

resulting remarkable range of most efficient military engines. From these, and with the experience derived from their design, manufacture and operation, we must be ready after the war, rapidly to build up an even better family of prime movers for civil air transport.

The whole future of the piston engine is closely governed by the quality of the fuels and lubricating oils which may become available in the future, and the history of aircraft engine development would have been very dull, compared with the records of the remarkable achievements actually realised, had it not been for the efforts of the fuel technologists between 1920 and the outbreak of the present war.

At least 15-20 per cent. of the specific power output of front-line aircraft engines realised between the two wars is directly attributable to the improvement in the quality of fuels.

How much longer the demand for specialised research will continue must depend upon the influence of gas-turbine development on the useful life of the reciprocating engine, but so long as there is active competition between the two types of power plant, the petroleum technologists will be pushed harder by the piston engine protagonists, particularly in regard to taking advantage of the possible "Achilles heel" of the turbine, economy in fuel consumption.

Prior to the last war, internal combustion engineers were not fuel conscious. Petrol was specified merely by its specific gravity, and particular brand. During the last war the anti-knock values of the fuels used varied between 50 and 60 octane number, but as a result of the outstanding work of fuel technologists immediately after the war in this country and later in America, combined with the co-operation of the metallurgists and the development engineer, the engines in this war have been provided with a far higher grade of anti-knock fuel. It will be of the utmost importance, if civil aviation is to prosper, that the fuel which represents some 15-20 per cent. of the cost of airline operation, should be supplied at the lowest possible price, and that it should be properly distributed along all the world's commercial air routes.

In view of the well-planned policy of the United Nations

### GEN. ARNOLD ON AIRCRAFT LOSSES

GEN. HENRY H. ARNOLD, Commanding General, U.S. Army Air Forces, at a recent War Department Press Conference, disclosed that the A.A.F., in operations against the enemy in all theatres from December 7th, 1941, to May 15th, 1944, had destroyed 16,510 enemy aircraft in aerial combat, probably destroyed 4,650 and damaged 5,546—a total of 26,706.

On the ground, he added, the A.A.F. had destroyed 3,664 enemy aircraft, probably destroyed 347 and damaged 1,432—a total of 5,443. The overall total of enemy aircraft destroyed, probably destroyed and damaged in aerial combat or on the ground was 32,149.

U.S. Army Air Force losses due to enemy action in this period, said Gen. Arnold, total 5,718 combat-type aircraft in aerial combat and 236 on the ground. In addition, he noted, approximately 200 non-combat-type aircraft have been lost due to enemy action in the air or on the ground.

The U.S. Army Air Forces, Gen. Arnold pointed out, flew 746,353 sorties in this period. The tonnage of bombs dropped amounted to 468,391. He also disclosed that 320,489 tons of Japanese shipping had been sunk by the Army Air Forces operating in the Pacific and Asia during the first four months of 1944. He gave the tonnage by months as follows: January, 10,160; February, 159,704; March, 38,450; April, 52,175.

Gen. Arnold said that as the intensity of American bomber attacks increased, the fighter opposition of the *Luftwaffe* has fallen off. When the U.S. Air Forces first went into action over Germany, he said, the enemy fighter opposition was very severe. Since that time the German losses have been so heavy that fighter opposition is now used according to the location and character of the targets attacked.

Gen. Arnold remarked that while it was once customary for the *Luftwaffe* to interpose as many as 400 fighter aircraft in an attack by the A.A.F., seldom do more than 200 fighter aircraft of the enemy now appear in opposition.

"Whereas our force has been greatly increased and continues

there seems no reason to doubt that post-war fuel, which is now termed 100-130 grade, will be available at about 1s. 6d. per gallon excluding duties. We may expect the introduction of much improved fuels such as Triptane for special military purposes. Thus for military and special applications in the civil field, we must encourage still closer collaboration between the petrol industry and aircraft and engine manufacturers. There is, in my opinion, too great a tendency to minimise the importance of fire risk on post-war civil aircraft.

We should give careful consideration to certain of the low volatility blends generally known as safety fuel. It would appear that safety fuels of 100 octane rating could be made available in substantial quantities, after the war, and would largely eliminate the danger of fire.

Whereas considerable progress has been made during the last 20-30 years on fuels, and the technique has advanced whereby an accurate basis has been established for estimating its performance in the engine, the position of lubricating oils is far less satisfactory, and as yet all that is known is that they are composed of a large number of complex hydrocarbons whose exact identification is beyond the capacity of the petroleum technologists.

Matters have not been improved by the British policy over the last 15 years of attempting to employ an oil to a physical specification, to be supplied at the lowest price possible, thus enforcing the running of our highly developed engines on a variable and indifferent quality of oil.

The drive for better lubricating oils in the future is absolutely essential if we are to take full advantage of high-octane fuels and maintain the necessary intensive development on piston engines.

It is reasonable to expect considerable improvements from film strength additives and detergents, and there is considerable scope for the closest collaboration between engine manufacturers and the oil companies. There is no doubt that, given full opportunities, considerably improved results will be obtained, providing longer life of engines between overhaul.

*This comprises the first half of Sir Roy's lecture. The remaining sections will be included in next week's issue.*

to increase, the German fighter opposition continues to drop," Gen. Arnold said.

He emphasised that the German problem to-day is to save their fighter force for employment in defence against the expected invasion attacks or to use their available fighter strength to protect the selected targets of Allied bomber assaults. "They cannot do both," he added.

### JOURNALISTIC LEND-LEASE

ELSEWHERE in this issue we publish extracts from President Roosevelt's fifteenth report on Lend-Lease, in which he makes handsome acknowledgment of the reciprocal aid given by Great Britain to the United States. With the example of the President of the United States before us, we feel that we cannot do less than acknowledge the aid given by *Flight* to an American contemporary, *Air Tech*.

When the April issue of that journal came to hand, our eye was caught by an article entitled "Fighter Design." It looked very attractive and we began to read. There was something familiar about both the text and the illustrations, although the latter were beautifully reproduced in colour, sometimes in black or blue lines on a white background and sometimes in white lines on blue or brown background.

Suddenly the pieces of the puzzle clicked together. In *Flight* of January 28th, 1943, we published an article by our Editor under the same title. The drawings in our contemporary had been printed in colour or "reversed" and half-tone blocks of the different types of fighter added, but they were undoubtedly our drawings. A closer study of the text revealed that it had been slightly paraphrased here and there, although many passages were quoted verbatim.

An examination of the title-page disclosed the fact that the "author" is Associate Editor of our contemporary. Since he did not see fit to acknowledge *Flight* in any way, we have much pleasure in doing so. We are happy to think that we have contributed, in our small way, a little bit of Lend-Lease in Reverse.