

# Lancaster I and II

## Interchangeability of Power Eggs Applied to One of Our Four-engined Bomber Types

**A**LTHOUGH we have somewhat of a reputation for meddling through, and also of having a flair for improvisation, it is refreshing to find a specific instance in which forethought and careful design have gone hand in hand. Actually, of course, the British are masters of the art of long-term thinking, and the suggestion that we live in a state of perpetual "flap" is an unmerited libel.

In 1938, when war appeared to be inevitable, the Air Ministry and the S.B.A.C. got together to thrash out a scheme whereby all the power units of roughly the same horse-power, air or liquid cooled, could be made interchangeable on any type of aircraft with the minimum of modification to the airframe structures.

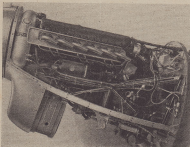
As was to be expected, the power egg resulted, and the engine manufacturers became responsible for everything forward of the engine bulkheads. On the airframe manufacturers' side the bulkheads were likewise standardized in that connections for pipes, electrical couplings, pneumatic and hydraulic controls, etc., followed a common pattern.

For many years previous to this the engine makers had toyed with the idea of the complete and interchangeable power unit, but this was mostly with the aim in view of saving time in changing engines for overhaul. The Bristol company, for instance, fitted such a unit to their ten-seater

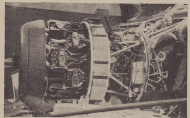
as early as 1922, and this had the added refinement of a hinge forward of the bulkhead for access to the accessories.

Up to a comparatively few years ago, engines and their components sprawled all over the place and were open to the breeze. They formed no small percentage of what was then facetiously termed "the built-in head wind." Cooling looked after itself and the leading of air through special ducts did not enter into the scheme of things. Nowadays, when at least three times the amount of horse-power has to be crowded into each cubic foot of engine space, cooling and airflow have become such a tremendous problem that it is economical only for the research departments of the engine makers to tackle it.

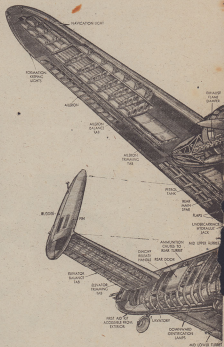
Digressing for a moment, it is this terrific density of



IN LINE: The Rolls-Royce Merlin XX power unit as fitted to the Lancaster I.



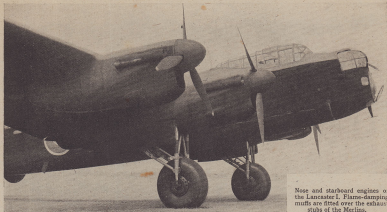
RADIAL: Fitting a Bristol Hercules XVI to the inner port engine mounting of a Lancaster II.



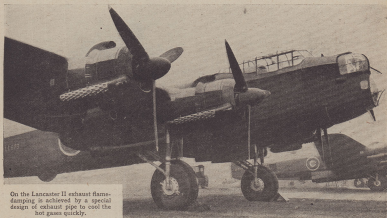
A Flight copyright drawing by Max A. Miller of the Hercules-engined Lancaster II.



## LANCASTER I AND II



Nose and starboard engines of the Lancaster I. Flame-damping muffs are fitted over the exhaust stubs of the Merlins.



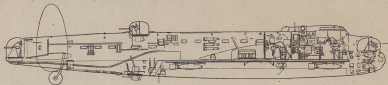
On the Lancaster II exhaust flame-damping is achieved by a special design of exhaust pipe to cool the hot gases quickly.

are built under the control of the few engine manufacturers and not as an assortment of designs by multitudinous airframe makers, a great saving of time results. A further saving in time occurs in the design of prototype aircraft. If the Air Ministry specify a Merlin or a Hercules or a Sabre engine to be fitted, the range in design of the power unit is immediately known to the airframe designer. An even greater advantage in wartime is the manner in which engine production can be speeded to its maximum advantage. If, for instance, the whole of the liquid-cooled engine production was smashed by enemy action, our bombers would

still be over Germany but they would have air-cooled radials instead. If production of one type is above expectations and output of another is below schedule, then adjustment can be made to employ all the available engines economically. Yet other advantages are found in cases where specific operations call for special performances, such as high take-off power or power at some particular altitude. The most appropriate engine can be easily fitted to the requisite number of aircraft.

In the case of the Lancaster I being changed to the Lancaster II by fitting Bristol Hercules XVI in place of

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Side elevation of the Avro Lancaster showing how the bomb load is supported by a beam built into the structure.

## MERLIN XX.

Bore	5.6in.
Stroke	6in.
Capacity	27 litres
Compression ratio	6:1
Gear ratio	0.42:1
Take-off power	1,280 h.p. at 3,000 r.p.m.
Dry weight	1,450 lb.

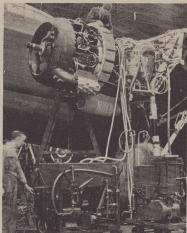
## HERCULES XVI.

Bore	5.75in.
Stroke	6.5in.
Capacity	38.7 litres
Overall diameter	52in.
Gear ratio	0.41:1
Take-off power	1,635 h.p.
Nett weight	1,800 lb.



Even the standard bomb bay of the Lancaster is capacious.

Rolls-Royce Merlin XX, the only structural alteration was in the design of the engine mounting. This was necessary to prevent alteration of the C.G. position. As will be seen



Checking the hydraulic pump of the port inboard Hercules by means of a test rig. The undercarriage leg is just beginning to retract.

from some of the photographs, the thrust line remains unaltered and the unbroken contour of the top surface of the main plane (which Mr. Chadwick, the designer, considers so essential) is preserved. The increased horse-power—the Hercules XVI is 1,635 h.p., compared with the 1,280 h.p. of the Merlin XX—has, of course, resulted in better take-off and climb to rated altitude.



Lancaster II is a neat aircraft from the head-on aspect.

ENEMY AIR LOSSES TO DEC. 4th				
	Over G.B.	Con- tinent	Middle East	N.W. Africa
Nov. 28	0	0	0	0
" 29	3	3	2	3
" 30	0	0	0	3
Dec. 1	0	30	0	0
" 2	0	0	0	0
" 3	0	4	0	11
" 4	0	11	1	6
"	1	39	3	43
Totals:	Wes. 3,778	Middle East, Over 5,735		North-West Africa, 3,712

BRITISH & U.S. AIR LOSSES TO DEC. 4th				
	Over G.B. A/c's.	Continent B'ns. F'ns.	Middle East A/c's.	N.W. Africa A/c's.
Nov. 28	3	0	0	0
" 29	13	13	10	0
" 30	3	2	3	0
Dec. 1	0	28	15	0
" 2	0	41	8	0
" 3	0	34	14	1
" 4	0	3	1	0
Totals:	Wes. 6,680	Middle East 2,038		North-West Africa, 1,363

Rome, and enemy airfields. The official communiqué states that "very accurate concentrations were obtained."

Another useful outing by the North-West African Air Forces last week was the attack on the submarine pens and construction works in Marseilles harbour. This was carried out by a strong force of Fortresses and was the first time this particular target had been visited. It was due for attention, however, because the submarine facilities, which had been under construction for some time, were nearing completion. Considerable damage had also been done a few days previously to the Germans' naval installations at Toulon, especially the dry docks.

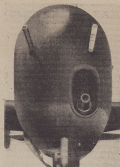
#### A Skillful Feint

BOMBER COMMAND has grown very, very confident in ringing the changes in its attacks on German production centres, and it has particularly good chances of puzzling the defenders now that the Germans rely mainly on fighters, and are very short of that class of aircraft. The enemy naturally wants to concentrate his fighters over the "target for to-night," while the

staff of Bomber Command delights to keep them guessing.

On the night of Friday, November 26th, a large force of Lancasters and Halifaxes, with a contingent of Mosquitoes hanging about warily in the background, set out ostensibly for Berlin. When only a few miles short of the German capital the Lancasters and Halifaxes turned sharply away to the south and made for Leipzig, while the Mosquitoes carried on to Berlin. The German fighters were completely fooled, and lost the main body of bombers. The people of Berlin must have been agreeably surprised to get only a comparatively light raid instead of a "saturation" effort. Leipzig, on the other hand, was caught unprepared, with barely any fighters in the sky to protect it. The guns and searchlights did what they could, but it was only at the end of the raid that the fighters received news of what had happened, and made off to Leipzig. Most of them arrived too late to affect the result of the raid.

Germany's last hope, the U-boat, has met with a very nasty knock in the Atlantic, and the blow was delivered from the air. Three convoys were at sea, when packs of U-boats



**AERIAL ARTILLERY:** The new nose of the Mitchell (B2G) with its two .5in. machine guns and a 75mm. cannon.

were observed lying in wait for them. Machines of the U.S. Navy worked heart and soul with those of Coastal Command, and, of course, the Royal Canadian Air Force played its part. Liberators, Sunderlands, Hudsons and Venturas all shared in the victory—for victory it was of a complete character. The fighting went on for eight days, and evidently the U-boats sometimes followed their new tactics of remaining on the surface and fighting it out with the aircraft. One Liberator was lost, and its captain was a son of Air Chief Marshal Sir Arthur Longmore.

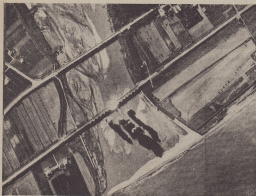
The Allied aircraft attacked 15 U-boats during the eight days, and six are known definitely to have been destroyed. But the air attack was so successful that not one merchant ship in the convoys was attacked, and finally the enemy gave up the contest and sheered off. Most of the crews in the U-boats must now be young and inexperienced sailors, and this defeat cannot but have a most demoralising effect on the whole of the German Navy.

The Japanese have had the impertinence to make a daylight air raid on Calcutta. They sent in two waves of bombers escorted by fighters. Our fighters intercepted, and some of the enemy were destroyed. There were some casualties among the civilians in the crowded city.

#### A.T.C. CALLING!

AN exhibition of A.T.C. training devices, equipment and photographs, together with R.A.F. pictures, will be opened at Harrod's, Knightsbridge, next Wednesday, 15th inst., by the Secretary of State for Air.

Features of the exhibition include the Link Trainer, a Synchronoph, a Kirby cadet glider, a Lancaster fuselage, and models made by A.T.C. cadets.



**LINE SHOOTING:** Marauders of the American 12th Air Support Command score a direct hit on the railway bridge at Fano on the Italian east coast.