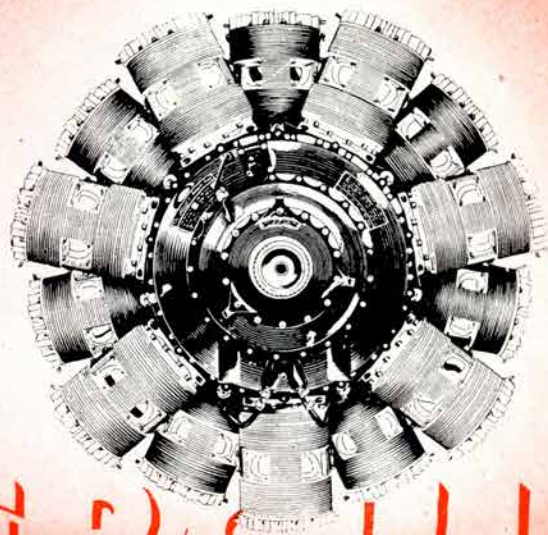


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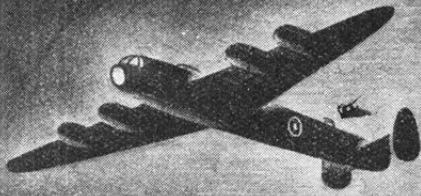
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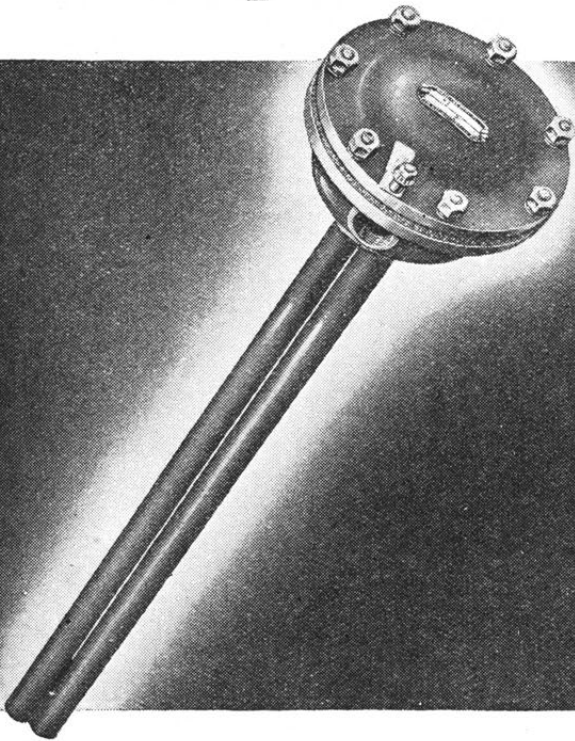
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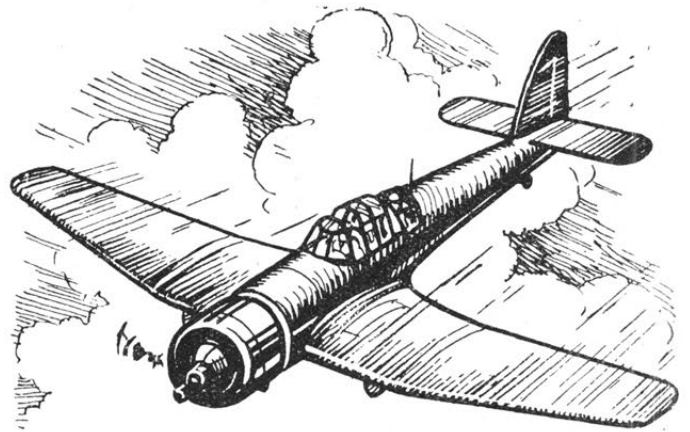


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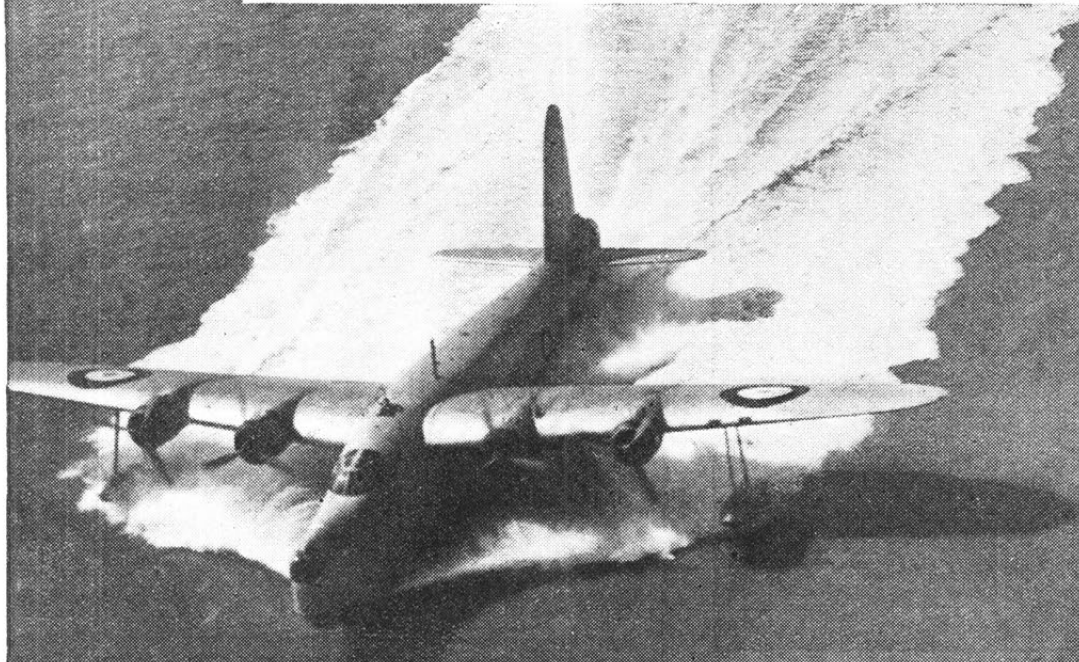
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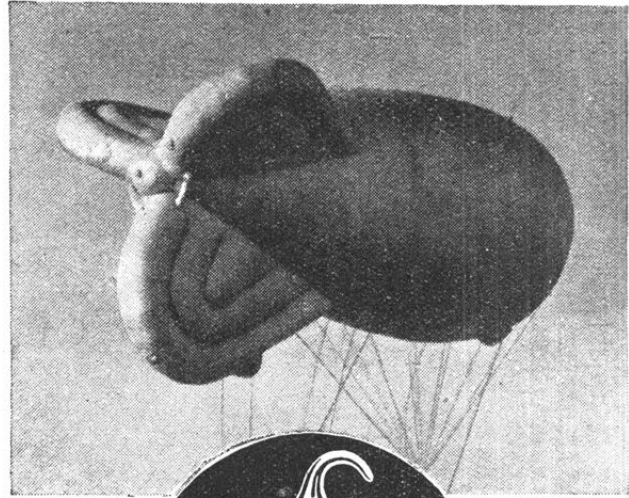
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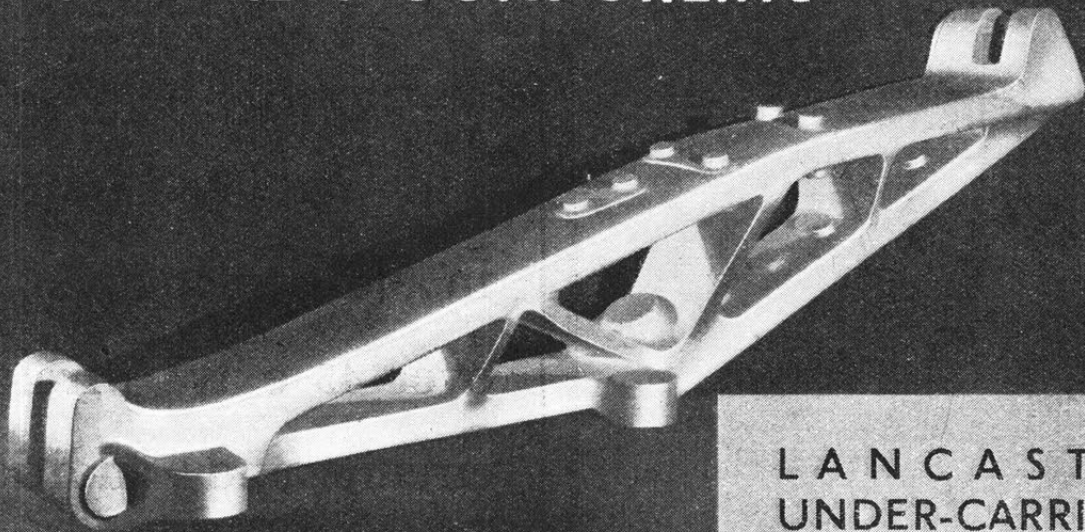
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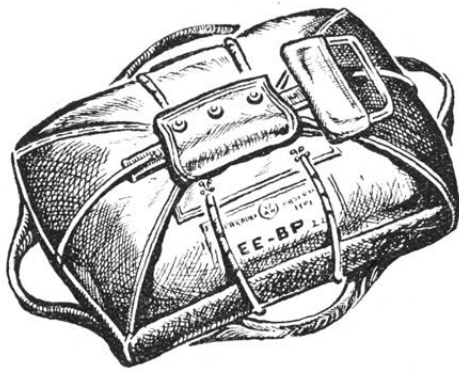
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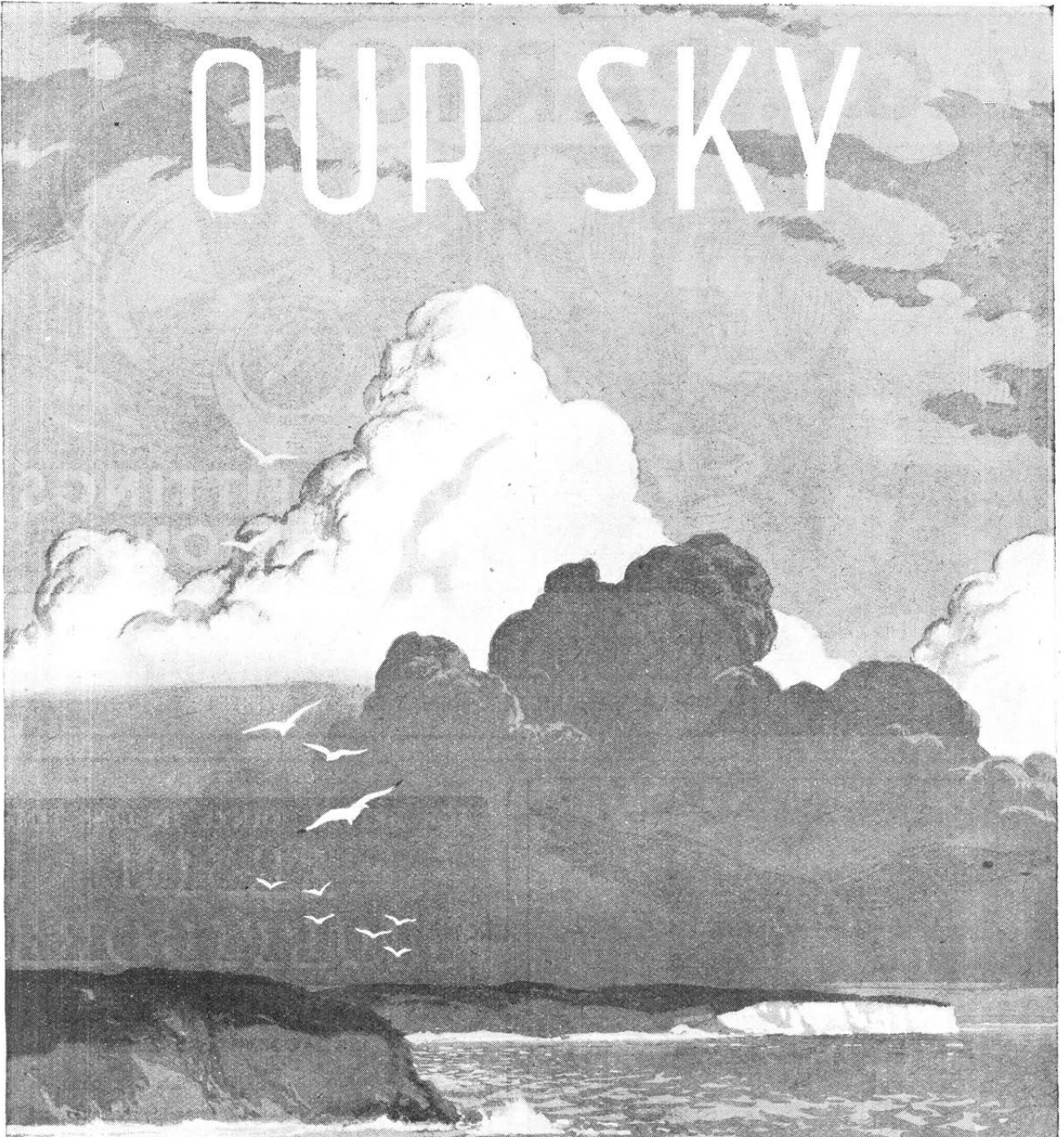
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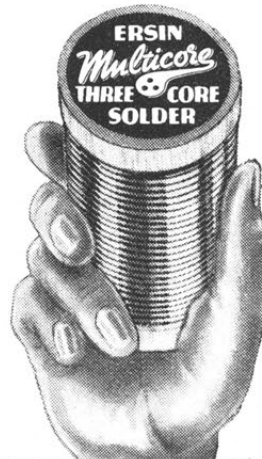
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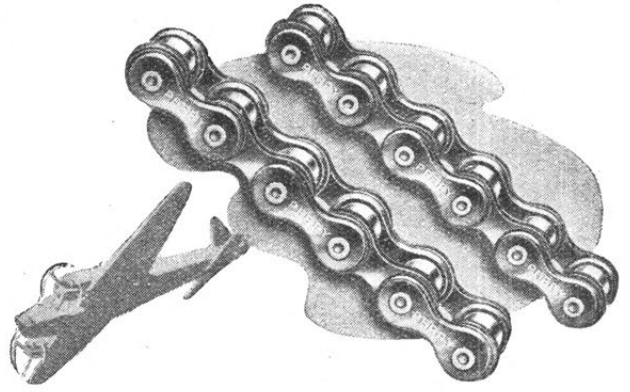
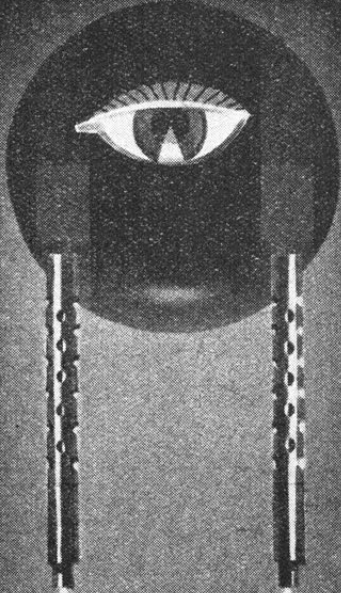
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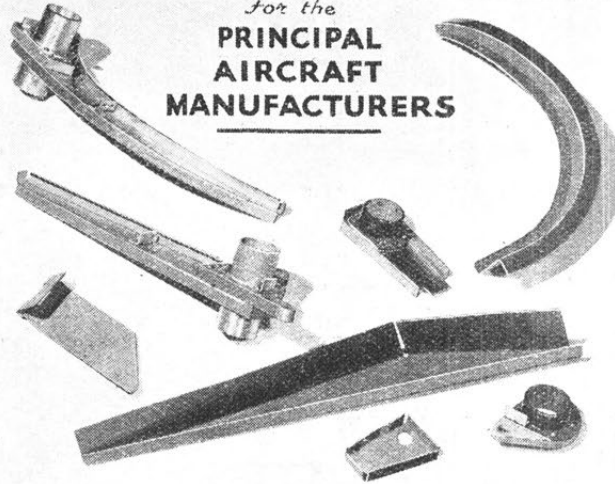
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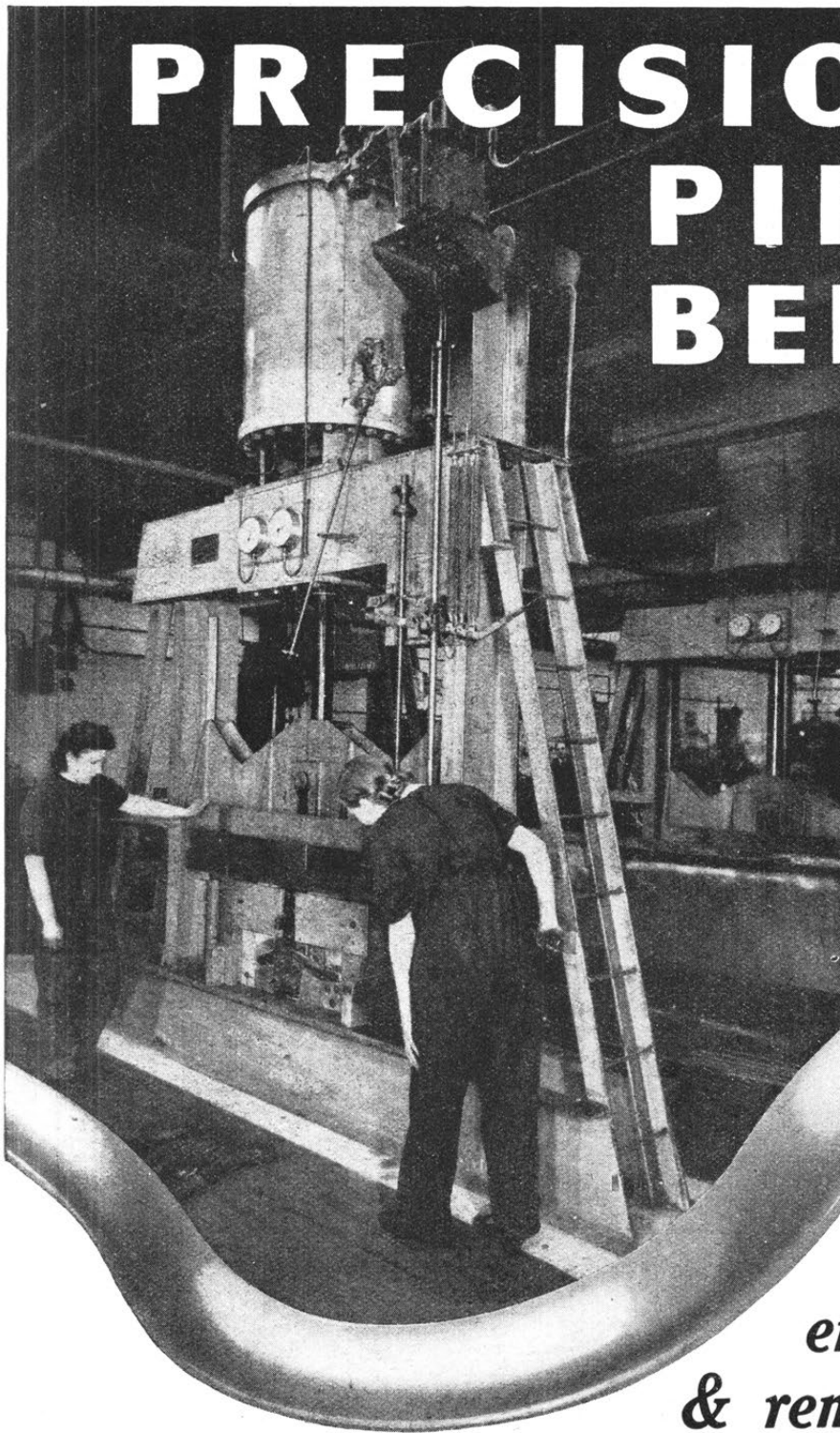


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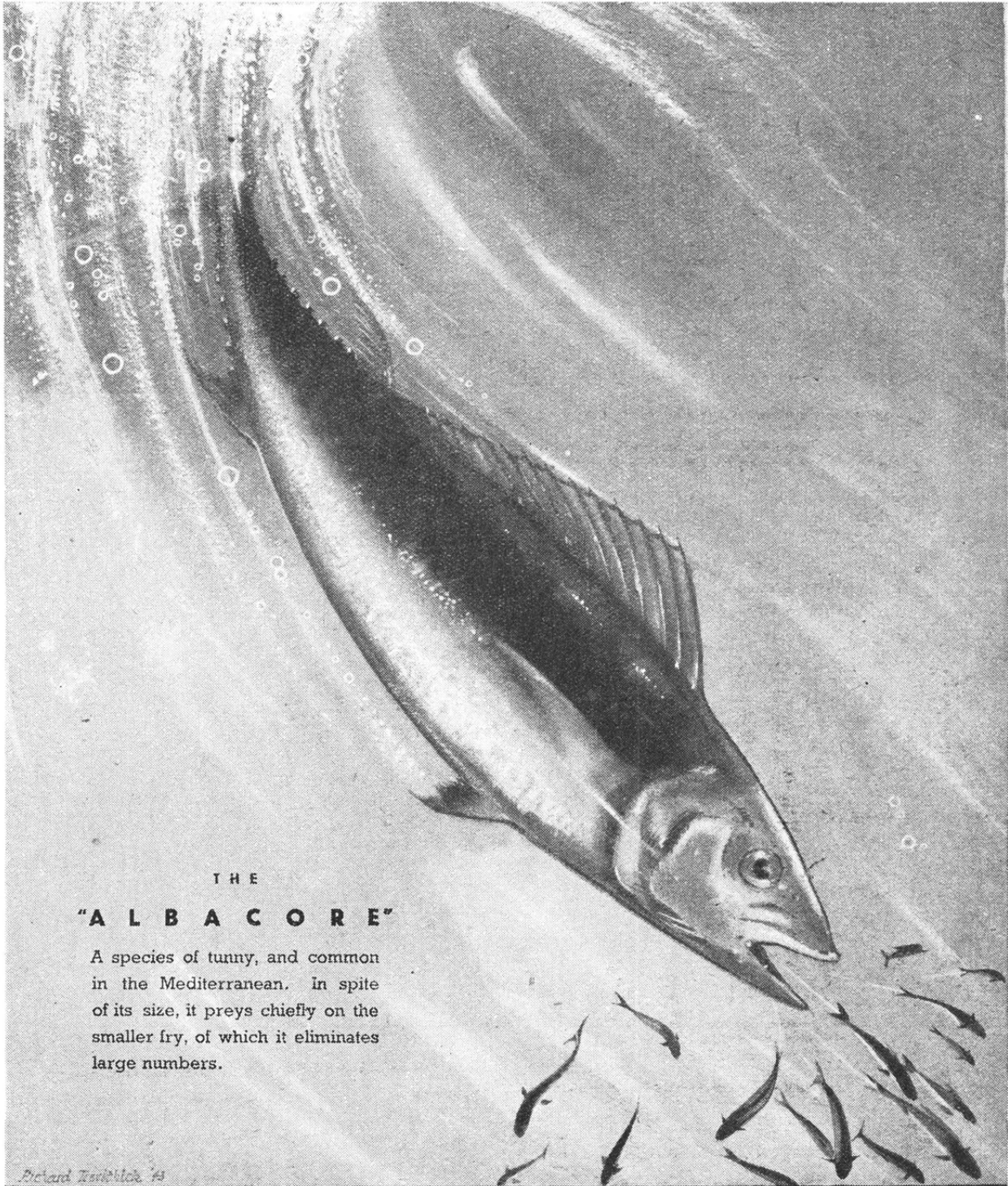
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March 23rd, 1944.

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## The Outlook

### The Hard Nut of Cassino

THE Mediterranean Air Force (excepting the separate body in the Middle East) used nearly its whole strength, tactical and strategic, on March 15th against the German strong point in the ruins of Cassino. The Allied infantry were withdrawn beforehand from the parts of the village where they had installed themselves, and the bombing went on from 8.30 a.m. until noon. It was intended to pulverise the remaining buildings in which the Germans had established strong defence points. As the last of the bombers cleared off at noon the Allied artillery opened up, and the infantry advanced once more.

This action shows that a break in the rains had occurred and had made extensive air action possible. It also gives a key to the ideas of General Alexander about the tactics to be used in the Apennines. It is generally admitted that in mountainous country bombing is less effective than it is over plains, and Kesselring has confirmed this view by reducing air action to a minimum (in accordance with general German policy in 1944), yet at the same time contriving to hold up the Allies in spite of their pronounced air superiority.

The German positions in the mountains have been assailed by infantry supported by artillery fire, and those tactics, too, have failed to dislodge the Germans. Bad weather, of course, has been a greater handicap to the attackers, who must of necessity move, than it has to the defenders, who could remain still.

General Alexander, therefore, took advantage of better flying weather to try if bombing could succeed where artillery and infantry had failed. According to what experience has hitherto taught, this move was unorthodox; but a resourceful General will vary the use of his arms and weapons as changing situations demand. Only an inelastic mind would conclude that because mountains

usually handicap the bombers therefore they can never be used with success—and General Alexander is anything but a hide-bound commander. In fact, it has been stated in Washington that this air attack had been planned for at least a fortnight before, but had been held up by bad weather.

### The Seven Brabazons

OUT of the excessive verbiage which sprouted from the fertile soil of the second debate on the Air Estimates the one solid fact which appears to stand out is Sir Archibald Sinclair's statement about the seven types of civil aircraft recommended by the Brabazon Committee and accepted by the Air Minister.

From Sir Archibald Sinclair's figures of gross weights it is obvious that the types recommended by the Brabazon Committee (or perhaps one should say Committees, since there have been two, the second of which is still sitting) cover an extremely wide range. Lord Beaverbrook recently quoted "more than 100 tons" for the Brabazon 1. At the lower end of the scale Sir Archibald quoted a modest 8,000 lb. In between these extremes there is a whole series of steps which, for convenience, may be referred to for identification purposes by their "Brabazon Numbers."

On this basis the huge Bristol 100-tonner has already been named Brabazon 1. Brabazon 2 is to be a land-plane of 100,000 lb. gross weight, capable of making the Atlantic flight with one stop at Newfoundland. Brabazon 3 was described by the Air Minister as slightly smaller than Brabazon 2, and of a gross weight of about 70,000 lb. This is evidently the Avro Tudor 32-tonner referred to by Lord Beaverbrook, who quoted for it a cruising speed of 220 m.p.h.

In connection with Brabazon 3 there appears to be some uncertainty as to details. Sir Archibald Sinclair

said it has a more capacious body than Brabazon 2, but Lord Beaverbrook gave the number of passengers to be carried as twelve, describing the journey over the North Atlantic as "an easy flight." If the 12-passenger body of the Tudor is "more capacious" than that of the much heavier Brabazon 2, that of the latter must be very small, a fact which tends to make one wonder if by any chance it should be a mailplane. But Sir Archibald's statement that "like the Bristol machine it will have a pressure cabin" rather discounts that idea. The explanation may, of course, be that it is the 100,000 lb. Brabazon 2 which is the Tudor, and that the design weight has gone up in the meantime from the 32 tons mentioned by Lord Beaverbrook.

The remaining three types mentioned by the Air Minister were a 30-passenger twin-engined landplane of 40,000 lb. gross weight for European services. This, retaining the system of identification, is then the Brabazon 4. Brabazon 5 is to be a jet-propelled civil type of which no gross weight was quoted. Brabazon 6 is to be a 14-seater for which the specification has not yet been drawn up, and Brabazon 7 is a little eight-passenger twin-engined machine of 8,000 lb. weight.

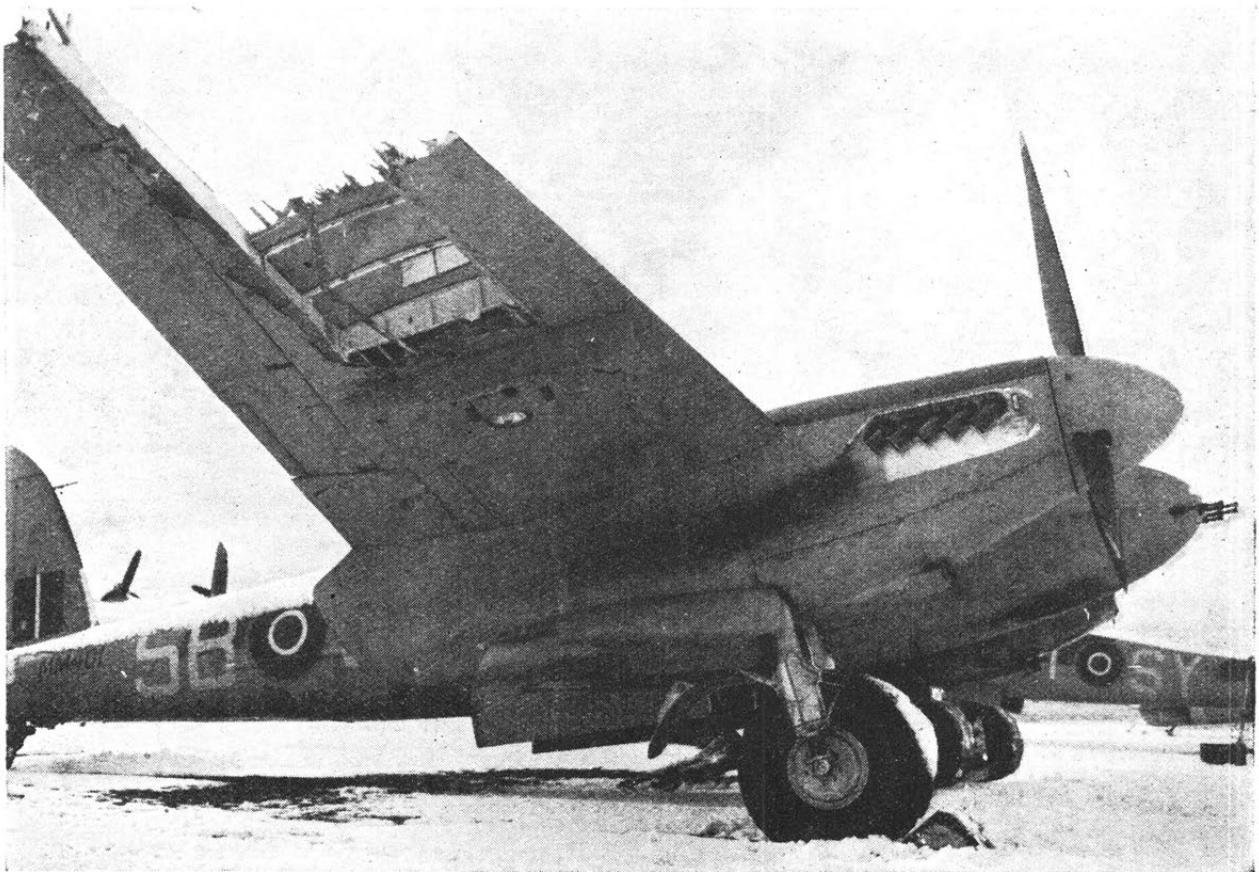
The reason for the secrecy maintained concerning the firms which have been entrusted with some of the civil types is somewhat puzzling. Bristols and Avros have figured in the recent statements, and at the time of the first Brabazon Committee other firms, such as De Havilland and Handley Page, were mentioned. The general impression was that the Handley Page Halifax was to have a civil version; yet in referring to this firm in the House last week Sir Archibald used the expression "a military transport version of the Halifax bomber will be readily convertible to civil operations."

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It is an interesting fact, and one which we welcome, that four of the seven types are to have pressure cabins. We are by no means certain that this aid to travel comfort ought not also to have been applied to some of the smaller types. The jet-propelled type will certainly require it, and even the Brabazon 6 "for use on feeder lines in the Colonies and in other overseas countries" might benefit, in some countries at least.

There will be dissatisfaction in many quarters with the fact that evidently no provision has been made for a flying-boat type. Sir Archibald Sinclair conveyed the impression that this aspect is considered covered by the Sunderland, saying that this type "has already proved its worth as a transport in the hands of B.O.A.C." If those who direct our post-war policy think that a converted Sunderland will meet our needs, the outlook is glum indeed. A new design in the heavy class should be included.



**THE NELSON TOUCH:** A Mosquito which arrived back at base on one wing, one engine and one wheel, after being badly shot up over enemy territory. The landing speed was in the region of 150 m.p.h.



Wrecked Axis aircraft (Junkers 88s) used as windbreaks to prevent tents being blown down on an Italian airfield.

## WAR in the AIR

### Russian Ideas on Bombing : 1,000 R.A.F. Heavies Over Germany : The Air Arm Tackles Cassino

**I**N accounts of the recent magnificent series of Russian victories some inklings have appeared of the part played by the air. Marshal Stalin in one of his Orders of the Day has mentioned air formations as having distinguished themselves. Marshal Konev, who finally destroyed the German 8th Army at Korsun, is reputed to be extremely skilful in co-ordinating the weapons at his disposal, and as being particularly skilful in the use of Stormoviks, which he calls his "flying tanks." Berlin has announced a recent attack on Feodosia in the Crimea by 80 bombers and much Russian air activity round Odessa, while far away to the north the Russian air arm has been very active against towns in Estonia, and in particular the Capital, Tallinn, which is said to have been hard hit.

Strategic bombing is not an aspect of warfare with which the Russians have much concerned themselves. To them aircraft are just one arm of the Army, mainly to be used as long-range artillery to disrupt the back areas of the German communications, but also as field artillery over the battlefield. In this conception they have followed German ideas rather than those of Britain and the United States, and that, no doubt, is why Stalin always speaks of the great bomber offensive in the West in terms of very moderate satisfaction.

However, he must appreciate the effect of our bombing on the output

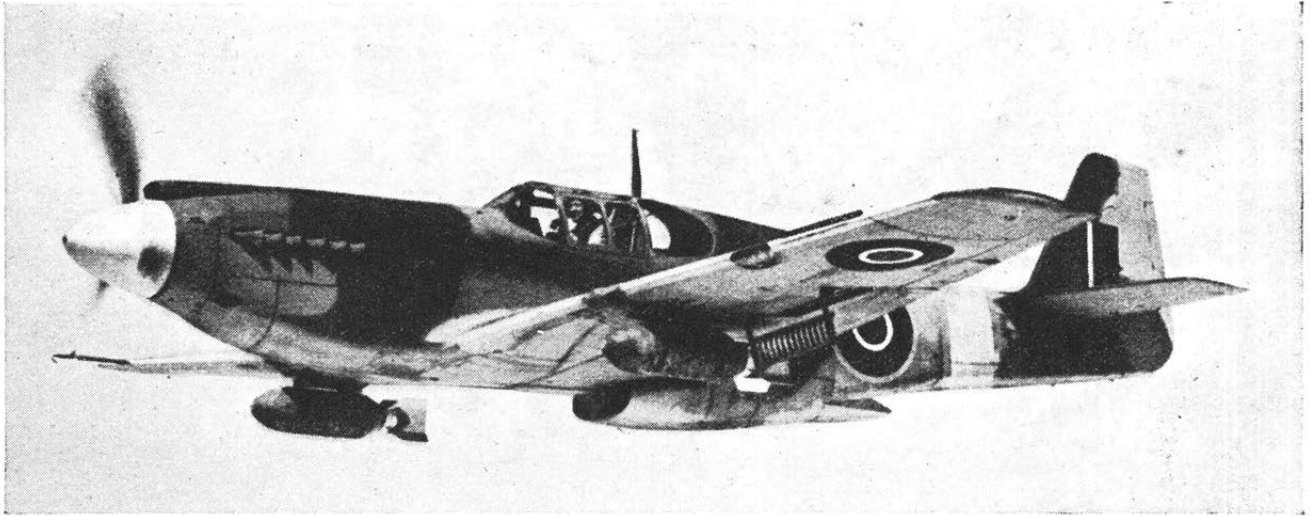
of such weapons as tanks. Lately the Russians captured 500 German tanks in one of their great victories. That was a heavy blow to the Germans, but at one time they would have been able to replace their losses before very long. But of late this has not been so easy. The output of tanks from the factories has been worrying the Germans, and the priority lately given to the production of locomotives has been altered

into one given to the manufacture of tanks. The German tanks, which once, in collaboration with the Stukas, lorded it over the battlefields, have now fallen on evil times. They have been hit in action and in their nests.

No Briton likes to think of enemy civilians being killed by Allied bombing raids; but as such things must inevitably happen, there are few civilians for whom less regret will be



**KNIGHTS ERRANT:** Beaufighters raking escort vessels with cannon fire during an attack on an enemy convoy off the Dutch coast.



## WAR IN THE AIR

**ATTACK BOMBER :** The dive-bomber version of the N.A. Mustang known as the A.36. It carries a 500lb. bomb under each wing and diving brakes on both upper and lower wing surfaces. The engine is a liquid-cooled Allison.

felt than Virginio Gayda, the mouth-piece of Mussolini, who was killed in a recent raid in Italy. The saying that the pen is mightier than the sword is open to much argument, but certainly few pens have been more poisonous than that with which Signor Gayda used to malign Britain and France in his paper, the *Giornale d'Italia*.

For the first fortnight in March the *Luftwaffe* left Britain alone. This quiet period could not be attributed to its loss of 83 aircraft in the 16 raids they had made in February, but to the fact that the moon was waxing. When the moon was past the full the attacks were resumed in the early hours before moonrise. The raiders, no doubt, belonged to the force which has been gathered together in the West to meet the coming invasion. These raids keep the crews in flying training as well as serving propaganda

purposes. They are still sharply in contrast with the unwillingness of the *Luftwaffe* to send up fighters to meet any but the most serious daylight raids by the Americans.

One wonders why there has been no second air attack on the Ploesti oil-fields. The Germans are known to have been feverishly at work repairing the damage done by the one raid. It may be that before long the advancing Russian armies will arrive within raiding distance of Rumania; but, as was mentioned above, the Russians are not experts at that sort of bombing, and it would take the experience and skill of British or American crews to do much damage at Ploesti.

### Pulverising Cassino

**L**AST week the Mediterranean Air Force was turned on to Cassino, and for three and a half hours all

available bombers, including the heavies of the American 15th Air Force, let loose their loads on the village, from which Allied infantry had previously been withdrawn. Mr. Stimson, the American Secretary for War, has stated that this attack would have been made at least a fortnight earlier, but bad weather had held it up. The place was reduced to heaps of rubble, and when the last aircraft had done their job the artillery opened up to catch the Germans who had scattered during the bombardment, and the infantry went forward once more.

The Germans must have suffered heavy losses from this concentrated bombing effort, but with that doggedness which is one of the few German characteristics which we can admire they immediately started to reorganise defence of the heaps of rubble. The Allies sent forward tanks, but they could not force their way through the heaps of fallen masonry until sappers had cleared a way for them.

Some of the squadrons of the Mediterranean Air Force get very little rest, and early in the morning of March 16th the night-bombing Wellingtons paid another visit to the railway junctions at Sofia. This was the sixth attack on the Capital of Bulgaria, and almost fantastic stories have been told of the dismay caused there. Some officials are said to have fled and hidden themselves so thoroughly that they cannot be found.

### 1,000 Heavies

**G**ERMANY has been allowed no respite. On March 15th the U.S. 8th Air Force raided Brunswick by day, and met with hardly any opposition from the overworked German fighters. Next day the Americans were out again, attacking Augsburg and Ulm, and this time the German fighter pilots resisted fiercely. The Americans lost 22 bombers and 13 fighters, but they shot down a substantial number of the

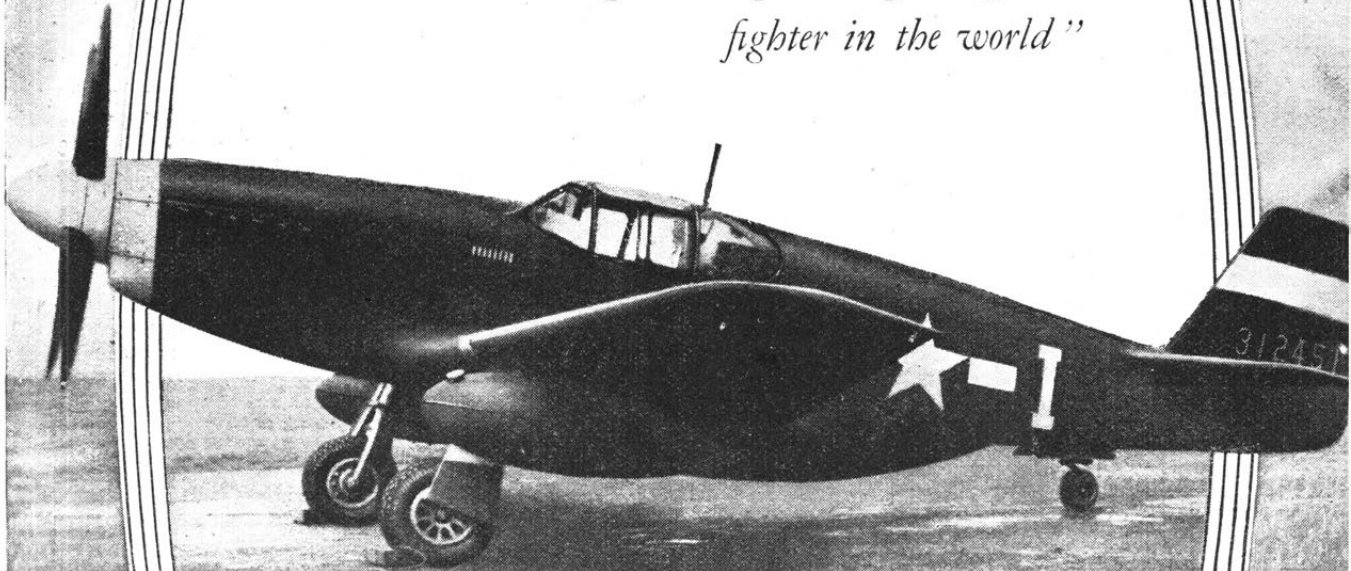


**BOGGED DOWN :** A waterlogged airfield near Algiers. The impression that North Africa has blazing sunshine in both summer and winter is quite wrong.



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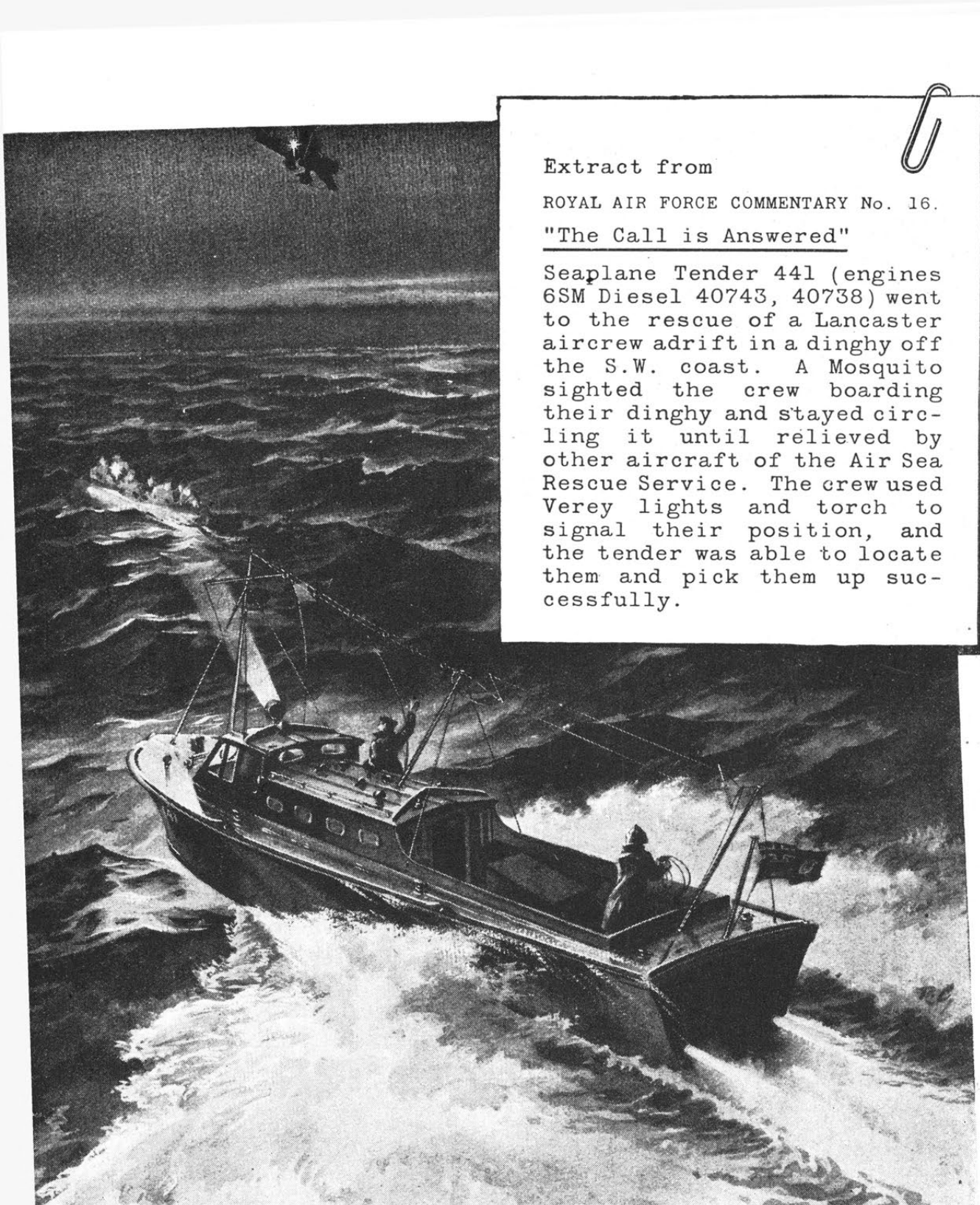
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14	0	0	0	1
15	0	43	6	6
16	0	22	14	4
17	0	0	8	11
18	0	46	10	12
	0	116	39	40
Totals : West, 10,537 ; Middle East, about 2,387 ; N.W. Africa and Italy, 1,826.				

enemy. One American fighter pilot escaped when his machine was shot down, and several of the bombers came down on Swiss territory.

In the night between these two day raids the R.A.F. set up a new record. No less than 1,000 heavy bombers were sent over Germany, with Stuttgart as the principal target. Over 3,000 tons of bombs were dropped in the course of the night. Less than four per cent. of our bombers were lost.

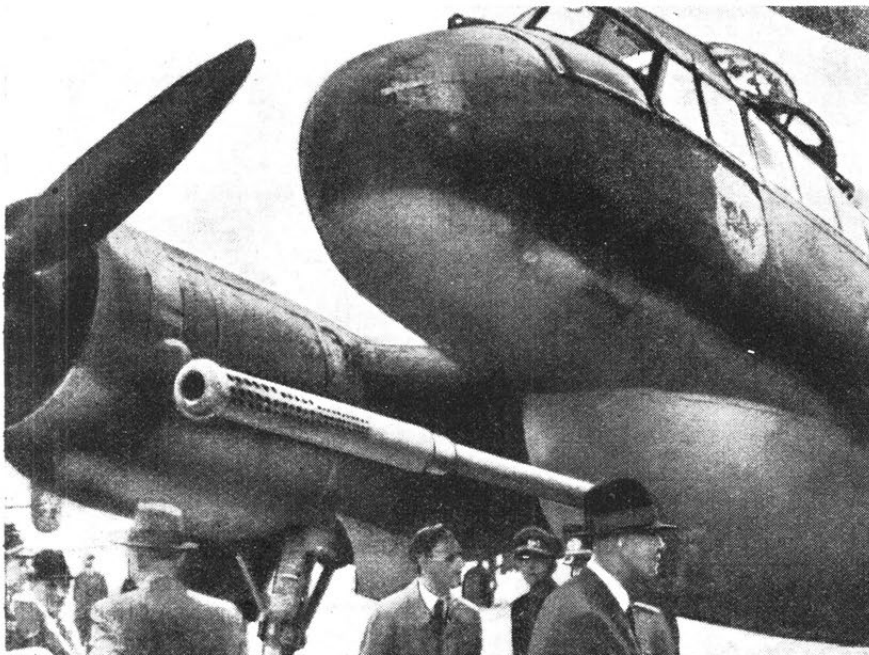
This raid naturally invites comparison with the raid by 1,000 machines on Cologne, in 1942, but then many of

ENEMY AIR LOSSES TO MAR. 18th				
	Over G.B.	Continent	Middle East	Italy
Mar. 12	0	0	0	1
13	0	0	2	3
14	12	2	0	4
15	0	6	0	1
16	0	6	0	3
17	0	0	0	9
18	0	0	0	56
	12	14	2	77
Totals : West, 8,079 ; Middle East, over 5,845 ; N.W. Africa and Italy, 4,781.				

the machines were Wellingtons and Whitleys, two-engined bombers now ranked as in the medium class. Moreover, some hundreds of them were training aircraft drawn with their crews from Operational Training Units, Heavy Conversion Units, and from Army Co-operation Command. Their crews were pupils who had not been out on operations before. The raid last week was made entirely by four-engined heavies with experienced crews.

Great interest has been aroused by the news that a body of air-borne troops has been landed over 100 miles behind the Japanese lines in Burma. The whole Burma front is lively, and both sides seem to be in aggressive mood.

As yet there is little experience available to any staff about the proper employment of air-borne troops, and this must be acquired by the old method of trial and error. But certainly the first desideratum is surprise, and this has been achieved in Burma according to the reports. The object seems to be to cut the communications of the Japanese 18th Division. It was an enterprise full of initiative and daring and the staff work was most thorough.



**TANK BUSTER :** A Junkers 88 fitted with a high-velocity cannon in a streamlined casing below the fuselage. The cannon appears to be of 37mm. or 40mm. calibre.

# HERE AND THERE

## R.A.F. Appointment

AIR VICE-MARSHAL HUGH HENRY MACLEOD FRAZER, C.B., has been appointed Director-General of Repair and Maintenance at M.A.P.

## Royal Air Force Club

THE annual general meeting of the Royal Air Force Club will take place at 6.30 p.m. on Thursday, March 30th, 1944.

## "One More River to Cross"

AN Egyptian company is to open a direct airline service between Damascus and Cairo as a result of negotiations between Syria and Egypt.

## Syrian "Hendon"

MASS demonstrations of aerobatics and parachute descents were recently staged by the R.A.F. in a three-day air pageant at Damascus, under the patronage of the President of the Syrian Republic, M. Shukri Kouatly.

## Multum in Parvo

IT was announced by Rio de Janeiro radio that a Brazilian squadron of airmen under the command of Major Bora has recently embarked for Europe, where it will go into action with the Allies.

## Shannon Airport

THE sum of £400,000 for the development of the Shannon Airport at Foynes, on which it is proposed to spend altogether £1,792,000, figures in the list of items in Ire's supply services for 1944-45.

## Martian Record

MARS has broken another record. The huge transport landed recently at San Francisco carrying 800,000 letters, weighing 23,846 lb.—the largest mail load yet shipped by air from the Pacific. Besides the mail, the ship carried more than half a ton of war materials.

## Blimps to the Rescue

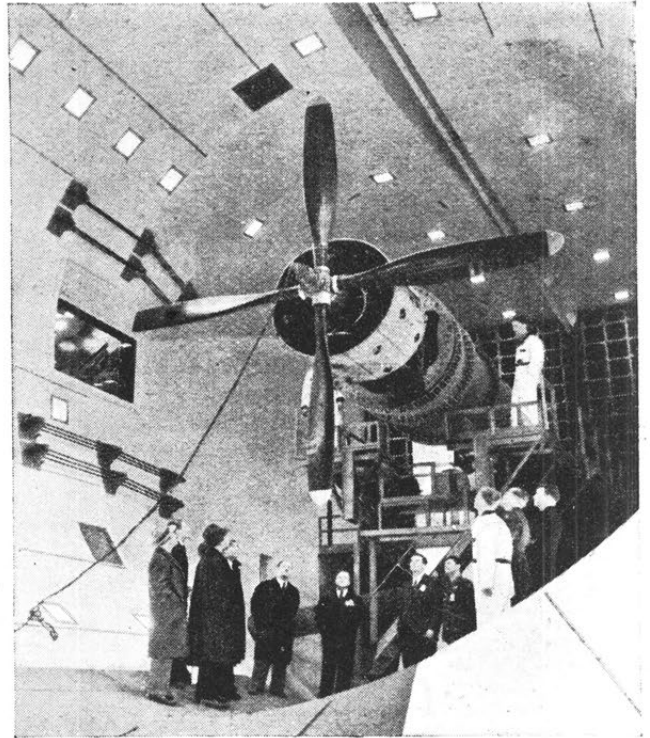
U.S. Navy "blimps" operating from Rio de Janeiro, have rescued over 500 American airmen forced down in the forests of the Amazon and the deserts

**DRAUGHT BOARD:** A 16ft. 8in. electric air-screw mounted for type test in a new U.S. testing chamber. The engine is a 2,200 h.p. unit, and the strain-gauge "pineapple" can be seen on the hub.

of North-Eastern and Central Brazil, it has been reported by Reuter.

In every case the blimps located the lost airman, landed, picked him up, and flew off again.

Once, Lieut. J. G. Dougherty baled out of his blimp and with the help of the man on the ground, pulled it in to land, a task usually done by a ground crew of 50.



## To Help Brazilian Pilots

FLT. LT. Walter Prettyman, R.A.F., will accompany Brazilian Air Force pilots who are members of the Brazilian Air Mission to this country when they return to Brazil, Rio de Janeiro Radio, quoted by Reuter, has announced.

He will help the Brazilian officers to draft their reports on their visit to Britain.

## Speed of the Mustang

THE U.S. War Department has "permitted the disclosure" that the P-51 Mustang fighter is "the world's fastest aircraft with a level flight speed of more than 425 miles an hour.

"It has a tactical radius of action well over 500 miles. With a four-blade airscrew and a Packard-built Rolls-Royce Merlin engine it can attain a height of 40,000 feet."

## Blazing the Trail

SIR PHILIP HALDIN, chairman and joint managing director of the Lamport and Holt Shipping Line, told the annual meeting the other day that the group of five shipping companies, of which Lamport and Holt is one, hoped before long to blaze the trail of air transport to South America.

"What we have an especial interest in is the carrying of post office mail and the highest class of fine goods, and in our view it will be that form of carriage by air from which we ourselves shall probably benefit the most."

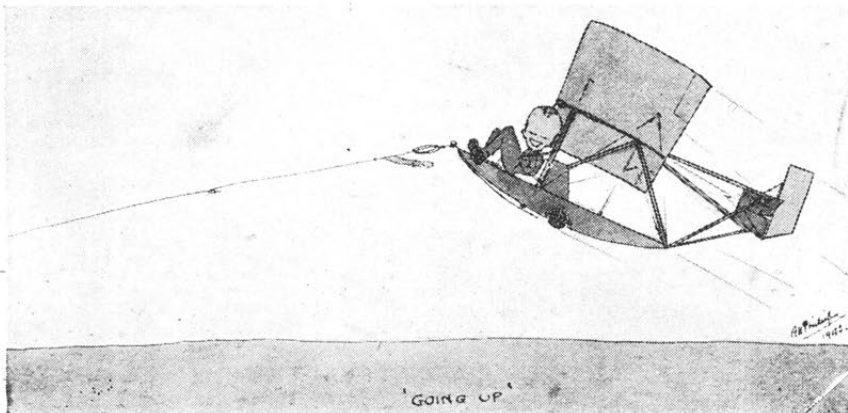
## Only One Refusal

TEN airline companies have, up to the time of writing, accepted the invitation of North-Eastern Airways, Ltd., to attend a meeting in London in May. They are: Wrightways, Ltd., Air Dispatch, Ltd., Portsmouth Aviation, Ltd., Det Norske Luftfartsselskap, Ceskoslovenska Statni Aeroline, Ceskoslovenska Letecka Spolecnost, Det Danske Luftfartsselskap, American Export Airlines, Inc., S.A.B.E.N.A., and Air France.

Contrary to a recent announcement in a contemporary journal intimating that the majority of the airlines invited had refused, North-Eastern says it has so far had only one refusal, namely, from B.O.A.C., who say that the moment is not opportune for discussions of this nature.

## Appointment

MR. D. McVEY, the Australian Postal Director, has been appointed Director-General of Civil Aviation in succession to Mr. A. B. Corbett, who is retiring. In making this announcement, Mr. A. S. Drakeford, the Commonwealth



# Q. How is the energy contained in the fuel accounted for by the aircraft?

**A.** Propulsion and lift are obtained by setting masses of air in motion with propeller and wing as explained in articles Nos. 11 and 8 ("Propulsion" and "Induced Drag"). The energy necessary is, of course, in the fuel, and the object of this note is to see how this is spent. A large amount is wasted, but the demarcation between waste and use is partly a matter of defining what is "useful." It might be performance in a fighter, or the transport of bombs in a bomber. In what follows the expenditure of fuel energy is divided up to show what is happening at a cruising speed of 210 m.p.h. at 11,000 feet on an actual pre-war civil transport aeroplane of good efficiency.

It may be as well to repeat here that any commotion or movement in the air after the passage of an aeroplane represents work done by the fuel but lost to the aeroplane. It is also the fact that if there were no such movement the aeroplane would have been flying without using energy or fuel—a drag-less aeroplane, which is, of course, absurd. Since propulsion and lift are obtained by thrusting against air and thereby setting it in motion, these particular motions and the lost energy contained in them may be regarded as not only necessary but also useful. The movements left in the air may thus be divided into those which have produced thrust and lift and the eddies and sideshows which are by-products of them and are wholly wasteful, such as skin friction, noise and heat.

There are three stages :—

- (1) Conversion of chemical energy in the fuel into mechanical power by the engine.
- (2) Transformation of this power by the propeller into a column of air moving backwards and thereby giving forward thrust.
- (3) Downward deflection by the wings of another mass of air, the thrust from which sustains the aeroplane.

Each of these operations is necessary for flight. Each is accompanied by losses, however, and these are wasteful. The engine converts some of the fuel energy into B.H.P. to drive the propeller. The rest it discards in its exhaust and cooling air to warm up the atmosphere needlessly. The factors governing the efficiency of the engine are not dealt with here.

If the propeller (the diameter of which fixes the amount of air engaged) were to push the air back without loss, a known amount of energy would be used to push it back fast enough to get the thrust. This amount is considered the *useful* part of the propeller's work, and the eddies, noise, rotation and non-uniformities of the slip are taken as losses.

Similarly with the wing. Its function being to deflect a mass of air downwards to get the lift (incurring "Induced

Drag"), the overcoming of this induced drag is considered the only useful work done by it. All the eddies, skin friction, etc., which it makes while doing this job are losses.

(It must be remembered [see articles Nos. 8 and 11] that the amounts of work which have to be done to perform the functions of propulsion and lift can be diminished by increasing propeller diameter and wing span. This, however, leads to increased weight and friction, the final arrangement being a compromise.)

The quantities involved can now be examined. It is assumed that a quantity of fuel containing 100 horse-power-hours (about 1.8 imperial gallons) of energy has to be accounted for. These will be referred to as "units."

The engine discards 72 units and drives the propeller with the remaining 28 units.

The propeller spends 4.2 of these 28 units in making eddies and noise, in giving a non-productive rotation to the slip and in projecting it back in blasts rather than uniformly.

It also leaves in the air 0.8 units which represent the minimum work which would have to be done if this propeller could behave perfectly and push back an eddy-free uniform slip stream to create thrust. This last item we have agreed to call useful.

The remaining 23 units are used to propel the aeroplane.

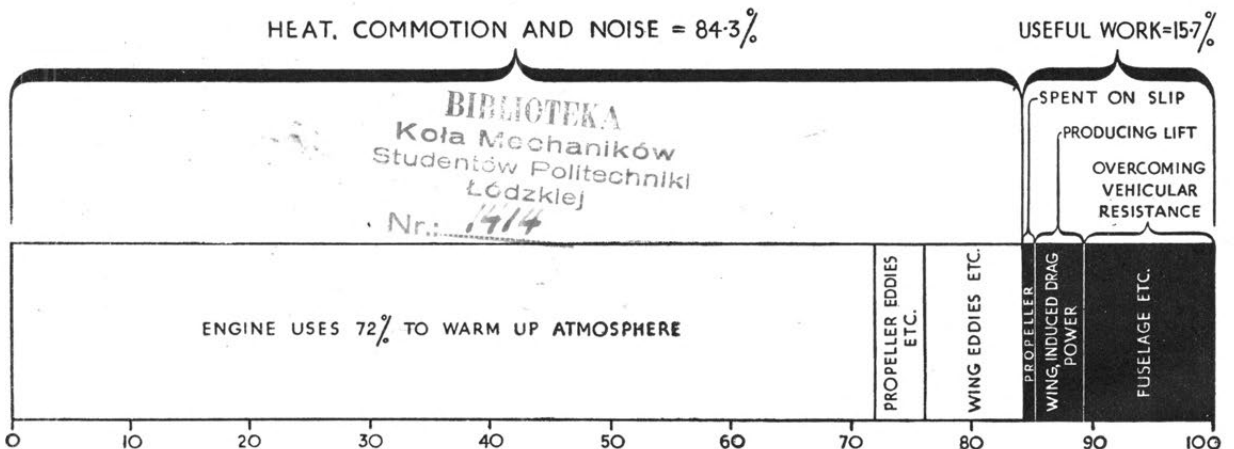
The wing now has to do its job of sustaining the aeroplane by deflecting air downwards. It uses up 8.1 units in making eddies (skin friction, disturbances, etc.) and leaves in the air 4.2 units of usefully circulating air from which the lift is obtained (this being the induced drag power).

There are now left 10.7 units which are usefully employed in propelling the business part of the aeroplane—fuselage, engines, control arrangements, etc.

The total sum is shown graphically in the figure below, from which it will be seen that 15.7 units out of the original 100 are usefully employed. It may be thought arbitrary to count the power used to propel the fuselage, etc., as a credit and the greater part of that used for the wing as a debit. However, the chief object has been to display the expenditures, and so far as their allocation to credit and debit goes, it is a fact that we do not wish to carry a wing about but cannot help it, whereas most of what we do wish to carry is in the fuselage.

Lest the results shown should seem depressing it may be added that the conversion of heat into work is a difficult business and the aero-engine stands high at the present stage of development. So far as the aeroplane goes it at least uses substantially more than it wastes.

There are, of course, many other aspects of this matter besides the cruising of a civil transport aeroplane.

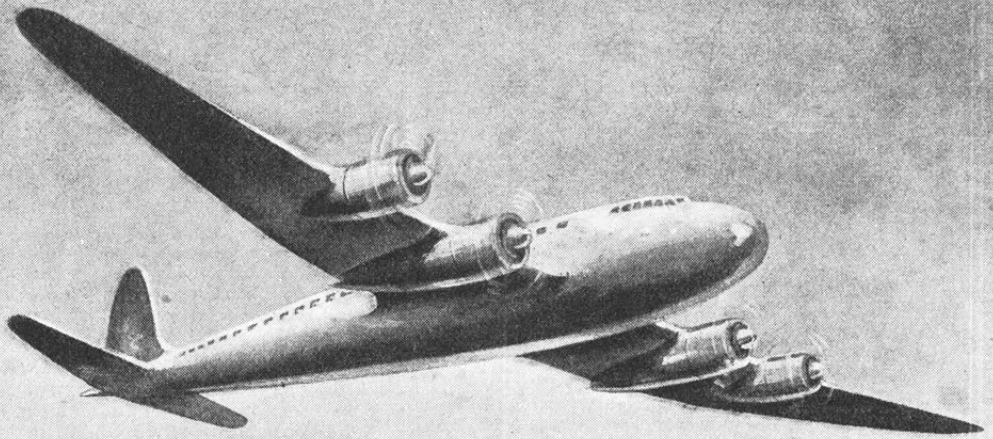
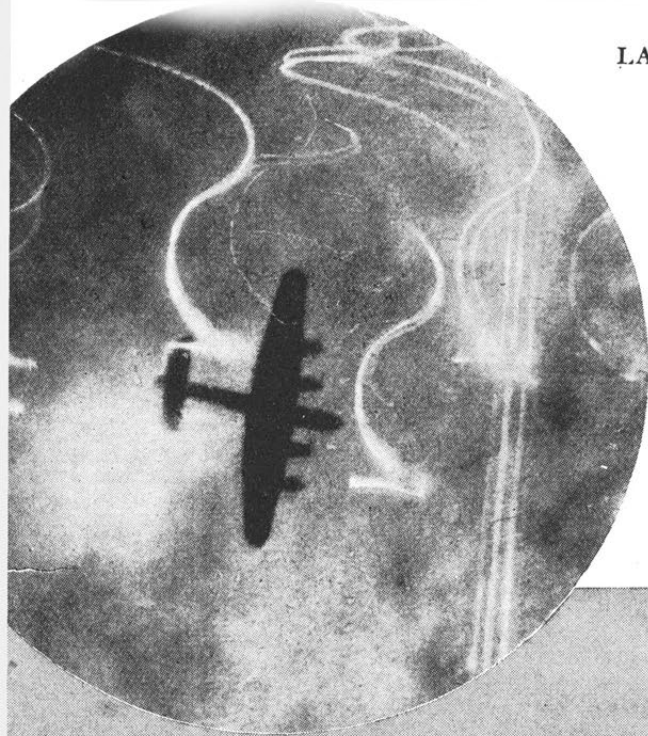


This is one of a series of articles on technicalities sponsored by The de Havilland Aircraft Co., Ltd., in the belief that they will prove of interest and use to students and others in the Services and the aircraft industry.

## LANCASTERS OVER HAMBURG

Lancasters flew through terrible weather to reach Hamburg on the night of January 30th, 1943. There was constant icing. And what a reception when they got there! Here is a photograph of the actual scene, with a Lancaster in action.

# THEY TAKE THE STRAIN IN WAR—



Artist's impression of a Lancaster bomber flying over the Arctic.

*let them carry the load in Peace*

*Superplanes by*

V. ROE & CO., LIMITED  
Branch of Hawker Siddeley Aircraft Co., Ltd.)



HERE AND THERE

Air Minister, said that Mr. McVey would shortly be visiting overseas countries.

**Pilot's Promotion**

HERBERT W. SEAGRIM, formerly chief pilot, Western Division, has been appointed assistant superintendent of flight operations, Trans-Canada Airlines, with headquarters at Winnipeg.

Seagrim was born in Winnipeg in 1912 and began flying at the age of eighteen. He had a great deal of experience as a bush pilot in the Canadian North Country, as a barnstormer and as a test pilot, before joining T.C.A. in 1937. He also holds an air engineer's certificate.

**A New Heinkel**

A TWIN-ENGINE Heinkel night-fighter, the He 219, is reported to be the latest attempt to cope with the "heavies" of Bomber Command. This aircraft, it seems, was originally intended to fulfil the duties of dive bomber, or attack bomber, but the *Luftwaffe* is now much more concerned with defence.

**Pacific Pacemaker**

A TRANSPORT Liberator has set up a new speed record between San Francisco and Honolulu, says Reuter, by flying the 2,100 miles of intervening Pacific Ocean in 9 hr. 27 min. This represents an approximate speed of 328 m.p.h., which suggests a really benevolent tail-wind.

**Alaskan Alternative**

A NEW air route to Alaska from Canada is now being surveyed by the R.C.A.F., Ottawa announces. It will be north and east of the present route from

Edmonton to Whitehorse, used mainly for military aircraft by Canada and the United States.

The new route will use the Mackenzie River airway route of commercial operators, turn east at McPherson, north of the Arctic Circle, and follow one branch of the Porcupine River to Fort Yukon, Alaska.

**Transit Gloria**

THE arrival in Lisbon of the B.O.A.C. clipper from Foynes on Tuesday, March 14th, is held in support of the view that the Eire travel ban will not affect the service between Lisbon and Great Britain, despite the fact that Foynes is an intermediate stage.

Passengers on the route are granted only Irish transit visas, and although occasionally they are required to wait a day or two in hotels appointed by B.O.A.C., travellers are barred from staying in Eire on their own.

**Fewer Schools, Same Output**

THE Canadian Air Minister, Mr. Charles Power, said recently in Ottawa that twenty-eight Air Training Schools would be closed down before the end of the year, but the production of air-crews during the next year will not suffer due to the closings.

**Naval Buffalo Bill**

IT has been disclosed in Washington that the U.S. Navy has developed a new scout plane which Congressman Maas, Chairman of the Naval Aviation Sub-Committee, claims will "revolutionise aerial reconnaissance from battleships and cruisers."

At the same time the Congressman revealed that the Curtis Wright Aviation Corporation was scheduled for production of the new type, and added that the firm was developing a new dive and torpedo bomber—Happy day!

**MacDuffs All**

THE leadership system which has been so successfully applied to air-gunners and air-bombers is now to be extended to flight-engineers.

The plan incorporates the specialised "post-graduate" training of selected men, who are then reposted to their squadron where they become leaders in their particular field, and, as such, responsible for the knowledge and efficiency of the other air-bombers, air-gunners or flight-engineers, as the case may be. It is reported that most squadrons now have their respective leaders.

**U.K.—Canada in 3½ Hours**

GROUP CAPT. D. F. MACINTYRE, head of Scottish Airways and o/c Prestwick Airport, speaking in Toronto, predicted that jet propulsion and other advances in aviation will make possible trips between Canada and Britain of only three and a half hours' duration.

He stated "we have proof that with jet propulsion and other means we will most definitely have 700 miles per hour in the sub-stratosphere within the next few years."

Group Capt. MacIntyre regretted, however, that everything possible was not being done to spur the development of future air travel, and hoped that "unnecessary conservatism, slowness to plan properly, and monopolistic selfishness would not retard aviation's future."

Unfortunately, this is only too likely to be a vain hope.

**Chilean Jubilee**

IT has just been learned that on December 12th last an interesting 25th anniversary was celebrated in Chile. The "Festivities" were in honour of an historic and aeronautically important flight made by the then Lt. Godoy, of the Chilean Military School of Aviation, who flew, on December 12th, 1918, from Santiago to Mendoza, involving flying over the Andes and the establishment of an altitude record for Chile.

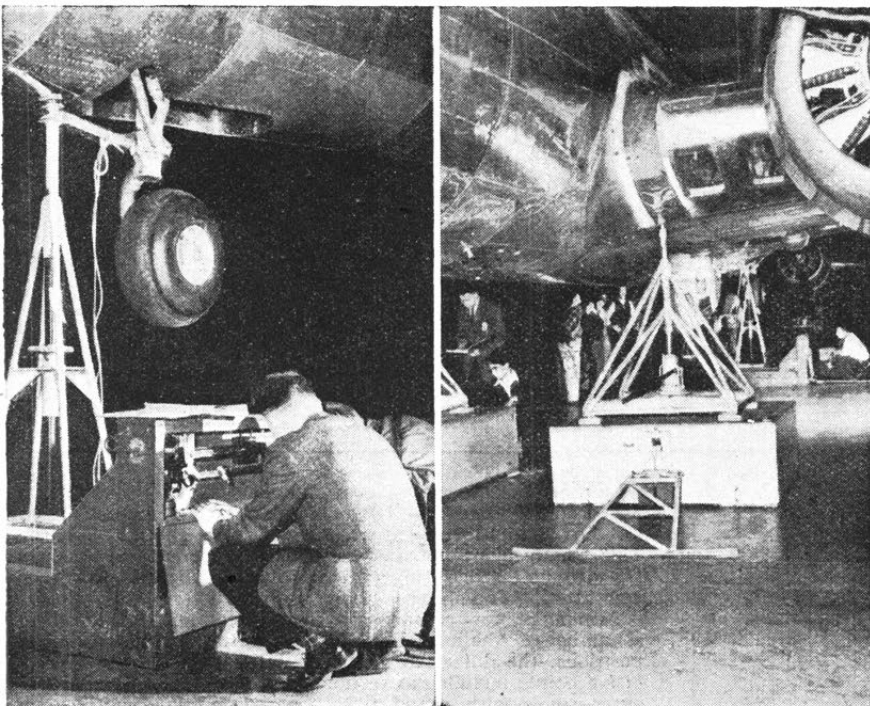
The aircraft used was a Bristol monoplane fighter designed by the late Frank Barnwell. The 12th of December is now named the "Day of the Chilean Air Force" and will be celebrated annually.

Capt. Godoy was present at the 25th anniversary and received gifts from the Bristol Aeroplane Company and the American Panagra Airline.

**Canada Proposes**

CANADIAN authorities have submitted to the State Department in Washington proposals for the formation of an International Air Transport Authority. The proposal includes an authority composed of an assembly, an international air transport board, and regional air transport councils, of which the assembly would consist of representatives of member nations who would elect a president as well as members of the board. *American Aviation* also reports that Canadians have, in addition, presented detailed proposals for the regulation of all phases of air transport.

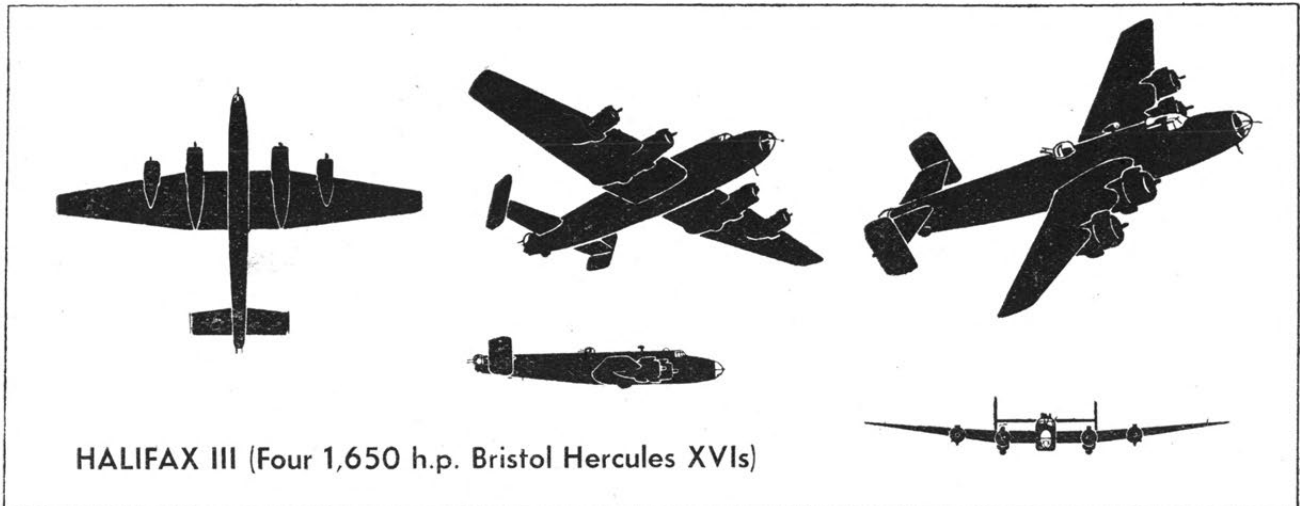
It is not made clear who the Canadian authorities are, nor how far the scope of the proposals extend, but it seems unlikely that the Government of Canada would take a lengthy step in matters of world air transport without prior consultation with the Home Government.



BUT NOT FOUND WANTING: Weighing a Flying Fortress for centre of gravity limit check. The system used is the orthodox one employing three scales at predetermined stations to provide constant lever moments.

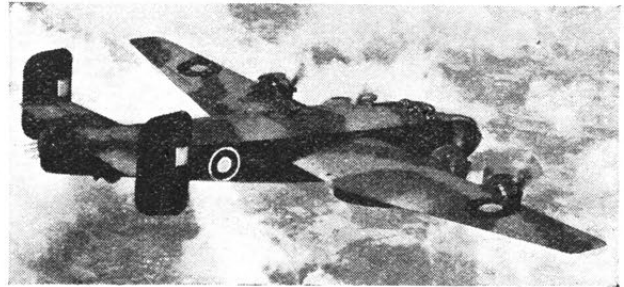
Studies in Recognition

# Aircraft in Flight

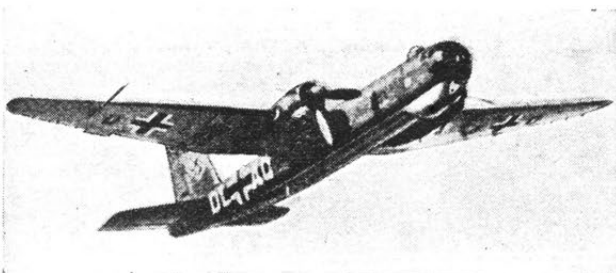
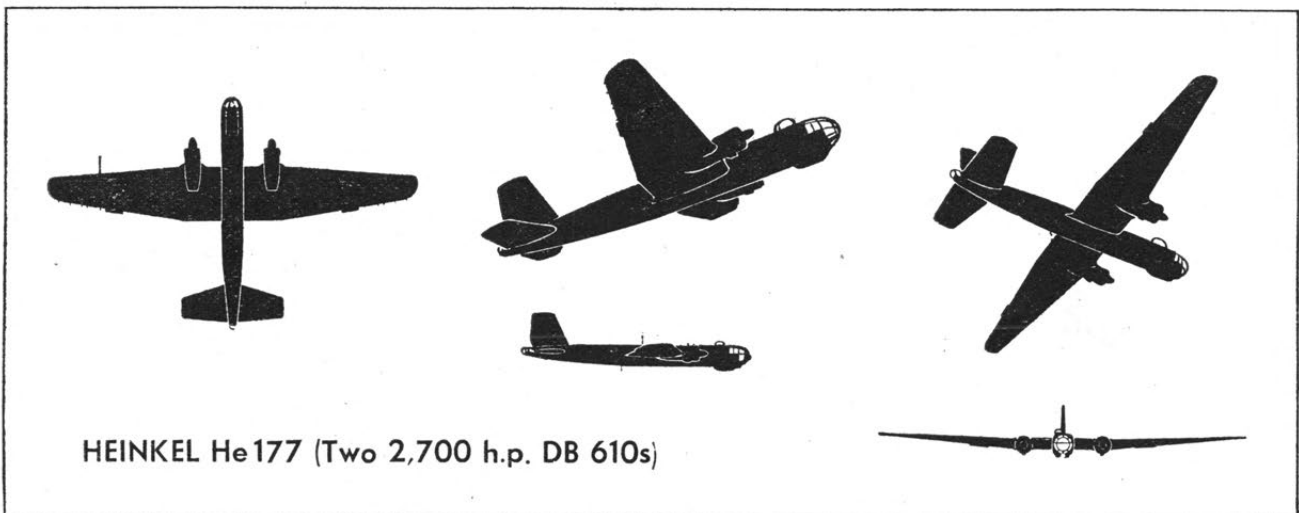


THE most important difference between the Handley Page Halifax III and the previous marks is the fitting of four 1,650 h.p. Bristol Hercules XVI sleeve-valve radial engines instead of in-line 1,280 h.p. Rolls-Royce Merlin XXIIIs.

Another modification embodied in the Halifax III is an increase of wing span by 5ft. The square tips were retained in a number of the first Halifax IIIs to go into service, but the latest versions have rounded tips; both forms of wing tip, therefore, will be seen. The fuselage remains virtually unchanged, having the rounded transparent nose mounting a single Vickers K gun. The rest of the armament consists of four-gun dorsal and tail turrets. The tail unit is also unchanged, having twin vertical trapezoidal fins and rudders. Dimensions: Span 104ft., length 70ft. 1in., height 20ft. 9in., wing area 1,275 sq. ft.



Handley Page Halifax III Heavy Bomber

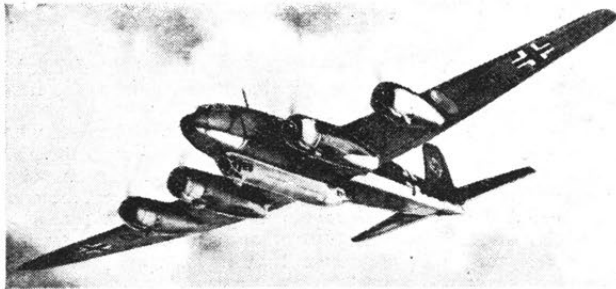
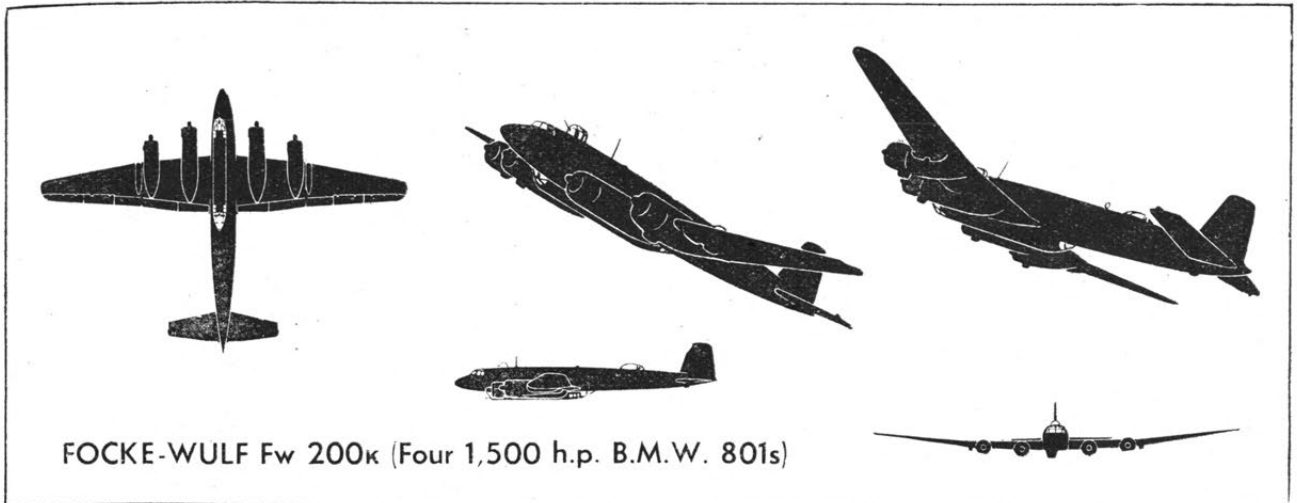


Heinkel He 177 Heavy Bomber

GERMANY'S newest heavy bomber, the Heinkel He 177, originally had two DB 606 units, each composed of two DB 601 engines coupled together behind circular radiators. This arrangement remains the same on current versions, but DB 610 units consisting of two coupled DB 605 engines are now fitted. Top speed is about 300 m.p.h.

Armament now comprises a 20 mm. cannon in the tail and a number of smaller calibre guns in dorsal, lateral and ventral positions, the dorsal turret being well forward. Other recognition points include flat rectangular centre-section and tapered outer-panels with round tips; tapered tailplane with square tips; large, angular, single fin and rudder; long, slab-sided fuselage with blister beneath round transparent nose. Dimensions: Span 103ft. 5in., length 66ft. 6in., height 15ft., wing area 1,000 sq. ft. (approx.).

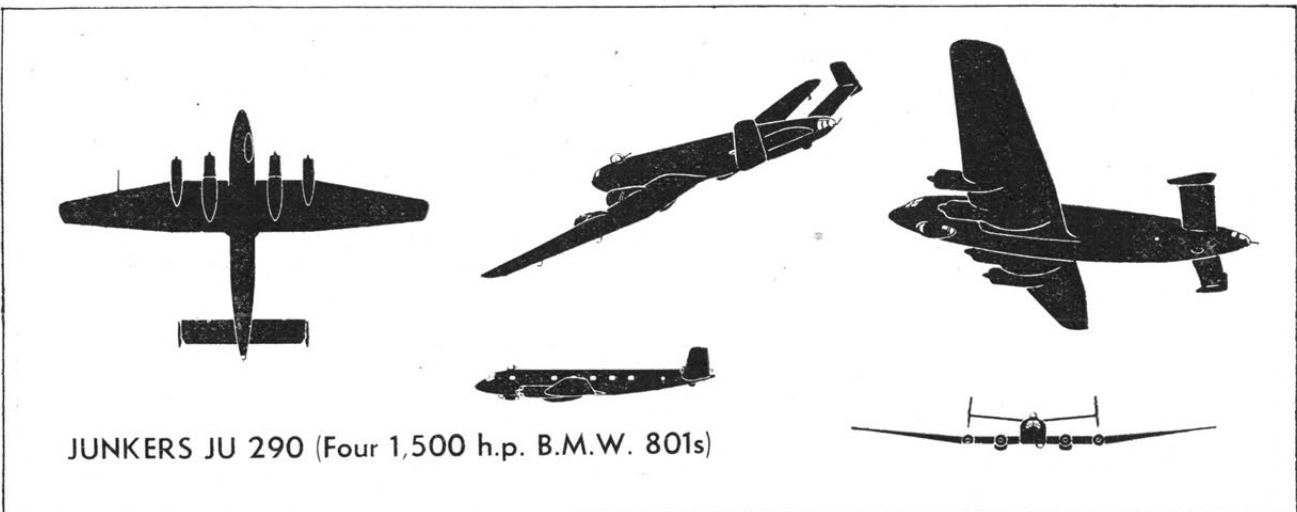
# ving Attitudes



Focke-Wulf Fw 200k Bomber-Transport.

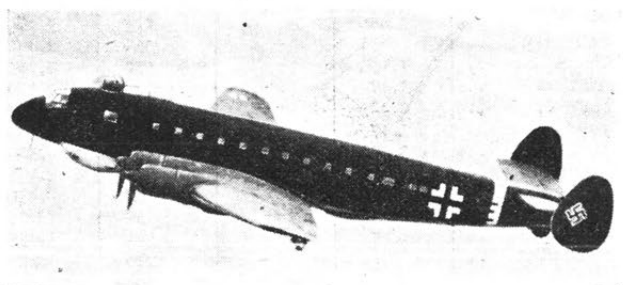
DEVELOPED from the Condor civil airliner, the Focke-Wulf Fw 200k was first named the Kurier, but subsequently reverted to the original name. The latest type, the Fw 200k2, is powered by four B.M.W. 801 engines, each of 1,500 h.p., and has a top speed of 279 m.p.h. at 18,100ft. Armament includes a 20 mm. cannon in the front of the long, offset gondola beneath the fuselage in which the bomb load is carried, and machine guns of 7.9 mm. or 13mm. in a power-operated upper turret immediately behind the cockpit, a dorsal position amidships, and at the rear of the gondola.

Recognition features include wide flat centre-section; high aspect-ratio wings tapering to small round tips, and "kinked" trailing edge; small, pointed nose and large angular fin and rudder. Dimensions: Span 108ft. 3in., length 78ft. 3in., height 23ft. 3in., wing area 1,293 sq. ft.



LARGER than the Ju 90 from which it is developed, the Junkers Ju 290 is primarily a transport, but has also been used as a bomber. Four B.M.W. 801 radial engines provide the power, and top speed is about 250 m.p.h. Armament comprises 20 mm. cannon in dorsal turret and tail, and four machine guns in offset chin blister and ventral position.

Recognition points include wide, flat rectangular centre-section with symmetrically tapered outer panels and small square tips; high aspect-ratio tailplane with small degree of dihedral angle, parallel edges and twin, endplate fins and rudders which may be egg-shaped or angular; wide, slab-sided fuselage with rounded top and small pointed nose; long row of small square windows; dorsal turret just behind cockpit. Dimensions: Span 137ft. 6in., length 92ft., height 22ft. 6in., wing area 2,210 sq. ft.



Junkers Ju 290 Bomber-Transport.

## Sir R. Fedden Reviews Anglo-American Efforts

SIR ROY FEDDEN, chairman of the Ministry of Aircraft Production Committee on Research and Education, who headed a mission to America which afterwards toured British factories to apply their ideas gained in America, told a luncheon meeting of the Midlands Area of the Engineering Industries Association, at Birmingham, recently, that America was now producing 9,000 aircraft and 20,000 engines a month—all the Allies could make use of.

He said that in four years the American aircraft industry had increased its workpeople 100 times and its output over 25 times. He stressed the necessity for Britain to introduce improvisation and rapid improvements in their types of aircraft, so that their much smaller output could remain the kingpin and spearhead of performance and technique.

There had been a great volume of training in America, and they had used many Walt Disney films. In February, 1943, women dilution was 40 per cent. on aircraft and 15 per cent. on engines, but it had considerably increased since that date.

British output was frozen on a comparatively small number of proven types, and it was impossible to make drastic or basic production changes. An appreciable amount had, however, been able to be accomplished by increased tooling, cutting out hand work, improving finish for aerodynamic reasons, closer supervision, conveyors, photo lofting, and in other ways.

The mission was impressed with American aircraft because of their excellent finish and consistent production. That had

been proved by results in the last six months in their considerable successes in the air in all theatres of war. Even more impressive was the American technical outlook for the future and their determination to elaborate and improve. They had spent £40,000,000 on research in the last four years.

He asked: "When the Allies have dealt finally and absolutely with the Axis powers in the way that our political leaders in this country and America assure us will be done, then how are we going to face the future?"

"I suggest we take careful stock of our position and determine to put our house in order for the future peace period which is coming. In suggesting this I do not for an instant advocate any let-up in our immediate engineering war effort. This would be fatal. Neither do I refer to any specific post-war design or development on the part of any particular branch of the industry. It is on the broader basic thinking and future planning, to see what we have got to do to help the young generation of engineers when they return from the war, that I think we should make a frank and honest review, so that when we are free we can put these considered plans into practical operation as quickly as possible."

He said that in aircraft factories in this country there were too many hammers and files used, whereas in America hand-work seemed to be eliminated. There was no piece-work in America, where piece-work was regarded as an admission that tooling was inadequate.

### U.S. MAY CREATE "SUPER AIR BOARD"

AMERICAN anxiety to keep pace with Britain in post-war civil air developments is reflected in an article in the *New York Journal of Commerce* from its Washington correspondent, predicting a Congressional move to enable American steamship lines to establish overseas air services.

The correspondent predicts legislation to set up an independent body with wider powers than those of the Civil Aeronautics Board, which has maintained that under the law it is obliged to forbid steamship companies to operate airlines.

The article adds, "Interest in the question was accentuated recently by news from London that the Cunard Company has

been authorised to enter the air transportation field, following similar moves affecting the Brocklebank Line, the Bibby Line, and the Furness Withy Company.

"The British Government has yet to give the ultimate word on whether or not British flag lines may branch into the air."

"While it is recognised that this may well hinge on policy agreements between British and American Governments, the steadily growing encouragement given foreign ship lines by their Governments to prepare for post-war air operations has given rise to opinion here that it may be desirable to create a 'super air board' in Washington."

### BOMBER COMMAND TONNAGES

TO show the ever-increasing scale of Bomber Command's attack on the Axis we publish the following table of monthly weights of bombs dropped since May, 1940. Before that date the figure is unappreciable. Totals do not include the laying of sea-mines or the bombs dropped by other Commands.

Month	Germany	Italy	Occupied Territory	Total
<b>1940</b>				
May .. ..	375	—	1,300	1,675
June .. ..	1,025	20	1,225	2,270
July .. ..	1,000	—	250	1,250
August .. ..	1,025	60	250	1,335
September .. ..	925	15	1,400	2,340
October .. ..	1,100	10	525	1,635
November .. ..	900	20	375	1,295
December .. ..	575	20	400	995
Total .. ..	6,925	145	5,725	12,795
<b>1941</b>				
January .. ..	575	10	175	760
February .. ..	850	—	550	1,400
March .. ..	1,150	—	550	1,700
April .. ..	1,400	—	900	2,300
May .. ..	2,225	—	550	2,775
June .. ..	3,475	—	800	4,275
July .. ..	3,200	—	1,125	4,325
August .. ..	3,675	—	500	4,175
September .. ..	2,000	100	750	2,850
October .. ..	2,225	—	750	2,975
November .. ..	1,375	—	500	1,875
December .. ..	800	—	975	1,775
Total .. ..	22,950	110	8,125	31,185

Month	Germany	Italy	Occupied Territory	Total
<b>1942</b>				
January .. ..	975	—	1,300	2,275
February .. ..	700	—	250	950
March .. ..	1,900	—	775	2,675
April .. ..	3,100	10	1,300	4,410
May .. ..	2,725	—	475	3,200
June .. ..	6,475	—	350	6,825
July .. ..	6,200	—	150	6,350
August .. ..	3,950	—	200	4,150
September .. ..	5,475	—	100	5,575
October .. ..	2,975	575	225	3,775
November .. ..	825	1,500	70	2,395
December .. ..	1,825	750	130	2,705
Total .. ..	37,125	2,835	5,325	45,285
<b>1943</b>				
January .. ..	2,950	—	1,375	4,325
February .. ..	5,725	625	4,575	10,925
March .. ..	8,725	—	1,850	10,575
April .. ..	9,900	950	600	11,450
May .. ..	12,600	—	300	12,900
June .. ..	14,200	120	900	15,220
July .. ..	15,350	1,000	450	16,800
August .. ..	16,650	3,275	200	20,125
September .. ..	12,250	—	2,575	14,825
October .. ..	13,675	—	90	13,765
November .. ..	12,925	—	1,550	14,475
December .. ..	11,350	—	425	11,775
Total .. ..	136,300	5,970	14,890	157,160
<b>Grand Total ..</b>	<b>203,300</b>	<b>9,060</b>	<b>34,065</b>	<b>246,425</b>

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**LET'S RECOLLECT**

One of a series of reminiscences from British Aviation history which will appear from time to time in FLIGHT and, it is hoped, prove interesting to readers



A landmark in the history of travel: Passengers disembarking from a D.H.16 (360 h.p. Rolls Royce 'Eagle' engine) on arrival at Hounslow aerodrome on the inauguration day of the London—Paris service.

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In 1919 the fare to Paris was £21. Twenty years later in the Summer of 1939 the flight from Croydon to Le Bourget could be made at almost any hour of the day in 75 minutes at a cost of £4.10.

*There is no public passenger service to Paris to-day and the goods delivered to Continental destinations are more substantial than they were in 1919. But when travellers and merchandise are again carried on those and longer routes the British Aviation Insurance Company will be ready to provide insurance protection for aircraft, crews, passengers and freight. In the meantime, B.A.I.C. Staff will willingly place their accumulated experience at the disposal of responsible officers of organisations interested in the post-war applications of aviation.*

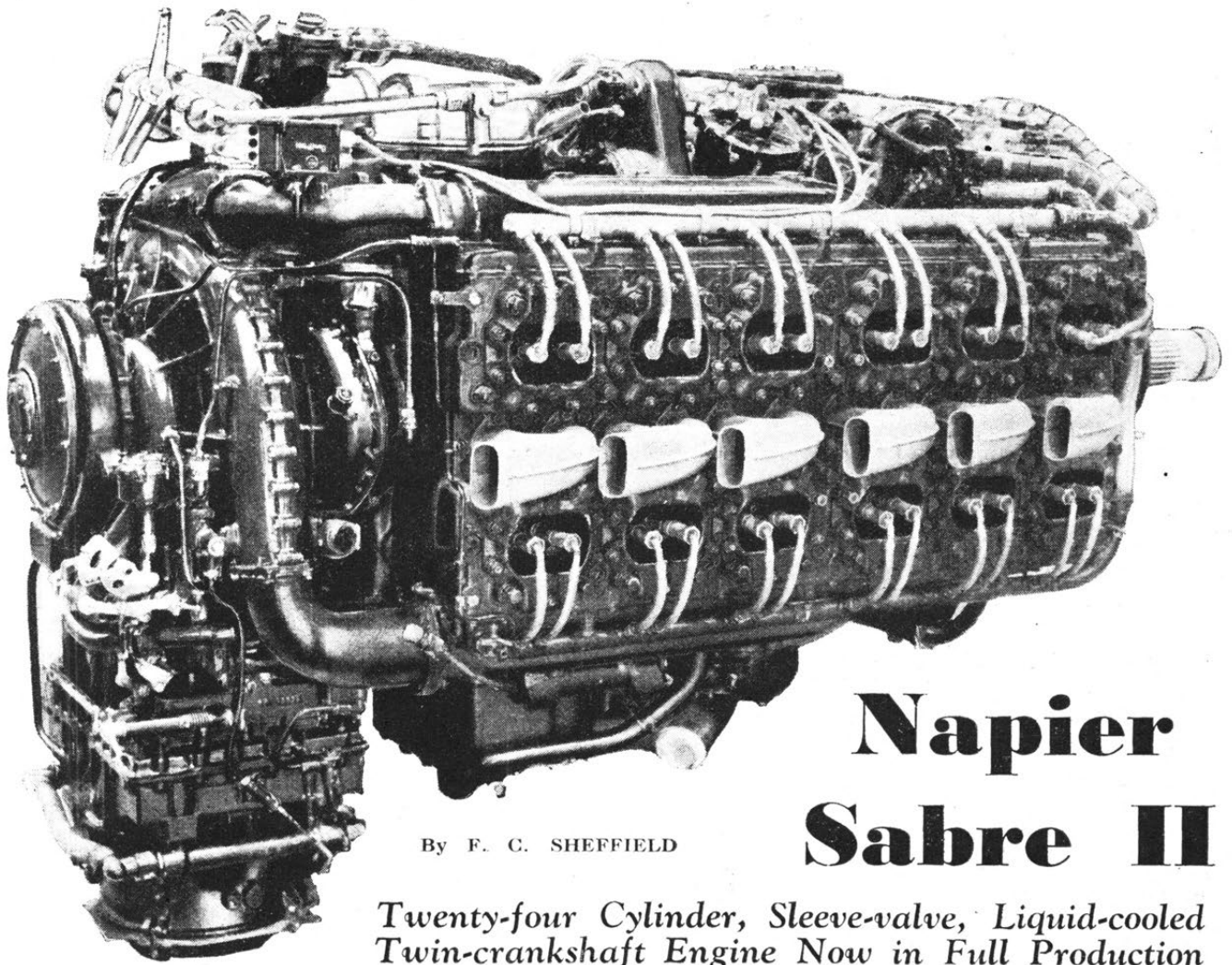
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# Napier Sabre II

By F. C. SHEFFIELD

*Twenty-four Cylinder, Sleeve-valve, Liquid-cooled  
Twin-crankshaft Engine Now in Full Production*

**E**ARLIER in the war the German propagandists were very fond of explaining that the Allied nations, softened by long years of living under a democratic régime, were decadent or effete and would be no match for the virile young Nazi state. For a variety of reasons, of which the strength and prowess of the Allied air fleets are not the least important, this specious philosophy does not now enjoy the same measure of popularity. Any dupe, at home or abroad, who may still be suffering from the effects of such propaganda can be recommended to examine the new Napier Sabre aircraft engine. No signs of decadence, either in conception or execution, will be found in this latest technical achievement. Perhaps no better praise can be given than to state that the Sabre II has already proved its merit operationally in the Hawker Typhoon and has taken its place alongside other famous British engines.

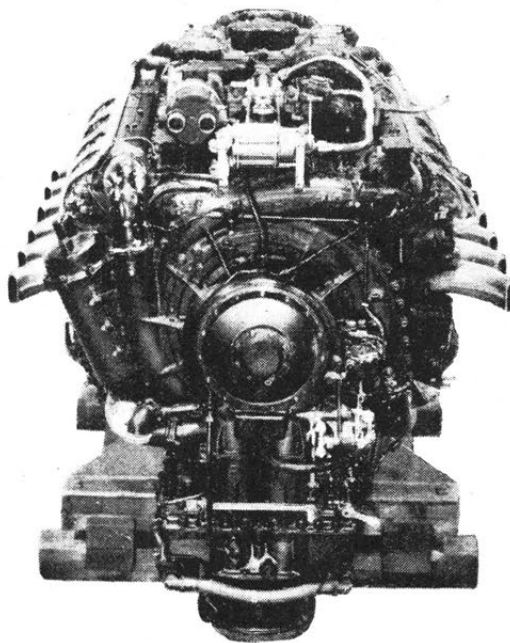
It was towards the end of the year 1935 when the Napier company decided to proceed with the development of a twin crankshaft engine of about 2,000 b.h.p. Experience had already been gained with the 24-cylinder Dagger engine, but this was of the poppet-valve,

air-cooled type and had a much lower power output. The new engine was projected as a 24-cylinder, liquid-cooled unit with single sleeve valves, and the layout was completely changed by the

decision to position the cylinders horizontally instead of vertically as hitherto. This arrangement enables all auxiliary components to be grouped accessibly above and below the cylinders instead of at the front and rear. The two-speed supercharging blower was still located at the rear.

As at that period the most powerful engines available had an output of only 1,000-1,200 b.h.p., some doubts were expressed concerning the wisdom of embarking on an entirely novel design for a unit of 2,000 b.h.p. However, the confidence of the company was not shaken, and due to the admirable foresight of the management, the Sabre is now in full production to meet a genuine need for an engine of this class. Actually it passed the Air Ministry's 100-hr. type test with a maximum output of 2,200 b.h.p. in June, 1940.

It will perhaps be remembered that a brief description and external views of the engine in its developed form, known as Sabre II, were published in *Flight*, January 13th,



2,200 h.p. in compact form.

# NAPIER SABRE II

1944, but it is now permissible to give further particulars and to disclose internal details of the design. As installed in the Typhoon the engine delivers a maximum of 2,200 b.h.p. at 3,700 r.p.m. Dry-weight is 2,360 lb., equivalent to a specific weight of 1.07 lb. per brake horse-power.

Merely to recount the bare specification: two crankshafts, 24 cylinders, sleeve valves, liquid cooling, geared-down airscrew shaft, two-speed supercharger with torsion shaft drive and hydraulic clutches, suggests a high degree of complication. The first sight of this compact mass of mechanism tends to confirm the impression. Only when it is carefully examined is the logical and convenient layout fully appreciated. Accessibility and ease of maintenance have been well provided for, and components can be inspected or serviced with a minimum of dismantling. There is no doubt that Major Frank Halford and his team of designers have done a brilliant job.

## Twin Crankshafts

At the outset it is perhaps best to think of the unit as two complete 12-cylinder horizontally opposed engines arranged one above the other. The two six-throw crankshafts run in seven lead bronze, steel shell bearings in a common light-alloy crankcase divided vertically across the main bearings on the longitudinal centre line. On each side of this crankcase are bolted light-alloy cylinder blocks, each embodying upper and lower rows of six cylinders. These three units constitute the main engine structure. Each crankshaft at its forward end is meshed with a pair of compound reduction gears, and from the forward helical pinions of these four gears is driven the large-diameter helical gear of the airscrew shaft on the centre line of the engine, midway between the two crankshafts. Both crankshafts rotate in the same direction—that is, anti-clockwise when viewed from the rear, and the double reduction gear gives a ratio of 0.274:1 to the left-hand airscrew.

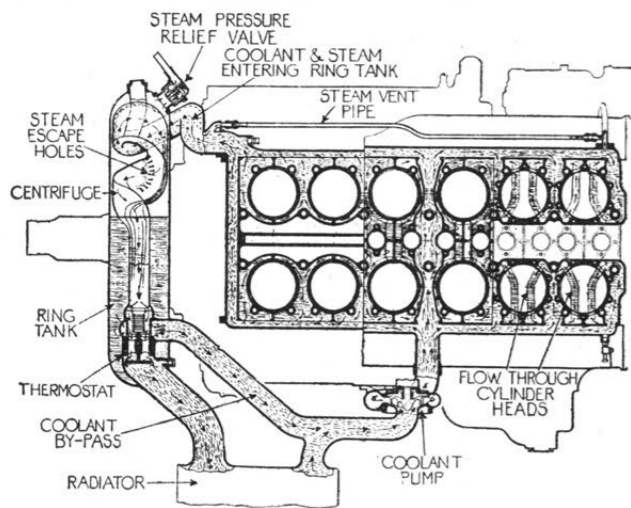
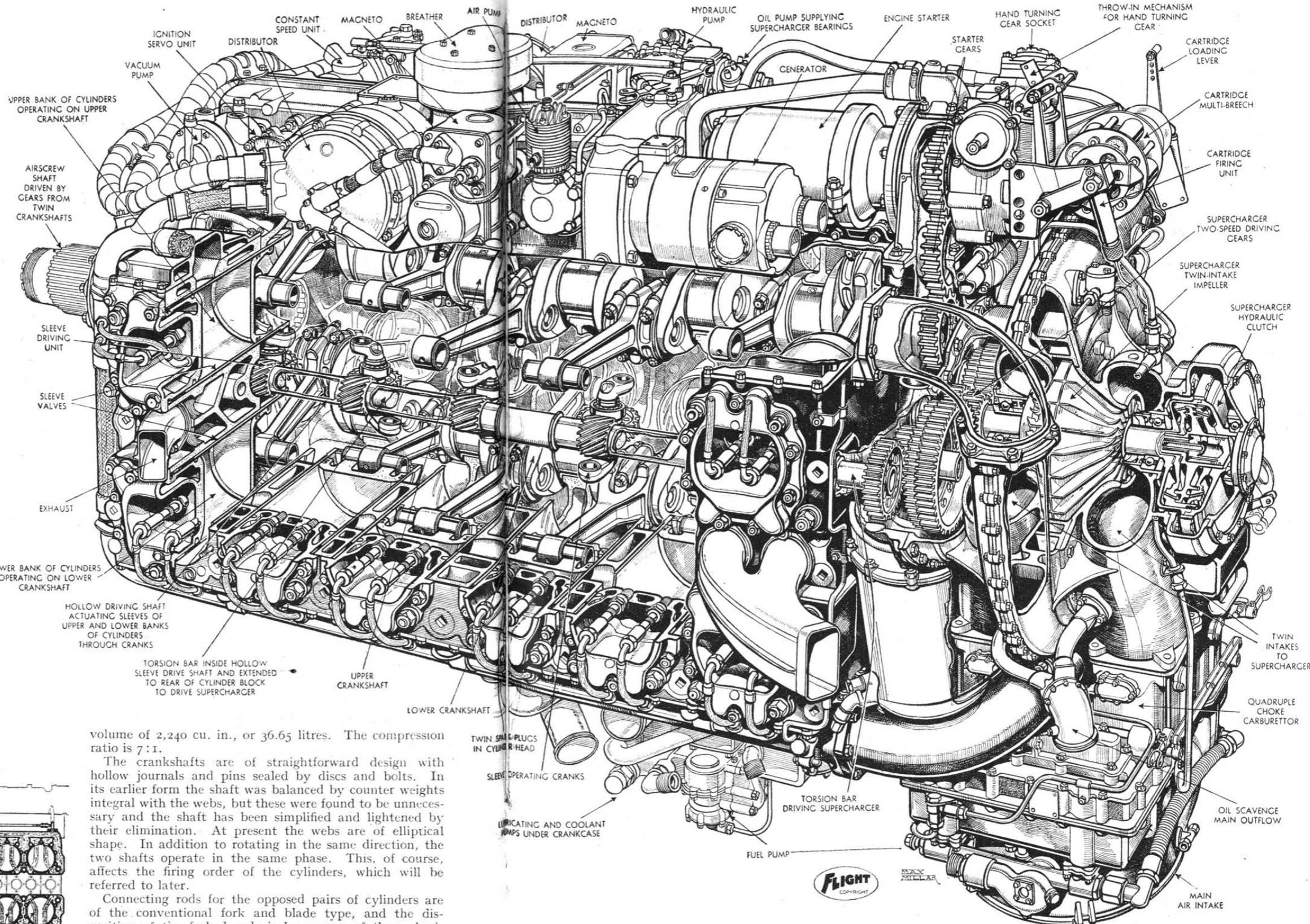
Cylinder dimensions are 5in. diameter bore and 4.75in. stroke, giving a total swept

volume of 2,240 cu. in., or 36.65 litres. The compression ratio is 7:1.

The crankshafts are of straightforward design with hollow journals and pins sealed by discs and bolts. In its earlier form the shaft was balanced by counter weights integral with the webs, but these were found to be unnecessary and the shaft has been simplified and lightened by their elimination. At present the webs are of elliptical shape. In addition to rotating in the same direction, the two shafts operate in the same phase. This, of course, affects the firing order of the cylinders, which will be referred to later.

Connecting rods for the opposed pairs of cylinders are of the conventional fork and blade type, and the disposition of the forked rods is by groups of three, horizontally and vertically. In other words, the upper crankshaft has forked rods for the three forward left-hand cylinders and the three rear right-hand cylinders, whilst on the lower shaft this arrangement is reversed. Big-end bearings are formed by steel shells, lined inside and outside with lead bronze, and are located by two pins in the fork-end caps. Small-end bushes are of phosphor bronze fixed in the rod, whilst the gudgeon pin is fully floating and retained in the piston by circlips.

As will be noted from the sectional drawings, the forged

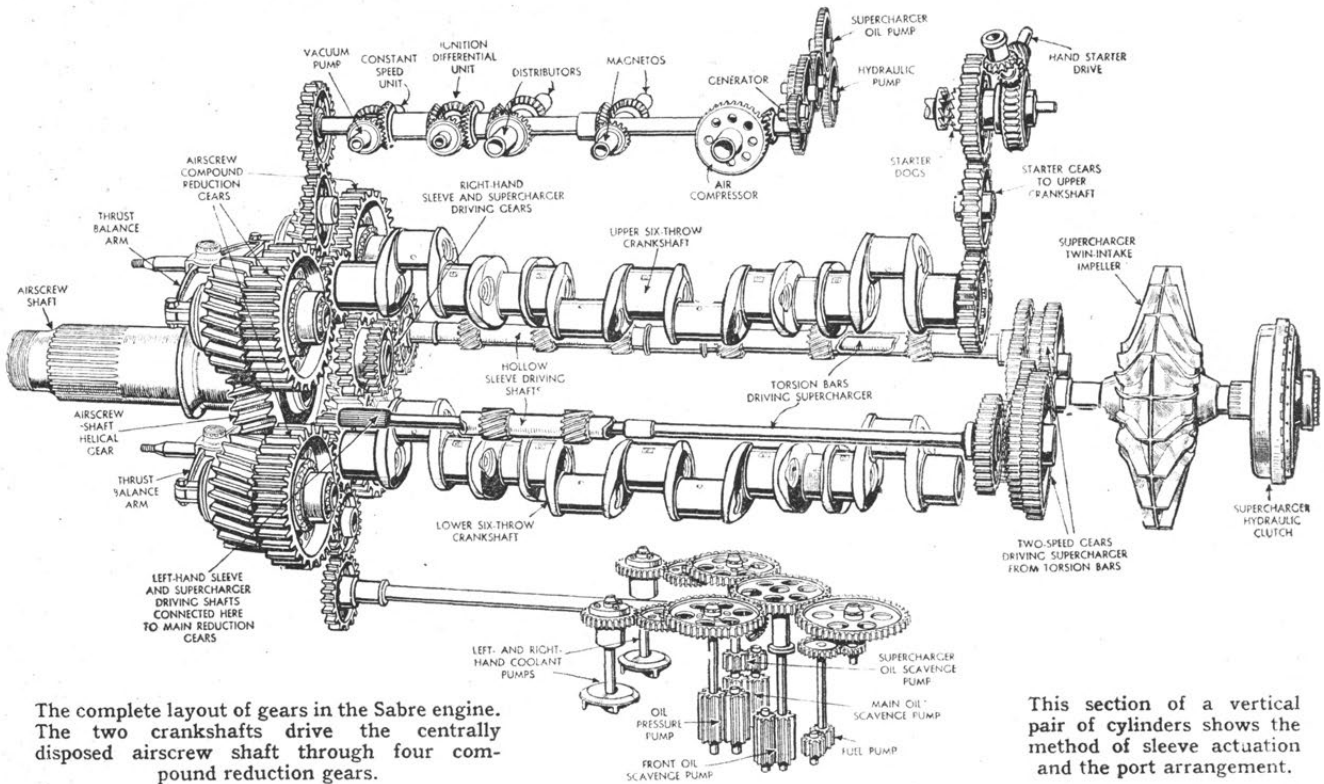


The ethylene-glycol pressure cooling system is thermostatically controlled.

**2,200 h.p. NAPIER SABRE**

The Sabre engine partly sectioned to reveal important features of its design. There is a separate six-throw crankshaft for upper and lower groups of twelve horizontally opposed cylinders. Valve sleeves of vertical pairs of cylinders are actuated by 180 deg. cranks geared from hollow shafts driven from the airscrew reduction gears at the forward end. Within each hollow shaft is a torsionally resilient rod which furnishes the drive for the double-entry 2-speed supercharging blower. Medium- or high-gear is selectively engaged by a fluid-actuated double-conical clutch unit. A special four-choke S.U. carburettor supplies the mixture to the supercharger. The Coffman combustion starter and its five-cartridge breech will be seen above the rear end of the crankcase.

NAPIER SABRE II



The complete layout of gears in the Sabre engine. The two crankshafts drive the centrally disposed airscrew shaft through four compound reduction gears.

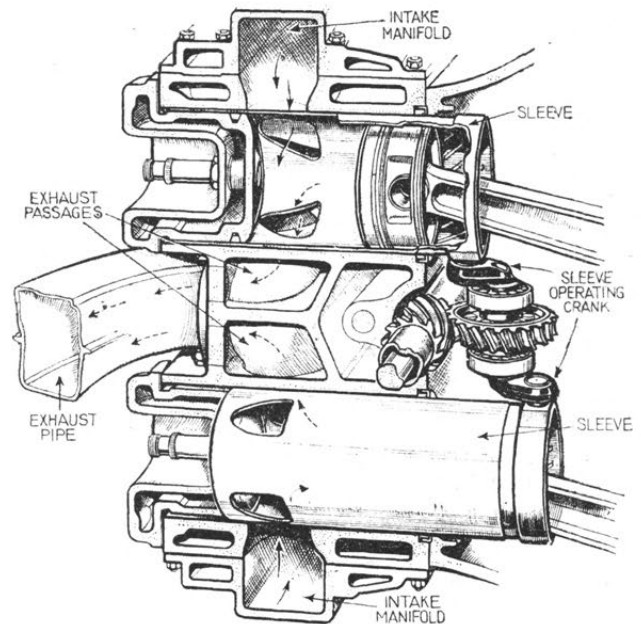
This section of a vertical pair of cylinders shows the method of sleeve actuation and the port arrangement.

light-alloy pistons are unusually shallow. This feature, in conjunction with the short stroke (less than the diameter of the piston) and the use of sleeve valves, has enabled the overall width of the engine to be kept down, and consequently the weight to be reduced. Incidentally, when the piston is at the bottom of its stroke, it is withdrawn completely from the cylinder, and is supported solely in the lower end of the valve sleeve. In shape the piston has a flat top radiused at the periphery, and the gudgeon pin bosses are webbed directly from the crown. All the piston rings are of special types; the upper pressure ring is tapered, whilst the second pressure ring is tapered and has an oil-scraper groove on the lower side. The bottom scraper ring, with a bevel on the upper face and a scraper groove on the lower face, is of the wedge-action type backed by a plain spring ring.

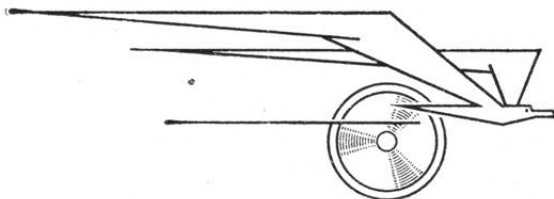
**Interchangeable Cylinder Blocks**

As mentioned earlier, the crankcase is divided vertically and the halves are drawn together by 20 long bolts. In addition, 12 tie bolts pass right through the crankcase and the cylinder blocks. To secure each cylinder block a further 26 studs are anchored in the crankcase. All the crankcase and cylinder block bolts and studs are fitted with a vernier washer engaging two pegs in the casting and two longitudinal grooves in the bolt or stud to avoid torsional stressing when the nuts are drawn up.

The cylinder blocks, incorporating jackets and ducts for the cooling medium, are made interchangeable for convenience of production and servicing. Right-hand and left-hand blocks are only differentiated by the fitting of the special coolant and induction manifolds. Individual cylinder heads, also jacketed for coolant, are spigotted in the cylinder bores and secured by two of the main cylinder studs and seven smaller studs directed from the block. Each cylinder bore has two exhaust ports and three inlet ports, while the steel valve sleeves, nitrided internally and machine lapped, each have four ports. One of these, designated the combined port, acts alternatively for exhaust and inlet.



Two types of sleeve are required due to the relationship of the combined port to the actuation trunnion. The problem has been rather to keep oil out of the cylinder than to admit it, and consequently a highly developed scraper device is fitted in the face of the cylinder block and operates on the outer diameter of the sleeve. This is in the nature of a contracting wedge-action scraper ring, resembling that used at the bottom of the piston. A clamping plate is fitted to retain these rings when the cylinder block is withdrawn from the crankcase. Internally the lower end of the sleeve is furnished with a series of helical grooves which facilitate the return of oil to the crankcase and tend to prevent it from being forced past the piston scraper ring. At its upper end the sleeve



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## NAPIER SABRE II

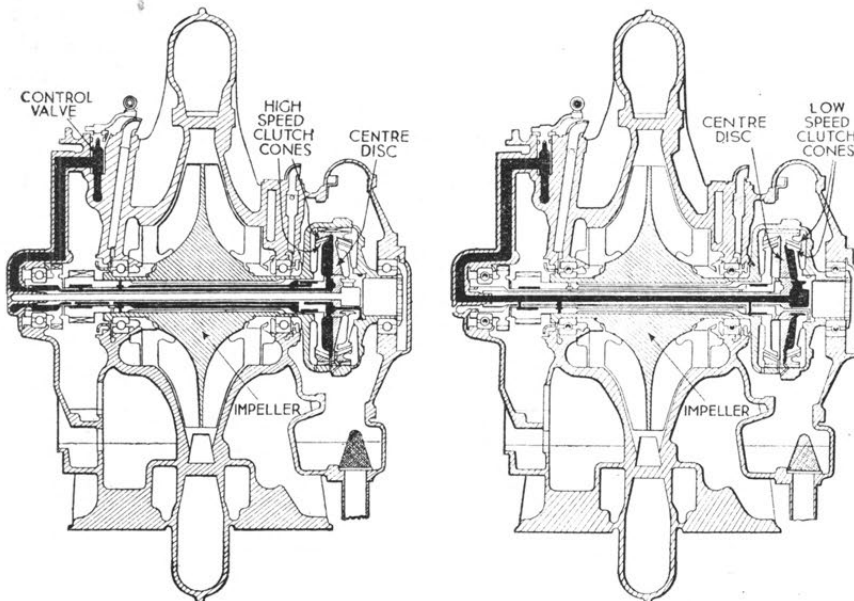
is sealed by a single taper-type pressure ring in the cylinder head.

The drive for the 12 sleeve valves of each cylinder block is by a divided hollow shaft driven at crankshaft speed through an idler gear from the rear pinion of the upper airscrew reduction gears. Each half-shaft runs in bearings bolted to the face of the cylinder block and has three integral worm gears for driving the sleeve cranks. A splined coupling joins the half-shafts at the centre. Sleeve cranks, arranged at 180 deg. and fitted with a bronze worm wheel to mesh with a drive-shaft worm, are mounted in roller bearings in pedestals which also form the caps for the drive-shaft bearings. The worm wheel has 22 teeth and is bolted to a vernier flange on the crank, which, in combination, furnish an adjustment of 1.48 deg. from the assembly datum for the timing of the sleeves. Each of these cranks actuates the sleeves of a vertical pair of cylinders. As will be seen from one of the illustrations, the sleeve-drive gear remains intact when a cylinder block is removed from the crankcase. Actually, sleeve phasing and timing can be made on the bench and final adjustment for the twelve cylinders effected in the meshing of the drive shaft pinion with the idler wheel transmitting the drive from the main reduction gears. Sleeve travel is somewhat longer than in common practice and, in fact, is almost equal to the piston stroke.

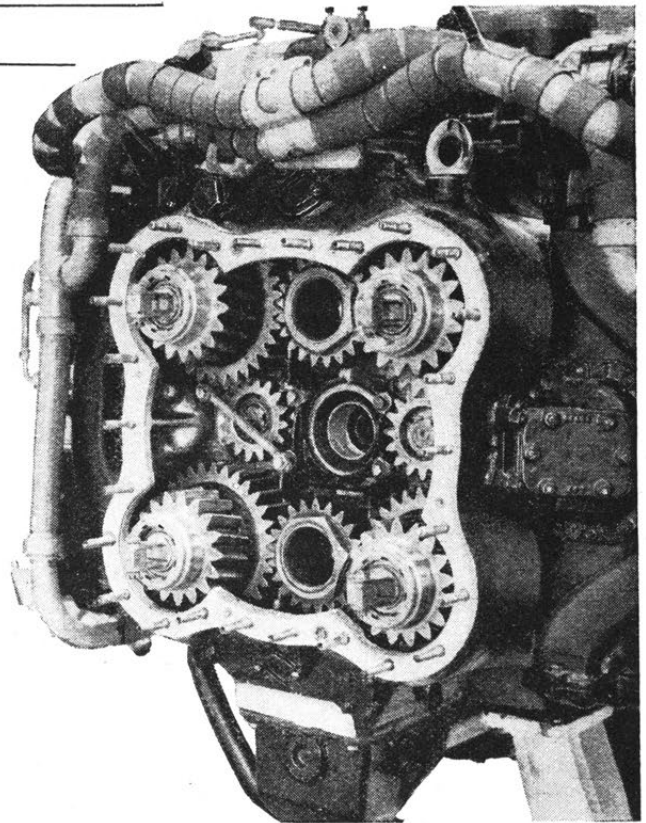
### Torsion Shaft Blower Drive

Arranged within the hollow sleeve-drive shafts are the torsion shafts for the two-speed supercharger drive. At its forward end each torsion shaft is splined to the drive shaft; to the rear end is splined and bolted the first pinion for the supercharger drive. The shaft is freely supported in a bearing at the rear end and also by a steady-bearing in the splined coupling muff joining the sleeve drive half shafts.

From the two torsion-shaft pinions the drive is transmitted to co-axial medium- and high-speed gear shafts of the double-entry centrifugal blower. Each shaft terminates in a cone, the two being spaced to accommodate centrally a floating double-conical member, slidably splined at its periphery to engage the driving drum of the blower impeller. Selective engagement of the two cones is effected hydraulically as shown in the sectional diagrams.



In the supercharger, medium- and high-gear shafts are both continuously driven by the two torsion rods. Selective engagement is effected by a fluid-actuated conical clutch, as indicated.



This view shows the four compound reduction gears driven from the two crankshafts, the central rear bearing of the airscrew shaft, and the two pinions of the sleeve drive shafts.

Mixture is supplied by a special four-choke S.U. carburettor. Two chokes feed the block of 12 cylinders on each side of the engine. The instrument follows usual S.U. practice, embodying oil-warmed throttle valves and automatic altitude and mixture enrichment controls. An automatic boost control unit is a separate component mounted on the supercharger casing.

From the volute collecting chamber of the supercharger the mixture passes through four tangential outlets to cast light-alloy manifolds, each serving a bank of six cylinders. Exhaust ports are arranged between the upper and lower banks of cylinders and each vertical pair is fitted with an individual ejector-type nozzle. These damp the exhaust flames and the efflux has a propulsive effect which improves the performance of the aircraft in which the engine is installed.

Considerable interest attaches to the airscrew-shaft reduction gear at the forward end of the unit. The rear bearing of the airscrew shaft, an undivided steel shell lined with lead bronze, is housed in the crankcase wall. This bearing receives two feeds from the general lubricating system and two separate feeds to the centre and the annulus of the shaft for the supply of pressure fluid for the pitch control of the Hydromatic airscrew. The four compound reduction gears are mounted in roller bearings in steel housings in the front wall of the crankcase and a steel carrier plate.

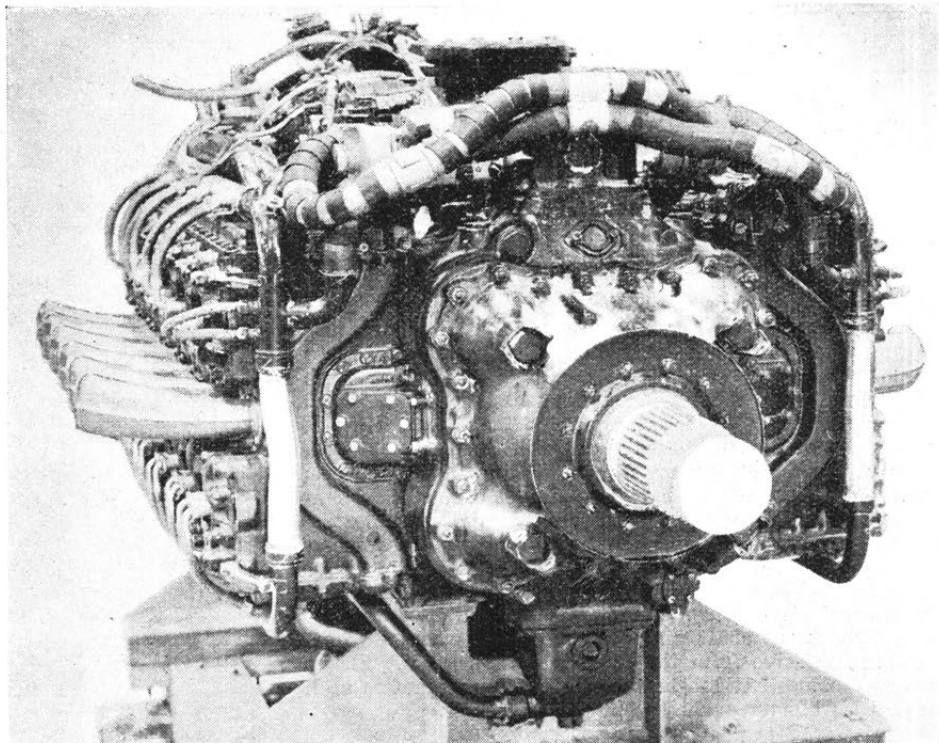
The upper and lower crankshafts

## NAPIER SABRE II

drive upper and lower pairs of straight-tooth pinions, and the airscrew-shaft gear is meshed with all four helical pinions. To equalise the drive from each crankshaft to its pair of reduction gears, a balancing device is provided. Each reduction gear is permitted a limited axial float and they are held up to their work by a balance beam pivoted centrally on a forked pillar anchored in the nose casing. Movement is damped by spring-loaded plungers on the ends of the beam, yoked to light tubular shafts mounted on two double-duty ball races in the hollow compound reduction gear. The nose casing carries the main ball thrust bearing and the outer roller bearing for the airscrew shaft.

Auxiliary components are arranged accessibly in compact groups on the upper and lower face of the crankcase. In each case the drive is by a longitudinally arranged tubular shaft driving through an idler gear from the forward end of the crankshaft.

Above the engine the components are in the main arranged transversely, and thus the drive is taken from the tubular auxiliary shaft by bevel gears. Starting from the forward end is the Pesco vacuum pump on the left and the



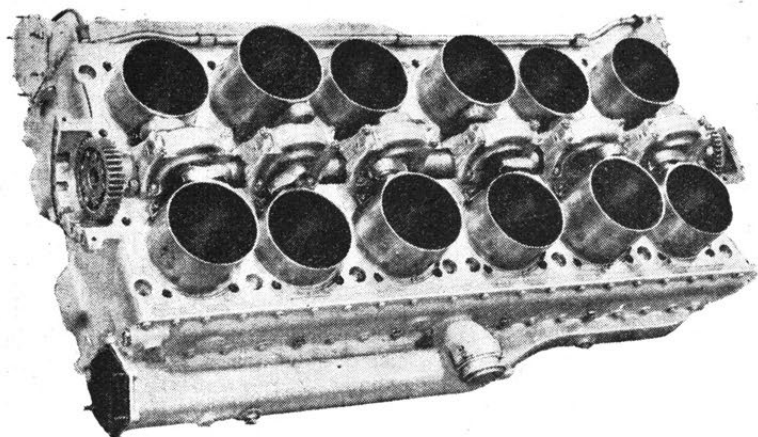
Viewing the unit from the nose, the accessibility of the cylinder heads, sparking plugs and also the auxiliaries is strikingly apparent.

airscrew control unit on the right. Next is the servo control unit which advances and retards the point of ignition in relation to the speed of the airscrew. Then come a pair of B.T.H. distributors running at half crankshaft speed, each of which has two concentric rings of 12 segments. The dual ignition system is divided into four groups controlled by four switches each isolating six cylinders.

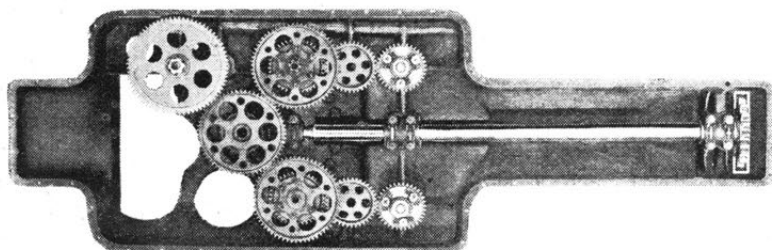
Due to the phasing of the two crankshafts, two cylinders fire simultaneously; thus for the complete unit there are six impulses per revolution. Upper and lower banks of 12 cylinders are numbered on the left 1 to 6 from rear to front and, on the right, 7 to 12 from front to rear. The firing order, referring to the upper 12 cylinders, is 1, 9, 5, 12, 3, 8, 6, 10, 2, 7, 4, 11. For the lower 12 cylinders, the consecutive order, of course, is the same but phased 180 deg. of crankshaft rotation in relation to the upper 12 cylinders. In other words, 1 (upper) and 6 (lower) fire simultaneously, followed by 9 (upper) and 10 (lower), then 5 (upper) and 2 (lower), and so on.

### Combustion Starter

Next to the distributor is a pair of B.T.H. duplex magnetos running at 1.5 times crankshaft speed. The last bevel-driven unit is the Heywood air compressor, but from the end of the tubular shaft is a train of spur gears from which three longitudinally arranged components are driven. These are the 500-watt, 24-volt electric generator on the left and the supercharger lubrication pump and the Dowty hydraulic services pump on the right. Between the generator and the pumps is mounted the Coffman combustion-type starter. This unit operates through a dog clutch to the train of gears extending from the rear of the upper crankshaft to the hand-cranking gear. The starter has a five-cartridge magazine and is fired electrically. When the starter is operated, or when the engine fires, an automatic device



The sleeve actuation gear is mounted on the underside of the cylinder block



The driving gear for fuel, oil and coolant pumps is assembled as a unit in the lower casing cover.

throws out the hand-cranking gear by lifting the hand-crank worm from its complementary wheel.

The tubular auxiliary shaft below the crankcase drives the fuel, oil and coolant pumps. All these units are mounted external to the crankcase with their spindles vertical, and the drive, after initial change of direction by bevel gears, is by trains of spur gears. All the driving elements are mounted in the bottom cover casing and can be detached as a unit; this is shown in one of the detailed illustrations. The lubricating oil pump and filter unit has one main pressure pump, a main scavenge pump (with which is embodied a smaller unit arranged above it serving as a scavenge pump for the supercharger casing), and a scavenge pump for the forward end of the crankcase. With this group are the high-pressure relief valves and two gauze filters. A large pressure filter, of the single felt element type housed in a light alloy cylinder, is mounted on the left of the supercharger casing.

Oil at high pressure lubricates the main crankshaft and big-end bearings, the airscrew shaft rear bearing, the reduction gear balance arms, and, by a series of pressure jets, the airscrew shaft reduction gears. Reducing valves for the low-pressure system are housed in the front and rear of the crankcase. This low-pressure system is employed for the valve-sleeve drives and upper and lower auxiliary drives. The valve sleeves and the small-end bearings of the connecting rods are lubricated solely by oil thrown off by the crank pins. It will be remembered that the supercharger has its separate oil pump driven from the upper auxiliary shaft. This feeds a metered supply to the intermediate and rear bearings of the blower impeller spindle. The outrigger ball bearing of the supercharger, beyond the two-speed clutch unit, depends entirely on oil mist for its lubrication.

Oil drained to the crankcase sump is returned by the main scavenge pump to the supply tank by way of the carburettor throttle valves and the jacket of the supercharger inlet. The front scavenge pump, drawing oil from the bottom cover casing, does not return it to the tank

direct, but instead delivers it to the sump, where it is then dealt with by the main scavenge pump.

Cooling is effected by a 30 per cent. ethylene-glycol mixture circulated under pressure. Special arrangements are made to by-pass the radiator when the temperature of the coolant falls, in order to maintain the engine at a suitable operating temperature at altitude. The coolant is circulated by two centrifugal pumps, each serving one block of 12 cylinders, and the direction of flow can be followed from the circulation diagram. The heated coolant and steam leaving each cylinder block at the upper forward end passes into a centrifuge pipe of electrolytic copper contained in a common annular header tank arranged around the engine nose casing. As the coolant whirls around this tube, the fluid accumulates at the outer wall, whilst any steam escapes through a series of holes in the inner wall into the coolant contained in the header. A spring-loaded valve is provided at the top of the header tank to relieve steam pressure.

At the lower termination of the centrifuge pipe is a thermostatically controlled valve, past which the coolant flows to the divided radiator and thence to the pump, which recirculates it through the cylinder block. Should the temperature of the coolant fall unduly, the thermostat partially or completely closes the valve, thus shutting off the radiator and diverting the flow by way of a by-pass pipe directly from the centrifuge pipe to the pump. Coolant outlet temperatures for various operating conditions range from 110 deg. C. to 125 deg. C.

Owing to the compact rectangular shape of the complete unit, mounting in the aircraft presents only straightforward problems. When installed, all cylinder heads and sparking plugs are accessible from the sides of the engine enclosure and all the auxiliaries from above or below.

The Sabre, despite its novel design, is probably the highest-powered aircraft engine in full production and fully operational. It fills a very real need in our production programme, and has already made its mark in the Hawker Typhoon. More will be heard of it in the future.

## NEW DE HAVILLAND ENGINE COMPANY DIRECTORS

THEIR many friends in the aircraft industry will be glad to learn that at a recent board meeting of the De Havilland Engine Co., Ltd., it was decided to add to the board of directors Mr. J. L. P. Brodie and Mr. Hugh Buckingham. The board previously consisted of Messrs F. T. Hearle, W. E. Nixon, F. E. N. St. Barbe, Major F. B. Halford, and Sir Geoffrey de Havilland.

Mr. Brodie, who becomes director in charge of the engineering division



Hugh Buckingham.

of the company, has been closely connected with de Havilland engine development ever since the first Gipsy was designed and built in 1926. He became first assistant to Major Halford in 1923 and has been his right-hand man ever since.

Mr. Hugh Buckingham, who becomes business director of the company, has been with De Havilland as apprentice, engineer, pilot and executive for 18 years. He has recently returned from New Zealand, where he inaugurated the sixth De Havilland overseas company and built its Wellington factory, at which Tiger Moths have been in production ever since.



J. L. P. Brodie, M.I.A.E.

## X-RAY CRYSTAL ANALYSIS OF METALS

A LECTURE entitled "Modern Views on Alloys and their Possible Application" was given at the 36th annual meeting of the Institute of Metals held in London by Dr. W.

Hume-Rothery, F.R.S. The lecturer dealt with alloys of typical univalent, divalent, trivalent and transition elements, of both scientific and practical interest. He showed that the development of X-ray crystal analysis permitted the determination of the positions of atoms in the different crystal structures, and was the first great step forward towards an understanding of the structures of metals and alloys. The study of the X-ray data and the equilibrium diagrams of alloys enabled a number of factors controlling alloy formation to be discovered empirically.

At the same time the mathematical-physicists were encouraged to examine the behaviour of electrons in the periodic field of the crystal lattices of metals, and the results obtained were found to have an immediate bearing on the properties and structures of metals and alloys. As a result of this work one was enabled to look beyond the mere crystal structure, and could begin to understand some of the factors which determined the structure and properties of alloys. In a limited way, from a knowledge of atomic structures, it was already possible to produce alloys with desired structures and properties.

## WEYBRIDGE BLADES

GRADED strength within a given outline may be said to be the salient feature of modern wooden airscrew blades. Such blades have now been made by the Airscrew Company for many years, and they have come to be taken for granted. It was therefore very welcome for friends of the company to see for themselves the many processes through which the blades go, in a coloured film shown in London the other day.

Mr. Titler, chairman of the Airscrew Company, explained that the film was originally made partly for educational purposes, and partly to enable those workpeople who were tied to one particular job or process to see the many others that go to the making of an airscrew blade.

The film takes one through all the many stages, from the sawing of the spruce planks to the finished product. The manufacture of the compressed wood (Jicwood) used in the root portion was particularly interesting, as was also the scarfing together of this hardwood root to the softwood blade. But most surprising was, perhaps, the comparative ease with which damaged and broken blades can be repaired.

# Behind the Lines

## Resigned

"CDR. BOTTO, Mussolini's Under-Secretary of State for Air, has resigned," said the German-controlled Rome radio, quoted by Reuter. "He has been succeeded by Major-General of the Air Force, Pezzari."

Botto, who was appointed six months ago, was given the task of forming a new Air Force for Mussolini's Fascist Republican Government.

## Labour Drive

A BRUSSELS report states that a large contingent of members of the Belgian Fascist Youth Organisation left the city on February 16th to start work as apprentices in the Junkers works. They have signed on for three years, two of which will be devoted to training. The Junkers works will provide them with lodging, clothes and pocket money.

A message from France says that at Nancy a centre has been established for the training of qualified workers for the aircraft industry. Courses vary in duration from eight to twelve weeks, according to the branch taken. All pupils are boarders and subjected to military discipline to "keep up the morale." Trainees are under the supervision of the Labour Service and receive 5 fr. per hour if under 21 or 7.50 fr. if over.

## For High Altitude

THE Type 3020 high-altitude experimental aircraft was designed by Engineer Rocca for flights at about 50,000ft. and was ordered from the Toulouse factory of the S.N.C.A. du Midi by the Cannes Development Centre. It has a rather thick, three-spar wing, the main spar of which is made of metal, while the front and rear spars and the remainder of the wing structure are constructed of wood. The fuselage, containing a pressure cabin for a crew of five, is of composite construction; the rear portion is built entirely of wood.

The power plant consists of two Hispano-Suiza 12Y or 12Z liquid-

## Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

cooled twelve-cylinder engines arranged side by side in the fuselage nose in a way that in plan they form a small angle to each other; three-stage supercharger, in which two of the three impellers can be disengaged; two coaxial, contra-rotating, electrically controllable airscrews which may be disengaged individually from the engine. The airscrews are driven by elastically coupled extension shafts and drives of the type N.C.-El developed by the S.N.C.A. du Centre. Reduction gear ratio 1 to 2 is achieved by means of herring-bone-toothed spur bevel wheels. Radiators are housed under a N.A.C.A. cowling in the fuselage nose.

## From France

THE trial flights of the Latécoère 631 "Maréchal Pétain" six-engined giant flying-boat, which are being continued at Marseilles-Marignane, have given satisfactory results on the whole. A maximum speed of 261 m.p.h. (420 km./h.) was recorded in flight, whereas the designed maximum speed was 217 m.p.h. (350 km./h.). On the other hand, aileron flutter occurred at certain speeds which it has not yet been possible to eliminate. The second flying-boat of the type, the "Amiral Lartigue," which, according to earlier messages, has practically been completed at Toulouse, has not yet been transferred to Marignane, where it is to be assembled and tested in flight; as may be recalled, Latécoère has been given a contract for two additional flying-boats of the same type.

S.N.C.A. du Sud-Ouest, which developed the 70-ton S.E. 200 six-engined flying-boat, now undergoing tests, and which some time ago announced am-

bitious plans for the development and construction of 120-ton and 250-ton flying-boats, is working on the designs of a commercial transport landplane, for which two versions are provided: a 41-ton gross weight version for Continental services, and a 46-ton version for overseas routes.

## German Views

GERMAN Overseas Radio, quoted by Reuter, said: "The American Air Force has evolved three different methods of fighter protection in their daylight raids on Germany.

"(1) The so-called relay-escort of fighters: the bombers start out with an escort of short- or medium-range fighters. When these fighters have reached their extreme range, long-range fighters take over and accompany the bombers to the target.

"The obvious disadvantage of this method is the risk involved in changing the escort over enemy territory and perhaps in the midst of an air battle.

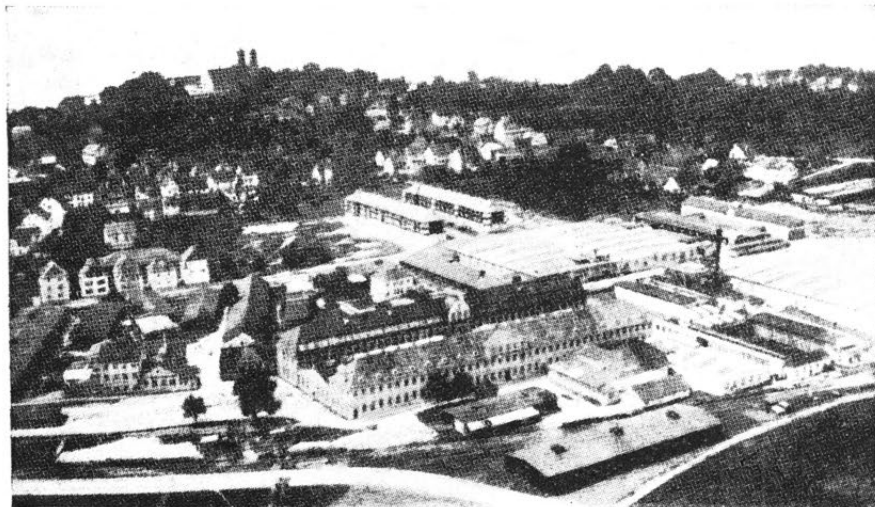
"(2) The exclusively long-range fighter escort. The drawback from the enemy's point of view is that the long-range fighter lacks in manoeuvrability and is no match for the German short-range or interceptor fighter.

"(3) The mass fighter escort: by putting in the air very large numbers of long-range fighters the enemy tries to make up for their inferiority by sheer weight of numbers. This means that the enemy has introduced into aerial warfare the battle of material, where the enemy tries to force a decision by multiplying his fire power with the fighters' cannon taking the place of the land artillery."

"Because Allied bombing attacks try to lay a 'bomb carpet' by a concentrated dropping of bombs by all attacking aircraft, German fighter defences have to adopt tactics to split their formations." This is the opinion of a highly placed expert in the Reich Air Ministry.

Attempting to explain the failure of German fighter defences, the expert said that the shooting down of enemy bombers is not the aim in itself, but is rather a means to an end. The German fighter defence tries not so much to destroy as many Anglo-Saxon terror bombers as possible, but rather to reduce the bombing effect as planned by the enemy.

The Anglo-Saxon tactics in air attack have created the following conditions for the German fighter defence: fighters and long-range fighter formations must assemble in as large a number as possible at a point from which they are led in closed formation against the enemy. They must not start too early or they will run out of petrol at the decisive moment—a contingency which must be taken into account because of the large petrol consumption of fighters. Neither must they start too late or they would not meet the enemy in time. The attack on the enemy formation must take place at that point of the approach which is closest to the target—a little while before the dropping of the bombs. This deprives the enemy of the calm he needs for aiming and prevents his getting into formation again. The representative of the Air Ministry said that the most efficient tactics used to scatter closed formations was a frontal attack by fighters and long-range fighters.



ANOTHER TARGET: The Maybach Motorenbau at Friedrichshafen, one of the leading German producers of high-speed Diesel motors for railcars, marine craft and tanks. Representative types in 1939 were the 6 cyl. 250 h.p., the 12 cyl. 450 h.p. and a 12 cyl. 650 h.p. high-speed Diesel with exhaust-turbo supercharger.

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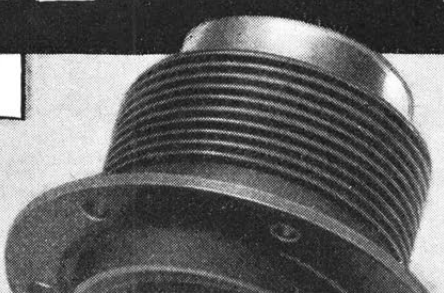
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# Seven Post-war Types

## Jet-propelled Airliner Mentioned in Commons Debate: Concerted Pleas to Remove Civil Aviation from Air Ministry

THE inclusion of a jet-propelled airliner among seven new types of civil aircraft recommended by the second Brabazon Committee was disclosed by the Secretary for Air, Sir Archibald Sinclair, when he replied to Government critics in the recent debate in the House of Commons on civil aviation.

This committee, he told the House, was given the task of finding out the wishes of potential operators so that it could help designers by giving them a more detailed description of the exact types of aircraft required in various parts of the world. Five types had been recommended by the first Brabazon Committee, and the second one, which had done invaluable work and was still sitting, had recommended two additional types, making seven in all.

In outlining these seven projected new types, Sir Archibald referred to the jet-propelled type as "the fifth," from which it may be inferred that it was recommended by the first Brabazon Committee. For obvious reasons it was not revealed at the time when the other four were announced—the four types on which actual design work has already been allocated to selected firms.

### Revolutionary and Fast

No details of the jet-propelled civil aircraft were given by the Secretary for Air, who contented himself with saying it was a revolutionary design whose main purpose represented the application of jet-propulsion to civil purposes, and whose speed would far outclass that of any civil machine now in operation.

The two additional types recommended by the second Brabazon Committee are a 14-seater landplane of conventional design (the specification of which is not yet drawn up) intended for feeder lines in the Colonies and in other overseas countries, and a smaller twin-engined landplane of 8,000 lb. all-up weight, seating up to eight passengers and also suitable for feeder lines and for taxi work.

Dealing with the first four new aircraft in his list, the Air Minister said, "The first of the seven types is the big transatlantic landplane being designed by the Bristol Aeroplane Co., about which the Lord Privy Seal (Lord Beaverbrook) has already spoken in another place. The second is a landplane of over 100,000 lb. all-up weight which will be capable of operating the North Atlantic route with an interim stop at Newfoundland. It will also be suitable for long-range operation on other trunk routes. Like the Bristol machine it will have a pressure cabin.

"The third is a slightly smaller four-engined aircraft, of about 70,000 lb. all-up weight, which will also be pressurised. It will be designed with a more capacious body than the previous one and is intended for the operation of trunk routes in medium stages. The fourth is a twin-engined landplane with a pressure cabin, of about 40,000 lb. all-up weight, and is capable of seating about 30 passengers. This will be suitable for European services and other short-medium range work."

Probably the next most significant point from the debate—the second on civil aviation within a fortnight—was that, although the members taking part differed on all sorts of other points, they were unanimous in their insistence that the control of post-war civil aviation must be removed from the Air Ministry. Some thought it should go to the Ministry of Transport, and others advocated the setting up of a separate Ministry of Civil Aviation, but the only voice raised in support of its being left with the Air Ministry was that of the Air Minister himself.

A third point of more than passing interest cropped up when Sir Archibald was dealing with the broad issues of policy and was deprecating any suggestion that Britain should depart from the principle of other countries and throw the air services open to private enterprise.

"Are we to understand," asked Sir Oliver Simmonds, "that the Lord Privy Seal's statement, in which he invited shipping companies to come into this deal, had no real basis in policy?"

"No," replied the Air Minister, "we are not inviting them to come in now. We have made it abundantly clear that there is no immediate intention of obtaining facilities for shipping companies to work on international routes. We have said that we cannot decide on our national set-up until the international organisation of civil aviation is settled." He added that we could not ask facilities from other Governments, nor were they asking facilities from us, in advance of international discussion which he hoped would start before long.

The debate was launched by Sir Alfred Beit, who said that he and his hon. Friend (Mr. Tree) were bringing forward the subject of civil aviation so soon after the previous debate on the subject because, on that occasion, it had been "too much fogged with the idea of internationalism." His chief quarrel with "hon. Members opposite" was that by concentrating on this aspect of the subject they had given his right hon. and gallant Friend, the Under Secretary (Capt. Harold Balfour) an opportunity which he did not fail to take of writing-off that topic and, consequently, circumnavigating the immediately obtainable matters.

Saying that he was personally opposed to the idea of internationalisation, Sir Alfred Beit mentioned that the American Press was already making references to the rights that country should enjoy, in many territories, where her money has been poured out in constructing airports and similar bases. "I should like to point out," observed Sir Alfred, "that all such expenditure is a contribution to the United Nations war effort and nothing more. . . . These new and imposing airports, which will be the nodal points of the great traffic routes of the future, must be available to all on equal terms, subject to orderly international agreement." On the subject of Air Ministry control, he pointed out that in the various debates they had had on this subject, no hon. Member seemed to have advocated a continuation of the existing system, and although he was fully aware that the wheels of a Coalition Government moved slowly, they might hazard the guess that "the House will react most unfavourably if my right hon. Friend shows no signs of parting with reluctance from what can only be described as a neglected child."

### Five-point Policy

Finally Sir Alfred Beit put forward what he described as "a perfectly clear and simple policy for civil aviation which we have every reason to commend to the House." This was a five-point policy, summarised as follows:—

- (1) The early adoption of freedoms of transport and emergency landings. Freedom of air operations and the use of airports to be subject to mutual agreement and traffic arrangements.
- (2) An international convention to supervise subsidies, regulate fares, and lay down the status of technical and personal requirements.
- (3) A British or Empire Licensing Board to which all applications for air operations must be made, to prevent unregulated competition.
- (4) Control of civil aviation to be vested in a separate Ministry or the Ministry of Transport.
- (5) Civil transport aircraft to be constructed in the immediate future to enable the Empire to operate its own air service without dependence on other countries.

With every passing year, said Sir Alfred, it became increasingly possible to operate airlines without subsidies: six British shipping companies which had got together to operate an airline to South America were prepared to operate without a subsidy, asking only an airmail contract.

## SEVEN POST-WAR TYPES

He was against a world-wide monopoly for B.O.A.C. though he thought the corporation would be a proper instrument to provide a link in an all-Empire chain encircling the globe.

He was supported by Mr. Tree, who said that there was no longer any need to fear civil aviation on the grounds that every aircraft was a potential bomber.

Civil and military design had diverged so greatly in the course of this war that, to-day, transport aircraft were no more potential bombers than the *Queen Mary* was a potential battleship.

To refute the idea that civil aviation was an infant industry still dependent on subsidies for its existence, he quoted from an article by Mr. William Burden, advisor to the Secretary of Commerce in Washington, which appeared in the *Atlantic Monthly*, in which the writer had said, "International Air Transport has been transformed by the war from a Government-subsidised experiment into an economically sound transportation industry." That statement, said Mr. Tree, was corroborated by recent C.A.B. figures showing that United States Domestic Airlines were now operating at 1½d. per passenger seat mile, and soon hoped to reduce it to 1d. He also quoted cargo figures to show favourable comparison with surface route charges, and said: "In other words, the internal airlines are now operating commercially and at a profit." He added that he was compelled to quote American figures because, unfortunately, we had no statistical department dealing with the matter in this country.

The question before them to-day surely was: Is this great and growing industry, on which many of our future hopes depend, to continue as second fiddle to a Service Ministry? Has not the time arrived when it should be accorded a Ministry of its own with a Minister of Cabinet rank? During the past 18 months he had talked to a great many people whose whole lives had been spent in trying to develop and build up this industry. "And I have never met a single person," said Mr. Tree, "who has not been quite emphatic in stating that he believed that until it is removed from the Air Ministry it will continue to be throttled and restricted."

#### Apprehension Everywhere

Similarly, there was great apprehension everywhere as to whether B.O.A.C. could carry out the great task entrusted to it, and he did not believe that one Government-owned monopoly, one body of directors, however good, could plan and operate the whole future of British and Colonial air transport after the war; it was neither possible nor right that they should do it. He did not see why private enterprise, which had never been lacking in energy and vision in the past, should not be allowed to participate. Licences should be granted to different companies to operate separate routes, and they should be allowed a mail surcharge for doing so, and if they were to catch up the years in which they had slept there was no time to lose now.

It was Mr. Montague who led the counter-attack for the Labour Party by saying that Sir Alfred Beit's speech in particular had indicated what was in the minds of those for whom he stood. The burden of his argument was that this great instrument of progress, "this miraculous invention of the aeroplane," should be used for competitive purposes by private individuals for private profit. The Labour Party did not accept that proposition, but believed that the air, a universal medium, should, so far as it was used for transport, be operated by the nations of the world in collaboration.

He knew there were difficulties in the way of internationalisation, but the attitude of the Labour Party was that we should so shape our home and Imperial policy that we could go forward towards clear international understanding and co-operation.

He wished the hon. Members opposite would make up

their minds whether they wanted civil aviation under a separate Ministry or whether they would be content with the Ministry of Transport. The Labour Party supported its transfer to the Ministry of Transport because it believed that transport was one and indivisible, and they wanted to apply the same principles to transport of all kinds. But that was not the reason the hon. Members opposite had; he rather suspected that their purpose in wanting to get civil aviation away from the Air Ministry was that they feared Air Transport Command and the whole idea of Government control of this new and developing means of world transport.

#### Not for Private Profit

The Labour Party stood for the Empire Air Board and the finest possible development of the Imperial services that could be undertaken, but certainly not in order that private companies could make profit. They could at any rate get as far towards the principle of internationalisation as an Empire service, with its powers of negotiation with other countries, which should be organised efficiently in the interests of the nation and not in the interests of private companies and private property.

The grandiloquent talk about civil aviation bringing the people of the world together and cementing the bonds of peace needed debunking. It was used by hon. Members in order to get away with their proposals for profits and subsidies; Brunel talked in precisely the same way about the steam engine. In the next ten or twelve years civil aviation would only bring together the well-to-do tourists, business men and commercial ambassadors, not the ordinary people of the world, of America and other countries. In saying this he was not deprecating civil aviation; he believed it should be fostered and developed, but far too much was being made of its possibilities at the present moment. There was not one person in 1,000 who would be able to afford to travel by air to other countries, and if he were to take to his Islington constituents some of the speeches that had been made in civil aviation debates in that Chamber they would rock with laughter; they would say, "Blimey, it's as good as Itma!"

Air Comdre. Helmore said it had frankly to be admitted that one had to pay for speed, and it was speed the aircraft provided. He hoped many people would, through improved social conditions, be able to pay for this speed, and thus the aircraft would be the omnibus of the future. We must get together with our Empire and our Allies and study the air problem broadly, not merely as a commercial or civil undertaking, but as a whole; one of the subjects to be discussed would be an Allied air police force, otherwise we might as well start planning for the next war. We could, and must, create a striking force for rapidly and finally eliminating aggression. On the subject of technical development, he said it took four weeks to make a Ministry, but four years to make a new aircraft.

Mr. Wakefield wanted to see civil aviation taken from the Air Ministry and B.O.A.C. stripped of its monopoly, while Mr. Hore-Belisha urged the need for an adequate terminal airport within easy reach of London. He thought that only three groups would be able to run airlines after the war, the U.S., Russia and Britain with her associates. Mr. Granville said that B.O.A.C. had been set up by Treasury mandarins backed by the Air Marshals and the Air Ministry, and it had been a failure.

Mr. Perkins said that civil aviation in this country had never had a penny spent on it for design or research; all the money was grabbed for the R.A.F. The crowning fallacy was when the Secretary of State had said that if civil aviation were taken away from his department, none of the young men and women in his department would have the same zeal for flying. This suggested that civil servants in civil aviation were merrily flying up and down the country and were keen on flying. The true fact was



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## SEVEN POST-WAR TYPES

that none of them flew and none of them could fly; they went by train and car.

Sir Archibald Sinclair dissociated himself from the idea that civil aviation was remote from the people. He thought it would be short-sighted to allow it to be subordinated to the interests of older forms of transport by placing it under the Ministry of Transport, for the risk that it would be directed into channels least harmful to the older forms could not be ignored. The establishment of a separate Ministry for civil aviation was clearly not to be considered.

Dealing with new types of civil aircraft, he mentioned

that the first Brabazon Committee, besides recommending the design of the five new types, had considered that at least four of our wartime military aircraft would be suitable for civil use with varying degrees of modification. In this class the Avro York was now flying successfully, and the second, a military transport version of the Halifax bomber, would be readily convertible to civil operations. There was also the famous Short Sunderland flying boat which had already proved its worth as a transport in the hands of B.O.A.C.

[See Editorial Comment on page 299.]

## Sir Stafford Cripps Surveys Output

BRITAIN'S aircraft industry is as good as that of any other country in the world, Sir Stafford Cripps, Minister of Aircraft Production, told a Press Association reporter the other day. His staff had achieved the colossal task of putting in hand a new and complete programme at great speed with very little upset to the industry considering the necessities of the situation. It could cope with all future military or civil requirements.

"We have got to cater for the design and production of a number of new types to meet demands which the Services have put forward for the future—some time some years ahead," he said. "We have also to consider the new civil transport problem, both in planes and engines, but of course that must take a second place to our war requirements."

"I do not think it is possible to say we have reached the peak of our output. I do not think from the point of view of operational strength we have reached it, but I think we have from the purely numerical point of view."

"We shall probably be producing more bigger aircraft and rather fewer smaller ones. The spurt for operational strength may be greater. We may work up that and work down on others. The civil transport programme has got beyond the research stage. It has reached the design stage."

### Good Team Work

Sir Stafford said that reviewing the aircraft industry for the past year, they could say the results achieved had been due to really good teamwork throughout the industry. They had concentrated on improving efficiency and saving labour wherever possible. The Production Efficiency Board set up about a year ago had undoubtedly brought about a great many improvements in the utilisation of labour and machinery which had met with a full response from the industry.

Another factor that had helped them had been the realistic planning by the Department. They had tightened up the organisation for the supply of raw materials. There had been some difficulties in individual units, but, on the whole, managements were congratulated on the first-class job they had done. Where there had been difficulties, they had managed, by co-operation, to get them smoothed out.

Going more into details, Sir Stafford said that on the production of Lancasters during the last 12 months, man-hours per machine had been decreased by 38.2 per cent. In the production of Spitfires there was less latitude for

economy. Between 1939 and 1943 there had been a reduction of 27.5 per cent. in man-hours, and skilled workers had been reduced to 40 per cent., while the employment of unskilled workers had increased by 500 per cent. Present types required much more skilful building than the original types, and man-hours were higher.

As regards engines, as a whole, if they took the index figure as 100 in 1939, the figure for 1941 was increased to 325, and for 1943, to 485. Taking a particular type, the Merlin, they found an almost spectacular figure. Taking 1939 as 100, it had risen in 1941 to 490, and in 1943 to 880.

### Spare Parts Problem

This was a continuing increase in spite of the many new types of Merlin engines. Side by side with that had gone the development of one type after another. One other factor had increased the difficulties. The more they went on to new types, more they were left with spares for the old ones. They still had factories making nothing but spares, and during the past year they had much increased their output.

The output of air frames now was somewhere in the region of 40 per cent. of the total output of new production, and the same sort of figure would apply to engines. That increase had absorbed in itself a lot of manpower.

One important thing was the maintenance of quality, and that did not apply only to air frames. In all branches there had been a great advance during the past year. Probably the most spectacular had been in the radio field, and this was also the most secret.

Sir Stafford said that he had visited 240 factories since he took office. The joint production committees were settling down extremely well to their job and they had proved their usefulness in producing good relationships between management and workers. It had been found that in a number of cases where excessive hours were worked, a reduction of hours had led to increased output. As far as possible, Sunday work had been cut out. The number of women employed in the aircraft industry was now nearly 40 per cent.

"I am extremely keen on part-time work," Sir Stafford added. "It is a very fine and efficient form of production, and, of course, some meal intervals are saved. We have one factory which is fully on part time making aircraft parts, and the average age of the women is between 45 and 50."

### POST-WAR CIVIL AVIATION TALKS

THE United States is conducting conversations with the British, Russians and Chinese looking to possible arrangements for a United Nations Conference on Post-war Civil Aviation," says the U.S. Office of War Information.

"Late last December the State Department began consultations with the Senate Committees on Commerce and Foreign relations and received in general encouragement to go ahead. The time for the conference and conversation has not yet been estimated. It is understood that former Ambassador Joseph

Grew will head the American delegation. The Civil Aeronautics Board and the Department of Commerce are aiding in this discussion.

"Although Government-sponsored and subsidised aviation has been discussed in both the U.S. and Britain, it is hoped that aviation will stand on its own commercial basis, although it is recognised that there will be certain lines, not commercially profitable, which countries will wish to maintain. The American position is governed by the Civil Aeronautics Act of 1938; if Congress changes our policy, the State Department will fall in line."

# 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.

## JET PROPULSION FOR AIRCRAFT Suggested Modifications

I CONGRATULATE Mr. Geoffrey Smith on his clear exposition of the turbine-operated jet (*Flight*, Feb. 17th), and the combination with it of the contra-prop which seems to promise interesting possibilities for the future when ton-miles per gallon becomes more important than enormous h.p. per lb. Mr. Max Millar's interesting drawing on page 17 of the combination is most helpful in visualising possible developments, but the design is open to objections, which I will try to formulate.

Having settled how the jet does its propelling, we are now entering the domain of thermodynamics, where the laws are as immutable to the engineer as those of Newton. First of all we have Carnot's well-known expression for the thermal efficiency of an ideal heat-engine, viz.:

$$\frac{T_1 - T_2}{T_1} = \eta \dots \dots \dots (1)$$

Next to be considered is the connection between temperature and pressure in adiabatic compression or expansion, viz.:

$$\frac{T_1}{T_2} = \left(\frac{P_1}{P_2}\right)^{\frac{\gamma-1}{\gamma}} = R^{0.29} \dots \dots \dots (2)$$

Combining (1) and (2), we have

$$\eta = 1 - \frac{1}{(R)^{\gamma-1}} \dots \dots \dots (3)$$

This shows the importance of the compression ratio, but there is a limit on  $T_1$  imposed by the materials of the turbine-blades, say,  $T_L$ . If, in an ideal adiabatic compressor and turbine,  $R$  is such that  $T_L$  is reached, then the set will not give power because it is impossible to add fuel heat. It is futile in this case to cool the compressed air after compression, as shown by Mr. Millar, because the fuel would only replace the heat thrown away, and the final result would be the same as before. A lower  $R$  would reduce the possible efficiency, and the aim should be to have the highest possible  $R$ .

True isothermal compression would solve the difficulty and could nearly be attained by cooling the diaphragms and guide blades between each stage of compression; nevertheless, the possible thermal efficiency of the turbine is limited by  $T_L$ . This temperature is reached by using less than the total oxygen content of the air, which is wasteful. By using all the oxygen, with fuel oil, a temperature in the neighbourhood of 5500° K is reached, but that is too high even for most refractories.

I suggest that Mr. Geoffrey Smith's design be amended in the following manner:—

- (a) That the air intake be enlarged so that the contra-prop forms the first stage of the compressor during take-off and cruising, but is finally stopped and feathered at abnormal speeds.
- (b) That the compression be in two isothermal stages, the first stage to an  $R$  which is suitable to the turbine, the exhaust from which forms one jet, and the second stage to a higher  $R$ , the air from which is taken to combustion chambers of refractory material, and the products of combustion expanded in de Laval jets. The jets,  $R$ , and fuel consumption should be so balanced, if possible, that the eject is at the lowest attainable  $T_2$ , and that  $P_2$  should be practically that of the atmosphere.
- (c) That the jet outlet should be an expanding one so that the slip stream velocity should be as low as possible compatible with the mass of air and desired thrust. I still object to high velocity jets!

It would be interesting to have particulars of the blower mentioned by Mr. G. W. Stanley (*Flight*, March 2nd), without which his figure of ½ per cent. of the power generated seems incredible. ["PROJET."]

## THE FLYING BOAT A Jet-driven Plastic Flying Wing

MR. C. A. N. POLLITT has raised a very crucial point in his article in *Flight* of Feb. 24th, i.e., "First of all . . . persistent claims of the flying boat having a ready-made landing surface may prove misleading . . ."

The truth is that the development of aircraft is making them more and more absolutely dependent on prepared bases, whether they be solid or liquid. In war, of course, the bases must also be held and supplied by the surface forces, but in peace it is only necessary to prepare the surface and provide terminal facilities. Now, half this job can be said to be

ready-made in the case of flying-boat bases on lakes and rivers, but let us altogether discount this advantage for forced landings, since only one quarter of the globe provides water.

Let us say "Given bases, how does the aircraft best evolve—landplane or flying boat?" I will describe extremely briefly such evolution along three channels (a) materials and stressing, (b) propulsion and take-off, (c) performance and control.

In the first place, there is a sound practical reason for plastic materials ousting metals, other things being equal, so that the stressing of a huge aircraft, efficiently and lightly designed, may be done by photo-elastic analysis of a model, also made of a plastic material with similar elastic peculiarities. Consequently the objection of the corrosion of metals by sea water can be replaced by the objection to holes for retracting wheels.

Secondly, the advent of jet propulsion, while removing the flying boat's headache of airscrew clearance, introduces the problem of where to blow out the jet. Instead of striving to keep such a hot and eroding blast away from the ground during take-off, it would be quite desirable to blow out as near as possible to a water surface.

Finally, the now generally accepted "flying wing" ideal can be used practically without modification as a flying boat, as explained by Dr. Roxbee Cox in the *Royal Aeronautical Society Journal* of July, 1938.

The C.L.W. Curlew, described in *Flight* of Sept. 17th, 1936, had quite remarkable aileron control near the stall, and this was ascribed to a peculiarity in the wing shape, i.e., elliptical in plan and straight tapered in elevation (Prov. Pat. No. 24623/36) from N.Ac.A. 2421 to 2418 aerofoil sections, using neither wash-out nor wash-in.

The result was that the relatively thinnest section occurred near the inboard end of the aileron (approx. N.Ac.2412), and a study of the lift curves will show that the outboard portion of such a wing might stall last. Similarly an increase in root chord in plan only, i.e., a drastic reversal of the elliptical curves of leading and trailing edges for about one-third span, might have an effect similar to increased aspect ratio—always keeping within the limits of peculiarity of the chosen aerofoil sections. If now our "flying wing" is of this rather unusual shape, it will be seen, if anyone cares to sketch it out, that we have a distinct pull formation which Dr. Roxbee Cox might prefer to his own suggestion in the paper referred to above.

R. C. ABEL.

## THE WORLD'S BEST AIRCRAFT

### Why Masefield's Sudden Change of Front?

THE other day, while looking through some old papers, I came across a copy of the *Sunday Times* of August 16th, 1942. In this appeared an article by Mr. Masefield in which he displayed little enthusiasm for American bombers. In fact, he wrote: "Much as we need bombers over the Atlantic, first-rate heavy bombers are needed over Germany in the greatest numbers possible. American production of heavy bombers is concentrated on the inadequate Fortress and Liberator." He continues: "If one may venture an honest—and constructive—criticism from this country, it is that America's greatest production need would seem to be to turn over her vast potential to new and improved types of heavy bombers without delay. She owes it to her men and to the Allies' cause."

"SIMPLETON."

### Accent on Anglo-American Superiority

I WAS very pleased indeed to read in *Flight* of February 24th the article by F. Lloyd and R. L. Lickley on "The World's Best Aircraft," in answer to Mr. P. Masefield's article on the same subject.

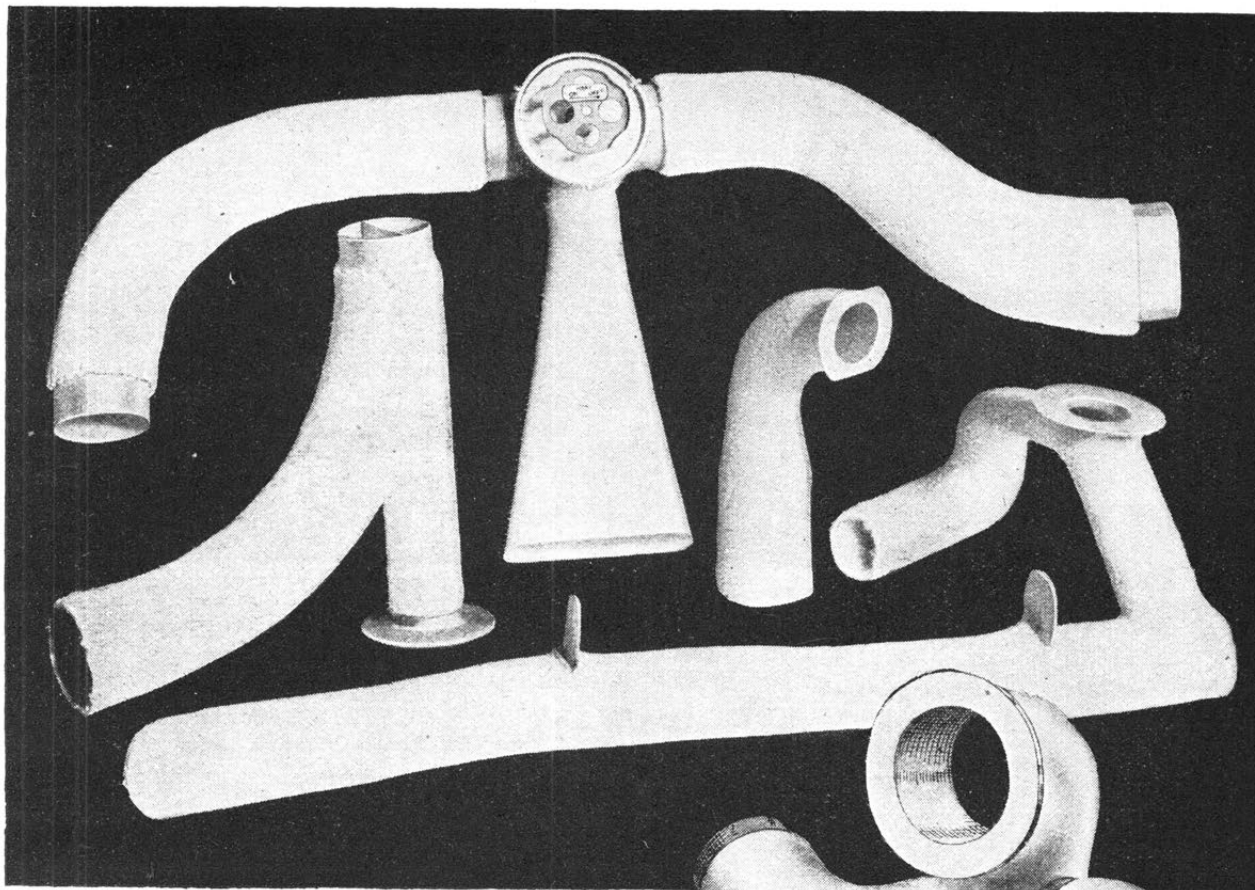
I do not profess to know anything about aircraft which are still on the secret list, but, taking fighters and bombers only, I should name four aircraft as being the most outstanding aircraft in this war, so far. They are the Spitfire, Mosquito, Fortress and Lancaster.

First, the Spitfire, because it started this war as a first-line fighter, and Mark IX is definitely a first-line fighter now, and I am sure at the end of this war future Marks of the "Spit" will be ranking alongside other first-line fighters.

The Mosquito, because of its unusual construction, its fire power, speed and versatility. I am sure it has no equal.

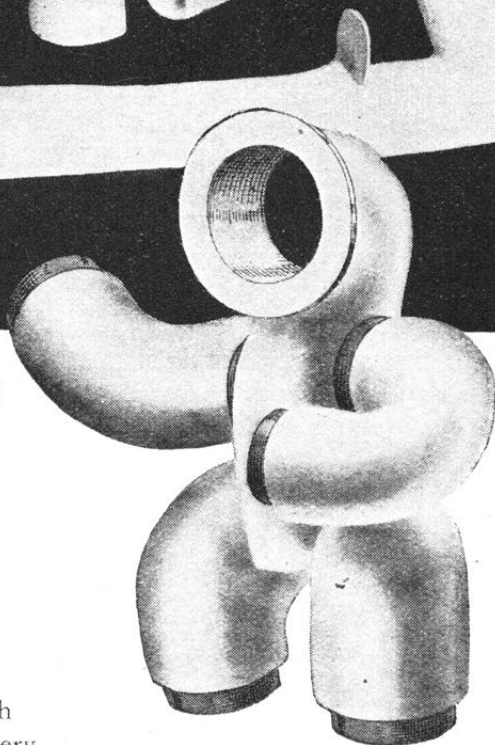
The Fortress, because of its tremendous fire power and ability to defend itself, makes it the ideal day bomber.

The Lancaster, because of its ability to carry a heavy load.



## Meet the Family!

“WE may not be much to look at, perhaps . . . though the photographer did call us a ‘charming ensemble’” (*said the little man from Johnsons*) “but we’re certainly warm-hearted and all joined up, serving the Old Country. Mind you, I won’t say we never have our ups and downs, but, oh boy, the ups! That’s when we fairly radiate a cheery glow to all airmen, because we’re the special alloy ducting used in Uncle Tom’s Cabin Heating System. Guiding the best quality therms through cockpit and cabin till they’re thoroughly exhausted, we’re the icicles enemy and pilot’s friend. There’s not much rest for us these days, but taking the RAF with the smooth, so to speak, we get along without fuss or trouble.”



**NOTE:—All ducting used is insulated with Bell’s Asbestos.**

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## CORRESPONDENCE

a very great distance, and I am sure the defence is something Nazi fighters respect.

As an afterthought I think I should add a fifth; that is, the new long-range Mustang with the Rolls-Royce engine. This fighter has certainly achieved something, being able to escort bombers nearly to Berlin and back again.

There is no point in the Americans and ourselves fighting over who has the best aircraft, because between us we do definitely have the best aircraft in the world, and as long as we keep this superiority over the enemy the quicker this war will be over; but I do think British aircraft are *not* given enough praise and publicity. Only the other day I saw a short film in technicolour entitled "Men of the Sky," showing the training of American airmen and the aircraft they fly. It was very good and most interesting, but how I should have liked to have seen instead of khaki, Air Force blue, and instead of American machines, British.

Lastly, I should like to make a comment on Britain's transport aircraft, the Avro York, which, in my opinion, is rather looked down on. The Americans in one of their journals go so far as to call it a "Flying Boxcar." Admittedly, it is not the super-post-war airliner, but for its job of wartime transport duties and a start for Britain's post-war airliners I think it is an excellent machine.

J. C. LAND.

## BACKBONE OF THE FLEET

*Multi-purpose Single-seater*

IN your issue of February 3rd your contributor, B. J. Hurren, in "Backbone of the Fleet," advocates a single-seater torpedo-fighter-bomber of elastic characteristics, and Peter Masefield the subsequent week categorised ship-based aircraft into:—

- (i) Interceptor fighters,
- (ii) Dive-bombers,
- (iii) Torpedo bombers,
- (iv) Escort fighters.

Although I am not well versed in technicalities, I can see no insurmountable difficulties in producing one omnipotent aircraft.

In order to enlarge and expound this theme let us assume that an aircraft carrier can stow 60 aircraft and that its complement is a tripartition of fighters, torpedo and dive-bombers. Now a situation may arise when, for example, a striking force in excess of 20 dive-bombers is urgently required, or, on the other hand, the fighters may have been so depleted as to render them incapable of maintaining the requisite air umbrella.

Now if these 60 aircraft were reasonably high-performance fighters capable of carrying bombs, depth charges, torpedoes or over-load drop tanks as the occasion demanded, the effective striking power of the carrier would be vastly increased. For, as long as the machines were serviceable, they would be competent to cope with any exigency. [I suggest the aircraft is called the "Wyvern."]

These "Wyverns" would naturally not be 100 per cent. in all categories, but my estimates of all-round efficiency are:—

- (i) Interceptor fighter—85 per cent. compared with the Seafire.
- (ii) Dive-bomber—equal if not superior to the Curtiss Helldiver.
- (iii) Torpedo bomber—superior to the Avenger or Barracuda.
- (iv) Escort fighter—equal or slightly inferior to the Hellcat.

The over-riding justification for the "Wyvern" lies in the fact that, having shed its torpedo or bombs (which would be stowed externally), it is once again a fighter, as the crutches and racks, if well faired off, would have a negligible effect on speed and manoeuvrability. The aircraft would naturally be equipped with dive brakes, which would also facilitate slowing down for torpedo attacks, and would presumably carry four or more cannon.

I am irrevocably certain that our designers could produce this aircraft, but I am equally sure that the Fleet Air Arm would emit a concerted howl to the effect that it would prove too great a task for one man to act as pilot, navigator, bomber, flight engineer, wireless operator, etc., in one small cockpit. This is understandable, for this "stringbag" conscious Service is still reeling from the effects of retractable wheels and flaps; but the answer is they will *have* to learn and become "super-men."

I now retire into my corner confidently to await the inevitable onslaught of outraged technicians (mainly amateur) and exasperated pilots.

"I. M. LEACH."

## ROUND-THE-CLOCK BOMBING

*Why Not U.S. Night Raids?*

WE have all been reading recently about the great American daylight air attacks against military and industrial targets in Germany and the occupied territories, and, hearing so much about these day raids, I have been wondering why the total U.S. bomber strength has been built up of day bombers only, the night work being undertaken by the Royal Air Force.

It is evident, even to the most casual observer, that the Allied air offensive against the enemy is being executed in daylight mainly by American "heavies"—Liberators and Fortresses—and at night by R.A.F. bombers. This appears to be quite logical, but on examining the available facts I cannot understand why part of the huge United States aircraft industry is not turning out considerable numbers of heavy night bombers.

I believe it is correct to say that the main object of a bombing offensive is to deliver the greatest weight of bombs possible with each blow struck at the enemy—in the right places, of course. In that case the night bomber is the best available weapon, as its bomb-load can be, say, three times greater than that of the heavy day bomber with its elaborate defences and consequent small bomb-load compared with the night bomber. Furthermore, half of a bomber force operating in daylight may be composed of escorting fighters. Greater numbers of enemy fighters are shot down on day raids, but the best method of reducing enemy air strength is to destroy the means of building aircraft.

It may be said that greater accuracy can be achieved in daylight bombing than at night. Is this true? It may have been some time ago, but with such effective target indicators as those now used by the R.A.F., night precision bombing must be greatly facilitated.

I do not advocate the abolition of day bombing—far from it—but I do believe that, if part of the vast American air potential were used in night operations, together with the R.A.F., richer dividends would result than by using it entirely by day.

I should be very interested to hear some of your readers' opinions on this subject.

R. L. GLADWELL.

## THE STUDENT'S POINT OF VIEW

*The Case for Generalisation*

THE recent article giving the students' point of view (*Flight*, February 3rd) raises some interesting points, some of which are highly controversial.

As regards specialisation, one imagines that this can only be justified as a short-term policy where rapid expansion becomes necessary, as has occurred during the war. In training operatives in this way, the main essential is for them to acquire the necessary skill, or specialised technique, without being burdened with too many theoretical considerations or "reasons why." The time available for training precludes any possibility of ranging over a wide field, and it is more a matter of attaining sufficient manual skill to perform one operation and perform it well.

In dealing with the training of a man for a career in engineering, however, it is difficult to see how specialisation can be justified in any way. Surely the whole point of an engineering training or education is to provide a background and to inculcate the habit of clear, orderly and logical thinking. A number of people are quite unable to think correctly, chiefly because they have never been so taught. Our present educational system, aimed at the successful passing of various examinations, encourages the mere reproduction of knowledge from textbooks, in which the possessor of a photographic or "eye" memory, is in his element. Alternatively, passages or condensed notes may be committed to memory in a parrot-like way. Original thought or deductive thinking seems to be pushed into the background.

In an article in *The Engineer* as far back as 1884, Rigg stated that "the great end and aim of education should never be, as too often found, cramming with mere knowledge, but rather the cultivation of the power of applying knowledge." Many mental exercises could be planned to develop the habit of reasoning; for example, the maintenance engineer engaged in fault-finding is surely using the same mental processes as are required to solve a murder mystery of the "who-did-it?" variety.

Again, many people possess a "pencil and paper" mind, which is quite capable of solving a problem on paper, but has no idea of its practical application. When faced with the problem of raising a 10 cwt. block of cast iron, I have heard

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a quite intelligent boy say promptly "10 cwt.—10 men," the trouble being that he thinks of a lever as a textbook exercise in the "Theory of Moments," and not as an actual practical means of obtaining mechanical advantage to move a load with the minimum of effort. How often is one asked "What is the use of mathematics?" the questioner being under the impression that it is a species of mental jugglery in which the manipulator, if he is sufficiently skilful, will produce a correct answer rather on the lines of a human slide rule. In this connection it seems a pity that the history of mathematics is not more widely taught, somewhat on the lines of Hogben's "Mathematics for the Million."

If the mind is incapable of using knowledge in an intelligent way, then the acquisition of knowledge becomes so much waste of time, and in this connection the question of "unused erudition" does not arise. The wider the range of subjects which are studied, the more pliable and versatile should the mind become, and the more capable of reasoned thought and application to new problems. In any case, it is often much more useful to know how and where to look for information than to try and memorise an impossible amount. Certain basic facts must, of course, be committed to memory, but it does not follow that all information need be of a strictly utilitarian value; much of it may never be used, but its study has certainly broadened the mind; the chief danger of early specialisation being the very narrow outlook which it engenders.

When the student leaves his university or technical college his education is not ended; it is really only beginning, as he is not faced with the problem of continuing to educate himself, a process which will probably continue throughout his professional life. In this event, if the student finds himself engaged subsequently in a highly specialised department, he will probably have at his disposal a considerable amount of information which has accrued through previous experience. In addition, he will have to read all published information on the subject, either in textbook form or the journals of the Royal Aeronautical Society, Institution of Production Engineers, or other appropriate technical body, both here and abroad. A close study of the current technical Press will be essential in order to keep abreast of developments.

The article deals more particularly with production problems, and there does appear to be a need for some basic training in the modern science of industrial management, time and motion study, quality control, etc., although it is difficult to see how training can be given in actual production problems without engaging in works production; in training conditions the amount produced can never be on sufficiently large a scale to simulate factory conditions. One imagines that in post-war education considerably greater use will have to be made of applied psychology in all types of training.

G. D. DUGUID.

## THAMES-SIDE AIRPORT

## Suggested Alternative to the "Miles" Plan

THE illustration of an aerial view of a model of the suggested Thames-side airport which you published in *Flight* on February 10th, visualised by Mr. F. G. Miles and designed by Mr. Guy Morgan, appears to me to overlook a number of most important points.

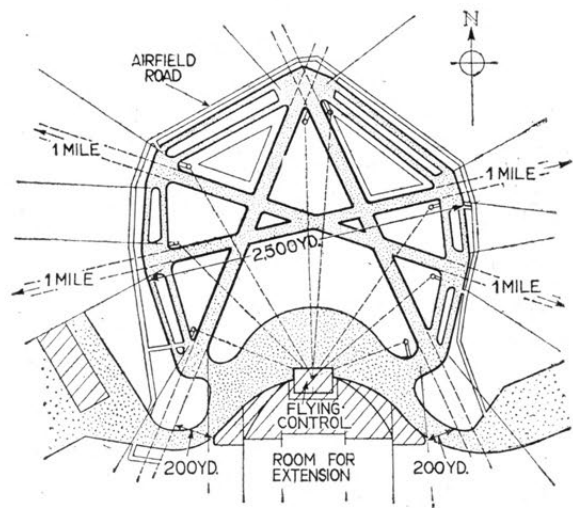
In view of the greatest length of the seadrome, the prevailing wind appears to be in such a direction that it is blowing from W.S.W. to E.N.E. across the picture, and this will therefore make it essential for boats to take off or land directly over the main airport buildings, which, to say the least of it, is extremely undesirable. Also there appears to be no jetty or refuelling station, or slipway for repairs, and these are essential for a flying boat base. The provision of a sheltered beach hangar would be essential for easy operation and quick maintenance. It would also be necessary to moor a certain number of boats to buoys, and this would restrict the available amount of water.

From the scissors runways it appears from the illustration that should the pilot of an aircraft be taking off towards the airport buildings he has only to swing 2-3 deg. to "write off" himself and his passengers, not to mention the unfortunate ground personnel. This also applies to other aircraft landing in the opposite direction and approaching past the main buildings. In addition, it appears that if an aircraft wishes to taxi out from one end of the airport building to the start of the runway, the only way it can get to its take-off position from the upwind side is by taxiing across the intersection of the main runways. This should provide quite a few headaches

for the flying control officer and much apprehension on the part of the fire crew.

These remarks apply to operations of the airport by day, but at night the hazards would be increased enormously with the close proximity of the main airport buildings. There also appears to be very little provision for accessible hangarage, and leaves the airport open to the possibility of unplanned development of odd buildings here and there such as developed at most of the civil airports now in use in this country. Judging from those which we have visited it appears that unless some rigid rule is laid down at the start, Air Ministry officials who have never flown an aircraft in their lives suddenly decide to construct hangars, maintenance buildings, static water tanks, etc., alongside runways, or in the main approach path to the runways. We think it is therefore essential that a definite area should be allocated for hangarage which will not interfere with the flying or clear approach to the runways.

One other point which appears likely to cause some difficulty will be the control of boats and aircraft taking off, each entering the other's circuit (it is only too easy for two aircraft to collide). We think that the idea of having what would obviously be a busy airport within a few hundred yards of an artificial seadrome would be very undesirable, and in view of the development of the landplane with its increasing range and speed we are sure that the most desirable procedure would be to make use of the existing flying-boat facilities and link those to a main airport with feeder lines.



The scale is not given in the photograph, but we imagine that by the appearance of the runways they are not more than 3,000 yards. This would make the take-off run the same as that of the seadrome, and although a flying boat does not need a great deal of space to take-off and land, in view of the fact that the seadrome appears to be bounded by a concrete wall, this distance does not appear at all safe to me.

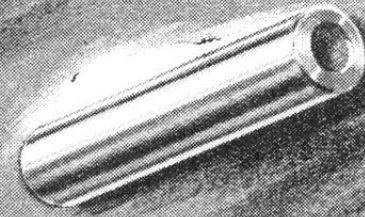
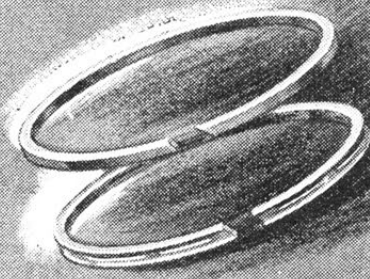
We enclose a sketch showing the lines on which we think an airfield should be constructed to cope with the heavy aircraft of the near future, and we think it essential for safe flying (which, after all, is the major consideration with regard to post-war airline operation) that open farmland should be preserved for at least a mile on the approaches to the runways. These we have indicated in the attached sketch.

Furthermore, as aircraft increase in size it will become essential, for ease in turning, to provide large concrete or tarmac spaces at the end of each runway. With regard to hangarage, definite spaces should be allocated which, as development takes place, will develop in such a manner that they will not interfere with the flying approaches to the airport; the main airport buildings should be extended away from the airfield rather than parallel to it.

A point we consider to be worth some consideration is that, generally speaking, unless local geographical conditions make it undesirable, flying control should be placed south of an airfield in this hemisphere so that the flying control officer for the most part of the day is not staring towards the sun, and also has the best view for take-offs and landings into prevailing wind, which is usually E.N.E.-W.S.W.

Such refinements as "Stop" and "Go" lights for airfield cars and electric indicator arrows for perimeter tracks to be followed, etc., will obviously come in due course as secondary considerations, but they add immeasurably to the ease and speed-up of operations which go to make for the smooth running

J. WINSTON.



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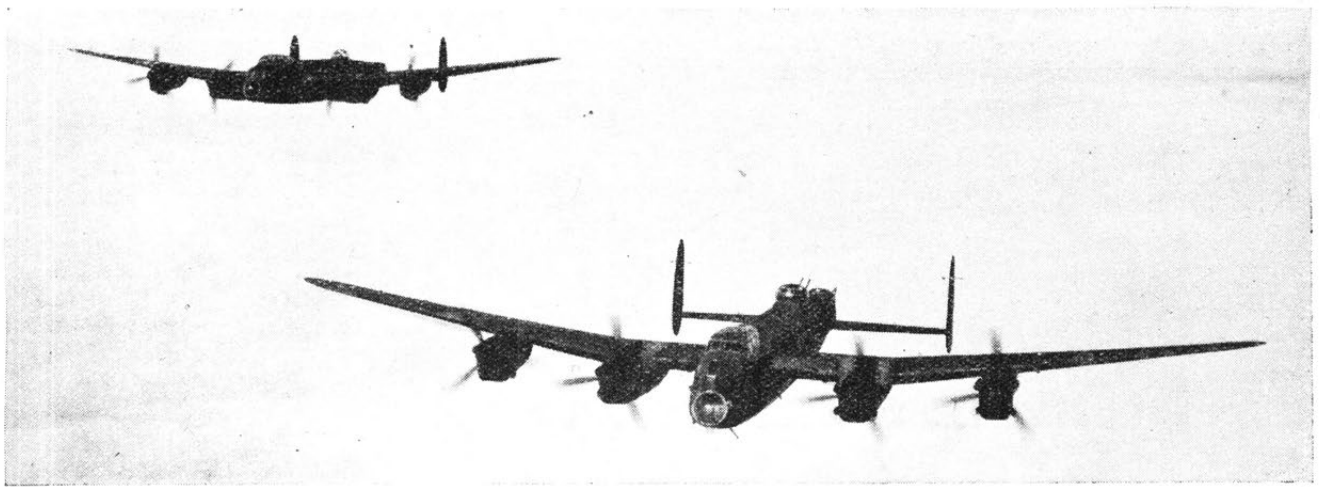
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Avro Lancaster IIIs in formation. These are fitted with Merlin XXVIII engines and have slightly modified bomb-aimer's panels.



# SERVICE AVIATION



## Royal Air Force and Fleet Air Arm News and Announcements

### Equerry to the King

THE KING has been graciously pleased to appoint Wing Cdr. P. W. TOWNSEND, D.S.O., D.F.C., R.A.F., to be an Equerry (temp.) to His Majesty.

### Promotions

#### GENERAL DUTIES BRANCH.

**AIR VICE-MARSHAL (TEMP.) J. W. BAKER, C.B., M.C., D.F.C.**, is granted the rank of Air Commodore (war subs.). February 7th, 1944.  
**Air Comdre. J. A. GRAY, C.B.E., D.F.C., G.M.**, is granted the rank of Act. Air Vice-Marshal. February 8th, 1944.

#### TECHNICAL BRANCH.

**Air Comdre. W. E. THEAK, C.B.E.**, is granted the rank of Act. Air Vice-Marshal. February 24th, 1944.

#### MEDICAL BRANCH.

**Air Comdre. T. J. KELLY, M.C., M.D., Ch.B.**, is granted the rank of Act. Air Vice-Marshal. February 21st, 1944.

### 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. Wing Cdr. L. WADE, D.F.C., R.A.F.V.R.**—Since being awarded a second bar to his D.F.C., this officer has continued to lead his squadron in operations against the enemy in the North African campaign and during the invasion of Sicily and the campaign in Italy. He has destroyed a further five enemy aircraft, bringing his total victories to at least 25 enemy aircraft destroyed and others damaged. An outstanding leader and fighter pilot, Wing Cdr. Wade's great skill, courage and devotion to duty have largely contributed to the high efficiency attained by his squadron.

**Act. Sqn. Ldr. A. C. DOUGLASS, D.F.C., R.A.A.F., No. 105 Sqn.**—Since being awarded the D.F.C., this officer has participated in a large number of sorties, involving operations in the battle of the Ruhr. He has displayed exceptional skill and his efforts have played a good part in the successes achieved in this phase of the attack on the enemy.

**Act. Sqn. Ldr. N. H. SCRIVENER, D.F.C., R.A.F.V.R., No. 85 Sqn.**—Sqn. Ldr. Scrivener is a navigator of high merit. He has taken part in a very large number of sorties, involving attacks on targets in the Ruhr, Berlin, Hamburg, and many others equally important to the enemy's war effort. Throughout these operations, he has displayed outstanding determination, and the successes obtained are an excellent tribute to his great skill.

#### Bar to Distinguished Flying Cross

**Act. Flt. Lt. G. H. F. CARTER, D.F.C., R.C.A.F., No. 35 Sqn.**—This officer is a most determined and reliable navigator. Since being awarded the D.F.C. he has performed his duties with exceptional accuracy, resulting in the successful completion of many missions. He has continued to display outstanding enthusiasm for

operational flying with marked ability and great devotion to duty.

**Act. Flt. Lt. T. W. MOPPETT, D.F.C., R.A.A.F., No. 156 Sqn.**—Since being awarded the D.F.C., Flt. Lt. Moppett has taken part in further operational sorties against some of the enemy's major targets. At all times his reliability and coolness have been outstanding, while his navigational skill has played no small part in the many successes achieved by his crew.

#### Distinguished Flying Cross

**P/O. A. WASHBROOK, R.A.F.V.R., No. 12 Sqn.**  
**P/O. H. W. D. WATTS, R.A.F.V.R., No. 97 Sqn.**  
**P/O. D. F. WEBB, R.A.F.V.R., No. 78 Sqn.**  
**P/O. H. WILTSHIRE, R.A.F.V.R., No. 78 Sqn.**  
**P/O. W. F. G. WOODLEY, R.A.F.V.R., No. 426 (R.C.A.F.) Sqn.**  
**W/O. A. C. FARMER, R.C.A.F., No. 12 Sqn.**  
**W/O. P. HAYTON, R.A.A.F., No. 460 (R.A.A.F.) Sqn.**  
**Act. W/O. V. A. M. HEDGES, R.A.A.F., No. 156 Sqn.**  
**P/O. H. MARSDEN, R.A.F.V.R., No. 158 Sqn.**  
**P/O. F. D. MAYOU, R.C.A.F., No. 405 (R.C.A.F.) Sqn.**  
**P/O. K. R. MIDDLEMISS, R.C.A.F., No. 12 Sqn.**

**P/O. J. A. NEVE, R.A.F.V.R., No. 51 Sqn.**  
**P/O. A. E. NEWMAN, R.A.F.V.R., No. 78 Sqn.**  
**P/O. F. H. QUICK, R.A.F.V.R., No. 101 Sqn.**  
**P/O. J. O. ROLLAND, R.A.F.V.R., No. 100 Sqn.**  
**P/O. A. S. RUSSELL, R.A.F.V.R., No. 51 Sqn.**  
**P/O. J. S. SALISBURY, R.A.F.V.R., No. 426 (R.C.A.F.) Sqn.**  
**P/O. H. T. SHEWAN, R.A.F.V.R., No. 101 Sqn.**  
**P/O. A. W. SOLE, R.A.F.V.R., No. 196 Sqn.**  
**P/O. L. J. STOW, R.A.F.V.R., No. 100 Sqn.**  
**P/O. C. W. STRINGER, R.A.A.F., No. 156 Sqn.**  
**P/O. A. D. TODD, R.A.F.V.R., No. 76 Sqn.**  
**P/O. D. R. TOOVEY, R.A.A.F., No. 50 Sqn.**  
**W/O. D. F. HODGE, R.A.F.V.R., No. 460 (R.A.A.F.) Sqn.**  
**W/O. S. HODGES, R.A.F.V.R., No. 51 Sqn.**  
**W/O. E. L. JONES, R.A.F.V.R., No. 49 Sqn.**  
**W/O. (now P/O.) O. M. MOORE, R.A.A.F., No. 460 (R.A.A.F.) Sqn.**  
**W/O. G. MUCKART, R.A.F., No. 97 Sqn.**  
**W/O. F. G. MURPHY, R.A.A.F., No. 35 Sqn.**  
**W/O. E. J. NORTON, R.A.F.V.R., No. 12 Sqn.**  
**W/O. J. M. THOMAS, D.F.M., R.A.F.V.R., No. 138 Sqn.**  
**W/O. E. M. WEBB, R.A.F.V.R., No. 49 Sqn.**  
**W/O. B. E. R. WHITEHOUSE, R.A.F.V.R., No. 199 Sqn.**  
**Act. W/O. T. H. EVANS, R.A.F.V.R., No. 7 Sqn.**  
**Act. W/O. J. H. MASON, R.A.F.V.R., No. 619 Sqn.**  
**Act. W/O. R. B. SMITH, R.A.F.V.R., No. 7 Sqn. (since deceased).**  
**Act. W/O. W. H. SWAIN, R.A.F.V.R., No. 7 Sqn.**

#### Distinguished Flying Medal

**Flt. Sgt. J. E. MORIARTY, R.C.A.F., No. 97 Sqn.**  
**Flt. Sgt. L. J. RUSSELL, R.A.F.V.R., No. 12 Sqn.**  
**Flt. Sgt. G. S. SHARPE, R.A.F.V.R., No. 51 Sqn.**  
**Flt. Sgt. L. H. STANDLEY, R.A.F.V.R., No. 7 Sqn.**  
**Flt. Sgt. S. B. STEVENSON, R.A.F.V.R., No. 97 Sqn.**  
**Flt. Sgt. F. J. TUDOR, R.A.F.V.R., No. 35 Sqn.**  
**Flt. Sgt. D. R. TULLOCH, R.A.F.V.R., No. 35 Sqn.**  
**Flt. Sgt. J. G. WALTERS, R.A.F.V.R., No. 35 Sqn.**  
**Flt. Sgt. R. C. WATSON, R.A.A.F., No. 101 Sqn.**  
**Flt. Sgt. H. D. WEAVER, R.C.A.F., No. 76 Sqn.**  
**Flt. Sgt. A. N. WEBBER, R.A.F.V.R., No. 138 Sqn.**  
**Flt. Sgt. G. YOUNG, R.A.F.V.R., No. 97 Sqn.**  
**Sgt. G. BOAG, R.A.F.V.R., No. 49 Sqn.**  
**Sgt. K. A. GRANGER, R.A.F.V.R., No. 100 Sqn.**  
**Sgt. V. B. HAZELL, R.A.F.V.R., No. 101 Sqn.**  
**Sgt. S. C. HEMSON, R.A.F.V.R., No. 78 Sqn.**  
**Sgt. C. HOGG, R.A.F.V.R., No. 35 Sqn.**  
**Sgt. G. IRELAND, R.C.A.F., No. 35 Sqn.**  
**Sgt. R. C. JUDGE, R.A.F.V.R., No. 101 Sqn.**  
**Sgt. R. H. LOCK, R.A.F.V.R., No. 192 Sqn.**  
**Sgt. T. MATTHEWS, R.A.F.V.R., No. 12 Sqn.**  
**Sgt. E. N. MAVILLE, R.A.F.V.R., No. 76 Sqn.**  
**Sgt. J. S. MITCHELL, R.A.F., No. 51 Sqn.**  
**Sgt. W. A. NAPIER, R.A.F.V.R., No. 101 Sqn.**  
**Sgt. F. A. NEWTON, R.A.F.V.R., No. 76 Sqn.**  
**Sgt. S. J. PEEK, R.A.F., No. 97 Sqn. (since deceased).**  
**Sgt. A. A. REED, R.A.F.V.R., No. 76 Sqn.**  
**Sgt. J. KENWICK, R.A.F.V.R., No. 101 Sqn.**  
**Sgt. R. W. SAIGAR, R.A.F.V.R., No. 78 Sqn.**  
**Sgt. D. B. SCOTT, R.A.F.V.R., No. 76 Sqn.**  
**Sgt. W. S. H. STRONG, R.A.F.V.R., No. 158 Sqn.**  
**Sgt. H. TURNHAM, R.A.F.V.R., No. 51 Sqn.**  
**Sgt. T. TYLER, R.A.F.V.R., No. 49 Sqn.**  
**Sgt. A. C. WALES, R.A.F.V.R., No. 51 Sqn.**



F/O W. H. Reid, R.C.A.F., No. 43 Squadron, who has been awarded the D.F.C.

## SERVICE AVIATION

## Roll of Honour

Casualty Communiqué No. 359.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in 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 the names in this list, 122 are second entries giving later information of casualties published in earlier lists.

## Royal Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. J. I. Barrie; F/O. R. B. Capon; F/O. J. H. R. St. John; Sgt. J. G. Steele.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. W. Armstrong; Sgt. W. H. Aytton; F/O. K. A. Barrett; F/O. A. D. Baxter; Sgt. B. T. Brett; Sgt. R. Brinkles; Sgt. R. G. Bridge; Sgt. E. Carter; F/O. D. J. D. Chitty; F/O. S. Cornforth; F/O. M. Davies; Sgt. A. G. Deane; F/O. R. Deere; Flt. Sgt. P. Fennell; Sgt. T. E. Hamley; Flt. Lt. J. R. Harries; Sgt. V. H. Hatchard; Sgt. R. Y. Herd; Flt. Sgt. J. A. Hoather; Sgt. I. A. Jervis; Flt. Lt. T. S. Lea, D.F.C.; Act. Flt. Lt. T. Luke; Sgt. W. Mapley; Flt. Sgt. A. J. C. Mason; Sgt. W. D. Mayor; Sgt. W. Nicholson; P/O. G. A. Nunez; Sgt. J. M. Randall; Sgt. D. W. Rowley; Flt. Sgt. A. E. Schildknecht; Sgt. A. Simpson; Sgt. B. Smith; F/O. H. E. Smith; Sgt. R. V. Smith; Sgt. B. W. Squires; Sgt. T. Teviotdale; F/O. H. K. Wainer; Act. Flt. Lt. R. Watkin; F/O. J. K. Webb; Sgt. K. E. Webb; Sgt. J. White; Flt. Sgt. R. J. White; Sgt. R. Wilson; Sgt. W. F. Wrenn.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. R. W. Allen; Sgt. A. E. F. Banning; Sgt. T. C. Henderson; F/O. W. J. James; F/O. R. MacKay; Sgt. E. C. McLaughlin; Sgt. J. Morton; Sgt. D. L. Smith; Sgt. W. A. Wall; F/O. R. C. Williams.

MISSING.—Act. Wing Cdr. W. Abercromby; Flt. Sgt. P. Allwell; Flt. Sgt. J. Anderson; Sgt. D. R. C. Appleyard; Sgt. J. Banks; Sgt. A. D. Barnes; Sgt. P. J. Barriball; Sgt. J. W. Bateman; F/O. A. B. Bearcraft; Sgt. A. W. Bell; Sgt. T. Bell; F/O. A. W. Blakeman; Sgt. J. J. Body; P/O. A. V. Borland, D.F.C.; Sgt. N. Bowman; F/O. J. G. Bryson; Sgt. D. Burden; Sgt. R. W. Carpenter; Flt. Sgt. R. W. Carver; Sgt. K. W. Cheshire; Sgt. P. Chittenden; Flt. Sgt. J. D. Clarke; Sgt. A. Cohen; Sgt. A. Colbourne; Sgt. W. R. Collier; Sgt. J. Cooke; Act. Flt. Lt. J. K. Cox; Sgt. R. G. Creber; Sgt. J. V. Dadson; F/O. G. R. Davidson, D.F.M.; F/O. A. G. Day; Sgt. D. A. Dixon; Sgt. J. McI. Dunlop; F/O. W. Dyker; Flt. Sgt. R. Ellwood; Sgt. R. S. Eminsang; Sgt. F. C. Eggleston; W/O. E. S. I. Evans; Flt. Sgt. G. R. Evans; P/O.

R. H. Filbey; Sgt. B. H. Fearn; F/O. L. J. Frost; Sgt. A. G. Fuller; Flt. Sgt. P. B. Green; Sgt. P. J. Greenmon; Sgt. C. R. Greenwell; Sgt. A. F. Gunnell; Sgt. A. J. Hackett; Sgt. W. D. Hall; Sgt. G. H. Hendry; Sgt. R. V. Hillman; Sgt. W. D. Holliday; P/O. J. Hooson; P/O. F. H. Hoyle; Sgt. E. R. Hughes; Sgt. J. H. Jaeger; Sqn. Ldr. H. R. Jaggard; Sgt. G. Johnson; Sgt. H. A. Joint; Sgt. L. H. Jones; Sgt. G. Jowett; F/O. L. C. Keeling; Sgt. J. S. Kennedy; Sgt. H. Landing; Sgt. A. J. Larby; Sgt. W. Laverick; Sgt. L. J. Loewenson; F/O. W. C. J. Lord; Flt. Lt. A. N. McGlashan; P/O. D. C. J. McKendry; Sgt. D. B. G. MacKenzie; Sgt. L. D. May; Sgt. S. J. Meeham; F/O. J. C. Osborne; Sgt. C. Parker; Flt. Sgt. E. N. Parker; Sgt. C. G. Payne; Flt. Sgt. K. C. Prouten; Sgt. B. S. Ranson; Sgt. G. V. Roberts; W/O. A. W. Robinson; Sgt. T. F. M. Roxby; Sgt. J. S. Scott; Sgt. A. G. Smith; Flt. Sgt. D. C. G. Snelling; Flt. Sgt. R. Stevenson; F/O. E. J. Stone, D.F.C.; Sgt. R. E. L. Stoneman; Sgt. R. Stuart; Act. Sqn. Ldr. A. E. Taylor, D.F.M.; Flt. Sgt. J. A. Thomas; Flt. Sgt. P. Traynor; Sgt. A. Waller; Flt. Sgt. R. G. Warwick; Sgt. E. E. Watson; P/O. R. P. Watts; P/O. S. Webb; Flt. Lt. R. E. Wesson; W/O. J. T. Williams; Flt. Sgt. J. B. Wood.

KILLED ON ACTIVE SERVICE.—L.A./C. L. Finch; Sgt. R. G. E. Sandy; Sgt. M. J. Trenaman; Sgt. W. R. Windsor.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A./C. E. Bamford; F/O. A. W. Gear, D.F.C.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. R. Dawson.

DIED ON ACTIVE SERVICE.—L.A./C. W. Johnson; A/C.1 S. H. Rance.

## Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Act. Flt. Lt. B. Burnley; Flt. Sgt. B. Finnane; Flt. Sgt. B. H. Harvey; Flt. Lt. R. J. Ingram; Flt. Sgt. K. James; Flt. Sgt. B. M. Muir.

MISSING, BELIEVED KILLED IN ACTION.—P/O. A. F. Nairn.

MISSING.—Flt. Sgt. K. S. Bell; Flt. Sgt. W. H. Hare; Act. Flt. Lt. G. H. Harvey; P/O. S. W. Lawson; P/O. K. M. MacDonald; Sgt. R. Miller; Flt. Sgt. A. B. Pearson; Flt. Sgt. M. E. Sadler; Flt. Sgt. W. A. Sampy; Flt. Sgt. M. Stuart.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—F/O. C. R. Norton.

## Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. J. L. Arthur; Flt. Sgt. J. G. Brady; P/O. L. J. Burpee, D.F.M.; Flt. Sgt. H. Erickson; F/O. R. Hodgson; P/O. L. W. Jones; Sgt. W. E. O'Halloran; Flt. Sgt. P. L. Rakoczy; Flt. Sgt. J. G. Sweeney; Flt. Sgt. J. H. W. Walker.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. E. H. Alderson; Flt. Sgt. M. Barrett; P/O. R. A. H. Bell; F/O. H. O. Bouchard; F/O. W. J. Boyce; W/O. P. K. Chambers; Flt. Lt. G. H. Cheetham; F/O. J. MacK. Colvin; Flt. Sgt. J. F. Cooper; Flt. Sgt. E. J. Cotton; Flt. Sgt. D. M. Davis; F/O. W. H. Flatt; Sgt. F. A. Garbas; W/O. B. H. Garoutie; Sgt. A. Garshowitz; Sgt. J. W. Gibson; Flt. Sgt. R. F. Glass; Sgt. C. G. Gowen; F/O. B. McGo. Gracie; F/O. C. O. Hatler; Flt. Sgt. H. D. Heximer; P/O. W. Holden; F/O. R. J. Hunter; Sgt. M. L. Hutchins; Sgt. C. R. James; Sgt. J. B. Johnson; P/O. W. Q. Johnson; Flt. Lt. B. N. Jost, D.F.C.; Sgt. W. G. Kapuscinski; Flt. Sgt. R. E. Labrie; Sgt. T. E. Lavallee; F/O. V. S. MacCausland; W/O. L. H. A. McCormick; Sgt. J. McDowell; P/O. M. Q. Moffatt; P/O. R. F. Moore; Sgt. N. F. Nottley; Flt. Sgt. W. G. Otterholme; Flt. Sgt. B. La. V. Owen; F/O. A. A. Pariseau; Sgt. W. H. Penrose; Sgt. R. E. Powis; P/O. J. Rankin; F/O. N. D. Reid, A.F.C.; Sgt. P. Shmugelsky; Flt. Sgt. W. A. Sparrow; Sgt. O. W. Todd; Sgt. H. W. Toombs; Act. W/O. A. G. Turner; Flt. Sgt. A. E. Vidal; P/O. F. A. Wile; Flt. Sgt. K. R. Wood; P/O. L. A. Wood; P/O. J. R. Wright.

MISSING, BELIEVED KILLED IN ACTION.—F/O. G. E. Bishop; Flt. Sgt. G. Cummine; F/O. D. J. Elliott; W/O. W. R. Halloran; F/O. R. A. Holby; Sgt. G. D. Keche; F/O. J. McN. Kendall; Sgt. J. J. Whelan; F/O. W. R. Widdles.

MISSING.—W/O. L. J. Adair; F/O. F. C. Allcroft, D.F.C.; Flt. Lt. J. A. Allen; F/O. D. C. Bissell; Sgt. W. J. Blakely; Sgt. J. A. Cobbett; F/O. W. G. Cockwill; F/O. K. Crawford; F/O. R. G. Crosby; W/O. W. E. C. Dillow; F/O. C. J. Donahue, D.F.M.; F/O. H. F. Doull; Sgt. I. A. J. Dupuis; P/O. C. A. Griffiths; F/O. J. A. P. Hefferman; P/O. G. W. Henderson; A. G. Innes; F/O. W. H. Jossman; P/O. D. A. McCabe; F/O. J. E. McGrath; P/O. H. H. MacKenzie; P/O. A. L. Merkle; Sgt. H. J. Moulard; W/O. T. H. Nolan; Flt. Sgt. L. Offer; P/O. J. McV. Ogilvie; F/O. G. S. Palin; F/O. J. F. Parker; F/O. C. W. Peasland; F/O. R. A. Pildrem; Sgt. E. Podborochinski; P/O. V. R. Purnal; Flt. Sgt. W. E. Raban; Flt. Sgt. C. D. Redgrave; Flt. Sgt. R. E. Roos; W/O. J. E. Scott; F/O. D. A. Shewan; P/O. E. B. Stiles; P/O. F. R. Symons; Sgt. R. J. H. Walsh; Flt. Sgt. A. M. Wilkinson; Act. Flt. Lt. W. T. Wilton.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—F/O. E. B. Edgett.

KILLED ON ACTIVE SERVICE.—P/O. K. G. Berry; P/O. G. E. Clode; Sgt. J. J. Golding; F/O. E. W. Ward.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. W. E. Scott.

## Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. W. L. F. Briant; Sgt. D. R. Ross.

MISSING.—Flt. Sgt. H. Baird; Flt. Sgt. H. W. A. Blackwood; Act. W/O. E. T. Townsend; P/O. H. R. Willis.

## Casualty Communiqué No. 360

Of the names in this list 109 are second entries giving later information of casualties published in earlier lists.

## Royal Air Force

KILLED IN ACTION.—Flt. Sgt. T. Campbell; Sgt. E. G. McE. Davis; Flt. Lt. R. H. R. Hemsted; P/O. R. Hepworth; Sgt. W. Howitt; Flt. Sgt. R. D. Kelly; Flt. Sgt. H. F. Tolliday; Sgt. T. W. Waters.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. J. Adsetts; Sgt. R. A. Grace; F/O. E. Harper; W/O. P. D. Hendra; F/O. A. MacKay; Flt. Sgt. T. P. Murphy; Flt. Sgt. K. P. O'Dowd; Sqn. Ldr. T. H. V. Pheloung; Sgt. N. E. Rivers.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. P. Arnott; Sgt. K. E. Bannister; Sgt. S. E. Barker; P/O. J. K. Barrett; Sgt. W. Barry; Sgt. K. F. Bell; Sgt. R. Bell; Sgt. R. C. Boardman; Sgt. R. Bradshaw; Sgt. G. Brick; Flt. Sgt. A. Burns; Flt. Sgt. R. Burridge; Flt. Sgt. R. Butler; Sgt. W. C. Butler; Sgt. J. E. Butt; Sgt. T. W. Connor; Sgt. W. Cox; Sgt. J. Davies; Sgt. E. S. Davis; Sgt. W. C. Digby; Sgt. W. Eddington; Sgt. L. A. Fisher; Sgt. N. Fotheringham; Sgt. S. L. Goodwin; Sgt. J. Greenfield; Sgt. J. Guterman, D.F.M.; Flt. Sgt. R. V. Harris; Flt. Sgt. F. S. Harrop; Sgt. S. E. Herbert; F/O. P. G. Herrin; Sgt. K. G. Higgs; Sgt. W. J. Holman; Sgt. F. B. Holmes; Sgt. T. H. Hornbrook; P/O. J. L. E. Houlston; Sgt. W. A. Ibbotson; Flt. Sgt. T. B. Johnston; Sgt. W. A. Kennedy; F/O. G. Kleinberg; Flt. Sgt. J. T. Knox; Sgt. J. E. W. Lane; P/O. J. N. Lockwood; P/O. J. R. McCall; Sgt. J. M. MacDonald; Sgt. G. A. H. Male; Sgt. B. C. Marling; Sgt. R. Marsden; Sqn. Ldr. T. B. Marshall; Sqn. Ldr. R. S. May; Sgt. R. C. Meyer; Sgt. P. Mills; Sgt. P. B. Mills; Sgt. K. G. Money; Sgt. D. F. Moon; Sgt. L. W. Nichols; Sgt. S. Orden; Sgt. W. O'Neill; P/O. W. Otley; W/O. G. F. Paddon; Sgt. T. S. Payne; Sgt. S. Payton; Sgt. E. W. Pittard; Sgt. N. A. Price; Sgt. A. E. Quair; Sgt. A. C. Redshaw; Sgt. R. W. Ridgley; Act. Sqn. Ldr. P. J. E. Ritchie, D.F.C.; Sgt. K. G. Roots; Sgt. D. B. Sach; Sgt. B. Sainthouse; Sgt. F. G. Salter; Sgt. A. Smith; Sgt. F. D. Stannard; Sgt. J. A. Stephens; Sgt. P. H. J. Strange; Sgt. J. W. Sturgess; P/O. J. P. Tay; Sgt. J. R. Thompson; Sgt. N. Thompson; Sgt. G. Tsitelis; Sgt. A. Twohy; Sgt. K. W. Valentine; Sgt.



The air-staff officer at work in the Operations Room of H.M.S. Battler, one of the American-built escort carriers specially designed to combat the U-boat menace.

R. S. A. Walker; Flt. Sgt. J. D. White; Sgt. G. A. Voo; Sqn. Ldr. H. M. Young; D.F.C. WOUNDED OR INJURED IN ACTION.—F/O. P. C. Kendall; Flt. Sgt. V. Sheridan; Sqn. Ldr. P. J. T. Stephenson, D.F.C.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—F/O. E. H. Francis

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. E. G. Cade; F/O. W. L. Evans

MISSING.—Flt. Sgt. J. Mc G. Aitken; Sgt. J. W. T. Anderson; Flt. Lt. R. J. Andrews; Flt. Sgt. D. A. Arthur; P/O. H. W. Bacon; Sqn. Ldr. M. J. Baird-Smith; D.F.C.; Sgt. E. F. Bartholomew; Sgt. S. Bates; Sgt. D. C. Bolton; Sgt. R. W. Branch-Flower; F/O. A. R. Broadbent; W/O. W. D. Brown; Flt. Sgt. D. E. V. Bunting; Sgt. S. W. Bury; Sgt. E. F. Bush; Act. W/O. W. V. Butler; Sgt. B. G. Capel; Sgt. R. E. W. Cheeseman; Sgt. F. C. Collins; Act. Sqn. Ldr. F. F. Colorado-Mansfield, D.F.C.; Sgt. B. Connors; Flt. Lt. J. M. Crabb; F/O. R. J. C. Croxford; P/O. S. Dawson; Flt. Sgt. F. A. Dobson; Sgt. L. Dryer; F/O. W. J. Evans; Sgt. A. H. R. Fielding; Sgt. T. A. Finch; Sgt. R. Frankish; Sgt. A. J. B. Gildare; Sgt. F. G. Goodall; Sgt. G. H. F. Gover; F/O. F. W. Harding; Sgt. J. W. Hennis; Flt. Lt. P. R. H. Henry; Sgt. W. H. Holmes; Sgt. K. E. Hutson; F/O. G. W. James; Sgt. A. Jeffries; P/O. D. C. Johnson; Sgt. E. W. H. Johnson; F/O. S. G. Jones; W/O. F. P. Jones; Sgt. R. F. Laishley; Sgt. J. E. Lyons; Sgt. W. J. C. MacDonald; Sgt. R. G. Mann; Sgt. E. Mortimer; Sgt. R. Mosley; Sgt. J. K. Mosman; Sgt. P. Mowbray; Sgt. L. C. Noworthy; Flt. Sgt. J. H. Nutt; Sgt. S. G. Pack-nall; F/O. B. N. Price; Sgt. J. E. Raven; Sgt. K. B. Reeves; Flt. Sgt. E. R. R. R. R. R. R. Richards; F/O. E. A. Richardson; Flt. Lt. J. N. Ridley; Sgt. F. D. Robbins; Sgt. R. Soo; F/O. F. Spencer; Sgt. J. C. Stones; Sgt. R. V. Turner; F/O. E. O. Waddington, D.F.M.; Sgt. P. Walker; Flt. Lt. R. B. Wharmby; Flt. Sgt. C. L. Y. Wilkins; Sgt. S. T. Willis

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Flt. Sgt. C. T. Cole; Sgt. C. F. Craig; Sgt. J. Davidson; Sgt. J. Gardner; Sgt. W. Swire; F/O. F. Woodmansey

KILLED ON ACTIVE SERVICE.—W/O. S. J. Biggs; Sgt. R. C. Bradbury; Sgt. R. Burgess; F/O. G. F. Deakin; L/A/C. T. Dick; Sgt. R. H. Dolden; Sgt. P. Downes; F/O. T. E. Eardley; F/O. W. Francis; L/A/C. E. T. Griffiths; Sgt. J. M. Haines; L/A/C. D. M. Hair; Sgt. R. Hayes; F/O. R. H. B. Jennings; Flt. Lt. G. Laurence, D.F.M.; F/O. A. J. Mabey; Sgt. F. G. Mallin; Act. Flt. Lt. O. J. C. Mason; P/O. A. J. Oakley; L/A/C. T. G. Parry; Sgt. W. H. Rogers; P/O. G. W. O. Sears; Sgt. K. E. D. Sillatote; Act. Wing Cdr. L. G. Wade, D.F.C.; P/O. R. F. Wade; L/A/C. D. F. Watson; Sgt. W. H. Welch

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. J. Bilton; Sgt. H. S. Hobbs

WOUNDED OR INJURED ON ACTIVE SERVICE.—W/O. W. T. Chard; P/O. E. Crowley; Sgt. W. H. T. McCarroll

DIED ON ACTIVE SERVICE.—W/O. G. V. Cockburn; Flt. Lt. J. T. E. Farmer; A/C1 D. H. Grant; P/O. H. Hare; F/O. F. B. Keene; A/C2 L. G. Lambert; F/O. R. S. Toone; Cpl. A. E. Turner; L/A/C. P. E. Woolley

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW1 H. J. Holland; L/A/CW. E. M. Hopkins; A/CW1 L. M. Watson

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. J. O. Wilson

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. E. K. Chivers. WOUNDED OR INJURED IN ACTION.—F/O. K. F. Hynes; F/O. G. E. Lapham

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. T. P. O'Hare

MISSING.—Flt. Sgt. T. M. Andersen; Flt. Sgt. R. D. Anthony; Flt. Sgt. S. R. Hore; P/O. G. C. Iye; Flt. Sgt. A. J. Lynch; Flt. Sgt. G. A. McGilvray; P/O. J. G. McLaughlin; Act. Flt. Lt. J. V. Newton; P/O. R. S. Yell

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—P/O. A. J. Wilcox

KILLED ON ACTIVE SERVICE.—Flt. Sgt. J. J. Cleary; W/O. J. H. Goldsworthy

Royal Canadian Air Force

KILLED IN ACTION.—F/O. H. J. Kirton; W/O. E. G. L. Robertson

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. C. Archer; Sgt. R. Steedman; Sgt. N. A. Stelter; F/O. E. V. L. Veira; Flt. Sgt. W. J. Watterson; Flt. Sgt. R. N. Westman; Sgt. S. E. Weaver; Sgt. J. A. Williamson

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. G. O. Ballentine; W/O. G. R. Doidge

MISSING, BELIEVED KILLED IN ACTION.—F/O. W. Wilkie

MISSING.—W/O. L. D. Annis; F/O. J. W. Astbury; P/O. J. B. Cameron; Flt. Sgt. P. H. Crickmay; Flt. Sgt. A. E. Dimock; P/O. J. A. Earle; P/O. H. A. Floren; P/O. L. L. H. Hansen; Sgt. E. C. Houlding; P/O. N. B. Hunt; W/O. N. Leone; W/O. H. MacLennan; Sgt. E. L. McManus; P/O. W. Y. McNeil; P/O. K. R. Middlemiss; F/O. J. N. Nelson; Sgt. E. J. Oakley; Sgt. J. M. Preston; Sgt. J. R. A. Rulhven; F/O. J. J. H. Souaillard; P/O. C. C. V. D. Spencer; F/O. W. Thatcher

KILLED ON ACTIVE SERVICE.—F/O. J. R. Gal-



A Spitfire IX—fitted with the new cylindrical long-range tank—standing in the snow on a southern airfield during the recent wintry spell.

braith; F/O. A. B. Henderson; F/O. F. J. Hjartarson; P/O. J. C. W. Hoop; Flt. Lt. C. F. Medhurst; F/O. E. Pennington; Flt. Sgt. W. R. Wilson

Royal New Zealand Air Force

KILLED IN ACTION.—Flt. Sgt. J. Garrett. PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. K. F. Morrison. WOUNDED OR INJURED IN ACTION.—Flt. Lt. I. J. McNeil

MISSING.—Flt. Sgt. J. S. Gallagher; Flt. Sgt. L. Kell; Flt. Sgt. P. E. Mason

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Flt. Sgt. B. N. Peterson

KILLED ON ACTIVE SERVICE.—Flt. Sgt. H. C. Aislabie

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. A. H. Smith

South African Air Force

KILLED IN ACTION.—Lt. F. A. Booyne; Lt. J. R. Harrison; Act. Flt. Lt. Lavellyce; Flt. Sgt. W. Oswald; Lt. J. B. Plck

KILLED ON ACTIVE SERVICE.—2/Lt. J. M. Wright

Casualty Communiqué No. 361

Of the names in this list, 110 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Flt. Lt. D. E. Fuge; Sgt. T. S. Sanders

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. G. Bowden; Act. Sqn. Ldr. H. D. R. L. Campbell, D.F.C.; Sgt. J. Chaplin; Sgt. W. H. Harries; Act. W/O. P. Horrocks; Sgt. A. S. Jellis; Sgt. M. Keogh; Sgt. R. W. Rouse; Flt. Sgt. J. C. Wood; Sgt. J. S. Yates

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. H. Ashton; Sgt. G. Batty; Sgt. A. T. C. Bromwich; Sgt. F. C. Brownlow; Sgt. T. Carter; Sgt. A. W. Cochran; Act. Flt. Lt. A. D. Coldicott, D.F.M.; F/O. R. H. D. Cook; Sgt. L. A. Cooper; Sgt. C. L. Crudden; Sgt. J. V. Dartnall; Sgt. H. R. Dick; P/O. A. H. Eades; Sgt. A. V. Edwards; Flt. Sgt. W. H. Ellis; Sgt. D. C. Ferris; Sgt. L. S. Fiddes; Sgt. R. M. Gibney; F/O. L. N. W. Goldspink; Sgt. C. Green; F/O. E. F. H. Heard; Sgt. K. G. Hoad; Sgt. R. Hughes; Sgt. S. James; P/O. J. W. T. King; Sgt. C. W. Larkin; F/O. H. B. Levinson; Sgt. J. D. Lindrea; Sgt. W. McCall; Sgt. R. McKenzie; Sgt. T. G. Matthews; Sgt. R. M. Morris; Sgt. J. G. Newall; Sgt. G. R. Nipper; Sgt. E. M. Offen; Sgt. S. Owen; Flt. Sgt. J. Parker; P/O. R. V. C. Pleasance; Sgt. D. H. Robinson; Sgt. A. K. Rogers; Sgt. E. Rome; Sgt. J. J. Ryan; F/O. T. H. J. Sackville; Sgt. W. Scott; Sgt. F. Sheppard; Sgt. N. Shield; Sgt. R. S. Sidwell; Wing Cdr. K. B. F. Smith, D.S.O.; Sgt. A. G. Stone; Sgt. D. C. Stone; Sgt. L. Tagg; Sgt. W. Thomson; F/O. A. J. Turner; Sgt. L. Urry; Sgt. L. Waldorf; Sgt. J. W. Webster; Sgt. T. Wharmby; Sgt. A. W. Whitcock; F/O. S. Wilkinson; Sgt. J. G. Wilson; Sgt. E. H. Wood

WOUNDED OR INJURED IN ACTION.—F/O. B. C. W. Heard

MISSING, BELIEVED KILLED IN ACTION.—F/O. K. Johnson; F/O. A. J. Milton

MISSING.—F/O. K. L. Agnew; Sgt. F. E. P. Allen; Flt. Sgt. W. M. Allen; Sgt. R. A. Allison; Flt. Sgt. J. M. Anderson; Sgt. J. H. Aplin; F/O. R. P. Mc M. Bagg; Act. Sqn. Ldr. H. R. Bailey, D.F.C.; Sgt. A. J. Barday; Flt. Sgt. M. G. Barnard; Sgt. R. Bateman; Sgt. A. Bell; P/O. D. J. Bell; Sgt. P. J. Bennett; Flt. Sgt. W. C. Berry; F/O. J. A. Bovier; Sgt. M. A. Brooks; Flt. Sgt. D. J. Bruce; Flt. Sgt. J. C. Cash; Sgt. D. Charlton; F/O. A. W. Cherrie; Sgt. B. E. Clarke;

Sgt. V. Clayson; P/O. W. A. Clegg; Sgt. H. G. Clements; Flt. Lt. J. F. Cobbett; F/O. D. W. Cobbin; Sgt. D. H. W. Cook; Sgt. R. S. Cornwall; Flt. Sgt. A. T. Counts; F/O. R. Crease; Sgt. L. W. Davey; Flt. Sgt. G. Deighton; F/O. K. S. Dickens; Sgt. R. L. Ditchfield; F/O. G. L. Downer, D.F.C.; Sgt. L. Easton; Flt. Sgt. K. N. Elkington; Flt. Sgt. J. S. Evans; W/O. D. B. Finlay; Sgt. W. C. Freeborn; Flt. Sgt. J. Froehman; F/O. D. C. Ganna-way; Sgt. R. W. Gooch; Sgt. M. W. Grover; Flt. Sgt. W. G. Handcock; Sgt. R. J. Harris; Flt. Sgt. L. C. Hartman; W/O. R. Haywood; Flt. Sgt. P. J. Hermolle; Sgt. F. C. Hickling; F/O. D. G. J. Higgs; P/O. W. Hodgson; Sgt. B. V. Howard; Sgt. R. Hunt; Sgt. R. A. Hutchinson; Sgt. A. C. Jackson; Flt. Sgt. H. L. James; Flt. Lt. R. B. Jarvie; Sgt. A. A. Johnson; Flt. Lt. F. E. W. Jowling; Sgt. A. Kewin; Flt. Sgt. P. H. Lamprey; Sgt. E. A. Lane; Sgt. R. Laverick; Flt. Lt. A. T. Lawson-Tancred; Act. Flt. Lt. R. G. Layley; F/O. A. M. H. Lewis; Sgt. W. W. McGhee; Sgt. R. C. McLaren; Sgt. G. T. McLatchie; Flt. Sgt. D. C. J. McLean; Sgt. B. G. Martin; Sgt. P. Mitchell; Sgt. J. A. Morrish; Act. Flt. Lt. H. Morton, D.F.M.; Sgt. H. E. Mottishaw; Sgt. J. W. Neeve; Flt. Sgt. Sgt. J. C. Nicol; Flt. Lt. J. G. Oliver; Sgt. C. D. Panes; Sgt. L. J. Pasfield; Flt. Sgt. M. C. Paterson; Sgt. G. E. Powell; Flt. Sgt. N. E. Pratt; Sgt. G. G. Rann; Sgt. S. H. Ratray; Sgt. D. S. J. Richards; Sgt. G. Richards; Sgt. J. Richardson; Sgt. R. A. Rodhouse; Act. Flt. Lt. T. W. Rowland; Sgt. A. W. L. Schneider; Sgt. D. H. Shaw; P/O. J. W. Slater; Flt. Sgt. D. F. Smith; Flt. Lt. J. G. Smith; Sgt. J. J. Smith; Sgt. N. R. Smith; F/O. S. Smith; Sgt. T. J. Smith; Sgt. T. W. Soulsby; Flt. Sgt. G. H. Spanton; Sgt. A. E. Spencer; Flt. Sgt. J. F. Stafford; Sgt. J. F. Stanley; Sgt. F. T. Stirling; Sgt. E. T. E. Sullivan; Sgt. R. E. Swann; Sgt. A. W. Tattersfield; Flt. Lt. D. L. C. Thomas, D.F.C.; Flt. Lt. A. T. Thornton; Sgt. G. Urfold; Lt. R. A. Vinson; Flt. Sgt. J. Waddell; F/O. A. H. Walsley; Sgt. G. A. Walton; P/O. S. E. Watchorn; Sgt. S. Watkins; Sgt. A. Watson; Flt. Sgt. N. E. West; Sgt. C. F. Wheatstone; Flt. Sgt. L. H. Whitear; Flt. Sgt. H. J. Wilkinson; Flt. Sgt. H. Williams; Sgt. R. Willis; Flt. Sgt. W. H. Yuill

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Flt. Sgt. P. E. King

KILLED ON ACTIVE SERVICE.—Flt. Sgt. A. T. C. Benson; F/O. G. P. C. De Neve; Lt. C. H. A. Dinnage; F/O. R. S. Frank; F/O. J. J. King; F/O. A. L. Seaman

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW REPORTED KILLED ON ACTIVE SERVICE.—P/O. T. A. Pittock

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Lt. G. T. Aylen; F/O. B. E. McCarthy

DIED ON ACTIVE SERVICE.—A/C2 K. P. Adams; A/C2 G. H. Bannister; L/A/C. F. W. Col; A/C2 I. S. Cooper; A/C1 F. Court; L/A/C. W. Ferguson; A/C2 T. Hardacre; A/C1 C. Joseph; A/C2 R. J. Napierala; Cpl. I. J. M. Roberts; A/C1 J. H. Simpson; F/O. R. H. Speight; Cpl. R. H. Spite; Flt. Lt. T. F. G. Strubell; A/C1 A. Wrighton

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Lt. G. B. Boreham, D.F.M.; Flt. Sgt. J. L. Brazil; Sgt. F. G. Hawthorn; Sgt. L. L. Kelley; Flt. Lt. G. A. Mason; P/O. D. I. Turner

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. A. E. Home, D.F.M.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. T. G. Dellar

MISSING.—Flt. Sgt. K. W. B. Davies; Flt. Lt. A. W. Dowsett; Flt. Sgt. T. L. Fieldler; W/O. E. A. Joyce; Flt. Sgt. R. H. Keating; P/O. P. N. Kingston; Flt. Sgt. R. M. Oakes; F/O. C. I. Reynolds; Flt. Sgt. A. E. Unwin; Flt. Sgt. H. M. Velleynoweth

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. W. G. Atkinson; Flt. Sgt. D. L. Farnell

KILLED ON ACTIVE SERVICE.—W/O. E. R. Lums-daine

## SERVICE AVIATION

## Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. G. Acker; Sgt. J. A. L. Allan; Sgt. G. E. Armstrong; F/O. C. L. Bolster; Sgt. J. W. Carley; Sgt. R. V. Clitheroe; F/O. R. P. Collins; Sgt. W. G. Dent; Sgt. C. A. Dunphy; F/O. S. J. Flannery; P/O. J. R. Gaudet; Sgt. S. J. Gergley; Act. Sqn. Ldr. E. G. Gilmore, D.F.C.; F/O. A. H. Gipson; Sgt. R. R. Gourde; F/O. R. J. Howard; Sgt. J. E. Isaacs; Sgt. J. C. Lyness; Sgt. D. C. Marshall; Sgt. F. G. Moore; Flt. Sgt. W. E. E. B. Pridden; Sgt. K. E. Radcliff; Sgt. G. K. A. Smallwood; Sgt. C. C. Strain; Sgt. J. Tongue.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—F/O. R. S. Clark.

MISSING.—Flt. Sgt. T. Bowskill; Sgt. L. A. Carr; F/O. G. R. Drimmie; Flt. Sgt. G. J. Ferguson; F/O. J. P. Gilbey; Sgt. L. K. Gilmar; F/O. W. R. Glen; Flt. Sgt. A. M. Goodall; F/O. J. L. McKeown; Sgt. B. W. Matheson; F/O. A. Nova; Flt. Sgt. R. F. Peterson; Act. Flt. Lt. G. H. Rainville, D.F.C.; F/O. W. H. Timmins; Flt. Sgt. A. R. Williams; Sgt. M. L. Wiper.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—F/O. L. E. Charnaud; Flt. Sgt. A. Wilson; Flt. Sgt. B. J. Yard.

KILLED ON ACTIVE SERVICE.—Flt. Lt. J. J. Marcus.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Sgt. M. A. Cuyler.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. J. M. Mahoney.

## Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. L. C. Maunsell.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. A. McWilliam; Flt. Sgt. A. T. W. Moore; Sgt. R. A. F. Woods. MISSING.—P/O. E. S. Blackwell; P/O. J. L. Boswell-Kitching; F/O. F. A. Braithwaite; Act. Flt. Lt. J. H. Christiansen; P/O. C. K. Waldrom; F/O. C. H. Wright.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. K. R. Russell.

## South African Air Force

MISSING.—2/Lt. L. A. Legoff; Lt. D. P. Short.

## Indian Air Force

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. J. R. Danara.

## Casualty Communiqué No. 362

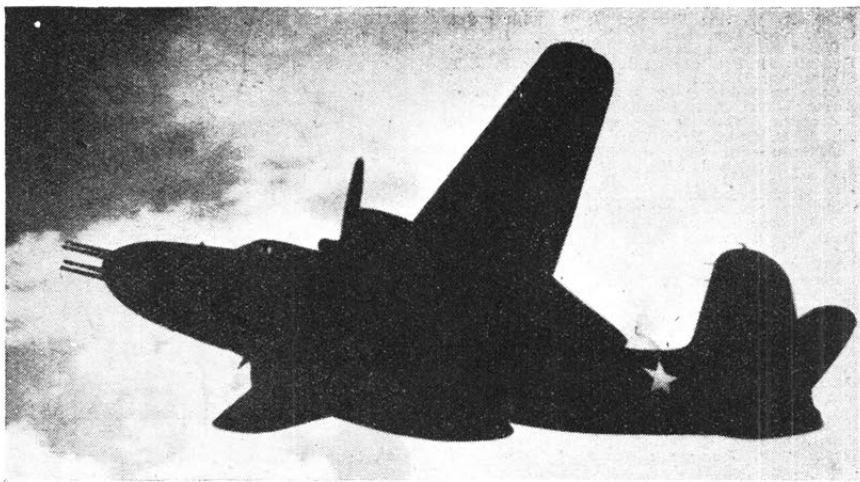
Of the names in this list 108 are second entries giving later information of casualties published in earlier lists.

## Royal Air Force

KILLED IN ACTION.—Sgt. J. S. H. Cox; Flt. Sgt. E. Fifth; Flt. Sgt. G. T. Foster; F/O. J. H. Hannibal; Flt. Sgt. G. A. Honey; Flt. Sgt. A. Lee; Sgt. F. E. Maher.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. A. Bailey; Flt. Sgt. R. J. Fowler; Sgt. A. B. Harper; Sgt. J. Lewis; Sgt. J. Palmerley; Sgt. H. Pape; F/O. H. H. Pearson; F/O. S. Peate; Flt. Sgt. D. R. N. Reynolds.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. R. E. Allen; Sgt. H. Baker; Sgt. R. C. Barrett; Sgt. K. G. Berry; Flt. Sgt. E. C. Blackman; Flt. Lt. R. H. Brinton; Sgt. J. G. Brown; Sgt. W. Brown; Sgt. D. McD. Buchan; Sgt. W. A. Bush; W/O. J. E. Buxton; Sgt. C. D. H. Campbell; Sgt. G. E. Chadfield; Sgt. M. H. Clark; F/O. A. V. I. Cook; Sgt. H. Cousin; Wing Cdr. H. R. Coventry, D.F.C.; P/O. G. A. Cozens, D.F.M.; Sgt. J. Currie; Sgt. J. C. Davidson; Sgt. M. Dixon; Sgt. G. C. Dynes; Sgt. F. W. Ealden; F/O. E. D. Eastwood; P/O. D. F. Erickson; F/O. H. J. Espy; Sgt. P. Falkingham; P/O. S. P. Farley; Sgt. R. A. Fleming; Sgt. D. C. Ford; P/O. W. S. Fyfe; Sgt. L. C. Gearing; Sgt. E. W. Geraghty; Sgt. F. Getting; Sgt. N. Goldie; Sgt. E. Hannel; Sgt. W. Hardy; Sgt. E. Harper; Sgt. R. F. Hathaway; Flt. Sgt. G. Hay; Sgt. P. Hodgkinson; Sgt. J. R. Irwin; F/O. J. Kay; Sgt. C. K. Killick; Act. Flt. Lt. F. E. King; Flt. Sgt. H. Langlands; Sgt. G. Liddle; Sgt. R. E. Livermore; Sgt. F. MacLeay; P/O. J. McCrossan, D.F.M.; Sgt. J. J. McDonald; Sgt. T. McLaughlin; Sgt. D. Mann; F/O. E. R. Midgley; Sgt. T. D. Mills; Sgt. W. J. Murray; Sgt. I. B. Nicol; Sgt. C. Paittison; Sgt. J. V. Potecary; F/O. C. F. Read; Sgt. A. Roberts; Sgt. P. B. Robinson; Sgt. A. Rodgers; Sgt. J. Rorison; Flt. Sgt. P. G. Rothera; Sgt. R. F. Russell; Sgt. B. L. Scott; Sgt. G. I. Simpkin; Sgt. R. C. Smith; Sgt. A. W. Stevens; F/O. J. H. Stewart; Sgt. A. H. Thomas; Sgt. H. G. Thomas; Sgt. E. A. Thompson; Sgt. A. R. Tickner; Sgt. F. W. N. Trowbridge; Sgt. B. T. Walsh; Sgt. W. E. Walter; F/O. H. C. Wheel; Sgt. J. T. Wilkinson, D.F.M.; Sgt. J. R. Williams; Sgt. E.



A silhouette of the Douglas P.70 night-fighter. It is a version of the Boston. The nose armament seen projecting comprises four 20 mm. cannon.

Wilson; F/O. R. W. Winfield; Sgt. S. Wood; Sgt. G. H. Yeates.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. D. J. Denman; F/O. L. J. Dexter; Flt. Sgt. C. A. Lock; F/O. J. Napier.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. K. J. Seeley; Sgt. P. G. Short.

MISSING.—Sgt. J. H. Adams; Flt. Sgt. R. G. Aldworth; Act. Flt. Sgt. R. C. Bailey; Flt. Sgt. K. R. Ball; Sgt. J. D. Barker; Sgt. A. Bellenger; Sgt. N. N. Bligh; Sgt. L. Bowes; Sgt. J. R. Bradshaw; Flt. Sgt. J. S. Brand; F/O. G. C. Brickwork; Sgt. K. H. Brittle; Sgt. C. D. Brown; Flt. Lt. T. Burger; P/O. R. J. Butler; Sgt. A. H. Campbell; Sgt. S. G. Cohen; F/O. D. Cooke; Sgt. W. W. Cottam; Sgt. P. Coyne; F/O. W. Craig; F/O. L. W. Creasey; Sgt. K. Cushing; Flt. Sgt. G. E. Edgcombe; F/O. A. Fletcher; Sgt. K. Foye; F/O. H. Furniss-Roe; Sgt. L. Gardiner; F/O. P. J. Garlette; Sgt. G. B. Greenfield; Flt. Sgt. V. M. Hanks; Flt. Sgt. T. W. Hill; Flt. Sgt. R. F. Holborow; Sgt. E. A. Hughes; Sgt. J. Johnston; Act. Flt. Sgt. W. C. Lawes; Act. Flt. Lt. A. L. Lazenby; Sgt. F. T. Lewis; Sgt. C. Lindsay; P/O. M. Livingstone, D.F.M.; Sgt. E. S. Lowe; P/O. A. L. MacKenzie; Flt. Sgt. W. McCulloch; Sgt. C. J. McLoughlin; Flt. Sgt. G. Marlow, D.F.M.; Act. Flt. Lt. H. J. Miller; Act. Wing Cdr. D. N. Milligan, D.F.C.; Flt. Sgt. N. Montgomery; Act. Flt. Sgt. S. G. Murrell; Sgt. E. J. Pitman; Flt. Sgt. K. A. Porteous; F/O. W. Preston, D.F.C.; Sgt. G. A. Race; Flt. Sgt. K. J. Roberts; Sgt. D. Robinson; Flt. Sgt. A. Rooks; Flt. Sgt. A. G. Ryder; F/O. S. M. Seddon; Sgt. E. A. Shorter; Flt. Lt. J. K. A. Simpson; Sgt. J. J. Sloan; Sgt. C. E. Smith; F/O. K. F. Smith; Sgt. T. C. Solomon; Sgt. D. H. Stephens; Sgt. M. A. Stevens; Sgt. J. F. Street; Sgt. A. B. Summers; Flt. Sgt. I. T. Taylor; F/O. M. J. R. Thom; Sgt. L. D. Thomas; Flt. Sgt. D. F. Tittley; Sgt. N. A. Verner; P/O. V. H. J. Vizer; Flt. Lt. B. G. Walsh; Sgt. A. A. Walton; Flt. Sgt. L. E. Watson; Flt. Lt. F. S. Whittlestone; Sgt. W. F. Whittock; Flt. Sgt. J. A. Whyte; Act. Wing Cdr. R. E. Young, D.F.C.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. H. B. Annan; F/O. J. H. Williams, D.F.C.

KILLED ON ACTIVE SERVICE.—L.A./C. B. G. R. Allen; Act. Flt. Sgt. G. A. Baker; Sgt. P. K. E. Bennett; Sgt. A. A. Clark; A/C.2 R. D. W. Eyres; Sgt. N. Fisher; Sgt. R. J. Fuller; Sgt. E. R. Gawler; Sgt. J. W. Gibb; Flt. Lt. B. B. W. Howe; F/O. D. A. Kington; P/O. A. L. Langworthy, D.F.M.; L.A./C. W. C. Lockhart; F/O. U. L. Lookyan; Act. Sqn. Ldr. E. M. Metcalfe; Flt. Sgt. A. L. Nash; Sgt. A. C. Parker; Sgt. J. V. Powell; Sgt. D. Ramsey; Sgt. L. H. Robinson; Sgt. J. S. Spriggs; P/O. F. H. Tillman; L.A./C. R. Trewthick; Sgt. W. H. Wareham; Sgt. R. F. Waterman; W/O. J. L. Williams; Sgt. S. F. Wise; L.A./C. C. Wolden; Sgt. W. G. Wyatt.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. H. K. Barker; P/O. R. Bridge.

WOUNDED OR INJURED ON ACTIVE SERVICE.—A/C.2 P. Fassett; A/C.2 T. G. Gray; Flt. Sgt. A. J. Harris; Flt. Sgt. B. J. L. MacKenzie; Act. Flt. Lt. R. H. A. Williams.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. E. W. Davey; W/O. T. W. Smith; Sgt. L. E. C. Wise; Flt. Sgt. G. C. Wright.

DIED ON ACTIVE SERVICE.—Act. Sqn. Ldr. H. Allen; Sgt. H. Barber; Cpl. L. F. Bateman; A/C.1 F. A. Beckford; A/C.1 G. W. Browne; Cpl. K. H. Butcher; A/C.1 H. J. Dean; F/O. G. McD. Duncan; L.A./C. T. Gold; L.A./C. W. L. Howie; Cpl. E. W. Hughes; L.A./C. W. G. M. Hughes; Sqn. Ldr. D. Jeremiah; Act.

P/O. F. W. H. Johnson; Act. Cpl. R. J. Leavy; A/C.2 G. E. R. Lloyd; L.A./C. T. McCann; L.A./C. L. A. Prince; L.A. C. A. Leg. Read; Cpl. G. A. Smith; L.A./C. L. A. Spinks; L.A./C. R. C. Todd; Sgt. E. A. Waite; L.A./C. J. E. Wright; Act. Sgt. W. C. Wrightson.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Lt. B. L. Kenyon, D.F.C.

## Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.2 J. R. Gowans; L.A./CW. M. E. Humphreys; A/CW.1 V. Westcott; L.A./CW. M. A. Williamson.

## Royal Australian Air Force

KILLED IN ACTION.—Flt. Sgt. R. A. Beal; Sgt. W. F. Brenton; Flt. Sgt. F. R. Clayton; W/O. C. S. Temby.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. F. L. I. Hill; Flt. Sgt. L. R. Johnson; Act. Flt. Lt. P. O. McKenzie; Flt. Sgt. H. K. Smith; Flt. Sgt. B. W. Thomas.

MISSING, BELIEVED KILLED IN ACTION.—P/O. S. M. Laman; F/O. L. B. McDermott; Flt. Sgt. N. Missing.—Flt. Sgt. N. G. Brodick; Flt. Sgt. L. R. Carius; P/O. L. S. Fairclough; P/O. P. E. Hanson; Flt. Sgt. W. R. Jager; Flt. Sgt. J. G. McLean; Flt. Sgt. A. J. White; Flt. Sgt. J. M. M. Wilson.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. W. T. Barnes; P/O. K. K. Cox; Sgt. F. P. Deshon; Flt. Sgt. L. G. Edmonds; Flt. Sgt. T. J. Hogan; Flt. Sgt. J. Kydd; Sgt. T. D. Murton; F/O. K. J. Perrett; Sgt. H. A. Perriam.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. J. R. Maitland.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Flt. Sgt. C. J. Covill.

DIED ON ACTIVE SERVICE.—Flt. Sgt. M. G. Marshall.

## Royal Canadian Air Force

KILLED IN ACTION.—W/O. D. E. Gibbon; F/O. N. McE. Scott.

MISSING.—Sgt. G. A. Beckett; F/O. J. McClure; P/O. K. J. Mulcair.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—F/O. K. A. Banks.

## Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. N. B. Black; Flt. Sgt. G. R. J. Duthie.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. D. Clearwater; P/O. S. N. Cross; P/O. A. A. H. Pullan.

MISSING.—Flt. Sgt. J. S. Bergin; Flt. Sgt. F. T. Lovegrove; P/O. J. E. Rule.

KILLED ON ACTIVE SERVICE.—Act. Flt. Lt. J. G. Neilson, D.F.C.

## South African Air Force

WOUNDED OR INJURED IN ACTION.—Lt. E. E. Adams.

KILLED ON ACTIVE SERVICE.—Flt. Lt. Muller.

## Official Correction

Casualty Communiqué No. 341.

Under "MISSING," for Sgt. J. F. Q. Brough, read P/O. J. F. Q. Brough.




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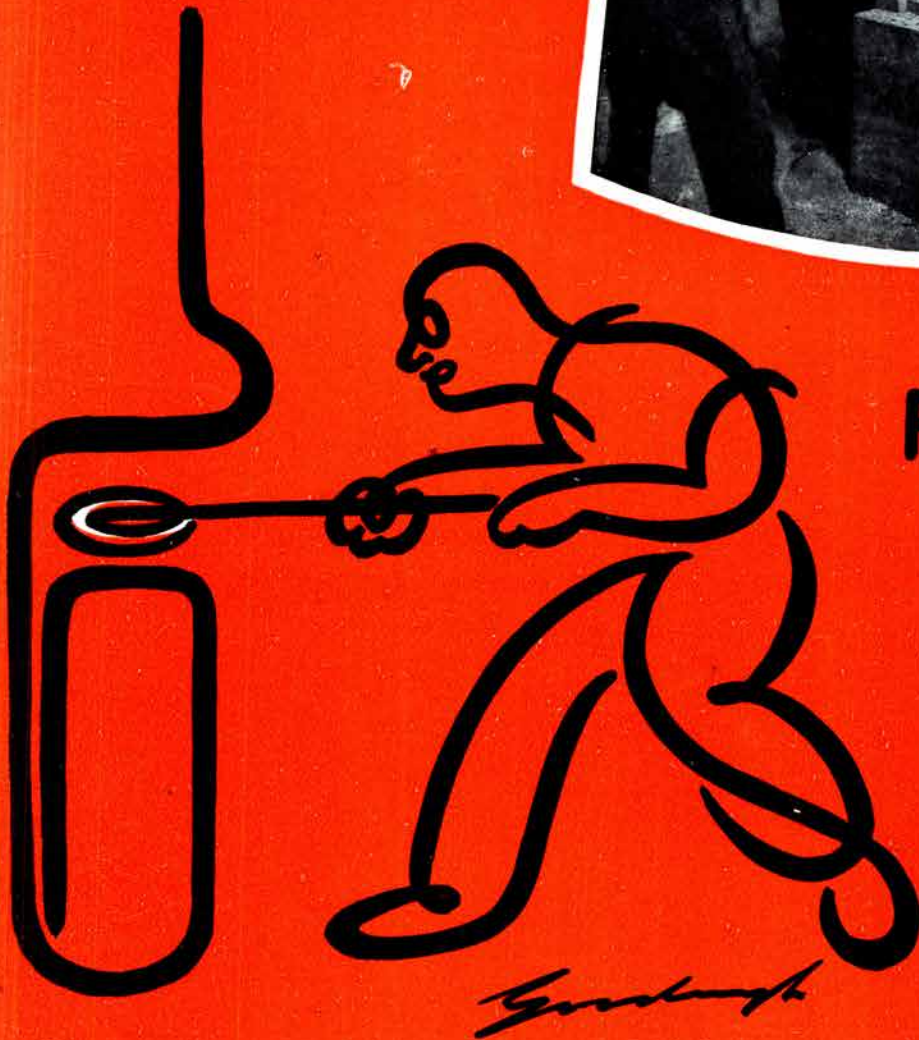
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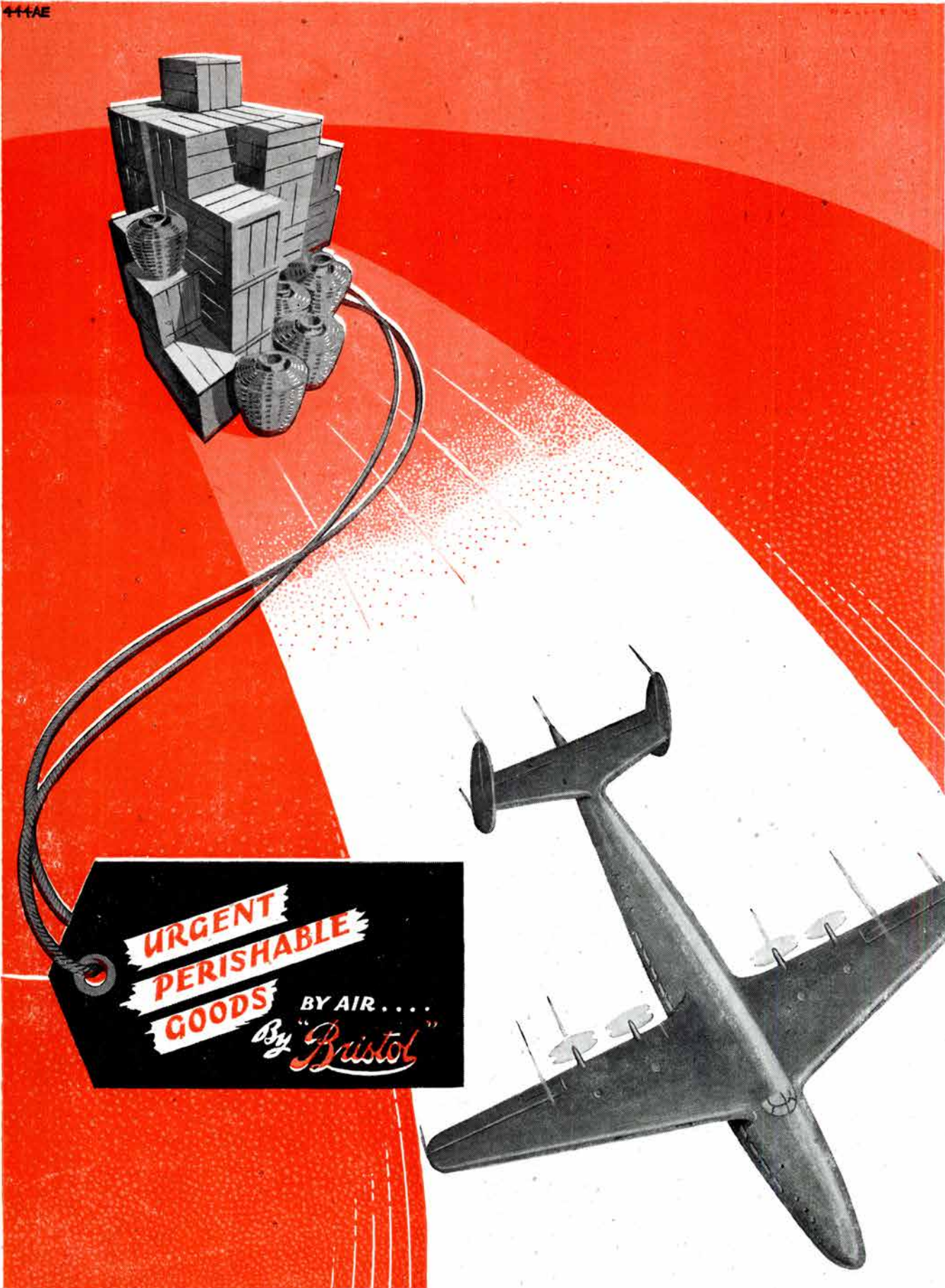
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