

# Miracles of Production and Supply

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**M**aking an unparalleled wartime effort on the homefront, Australia built up with great rapidity and considerable resourcefulness an armaments industry which duplicated in the Pacific, though necessarily on a smaller scale, the immense production achievements of Britain and America.

At a cost of over £250,000,000 in public money, 45 new Government war factories and 178 Government-controlled munitions annexes were built, war contracts were let over the entire field of heavy and light industry, and a tremendous flow of military equipment was supplied to Australian fighting men.

During the greater part of the war more than 900,000 people (760,000 men and 140,000 women) out of a total population of only seven millions, were engaged in the production of ships, planes, guns, mechanised military equipment, and the material for making them.

By the time the output of arms reached its peak in 1943, Australia had presented the United Nations with a highly efficient and largely self-contained Pacific arsenal, turning out a greater diversity of weapons and military equipment than any country in the world outside the ranks of the five Great Powers—the United States, Britain, Russia, Germany, and Japan. The output of her mobilised industries was sufficient in quantity not only to equip her own infantry divisions, but sufficient also to build up large strategic reserves and divert substantial surpluses to her Allies.

From this great armaments workshop in the South Pacific Ocean went invasion craft, aircraft accessories, gunsight prisms, machine

tools, army uniforms, and vast quantities of field rations to the American forces; corvettes, grenades, machine tools to India; factory equipment to New Zealand; rifles, shells, ammunition and steel air-raid shelters to Britain.

Australian-built 3.7-inch anti-aircraft guns were delivered to England in time to swell the great London barrage that beat off the Luftwaffe in 1940.

The high degree of self-sufficiency attained was the result of the remorseless pressure of events which in the war's early stages virtually isolated Australia from her friends and Allies and forced her to bend all her energies to the manufacture of items of equipment which neither Britain nor the United States was able to send her by reason of their own acute shortages and enemy action at sea.

From the pre-war Government ordnance factory at Maribyrnong, the small arms factory at Lithgow, from hundreds of commercial plants scattered all over the country, and from a new ordnance factory which the Government built during the war at Bendigo, flowed a stream of guns and small arms for the three Services. Most of these weapons were of the most modern type, never tackled in Australia before.

The best light field gun to come out of this war, the British 25-pounder, was produced in quantity before the Japanese began to pour over the Kokoda Gap. So was the Australian-designed Owen sub-machine-gun, still claimed by Australian infantrymen to be the best light sub-machine-gun in the world. By the time



The Australian designed Owen sub-machine-gun.

the British six-pounder anti-tank gun appeared in the North African desert to change the fortunes of war against Rommel, similar guns were coming off the production lines of Australian factories for delivery to the Australian forces.

Other weapons not produced in Australia before the war followed in quick succession—17-pounder guns (latest and deadliest of all British anti-tank weapons), 4.7-inch naval guns with which hundreds of merchant ships were armed in Australian ports at the height of the Japanese submarine war, medium altitude Bofors anti-aircraft guns, Bren guns, 20-millimetre aircraft cannon, and a range of light and heavy mortars which played an important role in New Guinea, Bougainville, and Borneo jungles.

These weapons were of standard British Army design copied to the smallest details in Australian factories, but Australia also can take credit for producing a number of weapons of original design, peculiar to the type of jungle warfare she encountered from 1941 onward.

Conspicuous among the novelties was the Australian short 25-pounder field gun used for the first time in an air-borne attack on Nadzab on September 5, 1943. It was a "baby" 25-pounder so designed that it could be "knocked down" into a number of small packages for transport by air, jungle, or track. It was designed by Australian artillery experts in Melbourne at a time when neither British mountain guns nor the



Australian built 3.7 inch anti aircraft gun.

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American 75 millimetre pack howitzer could be obtained from overseas.

Another Australian jungle weapon was the Austen sub-machine-gun, purely an Australian-designed weapon incorporating the best features of a number of sub-machine-guns, both British and German. It was finally manufactured in quantity by private enterprise in several Sydney factories.

The Australian cruiser tank was also of original construction and design. No tranks had been made in Australia before

the war, and the technique was quite unknown. It required an expenditure of £55,000,000 the application of considerable technical ingenuity, and an enormous labour effort before the first tanks rolled off the assembly line at Chullora railway workshops in 1944.

The first of these tanks were inadequately armed, only two-pounder guns being available when the tanks were in the designing stage, but the design was quickly modified to take a 17-pounder, and thus efficiently armed it would have taken a creditable place beside the best

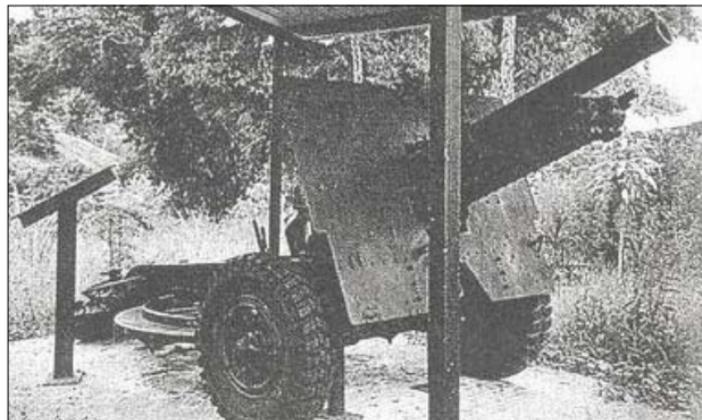
British and American models but for the changed strategic situation in the Pacific. Cancellation of the tank project after only 30 tanks had been produced was afterwards thrown up at the Government as an example of injudicious planning and wasteful expenditure. The facts are, however, that the project was initiated at the insis-



Australian-built aeroplane *Beaufighter*.

tence of the Australian Army at a time when an armoured division was being raised for service in North Africa, and Britain had lost all her own tanks at Dunkirk, and it was still being prosecuted under unparalleled difficulties when the country was clamouring for tanks to resist the threatened Japanese invasion of the Australian continent.

The armoured division did not go to North Africa, the Japanese did not land in Australia, and the sort of jungle warfare to which the Australian forces found themselves committed did not lend itself to the deployment of massed tanks.



A 25-pounder as a memorial to the Australian Artilleryman at Owers' Corner.

# Vast Expansion after Dunkirk

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## PART 2

At the time of Dunkirk, when Australia was called on to act as a supply base for the entire scene of operations east of Suez, the Federal Government initiated a great expansion of shell production and a £16,000,000 supplementary programme of explosives manufacture.

Vast new chemical plants and shell-filling stations were built at Salisbury, South Australia, and at St. Mary's and Villawood, New South Wales, with an output of high explosives, propellants, and pyrotechnics planned to meet the need, not only of Australia, but India, Malaya, and the Middle East. At Cheltenham, S.A., Rutherford, New South Wales, and Rocklea, Queensland, huge factories were built at enormous cost to increase the production of gun ammunition, but as the war developed and the United Nations' resources expanded, much of the potential capacity thus created became redundant, and sections of the plant were never used.

But because of this safety-first policy Australia's front line troops never suffered from a shell shortage.

Ammunition deficiencies experienced in the first three months of the Japanese war were limited to a few special categories, such as anti-tank shells, and were quickly overcome.

New industries unknown in Australia before 1939 had to be set up during the war to widen the range of munitions production.

One of the more exclusive of these new industries was the manufacture of ball bearings, said by industrial experts to be the most difficult thing to make in the whole range of modern engineering and for long considered beyond Australia's capacity. Two factories had to be built—one at Bendigo and the other at Echuca—special automatic machinery had to be made in Australia and a great deal of difficult engineering technique acquired. By 1944 millions of ball bearings were being turned out of a quality comparable with those formerly imported from Britain, the United States, and Sweden.

Even more spectacular was the extraction of nitrogen from the air, and

intricate and expensive process, which before the war had been considered impracticable for Australia. It is an adaptation of a chemical process invented in Germany before the last war, and was employed on a vast scale by the Germans in both wars to break the Allied economic blockade. To establish the new industry plant of the most modern description was installed at Villawood and elsewhere. The machinery will probably be used in peace for the manufacture of nitrogenous fertilisers, all of which have hitherto been imported.



Aerial view of the Salisbury, South Australia, explosives factory.

Another advance towards a flourishing young Australian chemical industry was the production of magnesium, the light metal used in the manufacture of aero engines. It was established at Newcastle early in the war by Broken Hill Pty. Ltd. and met with instant success. No magnesium has now to be imported.

Of unique significance, both to the war effort and the peace, was the manufacture for the first time in Australia of optical glass. This strategically vital industry was established at Alexandria, Sydney, late in 1941 by the Australian Window Glass Pty. Ltd., a subsidiary of Australian Consolidated Industries. Super-imposed was a diversified optical munitions industry which made all the gun-sights, range-finders, gun predictors, telescopes, tank periscopes, prismatic compasses, precision camera lenses, clinometers, and stereoscopes used by the Australian forces. The peak production at the Tasmanian optical munitions annexe was 800 camera lenses a month.

As a result of the war-time emphasis on industrial self-sufficiency, Australia has now joined the ranks of those highly-

industrialised countries that make stainless steel, required in the manufacture of aero engines and surgical instruments, and in peace-time of high-class cutlery; tungsten carbide tool tips, which enable machine tools to slice through the hardest steel as though it were butter; and a wide variety of high-speed tool steels needed in the war factories.

All of these developments in the steel industry were perfected during the war as a result of far-seeing research and experiment carried out about Munich time by the staff of metallurgists and industrial chemists of B.H.P., whose "back-room" activities received worldwide publicity in 1941 as the result of the production at Newcastle of the world's first malleable bullet-proof steel plate, free of the usual expensive alloys and capable of being welded instead of riveted.

This Australian invention, so important in the manufacture of armoured vehicles, was copied by all Allied nations.

Shortly after this discovery Australian engineers and metallurgists,

working under the direction of the Armoured Fighting Vehicles Directorate of the Ministry of Munitions, produced at Alexandria for the first time anywhere in the world a tank hull cast in one piece, an engineering technique which later became the universal practice among the Allied nations, permitting the production of the first really streamlined tanks.

Manufacture in Australia of armour plate, a serious bottleneck in early days of the war, was all the more remarkable because of the acute world shortage of the principal hardening agents for steel, such as nickel, molybdenum, and vanadium. Newcastle research workers eventually found an efficient substitute in Zircon common on the beach sands of Byron Bay, and were thus able to produce a steel as tough as any in the world.

It was B.H.P. research and development in the field of alloy steels that led to the successful production at the ordnance factory at Maribyrnong of semi-armour piercing bombs, subsequently used by the R.A.A.F. with destructive effect against Japanese naval targets.

*To be continued.*

# Naval Ships and Freighters

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## PART 3

At Whyalla, they built several ore freighters and many corvettes. At Sydney, Melbourne, and Brisbane they built seven 9,000-ton River Class cargo steamers and a number of 4,000 and 6,000 ton vessels.

Naval construction, chiefly at Sydney, gave the Royal Australian Navy three Australian-built destroyers of the latest British type, frigates, over 60 corvettes, and numbers of special naval craft.

Additionally, Australia built about 60,000 small craft as her contribution to the huge invasion fleet in the Pacific, including landing craft, ocean-going powered lighters and barges. Fairmile naval vessels, and a great variety of tugs and motor launches all powered by Australian-built marine engines which had never been made before. The whole vast enterprise was carried out under the direction of the Small Ships Construction Directorate of the Ministry of Munitions, and was undertaken in addition to the huge quantity of ship repairs which were effected in Australian shipyards, amounting to 1,000,000 tons a month.

One of the most fascinating war developments was the recovery of rare minerals hitherto neglected to supply the urgent needs of the chemical and metal industries. Two such minerals, Tantalum, indispensable to the manufacture of radar equipment, and Beryllium, needed for the manufacture of light non-corroding bronze, were mined in large quantities for export to the United States.

When Burma, chief source of Tungsten, fell, Australia stepped up her own production of this mineral with such success that by 1945 she was able to export to England 2,000 tons valued at £750,000.

In 1943, Australia was producing 60 new chemicals of commercial significance.

The secret of Australia's success in expanding her output of munitions so rapidly was the war-time growth of the machine tools industry. This in itself was a miracle of production.

When the war began there were only four firms in the country making machine tools, and their aggregate output was under 100 machines tools a year.

Hundreds of Australian engineering shops were mobilised for the production of this vitally necessary equipment. The output rose to 6,000 machine tools a year, ranging from small precision lathes to giant presses, weighing 135 tons. For every machine tool purchased overseas, Australia built three herself.

Parallel with the production of machine tools was the manufacture of tools and gauges—the key to standardised mass production. Hundreds of engineering shops all over Australia made them at the rate of 26,000 a day, at an annual cost of about £2,000,000.

During the war, Australia stepped up the construction of locomotives and railway wagons, supplied the Army and Air Force with all their transport vehicles, produced a vast volume of military engineering equipment and heavy earth-moving machinery for the Allied Works Council, manufactured naval mines, increased the output and range of electric motors and constructed every type of ship built in Australian yards.\*

Surveying the whole field of Australian industry and the miracles it accomplished, there appear only three major production gaps—oil, aluminium, and automobile engines. Yet even these strategic deficiencies have now been partly taken care of—oil by the establishment of a chain of plants for the

production of power alcohol from wheat and molasses, and petrol from shale; Aluminium by initial steps which have been taken to set up an aluminium ingot industry in Tasmania to feed the already well established aluminium fabrication industry; and automobile engines by plans for the production of motor cars and trucks in Australia.

Amid the awful destruction of these last six years, the war has contributed to the Australian economy one inestimable benefit—the technique of modern mass production, intimately linked with the National Standards Laboratory in Sydney. No one knows better the enormous peace-time implications of this technique that Mr. Essington Lewis and those other leaders of private and Government enterprise who devoted to the nation during the war their talents for industrial organisation.

\*Undreamed of war-time expansion took place in shipbuilding. Not only were hundreds of small shipbuilding yards installed up and down the country, including inland plants for prefabrication of ships and small craft, but in 1940 the Broken Hill Company built Australia's largest shipbuilding yards at Whyalla, at the head of the Spencer Gulf.



View of the engineering workshops, Defence Standards Laboratories, Maribymong, mid-1950s.