whether the electrical solution is economic as well as possible.

Weight is always a predominant consideration, and weight saving can be equated to the earning capacity of the aircraft. Earning capacity cannot be dissociated from initial cost, and the two, plus the cost of maintenance, add up to a figure which can be regarded as

an index of the commercial excellence of the product. If the index figure is high, the product sells itself; if it is low it may be possible to sell it, but not for long. It can readily be seen that this index figure arises essentially from the soundness of the technical solution of a problem, and since it will undoubtedly prove of the greatest importance, its connection with technical considerations and its dependence on them are pointed out.

Some divergence of requirement is inevitable between military and civil aircraft, and in the former case vulnerability must be considered as being of great importance. Since it is impossible to make the aircraft as a whole indestructible, the line of approach to this problem is always to minimise risks. This again is a matter for compromise, as, for example, in the fitting of armoured plate, and the yardstick which must be applied to the necessity for precautions must in the end be the consideration of the risk with and without them.

It has been stated that the electrical system, with its more ready fusibility, is less vulnerable than a hydraulic system where a hit on one service may put the whole power system out of operation. This, in general terms, is true, but the importance of it can only be properly assessed if the chances of either service being hit are reasonably well known. The present hydraulic system, spread-eagled in a haphazard fashion all over the aircraft, appears to have given rise to very much less vulnerability than might have been expected, and it might well be argued that if it were suitably condensed, as it must be for other reasons, this vulnerability would be reduced to proportions which could possibly be ignored. This must be proved and not assumed, but it would be incorrect also to assume without proof that the vulnerability of a hydraulic system is a serious matter.

Armour Protection

The degree to which the hydraulic system can be compressed and simplified can be judged from the fact that in the larger types of aircraft about half the transmission system is at present used for control purposes, and it is this part of the system which in the main is placed in the least armoured part of the aircraft. In all aircraft large enough for this condition to obtain, the control of the hydraulic system should unquestionably be electric, and the remainder of the system, by reasonable planning, could be so placed that it would receive a high degree of armour protection.

It is realised that the competition for such positions in the aircraft is keen, but the projected area of the transmission system (and indeed the whole of the

hydraulic system) is small and would not by its nature prove unduly difficult to accommodate in this way. Whilst it is true that hydraulic transmission has the advantage, also present in electrical transmission, of being adapted to avoid obstructions, it is unreasonable to insist that the installation should be almost completely unplanned; and this is not very far from the truth in a good many aircraft flying to-day.

Passing from the transmission system to the generator, it is necessary to consider from what source the hydraulic system should derive its power. In most cases at present it is by mechanical drive from the engine, and if this can be achieved without either increasing or complicating the hydraulic circuit, it represents the most efficient energy conversion that is possible, having a mechanical - to - hydraulic conversion efficiency of over 90 per cent. It can, however, be argued that, because the hydraulic system operates relatively seldom, this efficiency is of secondary importance, and that if it were reduced by interposing an electric generator transmission system and motor, which would certainly reduce it to 60 per cent. and probably considerably less than this, it would still be acceptable. This must depend on the ability of the electrical system to withstand very considerable overloads for short periods.

It is extremely difficult to give reliable general indications of the magnitude of such overloads, but allowing for the fact that undercarriage retraction times can hardly be too short and should be of the order of five seconds or better, and for the fact that flaps are increasing in size so that it requires more power to lower them than to raise the undercarriage, it may be said that present hydraulic energy in existing types is comparable with the available electrical energy.

It is known that electrical installations will have generators of greatly increased capacity, but it must be decided whether this increase, which has presumably been made for other reasons, is sufficient

to cover the additional peak demands of undercarriage and flaps, unless the overall efficiency is reasonably high. This consideration applies in its entirety to the all-electric system also.

If the electrical generator will accept these additional loads without increase, then it may fairly be claimed that a free source of power has been used. But if the generator has to be increased in size, it must be remembered that at present the weight per horse-power of electrical generators is very much greater than that of hydraulic pumps.

conversion is in the form of longitudinal motion and is a conversion at very much higher efficiency. Where such longitudinal motion is required (and most of the major services do require it) means have to be found for providing it both from the electric and hydraulic transmission systems.

For efficiency, the hydraulic conversion heads the list by a large margin and is probably of the order of 95 per cent. at the power point. Certainly this efficiency can be achieved for peak loads, where some slight slowing of the system is permissible. It should definitely be borne in mind that, under such conditions, the transmission efficiency of the hydraulic system increases as the flow decreases. It is,

therefore, possible to get peak efficiency at peak load and allow lower efficiency at lower loads. This very important point is often overlooked.

The other two alternatives are electro-hydraulic conversion and electro-mechanical conversion. It is generally felt that the former can be made more efficient and lighter, but it is difficult to see how it can achieve an overall efficiency much greater than 50 per cent. The electro-mechanical conversion, on the other hand, is possibly heavier and can hardly have an overall efficiency greater than 40 per cent.

The Designer's Choice

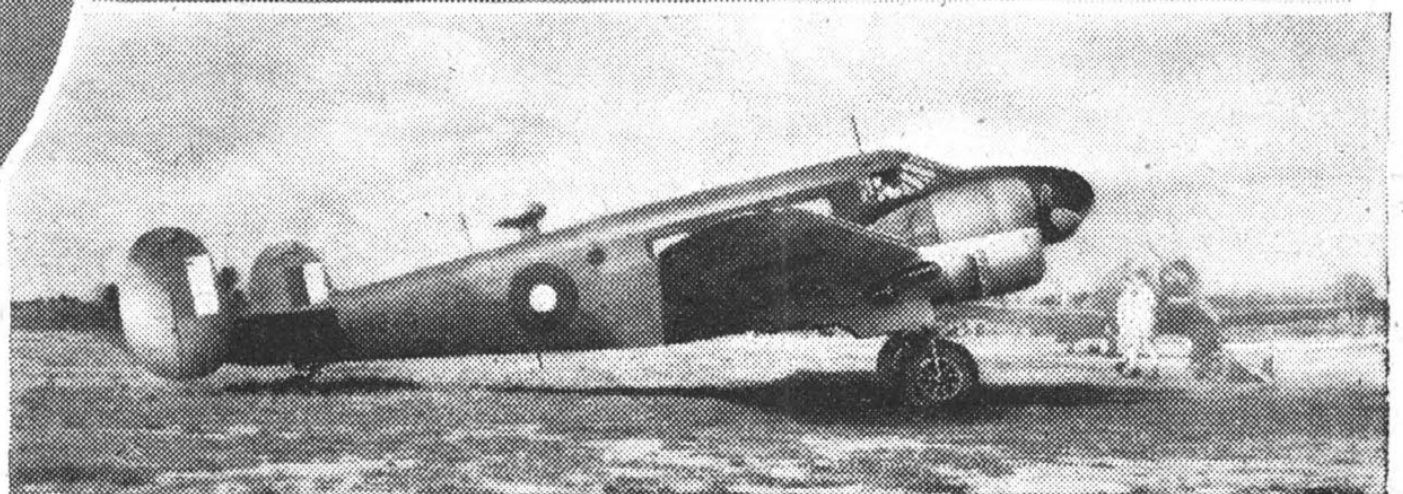
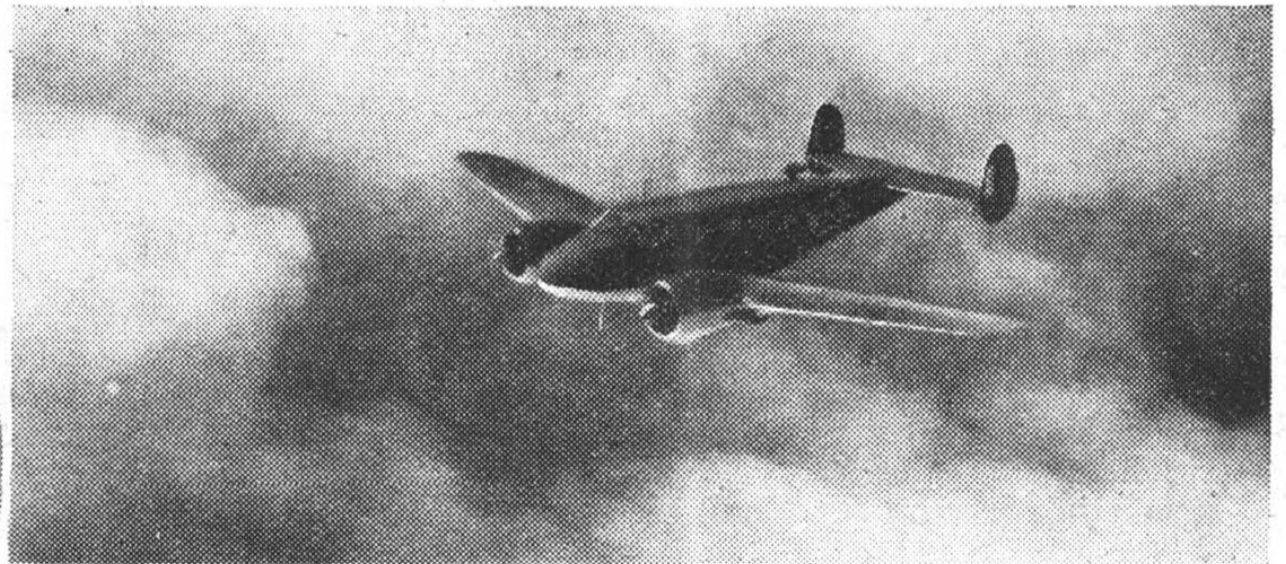
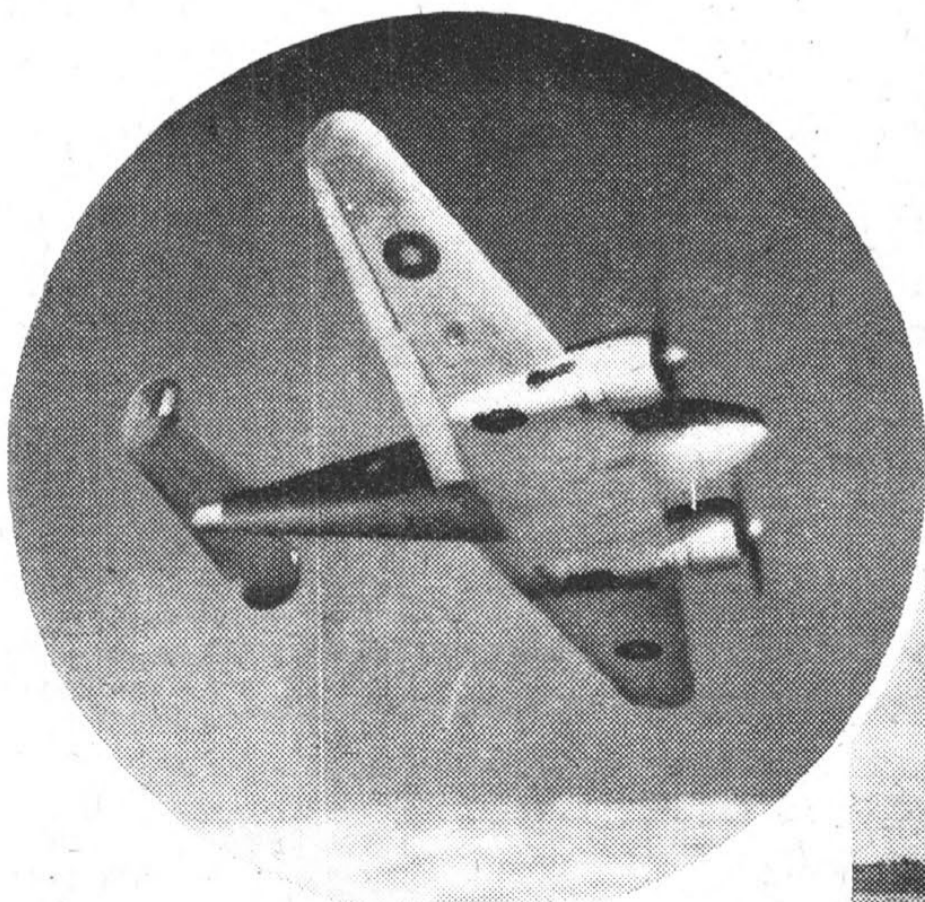
What, then, is the aircraft designer's choice? It must turn on meeting the three fundamentals: lowest weight, lowest cost, lowest maintenance, and, like everything else, it is unlikely that the best figure will be found for each factor in any one system. Without question, in all but the smallest class of aircraft, the hydraulic system must be combined with the electric, but it is by no means certain whether this should be limited to a junction at the control points, or whether the main electrical transmission system should be tapped for major power. Nor is it likely that any satisfactory answer will be found until a considerable number of such cases have been worked out.

AIRCRAFT ANCILLARY SERVICES

Returning to the question of the transmission system, the comparison lies between electric cables and hydraulic pipes. Once the voltages and pressures of the two systems are known, and the permissible inefficiencies are fixed, it is possible to compare the specific weight for the transmission of a given horse-power. At the same time, this comparison may be highly misleading because it is considerably affected by the distance apart of the power points and the existence of what may be regarded as mains power close to the power point. There is no doubt that, both in electric and hydraulic systems, there will be a much greater tendency towards planning the power system as a whole and not as a series of individual runs from generator to motor.

Nevertheless, both in economy of weight and cost, it is probable that the electrical generator and transmission system will, in a number of instances, show to advantage, although such advantage must never be assumed from general considerations. It must be proved from careful assessment of the requirements of each particular aircraft.

When we turn to the motor, however, either electric or hydraulic, a very different state of affairs is found. The fundamental point is that efficient electric conversion is always in the form of fast rotary motion, whereas hydraulic



A Beechcraft Expeditor in service with the R.A.F. When it is employed as a utility transport the cabin seats six. Two 450 h.p. Pratt and Whitney Wasp Juniors drive Hamilton Standard constant-speed airscrews.

The standard fuel tanks give a range of 900-1,000 miles.

THE first part of Mr. T. P. Wright's Wilbur Wright Memorial Lecture, a summary of which was published in last week's issue, dealt with the problem, the scientific approach, historical aspects, military aviation and war, technical development, and Government and civil aviation. The second part, of which the following is a summary, deals with such subjects as fields of usefulness for aircraft, the Chicago Conference, and collective security.

Fields of Usefulness

Under this heading the lecturer dealt with such aspects as economic uses, transportation, communications, cultural considerations, and the international field.

Economic Uses.—The science of economics deals with the production, preservation and distribution of wealth. As each involves employment, Mr. Wright had prepared a forecast in the form of the table, Fig. 3, to indicate how many jobs aviation should provide in the U.S. He explained that in spite of the great drop in employment compared with wartime peaks, there still appears to be a really important contribution to peacetime economy, viz., more than twelve times the number of persons than were employed in aviation before the war. "Grass roots" employment meant jobs outside the aircraft industry, such as mining and fabricating aircraft materials, supplying tools, etc.

Among economic uses were taxi services, which might be found more economical, and therefore more extensively used, than small feeder-line services operating to a schedule. Charter services offered another useful field, for such purposes as crop dusting, spotting services for many purposes, equipment-dropping in isolated districts, and aerial photography.

One of the most promising uses of aircraft was foreign commerce. When confidence in the hoped-for world security organisation was established, there would be no need for the uneconomical measures of self-sufficiency so paramount at present. Then there was the influence of the world-wide use of aircraft on the geographic division of labour, so that people in all parts of the world could perform the services for which they were best adapted. Ultimately, political unity rested upon rapid means of transportation and communication.

Transportation.—This was the sphere where aircraft could play a basic role. Their speed might allow us to accelerate the tempo of commerce and industry and so catch up with the time lost and the material destruction

Fig. 3.—U.S. EMPLOYMENT DERIVED FROM AVIATION. A FORECAST—8-12 YEARS AFTER THE WAR.

<i>Manufacturing—(*1)</i>			
Personal Aircraft	100,000		
Transport Aircraft	25,000		
Total	125,000		
Military	210,000		
Total Manufacturing ...	335,000		
<i>Air Transportation—(*2)</i>			
Scheduled (Domestic) ..	115,000		
Scheduled (International)	30,000		
Non-scheduled	30,000		
Total	175,000		
Service Industry	80,000		
Government	20,000		
Total Air Transportation	275,000		
Grand Total—(*3)	610,000 (*4)		

*1—Includes "Grass Roots" Employment at 33 per cent. of total.
 *2—Includes "Grass Roots" Employment at 20 per cent. of total.
 *3—The Money Value of the Products and Services given are under three billion dollars.
 *4—Pre-war Employment was 50,000; Wartime peak, excluding Uniformed Personnel, 2,750,000.

Aviation's Place

Part II of the 33rd Wilbur

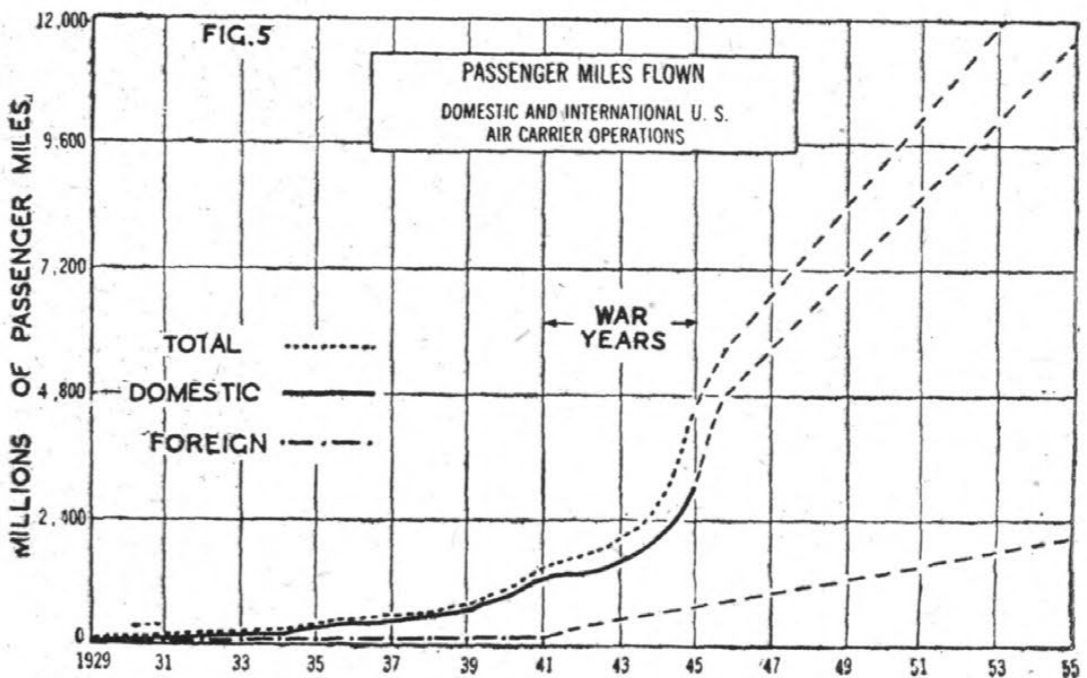
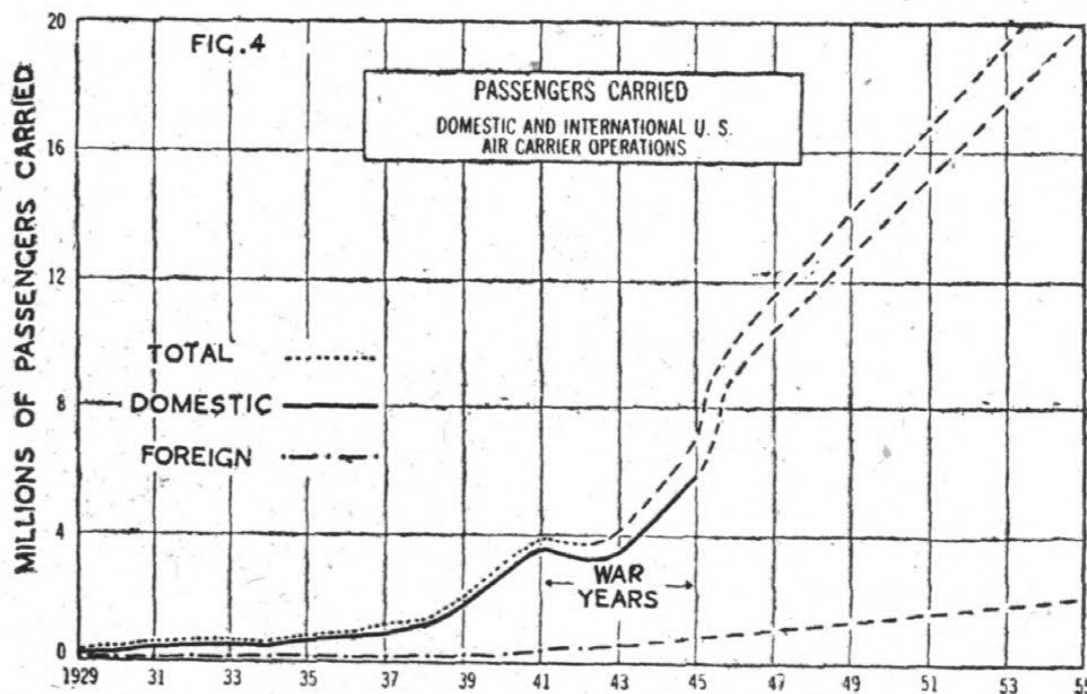
(Continued)

of the war. Air transport activities in war were readily susceptible to transfer to rehabilitation uses—transport of food, medicines and people.

The speed factor, most important contribution of the air carrier, must in itself be reckoned with when forecasting future increase in air traffic. Mr. Wright made the interesting suggestion that, whereas the economic qualities of aircraft could be compared on a simple basis, such as cruising speed multiplied by payload and divided by some function of cost, the same formula could not be used for comparing different media of transportation, and it would be necessary to give further weight to the speed factor, possibly by using cruising speed to the second power.

Mr. Wright then showed trend curves of U.S. air transport statistics for the ten years prior to the war, with extrapolations estimated for the next ten years. He explained that although statistics for the war years are included, these must be discounted as traffic was abnormally large and equipment gravely reduced. Although he considered optimistic the figure sometimes quoted of 200 dollars for the round trip between America and England, he thought a figure of 300 dollars certainly attainable, and expressed the view that over-ocean travel might well approach the astronomical figures which some authorities have recently predicted.

Communications.—While now dependent on mail, telephone, telegraph and radio, movement of persons might well come to be regarded as communication rather than as transportation. With Europe and America only 15 hours apart, and any part of the world from 50 to 60 hours, personal communications became possible, and many



in Civilization

Wright Memorial Lecture

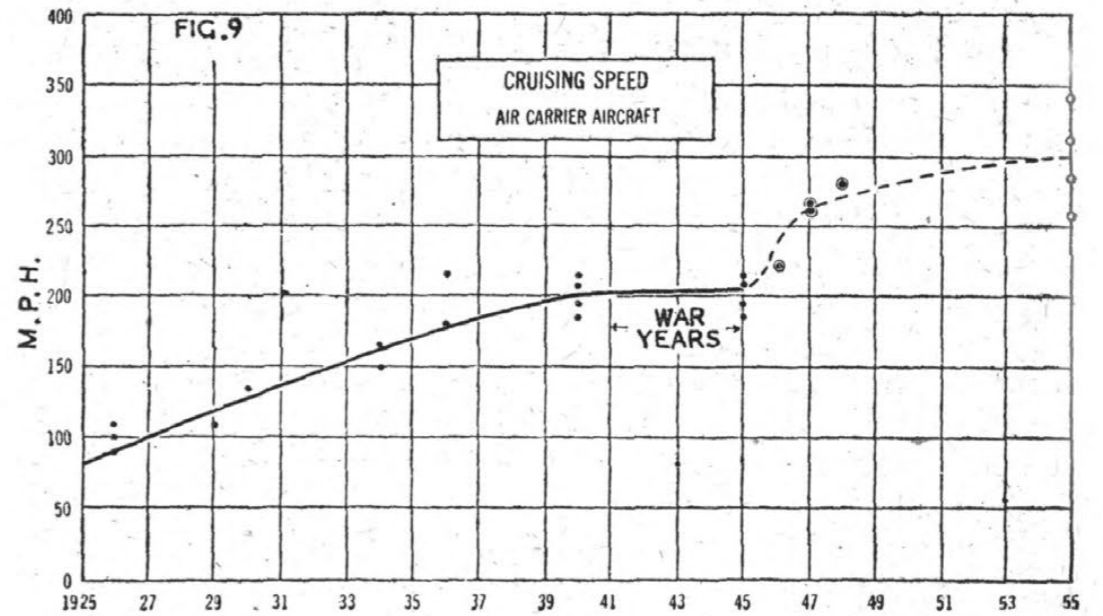
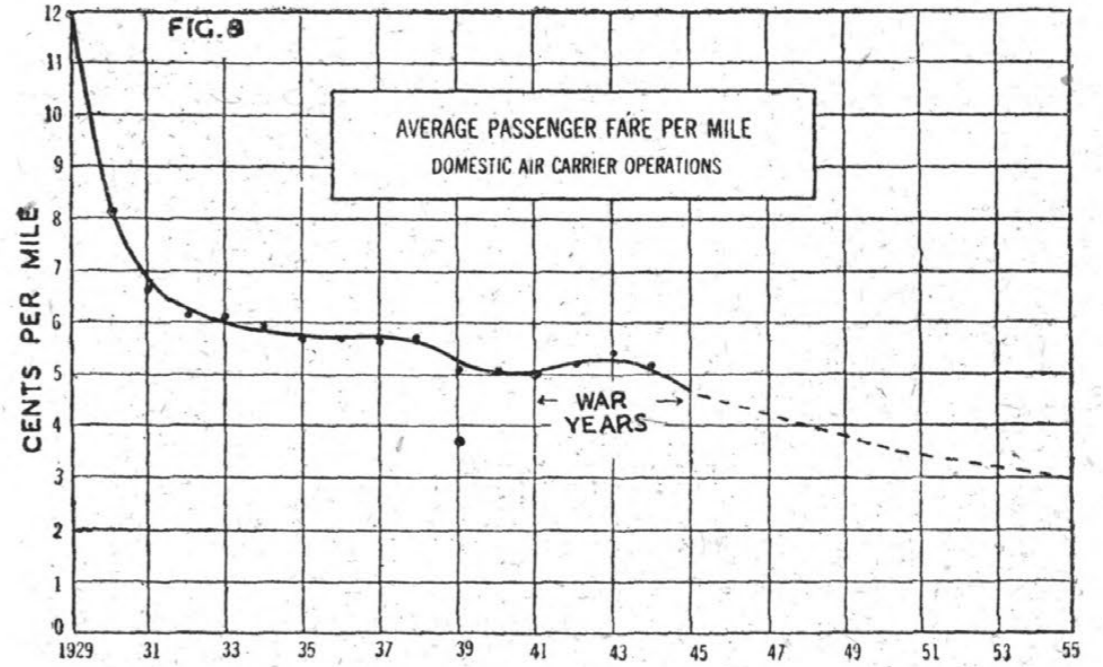
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business representatives would call in person rather than use older means of communication.

Cultural Considerations.—The speeding-up of transportation which the air could give should result in more leisure. Agencies of Government should work towards transforming this possibility into reality. Leisure did not automatically produce culture, but it gave an opportunity, and it was incumbent on education to develop the desire on the part of those who had this increased leisure to use it effectively for cultural purposes.

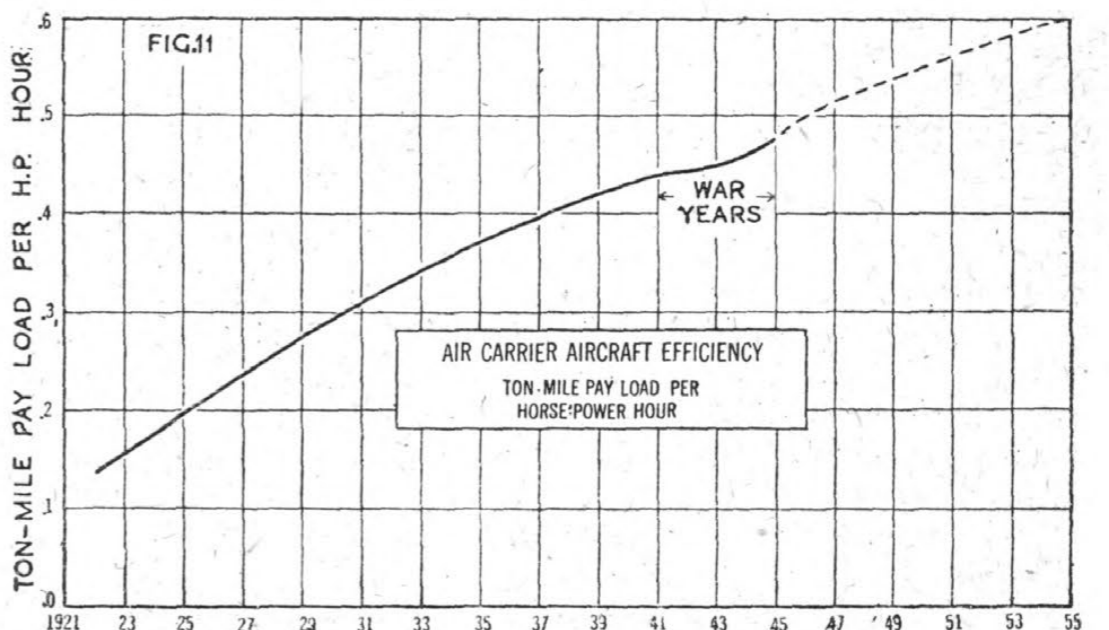
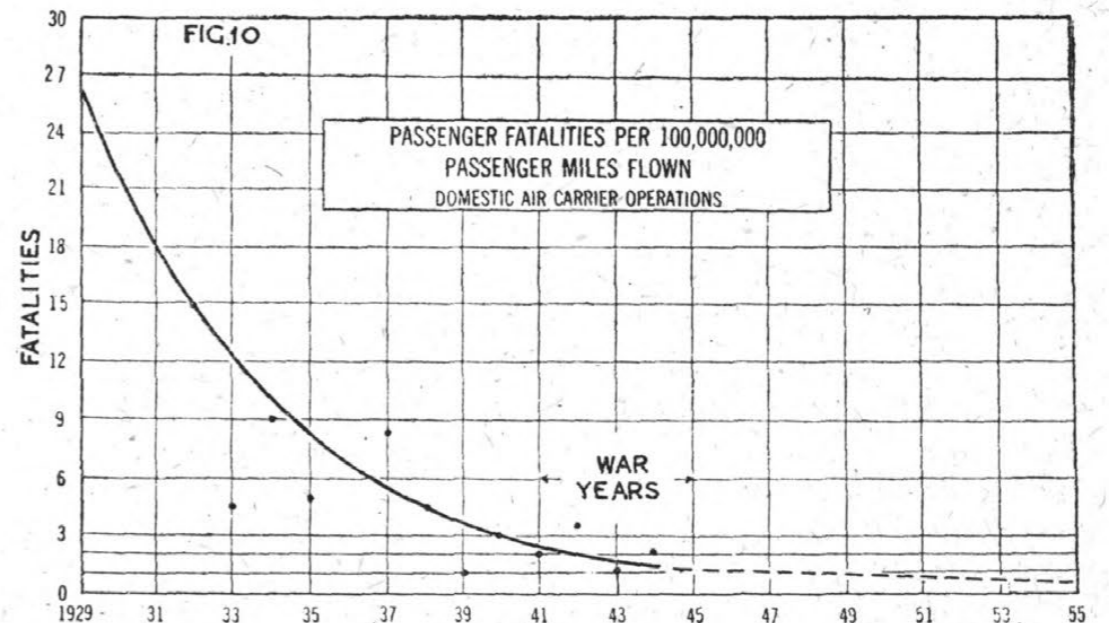
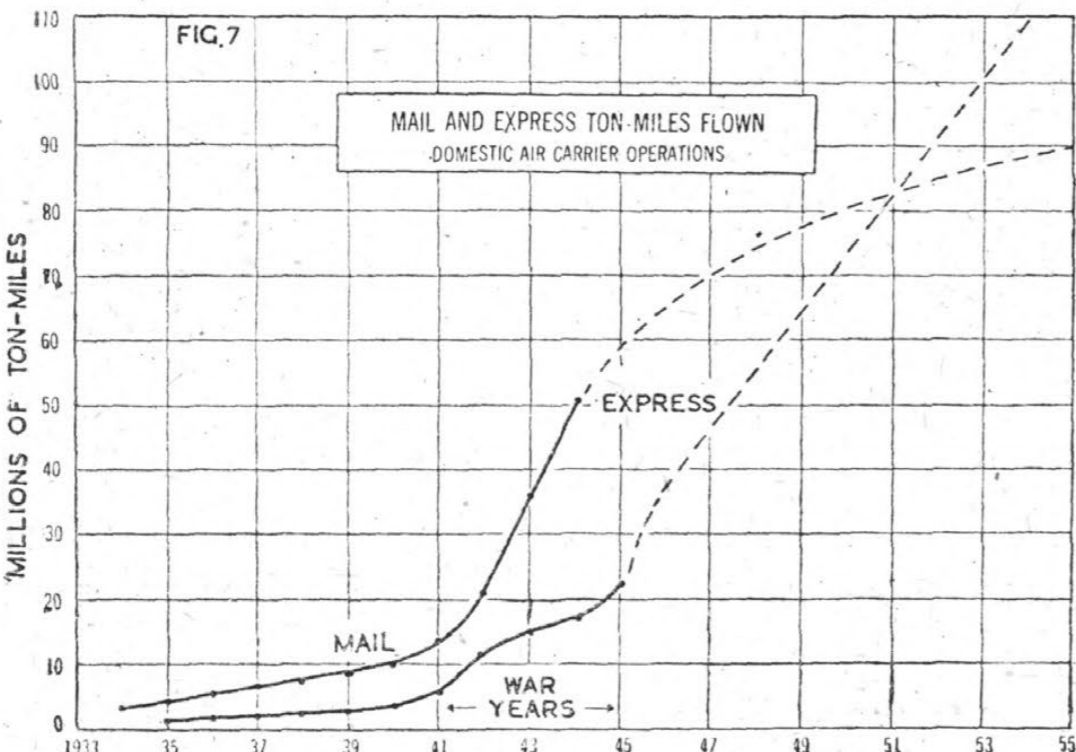
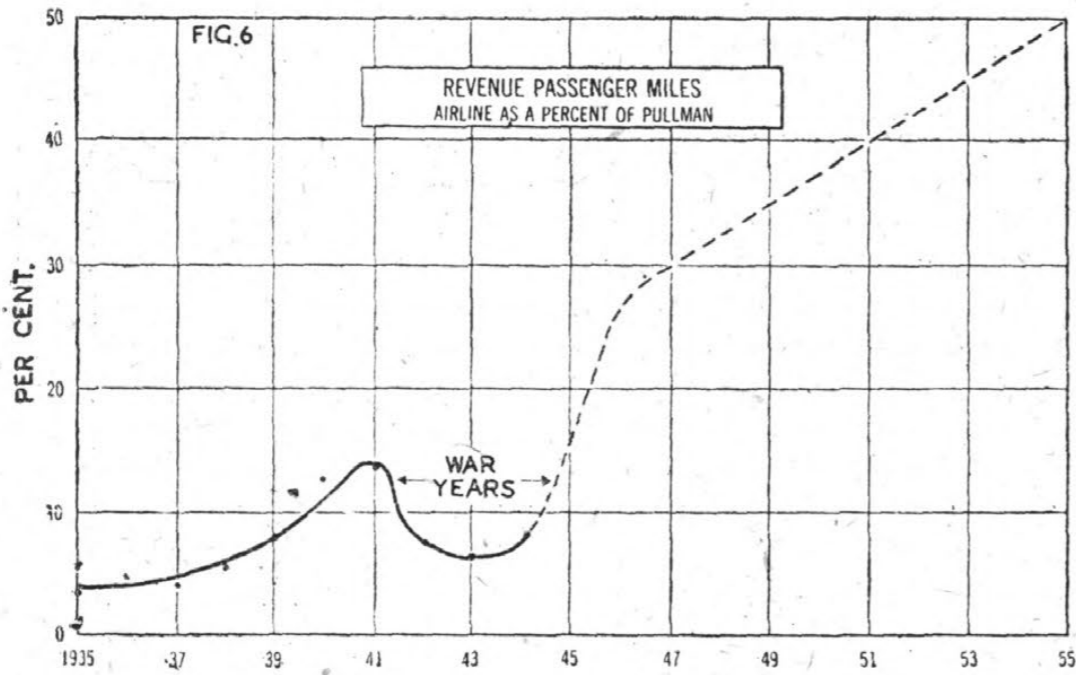
The International Field.—Useful spheres for aircraft in commerce and in relieving economic pressure have already been mentioned. It was important that we should be aware that aircraft make possible a greater availability of markets in any part of the world to any potential customer elsewhere. Aircraft underlined the importance of creating conditions under which the military aspects of aviation would be minimized and its commercial aspects developed. It was therefore important that greater emphasis should be placed on the economic than on the political aspects of air transport. Another factor was the increase in living space which the air age might bring about. Many past wars had been caused by the fear, real or imaginary, of insufficient living space, and if aircraft could alleviate these fears a worth-while mission would have been performed. All these factors should lead towards a general improvement in the world standard of living.

Referring to the way in which the conference method has come to the fore in facilitating international relations, Mr. Wright said that we must establish the conference



method as an international habit if frictions are to be removed at their inception. The role which aircraft could play in this respect was obvious.

The acceptance of international agreements must, to be effective, automatically entail the giving-up of some rights hitherto regarded as sovereign. It was natural that after a war an intensely strong nationalistic spirit should be rising through the world. This was inimical to the success



AVIATION'S PLACE IN CIVILIZATION

of the new association of nations. The more appropriate tendency would be towards greater emphasis on a strong international body on the one hand and more secure individual rights on the other. World citizenship was a concept on which few had cared to dwell, but it was one which must come into wider acceptance if a permanent peace was to be established.

The Chicago Conference

Mr. Wright pointed out that as Technical Secretary of the International Civil Aviation Conference at Chicago, and as an international public servant, he did not have the responsibilities of a delegate and in consequence was able to observe the meetings from a more detached point of view. He made it clear that this point of view was entirely his personal one and did not in any sense represent that of the U.S. Government, present or prospective.

The perspective of time was needed for judging the accomplishments of the Chicago Conference; possibly too much had been too hastily written in the Press of both countries. It became clear that there were two distinct points of view at Chicago: the regulatory and the "maximum use." The former aimed at international co-operation in establishing control and prevent unfair competition. The second felt that expansion of world air transport would in itself promote peace to such an extent as to make it worth while to risk slight international friction now, if by so doing a free system could be obtained. The men supporting both points of view were honest in their opinions. Mr. Wright thought at the time, and still thinks, that a compromise is possible. As the meetings progressed, the two points of view approached each other nearer and nearer, and disagreements were finally reduced to the determination of a proper wording of a United Nations participation clause and to an acceptable clause dealing with the adjustment of capacity to traffic offering in regions beyond the first division point of through-routes. This involved the now famous "Fifth Freedom." Even on this, Mr. Wright thought, agreement might have been reached. He put down the failure to do so to sheer physical fatigue of delegates.

Sight should not be lost of the fact that the Conference did result in some very real accomplishments. There was concluded an Interim Agreement on International Civil Aviation, which established a Provisional Organisation which was to meet as soon as one-half of the nations represented (26 required) had signed the document. It was hoped that this organisation would meet in Canada this summer. Then there were the two agreements known as the International Air Service Transit Agreement (two "Freedoms") and the International Air Transport Agreement (five "Freedoms").

Finally there was the Convention itself, with its technical annexes. This was very complete and represented a substantial advancement from the 1919 Paris Convention but lacked the vital articles dealing with air transport and freedom of the air privileges. Excellent progress was made in the technical annexes in establishing air navigation practices, rules of the air, airworthiness requirements, meteorological protection, aeronautical maps and charts, customs procedures, and search and rescue.

As for the unfinished business, a resolution stressed the importance of proceeding immediately with further consideration of the omitted transport articles. Thus the work may be resumed where it left off at Chicago, and Mr. Wright was hopeful of arriving at a successful compromise. It was his personal opinion that the position taken by the British delegation in the final document suggested by them (in which are clauses dealing with the "Fifth Freedom") represented a long step towards a solution and might, possibly with very slight modification, be made the basis of final agreement. This plan provided the flexibility needed properly to make determinations as

to what is fair in many different regional situations to which a standard formula could not possibly be evolved for universal application.

It was Mr. Wright's feeling "that very little restriction on important through-line operation would be occasioned by this procedure (that suggested by the U.K.), and that the alternative of completely wide-open competition might well result in injustices and in damage to amicable international relations to an extent out of all proportion to the expected gain in air transport expansion that might result."

Collectively Security

Under this heading Mr. Wright came out as a strong advocate of the establishment of an international air police force. He emphasised repeatedly that flying has now made the world of manageable proportions for such a step to be practicable. The old League of Nations failed because it had no power to enforce its decisions. "Justice without force is powerless, and force without justice is tyranny." Before such a force could be effectively used there must be a general will for peace. He submitted that the United Nations organisation, implemented by a properly constituted international air police force, could accomplish what the League failed to do.

Alternatives available were: police force composed of national contingents, a completely integrated international force comprising all types of arms from each member state, a quota system, and finally a specialised international force composed of the speediest and most mobile of the components of military action—the airplane. Of these he preferred the last, owing to its great mobility. He felt that nations would be willing to authorise their representatives on the security council to call out such an internationally constituted police force without the slow recourse to parliamentary procedure, whereas they would naturally be reluctant to permit use of national contingents by executive decision only. It had been calculated that fifty bases for such a force throughout the world would be adequate, and that a total force of some 50,000 aircraft would be appropriate. These would include training and cargo aircraft and the various combat types composing modern air forces.

As to whether or not America might be expected to participate in the setting-up and maintenance of such a force, Mr. Wright quoted a nation-wide sampling poll held last April. Whereas in 1937 26 per cent. answered Yes and 52 per cent. No, in 1945 the figures had become 81 per cent. in favour, 11 per cent. against, and 8 per cent. of no opinion on the subject. In view of this, and of certain views expressed by President Roosevelt and President Truman, he felt convinced that America would not be found wanting.

Mr. Wright concluded by saying that technological development in aviation will continue more rapidly than ever before. World co-operation will accelerate this progress, and world collaboration will determine its direction towards useful purposes. The fields of usefulness for aircraft are manifold. Their effects on society are staggering to the imagination. They encompass benefits in economics, transportation, communications, and in culture. Government has a task to perform, both nationally and internationally, in making the progress orderly. The trend must be towards greater emphasis on the human rights of the individual and of international responsibilities of nations. "It takes one state to make a war—it takes all to preserve the peace."

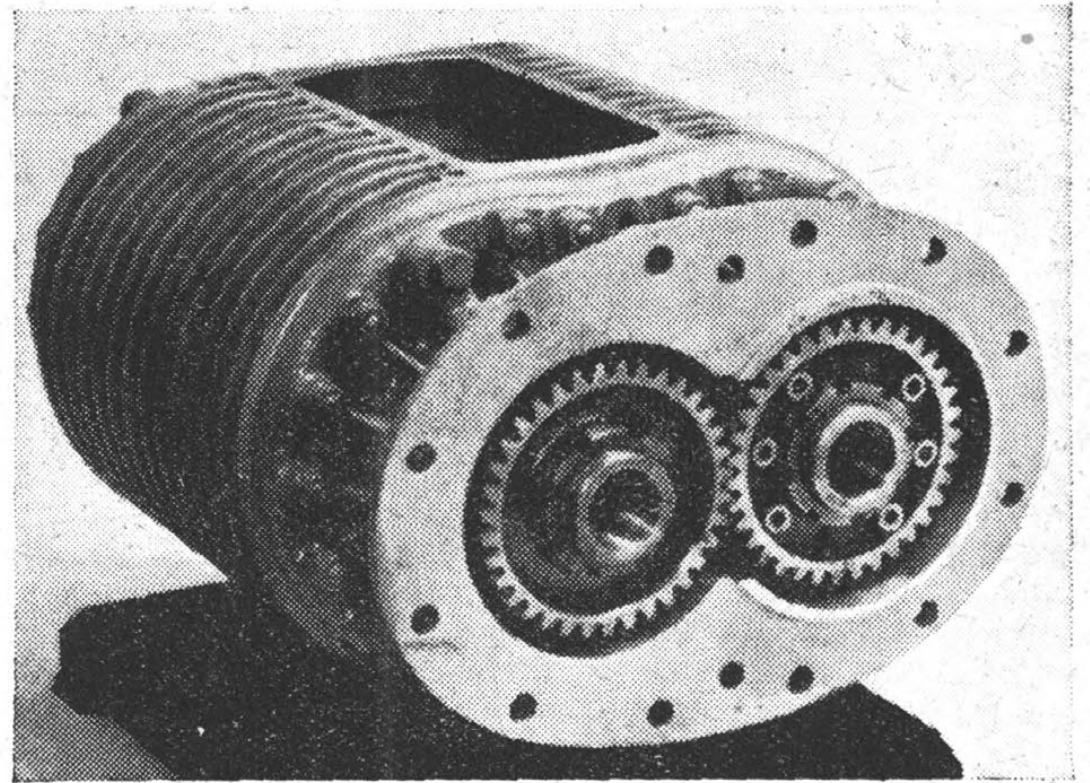
A reprint of the third edition of *GAS TURBINES AND JET PROPULSION FOR AIRCRAFT* by G. Geoffrey Smith, M.B.E., is now available from booksellers, price 6/-, or 6/4d. by post direct from FLIGHT offices, Dorset House, Stamford Street, London, S.E.1

Marshall Cabin Blower

Qualities and Performance of the Blower : Some Facts on Pressurising and the Conditioning of Pressure Cabins

ALTHOUGH for many years the pressurising of aircraft cabins has been a familiar topic in the aeronautical world relatively little has actually appeared in print about it, and of course, during the war years, although great strides have been made in the practical employment of pressure cabins for various military types virtually no publicity on the subject has been allowed. However, the time has now come when we can divulge a certain amount of the development work that has been going on, and in spite of the fact that the actual aircraft concerned are not yet fully cleared from security restrictions, some general facts on the installations and disclosure of future trends is permissible.

Since 1939 research and development work on cabin blowers, in this country, fell almost entirely to Sir George Godfrey and Partners Ltd. This company made proposals to the Air Ministry before the war that they should investigate the possibility of utilising an adaptation of the stan-



Externally there is little to be seen. Intake and output ducts are bolted to opposite sides of the finned casing and rotation is imparted to the rotors by means of a quill drive from the engine to the timing gears.

dard Marshall Blower of their manufacture for employment to pressurising. Tests were begun and were the prelude to a long and arduous period of development in which the co-operation and resources of the Royal Aircraft Establishment played a large part.

Prior to 1938, the Marshall Blower had 2-blade rotors and a rotational speed of 3,000 r.p.m., and with this, compression ratios did not normally exceed 1.5:1. To adapt the unit for operation at high altitudes and to reduce its weight presented many problems, not the least of which was uneven case expansion due to the inordinate temperature rise across the blower—this actually reaching the 200 deg. C. mark at great height. Another difficult problem was oil sealing. Nevertheless, by considerable research and refinement of the design the difficulties were overcome, and in 1941 blowers were supplied in quantity for a particular mark of Spitfire for which the requirements were a 2 lb./sq. in. pressure rise at 40,000ft.

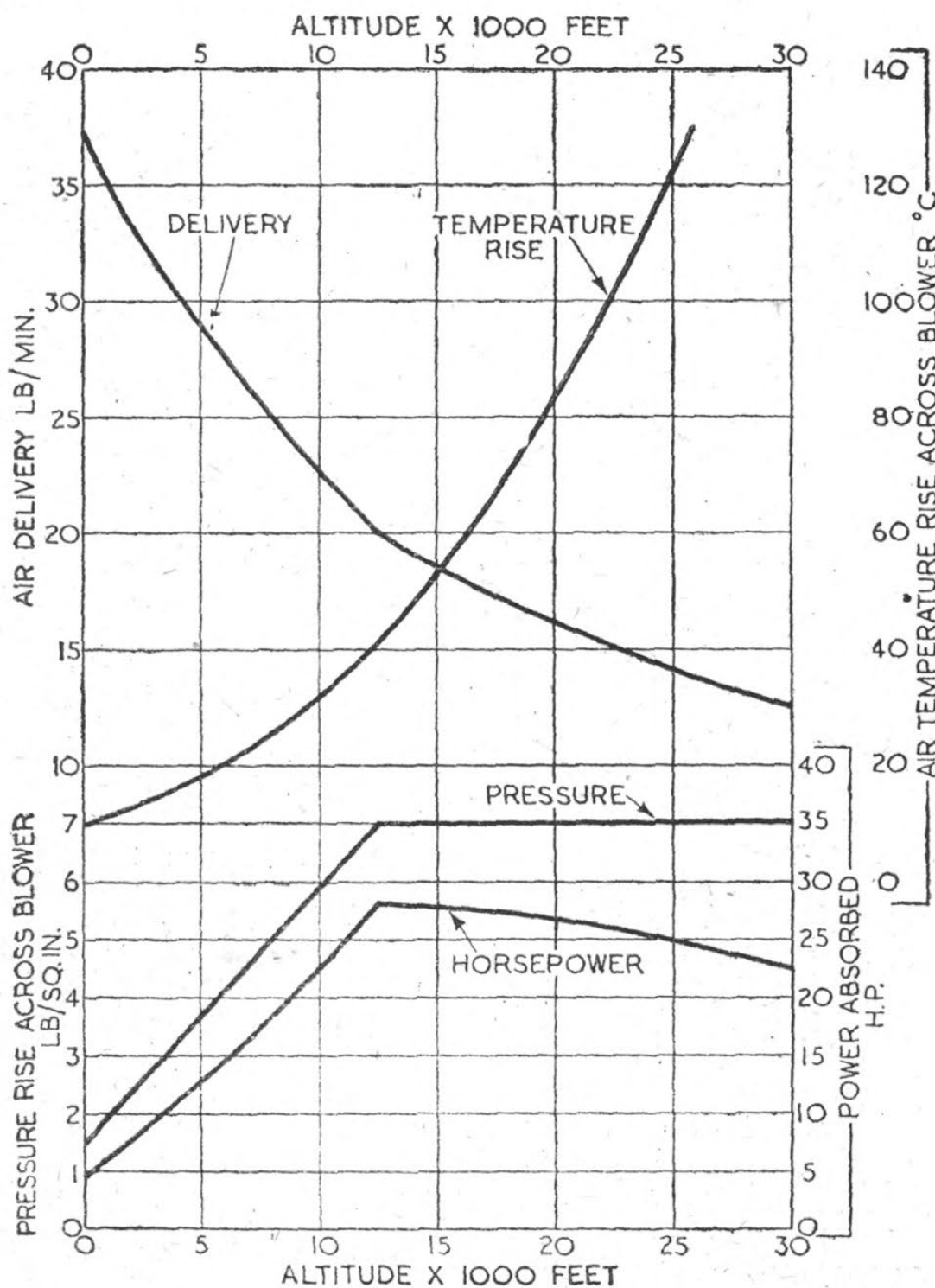
Internal Rotor Cooling

It is not possible to dilate upon the history of the blower development in the space at our disposal. However, some idea of the work put into the venture can be gained from the appreciation that blowers have been made for operation at 50,000ft. and also of output capacities ranging from 15 up to 80 lb. of air per minute. Rotor design has also progressed from the ordinary 2-blade type to the 3-blade straight and 3-blade helical types.

The present-day blower such as will be used on the new pressurised civil aircraft is an extraordinarily compact and efficient unit. Uneven case expansion has been taken care of by improvement of the external cooling and by introducing internal cooling of the rotors. For the latter, air is taken in through the rotor shafts and fed to the lobes of the rotor vanes whence it is evacuated via slinger discs to isolate it from the main airflow through the blower. The internal cooling air in the rotors is circulated automatically on the thermo-cycle system. Just how important the control of case expansion is will be realised when it is appreciated that the relative face clearance between the rotor blades is about 0.008in. and the blade-crown case clearance is 0.006in.

Gearing has been another problem for, with the small clearances demanding operational accuracy in the face of the working temperatures and the period between overhauls, only gears made to a master gear standard could be accepted. Nevertheless, such quality brings its own reward.

The Marshall Blower is of the positive displacement type and, as many motoring enthusiast readers will recognise, is of the Rootes variety. Such a blower, although not specifically a compressor, has many advantages over



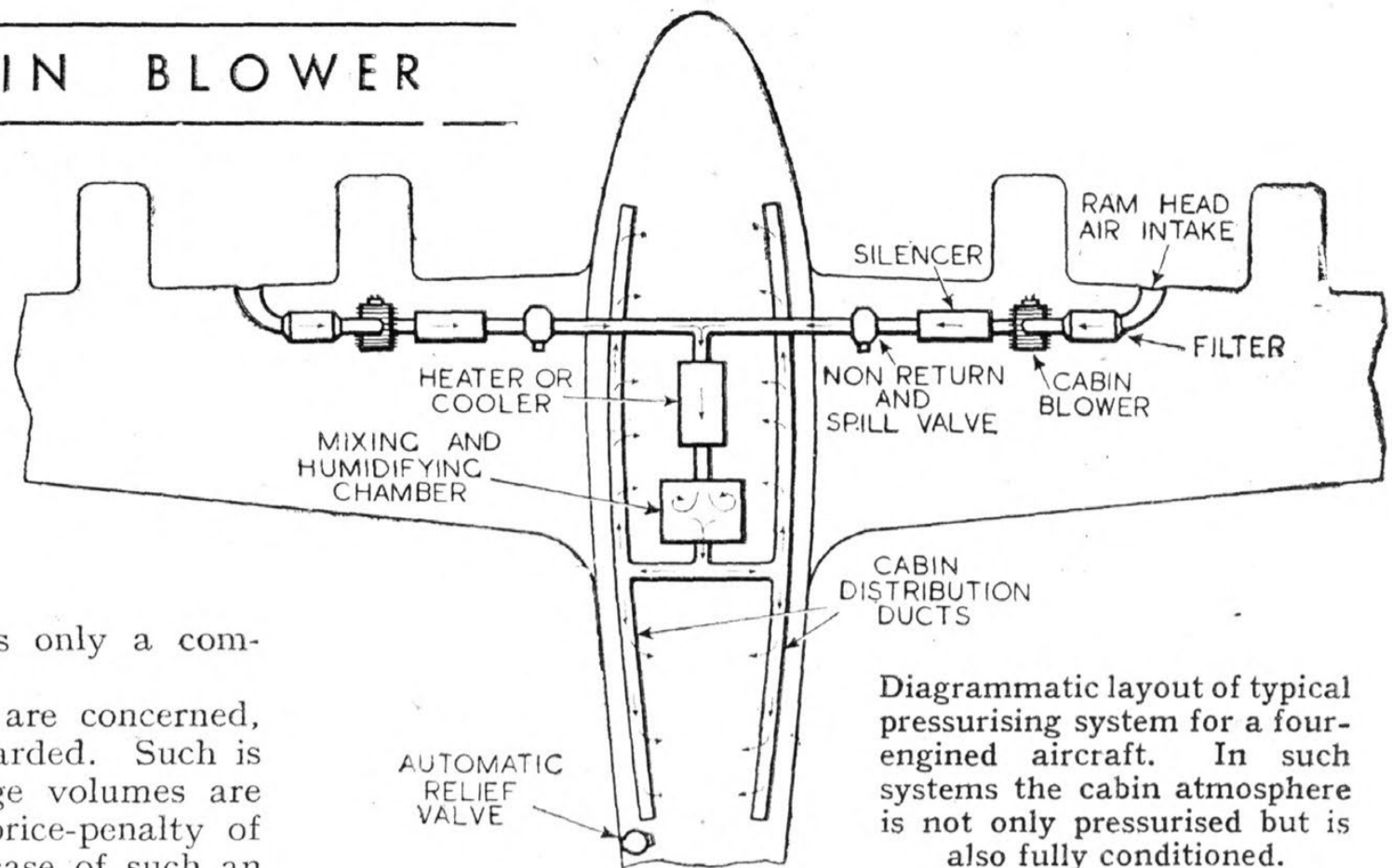
This set of typical performance curves applies to the Type 15 blower, which has an output of 15 lb./min. of air at 21,500ft. Two such units are fitted on the Avro Tudor I.

MARSHALL CABIN BLOWER

other positive-displacement types—particularly for aircraft cabin pressurising. For example, at ground level it is absorbing very little power, as it is doing virtually no work, and the temperature rise across it is correspondingly small. Again, adiabatically it is inefficient, and the more work it is called upon to do the greater the temperature rise of the air. This is of practical value for cabin work as the air delivered is, to a certain extent, preheated and thus needs only a comparable temperature additive.

In fact, where small-volume cabins are concerned, the additional heater can often be discarded. Such is by no means the condition where large volumes are involved, and it is a pointer to the price-penalty of pressurising that, for instance, in the case of such an aircraft as the new Avro Tudor I, no less than 100-odd h.p. is expended on pressurising and heating the cabin air. Probably the most important advantage possessed by a Rootes-type blower for this particular type of application is that it is one of the only positive-displacement types in which the pumping elements do not touch, and thus the air stream delivered is completely free from oil—a vital necessity. Centrifugal and axial-type compressors are not very suitable for medium, and quite unsuitable for small aircraft installations as to attain reasonable operative efficiency they must deal with very large volumes or run at extremely high speeds.

There is undoubtedly a very large field of endeavour



former is by far the more exacting, particularly in terms of operational range. A point to this is that as far back as 1940 Sir George Godfrey and Partners were producing blowers with a compression ratio of 3.7:1, whereas in the most extreme civil case so far envisaged a compression ratio of a little over 2:1 suffices—a useful yardstick for measuring relative safety factors.

Reliability is a great point of the Marshall Blower, as may be understood from the performance figures of the Type 15 model which are shown in the accompanying set of curves. The blower runs at 2.89 times engine speed, thus at the normal engine cruising r.p.m. of 2,100 the blower revs are 6,000/min.; in view of this the normal overhaul period of 1,000 hours is pretty conclusive.

It has been established that for long-range applications a pressurised cabin with all the ancillary equipment entails a smaller weight penalty than does providing the passengers with oxygen from bottles—this being a purely factual calculation which does not take into consideration the very important physiological effect upon the passengers.

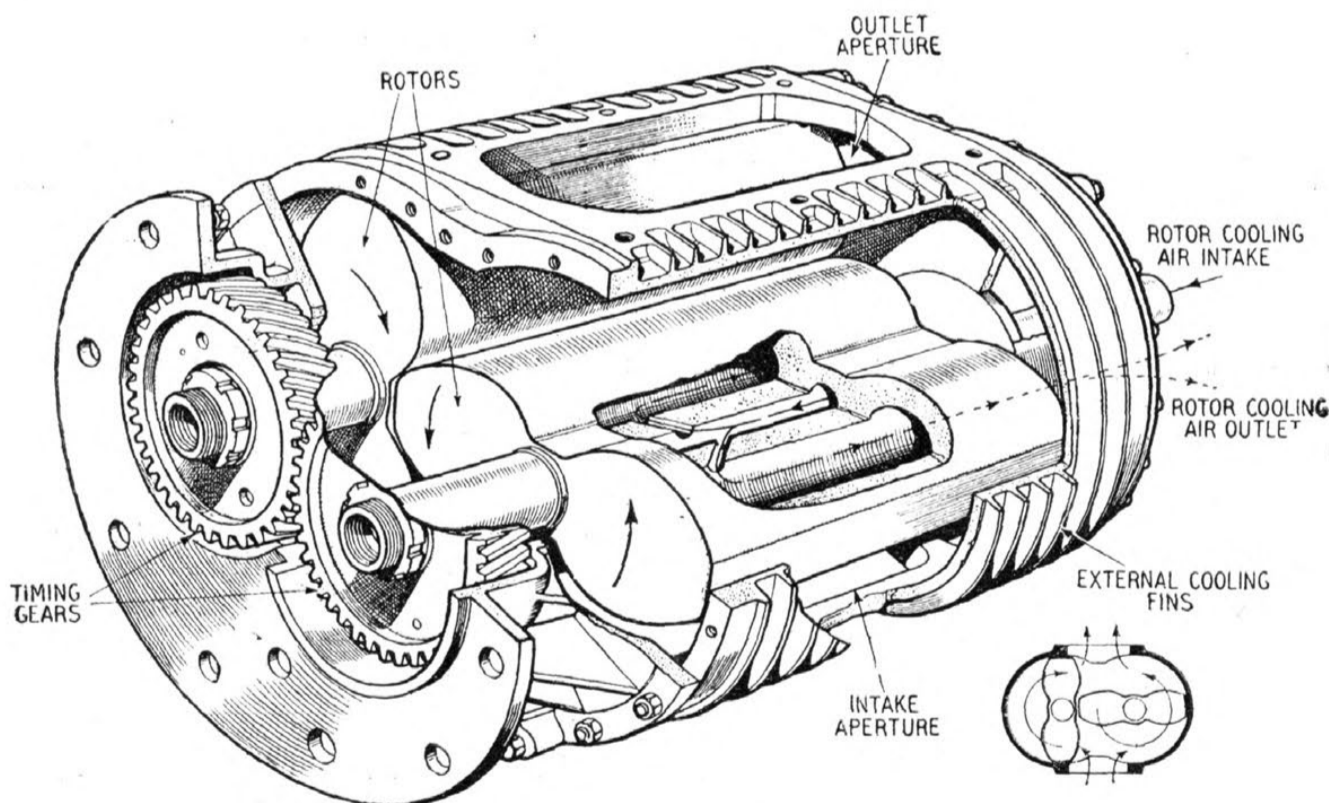
In consideration of the latter qualities it must be appreciated that pressurisation *per se* is not enough. The climatic conditions in which the aircraft is to operate exercise a profound effect upon the air supplied to the cabin, quite apart from temperature factors. For instance, a machine which is, say, flying the Arctic route will be abstracting air from the atmosphere which, in comparison with the temperate conditions such as obtain in this country and Europe as a whole, is abnormally dry. Further drying effect incurred by the high temperature rise of the air through the blowers aggravates the condition with the

result that, unless a humidifying chamber is incorporated in the system to wet the air delivered to the cabin, the poor passengers will suffer extremely sore throats.

Conversely, for operation in tropic conditions, the air abstracted is so saturated with moisture that drying is imperative to preclude the whole cabin interior, and the passengers, running with rivulets of water.

As previously stated, large volume cabin pressurising is disproportionately more difficult than pressurising small cabins, and, of course, the civilian passenger who has paid a not inconsiderable sum to be transported at high speed for some thousands of miles not unnaturally expects to be so transported within the lap of luxury.

High-altitude operation for long ranges holds too many positive advantages to be long delayed in commercial air passenger transport, and whoever is first in the field will hold excellent cards for developing in extended markets.



This sectioned perspective illustration shows the salient features of the Marshall Blower and makes clear the method of operation.

awaiting exploitation in the pressure cabin sphere, and it would appear that Sir George Godfrey and Partners are in an excellent position to give a valuable contribution. A very great deal of work on pressurising has already been done, but there still remains an even greater amount yet to be done, particularly in large volume cases. This is emphasised by an American admission that it will be a full two years before they can offer a large-volume pressurised cabin. Without being unduly optimistic, we are quietly confident that our own aircraft manufacturers will successfully fulfil their expectations in this direction within the very near future. Certain it is that the difficulty is purely a structural one, primarily involving the sealing and stressing of the fuselage. The blowers and ancillary equipment have already been developed to a pitch where their performance is vastly in excess of the airframe limits.

Military and civil applications are very different; the

Civil Aviation Policy

Government's Statement : Scope for Scottish Enterprise

AN important statement on the Government's policy on civil aviation was made by Flt. Lt. Perkins, Parliamentary Secretary, Ministry of Civil Aviation, when the House went into Committee on a Vote of £3,536,010 for the salaries and expenses of the new Ministry.

This statement, which in some respects modifies the original White Paper, classifies air services into three main divisions:

1. Commonwealth and Empire Services, including transatlantic service to Canada and the U.S., will be operated by the British Overseas Airways Corporation, shipping lines associated with them on particular routes and the British will operate on parallel lines with Commonwealth operators.

2. Foreign overseas services are to be treated in a dual fashion, viz. (i) the South American service is to be assigned to the British Latin American Airways, and (ii) services to the European continent are to be run by a British European Corporation. Participating in the latter will be the B.O.A.C. railway companies, short sea shipping lines, travel agencies and such other operators as desire to participate.

As stated in the White Paper it is the Government's intention to assign to this Corporation services to the Continent as soon as war conditions permit and aircraft are available. The modification introduced in the Parliamentary Secretary's statement is that this Corporation and their subsidiary Scottish Airways will be automatically barred from running services from Scotland to the Scandinavian countries, including Denmark, such routes being reserved to Scottish enterprise.

Provided that the Government can make arrangements under the Chicago Agreement with the Scandinavian countries and that the tribunal will approve of the operator, any new company will be able to operate services to Scandinavia from Scotland.

3. Internal services. The Government proposed to assign a number of such services to the British European Corporation. Some of these services have, in fact, been operated in the past by existing airline companies who will participate in the Corporation. Any pre-war operator who was licensed to run an internal airline at the outbreak of war shall be entitled to resume services provided he satisfies the licensing tribunal described below.

Apart from these "assigned" routes, provision is made for the operation of new routes which are left open to whatever operator can best establish he is fitted to run them.

Licensing Tribunal

To this end a tribunal foreshadowed in the White Paper to deal with any complaints of the public on such matters as absence of reasonable facilities, rates, etc., would be given powers by legislation to grant licences for unassigned routes. This tribunal will be absolutely independent of the Civil Aviation Ministry, presumably presided over by a judge and shall have discretion in granting licences. The only general directions which it will have to follow in considering an applicant's qualification would be to insist on conditions on these lines: first, British aircraft should be used if available: provisions for the welfare of crews, financial ability to carry out the job.

Details on which routes are assigned in the U.K. and which are not were not supplied by the P.S., but so far as Scotland is concerned the Government proposes that there should be a very considerable extension of internal services operated by Scottish Airways. The network so envisaged will include services from Glasgow (Renfrew Airport) to Perth, Dundee, Aberdeen, Inverness, Thurso, Oban and Fort William, Kyle of Lochalsh and Ullapool. There will be an air service between Edinburgh and

Glasgow, and both Edinburgh and Glasgow will be linked by air with the Western Isles, the Hebrides, the Orkneys and the Shetlands, and inter-island services will be operated as well.

In addition to the internal services it is intended that the Corporation shall run services linking Glasgow with Belfast, Liverpool, Manchester, Newcastle and London, and linking Edinburgh with Newcastle, the West Riding of Yorkshire and London.

It will be noted that none of these assigned services emanate from Prestwick, it being the Government's intention to leave it open to the licensing authority to entertain applications from any new operator to run services from Prestwick.

Prestwick's Future

The Government statement clarified the future position of Prestwick, which has been the subject of much speculation and agitation. Under the Chicago Agreement His Majesty's Government has to designate airports in the United Kingdom for (a) non-traffic stops, and (b) for traffic stops, i.e., embarkation and disembarkation of passengers, freight and mail. Prestwick will be one of the airports designated for all such purposes. In other words, airlines of any nationality will be able to pick up and set down their traffic at Prestwick. Pending the completion of Heath Row the Government will arrange that British land-based aircraft to and from the United States and Canada shall stop to pick up and set down at Prestwick.

Summarising the present position of British aircraft, Flt. Lt. Perkins stated that the prototype of Tudor I will fly within one week. This was the particular machine which they hoped will fly the Atlantic, and it is for this reason that only a comparatively small number (twenty) of this type has been ordered. The prototype of Tudor II is to fly next November, and deliveries should start in January next year. A considerable order had been placed for this aircraft. The prototype of the Viking, intended for internal services, is expected to fly this month. A large order—which can be easily increased—has been placed, and it is hoped that deliveries of the Tudor II will start in December this year.

No order had been placed for the Hermes, the prototype of which is expected to fly this September, because they were using the Tudors.

On the subject of jet propulsion, the Parliamentary Secretary said that his department is exceptionally interested in it, and he fully anticipated that in seven or eight years' time they would see some civil jet-propelled airliners. At present, however, still a lot of work remains to be done on pressure cabins which are necessary for jet-propelled aircraft.

NEWSPAPER SERVICE

LIVERPOOL DAILY POST has already turned to air transport for distribution. Each morning copies are sent to the Isle of Man by air and are there on sale by midday.

30 NATIONS AGREE

THE interim agreement on international civil aviation came into force on June 6th as the 26th nation announced its formal acceptance.

Although under the terms of the agreement the acceptances of only 26 nations were required to bring the agreement into force, 30 acceptances have been received.

The seat of the provisional international civil aviation organisation will be at Montreal and its first meeting is expected to be held in the near future. The date has not been announced, but it is believed the meeting will be held before the international air operators' organisation meeting on October 15th.

CIVIL AVIATION NEWS

NEW YORK-LISBON

THE first Clipper of the Pan American direct service from New York to Lisbon arrived at Lisbon last week.

IN CONFERENCE

A DEPUTATION of the Aerodrome Owners' Association met Lord Swinton to discuss the association's recommendations on civil aviation, especially their part in the development of air transport and of private flying.

SAFETY RECORD

K.L.M. Royal Dutch Airlines have been awarded by the Inter-American Safety Council the annual Aviation Safety Award for 1944 for having operated without an accident or a fatality to passengers or crew.

EXPANSION

VANCOUVER airport is to be enlarged to become a terminus of a Pacific service. It will serve both a service from Australia and a new route which the United Air Lines propose to start at some future date from Mexico City direct to Vancouver.

SHIPAIR

A PETITION of three Clan Line Group members—the Houston Line, Ltd., the British and South American Steam Navigation Co., and Turnbull, Martin and Co., Ltd.—to alter the objects of their companies so as to enable them to operate air transport and own aircraft has been approved by Mr. Justice Cohen.

ACCEPTED

THE Governments of Afghanistan, Australia, Colombia and Peru have declared their final acceptance of the Interim Agreement adopted by the Civil Aviation Conference in Chicago.

The Mexican Government accepted the agreement and will put it into force provisionally until it is approved by the Senate of the Republic in accordance with Mexican constitutional procedure.

CROYDON-STOCKHOLM

THE British Overseas Airways Corporation service to Stockholm which, during the war, operated secretly from Leuchars, in Fifeshire, is now using Croydon as the terminal airport for Great Britain.

A daily service in each direction is being operated with Dakota aircraft. On the outward journey the time taken is 5 hours 30 minutes owing to prevailing tailwinds from the west. The inward journey takes 6 hours 15 minutes.

INDIAN PROGRAMME

OVER 11,000 miles of post-war air routes are planned in India, according to a Government statement of policy.

The statement said that it is the Government's intention "to promote the development of air transport services, internal and external, by a limited number of sound and reliable private commercial organisations, with their own capital and operated under normal commercial principles.

"In selected cases the Government will take a financial interest, but not a controlling interest, in companies operating air services and will appoint a director on the board." This policy, it was added, does not rule out the operation of air services by the Central, Provincial or State Governments.

It is intended to operate daily air services on a series of trunk routes radiating from Karachi and Calcutta.

SOUTH COAST PLANNING

HASTINGS Reconstruction Committee recommended to the Town Council that the airfield at West St. Leonards, on which the Council have already spent £51,000, should be abandoned because it is too small for modern needs.

The committee point out that it is now necessary for the smallest type of airfield to have a main runway of not less than 1,920 yards long and 150 yards wide. This is nearly double the size of the airfield at West St. Leonards, and the minimum may be raised.

As air transport seems likely to become at last a regional

concern, the committee states that any further expenditure will be so heavy that it should not be borne by a local council. The practical course, they say, is to act in conjunction with one or more neighbouring towns, but they add a proviso that a new airfield should be within ten minutes of Hastings.

AIRPORT WANTED

FOLLOWING on the report that Southern Rhodesia was asking consideration of Bulawayo or Gwelo as an international air traffic stopping place, it is now said that experts cannot visualise a suitable existing aerodrome in Southern Rhodesia.

Operators agreed that an airport was needed near Salisbury because it was on the direct route and fitted in with operational needs as to fuelling, loads, flying distance and passenger traffic.

FUTURE TYPES

FOUR types of aircraft are likely to be in use five years after the war, according to D. R. Parvin, of the United Airlines.

A 70-ton four-engined low-wing monoplane equipped with a supercharged cabin accommodating 100 passengers for long-range de luxe services. For schedules with frequent stops, a four-engined low-wing, 35-ton type is envisaged, also equipped with a supercharged cabin to carry 75 passengers over moderate range. For the initial period of development of freight transportation Mr. Parvin predicts a mixed type which he calls a "variable" carrier either for passengers or freight or both. The change-over would be effected by quickly adjustable bulk-head separating passengers from cargo. This type would be a twin-engine high-wing monoplane of about 20 ton carrying a maximum of 52 passengers or 14,000 lb. of freight at a cruising speed of about 212 m.p.h.

Finally, with the increase in freight carriage a specially designed freighter is foreshadowed. This type would be a high-wing monoplane of about 15 ton carrying over 5 ton of freight at 210 m.p.h. cruising speed.

TAXATION PROBLEMS

THE Civil Aeronautics Board, in a report to Congress, has urged Congressional action to safeguard the development of the air commerce of the United States against the economic barriers of multiple and other burdensome taxation by States and their political subdivisions.

Congressional action had followed the recent decision of the Supreme Court in the North-west Airlines Case, in which concurring justices had suggested that the problems of multiple taxation should receive the attention of the Congress. In that case Minnesota had taxed the entire aircraft fleet of North-west Airlines to its full value notwithstanding the fact that six of the seven other States through which the airline operated had each also taxed a portion of the same fleet.

To avoid multiple taxation of air carriers, the Board recommends a federal statute to accomplish an equitable apportionment of taxable property among the States through which the airline's operations are conducted. The statute would prescribe certain methods under which this taxable property would be allocated. Because there may be need for some flexibility in the application of the statute, the Board recommend that the federal statute may provide for an existing federal agency to interpret and administer the formula, working with an advisory committee of tax experts nominated by the States.

The Board was critical of the taxation by some States of aviation fuel used in inter-State commerce, stating that such taxation threatens to impede the development of air transportation.

It recommended that Congress "direct the Treasury Department to make a study, in the light of the overall fiscal interests involved, of the merits of such proposals as that for the exclusive taxation of aviation fuel by the Federal Government and the ultimate exclusive taxation of motor fuel by the States, and of proposals for the sharing of tax revenues between the Federal Government and the States."

The report also condemns the multiple taxation of flight personnel under State income-tax laws, and urges that the plight of all multi-State workers be remedied by co-operative State action, if necessary, under federal leadership. It also recommends that airmen operating or taking part in the operation of aircraft engaged in inter-State or foreign air commerce not be required to obtain a State licence or pay State licence or registration fees.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

PASSENGER COMFORT

High Wings Provide Better View

DO the designers of our new transport aircraft remember the scramble for corner seats on main-line railway expresses?

In my opinion, as a layman, passenger comfort does not seem to be receiving the attention it should from the designer. I note, out here, the visibility from the fuselage of a Dakota—the commonest type used in Italy—and the Commando. Both are poor. The Skymaster is little better, the York good.

Then I note with regret that the de Havilland Dove, the Avro Tudor, and the Bristol Brabazon are all of low-wing construction. Passenger visibility is likely to be poor with these types, too, unless "observation lounges" are envisaged. (Igor Sikorsky had observation balconies on his four-engine transports in 1913!) Was there anything wrong with the Flamingo?

What will be duller than a several hours' semi-blind flight? As a potential customer, designers, please seriously consider high-wing types and let us have a "room with a view." We are going to pay our pennies, remember. So we shall, where possible, take our choice. F. F. BRUNDLE (C.M.F.).

GRADING THE AMATEUR

"Control" Would Give Greater Freedom to All

IT does not seem to me that Mr. Dickinson, judging from his remarks in *Flight*, May 24th, can have studied my tentative suggestions very carefully, or that he can have had much practical experience of club operation in pre-war years.

The "regulations" outlined in the article are surely those which were always unofficially in force for hirers of aircraft. Pupils were and will certainly be "allowed to fly club aircraft without any licence"—how otherwise can they put in their necessary time?—but cross-country flying by inexperienced licencees was normally carried out only under instructional supervision. Such cross-countries were of a very local type and were discouraged when the weather was anything but perfect, simply because the instructor could not reasonably trust, say, a 30-hour soloist—whether he had a licence or not.

With my system of grading, such primary licencees could be allowed much greater freedom of movement, since the instructor would know that his pupil's later travels would be automatically supervised; the instructor's responsibilities would cease after he had seen that the weather and other conditions were suitable for the first "leg." There would be none of this "come straight back and don't leave later than four o'clock and don't forget to have the tank topped up" business which made all our early air travels such tedious exercises. With flying by all pilots having less than a set standard of experience under friendly but firm control, the insurance companies will certainly not need to restrict the actions of the unknown club pilots as they were forced so to do, however indirectly, in the free-for-all days.

In fact, everything appears to point to the likelihood that proper control would, paradoxically, give far greater flying freedom to the inexperienced pilot, while leaving the experienced pilot in the same position as before.

"INDICATOR."

IN SPITE OF DIFFICULTIES

Highland Airways Put Safety First

AN article appearing in *Flight*, May 10th, headed "In Spite of Difficulties," has been brought to my notice. The statement made at the bottom of the second column, in which it is asserted that the Sumburgh Land Company in 1936 gave up the golf course to be formed into a landing ground, the use of which was granted to two companies, is incorrect. The pioneer work of the Orkney and Shetland routes was carried out by myself two years before Allied Airways came on the scene, and the lease for Sumburgh Aerodrome was negotiated and made out in the name of Highland Airways, Ltd. The agreement stipulated that Highland Airways were to have the sole use of the airfield. At that time the Air Ministry would not agree to instal radio stations on airfields unless they were made available for public use, but on my advice in the interest of safety, Highland Airways applied for and had installed an Air Ministry radio station at Sumburgh, thus voluntarily forfeiting our monopoly of landing rights in Shetland. Similar

circumstances applied in the case of our airfield at Kirkwall.

This public gesture was not made by the owner of Dyce Airport, and, as the article correctly states, Dyce was therefore not accorded radio safety facilities. This action debarred Highland Airways using Dyce Airport, although the owner was using Highland Airways airfields in the North. Accordingly, the pioneers of the Aberdeen/Orkney service, Highland Airways, were forced to fly out of a smaller airfield made at Highland Airways' expense, situated at Kintore, approximately 12 miles from the centre of Aberdeen.

Other companies operating from the South also were penalised, because it was found impossible to operate with the necessary regularity and safety without the assistance of a radio station at Dyce Airport. The competition referred to in the article was self-made during 1935 by Allied Airways deciding to operate in competition on a route which Highland Airways and myself had found, surveyed and started during the years 1932/33/34.

The point about Allied Airways not being allowed goodwill is irrelevant, as the White Paper specifically provides that no former operator is to receive goodwill in respect of past pioneering endeavours.

Under the circumstances, it is therefore difficult to understand what goodwill is sought, more especially as Allied Airways has been invited to participate in the set-up for post-war civil routes in Scotland.

E. E. FRESSON

(Director, Scottish Airways, Ltd.).

AIRSCREW QUIZ

A Practical Demonstration

WITH reference to Flt. Sgt. Skinner's problem (*Flight*, May 19th) regarding "what happens to airscrews when they part company with the engine in flight," may I give him my first-hand information.

This actually happened to me when flying with the R.A.F., and the starboard inner airscrew was the offender. The airscrew took the reduction gear and casing with it, and flew on straight past the aircraft, being freed of its load and dropped as its revolutions decreased.

The airscrew most certainly did not swing inboard as the fuselage was not touched. May I add my opinion, beyond doubt that, due to centrifugal force being equal at all points around the axis, the airscrew will not swing in any direction, but naturally screw itself forward until the rotating force imparted by the engine is lost.

DENIS G. COOK

(ex-R.A.F. Flight Engineer).

DESIGNERS SHOULD FLY

Especially in Their Own Creations

WITH reference to "Test Pilot's" letter in *Flight*, May 3rd, I wish to express my wholehearted agreement with his contention that design personnel should fly as much as possible, especially in aircraft of their own design. Most of my younger colleagues share this view. From the lowly eminence of a design assistant it can frequently be seen that mistakes are being made, both in project and detail stages of design, which would not occur if the personnel concerned were kept in touch with the user's point of view by frequent flights and personal contact with maintenance crews.

"Indicator's" article, "Getting over the hump," in the same issue, attacks this problem, suggesting that, in general, designers cannot be expected to pilot present-day designs, whereas test pilots should be able to acquire enough of the designer's knowledge to bridge the gap from their side. The test pilot is often far too vague from the theory point of view to be of much help to the designer in a difficulty, and he cannot have appreciable power in design until his theoretical knowledge is much improved.

A great step forward is now being made in this direction, but it is obvious that designers can and must familiarise themselves with the flying side of the game. It is too much to expect to-day of any but a superman that one individual be fully trained and experienced in both the design and the flying sides; life is too short. This was possible only in the early days, when things were much simpler. Incidentally, I must differ from "Indicator" in pointing out that, with existing

CORRESPONDENCE

test pilots, the definite information in cine form available from an automatic observer is of great help to the designer in supplementing and checking the pilot's impressions.

The flying-designer suggestion brings up a fundamental weakness in our design organisation which calls, I think, for bold action on a long-term policy basis. The weakness consists of ignorance of—and to some extent, indifference to—the practical aspects of design from both production and flying points of view, and is due in large measure to the increasing hiatus between the slide rule and drawing board on the one hand and the workbench and cockpit on the other. The result is a lack of incentive, imagination and practical gumption on the part of the majority of the design staff, both high and low.

There is a general tendency to-day towards over-specialisation; personnel are divided up into watertight compartments and are not encouraged to co-operate fully with individuals in other departments. A greater degree of interlocking of functions and better all-round knowledge and experience are required if serious design mistakes and weaknesses due to lack of co-operation are to be avoided.

The cure, which should have excellent results in the long run, would appear to consist of organising for a minimum of so many weeks in shops and ground crew, and so many hours of flying per-year for each individual playing any direct part in design, either basic or detail. A certain nucleus of design staff, including project engineers, aerodynamics, engine and airframe technicians and senior draughtsmen should certainly be assisted to qualify for "A" licences, and later this should become a necessary qualification for major design posts throughout our industry.

During the war we have had to adopt a short-sighted policy of rushing out designs—on the principle that anything is better than nothing—and design refinements and efficiency have to a considerable extent gone by the board under the pressure of extreme urgency and shortage of technicians. The same can also be said of the organisation of design work. We must drop our bad habits now, however, as performance and immediate production are no longer the sole criteria. An overall reduction in man-hours for design, production and maintenance, and concentration on development of excellent flying properties, are now called for if we are going to hold our own against hot competition from abroad.

We are in for the fight of our life in aircraft design, and we cannot afford any inefficiencies. Thank heavens for the new competition—let's roll up our sleeves and best it!

"STRAINING STRESSMAN."

DANGERS IN TURNING

Only Elevators Affect Wing-loading

IN his letter to the Editor (May 24th issue), Mr. H. W. Jones sounds plausible enough, but I feel he is not completely logical. He agrees that in a steep turn the increase in wing-loading is governed by acceleration in the pitching plane. He then says that force must be applied to cause such acceleration, and that "such force could only be supplied by the lift of the wings in a . . . degree proportional to the bank," thus proving (he says) that acceleration in the pitching plane is governed by the angle of bank.

How easy it is to disprove this statement! A loop, a zoom

or a pull-out from a dive all entail an acceleration in the pitching plane, and the force which causes the acceleration is applied by the pilot via the elevator control, causing a change in the aircraft's angle of attack. By strong enough back-pressure on the stick, the wing-loading can be increased to such a value that either the pilot blacks out, a high-speed stall occurs, or the aircraft bursts apart in the man's face. Take your choice, *but notice that no bank need be used whatsoever.*

Perhaps Mr. Jones is still unconvinced, as the above example is divorced from banking? If so we can bank during any of these manoeuvres through 70 or 80 or 90 or 120 or 170 degrees, without affecting the issue in the slightest. The acceleration in pitch is still caused by pulling back on the stick, and can be stopped in any attitude of bank by easing the stick back to neutral again.

To give another example, an axial roll is made by *banking only*, preventing any tendency to turn by appropriate use of elevator and rudder. There is no acceleration in the pitching plane (or not much—depending on how ham-fisted we are). The wing-loading only varies to the extent of acting in an unusual direction during the inverted part of the roll, when the dried mud on the cockpit floor falls up into our face, making us glad we are wearing our goggles.

For a third example let us try a steep turn using bank only. We are flying, say, at 200 m.p.h., at 10,000 feet. Holding the rudder quite still, we gently apply 70 degrees of bank, taking care not to allow the stick to move either back or forward. Almost at once the nose begins to drop, owing largely to weather-cock effect. Then begins a slowish turn, the weather-cock effect yawing the nose until it is finally pointing vertically downwards. At about this time we take a glance at the artificial horizon, the little aircraft on which is probably standing shyly on its head in the corner. The "angle of bank" can still, of course, be judged (if we are interested) by a convenient road straight ahead, as we dive vertically toward it. As from now on no further sideslip occurs, yawing ceases and the aircraft goes straight down. The wing-loading is quite normal, there being no acceleration in pitch. The pointer on the A.S.I. is very likely starting on its second trip round the clock, so we ease back the stick and pull out. This action, of course, introduces acceleration in the pitching plane for the first time since beginning the turn, and has nothing to do with angle of bank.

Normally, of course, the stick is eased back as the turn begins, first to prevent the nose from dropping, and secondly to make the aircraft turn. If the stick be eased forward to neutral again, the turn stops immediately and becomes a sideslip instead. Mr. Jones remarks that 70 degrees bank is nearly the useful limit for a level turn, and I agree. Nevertheless, the tightness of a turn at 70 degrees bank can be varied considerably, up to the pilot's black-out point, so why bank any steeper for a tight turn? And as the tightness affects the increase in wing-loading, and is controlled by the elevator, how can the angle of bank be said to govern the wing-loading? In high-speed diving or climbing turns, of course, it is quite usual to bank past the vertical, but no matter what the angle of bank, the wing-loading does not increase appreciably unless the stick is pulled back.

Mr. Jones misrepresents my contentions twice in his final paragraph, so I would merely suggest that he re-reads my first letter.

R. H. HENDERSON.

BOOK REVIEWS

The Modern Gas Turbine. By R. Tom Sawyer. Prentice-Hall Inc., 70, Fifth Avenue, New York, U.S.A.

THE enormous amount of publicity accorded in recent years to the jet-propelled aircraft has tended to overshadow the actual and potential development of the gas turbine for other applications. This book will serve as a useful corrective. It shows the importance attached in the U.S.A. to the gas turbine as a source of power for various industries and a propulsion unit for locomotives and ships as well as aircraft. Special sections are devoted to all these aspects.

The author, who is the chairman of the American Society of Mechanical Engineers' Co-ordinating Committee on Gas Turbines, gives a comprehensive history of gas turbines from the earliest attempt to current productions and projects. Considerable space is devoted to exhaust gas-driven turbo-superchargers for petrol aircraft engines and diesel engines. The possibility of employing a diesel engine, of either conventional or free-piston type, as a gas generator for a turbine is also discussed.

The text is supplemented by useful formulae, calculations, graphs and illustrations, and numerous references to other sources of information are quoted.

"Red Air Ace." By Guards Colonel Alexander Pokryshkin of the Red Air Force. Published by Soviet War News, 630, Grand Buildings, Trafalgar Square, London, W.C.2. 1s. net.

COL. POKRYSHKIN is the leading air ace of the Soviet Union. He has written a book about the work of a fighter squadron in the late war with Germany, much on the lines of many books written by Allied fighter pilots about the war of 1914-18. The impression he gives is that when Russia was first invaded her fighter squadrons were inadequately trained in their special business. They gradually learnt how to fight by fighting; and as the older hands became adepts they trained the new pilots very carefully. The author speaks with the highest praise of the aircraft turned out by Russian designers.



SERVICE AVIATION



Royal Air Force and Fleet Air Arm News and Announcements



A Skymaster negotiates the flooded perimeter track on an Azores airfield used by aircraft of Coastal Command.

Appointments

THE Air Ministry announces the following appointments:—

Air Vice-Marshal Sir Brian Edmund BAKER, K.B.E., C.B., D.S.O., M.C., A.F.C., to be Senior Air Staff Officer, H.Q., Middle East.

Air Vice-Marshal Hugh Sydney Porter WALMSLEY, C.B., C.B.E., M.C., D.F.C., to be Air Officer Commanding a Group, Bomber Command.

Air Vice-Marshal John Rene WHITLEY, D.S.O., A.F.C., to be Air Officer Commanding a Group, Bomber Command.

Air Commodore Henry Norman THORNTON, M.B.E., to be Air Officer Commanding a Group, Air Command, South East Asia, with the acting rank of Air Vice-Marshal.

Brigadier H. G. WILLMOTT, C.B.E., S.A.A.F., to be Air Officer Commanding, A.H.Q., East Africa.

Air Vice-Marshal Sir Brian BAKER has been Air Officer Commanding A.H.Q., East Africa, since the end of last year. He was previously A.O.C. a Group in Coastal Command after being A.O.C., R.A.F., Iceland.

He was commissioned in the 15th (Service) Battalion Rifle Brigade at the beginning of 1915 and transferred to the Royal Flying Corps, serving with various squadrons in France.

In 1924 he commanded a flight at Aden and on his return commanded the Experimental Section of the Royal Aircraft establishment in March, 1926. In 1934 he served successively in H.M. Aircraft Carriers, *Eagle* and *Courageous*, in the latter as Senior Air Force Officer.

Air Vice-Marshal WALMSLEY has been Senior Air Staff Officer at H.Q., Bomber Command, since 1944, prior to which he was A.O.C. of a Bomber Group. He was commissioned in the Loyal North Lancashire Regiment and transferred to the Royal Flying Corps in 1917.

After the last war he took a course at the School of Navigation and Bomb Dropping, later being posted to Iraq. After serving as flying instructor and adjutant at No. 603 A.A.F. Squadron he took a refresher course at the C.F.S. in 1933 and later went to Aden in command of a squadron. During most of this war he has served with Bomber Command.

Air Vice-Marshal WHITLEY has been Air Officer Commanding a Bomber Group since February, 1945. Previous to that appointment he was a base commander in the same group. Before then he commanded a number of R.A.F. stations, and in 1940 was on Operations Room duty at Headquarters, Bomber Command.

Air Vice-Marshal Whitley was awarded the A.F.C. in 1937, and the D.S.O. in 1943.

Air Vice-Marshal H. N. THORNTON has been commander at a Bomber Command Base and also at H.Q. of the Command.

Joining the 9th Northumberland Fusiliers at the outbreak of the last war as a private, he was commissioned in the Royal Flying Corps in October, 1917. Between 1928 and 1931 he was adjutant and flying instructor to the No. 601 City of London A.A.F. Squadron, and in 1932 served in the Chief of Air Staff's Department at the Air Ministry, becoming P.A. to the C.A.S. In 1935 he was on special duties as Air Attache at Brussels, later occupying the same post at Stockholm and Washington in 1940 and 1941 respectively. In 1944 he went to H.Q. Bomber Command.

Brigadier H. G. WILLMOTT, of the South Atri-

can Air Force, was deputy to the Director-General of the S.A.A.F. from the end of 1942, and came to Britain in the following year where he served with R.A.F. Coastal Command. He had previously been Senior Air Officer to the G.O.C. Coastal Defences in South Africa of the combined S.A.A.F. and R.A.F. Staff.

He was awarded the C.B.E. in recognition of his work in North Africa, where he was in command of a Light Bomber Wing of the S.A.A.F. from the middle of 1941 to the end of 1942.

Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations:—

Distinguished Service Order

Act. Group Capt. K. J. SOMERVILLE, D.F.C., A.F.C., R.A.F., No. 105 Sqn.—Group Capt. Somerville has a long and distinguished record of operational flying, having completed more than 100 sorties, most of them against well-defined targets. He has displayed a high degree of skill throughout and his example of coolness and

courage in the face of the fiercest enemy fire has inspired all with whom he has flown. His sterling qualities have been reflected in the efficiency and fine fighting spirit of the squadron he commands.

Sqn. Ldr. J. V. WATTS, D.F.C., R.C.A.F., No. 105 Sqn.—This officer has completed more than 100 sorties. He has at all times displayed the greatest keenness and devotion to duty and his example has impressed all. Sqn. Ldr. Watts is a navigator of high merit and the successes obtained on the many sorties in which he has taken part are a fine tribute to his outstanding skill. This officer has proved of the greatest value to the squadron.

Act. Sqn. Ldr. H. ALMOND, D.F.C., R.A.F.V.R., No. 105 Sqn.—This officer's operational record is most impressive. Since being awarded the Distinguished Flying Cross he has completed a large number of sorties. On one occasion, whilst over Cologne, his aircraft was severely damaged when hit by anti-aircraft fire. Nevertheless, Sqn. Ldr. Almond flew back to an airfield in this country. When coming in to land the starboard engine failed. The hydraulic system had sustained damage and the undercarriage would not lower beyond the half-way down position. Despite these hazards, and without the assistance of the flaps Sqn. Ldr. Almond effected a successful crash-landing. This officer has invariably displayed skill, courage and coolness of a high order.

Act. Sqn. Ldr. G. BAXTER, D.F.C., R.A.F.V.R., No. 83 Sqn.—This officer has participated in numerous sorties since being awarded the Distinguished Flying Cross. He has shown the highest standard of navigational ability, coupled with great courage and resolution. His faultless work, often in the face of fierce opposition, has played an important part in the successes obtained. Sqn. Ldr. Baxter has rendered much loyal and devoted service.

Act. Sqn. Ldr. W. A. G. GALLIENNE, D.F.C., R.A.F.V.R., No. 139 Sqn.—This officer has participated in more than 80 sorties during which attacks have been made on a wide range of enemy targets. He is a navigator of high merit, whose exceptional skill, great courage and devotion to duty have set a splendid example to all. In spite of more than one trying experience, Sqn. Ldr. Gallienne has shown the greatest keenness and has taken every opportunity to operate against the enemy. His efforts have been untiring and he has contributed much to the success of the squadron.

Bar to Distinguished Flying Cross

Flt. Lt. R. E. SCHOLLES, D.F.C., R.A.F.V.R., No. 692 Sqn.—Since the award of the Distinguished Flying Cross, Flt. Lt. Scholes has participated in a large number of operational sorties, including 16 attacks against Berlin. He has played a large part in the success of these operations by his outstanding skill and navigational ability, combined with his determination to accurately locate and bomb all his targets. Both in the air and on the ground Flt. Lt. Scholes has always shown cool courage and devotion to duty of a high order.

Flt. Lt. F. G. D. SMITH, D.F.C., R.A.F.V.R., No. 101 Sqn.—Since the award of the Distinguished Flying Cross, Flt. Lt. Smith has participated in further operations against many varied targets. By his excellent skill, undaunted courage and resourcefulness he has rendered valuable assistance to his captain, frequently in the face of intense enemy opposition. As Signals Leader Flt. Lt. Smith has shown outstanding leadership and the utmost determination to ensure the successes of the missions he has led.



Air Vice-Marshal J. R. Whitley, D.S.O., A.F.C., now appointed to command a Group in Bomber Command.

SERVICE AVIATION

Flt. Lt. R. A. STRACHAN, D.F.C., R.A.F.V.R., No. 105 Sqn.—Throughout his long operational career Flt. Lt. Strachan has consistently maintained a very high standard of navigational skill, courage and devotion to duty. His ability to concentrate on the task in hand under the most adverse circumstances has largely contributed to the successful completion of many missions. Since the award of the Distinguished Flying Cross this officer has participated in many further operational sorties including attacks against Duisburg, Bonn and Coblenz.

Flt. Lt. F. WRIGHT, D.F.C., R.A.F., No. 15 Sqn.—As wireless operator Flt. Lt. Wright has shown great skill and enthusiasm and his work as squadron signals leader has been of the highest order. Since the award of the Distinguished Flying Cross he has completed many further sorties against a variety of important targets. At all times he has operated with noteworthy courage and devotion to duty.

Act. Flt. Lt. C. F. BOND, D.F.C., R.A.F.V.R., No. 109 Sqn.—Since the award of the Distinguished Flying Cross this officer has continued to operate with skill and devotion to duty, participating in attacks against strongly defended industrial and tactical targets.

Act. Flt. Lt. G. HALL, D.F.C., R.A.F.V.R., No. 582 Sqn.—As captain of aircraft, this officer has achieved a high standard of accuracy frequently in the face of bitter opposition. Since the award of the Distinguished Flying Cross, he has continued to operate with great enthusiasm and has successfully attacked a wide range of strongly defended targets. His keenness and outstanding courage have been an asset to his squadron.

Act. Flt. Lt. N. H. KIRBY, D.F.C., R.A.F., No. 105 Sqn.—Since the award of the Distinguished Flying Cross, Flt. Lt. Kirby has continued to display outstanding qualities of courage, reliability and devotion to duty. He has operated against targets demanding the greatest skill and determination, and has contributed greatly to the excellent results achieved.

Act. Flt. Lt. K. L. TRENT, D.F.C., R.A.F.V.R., No. 625 Sqn.—Since the award of the Distinguished Flying Cross this officer has taken part in attacks against many well defended and important targets in Germany. Several of these missions were completed in the face of intense anti-aircraft fire and fighter opposition and in adverse weather.

Distinguished Flying Cross

F/O. R. BLACK, R.A.F.V.R., No. 35 Sqn.
F/O. R. J. BROMLEY, R.A.F.V.R., No. 424 (R.C.A.F.) Sqn.
F/O. A. J. BROWN, R.A.F.V.R., No. 578 Sqn.
F/O. R. W. BRUTON, R.A.F.V.R., No. 102 Sqn.
F/O. E. J. BUMFORD, R.A.F.V.R., No. 106 Sqn.
F/O. L. B. CAMERON, R.A.F.V.R., No. 550 Sqn.
F/O. T. B. CARPENTER, R.A.F.V.R., No. 514 Sqn.
F/O. K. CARR, R.A.F.V.R., No. 76 Sqn.
F/O. E. G. COOK, R.A.F.V.R., No. 57 Sqn.
F/O. J. E. GROSSFIELD, R.A.F.V.R., No. 625 Sqn.
F/O. D. J. DAVIES, R.A.F.V.R., No. 460 (R.A.A.F.) Sqn.
F/O. R. J. DAY, R.A.F.V.R., No. 138 Sqn.
F/O. J. B. DONALDSON, R.A.F.V.R., No. 101 Sqn.
F/O. R. H. G. EASTWICK, R.A.F.V.R., No. 158 Sqn.
F/O. K. A. J. ELLIS, R.A.F.V.R., No. 218 Sqn.
F/O. A. J. FARMER, R.A.F.V.R., No. 77 Sqn.
F/O. E. D. FIELDSON, R.A.F.V.R., No. 76 Sqn.

F/O. N. E. FREEMAN, A.F.M., R.A.F.V.R., No. 142 Sqn.
F/O. H. E. FRYER, A.F.C., R.A.F.V.R., No. 142 Sqn.
F/O. J. A. GARDNER, R.A.F.V.R., No. 35 Sqn.
F/O. R. A. GOSLING, R.A.F.V.R., No. 142 Sqn.
F/O. F. J. GOULDING, R.A.F.V.R., No. 171 Sqn.
F/O. R. HAMMERSLEY, R.A.F.V.R., No. 692 Sqn.
F/O. B. E. B. HARRIS, R.A.F.V.R., No. 627 Sqn.
F/O. A. G. T. HART, R.A.F.V.R., No. 408 (R.C.A.F.) Sqn.
F/O. W. B. HARTNETT, R.A.F.V.R., No. 100 Sqn.
F/O. T. J. HARVEY, R.A.F.V.R., No. 7 Sqn.
F/O. A. C. KENNETT, R.A.F.V.R., No. 12 Sqn.
F/O. G. KNOTT, R.A.F.V.R., No. 166 Sqn.
F/O. W. LAMONT, R.A.F.V.R., No. 218 Sqn.
F/O. R. B. LEIGHTON, R.A.F.V.R., No. 7 Sqn.
F/O. A. Y. LICKLEY, R.A.F.V.R., No. 105 Sqn.
F/O. W. H. MASON, R.A.F.V.R., No. 78 Sqn.
F/O. W. McDONALD, R.A.F.V.R., No. 35 Sqn.
F/O. C. J. MCPHERSON, No. 582 Sqn.
F/O. J. L. M. McTERNAGHAN, R.A.F.V.R., No. 582 Sqn.
F/O. K. A. MOORE, R.A.F.V.R., No. 576 Sqn.
F/O. A. J. MOTT, R.A.F.V.R., No. 142 Sqn.
F/O. L. A. MOTTRAM, R.A.F.V.R., No. 76 Sqn.
F/O. H. T. MURLEY, R.A.F.V.R., No. 218 Sqn.
F/O. A. E. NETTING, R.A.F.V.R., No. 101 Sqn.
F/O. A. NEWHAM, R.A.F.V.R., No. 102 Sqn.
F/O. K. J. NEWMAN, R.A.F.V.R., No. 12 Sqn.
F/O. D. J. PARSONS, R.A.F.V.R., No. 158 Sqn.
F/O. K. PORTER, R.A.F.V.R., No. 12 Sqn.
F/O. G. D. RAYMENT, R.A.F., No. 218 Sqn.
F/O. G. H. REYNOLDS, R.A.F.V.R., No. 625 Sqn.
F/O. H. RICHARDSON, R.A.F.V.R., No. 76 Sqn.
F/O. J. R. RIGBY, R.A.F.V.R., No. 550 Sqn.
F/O. C. D. E. SEATON, R.A.F., No. 35 Sqn.
F/O. I. I. SEGAL, R.A.F.V.R., No. 218 Sqn.
F/O. P. J. SINGER, R.A.F.V.R., No. 550 Sqn.
F/O. G. L. THOMAS, R.A.F.V.R., No. 431 (R.C.A.F.) Sqn.
F/O. F. A. TUCK, R.A.F.V.R., No. 460 (R.A.A.F.) Sqn.
F/O. E. S. WAKEHAM, R.A.F.V.R., No. 156 Sqn.
F/O. S. A. WIGGINS, R.A.F.V.R., No. 158 Sqn.
F/O. S. H. WHITE, R.A.F.V.R., No. 578 Sqn.
F/O. J. F. WHONE, R.A.F.V.R., No. 427 (R.C.A.F.) Sqn.
F/O. R. W. WISHART, R.A.F.V.R., No. 467 (R.A.A.F.) Sqn.
Act. F/O. J. BANKS, R.A.F.V.R., No. 10 Sqn.
Act. F/O. R. J. HILLS, R.A.F.V.R., No. 115 Sqn.
Act. F/O. H. S. YOUNG, R.A.F.V.R., No. 186 Sqn.



The Badge of No. 733 Squadron, Fleet Air Arm. "Sursum in Nubes" (Arise into the Clouds). Field: White. Upon a pellet an eagle volant gold, in front of two rays of light in saltire, white.

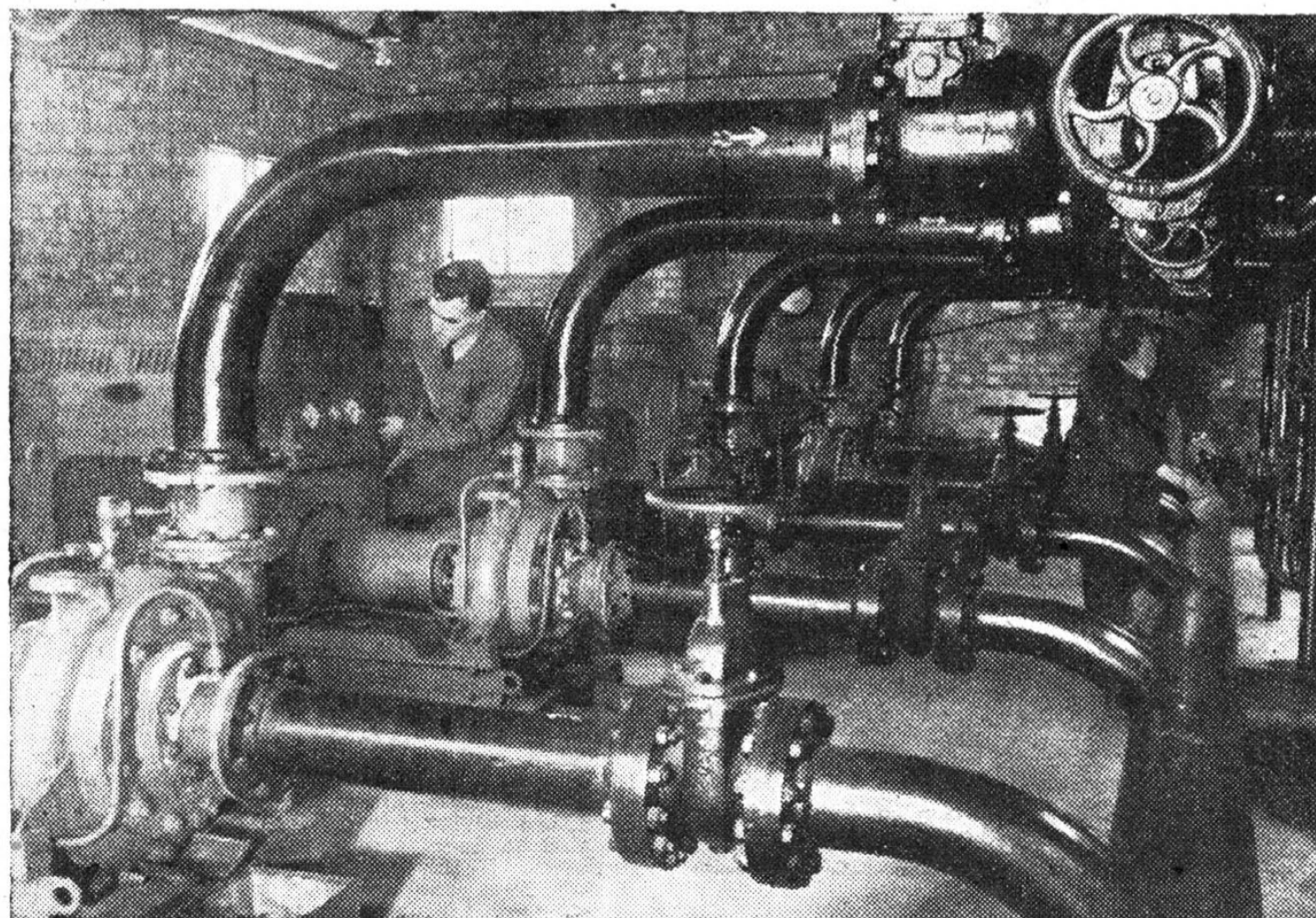
P/O. J. D. ALLEN, R.A.F., No. 102 Sqn.
P/O. L. BELL, R.A.F.V.R., No. 635 Sqn.
P/O. R. BOUND, R.A.F., No. 578 Sqn.
P/O. K. E. H. BROWN, R.A.F.V.R., No. 158 Sqn.
P/O. G. CANN, R.A.F.V.R., No. 166 Sqn.
P/O. J. M. CATFORD, R.A.F.V.R., No. 635 Sqn.
P/O. E. CLARKE, R.A.F.V.R., No. 578 Sqn.
P/O. J. CLARKE, R.A.F.V.R., No. 626 Sqn.
P/O. G. E. COLLEY, R.A.F.V.R., No. 51 Sqn.
P/O. J. J. COVNE, R.A.F.V.R., No. 78 Sqn.
P/O. S. A. CRAGIE, R.A.F.V.R., No. 102 Sqn.
P/O. H. W. CROOK, R.A.F., No. 10 Sqn.
P/O. J. CUTHILL, R.A.F.V.R., No. 192 Sqn.
P/O. P. HARVEY, R.A.F.V.R., No. 149 Sqn.
P/O. B. G. HILL, R.A.F.V.R., No. 76 Sqn.
P/O. G. HOCKENHULL, R.A.F.V.R., No. 142 Sqn.
P/O. F. C. HOPTON, R.A.F.V.R., No. 101 Sqn.
P/O. S. T. HOWARD, R.A.F.V.R., No. 100 Sqn.
P/O. E. C. JELLINGS, R.A.F.V.R., No. 578 Sqn.
P/O. A. L. LAUNDER, R.A.F., No. 83 Sqn.
P/O. W. J. MCKNIGHT, R.A.F.V.R., No. 578 Sqn.
P/O. M. McLEOD, R.A.F.V.R., No. 76 Sqn.
P/O. A. MILLAR, R.A.F., No. 76 Sqn.
P/O. L. F. MILLER, R.A.F.V.R., No. 35 Sqn.
P/O. T. W. PIERSON, R.A.F.V.R., No. 90 Sqn.
P/O. W. F. PHILPOT, R.A.F.V.R., No. 186 Sqn.
P/O. A. J. RIDDLE, R.A.F.V.R., No. 139 Sqn.
P/O. T. D. RODGERS, R.A.F.V.R., No. 550 Sqn.
P/O. I. SEWELL, R.A.F.V.R., No. 76 Sqn.
P/O. F. SMITH, R.A.F.V.R., No. 10 Sqn.
P/O. A. STURROCK, R.A.F.V.R., No. 101 Sqn.
P/O. H. M. SWEENEY, R.A.F.V.R., No. 76 Sqn.
P/O. H. A. SYGROVE, R.A.F.V.R., No. 635 Sqn.
P/O. G. R. H. THOMAS, R.A.F., No. 429 (R.C.A.F.) Sqn.
P/O. G. M. TIERNEY, R.A.F.V.R., No. 76 Sqn.
P/O. J. TINDALE, R.A.F.V.R., No. 76 Sqn.
P/O. C. W. TOLL, R.A.F.V.R., No. 578 Sqn.
P/O. H. E. W. WAINWRIGHT, R.A.F.V.R., No. 578 Sqn.
P/O. R. G. WALL, R.A.F.V.R., No. 429 (R.C.A.F.) Sqn.
P/O. A. WILLIAMSON, R.A.F.V.R., No. 76 Sqn.

P/O. J. A. WILLIE, R.A.F.V.R., No. 76 Sqn.
P/O. H. C. WOODING, R.A.F.V.R., No. 635 Sqn.
Act. Sqn. Ldr. T. H. CHAPMAN, R.C.A.F., No. 425 (R.C.A.F.) Sqn.
Act. Sqn. Ldr. G. E. NICKERSON, R.C.A.F., No. 434 Sqn.
Flt. Lt. C. N. CROWE, R.C.A.F., No. 405 (R.C.A.F.) Sqn.
Flt. Lt. L. L. CURRIE, R.C.A.F., No. 514 Sqn.
Flt. Lt. W. T. GLASS, R.C.A.F., No. 429 (R.C.A.F.) Sqn.
Flt. Lt. G. J. L. JONES, R.C.A.F., No. 420 (R.C.A.F.) Sqn.
Flt. Lt. J. E. MARLER, R.C.A.F., No. 434 (R.C.A.F.) Sqn.
Flt. Lt. C. S. POPE, R.C.A.F., No. 429 (R.C.A.F.) Sqn.
Flt. Lt. D. R. REDMOND, R.C.A.F., No. 608 Sqn.
Flt. Lt. I. P. STONEHOCKER, R.C.A.F., No. 403 (R.C.A.F.) Sqn.
Flt. Lt. G. C. J. VANN, R.C.A.F., No. 405 (R.C.A.F.) Sqn.
Act. Flt. Lt. W. B. BRITTON, R.C.A.F., No. 427 (R.C.A.F.) Sqn.
Act. Flt. Lt. L. F. BOYD, R.C.A.F., No. 635 Sqn.
Act. Flt. Lt. L. A. CARLEY, R.C.A.F., No. 138 Sqn.
Act. Flt. Lt. J. W. KAISER, R.C.A.F., No. 90 Sqn.
Act. Flt. Lt. J. P. LEYDON, R.C.A.F., No. 35 Sqn.
Act. Flt. Lt. R. P. MADDEN, R.C.A.F., No. 186 Sqn.
Act. Flt. Lt. D. I. THOMSON, R.C.A.F., No. 77 Sqn.
Act. Flt. Lt. P. C. THOMPSON, R.C.A.F., No. 419 (R.C.A.F.) Sqn.
Act. Flt. Lt. W. L. TURNBULL, R.C.A.F., No. 428 (R.C.A.F.) Sqn.
F/O. N. L. AUSTEN, R.C.A.F., No. 101 Sqn.
F/O. F. H. BIDDLE, R.C.A.F., No. 429 (R.C.A.F.) Sqn.
F/O. I. J. BITTNER, R.C.A.F., No. 514 Sqn.
Distinguished Flying Medal
Sgt. N. M. PARK, R.N.Z.A.F., No. 126 Sqn.
Flt. Sgt. N. D. DIXON, R.C.A.F., No. 433 (R.C.A.F.) Sqn.
Flt. Sgt. H. R. DAY, R.A.A.F., No. 462 (R.A.A.F.) Sqn.
Flt. Sgt. F. J. WARD, R.A.A.F., No. 467 (R.A.A.F.) Sqn.
Flt. Sgt. K. G. CRAWFORD, R.A.A.F., No. 149 Sqn.
Sgt. A. SLEEMAN, R.A.F.V.R., No. 640 Sqn.

THE KING has been graciously pleased to approve the following awards:—

B.E.M. (Mil.)

Cpl. E. R. C. MELVILLE, R.A.F.V.R.—Cpl. Melville landed with the invasion forces on D-day and assisted in clearing mines and other enemy munitions from sites which were urgently required for special purposes. On one occasion Cpl. Melville and his section received information that a mine had exploded and had caused casualties. They proceeded to the scene and cleared a lane of mines, recovering four dead persons and rescuing a young boy who was seriously injured. In September, 1944, whilst working on mine clear-



REGULATING THE WEATHER: The fuel control house of a "Fido" fog dispersal apparatus on an R.A.F. airfield.

ance of an area required for use as a glider strip, an "S" mine exploded within ten yards of Cpl. Melville, causing five casualties, of which one was fatal. Although he had a narrow escape and suffered from shock, Cpl. Melville was ready, when called upon, to continue his hazardous duties. During a period of six weeks when an airfield was being cleared of mines, he set an example to all ranks by the speed and efficiency with which he located and neutralised all types of enemy mines. Leading a section of three men, he cleared 2,062 anti-personnel Schu-mines, apart from many other mines of different types. On one day his section recovered and rendered safe as many as 336 Schu-mines. The rapid completion of the work was materially helped by his skill, leadership and determination. Cpl. Melville is an exceptionally courageous and determined worker and is completely unperturbed by any of the disturbing circumstances which frequently arise in the course of his hazardous work.

Cpl. W. H. MORRIS, R.A.F.V.R., and Cpl. W. K. REID, R.A.F.—For a period of six weeks in 1944, Cpls. Reid and Morris were engaged with a section in breaching minefields in order to locate the patterns of the mine belts and to assist in the general mine clearance. In spite of the worst conditions of weather they continued the work until all mine patterns had been discovered and general clearance could commence. The section detected and neutralised over 400 anti-personnel "S" mines alone, many of these being hidden in inaccessible and unexpected positions. Many "S" mines were buried in marshy ground, under water, necessitating feeling for and neutralising the igniters with hands numbed by the cold. Cpls. Reid and Morris worked together as a team, the former detecting and the latter neutralising mines. Each has shown the greatest confidence in the ability of the other and their work contributed largely to the successful disposal of many anti-tank mines. They both showed exceptional skill, courage and leadership in dangerous circumstances.

Cpl. G. H. ROSE, R.A.F.—In September, 1944, Cpl. Rose and others were engaged on mine clearance in a cornfield adjacent to a glider strip at Ousterham. When an "S" mine exploded, causing five casualties, including the flight commander, Cpl. Rose, who was about 25 yards away, rendered first-aid until the arrival of a medical officer and afterwards continued his work. For a period of six weeks he and others were detailed to clear mines from an airfield. Though still affected by his previous experience, Cpl. Rose did not hesitate to continue his hazardous duties in a courageous and efficient manner, thereby setting an example to his comrades. The section he led dealt with over 2,000 Schu-mines, many of them in a dangerous condition owing to partial functioning by cattle. Cpl. Rose also dealt with stock-mines in woods and all types of mines in swampy land and rough country. This airman has been engaged in bomb disposal duties since March, 1941.

Cpl. T. C. WOODHEAD, R.A.F.V.R., No. 85 Sqn.—One afternoon in November, 1944, an aircraft, whilst attempting to make a forced landing on an airfield, crashed and burst into flames. Cpl. Woodhead ran to the scene of the accident in company with other airmen. By the time they arrived one wing was burning fiercely and the fire was spreading to the cockpit and fuselage. Disregarding the flames and the ammunition which had started to explode, Cpl. Woodhead and his helpers jumped on to the port wing and the cockpit Perspex canopy and tried to break into the cockpit, but they were unable to release the emergency roof exit or to get at the crew. They could see that the pilot was bent over the control column and that the navigator was on the floor. By this time a fire engine had arrived and commenced to play foam jets on to the cockpit, but the heat had become so intense that all were forced to retire. A few moments later the navigator's head and shoulders appeared through a hole which had been made in the side of the fuselage. Despite the intense heat and danger from exploding tanks, Cpl. Woodhead immediately dashed into the flames and dragged the injured man to safety. Cpl. Woodhead then attempted to return and search for the pilot, but was driven back by the heat, which was by then too great to allow of any further rescue attempt to be made. Cpl. Woodhead had shown complete disregard of his personal safety and his action in finally rescuing the navigator from the blazing wreckage was one requiring great courage.

Air Force Medal

- Flt. Sgt. T. S. GRIFFITHS.
- Flt. Sgt. C. C. BRUCE, R.A.F.V.R.
- Flt. Sgt. S. J. BURTON, R.A.F.V.R.
- Flt. Sgt. E. W. FELSTEAD, R.A.F.V.R.
- Flt. Sgt. C. MARSON, R.A.F.V.R.
- Cpl. D. V. MORRIS, R.A.F.V.R.
- Act. Cpl. E. R. PEACOCK, R.A.F.V.R.
- L.A./C. C. T. BARNES, R.A.F.V.R.

Roll of Honour

Casualty Communiqué No 514.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in



NILE SQUADRON: A yacht club has been formed for the benefit of officers and other ranks on leave in Cairo. W/O. C. E. Challinor, R.A.F. (right) is vice-commodore and secretary of the the club.

action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of these, 202 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. D. P. Aplin; Sgt. W. T. Banner; Flt. Sgt. V. J. W. Brookson; Sgt. W. Bunyan; Flt. Sgt. L. H. Chell; Sgt. C. K. Davey; Sgt. E. Dobson; Sgt. F. V. J. Dunstone; Sgt. J. Gallagher; F/O. R. A. Gibbs; Flt. Sgt. L. Ginno; Sgt. E. W. Hamilton; Flt. Sgt. P. D. Hewitt; F/O. B. R. James; F/O. D. W. B. Lansdown; Sgt. J. M. Lennon; Flt. Lt. A. N. L. McQueen; F/O. W. P. Parham; Sgt. V. Pascoe; F/O. W. W. Russell; Sgt. W. R. Scott; Sgt. W. H. Seabridge; Flt. Sgt. E. C. Slaughter; F/O. R. W. Smallwoods; Sgt. T. C. Smith; Flt. Sgt. P. C. Williams; Flt. Sgt. J. K. Wilson; W/O. R. M. Wilson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. R. G. James; F/O. W. J. Rogers.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. D. Balmforth; F/O. E. Bashi; P/O. W. J. Bell; P/O. M. Bunnagar; Sgt. J. Burke; Sgt. J. A. Chambers; Sgt. G. N. Cribbin; Sgt. B. G. Easterlow; Sgt. W. L. Evans; Flt. Lt. C. C. Fox, D.F.M.; F/O. J. Grantham; Flt. Sgt. R. E. Hardwick; Sgt. A. I. Henderson; Sgt. L. Jakeman; Flt. Sgt. R. H. Jones; Flt. Sgt. K. S. Keeping; Sgt. R. F. Leggitt; Sgt. T. Newman; Sqn. Ldr. R. Reavill; P/O. C. D. A. Short; Sgt. D. C. Stock; Sgt. H. Tattler; Sgt. J. E. Trollope; Sgt. R. G. T. Watson; Sgt. J. A. Williams.

WOUNDED OR INJURED IN ACTION.—Flt. Lt. R. T. Hathaway; P/O. L. J. Minns; F/O. J. P. Roberts.

MISSING, BELIEVED KILLED IN ACTION.—P/O. R. Cannon.

MISSING.—Sgt. J. Ashton; P/O. D. Blair; P/O. A. O. Blencowe; Flt. Sgt. W. Blyth; Sgt. H. Boulding; Sgt. D. G. M. Brettel; Sgt. G. E. Brook; Sgt. C. A. Butler; Flt. Sgt. C. Butler; Flt. Sgt. N. S. C. Colley; F/O. P. Cook; F/O. H. Coulton; Sgt. J. Gibb; Sgt. D. F. Hadland; Sgt. S. R. Harris; Sgt. D. G. Howdle; Flt. Sgt. R. M. Jenkins; Flt. Lt. A. E. Johnson; W/O. H. F. Laing; F/O. G. E. Locke; Sgt. A. G. R. McFarlane; Sgt. J. MacKie; Flt. Sgt. R. Neale; Flt. Lt. A. V. Pearson; Sgt. R. Powell; Sgt. J. E. Ralph; Sgt. R. H. H. Side; Sqn. Ldr. L. H. Skinner; Sgt. E. Smalls; Flt. Sgt. G. B. Thomas; Flt. Sgt. W. J. Treadwell; Sgt. J. C. Whyte; Sgt. R. F. Winstanley.

KILLED ON ACTIVE SERVICE.—F/O. B. Adams; W/O. A. Folwell; P/O. A. J. Goldie; Sgt. P. W.

Harris; F/O. J. C. Hobby; Flt. Lt. F. D. Holdsworth; Flt. Sgt. J. Magill; Sgt. J. Martin; Sgt. A. Mercer; Flt. Sgt. F. A. C. Nesbit-Bell; W/O. F. G. Posse; A/C.2 J. B. Ritchie; Sgt. K. J. Williams.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. B. A. Day; L.A./C. E. W. Fisher; Flt. Sgt. J. L. M. Hermelin; Cpl. R. C. Roke.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—W/O. R. S. Braby.

DIED ON ACTIVE SERVICE.—L.A./C. F. P. Anderson; Flt. Sgt. H. Bedford; A/C.1 J. R. Burlison; L.A./C. W. Chalmers; L.A./C. F. H. S. Evans; A/C.1 W. H. Howe; Sqn. Ldr. I. N. Locke; Cpl. E. G. Richings; L.A./C. P. E. Scott; L.A./C. O. W. Swallow; A/C.1 H. H. Thompson; L.A./C. R. Trudgill; L.A./C. D. N. Turner.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—Cpl. E. B. T. Brackstone; A/CW. M. C. Wagstaff; A/CW.2 M. B. E. Ward.

Royal Australian Air Force

KILLED IN ACTION.—Flt. Sgt. R. F. Cross; Flt. Sgt. B. H. Elliott; Flt. Sgt. K. J. King; Flt. Sgt. P. L. Kirkpatrick; Flt. Sgt. W. T. Paine; F/O. A. N. Robinson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. H. D. Campbell; F/O. R. C. Fidock; Flt. Sgt. K. F. Heidtman; Flt. Sgt. W. R. Hullett.

MISSING.—Flt. Sgt. L. C. Barrett; Flt. Sgt. F. J. Bean; Flt. Sgt. N. B. Bird; F/O. G. S. Brown; Flt. Sgt. P. J. Carter; F/O. V. Dunn; Flt. Sgt. F. E. Everatt; F/O. J. M. Inkster; P/O. K. O. Langham; P/O. P. Myerson; P/O. A. H. Pearce; Flt. Sgt. R. E. Plante; F/O. J. L. Walters; W/O. B. F. Weber; Flt. Sgt. F. H. Wilkins; Flt. Sgt. R. J. Young.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. G. M. Dockery; F/O. J. J. Downing; P/O. R. A. G. Miller; Flt. Sgt. R. L. Pope; Flt. Sgt. A. G. Robinson.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. C. M. Beauregard; P/O. T. P. Bourque; F/O. C. F. Bull, D.F.C.; W/O. F. L. P. Cains; P/O. R. S. Chapman; P/O. H. J. Cunningham; P/O. W. Draganiuk; Flt. Sgt. W. J. Fullum; F/O. W. P. Hugli; P/O. G. W. Mayor; F/O. W. Murphy; Flt. Lt. S. J. R. Soper; Flt. Sgt. D. Tomlin; F/O. N. Vlassie; Flt. Lt. J. A. Watson; F/O. D. D. Watterson; W/O. E. V. Webb; Flt. Sgt. J. W. White; P/O. H. C. Wilson; F/O. L. J. Yeats.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. W. R. Adlard; P/O. E. L. Alberts; Flt. Lt. H. T. Amy; F/O. J. I. Atkins; Sqn. Ldr. J. M. Bissett, D.F.M.; P/O. G. Boucher; P/O. E. P. Boutillier; W/O. D. S. Brillinger; P/O. L. A. Brenton; P/O. R. G. Brock; F/O. C. D. Brown; W/O. G. Bryson; W/O. F. L. Bulman; F/O. G. C. Burns; F/O. D. H. Calder; P/O. E. R. Caldwell; P/O. K. L. Cannings; P/O. J. A. Carter; W/O. J. N. C. R. Casaubon; F/O. J. A. Cole; P/O. J. J. Cooke; P/O. W. W. Crum; F/O. W. E. Cummings; P/O.

SERVICE AVIATION

J. E. G. Desmarais; P/O. J. P. L. W. L. Desroches; Flt. Sgt. I. I. Donovan; P/O. H. W. Doiron; F/O. R. O. Ellsmere; F/O. T. R. Forsyth; F/O. L. R. Georgeson; W/O. J. Gilson; P/O. W. H. Goodwin; P/O. G. T. Greig; P/O. J. Grodecki; P/O. W. C. Hall; F/O. S. A. Hawkins; Flt. Sgt. G. Q. Hansen; F/O. J. Heath; P/O. R. E. Hendry; P/O. A. S. F. Holmes; P/O. T. E. G. Howe; Flt. Sgt. H. E. Isles; P/O. C. S. Johnston; P/O. J. G. Johnson; P/O. P. Kalyta; W/O. L. T. Kennedy; Flt. Lt. G. W. Knupp; F/O. P. F. Korbyl; P/O. S. Kuleski; W/O. J. A. R. W. Lalonde; F/O. H. K. Langrish; Flt. Sgt. O. A. Lapointe; F/O. J. J. H. G. G. Leclaire; F/O. H. W. Linscott; P/O. L. T. Linton; F/O. D. H. Loewen; W/O. A. J. Long; F/O. H. M. Long; Sgt. E. W. H. McCaffrey; P/O. R. J. McCormick; P/O. R. V. McDougall; F/O. P. G. McGuire; Flt. Lt. H. C. McIver; P/O. R. J. McKay; P/O. H. F. MacKenzie; P/O. D. A. G. McKerry; P/O. P. J. B. Madore; P/O. O. C. Markle; F/O. T. R. Martin; F/O. W. H. Matthews; P/O. J. T. Metka; F/O. H. J. Miller; P/O. E. Milner; Flt. Sgt. A. F. Moore; Sgt. T. H. Morris; F/O. F. W. Morrison; P/O. C. B. Murray; Flt. Lt. J. N. Nelson; Sgt. A. C. Neville; F/O. J. McV. Oglivie; P/O. J. Oliver; F/O. R. E. Padgett; P/O. J. A. Parker; F/O. W. H. Parkinson; F/O. E. D. Patterson; P/O. A. G. Pearce; Flt. Lt. R. H. Penalanagan; F/O. K. T. Penkuri; Flt. Lt. T. O. Pledger, D.F.C.; P/O. R. W. Pratt; P/O. J. L. Priamo; P/O. K. W. Priske; Flt. Sgt. L. K. Raymond; W/O. C. L. Reed; F/O. W. W. Rehkopf; F/O. M. J. Reid; Sgt. J. P. F. Richard; F/O. G. W. McK. Richter; F/O. C. F. Ridgers; Flt. Sgt. R. W. Ritchie; P/O. S. L. Roach; P/O. S. J. Rogers; P/O. L. G. Rowell; W/O. J. N. L. Roy; P/O. J. E. Russell; W/O. L. G. Scott; W/O. D. J. Setter; F/O. R. A. Shannon, D.F.M.; F/O. T. R. Sherrill; W/O. K. F. Shoener; F/O. T. Siltala; P/O. C. E. Simpson; Flt. Lt. W. R. Smith; Sgt. M. R. Smoke; F/O. H. C. Sorley; P/O. B. V. Starrup; F/O. H. B. Steeves; W/O. G. E. Stevenson; P/O. A. H. Stockton; W/O. R. A. Storbakken; Sgt. D. G. Strachan; P/O. J. E. Strain; P/O. W. J. D. Sturmy; P/O. R. F. Sykes; P/O. C. M. Sylrah; Flt. Sgt. J. A. Taylor; F/O. R. C. Taylor; F/O. H. P. Theriault; P/O. D. O. Thomas; Flt. Sgt. H. B. Thompson; F/O. L. E. Thompson; P/O. F. L. Travers; P/O. S. J. Vernon; W/O. D. V. Walker; Sgt. G. L. Ward; Sgt. L. T. Wardell; P/O. E. G. Waterston; Sgt. E. C. Webb; F/O. F. M. Webber; P/O. V. G. Whalen; P/O. J. W. Wheeler; F/O. R. J. White, D.F.M.; P/O. J. Wilson; P/O. M. Wiwianski; F/O. R. B. Wright; Flt. Sgt. C. T. Young; Flt. Sgt. J. O. Young; F/O. F. R. Zulauf, D.F.M.

MISSING.—Sgt. L. J. Collinson; F/O. T. B. Little; F/O. H. T. McGovern; Flt. Sgt. T. P. Quinn; Flt. Sgt. R. L. Siewart; F/O. R. MacM. Wallis.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. J. A. Emerson; Sgt. J. F. Fitzgibbon; Flt. Sgt. R. B. Rathbone; Flt. Sgt. J. H. Reid; Flt. Sgt. H. M. MacKenzie.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. L. R. J. Meech.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. G. S. Hadfield.

MISSING.—F/O. N. A. Heffernan; W/O. R. W. G. Leslie.

South African Air Force

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Major J. P. de Villiers, D.F.C.

MISSING.—Lt. R. V. Jacobs; Capt. P. G. MacGuire.

Casualty Communique No. 515

Of the names in this list, 222 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—F/O. D. T. Blain; Sgt. B. H. Chappell; Sgt. N. R. Daynes; Sgt. A. MacLeod; Sgt. J. Purdon; L.A./C. V. J. Riches; Flt. Sgt. A. M. Scott; Sgt. L. Smith; F/O. C. F. Wellman; Flt. Sgt. H. R. Woodward.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. A. Bates; Sgt. K. Chiles; Flt. Sgt. A. F. W. Farley; Sgt. A. R. Green; P/O. M. Henderson; P/O. C. H. Neary; Flt. Sgt. A. W. Oram; F/O. W. G. Philpot; Sgt. G. S. Pritchard; Flt. Sgt. N. A. Rawlinson; Sqn. Ldr. W. G. Shadforth, D.F.C.; Sgt. W. C. Truman; Sgt. A. J. Veale, D.F.M.; Flt. Sgt. B. W. Webb.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. C. Adams; F/O. J. C. O. Allan; Flt. Lt. R. G. Armstrong, D.F.C.; P/O. S. S. Atkin; Sgt. J. A. Atkinson; Sgt. F. C. Barker; Sgt. W. J. Batchouski; Sqn. Ldr. R. Bows; Flt. Lt. C. S. Bradford; Flt. Sgt. J. Brown; Sgt. R. Brown; F/O. R. S. H. Browning; Flt. Sgt. A. Campbell; Sgt. D. J. Cooper; Sgt. H. Crabtree; Flt. Sgt. A. C. J. Curley; Flt. Lt. R. Curtis; Sgt. J. Cutting; Flt. Sgt. G. E. Edgecombe; Sgt. T. E. Edwards; Sgt. D. E. Endean; Sgt. K. A. Essex; Sgt. F. W. Gander; Flt. Sgt. R. F. A. Giles; Sgt. C. W. Goodwin; P/O. J. L. Halpin; F/O. J. V. Hayward; Sgt. R. Hepworth; P/O. K. K. Hignett; Sgt. A. J. Holdom; Sgt.

J. Horrocks; Sgt. C. McK. Hossack; Sgt. M. A. Hutchinson; Flt. Sgt. T. Jefferson; P/O. P. Johnson; Sgt. W. H. Johnson; Sgt. J. O. Johnston; P/O. G. Jones; Flt. Sgt. P. L. Jones; Sgt. W. P. J. King; Sgt. L. Lanaghan; F/O. F. C. Langridge; P/O. R. Latham; Flt. Sgt. H. E. Lillcrap; P/O. C. H. Lines; Sgt. W. A. Littlewood; Sgt. W. A. Loose; Flt. Sgt. D. J. Lowe; Sgt. W. H. Lyssington, D.F.M.; Sgt. T. McCall; Sgt. W. E. McIlwaine; Sgt. P. L. McIver; Sgt. A. W. McWhirter; P/O. K. R. Mather; P/O. A. C. Middleton; Flt. Lt. J. R. G. Milton; F/O. P. R. Mitchell; P/O. F. H. R. Moody; Sgt. R. E. Muffett; F/O. J. C. Murphy; Flt. Sgt. R. G. Osborne; Flt. Sgt. R. Parkyn; Sgt. S. Patterson; Flt. Sgt. W. M. Patterson; Sgt. H. F. Payne; F/O. R. T. Peace; Flt. Sgt. C. Philp; Sgt. I. C. Plumb; F/O. J. B. Poat; Flt. Sgt. R. E. Porter; Sgt. T. J. Pullman; P/O. A. L. Puttock; P/O. G. N. Rackley; Sgt. J. Rafferty; F/O. J. S. Ragless; Flt. Sgt. B. W. Ralph; P/O. H. Rankin, D.F.M.; Flt. Lt. A. M. Rhodes; Sgt. R. E. D. Robinson; Flt. Sgt. J. H. Robson; Sqn. Ldr. D. G. Ross, D.F.C.; W/O. C. H. Sheridan; P/O. H. Sherlock, D.F.C.; Sgt. M. R. Singer; Sgt. F. J. W. Smith; Sgt. J. Smith; Flt. Lt. G. A. Spark; Sgt. W. G. Spencer; Flt. Sgt. J. F. Stafford; Flt. Sgt. S. Sutton; Sgt. A. Symonds; Flt. Lt. A. F. Taylor, D.F.C.; Sgt. D. F. Taylor; Sgt. W. Thompson; Flt. Sgt. J. Vaughton; P/O. R. T. Walsham; Sgt. A. R. Ward; Sgt. R. W. T. Weir, D.F.M.; P/O. W. P. White; Sgt. M. L. Worth; P/O. A. O. Wright; F/O. S. F. Yardley.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. A. Gregory.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. R. E. Tootell.

MISSING, BELIEVED KILLED IN ACTION.—W/O. J. G. Galley, D.F.M.; Sgt. G. J. Harris; Sgt. R. Hartop; W/O. R. J. Holman; Sqn. Ldr. R. K. H. Johnson, D.F.C.; F/O. F. A. Mason; W/O. R. E. Ralph; P/O. H. Roe; Flt. Lt. G. Trail.

MISSING.—Flt. Lt. R. Baker; Sgt. G. Banks; F/O. K. T. Bell; Sgt. D. G. Betts; P/O. J. C. Botting; Sgt. C. S. Bowers; Flt. Sgt. W. G. Cheeseman; Flt. Sgt. J. A. Clements; Flt. Sgt. J. Coles; Sgt. E. H. Copley; Flt. Sgt. A. V. Crory; F/O. B. O. Davis; Flt. Sgt. J. F. Borner; Sgt. D. W. Farrar; Flt. Sgt. H. Ferguson; Flt. Sgt. E. W. Fletcher; Sgt. J. R. Fuller; F/O. K. R. Goldthorpe; Flt. Sgt. A. R. Gray; Flt. Sgt. S. E. Hanson; Sgt. R. C. Harris; F/O. D. J. Hinton; Flt. Lt. E. G. Hunt; Flt. Lt. P. J. Huntley; F/O. W. J. Jenkins; Flt. Sgt. P. R. Jenkinson; F/O. O. M. C. Jones; Sgt. D. A. Jordan; Sgt. J. E. Judd; Wing Cdr. L. H. Kay, D.F.C.; Sgt. J. S. Kewell; F/O. K. C. S. Legge; Sgt. N. S. Levick; F/O. T. Lowe; Sgt. G. E. Lowndes; Flt. Sgt. G. E. Maidment; Flt. Sgt. J. W. Milburn; Flt. Sgt. K. J. Molloy; Sgt. W. Osmond; F/O. I. G. Owen; W/O. W. Poston; F/O. J. Ross; Flt. Lt. J. B. J. Smith; Sgt. J. A. Sparke; Sgt. H. Stainthorpe; Sgt. F. J. Tate; Sgt. K. Trevitt; Flt. Sgt. J. Watt; Flt. Sgt. W. C. Webley; Sgt. W. J. Wilson; P/O. C. Worrall; Flt. Lt. J. S. B. Wright; F/O. R. W. Young.

KILLED ON ACTIVE SERVICE.—W/O. D. F. Barner; Sgt. J. MacG. Burdon; Flt. Sgt. J. A. Coleman; F/O. J. G. C. Koes; Flt. Lt. J. A. H. Pinny.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. L. W. Chapman, D.F.M.; A/C.2 A. G. Clark; A/C.1 V. J. Collett; L.A./C. R. E. Giles; L.A./C. T. Govland; L.A./C. P. L. Heath; A/C.2 W. E. Holder; Cpl. A. Johnson; A/C.1 L. Mawer; L.A./C. J. A. B. McIntosh; P/O. D. V. Randall; L.A./C. J. Rathbone; A/C.1 C. W. Turner; Cpl. J. Whelan.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. L. O. Daniels.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Lt. A. E. Allsworth.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A./C. T. Lynch.

DIED ON ACTIVE SERVICE.—L.A./C. W. E. Cartwright; W/O. W. H. L. Cusack; Cpl. A. J. Drewett; L.A./C. H. H. Faulks; L.A./C. P. Lancaster; F/O. W. N. Perry; Sgt. S. Pollock; A/C.1 W. J. L. Rocks; A/C.2 H. G. Slocock; A/C.2 J. W. Stephenson; F/O. W. E. Whitby.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. J. W. Angus; Sgt. H. L. Lyne; P/O. D. R. Murphy.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—Cpl. R. Beedie; A/CW.1 D. E. Saxby.

Royal Australian Air Force

KILLED IN ACTION.—F/O. G. R. Palmer.
PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. G. C. Townend; F/O. P. K. Turner; Flt. Sgt. K. C. Waight.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. G. Armit; Flt. Sgt. R. W. Ash; P/O. D. C. Ballour; Flt. Lt. W. N. Belford; F/O. R. E. Berkley; F/O. W. H. Bowen; Flt. Sgt. J. H. Brown; W/O. L. W. Cain; Flt. Sgt. I. Chapple; Flt. Lt. J. A. Cleary; P/O. K. E. Crawford; F/O. H. R. Crout; Flt. Sgt. G. M. Dann; Flt. Lt. I. G. Durston; Flt. Sgt. C. H. Eastgate; P/O. W. E. Felstead; Flt. Sgt. H. W. R. Ferguson; F/O. K. W. P. Francis; Flt. Sgt. R. D. Gallagher; Flt. Sgt. P. R. Gill; Flt. Sgt.

M. H. Graydon; P/O. G. C. Ive; P/O. R. W. Jones; P/O. R. L. Ludlow; Flt. Sgt. W. R. McLachlan; P/O. J. P. MacMillan; P/O. K. C. McPhie; P/O. L. E. Mehden; P/O. J. Mitchell; Flt. Sgt. P. Moylan; Flt. Sgt. G. F. Pate; F/O. L. W. Pearce; W/O. R. W. Purcell; P/O. C. E. Stephensen; Flt. Sgt. B. H. Stevens; Flt. Sgt. J. W. A. Sutherland; Flt. Sgt. L. Thornton; F/O. A. E. Tyne; Flt. Sgt. P. S. Wade; F/O. D. F. Ward, D.F.C.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Lt. P. J. Hedderwick.

MISSING.—Flt. Lt. L. E. Button; P/O. J. H. Carter, D.F.M.; Flt. Sgt. L. A. Davies; F/O. J. G. Eaton; F/O. L. J. Fowler; Flt. Sgt. J. P. Holian; F/O. R. J. McDermott; F/O. R. L. Maloney; P/O. R. S. Seaman, D.F.M.; W/O. P. H. Wales.

KILLED ON ACTIVE SERVICE.—W/O. B. J. Skelly.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. J. P. Hayden; F/O. C. A. McPherson.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. G. H. Blachford; Wing Cdr. D. S. Jacobs, D.F.C.; Sgt. G. D. Lees; W/O. A. M. Leonard; F/O. S. W. Lough; Flt. Lt. T. R. McDougall, D.F.C.; P/O. H. E. MacDuff; P/O. D. R. McEvoy, D.F.M.; P/O. R. D. Ochsner; Flt. Sgt. F. D. Maddock; P/O. J. B. Morrill; P/O. R. L. Porter; P/O. C. E. Rose; Sgt. J. Rutzki; P/O. L. R. Towsley.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. L. D. Bonnett; Flt. Sgt. J. A. Buckingham; Sgt. I. Larson; P/O. G. McDougall; P/O. A. C. MacGillivray; P/O. J. E. McIntyre; F/O. R. McLeod; P/O. H. J. Menzies; Flt. Lt. V. K. Moody, D.F.C.; F/O. S. A. Phillips; Sgt. J. R. Rankin; P/O. E. P. Sabine; P/O. C. H. Shaw; P/O. R. S. Smith; P/O. C. D. Stroud; F/O. T. W. Taylor; F/O. C. W. E. Tiplady; F/O. W. L. Vander-Dasson, D.F.M.; P/O. D. Wallbank; F/O. G. K. Willis.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Lt. W. F. Borrett; Flt. Sgt. D. K. Clark; Sgt. A. L. Evens; Flt. Sgt. W. A. Gray.

MISSING.—F/O. V. R. Adams; F/O. D. J. Bailey; F/O. W. A. Booth; Flt. Sgt. W. K. Bradley; F/O. C. F. Bryce; Sgt. W. H. G. Field; Flt. Sgt. W. J. Glass; Sgt. L. F. B. Goodwin; P/O. R. E. Harvey; F/O. W. Kerluk; F/O. J. Klatman; Sgt. D. E. Linington; Sgt. M. L. Long; Sgt. J. F. McCormick; Flt. Sgt. P. R. Mogridge; Flt. Sgt. P. E. O. Morissette; Flt. Sgt. K. D. Reid; Flt. Sgt. W. A. Wegenast; Flt. Sgt. R. J. Wilson.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—F/O. K. W. Gordon; Flt. Sgt. L. T. Grenon.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. I. W. Entwistle.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. L. Dunn; F/O. K. A. Galloway; Flt. Sgt. J. M. Hart.

MISSING.—Flt. Lt. W. R. Arnold; P/O. J. D. K. Balfour; P/O. A. P. Hoare.

South African Air Force

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—2/Lt. C. J. De Jager; Lt. L. W. M. Dutoit.

MISSING.—Capt. E. J. Jennings.
KILLED ON ACTIVE SERVICE.—Lt. D. J. Beisiegel.

Official Corrections

Casualty Communique No. 507.

Under "MISSING" delete F/O. K. G. Booth, P/O. C. G. Broad, Sgt. P. L. Greaves, Flt. Sgt. J. Holland.

Sgt. J. O. Cooper should read Flt. Sgt. Delete F/O. G. Floyd and place him under "KILLED IN ACTION."

Flt. Sgt. G. A. Morton-Moncrieff should read W/O.

Under "KILLED ON ACTIVE SERVICE," after Flt. Lt. E. D. Eyles add D.F.C. P/O. G. D. Wright should read F/O.

Delete the heading "PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR," and the names beneath.

Under "R.A.A.F. MISSING" delete Flt. Sgt. M. J. Kerrigan.

Under "S.A.A.F. MISSING" delete Lt. C. W. L. Boyd and Lt. H. J. Krizinger.

Delete the R.N.Z.A.F. heading "PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR" and the name beneath it.

Casualty Communique No. 508.

Under "MISSING" delete F/O. G. Davies, F/O. D. L. Groom, Sgt. R. Hoyle, Flt. Sgt. H. K. Radcliffe.

Under "MISSING, BELIEVED KILLED ON ACTIVE SERVICE" delete Sgt. G. H. Butler, W/O. G. A. Clowes, Flt. Sgt. C. G. Grubb, Sgt. J. A. Haddow, Flt. Sgt. J. Jones, Flt. Sgt. D. O. Lane, Sgt. J. A. Woodgate.

Under "KILLED ON ACTIVE SERVICE" after P/O. W. A. Marritt add D.F.M.

Under "PREVIOUSLY REPORTED MISSING, NOW PRISONER OF WAR" delete Sgt. E. F. Deadman, Flt. Sgt. A. D. Eagle, Sgt. R. L. Leverington, Sgt. J. B. Lucas, Sgt. H. K. Ormrod.

Under "R.C.A.F. MISSING" F/O. M. Bernyk should be inserted under "KILLED IN ACTION."

Under "MISSING, BELIEVED KILLED ON ACTIVE SERVICE" delete F/O. T. H. R. MacAulay.