Contribution to Victory

Foreword

To those who have endured the hardships of making A.E.C. vehicles and other war time equipment amid dangers and tribulations

To those whose brains have mastered technical problems when concentration was well-nigh impossible

To those who have stood at the helm to steer the Company through seas of perplexity

To those who, in the stress of battle or through danger at home, have handled A.E.C. vehicles—

THIS BOOK IS DEDICATED.

It is a record that inspires a feeling of justifiable pride in all who shared in the war time achievement of a wonderful team, known the world over as

AEC
SOUTHALL

From a painting by Francis Hodge, R.I., R.P.

MR. C. W. REEVE, C.B.E.
Chairman

Contribution to Victory by The Associated Equipment Co. Ltd.

CHARLES WILLIAM REEVE, C.B.E., A.C.I.S.

Chairman. Mr. Reeve who served in his early business life with the Premier Gas Engine Co. Ltd., John Wright & Eagle Range (now Radiation Ltd.) and the British Westinghouse Co. Ltd. (now Metropolitan Vickers Electrical Co. Ltd.) was appointed works accountant in 1915. A year later he became accountant and in 1918 was appointed joint manager.

In 1924 he accepted the position of General Stores Superintendent of the London Underground Group of Companies, including the Associated Equipment Co. Ltd., and was responsible for the supplies of railway, tramway and omnibus services and power stations, and remained in that capacity until 1928. He then returned to the Associated Equipment Co. Ltd. as assistant to Lord Ashfield, who was then chairman.

The experience and intimate knowledge of the company's activities acquired by Mr. Reeve fitted him for greater responsibilities and in 1929 he was elected to the board and appointed managing director. He retained this position until 1933, when he became chairman in succession to the late Mr. H. A. Vernet, retaining at the same time the managing directorship of the company.

From 1920 to 1923, Mr. Reeve served as a member of the council of the Motor Trade Association and was elected president for two periods (1922 and 1923). From 1919 to 1924 he served on the council of the Society of Motor Manufacturers and Traders. He was also a member of the Board of Trade Advisory Council.

Mr. Reeve has also been associated with D. Napier & Son Ltd., the well-known aircraft engine manufacturers, first as director in 1938 and later as managing director until his resignation in 1942 when that company was acquired by the English Electric Co. Ltd.

During his period of office, the number of employees increased from 2,000 to over 20,000. He was also responsible for a large Shadow Factory at Liverpool. He was a Member of the Council of the Society of British Aircraft Contractors.

Meanwhile, in November 1941, when 120 prominent industrialists met to discuss the industrial future of the country, Mr. Reeve was a signatory to their subsequent statement entitled "A National Policy for Industry," which among other things laid down a code of obligations towards employees which was described as a first charge on industry. The Chairman is a recognised authority on motor vehicle factory administration and procedure, while his knowledge and experience relating to all aspects of motor vehicle export business has been appreciated by the Society of Motor Manufacturers and Traders who elected him to the Executive Committee of the Export Group.

Mr. Reeve appeared in the Coronation Honours List of 1937, when he became a C.B.E. for services to the Air Ministry.

He is a Liveryman of the Coachmakers' and Coach-harness Makers' Company.

With the object of studying overseas goods and passenger transport problems at first hand and to make contact with A.E.C. representatives, he has twice made world tours. On the last occasion Mr. Reeve undertook a four months' tour in 1935 and succeeded by travelling in aeroplanes, steamships and motor vehicles in covering a total distance of 28,000 miles in that period. Among the countries visited were Australia, New Zealand, Honolulu, U.S.A. and the Dutch West Indies.

Having resigned the position of managing director in 1944, Mr. Reeve still continues to guide the company he has served so well and to encourage the entire personnel whose respect he has won, by retaining the office of Chairman.

Rt. Hon. LORD BRABAZON of TARA, P.C., M.C.
Director.

Commodore The Rt. Hon. The EARL HOWE,
P.C., C.B.E., V.D., R.N.V.R.
Director.

Major-General The Rt. Hon. SIR FREDERICK SYKES,
P.C., G.C.S.I., G.C.I.E., G.B.E., K.C.B., C.M.G.
Director.

Director. Lord Brabazon of Tara (formerly J. T. C. Moore-Brabazon) was educated at Harrow and Trinity College, Cambridge, and has been associated with motoring since pioneer days. In the year 1904 he became, at the age of 20, a member of the Royal Automobile Club Committee, a position that he still holds. His first notable achievement as a motorist was an outstanding performance in 1907 when he won the Circuit des Ardennes by covering 375 miles in 6 hours 14 minutes. He competed in many other classic events such as the Tourist Trophy Race, the Four Inch Race in the Isle of Man, the Kaiser Cup Race, the Coupe de Liederkerke and the Grand Prix at Dieppe.

Civilian aviation next attracted his attention and in 1909, the first flight in England gained for him No. 1 Certificate (for pilots) awarded by the Royal Aero Club. In the same year he won the £1,000 *Daily Mail* prize for flying one-mile in an all-British machine. In the following year an 18-miles flight won for him the British Empire Michelin Cup.

Experience with pioneer aircraft was turned to good account in World War I, when he joined the Royal Flying Corps and organised its photographic department, which rendered such valuable aid in planning attacks. As a recognition for technical contributions he was elected a fellow of the Royal Photographic Society while the British and French military authorities awarded him the Military Cross and the Legion d'Honneur. He was also mentioned in despatches on three occasions.

Lord Brabazon entered politics in 1918 as Unionist Member for the Chatham Division of Rochester and retained the seat until 1929, when he became a member of the L.C.C. for St. George's Division, Hanover Square. In 1918 he was also appointed Parliamentary Private Secretary to the Rt. Hon. Winston Churchill, then Secretary of State for War, being appointed later Parliamentary Secretary to the Ministry of Transport from 1923–1924 and 1924–1927. Re-appointed to that position on the return of the Baldwin administration, he was entrusted with investigations on electric supply problems which ended in promotion of the 1925 Act establishing the grid system in this country. Lord Brabazon's experience in aviation was next applied to the development of air mails when he served as chairman of the Air Mails Committee and, again, in connection with the R101 airship disaster when he acted as assessor in the subsequent enquiry. In 1931 he acted as member of the Gorell Committee on Civil

He re-entered Parliament in 1931 to represent the constituency of Wallasey, Cheshire, and in 1939 was appointed Parliamentary Private Secretary to Sir Samuel Hoare, then Lord Privy Seal whom he followed in the same capacity to the Air Ministry. He became Minister of Transport in 1940 and was Minister of Aircraft Production from 1941–1942.

Other notable events in His Lordship's career were his appointment as Privy Councillor in 1940 and his elevation to the Peerage in 1942, while his services to British Industry may be assessed from the directorships he holds in five notable undertakings.

He is a Past President of the Royal Aeronautical Society (1935), the Radio Manufacturers' Association (1931-1934), English Golf Union (1938), and is at present President of the Royal Aero Club, and Chairman of the Air Registration Board.

EARL HOWE, P.C., C.B.E., V.D., R.N.V.R.

Director. Educated at Eton and Christchurch, Oxford, Earl Howe joined the R.N.V.R. in 1903 and was promoted to the command of the Sussex Division of that formation in 1907, a position that he held until 1944.

In 1913, he was appointed to the staff of Lord Beatty, and at the outbreak of World War I, commanded the "Howe" Battalion of the 2nd Royal Naval Brigade in England and Belgium. From December 1914 until March 1919, Earl Howe was assistant gunnery officer on H.M.S. *Queen Elizabeth* which took part in the Dardanelles campaign. Towards the end of hostilities he was placed in charge of highly important photographic work in the Grand Fleet.

His first entry into politics was in 1918, when he was returned as Conservative member for Battersea South, retaining this seat in Parliament for ten years. Between 1927 and 1932 he was in charge of the London Department of the Conservative Central Office and was Junior Lord of the Treasury from 1927 to 1929.

Another important appointment held from 1925 to 1928 was A.D.C. to His Majesty the King in connection with the Royal Naval Volunteer Reserve. In the Honours List of 1927, Earl Howe was made a C.B.E. (Military Division) and in 1929 he became a Privy Councillor.

During World War II, the A.E.C. was deprived of Earl Howe's services when he was called to the staff of the Admiralty Commanding Reserve.

of the Home and Allied fleets and the Merchant Navy both of this country, our Allies and Neutrals, on the East Coast of Scotland, including the Orkneys and Shetland Islands.

Having achieved distinction in a naval career and carried responsibilities in Parliament and State, Earl Howe applied the same boundless energy to the equally exacting, and far more dangerous, hobby of motor racing which began to occupy his attention in 1928. His stable of cars has included examples of the world's finest and fastest racing models and the interest of any speed event in this country or international contests abroad was always augmented when the name of Earl Howe appeared on the programme.

He has participated in many motor races in this country, Northern Ireland, Eire, France, Belgium, Italy, Germany, Switzerland, South Africa and the U.S.A.

The coveted Gold Star awarded by the British Racing Drivers' Club has been won by Earl Howe on three occasions and his "fans" at Brooklands Track have twice acclaimed his victory in the Brooklands Automobile Racing Club's Gold Star event.

Among the motor racing successes of Earl Howe in different parts of the world are the Millie Miglia in Italy; the Grand Prix, Capetown; the Le Mans 24-hours Race and races of the same duration in Spa, Belgium and Pescara, Italy.

Even when opposing Nazi-subsidised motor racing teams, Earl Howe succeeded in getting the chequered flag at the famous Nuremburg Ring and at the Avus Track in Berlin.

In addition to active participation in motor racing events Earl Howe has placed his experience at the disposal of the governing bodies of the sport, being chairman of the R.A.C. Competitions Committee and representing South Africa on the A.I.A.C.R., the international body governing all motor sport. He is also a member of the C.S.I., and C.T.I. and International Court of Appeal. His interest in the sister sport of motor boat racing is shown in his chairmanship of the Marine Motoring Association, the body that controls motor boat racing in this country.

Among other official appointments held by Earl Howe are membership of the Imperial War Museum Board of Trustees and the Royal National Lifeboat Institution Board of Management.

MAJOR GENERAL THE RIGHT HONOURABLE SIR FREDERICK SYKES, P.C., G.C.S.I., G.C.I.E., G.B.E., K.C.B., C.M.G. and Knight of Justice of St. John of Jerusalem.

Scouts in the South African war, when he was severely wounded. Later he received a commission in the 15th The King's Hussars. He then served for a time in India, then in West Africa, and again in India, with the Intelligence Branch. He passed the Staff College in 1908 when he was promoted to the rank of captain. In 1911–1912 he acted as G.S.O. at the War Office and afterwards raised the Royal Flying Corps, Military Wing, which he commanded until 1914.

During the 1914–1918 War, Sir Frederick was with and some time commanded the R.F.C. in France until the middle of 1915 when he was in command of the Royal Naval Air Service in the Eastern Mediterranean, attaining the rank of Col. and being granted the C.M.G. in 1915. Returning to the War Office in 1916, he was promoted to Brigadier General and Deputy Director in 1917. He served on the Supreme War Council at Versailles in 1917–1918 and, as Major General, was appointed Chief of the Air Staff, 1918–1919.

After the war he became Controller-General of Civil Aviation and entered Parliament for the Hallam Division of Sheffield in 1922. In 1928 he was appointed Governor of Bombay and remained in that position until 1933.

Besides numerous British decorations won during his military career, he was awarded the Croix de Commander de la Legion d'Honneur and equally distinctive military medals from Belgium, Russia, Japan, Persia and the United States of America.

His experience in aviation dates from the year 1904, when he obtained a ballooning certificate, and, learning to fly in 1910, gained the Royal Aero Club Pilot's certificate (No. 95) in 1911. Among the learned societies which benefited from Sir Frederick's wide knowledge and experience were the Royal Aeronautical and the Royal Geographical, on both of which he served as a member of the council. In 1920 and 1922 he acted as chairman of the unified Meteorological Service.

Other distinguished positions he has held include the chairmanship of the Government Broadcasting Board, member of the Post Office Advisory Council, chairman of the Miners' Welfare Commission since 1934, chairman of the Royal Empire Society and President of the East India Association.

In 1940, Sir Frederick was returned as M.P. for the Central Division of Nottingham. He holds positions as director of numerous companies, has written on political, communications, defence and transportation topics and is the author of "Aviation in Peace and War," his autobiography "From Many Angles," "Roads to Recovery," etc.

A PROTECTED PLACE

Previous to 1938, the Associated Equipment Company's organisation at Southall, Middlesex, had pursued an uninterrupted programme in manufacturing goods, passenger and trolleybus types of chassis as well as railcars, marine engines and stationary power plants.

Then, almost at a moment's notice, the Factory was declared a "Protected Place" and became subject to the Official Secrets Acts, scheduled for control by one or more of the various Ministries to produce vehicles and other military requirements as described elsewhere.

From external appearance these would seem to have little in common with the Company's peacetime products, and it might well be assumed that the big change-over would have entailed drastic reorganization of the entire Works. In point of fact, nothing of the kind was needed, simply because many of the wartime products incorporated the same fully standardised chassis units as those built into normal A.E.C. goods and passenger vehicles.

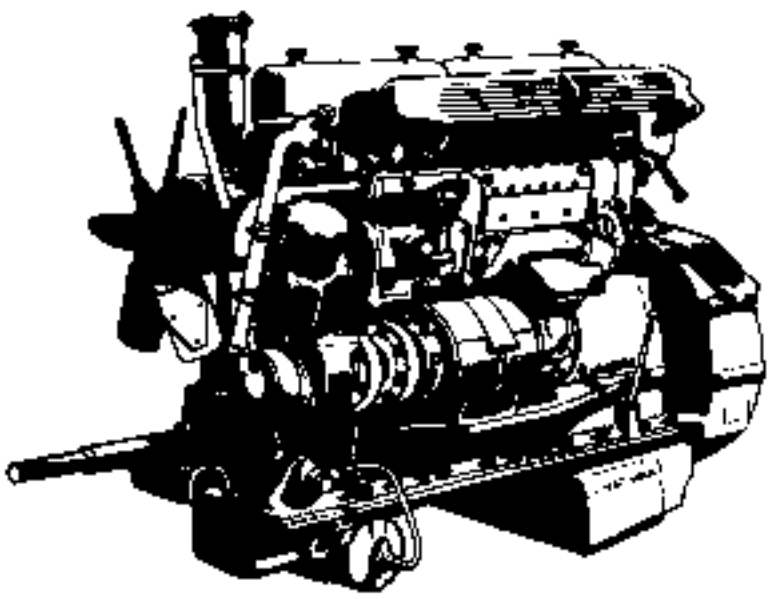
Furthermore, while to outward appearance the Southall Works now presented quite a different picture to that of pre-war days, the actual manufacturing routine underwent little, if any, modification as borne out by the following description of the Works in wartime.

Standing in a site of 65 acres the A.E.C. factory, one of the most modern British industrial establishments, covers an area of approximately 14 acres, and is served by a branch line from the G.W.R. leading into the Goods Inwards Department. Here, vast quantities of raw, finished and consumable stores arrive weekly, though the greater proportion is delivered by road vehicles.

The Goods Inwards Building, covering an area of some 29,680 sq. ft., extends along the northern side of the Factory, the whole of the interior being served by traversing cranes which deposit castings, forgings, stampings and the like in vast quantities in positions adjacent to the machine lines of the main works. All bar metal is conveyed direct by railway trucks to a separate store from which supplies to feed the batteries of automatic machines are drawn.

While passing through the Goods wards Department, one may observe certain boxes of material marked "N.P.L." which has no reference to the National Physical Laboratory, but indicates that the contents have "Not Passed Laboratory," and may not be moved until the chief chemist has advised the departments concerned that the material is to the specification required.

Lying just outside the building are accumulations of castings and other raw material which, covered with rust, seem to have been forgotten. The rusting, however, is intentional for the oxidisation helps to remove foundry scale prior to the pickling process. A special labour-saving plant has been installed for this purpose and comprises three large tanks containing a solution of acids, clean water and a preparation of caustic soda respectively. The tanks are served by a mechanical conveyor, and during the course of each day superficial obstructions to the high-speed machine tool cutters are removed from many tons of raw material. This is further prepared for subsequent operations by various processes conducted in the Heat Treatment Department, to which reference is made later.



The A.E.C. "Matador" 4-wheel drive medium artillery tractor, 9,620 of which were designed and built for operation in every theatre of war.

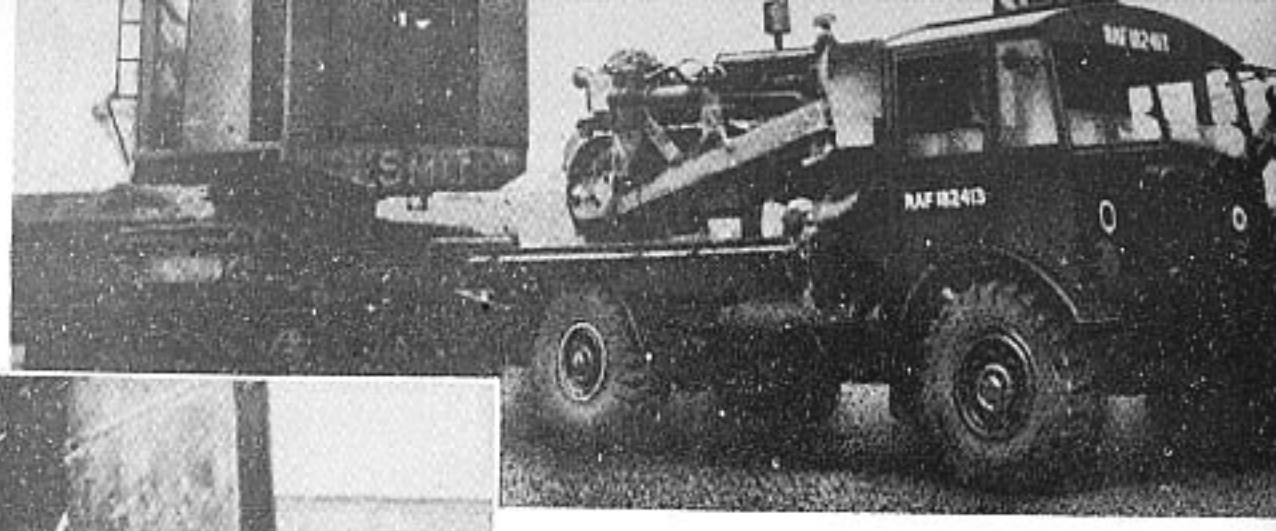
A convoy of "Matador" medium artillery tractors engaged on manœuvres "somewhere in England."

On this and the following pages are detail and general views of the famous A.E.C. "Matador" 4x4 medium artillery tractor, which was referred to in official circles as "the best in the opposing armies."

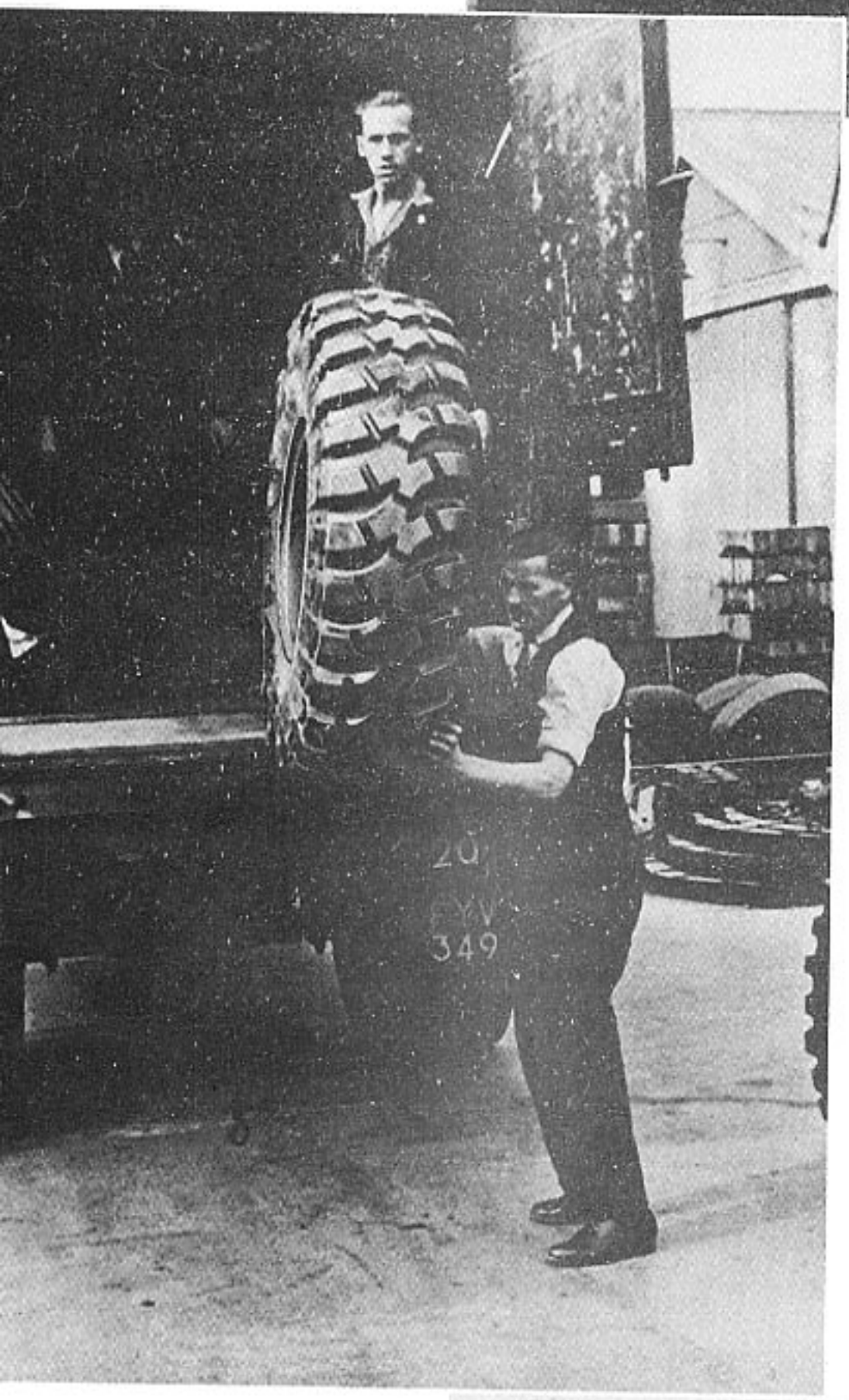
An interior view of a typical "Matador" body. Note the adjustable shelf racks.

A Fleet of A.E.C. "Matador" chassis ready for road testing and delivery to body builders.

In the A.E.C. Chassis Inspection Department: A batch of "Matador" tractors ready for final delivery.



In the Far East a "Matador" R.A.F. flat platform model carrying a 7 tons load and hauling a bull-dozer of 16 tons dead weight at Singapore.



Unloading giant pneumatics for the A.E.C. "Matador," 4 × 4 tractor vehicle.

Nicknamed "Sneezy" this "Matador" is shown operating over the soft sand of the Middle East.

LABORATORY ROUTINE

Few people not conversant with motor vehicle manufacturing routine have any conception as to the vital part played by the works laboratory.

At Southall much care has been devoted to the development of scientific research affecting the quality of all materials incorporated in the Company's products. For example, all raw materials from which the units built into A.E.C. vehicles and other wartime products were made, conformed strictly to the specifications prepared by the designers, as in peacetime, and it rests with the laboratory staff to test samples from every batch of raw material delivered by outside suppliers before manufacturing is allowed to begin.

As soon as the chemical analyses of selected samples have been completed, other samples are handed over to the physical laboratory where they are machined into test pieces for insertion in the various laboratory appliances. The information required concerning raw material refers to the following characteristics: (1) elastic limit and yield point; (2) maximum stress in tension and torsion; (3) elongation per cent.; (4) reduction in area per cent.; (5) hardness; (6) impact value; (7) capacity for bending; (8) resistance to alternating stresses and (9) fatigue range.

Most of the aforementioned characteristics are determined by routine tests, but others—notably those for fatigue range—may take months to complete and are only conducted when some new material is incorporated in any manufactured article.

It is interesting to observe that all the standard routine tests are conducted with the aid of conventional laboratory equipment, such as the 50-ton Buckton tensile tester, the Izod impact pendulum and hardness testers of the Brinell, Rockwell and Shore varieties. The fatigue values call for the use of the Wöhler apparatus, the action of which is to rotate weighted test pieces at the rate of 3,000 revolutions per minute, alternately in opposite directions, until they fracture from sheer molecular fatigue.

Whatever the method of fracturing test pieces, in addition to microscopic examination of the breaks, sections of the material are also examined by photomicrography and the prints, together with full reports upon every test, are filed in the laboratory office for future reference, unless any particular sample is in any way defective, in which case the suppliers are notified immediately.

CLASSIFIED HEAT TREATMENT

Five general classes of heat treatment are applied to the steels used in A.E.C. manufacture, namely annealing and normalising, hardening, tempering and case-hardening. These are employed to effect certain changes in the existing properties of the material whereby predetermined characteristics are produced to resist known stresses.

As the result of rolling, stamping and hammering while being formed together with the heat employed, some of the steel billets from which chassis components are made may be subject to considerable internal stressing, liable to disturb their crystalline structure to the detriment of durability of the products. The necessary correction is affected by annealing or normalising to restore the greatest possible degree of grain refinement and to facilitate subsequent machining operations. Surfaces which need great resistance to wear are given the required characteristics by various methods such as case-hardening, induction-hardening, etc.

All this work is conducted in the Heat Treatment Department through which in the course of a normal day's work, thousands of components pass. The furnaces used for the various kinds of treatment are regulated by pyrometers, recording within limits of plus or minus 5 degrees Cent. of any specified temperature. These instruments are connected to indicating scales on which the temperatures may be read at a glance so that the men in charge can tell exactly what is happening inside each furnace.

Before leaving the Department, all components extracted from the furnaces are allowed to cool, and, after removal of scale and roughness by sand or shot blasting, and checking for correct heat-treatment by a hardness test, pass into their appropriate section of the Works for processing.

On manœuvres: the "Matador" working in conjunction with the artillery.

One of the Cyrenaican police holds up an A.E.C. "Matador" whilst receiving instructions in correct traffic signalling from a British M.P. in Benghazi.

This picture shows the exceptional manœuvrability of the A.E.C. "Matador" over uneven ground.

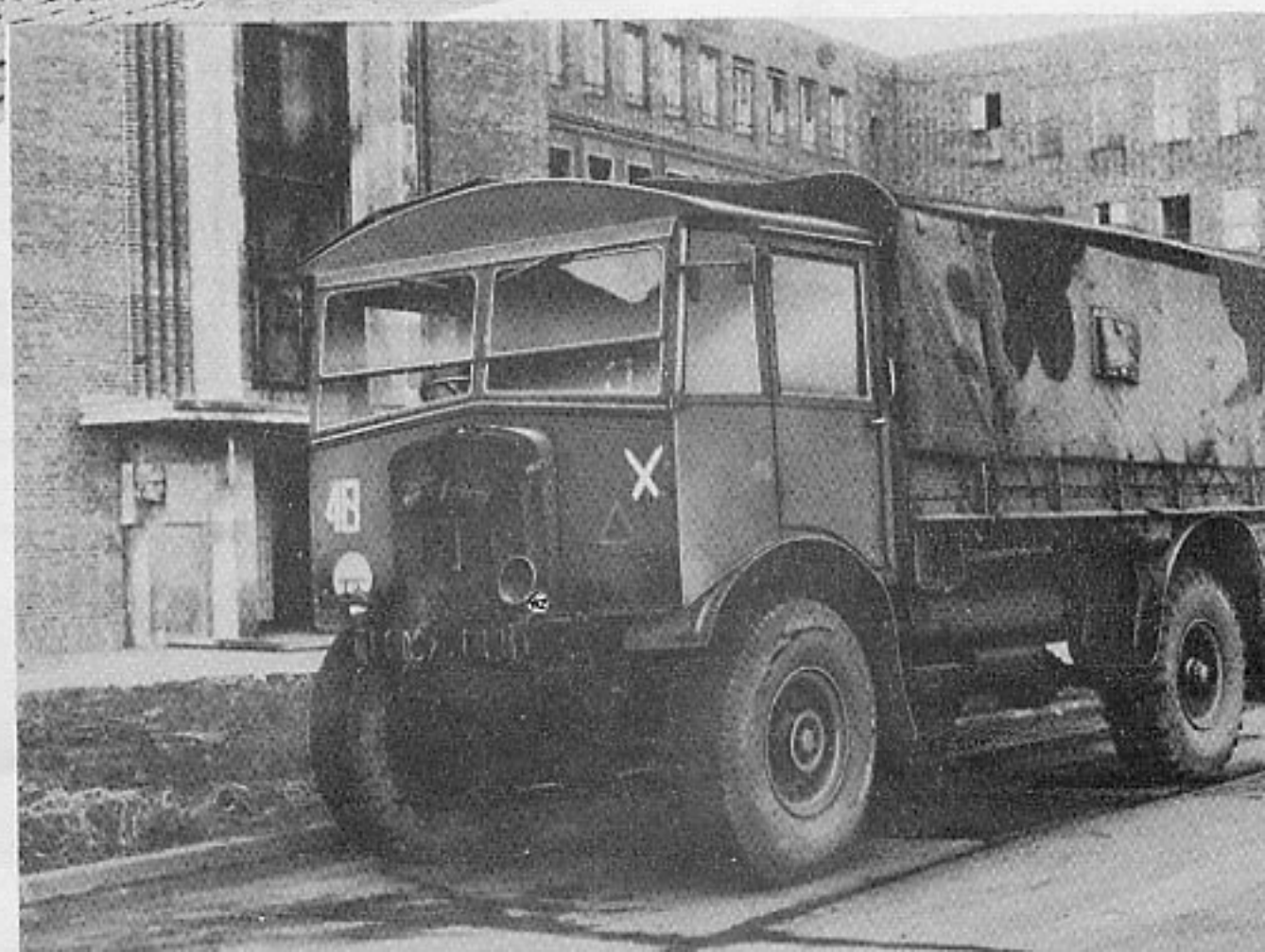
The ever faithful servant of the fighting man this "Matador" is hauling a 5.5 gun-howitzer towards a Western battle zone in France.

Photo courtesy "The Motor."

A "Matador" in the forefront of one of the many W.D. vehicle parks which abounded in this country during hostilities.

A.E.C. "Matador" towing a French watch gun through Pacy-Sur-Eure en route for the river Seine, August, 1944.

A.T.S. girls are engaged on maintenance work on this A.E.C. "Matador."



With the British occupying forces in Germany. This "Matador" is standing against the Volkswagenwerke, Wolfsburg, the home of the much talked of "People's Car."

Negotiating a difficult road bend in Sicily, this "Matador" was among the first vehicles to land on the island during the advance on Italy.

A "Matador" handled by a trainee driver drawing a long line of army vehicles up a steep rise during a special course in the West Country.

Decorated by enthusiastic A.E.C. operatives, this "Matador" is the last of 9,620 built for the war and is shown coming off the assembly line at A.E.C.'s Southall factory when production was switched over to peace-time activities on November 25th, 1945.

The last convoy of "Matadors" to leave the A.E.C. factory for the R.A.O.C. chief depot at Chilwell, Nottingham.

HOW WARTIME PRODUCTION WAS PLANNED

Be it never so complicated, the process of fashioning raw material into finished components had its counterpart in the activities of the Production Control Department which has been responsible for the movement of every piece of raw material through the Works and the control of processing right up to the actual completion of the products, including wheeled vehicles, armoured cars, engines and components to be assembled in other factories.

Having performed these duties for many years in the course of normal manufacture, the Departmental organisation was readily adaptable to wartime requirements, though naturally the work of the staff became even more onerous under the then-prevailing conditions.

In order to cope with this important work under wartime conditions and with wartime staff, as a preliminary measure, the Department drew up schedules showing all the part numbers of every component required for the completed product, the number needed for any given contract, details of material to be used and material specification identification numbers.

These schedules enabled the Department to compile the necessary requisitions for the supply of raw and bought-out finished material needed for every contract and it became the responsibility of the Production Control Manager to see that deliveries from outside suppliers arrived in time. Many were the vicissitudes encountered by the staff during those difficult days of "short supply," and although the intricacies of the clerical organisation would provide a topic of absorbing interest, this must be passed by to deal with other phases of the work.

In the meantime, specially trained and selected planners and rate-fixers carried out their respective duties such as the preparation of production layouts showing the exact number and sequence of every operation required on individual components, the machines to be employed together with their jigs and fixtures, and the time allotted to each process.

All such essential information was summarized on a Master Process Layout in conjunction with a Machine Load Analysis, from which action was taken to ensure the availability of needful machine shop facilities. If, as happened more than once during the war period, the existing plant proved inadequate for the required output of Government contracts, additional machine tools were purchased and installed forthwith to deal with wartime loads on the plant in order to meet the requirements of the Works Manager who was responsible for seeing that suitable equipment was installed.

To give an idea of the complicated procedure in this connection it may be mentioned that one of the charts prepared by the Works Manager's Department represents the entire factory layout showing the size and position of every machine tool in the plant, cut out in cardboard and attached to the chart by pins. Sometimes the planning of wartime contracts necessitated a complete regrouping of certain machine tool sections, in which case the new arrangement was replotted on the chart for the guidance of the Plant and Equipment Department personnel who effected the change.

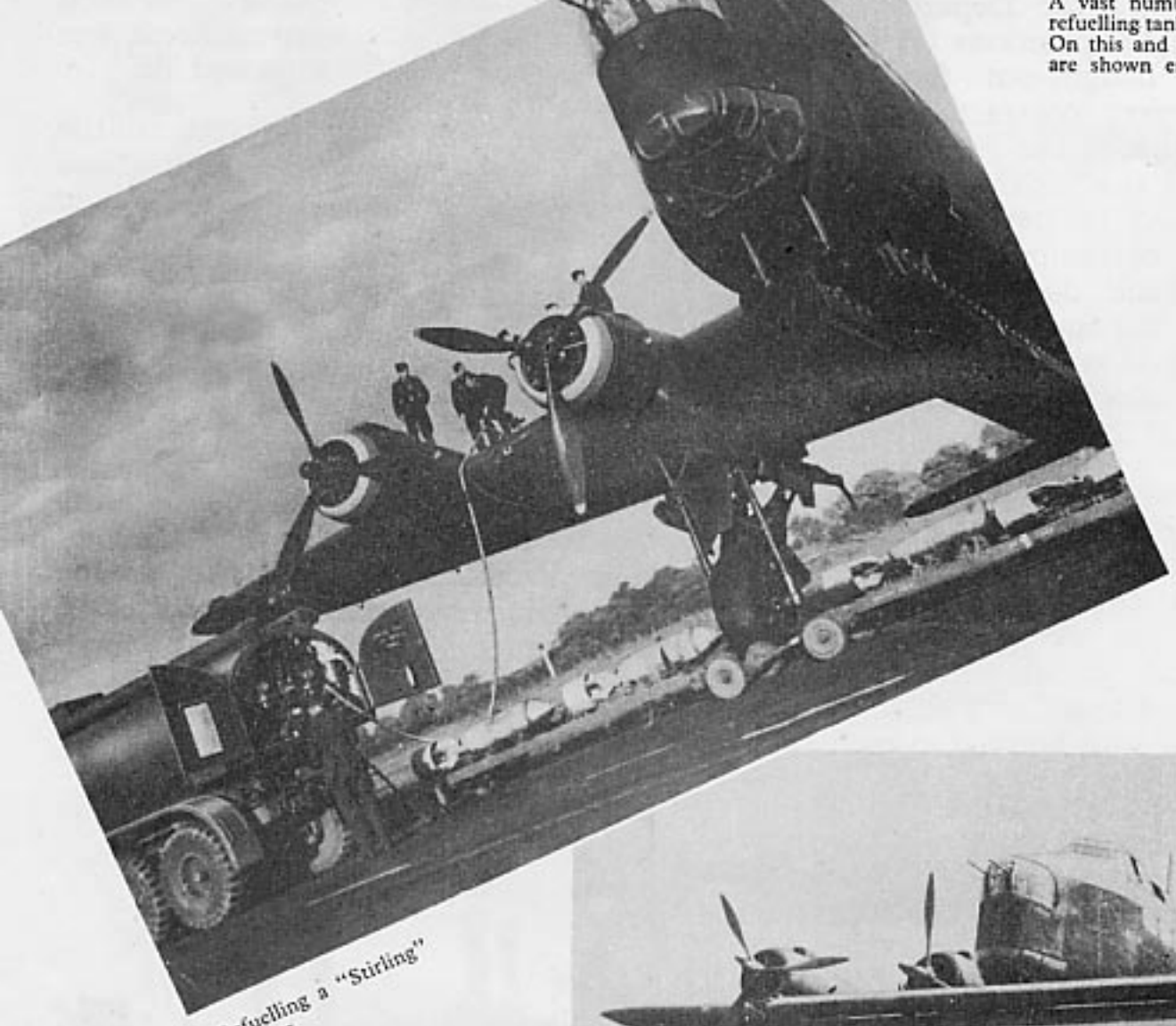
Another useful function of the Production Control organisation is the issue of progress records for the guidance of shop foremen and the progress men, the latter being required to exercise a dual control on manufacturing routine, firstly by keeping the work continually on the move and, secondly, by attending to the essential synchronising of production so that components taking several weeks to complete shall not lag behind those produced in a few minutes which might well accumulate in unwanted heaps.

These progress men were, of course, kept fully occupied during wartime production and saw that, under the supervision of their chief, every detail of the whole scheme was interpreted correctly by the rank and file.

One of the most outstanding features of the Production Control organisation as practised at Southall was its perfectly smooth working and, indeed, it might well be described as a Production Assistance Department, the word "control" being somewhat suggestive of resistance of which no signs were to be observed in the well ordered routine prevailing throughout the Factory.

This fact so greatly impressed representatives of the various Ministries who visited the Works as to result in the inauguration of lectures on Production Control, under the *ægis* of the Ministry of Labour as described in another chapter.

A vast number of A.E.C. 6-wheel driven 2,500 gallon refuelling tankers were delivered for service with the R.A.F. On this and the following pages, these capacious tankers are shown engaged on refuelling operations.



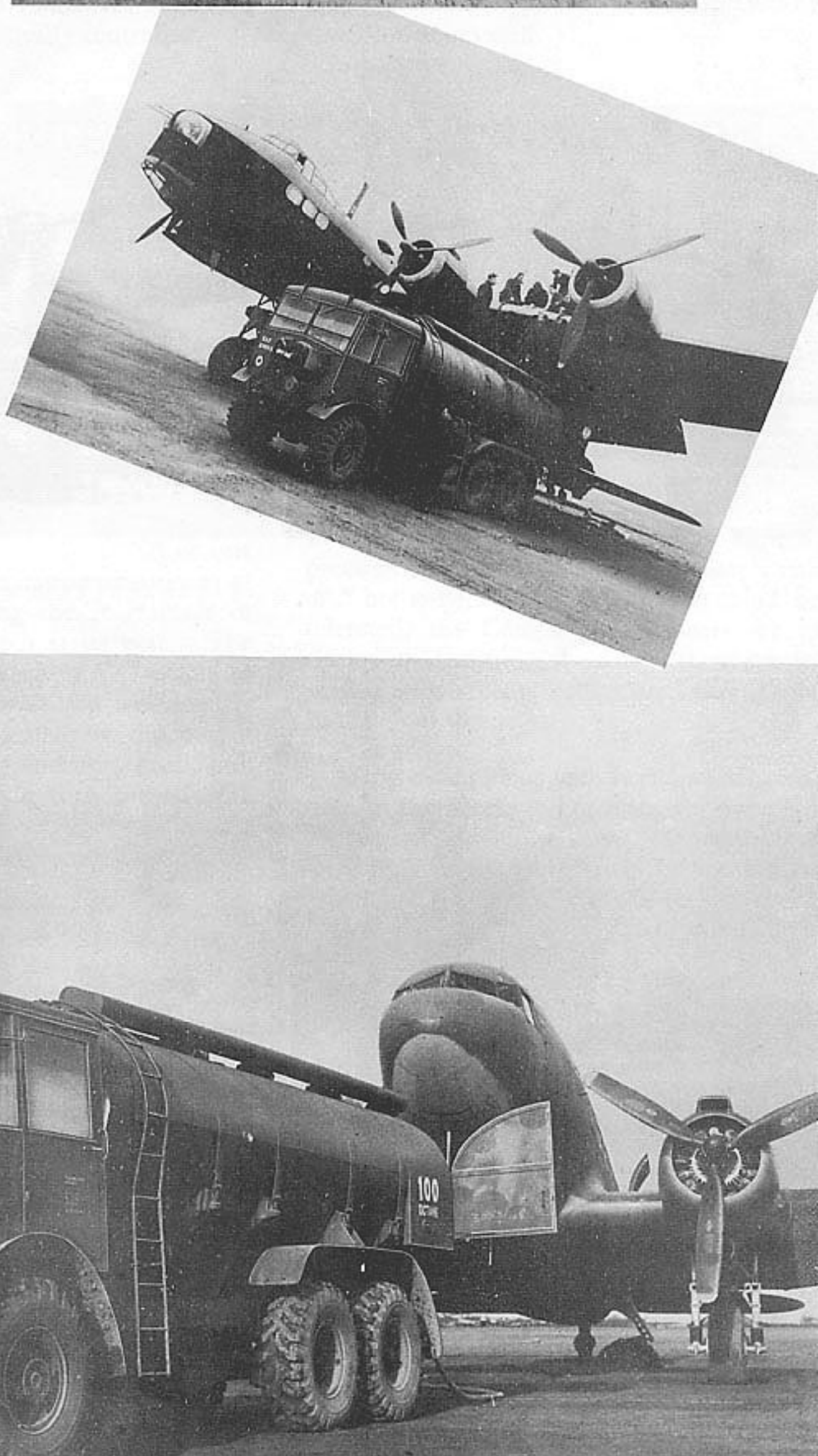
Refuelling a "Stirling" bomber.

An A.E.C. 2,500 gallon tanker taking up refuelling position on the runway.

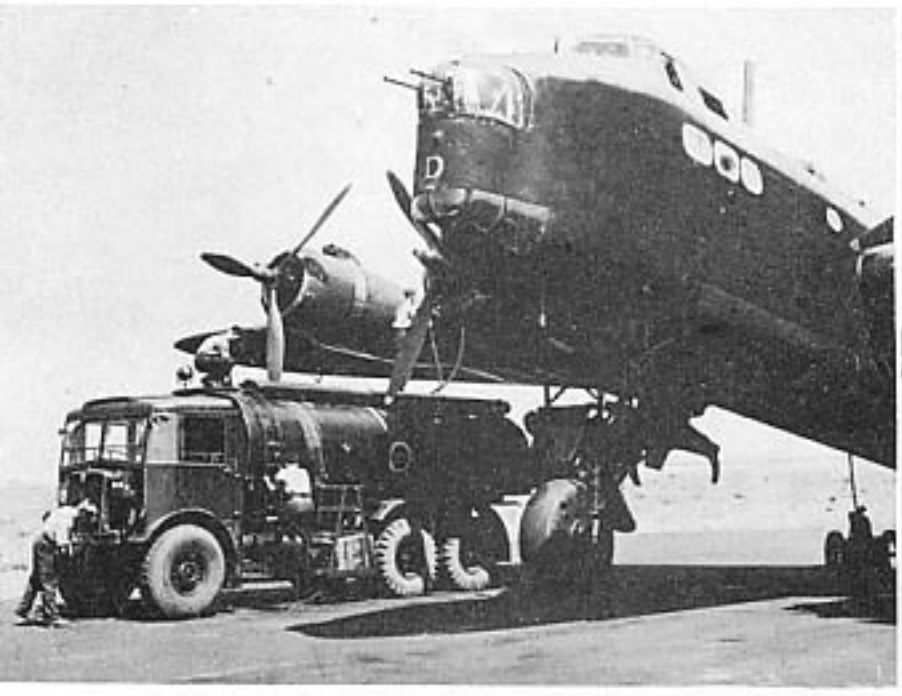
Preparing for the next sortie over enemy territory.

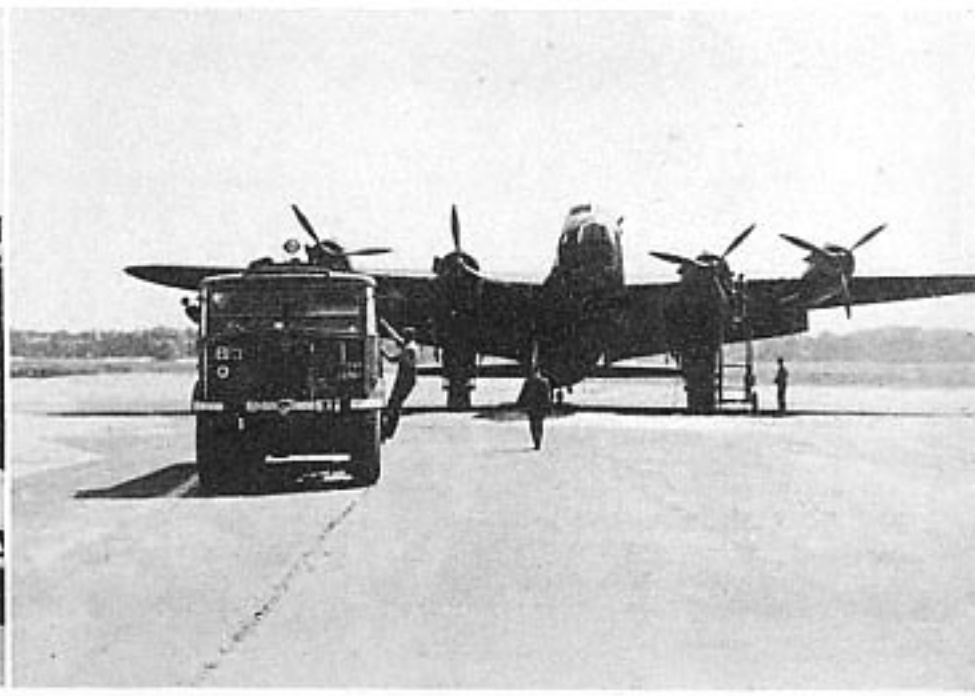
Top. Refuelling a "Lancaster" from an A.E.C. refuelling tanker.

Centre. Refuelling a "Stirling."



Bottom. A "Dakota" of R.A.F. Transport Command being refuelled from an A.E.C. tanker on Lagens airfield, Azores, in readiness for its return flight to Britain.





A page of general views showing refuelling operations to R.A.F. bombers. At one station visited the number of "kites" thus served has often been as high as 57 in twenty-four hours.

A FACTORY WITHIN A FACTORY

Such a description may well be applied to the Tool Room at Southall, equipped with a comprehensive range of precision machine tools for the manufacture of jigs and fixtures designed to hold the various components in position while undergoing their machining processes. Some of the Tool Room equipment is designed to work to such incredibly close tolerances that the slightest variations in shop temperature would effect their accuracy and, in consequence, such machines are installed in special enclosures kept at a uniform heat thermostatically controlled.

The Tool Room personnel is responsible for maintaining the accuracy of all cutters used on the production line machines, and checking all gauges used by operatives and inspectors.

It is no exaggeration to state that the high degree of interchangeability of A.E.C. parts which served such good purpose during the War was attributable in no small degree to the technical skill and craftsmanship displayed by the Tool Room staff.

THE SECRET OF "FLOW" PRODUCTION

When the first wartime contracts were placed with the Company the stipulated delivery dates might well have produced alarm among the executives, but for the existence of a normal system of genuine " flow " production in the Works. The extra demands upon increased productive capacity actually involved little more than a general speeding-up of the whole organisation and, to a man, staff and employees alike responded to the call.

By taking the famous " Matador " chassis as an outstanding example, there is no great difficulty in discovering the real secret of " flow " production, seen at its best. The " Matador " chassis assembly line could be likened to a main waterway, fed continuously by small rivers represented by the output from the component machining and unit assembly lines, which in turn carried with them the smaller flows of partly fabricated components and unit sub-assemblies.

The same principle applied throughout the Factory and characterised the movement of all work in progress, irrespective of its class or description. The only exception consisted of research and experimental work, conducted quite independently of production rules and assessed by results only.

All major components were machined from the rough in their own special lines, the grouping of the machines to achieve this end having been planned by the Production Control Department to ensure a smooth and uninterrupted flow of work from one end of each line to the other. Here mention must be made of the drastic action adopted in the case of any machine that failed to keep pace with its fellows. Down came the Plant and Maintenance men to uproot the offender and install a new one that would do the job according to plan. When the A.E.C. " flow " production scheme was first inaugurated, the management spared no trouble or expense to acquire the most modern works equipment to ensure its success. In some instances, however, machine tool manufacturers or importers were unable to supply exactly what was required with respect to operating speed, precision or capacity. Since no possible risk of " bottle-necks " in production could be tolerated, the Company's engineers set to work with designs of their own, these special machine tools being constructed throughout in the Tool Room.

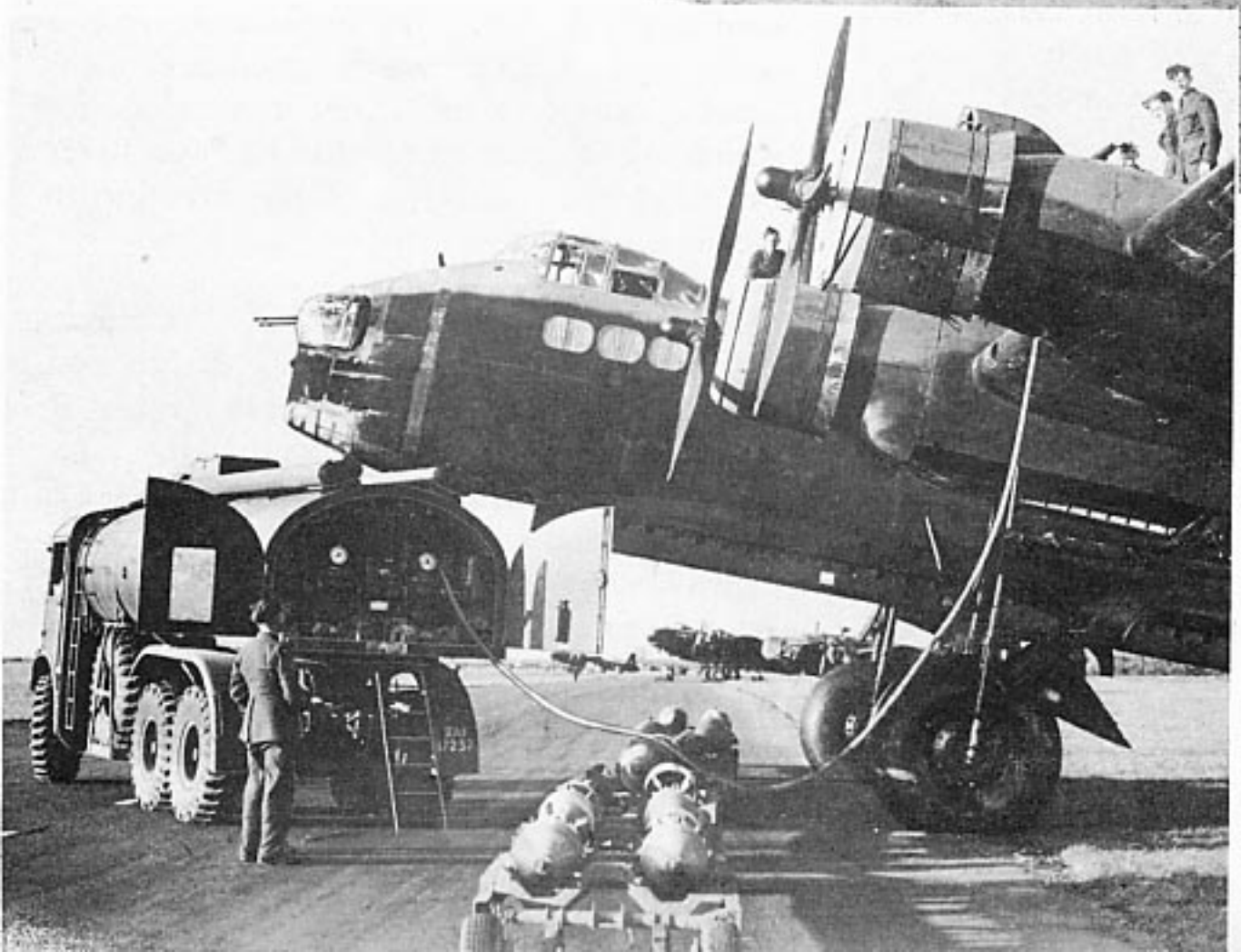
Many examples of such machines are to be seen in the Works. For instance, there is a battery of A.E.C. engine crankcase main bearing borers, with electric button control which are duplicated so that the operatives can work on either side of the machine to facilitate production.

Prominent in the crankshaft machining line is another tool of A.E.C. design and manufacture. A veritable giant in its class, it stands 16 ft. high and weighs 16 tons. Its function is to drill and ream the holes through the main and crank-throw journals, and is controlled by light rays from 12 volt lamps. It is protected by British and foreign patents. Incidentally, it may be mentioned that the production of a finished A.E.C. crankshaft from the rough forging involves no fewer than 35 operations.

[*Continued on page 25*

R.A.F. maintenance staff and technicians with the aid of the A.E.C. refuelling tanker prepares this giant aircraft for its next bombing raid.

An R.A.F. "Mosquito" bomber squadron prepares for another thrust at the enemy.

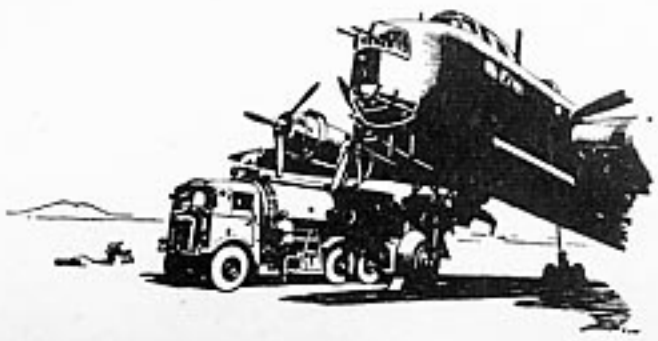


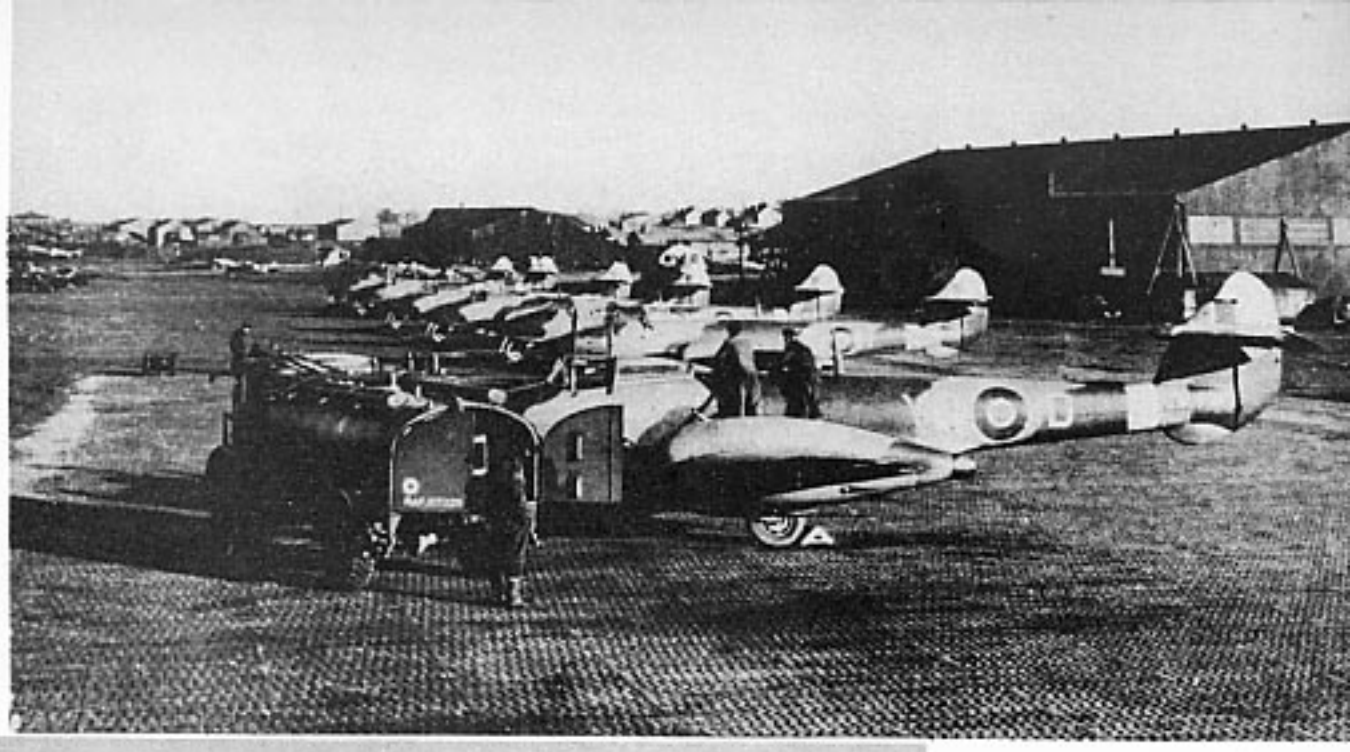
Part of a "Stirling" bomber squadron. At the same time as bombing-up takes place A.E.C. refuelling tankers fill the "Stirling's" tanks.

Refuelling a "Lancaster" bomber at the rate of 40 gallons a minute.

"S" for Sugar completes its 100th operation. Picture shows "S" for Sugar filling up before one of her trips.

Refuelling "N" for Nuts in preparation for a night bombing attack.





A squadron of "Meteor" jet planes with an R.A.F. refuelling tanker in the foreground.

Not only a fuel tanker but a towing vehicle as well. This A.E.C. R.A.F. tanker accomplishes with ease the secondary task of towing "Sunderlands" ashore at a Scottish coast station.

An interesting picture obtained in the Azores from where aircraft operated on U-Boat hunting work. Picture shows petrol cans captured from the Germans and used by the R.A.F. with an A.E.C. refuelling tanker in the background.

Another noteworthy tool produced in the Works is the twelve-spindle horizontal borer, capable of dealing with two sets of six-cylinder blocks simultaneously by leaving only the smallest possible amounts for final smoothing by a honing operation.

Large castings, such as engine crankcases, are faced on an enormous milling machine with a table 24 ft. in length in order to accommodate one batch of castings for machining, while a second batch can be fixed into position. The normally slow movement of the milling cutters up to their work has been accelerated by the provision of a moving cutter head which travels quickly up to the casting, slows down while the tool is in action, then moves away at a rapid rate directly the cut is completed. Compressed air controls the electrically-driven head and numerous other mechanical refinements provide for increased output of high quality.

Considerations of space and for the non-technical reader must bring this brief reference to A.E.C. wartime machining processes to an end. Before leaving the main shops, however, there is something to be said on the all important subject of inspection which is entitled to a section of its own in this chapter.

A.E.C. INSPECTION SYSTEM

Increased pressure on the Company's production capacity during the war period was not allowed to interfere in the slightest degree with the rigid inspection routine that normally prevails. In fact, if the inspection could have been more exacting than usual, wartime manufacturing conditions would have made it so.

A.E.C. inspection begins in the Drawing Office whence the working drawings, marked with details of all working tolerances and gauges to be used for the guidance of operatives and inspectors, are issued.

The gauges, identified by initials and numbers agreeing with those on the working drawings, are held ready for issue in the main Tool Store, where by means of a special card index system every gauge can be located at a moment's notice.

With the object of eliminating unnecessary internal transportation and avoiding congestion of factory gangways, A.E.C. inspection is conducted on decentralised lines. The system starts at the Goods Inwards Department, where all rough castings, forgings and stampings are measured to see that adequate metal is allowed for subsequent machining and that these items will also fit into the machine tool jigs and fixtures.

Another very important phase of the work is to check all dimensions of the first component produced from a newly "set-up" machine tool. When this has been done and the operative is provided with the necessary gauges there is little chance of human error creeping in.

In addition to the main View Room, as a further measure in the ensuring of accuracy, there are inspectors' tables at the ends of the machine lines, where the work of each line is checked before passing on to the next series of operations.

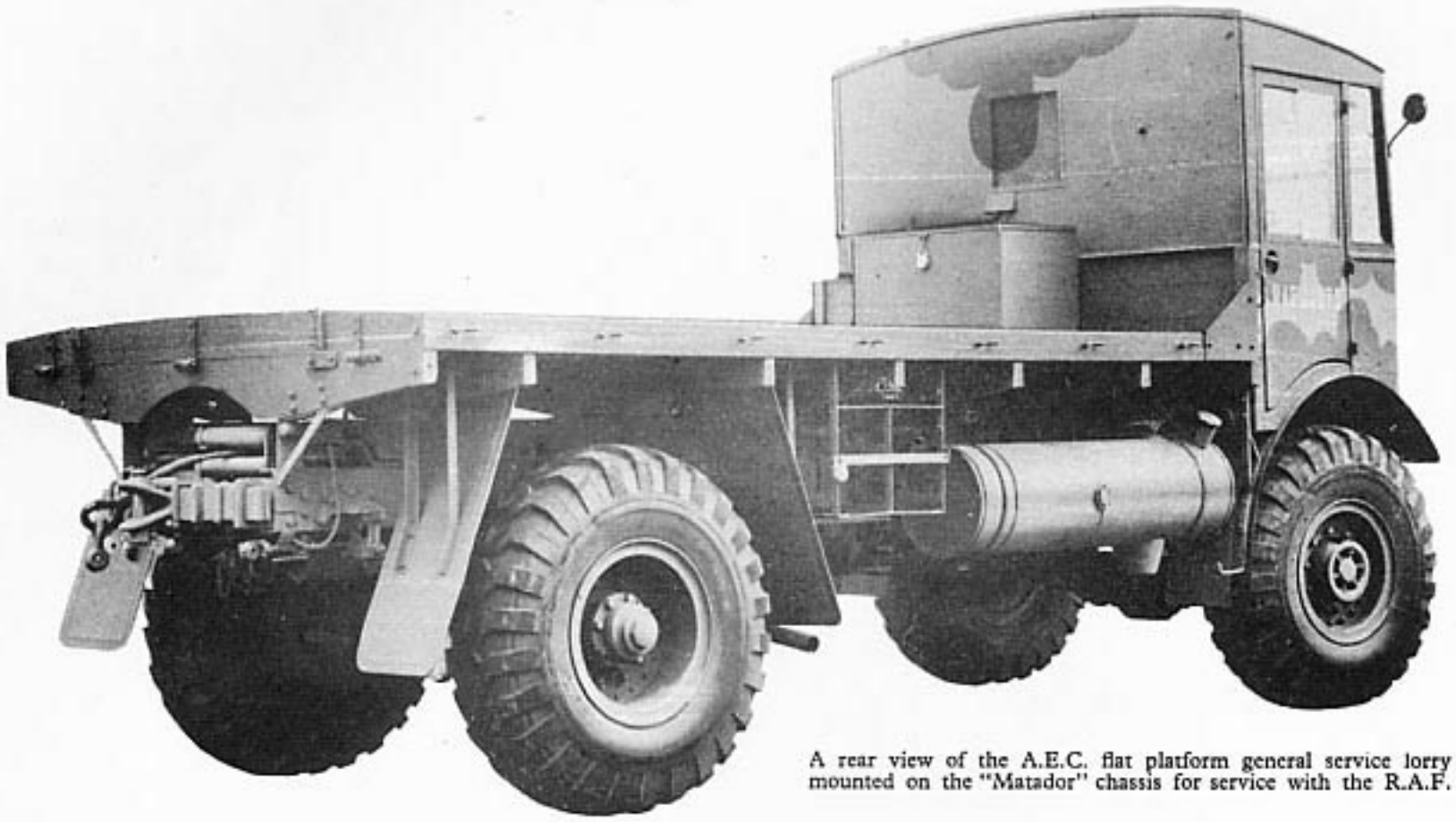
The fact that specially designed jigs facilitated war production in no way lessened the duties of the inspectors who, having served as practical machinists themselves, are familiar with every circumstance likely to detract from the highest possible standards of workmanship.

Thus through the whole production organization from the delivery of raw material until the finished vehicles were ready for despatch to the Forces, the Company's inspectors worked with a degree of efficiency that left little for their opposite numbers from the various Ministries to criticise.

A special type of signals vehicle mounted on the well known F.W.D. "Matador" chassis and supplied for duty with the R.A.F.

A general view of a mobile Radar unit station equipped with A.E.C. "Matador" vehicles.

One of a large number of A.E.C. "Matador" flat platform lorries supplied for service with the R.A.F.

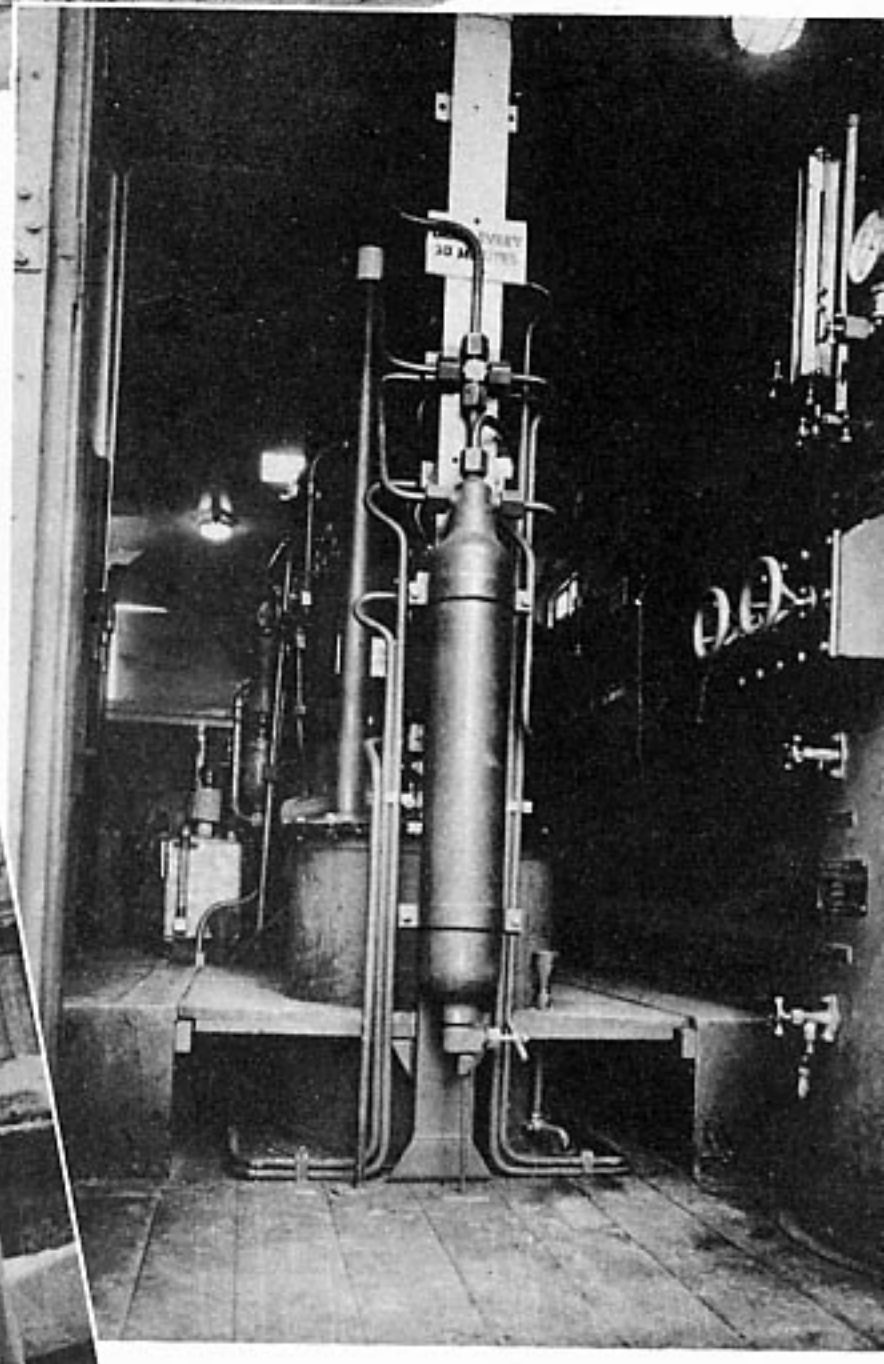


A rear view of the A.E.C. flat platform general service lorry mounted on the "Matador" chassis for service with the R.A.F.

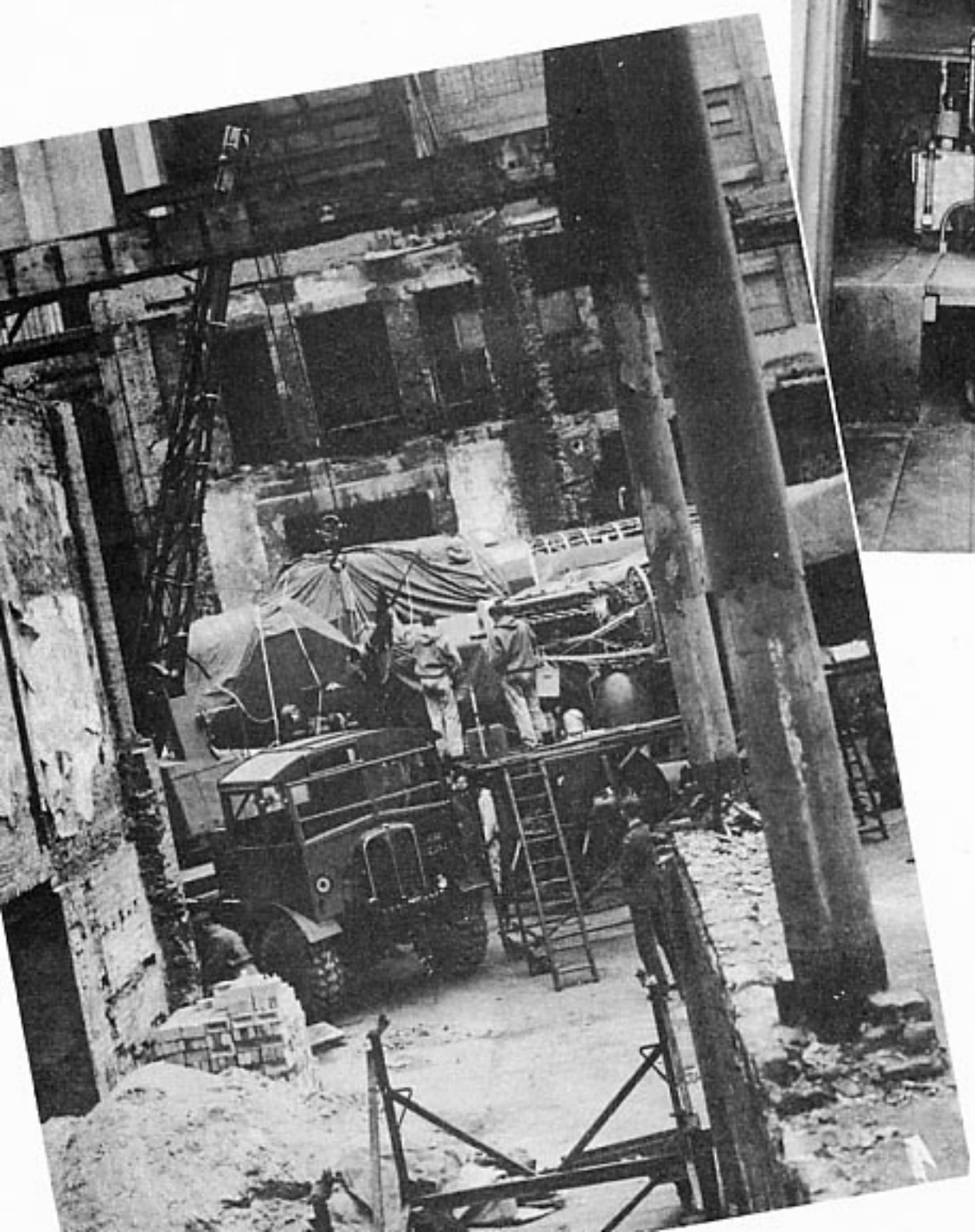
One of the large number of 6-wheel drive A.E.C.'s fitted with 10 ton Coles cranes for aircraft recovery and other salvaging operations.

An A.E.C. "Matador" float lorry conveying an air compressor and towing a 10 ton roller, equipment used on Airfield Construction Service.

R.A.F. mobile oxygen equipment mounted on the A.E.C. 6-wheel drive chassis.



Interior view R.A.F. mobile oxygen equipment.



An A.E.C. 4-wheel drive R.A.F. float lorry hauling a Lancaster bomber into position at the bombed Lewis Store site Oxford Street, London, W.

CHASSIS ASSEMBLY

In the case of machined components, wartime assembly of A.E.C. chassis followed the normal peacetime routine in respect of "flow" production; but, to the non-technical observer, it is more obvious in the erecting shops by reason of the easily discernible layout of the benches and conveyor lines.

In the engine assembly section, for example, the benches are arranged at right angles to the engine assembly conveyor, feeding it with components and sub-assemblies to synchronise with the movement of the engines as they proceed along the conveyor.

The main bearings of the engine crankcases are bored out in position by tungsten-carbide tools mounted in high-speed boring machines. The resulting accuracy of finish dispenses with all need of final fitting by hand which is conspicuous by its absence throughout each succeeding group of engine or other unit assembly operations.

During the war, a curtailment of normal road tests for the completed chassis called for a correspondingly increased amount of attention to engine bench tests, to ensure that in addition to satisfying high standards of performance, the units should be thoroughly well "run-in" and ready for immediate strenuous service with the Forces.

The pre-war equipment of the engine test house, including 13 electrical dynamometers, was employed to good effect during the period under review. These are capable of testing engines up to 250 b.h.p. and at speeds up to 4,000 r.p.m. For larger power units, such as those employed for marine purposes, the Mulberry and the like, great use was made of the big Heenan & Froude water brake testing installation which can deal with engines developing up to 700 brake horsepower.

All the testing dynamometers are equipped with the necessary apparatus for recording engine performance under every conceivable condition, which information is preserved on charts for future reference.

Engines were first "motored" on the test stands for 1½ hours before being started under their own power. The loads were then increased progressively, until full load and maximum speed was reached. The time usually allotted to each engine test was a further 6½ hours, after which each unit was partially dismantled for examination of the principal working parts.

An immense variety of work was handled in the tinsmithy and included the fabrication of drivers' cabs, fuel tanks, bonnets, piping, radiators and sheet-metal components of all descriptions. Perhaps the most interesting phase of tinsmithy work is the building of radiators, conducted on the progressive assembly system and concluding with tests to ensure that no leakages shall occur in service.

Then finally at the far end of the chassis line, the famous "Matador" chassis and other A.E.C. war vehicles left the building to undergo short but nevertheless exacting tests on the trial track surrounding the works for a quick check on general performance and freedom from minor defects which, thanks to the infinite care exercised by the workers at every stage of manufacture, were rarely found to exist. So much for a very cursory review of the outstanding characteristics of the Company's wartime production routine, which brings us to a point where a little should be said of the people who brought this gigantic task to its successful fulfilment.

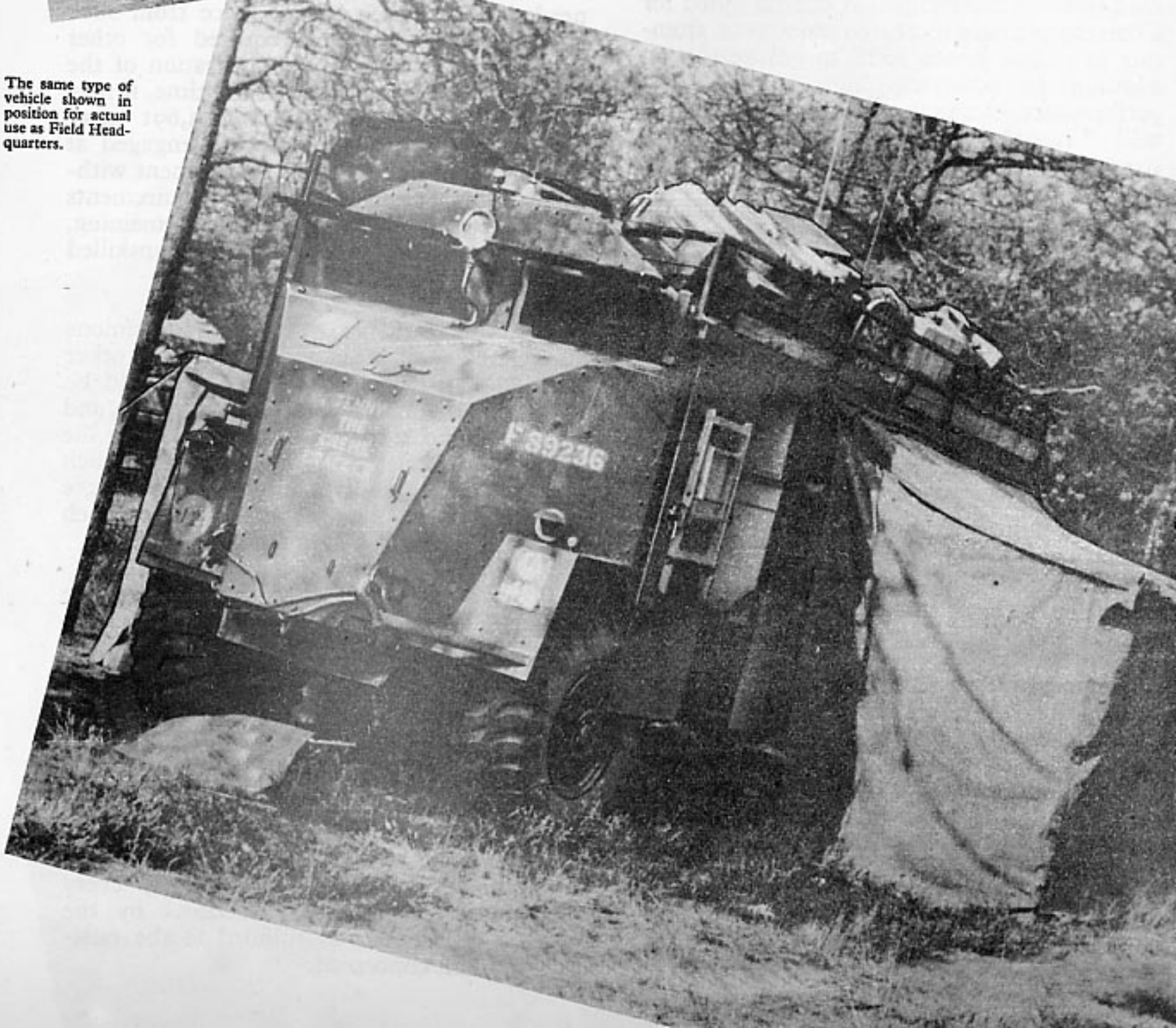
To meet its commitments, the Company needed to recruit a labour force from such man-power as was not required for other national duties and, as an illustration of the labour situation prevailing at the time, it may be stated that during the war 3,691 men, 933 women and 385 boys were engaged at Southall. But against this recruitment withdrawals for Service and other requirements totalled 4,146. Of the balance remaining, the predominant proportion was unskilled labour.

Under agreements with the trade unions suitable personnel, made available from other industries, was trained. Here it should be noted that the policy of the Company was, and is, to train unskilled workers directly on the actual machines or assembly benches on which they would be individually called to serve later. The result was that many of such trainees became highly qualified.

Pre-war employees of known ability were selected for up-grading to undertake the additional setting-up of production machines as well as for the most exacting of inspection duties.

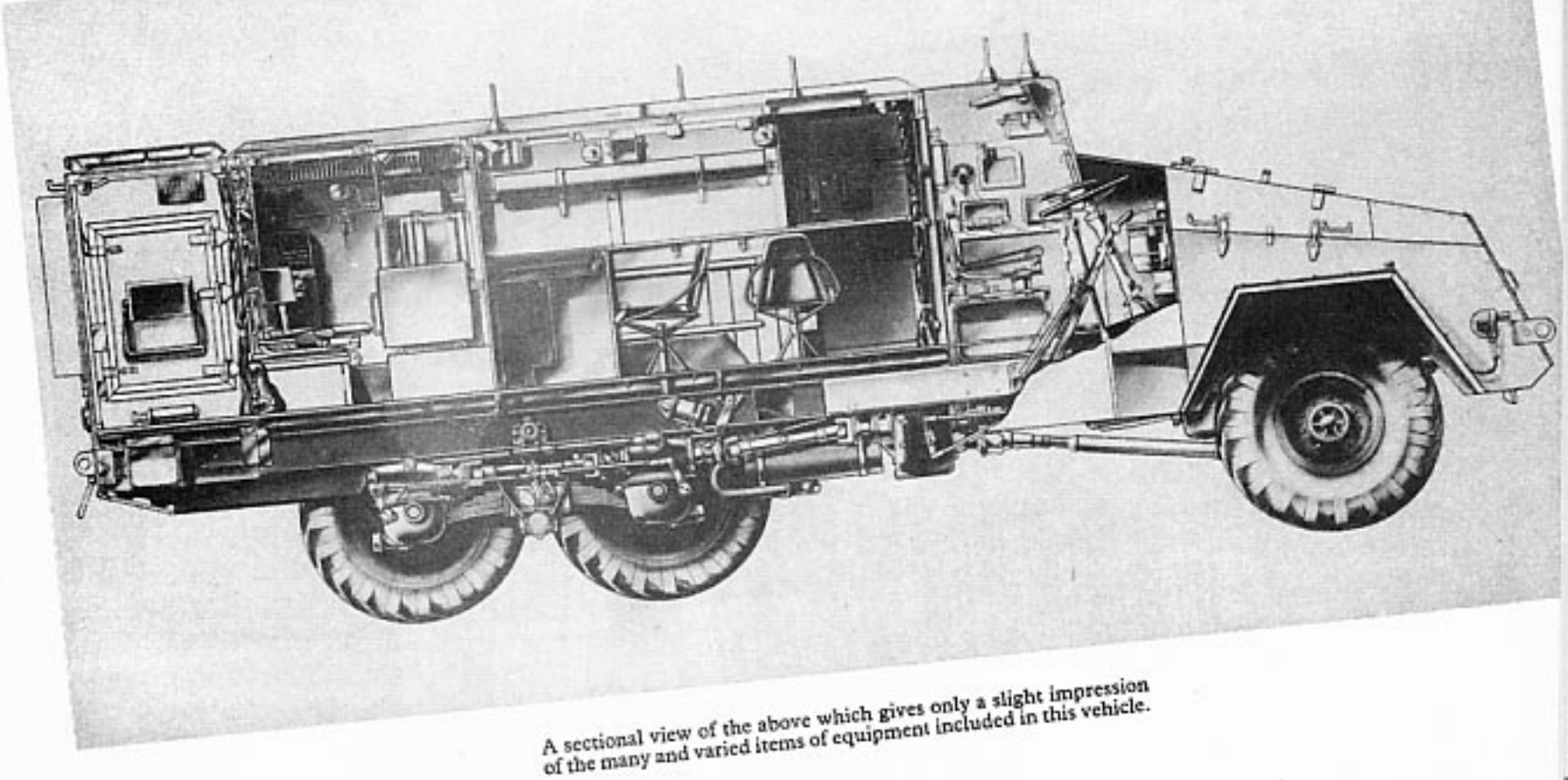
In spite of the acuteness of the problem and the great scarcity of skilled labour, A.E.C. production at no time fell below the required volume and it is with a sense of pride that the Company can claim that throughout the entire war period, every demand made upon its resources by the various Ministries was fulfilled to the satisfaction of all concerned.

A special type of mobile armoured command field control vehicle mounted on the A.E.C. "Matador" 4-wheel drive chassis.



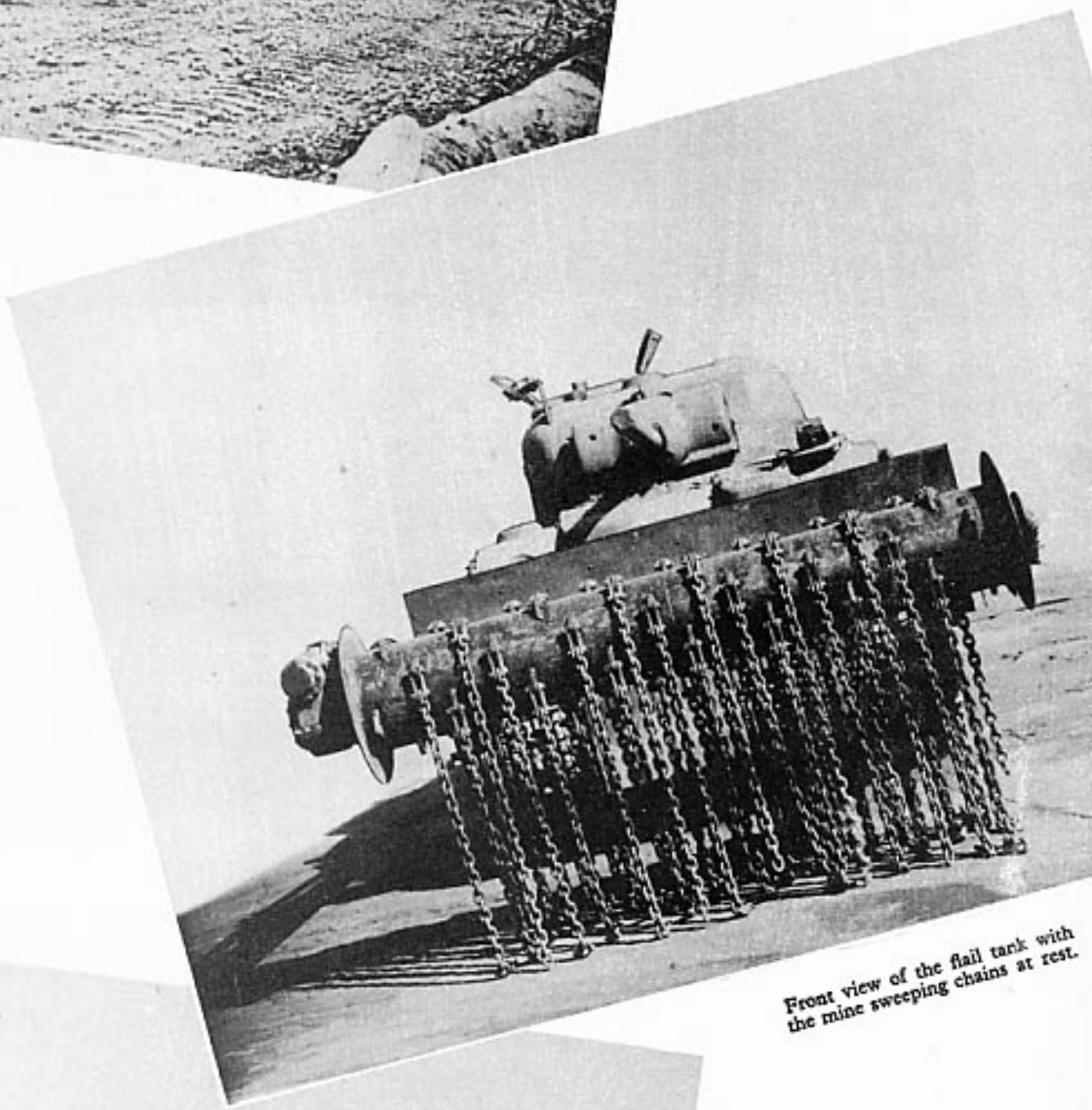
The same type of vehicle shown in position for actual use as Field Headquarters.

An A.E.C. 6-wheel drive armoured command vehicle of which 151 were built for service overseas.

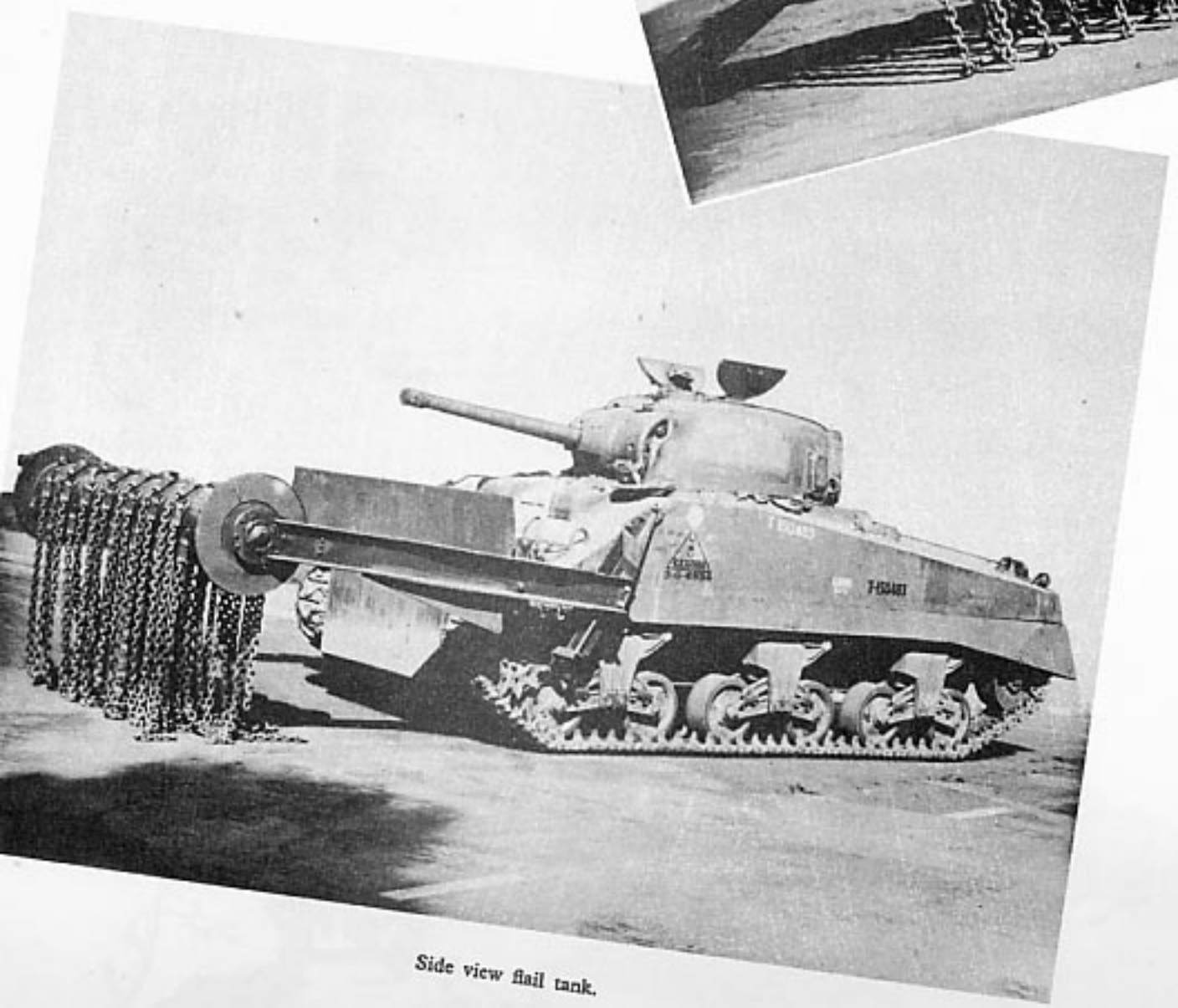


A sectional view of the above which gives only a slight impression of the many and varied items of equipment included in this vehicle.

The flail mine sweeping tank in various forms was developed by A.E.C. engineers working in conjunction with the inventor. Afterwards, the flail was produced in quantities in other factories. Picture shows a flail tank making its way towards the river Orne after the capture of Caen.



Front view of the flail tank with the mine sweeping chains at rest.



Side view flail tank.

SERVICE MUST GO ON

Never in the history of the Company has its Service organization been called upon to deal with so great a volume of work as during the five-and-a-half years of the war. From September 3rd, 1939, to April 30th, 1945, no fewer than 40,674 jobs were undertaken at Southall, over 3,000 at the Bradford Depot and more than 2,300 at the Nottingham Depot.

The magnitude of this work will be appreciated when it is explained that a single order might refer to a power unit or a complete chassis overhaul; or alternatively, might in the case of other units such as gear boxes, rear axles or various sub-units, cover, say, six gear boxes or some 300 connecting rods. Actually, the figure of 40,674 involved the complete overhaul of 4,250 power units.

No mean achievement in the best of times, it will be agreed, but in point of fact this impressive volume of work was completed under the most difficult wartime conditions, as the following notes will indicate.

On the night of September 24th, 1940, the Southall Service Department was struck by a bomb which put a large part of the building completely out of action for six months. Happily, workers on the night shift had taken cover in nearby shelters and not a single man was injured. Damage to the building, however, was extensive the explosion having wrecked the roof, blown out windows and doors, uprooted machine tools and rendered many vehicles unrepairable.

At the time over 700 separate jobs were in hand, but luckily all correspondence and documents relating thereto escaped destruction so that every order could be completed, apart from the vehicles that had to be written off as having disappeared " without trace."

A great amount of additional work was caused by some of the curious effects of blast. For example, examination of several gear boxes, undamaged externally, revealed that many of the gear teeth had disappeared. In another instance, a rear axle was opened up in search of glass when it was found that four of the bevel pinions were split in half. As the result of these and similar strange happenings, every unit and sub-unit became suspect and had to be examined or stripped before it could be released for service.

In addition to dealing with unpredictable defects, the service work went on under supremely difficult conditions; vehicles were overhauled in odd corners of the main factory while units were dismantled and reconditioned wherever cover could be found.

For many weeks the service mechanics worked at their machines and benches exposed to every wind that blew, with only a tarpaulin overhead to protect them from the rain. During the severe winter of 1940, nothing better than temporarily installed braziers could be used for internal heating and all work had to finish immediately at the hour of blackout.

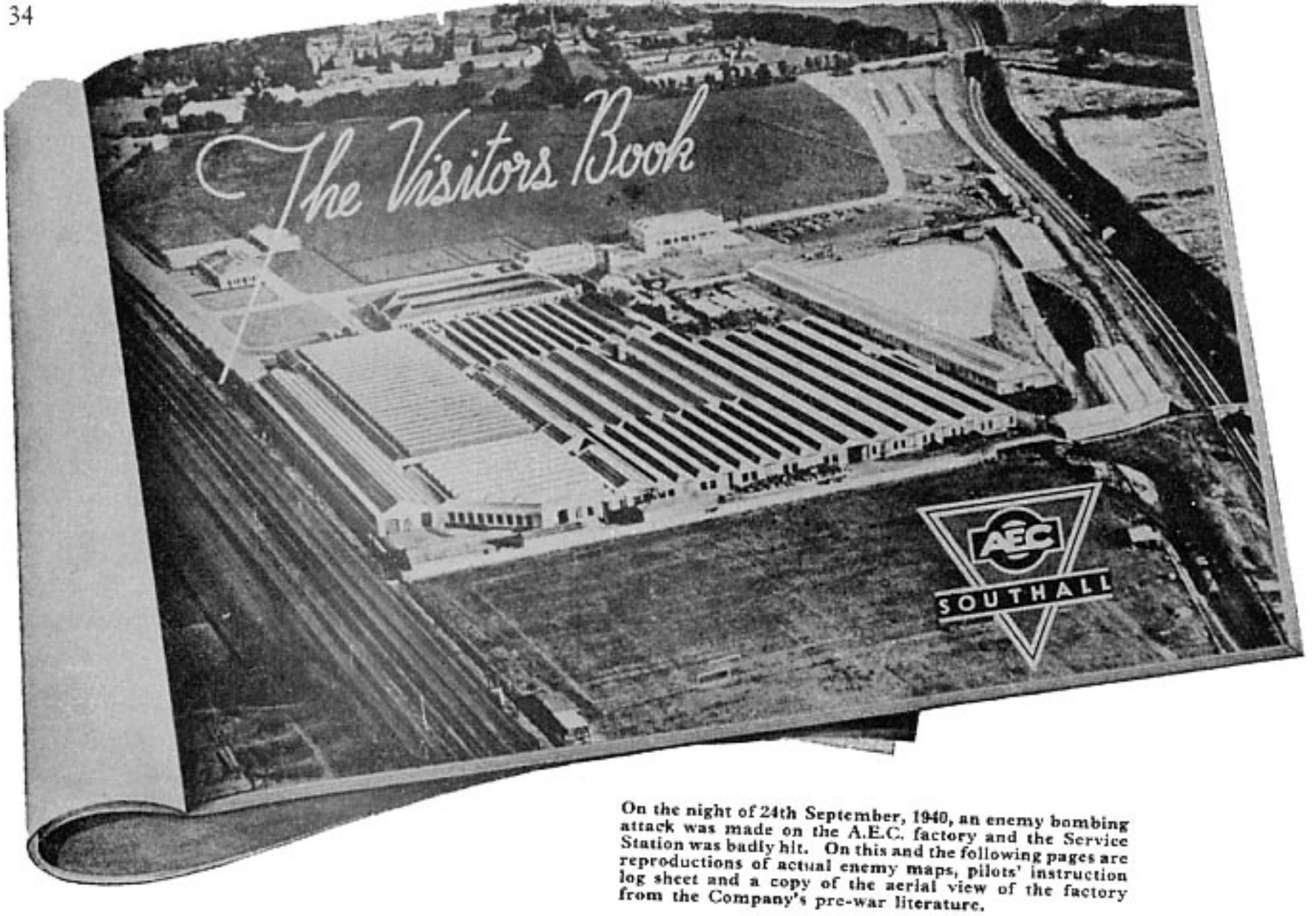
Added to this were repeated air-raid warnings, sometimes as many as eight in twenty-four hours, yet notwithstanding all these hard conditions, the service went on and as the result of steadfast efforts, willingness and co-operation of the depot personnel —men and women alike—A.E.C. traditions of service were maintained at the highest possible level.

On the administrative side, labour difficulties were a source of constant anxiety, and although unceasing applications were made for additional operatives, these were largely unsuccessful, the number of hourly-paid service station employees remaining for five-and-a-half years at the pre-war level. Actually, there was an appreciable loss of skill and experience because the male employees included a large proportion of dilutees and, of necessity, a high percentage of women and youths had to be brought in to replace those who either volunteered for the Services or who were called up; the latter amounted to 36 per cent. of the total staff. The wartime staff was made up of 63.5 per cent. men; women 22.5 per cent. and youths 14 per cent.

Applications by the Army and Royal Air Force for A.E.C. key men to give instruction to their repair personnel made considerable inroads upon the Service Department staff, first at Southall and later at the branch depots by, in the former case, taking away those who were not needed for the training of unskilled women and dilutee labour directed to the Southall Service Department.

This instruction for the Services was both theoretical and practical; the first being based upon the use of large wall charts and graphs, the second comprising the dismantling and rebuilding of A.E.C. units. The majority of the men so trained had little or no previous knowledge of the working or maintenance of oil engines and yet, as subsequent war service revealed, the time they spent at Southall stood them and their country in good stead.

[*Continued on page* 37

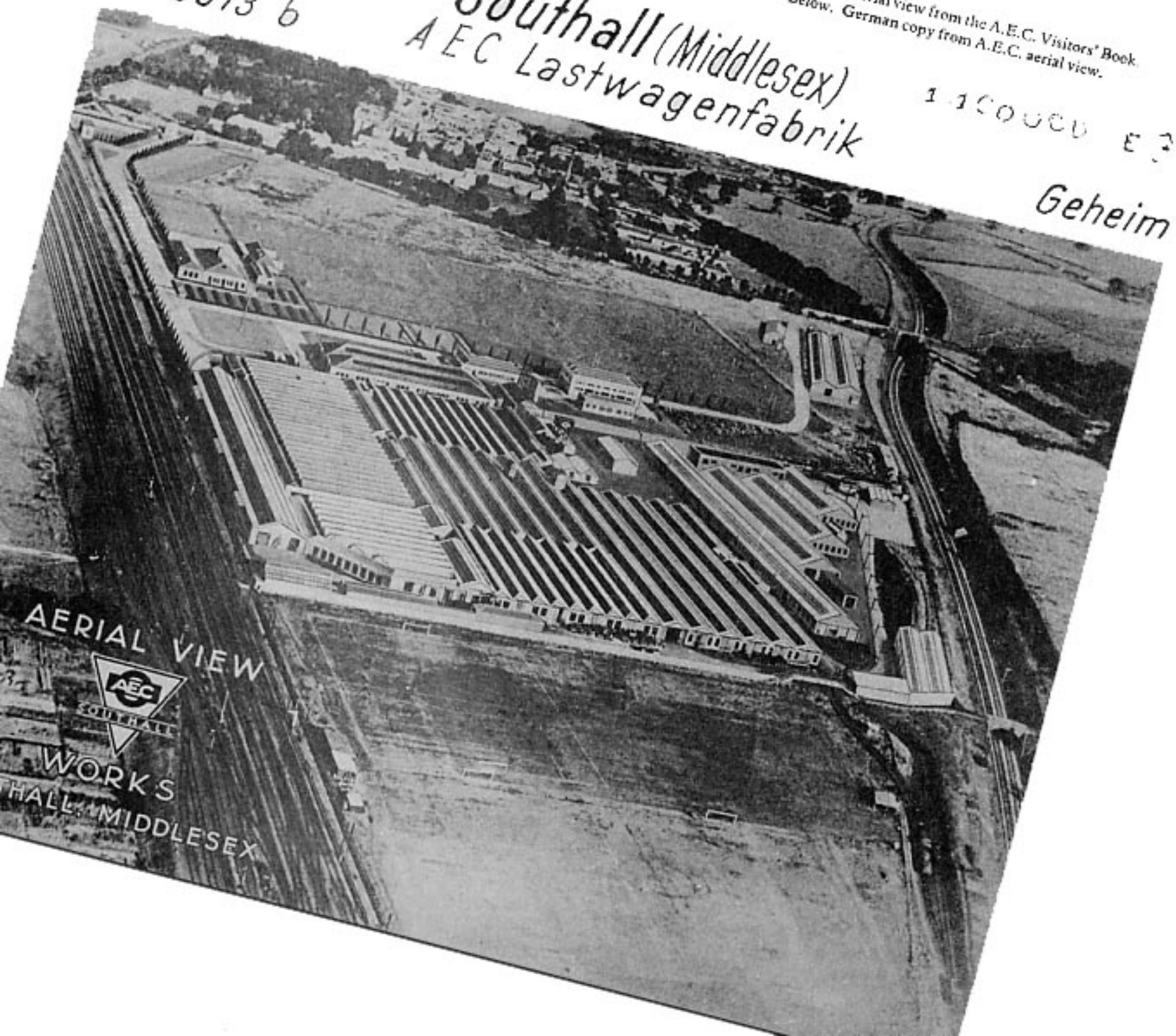


On the night of 24th September, 1940, an enemy bombing attack was made on the A.E.C. factory and the Service Station was badly hit. On this and the following pages are reproductions of actual enemy maps, pilots' instruction log sheet and a copy of the aerial view of the factory from the Company's pre-war literature.

Southall (Middlesex)
AEC Lastwagenfabrik

Geheim

Above. Aerial view from the A.E.C. Visitors' Book.
Below. German copy from A.E.C. aerial view.



Copies of maps with German inscriptions, showing that portion of the County of Middlesex where the A.E.C. factory is situated. A curious fact to record is that the originals from which these reproductions were made were handed to a member of the Company's own electrical dept. staff serving with the British army advancing through Belgium after the "D" day landing.

Geheim

Southall (Middlesex)

A.E.C. Lastwagenfabrik

GB.8013 c

Länge (westl. Greenw) 0°21' 40", Breite 51°30'22"
Missweisung: -10°52' (Mitte 1940)

1:63360 Bl. Nr. 114
1:100000 Bl. Nr. 34

SOUTHALL NORWOOD

SOUTHALL GREEN

Stand: Sept. 40

100 50 0 500 1000 m

Geheim

Zielstammkarte (L)

Land: Großbritannien (S)
England (Middlesex)

Ort: Southall (Middlesex) (Nähere Lage) 16,3 km in WNW von London-Stadtmitte.

Geogr. Werte: 0°21'40" W 51°30'22" N

Ziel-Nr. G.B.80 13

Kartenbl.-Nr. 114 England (1:63360)

E.B.Nr. 34 England (1:100000)

1. Bezeichnung des Zieles: AEC – Lastwagenfabrik.

Vgl. auch Ziel-Nr. G.B. 53 20, 53 22, 53 7, 53 8.

2. Bedeutung: Wehrwichtiges Werk für Militärfahrzeuge.

3. Beschreibung des Zieles: Höhe über NN: etwa 20 m.

a) Eisenbahnanschluß: Anschluß an Hauptbahn.

b) Bebauung insgesamt: etwa 6 ha. Überbaute Fläche:

c) Bauweise, Bauausführung, Luftangriffsempfindlichkeit, Brandgefahr:

Geschlossene Bauweise; flache Stahlkonstruktionshallen mit Sheddächern. Durchgehende Fließbandfabrikation, die im NW-Teil der Anlage beginnt und in deren SSW-Teil beendet wird. Am N-Rand erstreckt sich mit etwa 120 m Länge und 16 m Breite das sehr wichtige Materiallager. Am O-Rand liegt das Verwaltungsgebäude mit Nebengebäuden. Das Werk wird mit Fremd-Strom betrieben.

Einsturz- und Brandgefahr.

d) Erzeugnisse: Lastwagen, Panzerwagen, Tanks.

Flughindernisse: Die Kirchtürme und Schornsteine von London.

f) Belegschaft: ca. 3000 Mann.
Männer, Frauen, Gesellschaftsschicht, politische Einstellung, Unterbringung.

g) Lebenswichtige Teile, Wasser- und Kraftversorgung, Sabotage:
Die gesamte Anlage.

h) Rohstoffversorgung:

i) Lagerung:

k) Sonstiges: Nächste Flugplätze:

etwa 13,9 km in NO	Fliegerhorst Hendon mit Nachschublager	(G.B. 10 103)
etwa 11,5 km in W	Flugplatz Langley-Slough	(G.B. 10 121)
etwa 7,4 km in SSW	Flugplatz Feltham	(G.B. 10 79)
etwa 6,5 km in NW	Fliegerhorst Northolt	(G.B. 10 160)
etwa 6,5 km in SW	Flugplatz Heathrow	(G.B. 10 101)
etwa 2,6 km in SW	Fliegerhorst Heston	(G.B. 10 105)

4. Aktiver und passiver Luftschutz, örtl. Verteidigung:

Ziel liegt in sehr stark luftverteidigten Raum von London mit Jagd- und Flakabwehr, Scheinwerfern und Ballonsperren. Nächste schwere Flakstellungen
15,4 km in OSO in Regent Park
16 km in OSO in Clapham.

Mit örtlicher Flakabwehr ist zu rechnen.

5. Orientierungspunkte zur Zielerkennung:

Ostküste Englands mit Mündung der Themse etwa 50 km in O,
London-Stadtmitte 16,3 km in OSO,
2 große Wasserreservoire etwa 22,4 und 20,8 km in SW,
das N-Ufer der Themse etwa 5,2 km in SO.

Das Ziel wird im N von einer Hauptbahnlinie
im S von einer Nebenbahnlinie begrenzt, die
sich 800 m im W vereinen.

6. Bild- und Kartenunterlagen vom Ziel und vom Zielraum:

a) Vorhanden:
a: Kartenausschnitt
b: Bild
c: Lageplan

b) Aufgenommen vom Zielraum vorhanden:
Z K 1.b.

7. Zielunterlagen hat: Stand September 1940.

Pilots' bombing instructions.

TRANSLATION

SECRET

MAIN TARGET MAP (L)

Country: Great Britain (S) England (Mddx.)

Location: Southall (Mddx.)
(Exact position): 16.3 km. WNW from Central London.
Geographic location: 0°21'40" W. 51°30'22" N.

Target No. G.B. 80 13.

Map No. 114 England (1:63360).

E.B. No. 34 England (1:100000).

1. Name of Target: A.E.C. Commercial Vehicle Works. See also Target Nos. GB. 53 20, 53 22, 53 7, 53 8.

2. Degree of Importance: Important works building military vehicles essential to the war effort.

3. Description of Target: Height above datum line: about 20 m.

(a) Rail connection: Connection to main line.

(b) Total area: about 6 hectares.
Built-up area.

(c) Layout of buildings, type of building, vulnerability to air attack, fire risk.

Compactly built, flat steel frame buildings with shed-type roofs, continuous production line commencing in NW part of plant and terminating in SSW part.

Along the N boundary is a very important stores (? storage yard) about 120 m. long and 16 m. wide. On the E boundary are the offices with annexes. The current used in the works is obtained from an outside source.

Danger of collapse and fire.

(d) Products: Lorries, Armoured Cars, Tanks.

Obstacles to aircraft: The church spires and chimneys of London.

(f) No. of employees: about 3,000.
Men, women, social classes, political leanings, accommodation.

(g) Vital parts: Water and Power Supply, Sabotage: The entire plant.

(h) Supplies of raw materials.

(i) Storage accommodation.

(k) Miscellaneous: Nearest aerodromes:

About 13.9 km. to NE Hendon Aerodrome and Camp (G.B. 10 103) with possibility of reinforcements.
About 11.5 km. to W Langley-Slough Aerodrome (G.B. 10 121).
About 7.4 km. to SSW Feltham Aerodrome (G.B. 10 79).
About 6.5 km. to NW Northolt Aerodrome and Camp (G.B. 10 160).
About 6.5 km. to SW Heathrow Aerodrome (G.B. 10 101).
About 2.6 km. to SW Heston Aerodrome and Camp (G.B. 10 105).

4. Military and Civil Air Defence, Local Defence.

Target lies in a part of London very strongly defended against air attack with fighter aircraft and A.A. batteries, searchlight and balloon barrage.

Nearest heavy A.A. batteries:
Regents' Park 15.4 km. to ENE.
Clapham 16 km. to ESE.

Local A.A. batteries must be expected.

5. Target Identification Points:

East coast of England and Thames Estuary about 50 km. to E. Central London 16.3 km. to ESE.

Two large water reservoirs about 22.4 and 20.8 km. to SW.

North bank of Thames about 5.2 km. to SE.

The target lies to the North of a main railway line.

The target is bounded on the South by a branch line which joins the main line 800 m. to the West.

6. Photographs and Maps of Target and Target Area:

(a) Attached:
(a) Section of map.
(b) Photograph.
(c) Location plan.

(b) Also available covering Target Area Z. K. 1. b.

7. Details of Target available at: Position in September, 1940.

Throughout the whole of the war period it was imperative in the national interest to conserve material, and in order to keep the A.E.C. vehicles on the road frequent resort had to be made to welding, the building-up of worn components by various means, and to general improvisation. These improvisations were often uneconomical but justifiable, nevertheless, as the only possible way of keeping the wheels turning.

Special emphasis must be accorded to the work of the Spares Section—an integral part of Service—carried on, as so often happens, unobtrusively but with unfailing efficiency under numerous handicaps. Not the least of these was the recurring problem of procuring adequate packing material such as second-hand timber for the construction of essential packing cases, and paper shavings to replace the wood wool of pre-war days.

Transport, the conveyance of urgent spares to the London railway termini through blitz and blackout, the frequent inability of the railway companies to accept the traffic offered to them and the steady curtailment of road deliveries to the provinces, all increased the difficulties encountered by the A.E.C. Service and Spares organization.

Staff problems, too, were frequently acute. There was, for instance, the transference of key personnel to the Pre-packing department opened in February 1944. This department was charged with the important duty of packing spares, already treated with grease or water-proofing solutions, into cartons and containers, which were then sealed and water-proofed and finally the parts were permanently packed in their wooden or stout cardboard cases. A system of packing which enabled vital "Spares" to be quickly unloaded on to surf-ridden beaches without any deleterious effect from sea water.

Furthermore, there was the absence and in some cases, unfortunately, the loss of men and women who were victims of flying bomb and rocket attacks.

Then came the extra burden of work imposed by the "certificate of need," yet somehow the troubles were overcome and spares continued to reach their destinations so that both Service and civilian transport were maintained throughout these times of intense difficulty.

Much good work was also done by the Service sections of the branch depots at Bradford and Nottingham, both opened during the war years. At the former, which began to function in May 1941, with a few key men transferred from Southall, the staff was, with the exception of the men mentioned, recruited locally. Early classified as an Army Auxiliary Workshop, this depot undertook the complete overhaul of A.E.C. "Matador" tractors—some returned for this purpose from as far afield as Iceland—and of A.E.C. fuel tankers supplied to the Royal Air Force. Coupled with this was the continuous work of overhauling and repairing civilian type A.E.C. vehicles in the fleets of Midland operators, among them a number of "Regent" double-deckers owned by the Sheffield Corporation which were severely damaged during the air raids on that city.

During the war period many petrol-engined vehicles were converted to run on fuel oil, in which case A.E.C. oil engines were fitted to replace the original power units.

As an example of the close co-operation between the Company and H.M. Forces, it may be mentioned that members of the depot staff were sent frequently to nearby Royal Air Force operational stations to service A.E.C. tankers on the spot, whilst others were at different times engaged in giving tuition to Royal Air Force personnel in the correct maintenance of the A.E.C. oil engine.

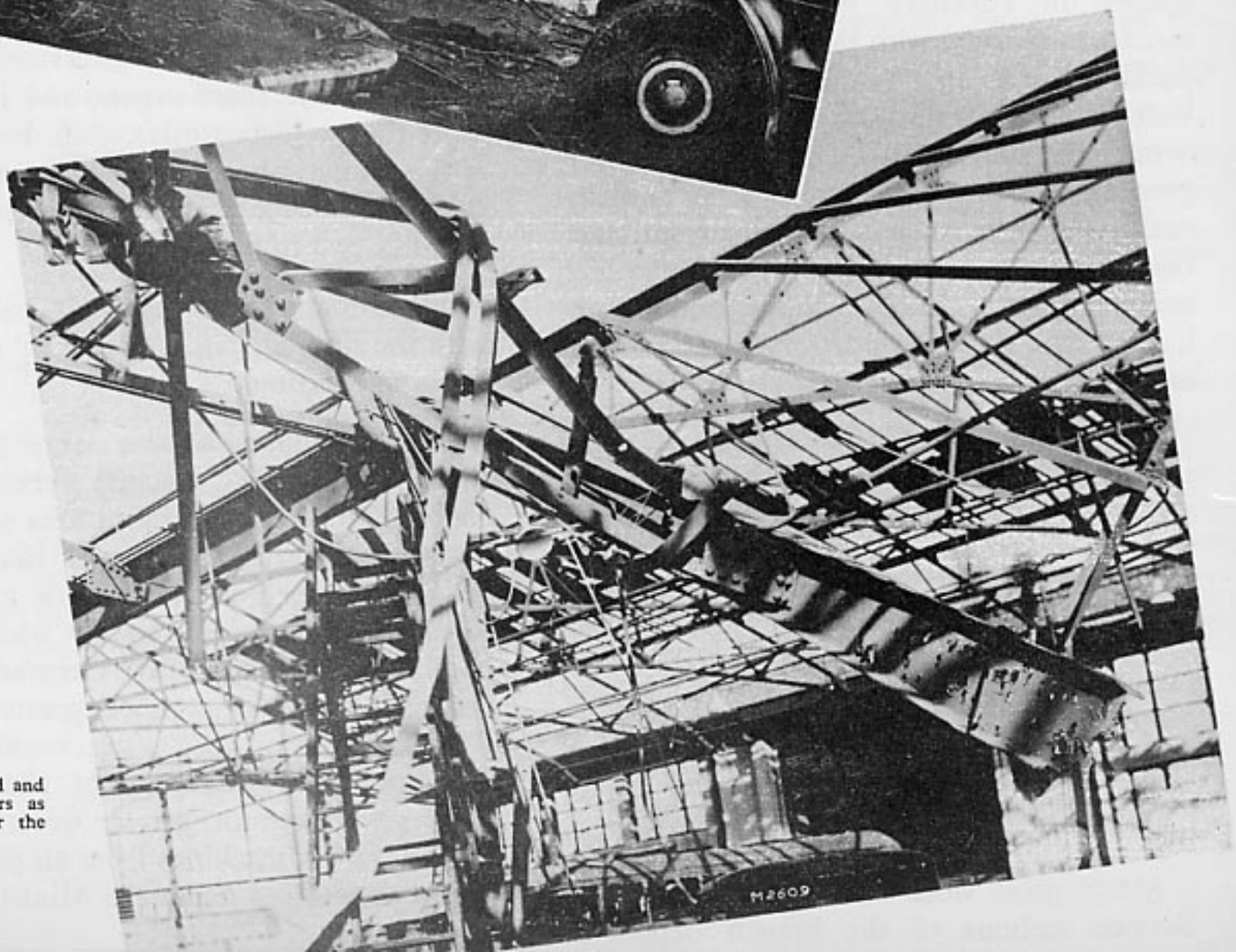
The demands of the Services were, of course, always most urgent and in order to meet them satisfactorily, while keeping faith at the same time with civilian operators, considerable re-organisation of the depot repair facilities had to be effected.

These many tasks were only accomplished with the limited staff available by continually working overtime.

At Nottingham also, a large number of A.E.C. "Matador" tractors were overhauled and rebuilt. Situated in an area surrounded by airfields, this depot was likewise kept actively engaged in servicing a great many Royal Air Force fuel tankers which, as the bombing offensive against Germany and the occupied countries attained greater strength and persistency, were often working round the clock. While many of these A.E.C. tankers were rebuilt, service work was being carried out on machines from all parts of the country operating under the Ministry of War Transport.

The bombed Service Station. Although the building was reduced to a mere shell, men and women worked in it without adequate protection or warmth for many months so that A.E.C. Service should be maintained.

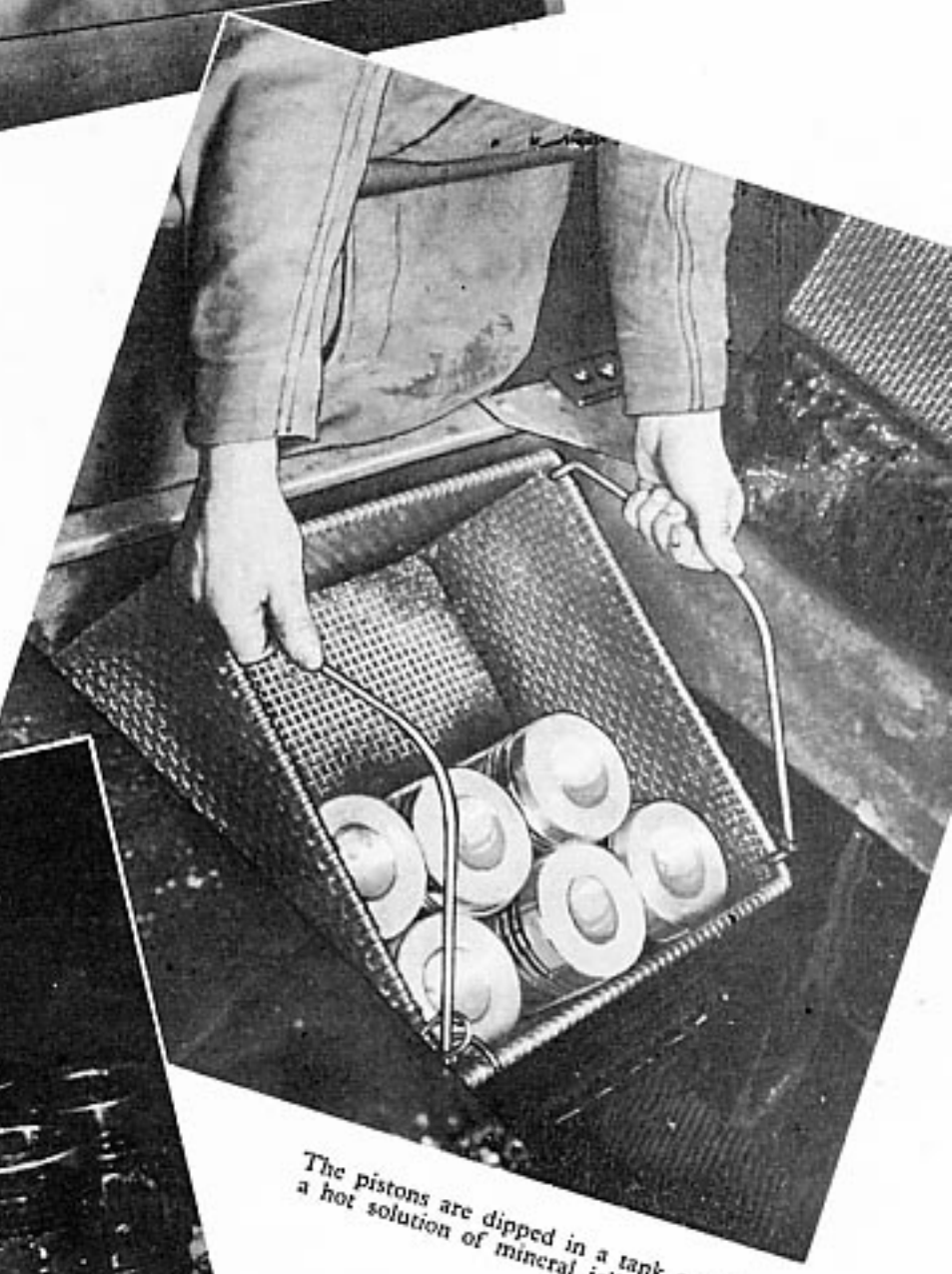
Showing the steel roller doors billowing out from the force of the explosion.



Some of the twisted and tangled roof girders as they appeared after the bombing.

STAGES IN THE PRE-PACKING OF A.E.C. PISTONS

A general view in the A.E.C. pre-packing dept. where some two million parts were specially pre-packed and then finally packed to prevent damage from sea water, heavy mist, humidity, etc., experienced in the various theatres of war.



The pistons are dipped in a tank containing a hot solution of mineral jelly preservative.

Each piston now covered with preservative is wrapped in grease-proof paper.

The grease-proof wrapping is surrounded with corrugated paper.

The container, with its label protected by adhesive cellophane, is now tightly sealed with cloth adhesive tape.

The piston, double-wrapped, is inserted into a special metal-ended, grease-board carton and rendered airtight.

Six containers are placed in a stout wooden case which carries one interior and two exterior labels all protected by adhesive cellophane.

The case is doubly bound with steel wire to give it strength and rigidity

Packing small studs which after being dipped in preservative were inserted six at a time in cartons and afterwards packed in wooden cases.

As at Bradford, great effort was needed to meet Service demands and those of civilian operators, the latter sending to the depot a considerable volume of public service vehicles employed on special works transport for Government shadow factories in the district. Eighty new A.E.C. 7.7 litre direct-injection oil engines were fitted into " Regal " single-deckers and to a number of goods chassis, while immense quantities of spare parts were supplied.

At the Glasgow A.E.C. spares depot, the staff during the first six months of the war supervised the installation of A.E.C. engines in " Matilda " tanks at the North British Locomotive Works, and prior to " D-Day," the installation of the A.E.C. oil-engined generating sets in the Whale pierheads for the Mulberry Harbour.

Lectures to Army and Royal Air Force personnel on the operation and maintenance of A.E.C. power units and the " Matador " tractor were frequently given by the staff throughout the war years. Apart from this, no efforts were spared to ensure that all possible service was rendered to civilian operators.

These, then, are some wartime accomplishments of the A.E.C. Service Departments at Southall and in the provinces. From facts now disclosed the record is revealed as one of high merit and specially worthy of recognition in that it contributed materially to the war effort on the Home Front, and that despite great difficulties and recurrent setbacks at Southall, it largely upheld the high standards at which the Company has always aimed in this important sphere.

A.E.C. WAR HISTORY

Soon after the veil of secrecy was lifted, it became known that some considerable time before the outbreak of the last world war when the European situation became ominously tense, the Government selected the A.E.C. Factory at Southall as one of the engineering establishments whose services would be needed in the event of a national emergency.

Thus within a few hours of the memorable announcement made by the late Rt. Hon. Neville Chamberlain on September 3rd, 1939, the A.E.C. Factory and other premises of the Company were declared " Protected Places " and became subject to the Official Secrets Acts.

A contrast this, with the summer of 1914 when young men, just back from their summer holidays, gaily took the King's Shilling and joined the Army under the firm conviction that after a Government-sponsored tour of France and Germany they would return home victorious by the following Christmas.

No such illusions existed in the minds of the staff and employees at Southall just seven years ago. This would be a grim affair, inevitable total warfare with all its frightful possibilities; when, a few days later, there were empty places at the benches and along the machine lines, everyone knew that the men who had gone would be difficult to replace.

At 9.15 a.m. on one of those critical days, the principal executives were summoned to the Chairman's office to receive orders for the immediate suspension of civilian vehicle production with but a few exceptions. " Until further orders," he said, " we shall concentrate on the manufacture of vehicles and such other equipment as may be needed for the Forces. Our first wartime commitment is the production of " Matador " F.W.D. medium artillery tractor vehicles. You will take any necessary action to ensure their delivery by the specified date," adding in his own encouraging way, " and I know you can do it."

From that moment the clouds of war and uncertainty that obscured the outlook at Southall were lightened by a spirit of firm resolve that carried many an individual worker and the Company as a whole through the difficult times which followed.

First and foremost came the problem of filling those vacant places in the shops, for whereas prior to the war, the Company had been able to select their skilled workers, the outbreak of hostilities produced an entirely unprecedented situation.

Demands made by all branches of the Services on available man-power, together with the control exercised by the Ministry of Labour and National Service created a very difficult problem for the Company. Particulars as to the measures adopted, stated in another chapter, will show how the situation was soon brought under control and full scale production on wartime contracts was not long delayed.

Many anxious hours were spent by the management in endeavouring to solve the personnel problem, which was by no means confined to recruiting and training new workers for the Factory, since from the very beginning of the War, the services of A.E.C. designers and technicians from many departments were in demand by various Ministries, several key-men being loaned to the Government to assist in the development of secret projects. At this time, members of

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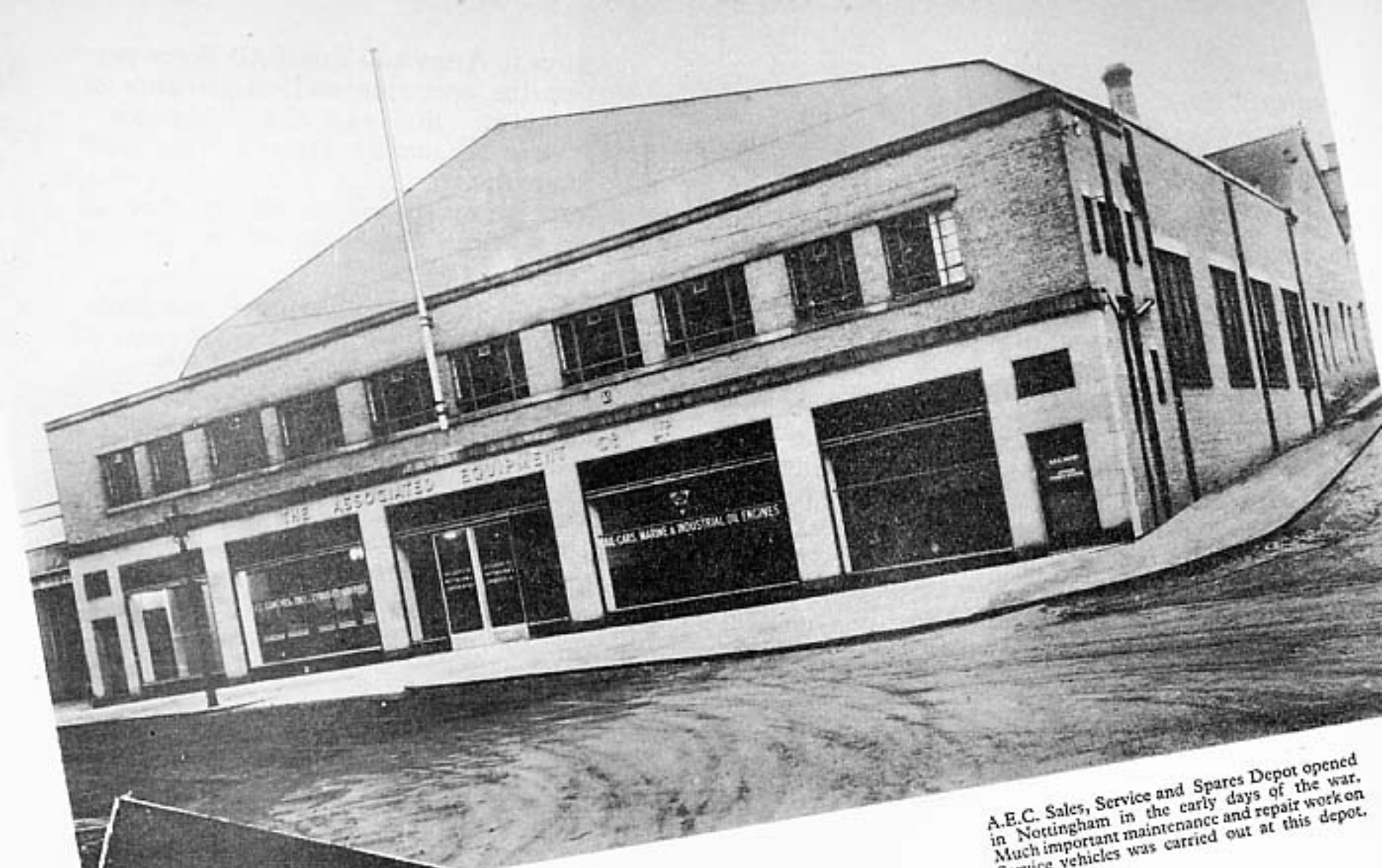

A.E.C. Sales, Service and Spares Depot opened in Nottingham in the early days of the war. Much important maintenance and repair work on Service vehicles was carried out at this depot.

Interior view at the Company's Nottingham Depot.

All that remained of the Southampton A.E.C. Depot after the enemy bombers had passed that way.

The new (temporary) A.E.C. Southampton Depot.

the sales staff and the Company's representatives in different parts of the country were called in from their territories to fill positions in the factory organization vacated by those who had been called away to other duties. Another marked effect of the general staff shortage was that, from the first few days of the war until its conclusion, every departmental head found himself in the position of having to perform the work of two or more persons.

These, too, were the days of "short supply," when normally heavy deliveries of raw material into the Factory dwindled down to the barest amounts that would supply the machine tools working at full pressure to feed the "Matador" unit assembly sections and chassis erecting lines with essential components and sub-assemblies.

To describe the general situation affecting production as critical would be expressing it mildly and while giving full credit to the Ministry of Supply, aided by hundreds of men belonging to the motor industry, production had to be protected against every possible risk of stoppage by persistent and energetic efforts of A.E.C. officials. In the nation-wide scramble for supplies and raw material, members of the A.E.C. production control staff brought their long experience of dealing with "short supplies" to bear upon these difficult problems but even so they often found themselves dealing with a few hundredweights of raw material at a time, instead of consignments of several hundred tons as when deliveries were normal under peace time conditions.

While for their part, the suppliers did everything possible to maintain the quality of such material as could be delivered in relatively small quantities, there was the ever-present risk of quality deterioration due to all kinds of wartime difficulties. The inevitable result was to throw more responsibility than ever upon the laboratory and inspecting staff at Southall, lest perchance some inferior material should pass into the Factory with the potential risk of serious faults occurring when the vehicles were on vital war service.

At this initial stage of manufacture, as throughout the entire production routine, the company personnel—managers and workers alike—all knew that nothing less than traditional A.E.C. quality and workmanship would be good enough for the vehicles and other wartime products so soon to play their great part in what was, at first, a life and death struggle for the future of the country.

This fact was brought home to all concerned in no uncertain manner, first when all the premises were blacked-out and when surface shelters were constructed at vital points and other measures taken as a reminder of the importance of the Factory as a priority target for enemy bombing.

Nor were all these but idle precautions for it was not long before the premises attracted the attention of the Luftwaffe whose bombers paid several visits to Southall and some of the Company's depots.

The German High Command was doubtless quite aware of the extent to which A.E.C. production contributed to the frustration of Hitler's wild ambitions.

Evidence of this may be drawn from the fact that when the War ended, enemy documents came into the Company's possession in the form of maps, issued from enemy operational headquarters, showing the exact location of the Factory, the anti-aircraft gun positions and the airfields from which fighter planes might be expected to start, together with full bombing instructions and information dealing with the importance of permanently destroying the entire Factory plant.

Notwithstanding the danger of air attack, enemy activity at no time caused any excessive loss of working hours, after the inauguration of the spotting system. The Factory came under the London Defence Area and was subject to all alarms affecting that district.

Thanks, however, to the full co-operation of the workers and a comprehensive warning system, only the bare minimum of time was lost by reason of "Alerts." The "take cover" warning, in agreement with the workers, was never sounded until such warning was imperative for the common safety.

Neither the air-raids nor stringent blackout regulations, with the added discomfort and difficulty of transport to and from the Factory, had any serious affect upon the output and intensive production was maintained continuously throughout the war.

Chosen by the authorities for its efficient organisation and competent personnel the A.R.P. Control Post at the Southall works operated as the main source for warning a number of other industrial establishments within the immediate area and it

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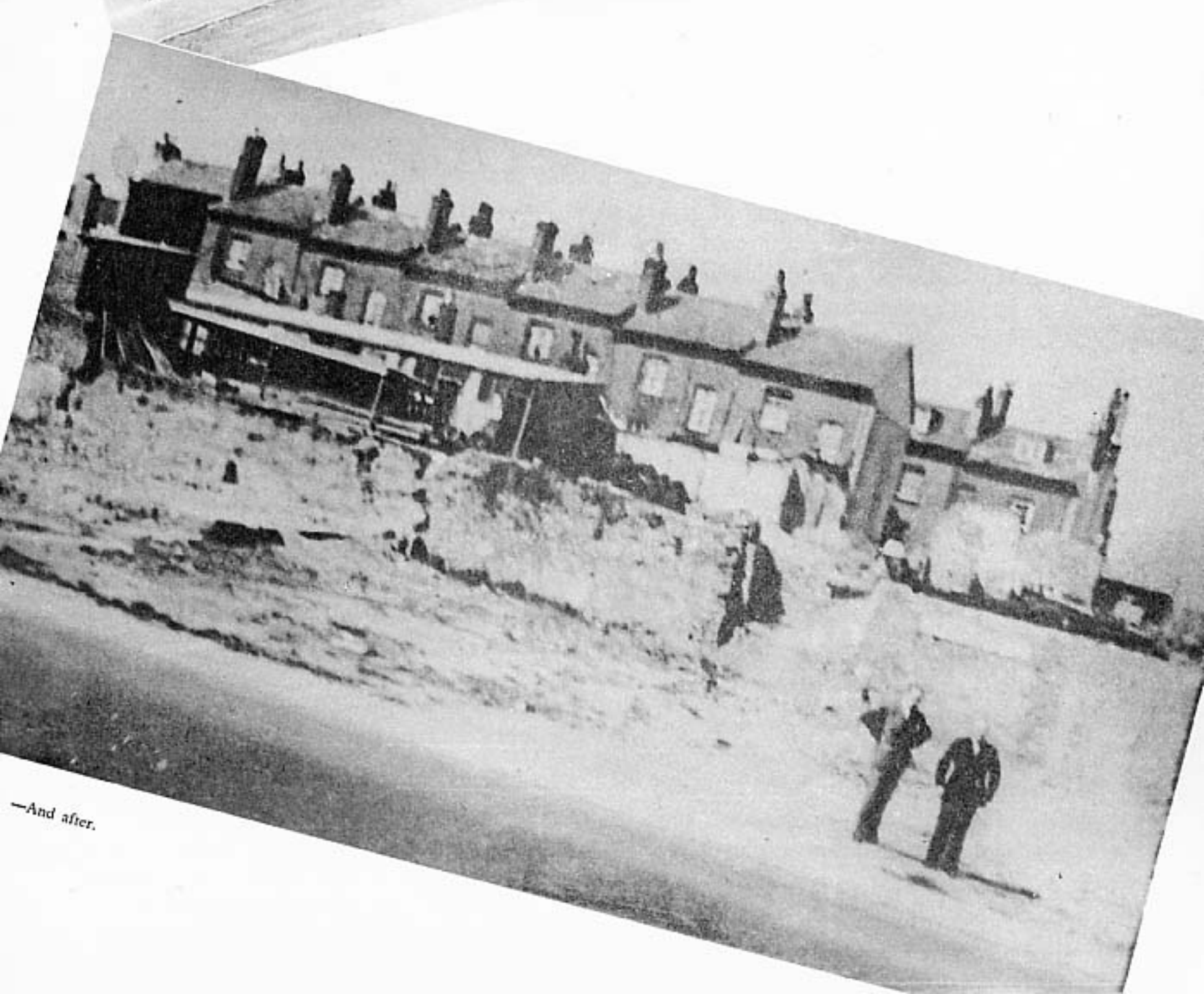
A.E.C.'s Exeter Depot as it was before the enemy aerial blitz.



—And after.

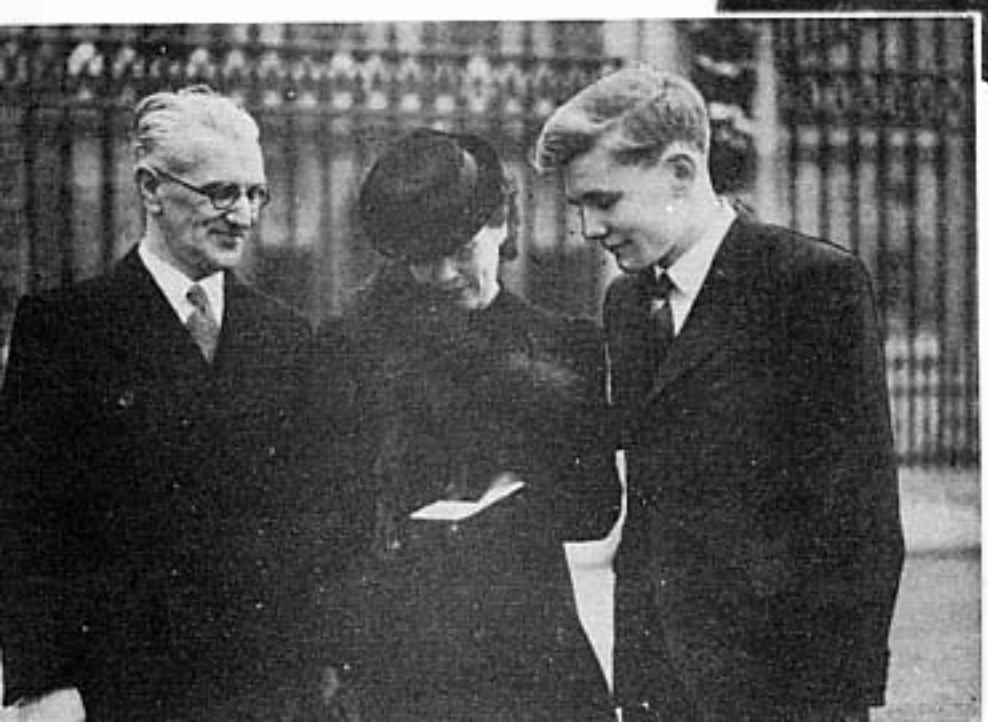
A.E.C.'s chief roof-spotter on duty. The safety of many work-people depended upon him and his colleagues.

A contingent of A.E.C. Home Guard reviewed for the first time on 20th July, 1940, by A.E.C. Director, Major General the Rt. Hon. Sir Frederick Sykes, P.C., G.C.S.I., G.C.I.E., G.B.E., K.C.B., C.M.G., M.P.

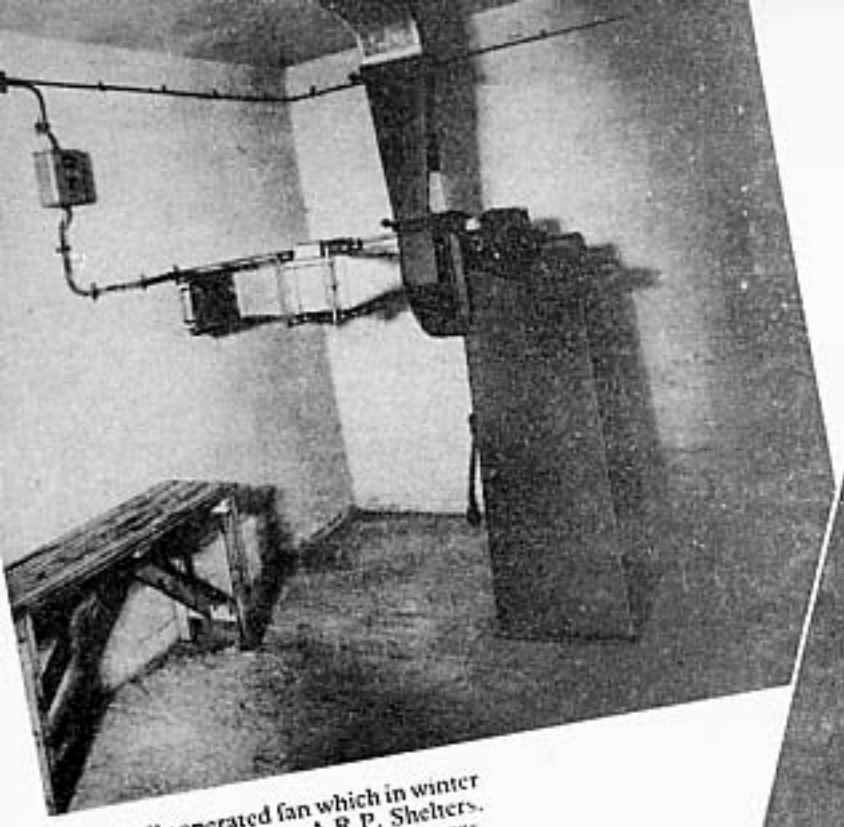
Mr. C. W. Reeve, C.B.E., A.E.C.'s Chairman reviews the Factory Battalion A.E.C. Home Guard November, 1941.

Two members of the A.E.C. Home Guard, Sergt.-Major G. Turner (left) and Corpl. H. T. Morris, were awarded the B.E.M. for conspicuous service in combating the effects of incendiary bombs during a night raid.

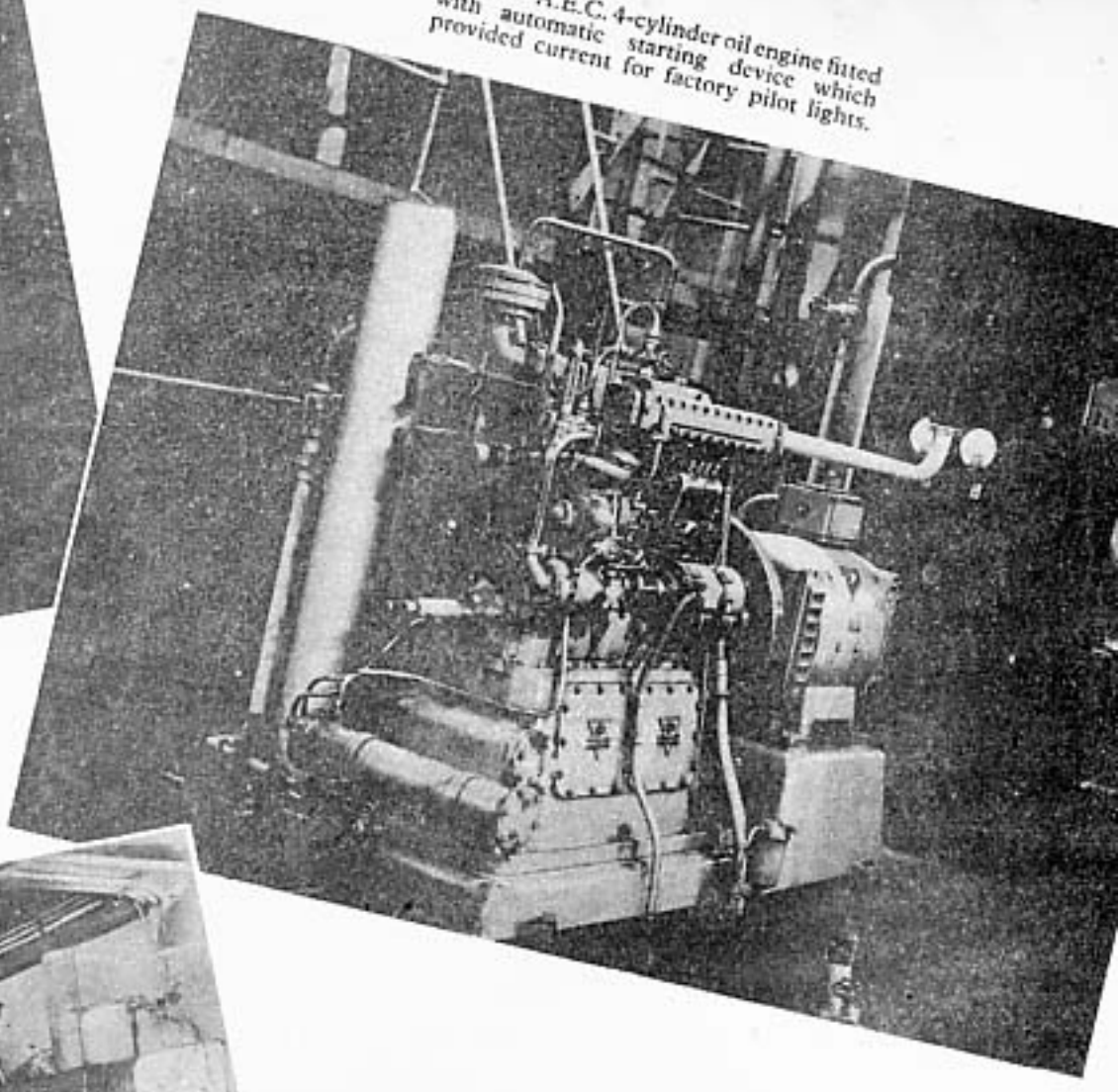
Awarded the M.B.E. in the Birthday Honours List of 1944, Mr. E. H. Jones A.E.C. works manager, was decorated by H.M. The King at an Investiture held at Buckingham Palace in November, 1945.



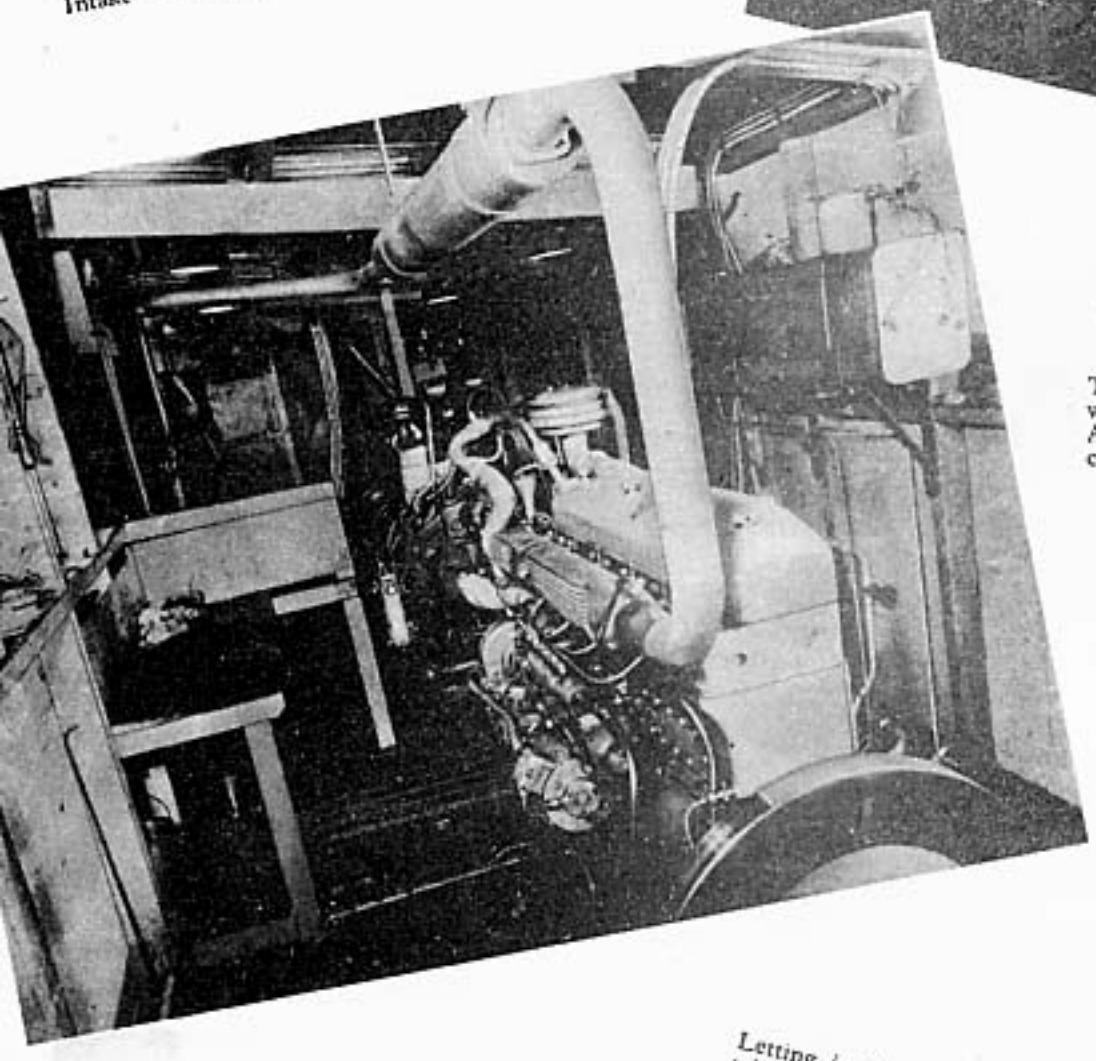
Pilot Officer P. Durnford, who in pre-war days worked in the A.E.C. View Room, was awarded the D.F.M. in November, 1942.



Electrically operated fan which in winter supplied warm air to A.R.P. Shelters. Intake could be sealed against gas.



A.R.P.—A.E.C. 4-cylinder oil engine fitted with automatic starting device which provided current for factory pilot lights.



Two A.E.C. 6-cylinder oil engines which provided current for lighting A.R.P. trenches. Five engines ran continually during blackout.

Letting in the light. Men labour with a will to remove camouflage and blackout paint from 28,000 square yards of factory roofing.

After the war. The mobile factory crane raises a 3¼ ton segment of blast wall for final breaking up.

may be noted with satisfaction that at a full meeting with members of the firms concerned, a vote of thanks was passed to the Company's Control Room personnel for their efficient spotting work and the prompt transmission of warnings.

By extremely good fortune, German bombers failed to carry out the carefully prepared attempts to destroy the A.E.C. Factory and, in fact, the actual damage brought about by enemy action was small—apart from that inflicted upon the Service Department—and no major disturbance was suffered by the main works.

Bombs, flying bombs and rockets caused many broken windows and damaged roofs. The incendiary bombs dropped on and around the premises were speedily rendered harmless by the Works Fire Brigade and the A.R.P. personnel. One oil bomb, however, fell near the corner of one of the Factory buildings, but all danger was averted by the courage and speedy action of two members of the A.E.C. Home Guard, for which they were each awarded the British Empire Medal (Military Division).

At the request of the Ministry of Supply, the Company took control of a Shadow Factory at Park Royal, London. The premises were allocated to the production of components for gun tractors, armoured fighting vehicles and all types of motor vehicles for the Services. Before this work could be started, it was necessary to install an entirely new production plant and a new set of operatives. Accordingly, a nucleus of skilled craftsmen was transferred from Southall to Park Royal and they were responsible for training all the unskilled workers who were drawn from diverse trades and occupations including publicans, race-horse trainers, hairdressers and actors, to mention but a few.

This factory, which closed down in December 1945, was badly shaken by the explosion of a flying bomb which landed in the vicinity towards the end of the war.

The winter of 1939 will long be remembered for its severity and the consequent bad effects upon wartime production. Workers found transport conditions extremely difficult and the supply of materials was indeed critical; but Government demands for wheeled vehicles became more insistent as the tempo of the campaign increased.

Fortunately, as far as the A.E.C. was concerned, production of the famous " Matador " four-wheel driven gun tractor had commenced before the outbreak of war, and, accordingly a steady output could be maintained despite all prevailing difficulties and handicaps.

It was this outstanding vehicle that earned such high praise from the Commander-in-Chief of the Middle East Forces and a message received by the Company from G.H.Q. Cairo reads : " The British Army is the most satisfied customer the A.E.C. ever had. The " Matador " is regarded as the best tractor in the medium class in either of the opposing armies." This expression has been backed up freely by those in the ranks who have learned by hard experience in the North African desert, on the hill roads of India and the shell-shattered highways of Western Europe, something of its robust and reliable qualities.

Then came Dunkirk with its terrific losses of equipment, including vehicles of every type, all of which had to be replaced before any hope of recovery could be contemplated. Furthermore, the general war situation had changed and, as happened later with so many different phases of the conflict, vehicles for new and diverse duties had to be designed and manufactured at the shortest notice.

In its original form, as built in 1938, the " Matador " gun tractor had a gross weight of 10½ tons and a load capacity of 3½ tons. Next came the " Matador " load carrier of which large numbers served throughout the campaign. Later there was a sudden demand for the same type of vehicle but equipped with a power-driven winch, cable drum and fairleads fore and aft, the wheels being fitted with 13.50 in. tyres.

A " Matador " of special design was next produced and, known as the Armoured Command vehicle 4 x 4, was equipped with spacious bodywork fully armoured, and office furniture to serve as battle headquarters for commanders of military formations at the Front. The " Matador " was selected for such duties by reason of its reliability and ability to travel over the roughest country.

Another important duty carried out by this most versatile of military vehicles was minelaying in battle areas, for which purpose special moving belt equipment was added, while others were fitted out with the whole impedimenta needed for demolition work.

In addition to its appreciation by the Army authorities, the " Matador " attracted the

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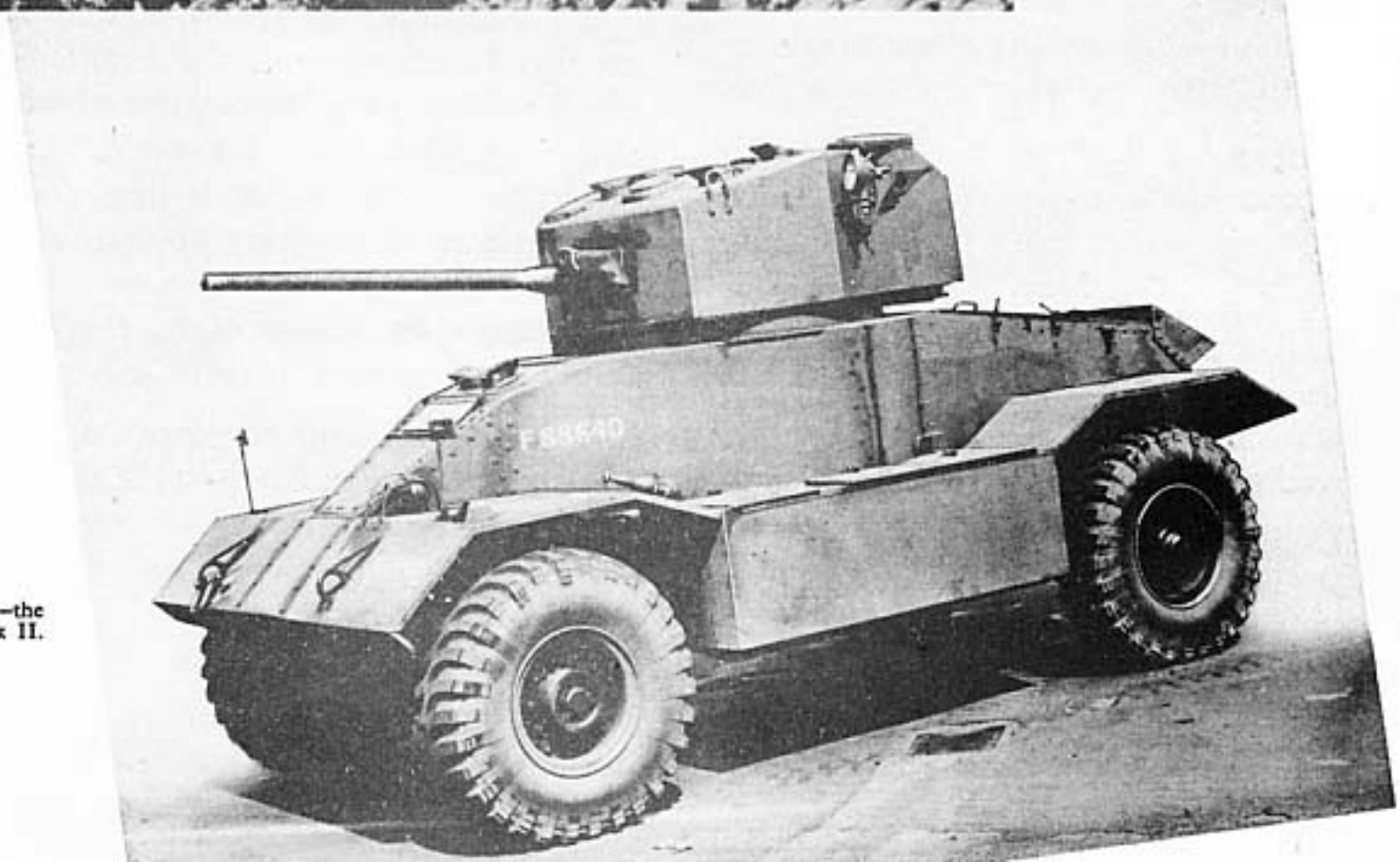
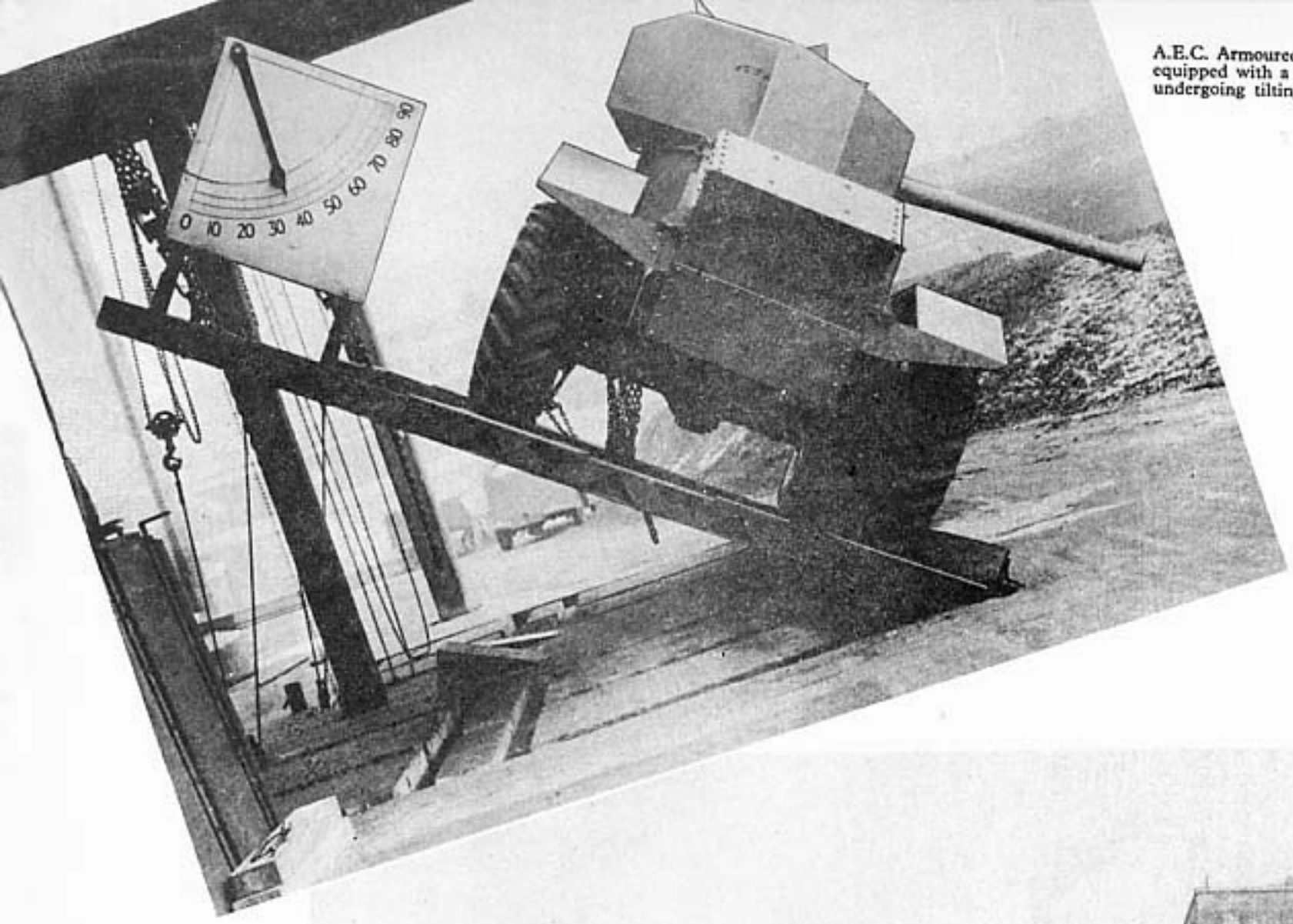
The A.E.C. Armoured Car Mark I.

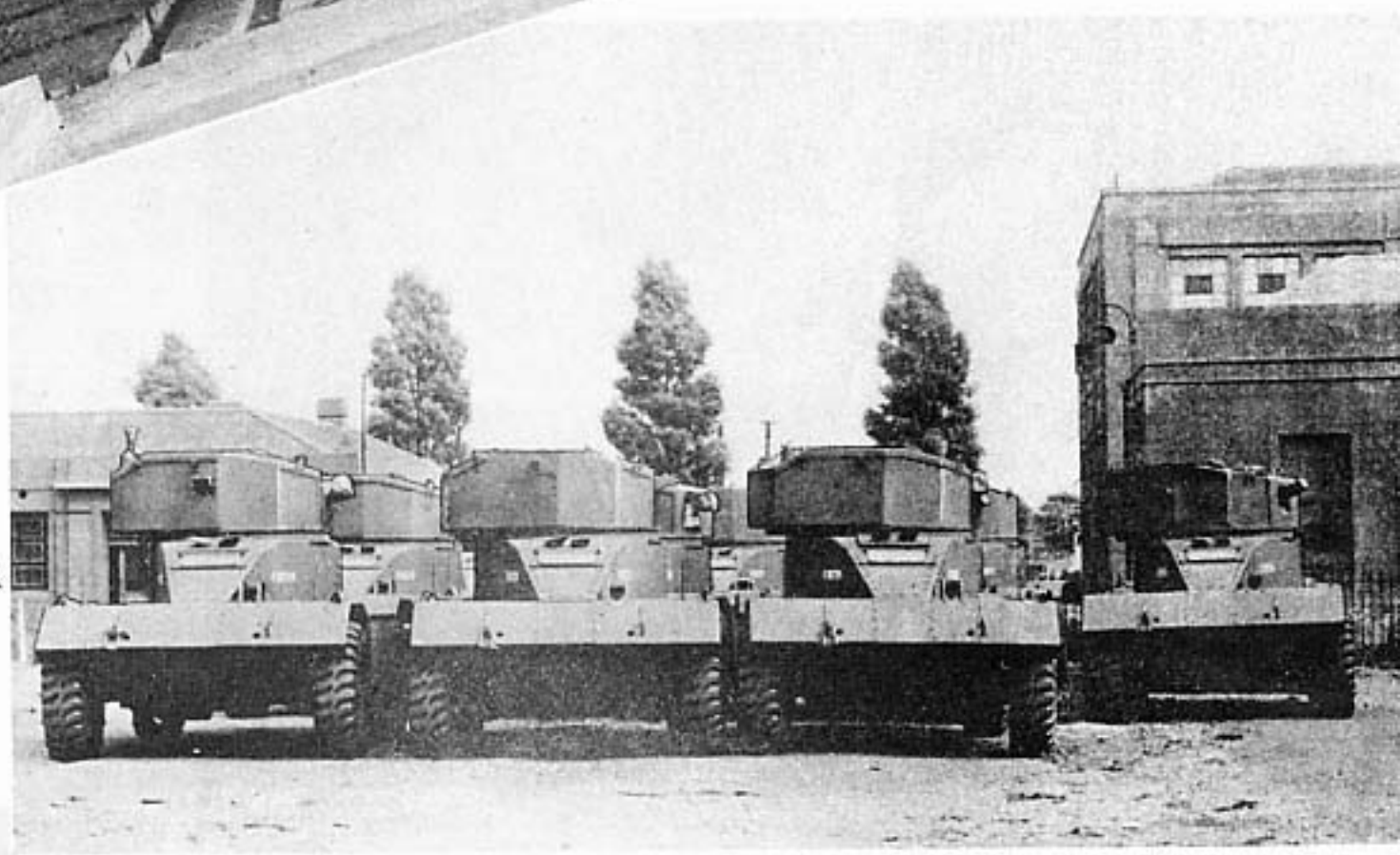
Operating through a morass of mud—the A.E.C. Armoured Car Mark II. fitted with a 2-pounder gun in action.



With slightly different hull—the A.E.C. Armoured Car Mark II.



A.E.C. Armoured Car Mark II. equipped with a 6-pounder gun undergoing tilting test.

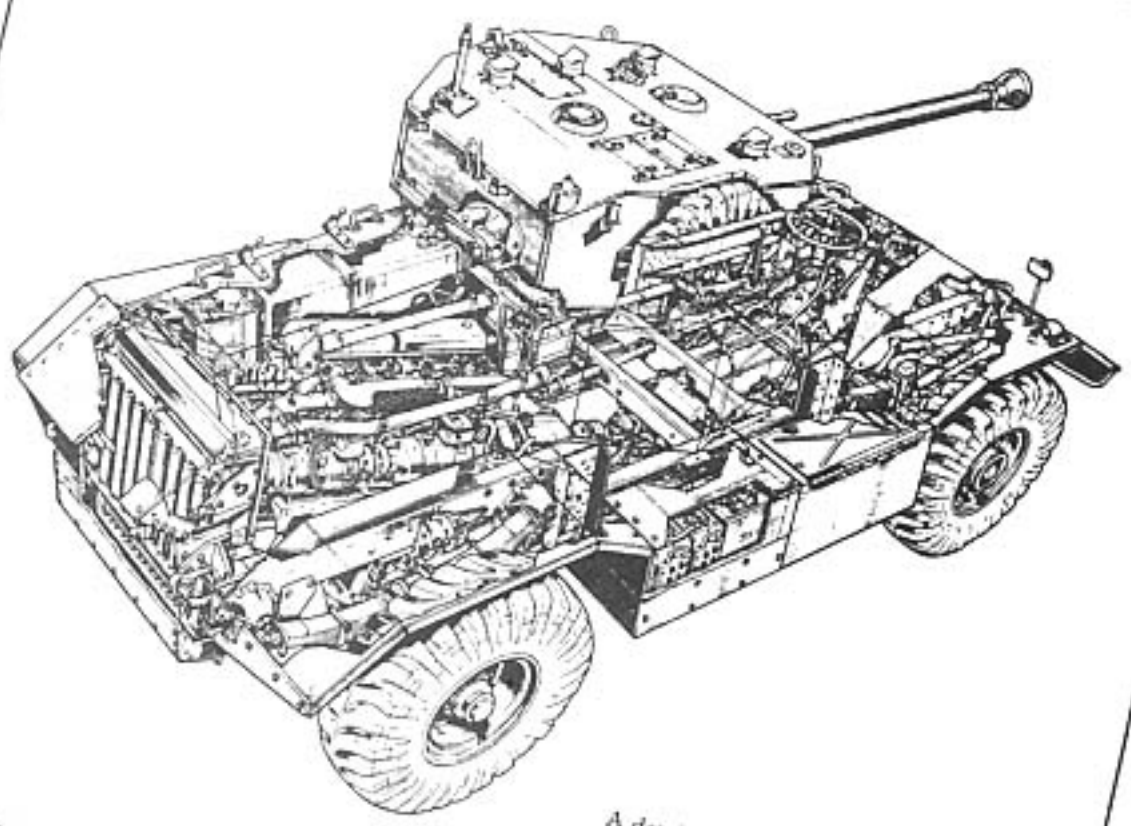


A convoy of A.E.C. Armoured Cars (Mark II.) photographed before delivery in August, 1943.

A.E.C. "Matador" 4-wheel drive chassis with 6-pounder gun and armoured protection for crew and ammunition. Famous in the North African campaign and known as the "Yellow Devils."

The A.E.C. Armoured Car Mark III., provided with a 3-man turret. The main armament is a 78 mm gun.

A.E.C. Armoured Car convoy just prior to leaving the Southall factory.



A detailed diagram of the A.E.C. Mark III Armoured Car.

After water-proofing, the A.E.C. Armoured Car is here shown entering the water on a pre-invasion test.

attention of the Royal Air Force and the Air Ministry selected this type as being suitable for hauling trailers on aerodromes as well as for general maintenance work on airfields; for this purpose large numbers were supplied in the form of flat platform lorries. Initially, the R.A.F. insisted upon petrol-engined types only, presumably with the idea of having to store one kind of fuel. Eventually, however, the outstanding advantages of oil-engined vehicles were recognised after which the standard " Matador " was employed.

There was another notable exception when petrol-engined " Matadors " were specified, namely, those destined for shipment to Norway. In this instance, delivery was a matter of such great urgency that a number of the chassis ready for shipment to other war theatres had to be converted from oil to petrol driven power units.

Always adaptable to fulfil a seemingly inexhaustible variety of military needs the A.E.C. " Matador " occupied the foreground in the war picture at the time of El Alamein when it was produced with a flat platform and armour plated cab. A 6-pounder gun was mounted on a swivelling base and protected by an armoured shield. Some 150 such units were sent out to the Middle East where, painted with suitable camouflage in which yellow predominated, they were known among the troops as the " Yellow Devils."

Reporting on his experiences during the Middle East campaign, a major in the Indian Corps of Electrical and Mechanical Engineers remarked as follows : " I came across A.E.C.'s hauling artillery and doing recovery work everywhere I went. At one period, the Armoured Brigade Workshop of an Indian Division in which I served had the job of helping to clear up the battlefield after El Alamein and the ' Matadors ' were in constant use hauling derelict tanks back to the graveyard. That A.E.C.'s earned a great name for sturdy reliability and high performance is beyond doubt and I always had a feeling of pride whenever I came across the familiar red and blue triangle, even if it was usually smothered with camouflage paint."

The " Matador," in fact, established a great reputation for ubiquity in every branch of the Services, either in its original form or when modified to meet specific requirements. Thus when the Royal Air Force needed vehicles suitable for carrying 2,500 gallon fuel tanks, the Company produced the type known as the 6 x 6 rigid six-wheeler with all axles driving. The model was a cross between the " Matador " and the " Marshal," the forward portion of the first-named being combined with the " Marshal " dual drive rear bogie. The same form of chassis was also used as an Armoured Command Vehicle 6 x 6, and having greater dimensions than the original " Matador " version, could carry more comprehensive equipment, including radio transmitting and receiving apparatus of a more powerful type than that employed previously.

The value of the A.E.C. 6 x 6 tanker can be obtained from the following facts concerning its work on a typical bomber station in England. During periods of intense operational activity as many as 57 Lancaster bombers had to be refuelled every twenty-four hours by the use of six of these machines. As the tanks of the Lancaster bomber hold 2,254 gallons at a time, the magnitude of the task becomes at once apparent. The vehicle establishment on a typical home bomber station also included one similar type of chassis equipped with a 10-ton Coles crane for aircraft recovery and other duties. In emergency, the A.E.C. tankers often had to act as recovery vehicles, and on occasions, proved indispensable for hauling aircraft out of difficult situations on the airfields. This they did with the aid of the power winch and cable forming part of the standard equipment which provides a maximum pull of 7 tons. With low auxiliary gear in action, the 6 x 6 could pull almost anything out of almost anywhere.

As far as the normal duties of the A.E.C.-Coles crane vehicles were concerned, there is nothing particularly exciting to relate, but " off the record " some of these machines performed many quite astounding feats. Two examples may be given to support the statement, one being an occasion when a Stirling bomber, weighing 26 tons, made a bad landing on one wing before the landing wheels could be lowered. The situation would have been very awkward but for the presence of an A.E.C.-Coles crane on the station and a few minutes after its arrival on the scene this vehicle with its long jib was able to lift the Stirling high enough to bring it level and lower the landing wheels.

On the second occasion a vehicle of this type was called upon to save an aircraft from a situation in which irreparable damage seemed inevitable for another Stirling hap-

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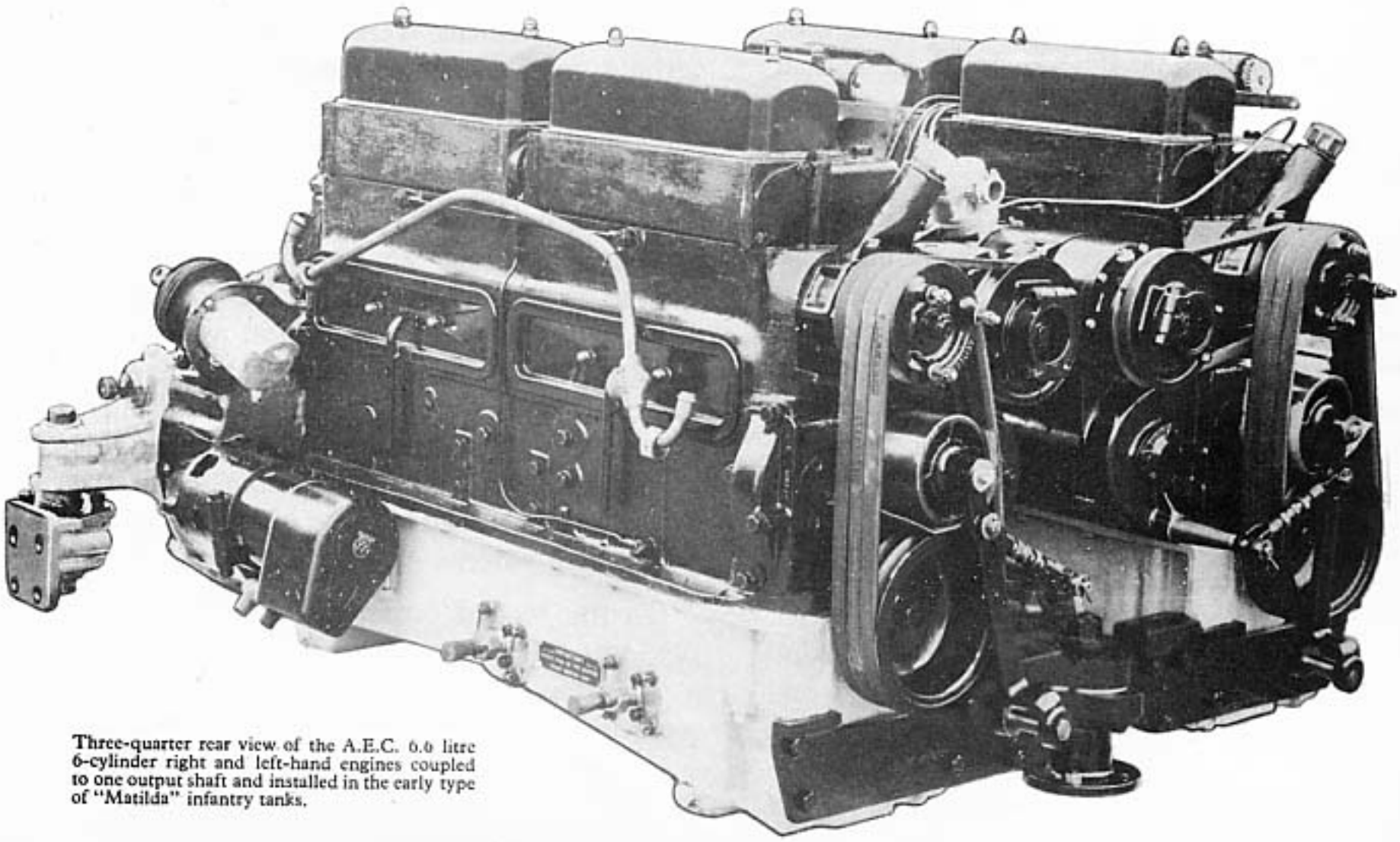
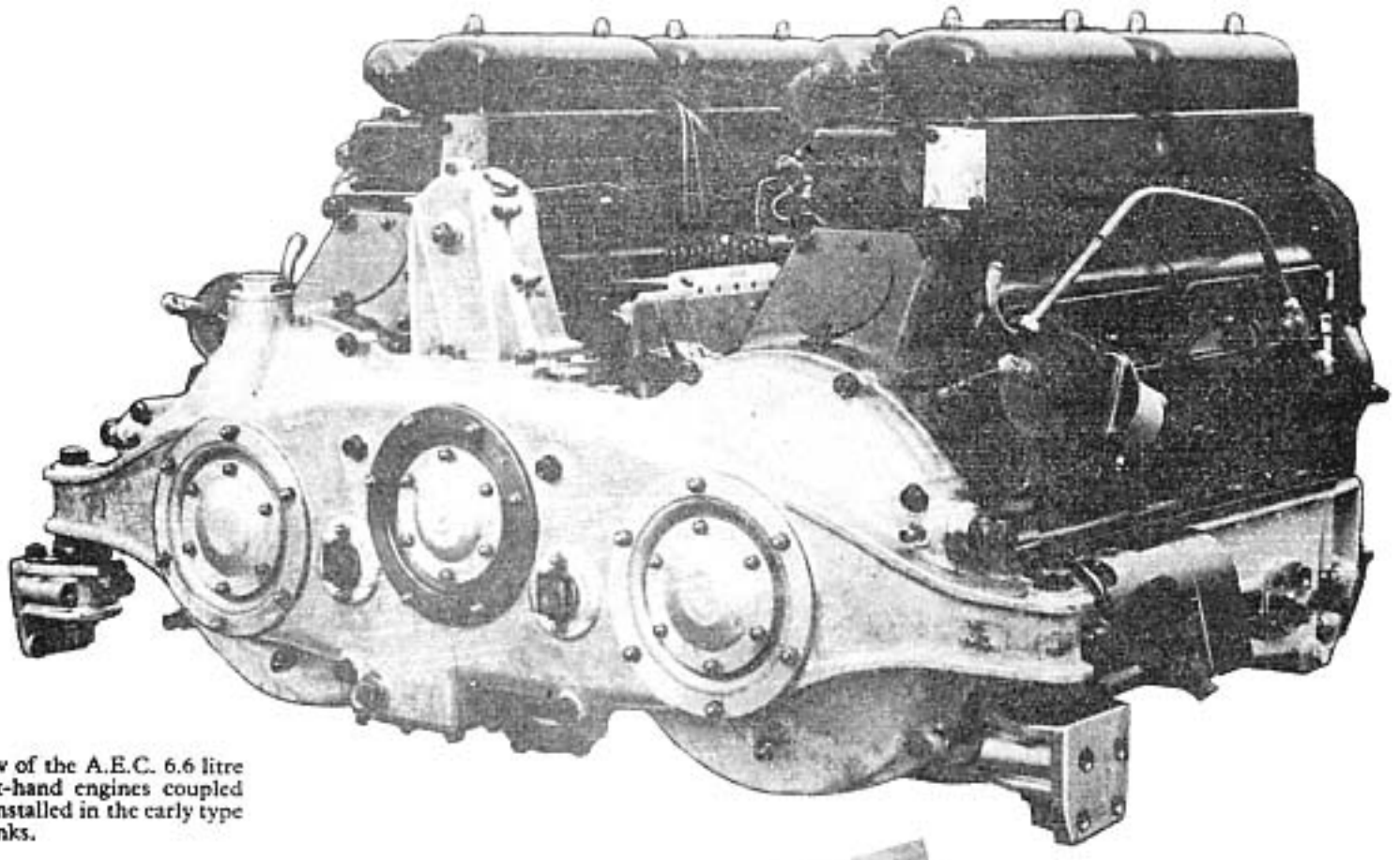
Powered by A.E.C. oil engines, a Valentine Tank takes part in the 1941 Lord Mayor's Show.



Three-quarter rear view of the A.E.C. 6.6 litre 6-cylinder right and left-hand engines coupled to one output shaft and installed in the early type of "Matilda" infantry tanks.

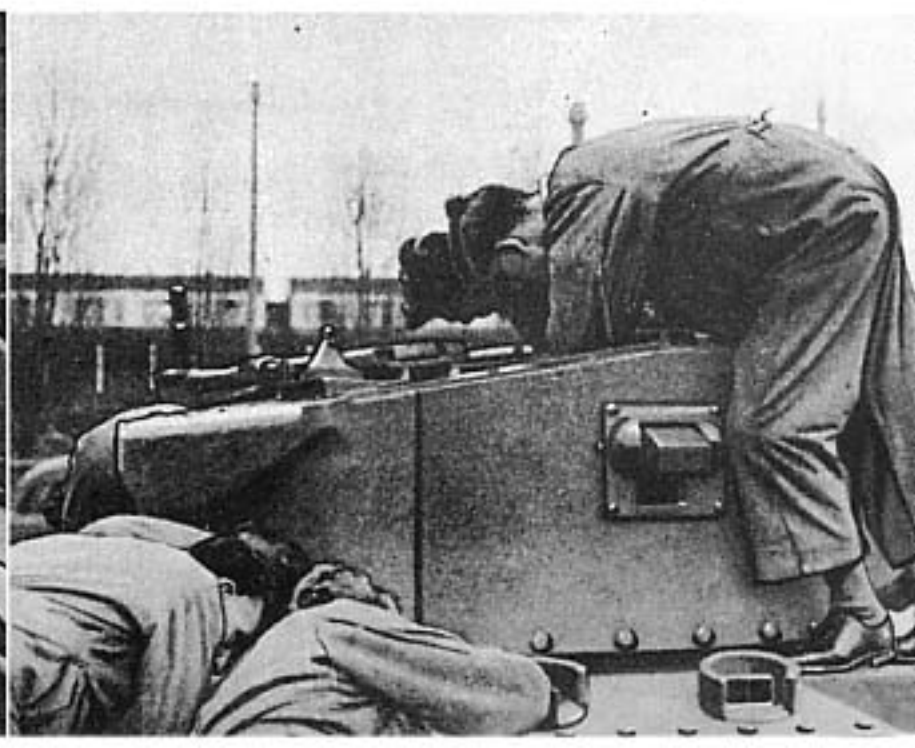


Three-quarter front view of the A.E.C. 6.6 litre 6-cylinder right and left-hand engines coupled to one output shaft and installed in the early type of "Matilda" infantry tanks.

At the saluting base, Buckingham Palace, a Valentine Tank powered by A.E.C. oil engines passes their Majesties the King and Queen.

A Valentine Tank visits the A.E.C. Southall factory to enable staff and works operatives to see the complete machine to which their work has contributed.

Both male and female workers display the keenest interest in the Valentine and its power units.



pened to land on a very muddy part of the airfield with its tail wheel doors well covered, its position being such that no normal jacking gear could have been used to any good effect. Accordingly, the A.E.C.-Coles crane was called into action and although its jib could only be operated at half elevation, thus depriving the crane of one-half of its lifting power, the big bomber was quickly extricated without being any the worse for the unhappy landing.

In addition to recovery operations of the kind mentioned, this type of mobile crane performed countless tasks including the movement of aircraft engines from place to place in the course of servicing or overhaul. Such examples as those mentioned previously in connection with home airfields could doubtless be surpassed by exploits in R.A.F. stations at the battle front, where machines of the type were generally reported as being highly satisfactory, without details of their achievements being described.

Largely as the result of the A.E.C. 6 x 6 performance and reliability on various Fronts, the War Office called upon the Company to produce designs for a heavy 6 x 6 tractor which, while capable of towing guns, heavy trailers and the like, had to be of greatly reduced height, thus presenting the least possible target for enemy guns or detection by German reconnaissance aircraft. This order was given to the Company when the War had taken a distinct turn in our favour with the result that prototypes only were delivered and no actual full scale production was started.

A.E.C.'s MANY DEVELOPMENTS

A very interesting story attaches to the origin and development of the A.E.C. Armoured Car, details of which are known to very few members of the Company's personnel. When serving on the Tank Design Committee of the Ministry of Supply, the chief engineer heard news from the Middle East to the effect that our tanks at that time were inferior to those of the enemy with respect to fire-power, speed and mobility, thus leaving our formations at a distinct disadvantage in every tank engagement. Turning this problem over in his mind, he came to the conclusion that a fast, heavily armed and armoured wheeled vehicle should be able to beat the German tanks at their own game, but his colleagues on the Committee did not endorse such views. On returning to Southall, he conferred with the Chairman and it was agreed that an experimental "mock-up" should be constructed in the Works as a private venture. This might well have passed into obscurity as a private venture but for a strange series of happenings which, in cold print look almost fantastic.

The Armoured Car "mock-up" having been completed without exciting much outside interest did not prevent whispers as to its existence becoming heard and, in due course, the information percolated into the War Office, where, since the tank school of thought was still in the ascendent, nothing much happened.

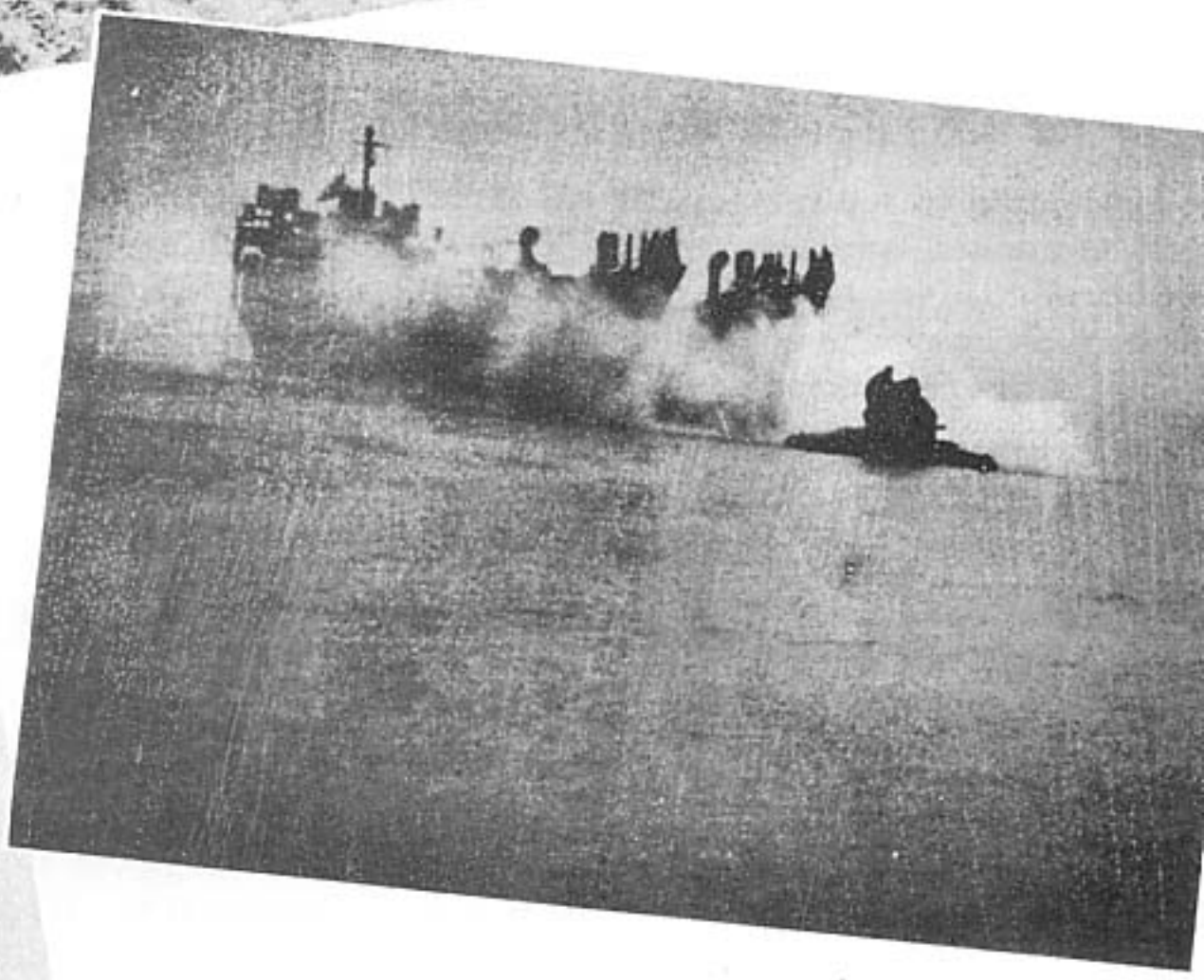
Then, some little time later, news concerning a forthcoming display of military vehicles in London came to Southall and this seemed to be an occasion when "Operation : Gate-crashing" might be put into effect. Accordingly on the morning of the demonstration at the Horse Guards Parade ground, the A.E.C. Armoured Car, painted in brightly conspicuous colours and with a gun barrel protruding from its turret, brazenly bluffed the sentries and gained admittance without an invitation to the closely guarded parade ground.

Official vehicles of sombre hue, surrounded by Army officers of high rank and Government officials, were parked on the Whitehall side of the Square, but the attention of those present was soon diverted to the gay stranger within the barricade.

Surprised glances quickly changed to close interest which left all the official vehicles to remain unattended whilst the A.E.C. Armoured Car stole the picture completely. A few minutes later there appeared on the scene the former Prime Minister, the Rt. Hon. Winston Churchill, who called for the senior officer present to explain what it was all about. To cut a long story short, the Southall bluff won the day and shortly afterwards through the good services of Sir William Rootes, K.B.E., orders were issued by Lord Beaverbrook for delivery of a number of machines to be built on the designs of the original "mock-up." That is how an audacious move by some person or persons at Southall paved the way for the production

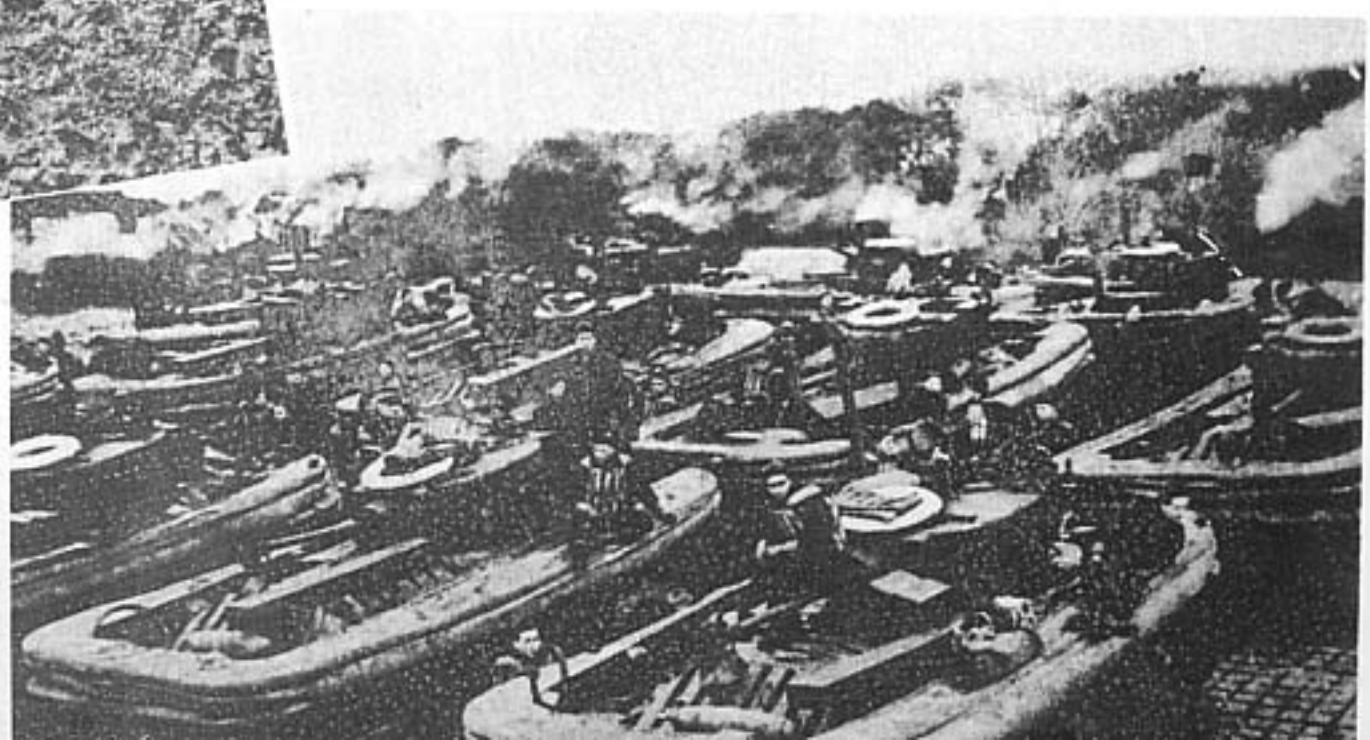
[*Continued on page* 61

A "Valentine" Tank fitted with the 9.6 litre A.E.C. oil engine.

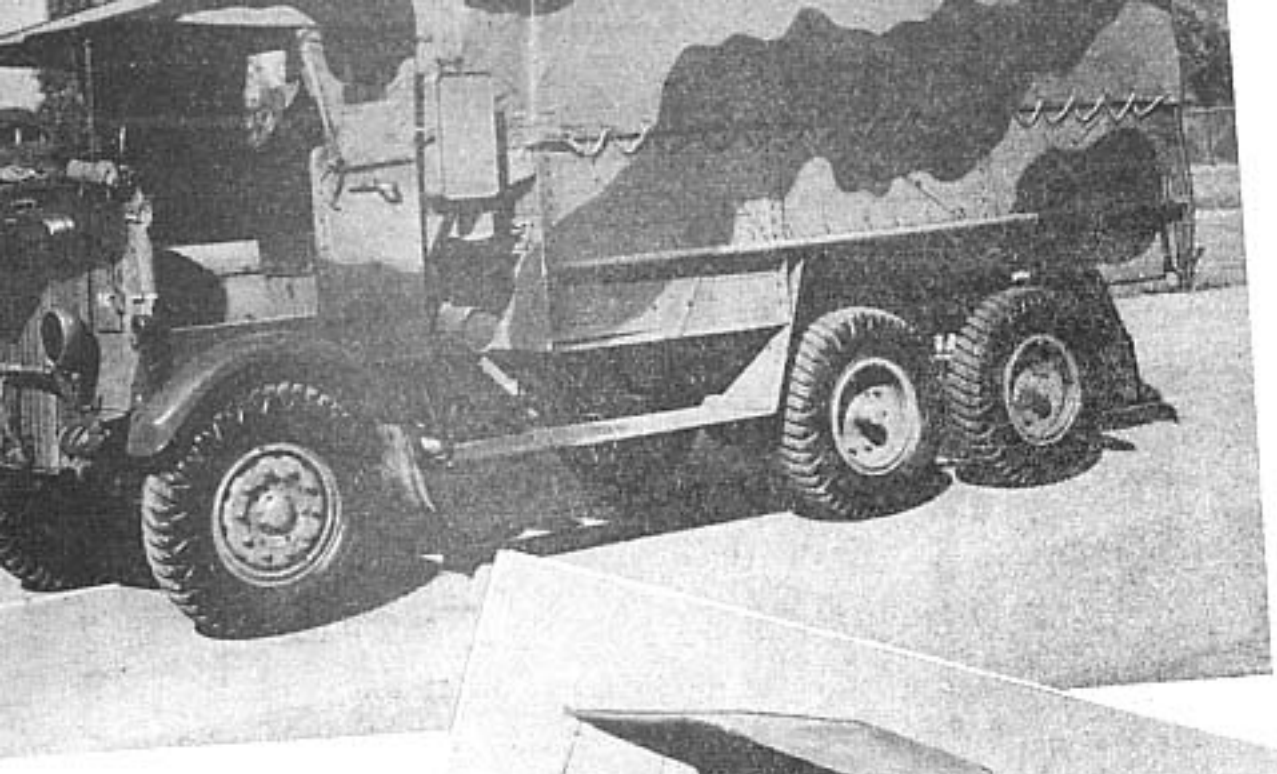


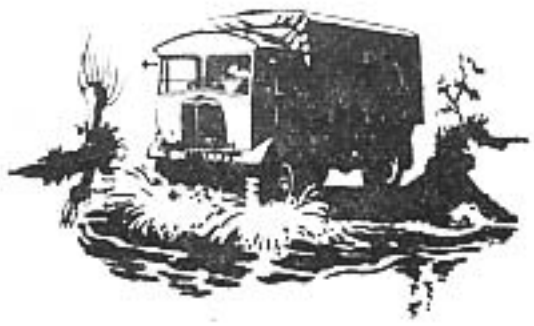
An A.E.C. powered "Valentine" Tank wading ashore.

Negotiating a giant crater this A.E.C. powered "Valentine" Tank is depicted in action in Goch.

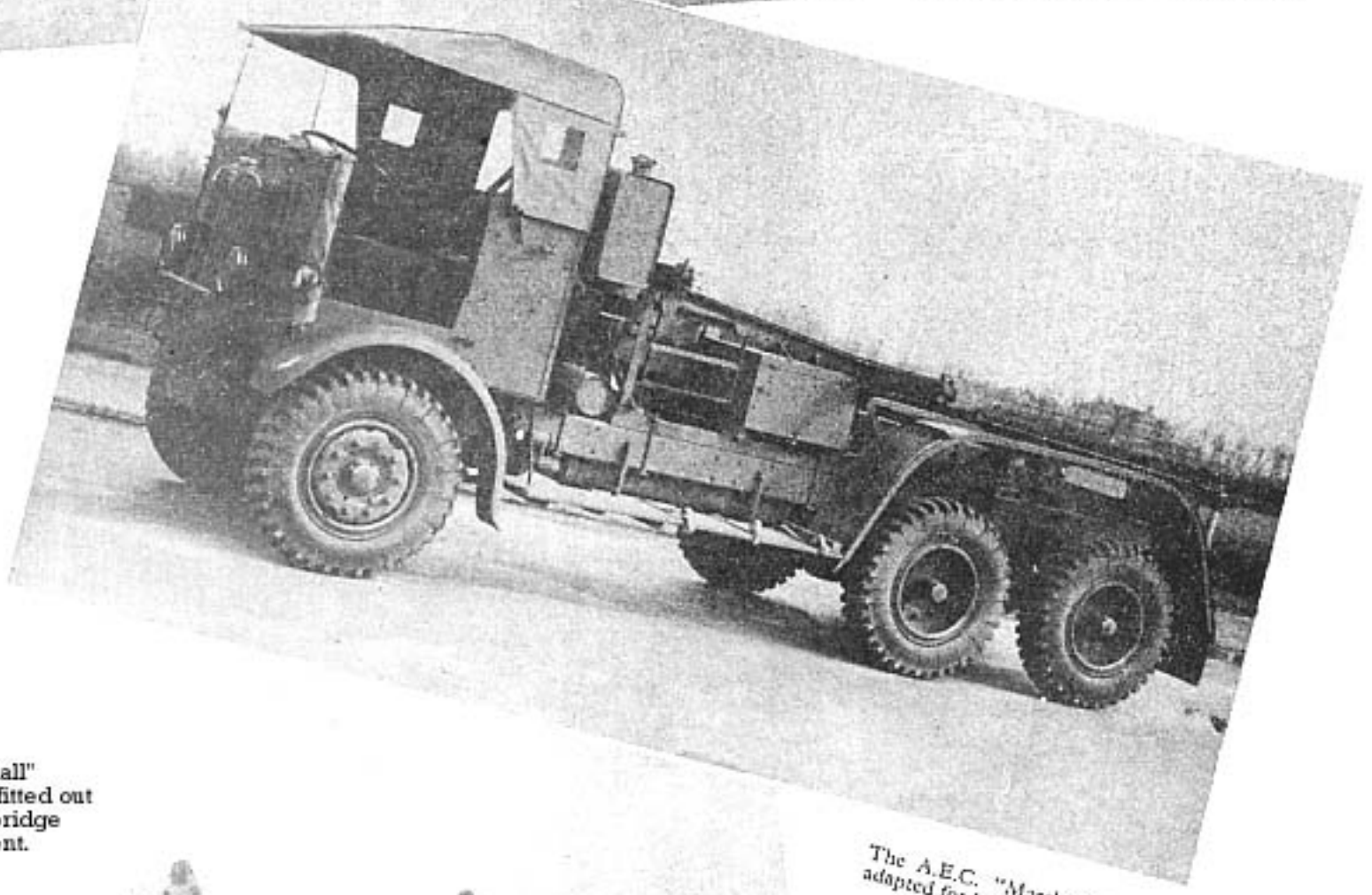


"Valentine" Tanks, powered by A.E.C. 9.6 litre oil engines, specially prepared for "swimming" and waiting to embark on a landing craft for Europe.



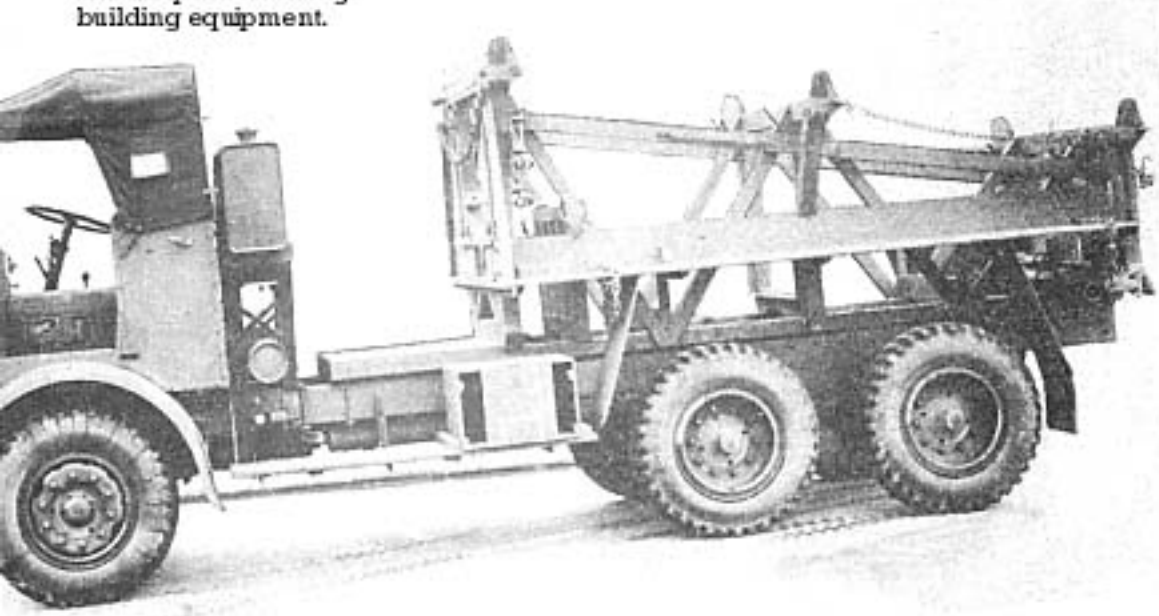


The A.E.C. 6-wheel "Marshall" general purpose lorry equipped with a 5.1 litre 4-cylinder petrol engine.

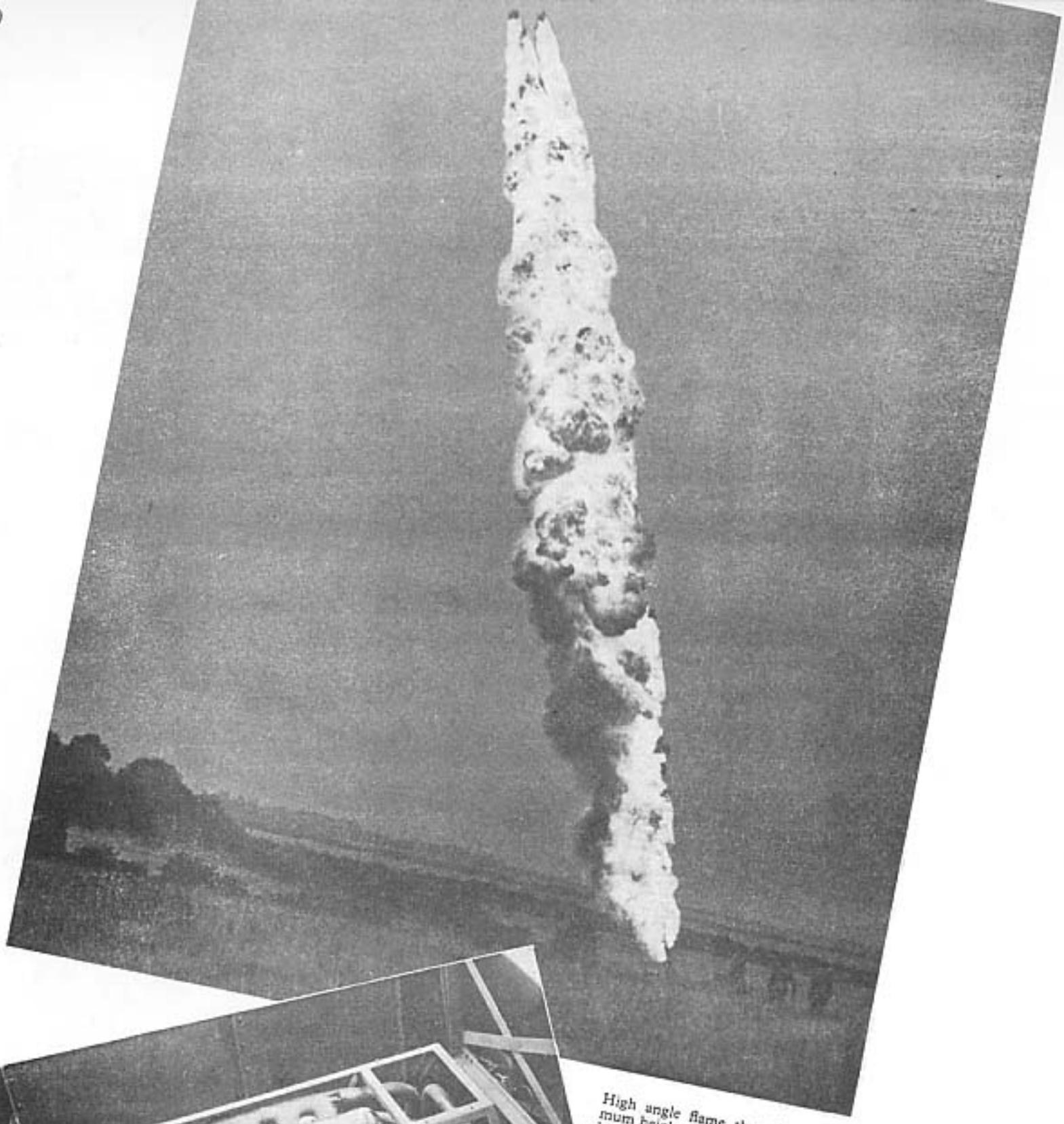


The A.E.C. "Marshall" vehicle adapted for bridge carrying work.

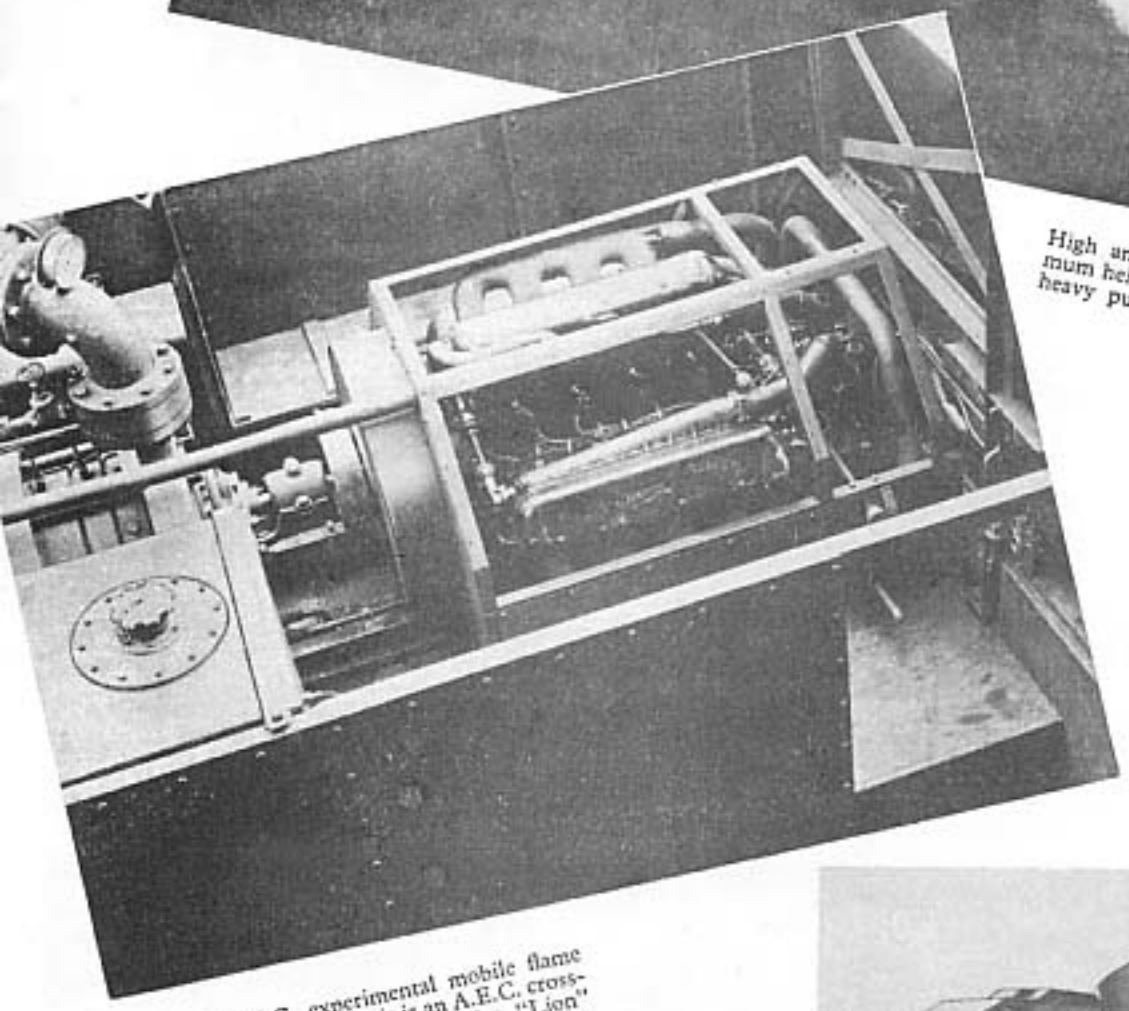
The A.E.C. "Marshall" vehicle specially fitted out and adapted for bridge building equipment.



A convoy of A.E.C. "Marshall" W.D. vehicles leave the Southall factory.



High angle flame throwing, maximum height 325 feet, by the A.E.C. heavy pump mobile unit.



The first A.E.C. experimental mobile flame throwing unit. The chassis is an A.E.C. cross-country type fitted with a Napier "Lion" aero engine direct coupled to a pump for flame throwing equipment.

An early type A.E.C. experimental flame thrower. The flame gun, mounted on a trailer, is capable of operation some distance from the power unit.

of the largest and most heavily armed vehicle of its class that ever went into battle.

Technical details of the Armoured Car chassis design are given in another chapter but here it may be mentioned that the original Mark I model was powered by the same 7.7 litre oil-engine as used in the Company's range of civilian goods and passenger vehicles. It carried a 2-pounder gun and a Besa 7.92 mm. machine gun, whereas the Mark II and Mark III types were armed with a 6-pounder or a 75 mm. gun in place of the 2-pounder, extra power for the two later Marks being provided by the 9.6 indirect-injection oil engine as used in the Valentine tanks.

As may well be supposed, the operation of vehicles of this description under active service conditions in the desert was not always plain sailing and at one time a certain amount of engine bearing trouble was reported from the Middle East. Following a request from the Ministry of Supply, the Company sent their Experimental Engineer to investigate these reports on the spot and during the course of a three months' tour in 1943 he obtained technical information of the greatest possible value.

On arriving at the Middle East headquarters, the A.E.C. representative asked to examine all technical records likely to throw any light upon the alleged failures, a request that was readily granted. After a few hours spent with the officers concerned in sorting out and analysing the documents, the information obtained appeared to indicate that the alleged bearing failures were not attributable to A.E.C. design, materials or workmanship for the simple reason that, whereas four separate workshops in the Delta were overhauling the engines concerned, all report failures emanated from one particular workshop.

A visit was therefore arranged to the shop in question and then it was revealed that the workmanship left much to be desired. The whole trouble was cured with the transfer of an officer from the Advanced Base Workshop at Alexandria where these engines had been overhauled without the alleged defects having appeared at all.

It should be remarked at this juncture that local labour, as high as 96 per cent. of the entire personnel, was employed in all the Middle East Workshops which meant that supervision of a very high class was essential in order to maintain anything like the required standard of workmanship to ensure battle-worthy vehicles.

A visit was next paid to the Middle East Mechanization Experimental Department where the A.E.C. engineer spent a day on the test track which was representative of the worst desert conditions. Here, it became obvious that the people who carried the most vital responsibility were the air-cleaner manufacturers. Unless these accessories were efficient to the last degree, the mortality rate in engines due to sand-produced internal abrasion was appallingly high.

In this establishment one of the original Mark I Armoured Cars was shown on which that standard 2-pounder gun had been replaced by a 6-pounder. A quantity of the larger weapon with turrets and auxiliary equipment had been ordered for the conversion of other armoured cars of the Mark I type to increase their effectiveness in battle. In the same department, two production models of the Mark I armoured car had been fitted with spiked rollers to be pushed ahead of the vehicle to locate minefields for subsequent sweeping by " Scorpions."

At Alexandria many A.E.C. vehicles were in process of routine overhaul and in this instance the visiting engineer was very favourably impressed by the class of work being turned out. The R.E.M.E. personnel had the highest praise for A.E.C. vehicles and apart from a few cracked valve seats, caused by the exigencies of wartime operation or, maybe, the carelessness of drivers in replenishing the cooling water while the hot engines were partly dry, there were no defects whatever to report.

Visits to the workshops at Tel-el-Kebir and Geniffa, near Suez, revealed highly efficient organization, these establishments being comparable with the finest factories at home with nothing makeshift about them. In Sarafand and Haifa, A.E.C. 6-pounder gun carriers, known as " Deacons " were seen on their way to Turkey and good reports were forthcoming about these " stop-gap " vehicles.

On returning to Cairo, a second visit was paid to the workshop from which the reports concerning faulty bearings had originated and it was found that great improvements had taken place with regard to workmanship and supervision and that a steady flow of overhauled engines was being maintained without trouble of any kind.

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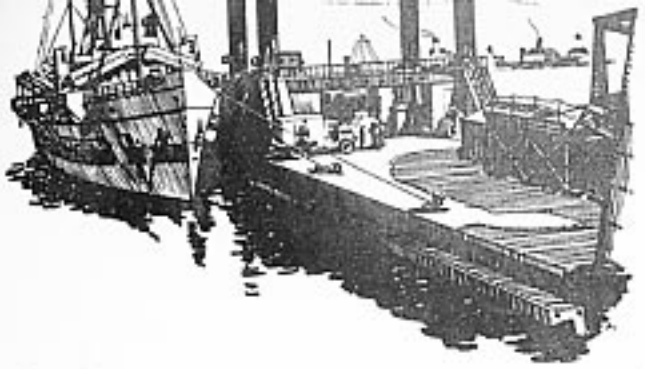
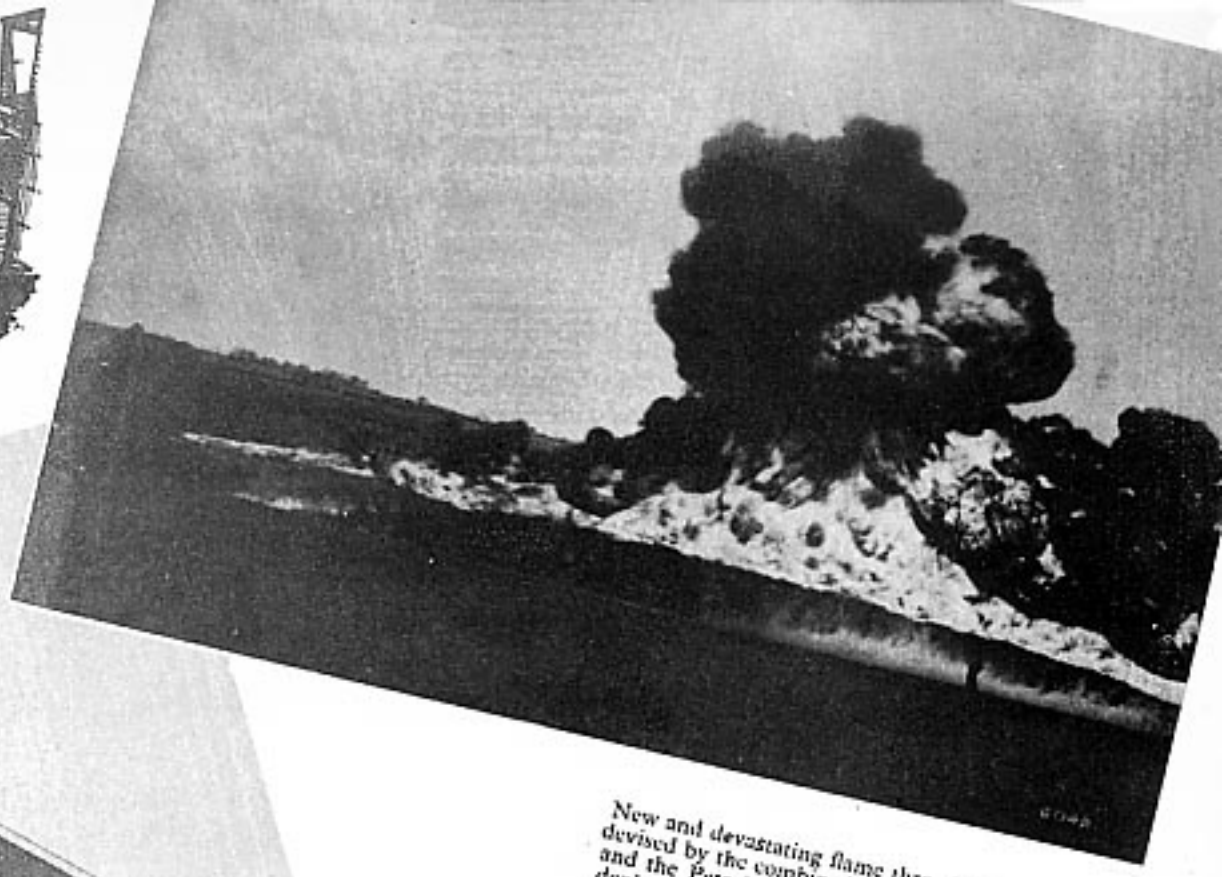
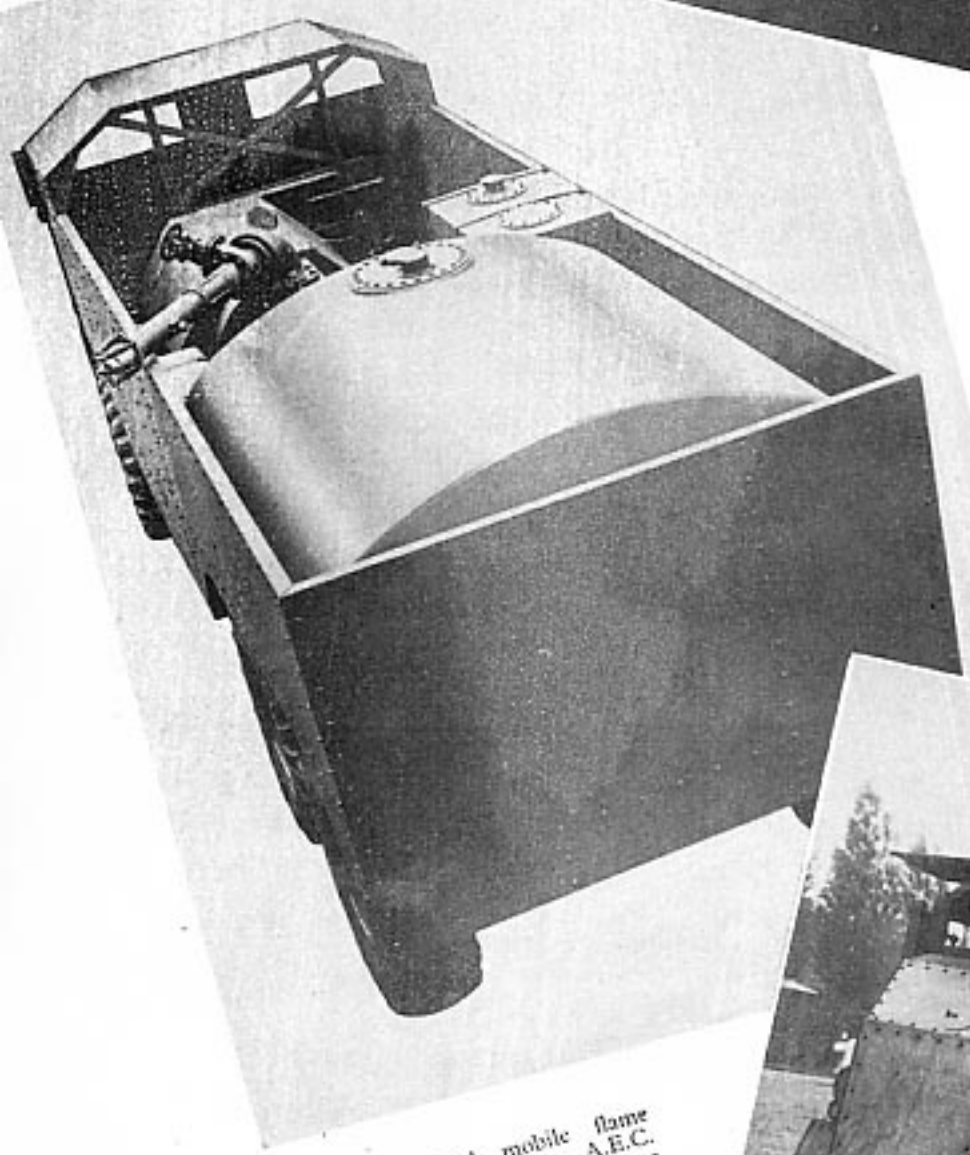




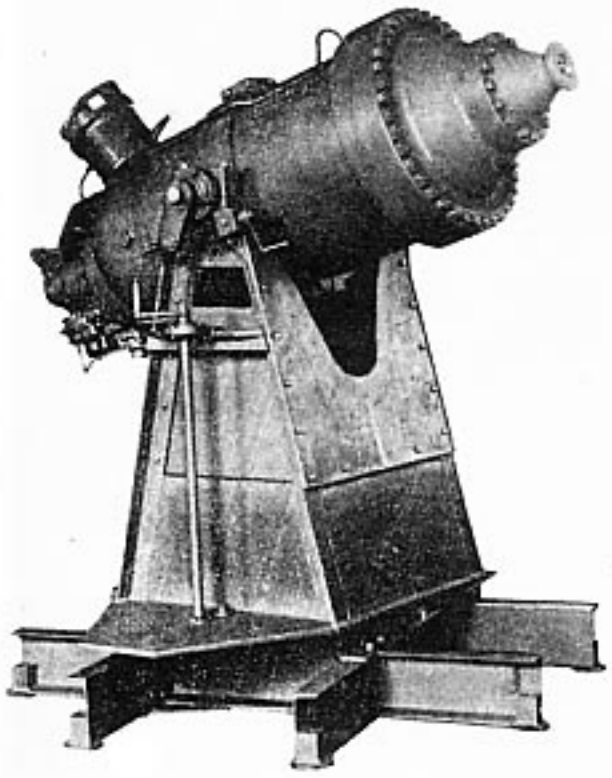
New and devastating flame throwing weapons were devised by the combined efforts of A.E.C. engineers and the Petroleum Warfare Department. Here is depicted a mobile flame thrower in action.



Three-quarter near side view of the A.E.C. trailer type flame throwing experimental chassis.

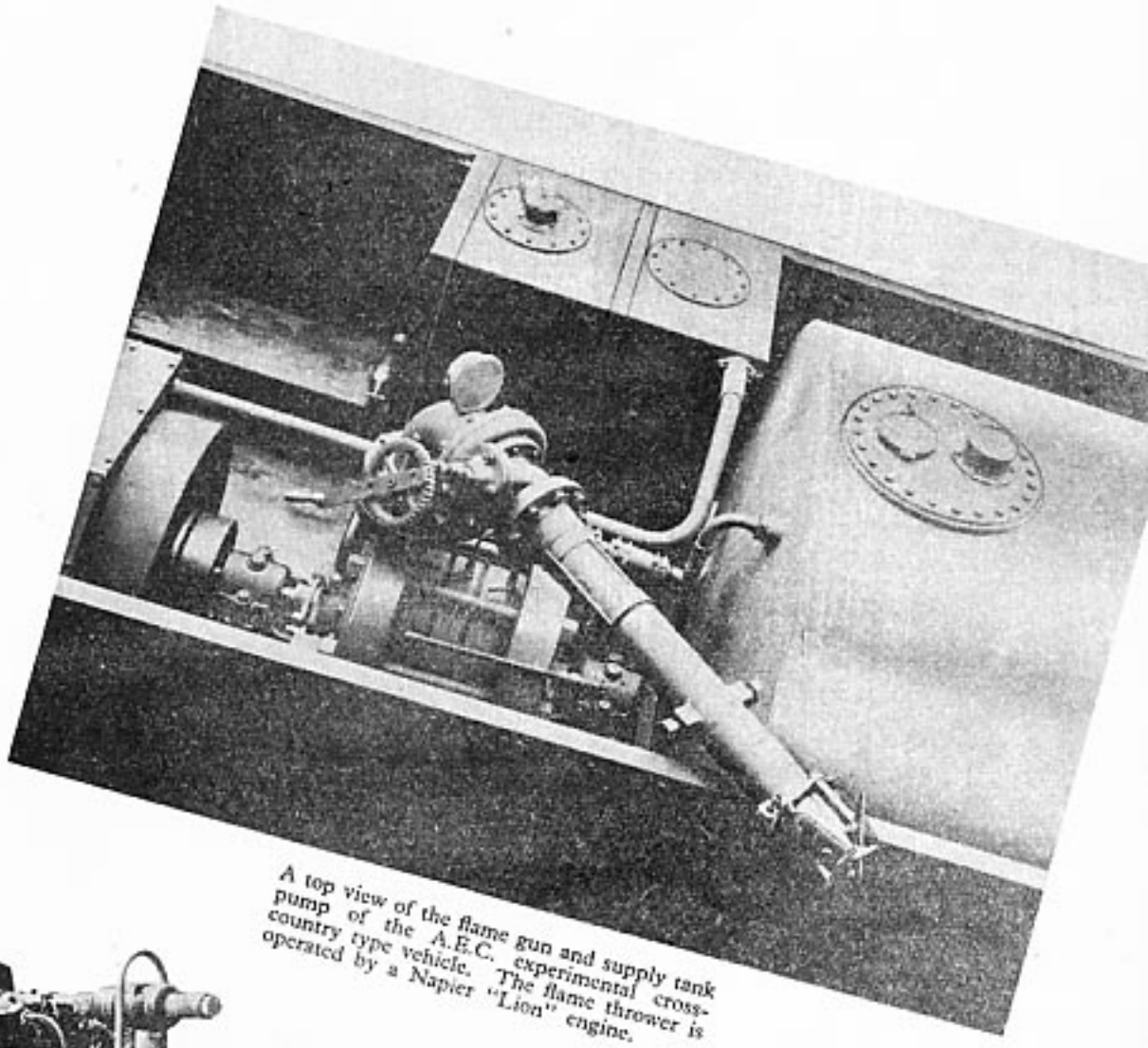
The A.E.C. experimental mobile flame throwing unit, mounted on an A.E.C. 6-wheeled drive cross-country chassis, flame throwing equipment was powered by the Napier "Lion" engine.

"Basilisk" flame thrower fitted to an A.E.C. Mark II Armoured Car—developed for the Petroleum Warfare Department.

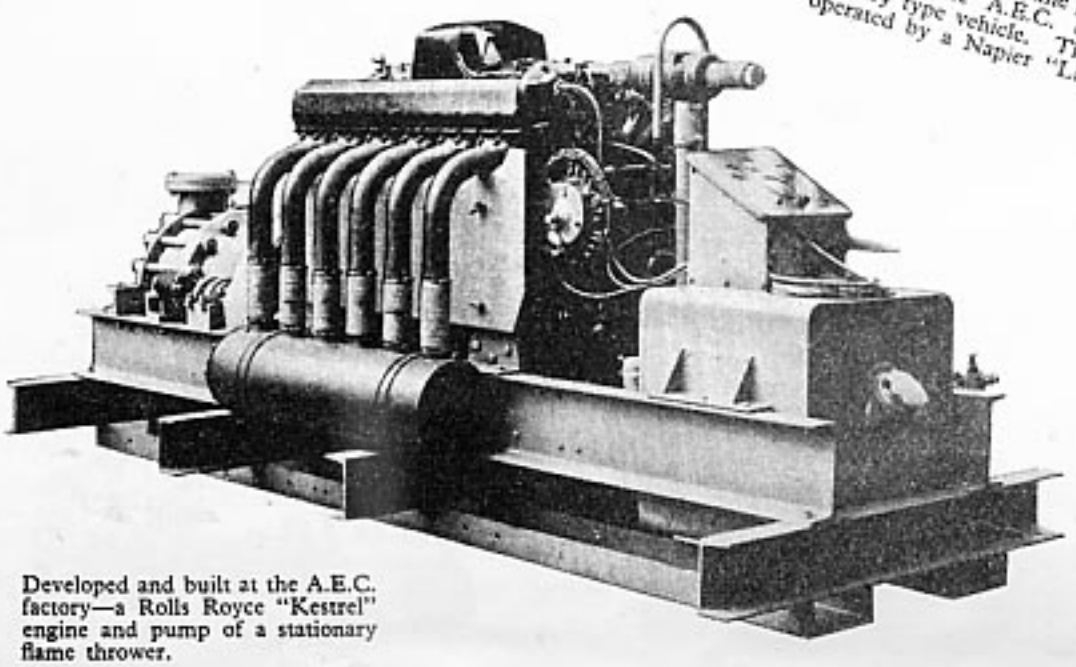


An A.E.C. built cordite operated stationary type flame thrower developed for harbour defence work.

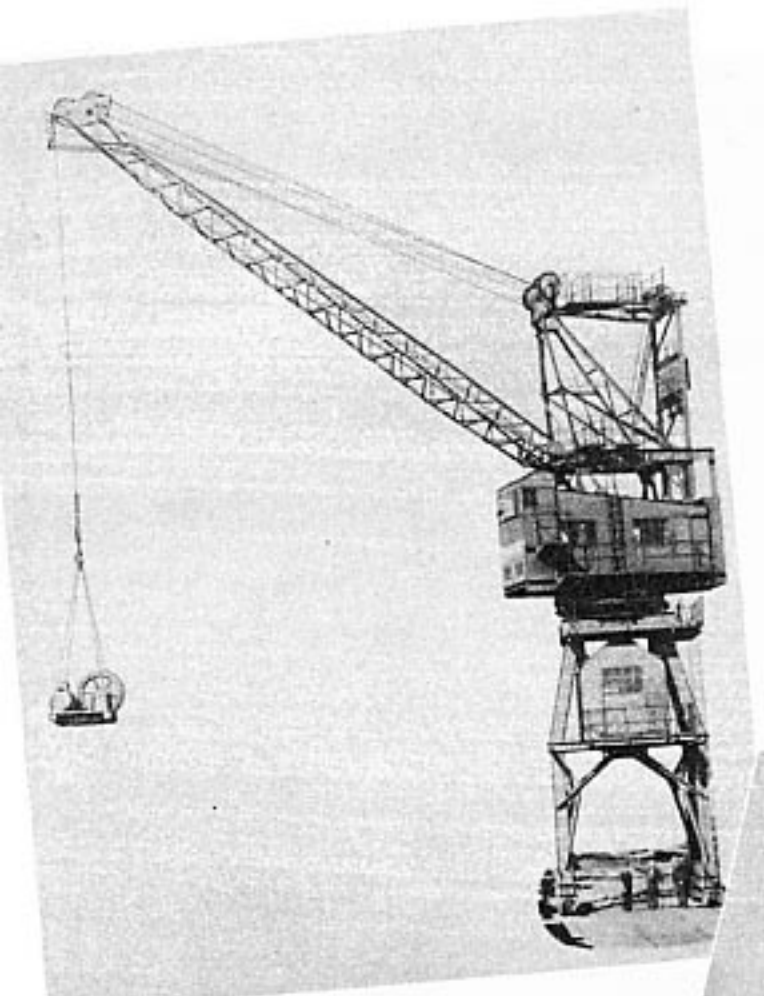
Behind the ultimate efficiency of these flame throwing machines lay over two years' intensive development work.



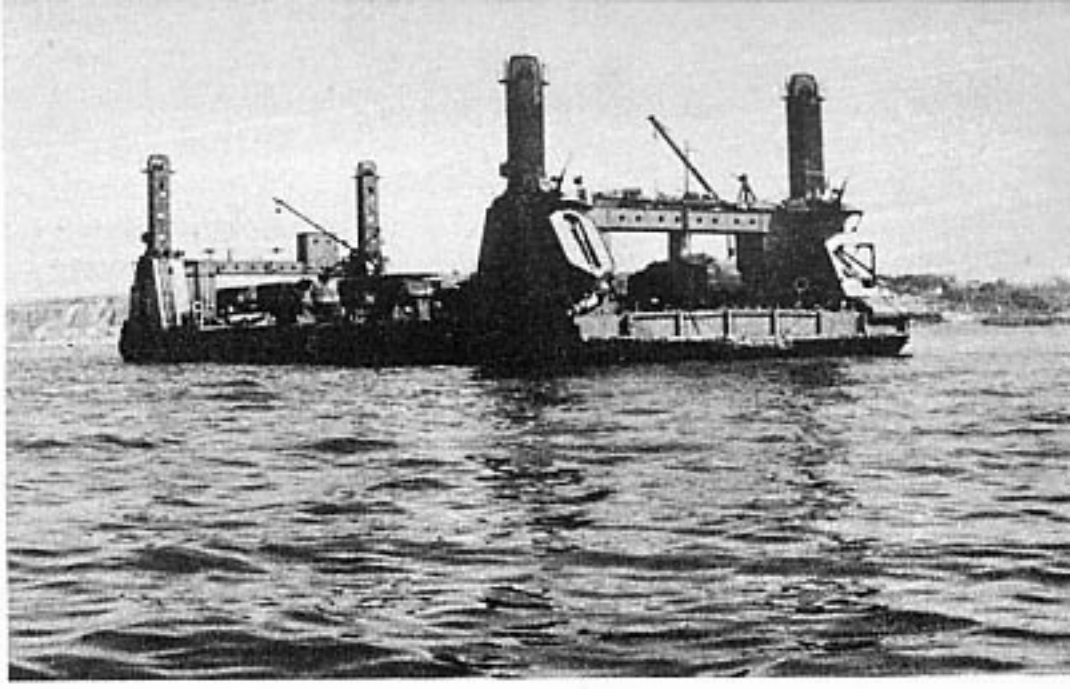
A top view of the flame gun and supply tank pump of the A.E.C. experimental cross-country type vehicle. The flame thrower is operated by a Napier "Lion" engine.



Developed and built at the A.E.C. factory—a Rolls Royce "Kestrel" engine and pump of a stationary flame thrower.

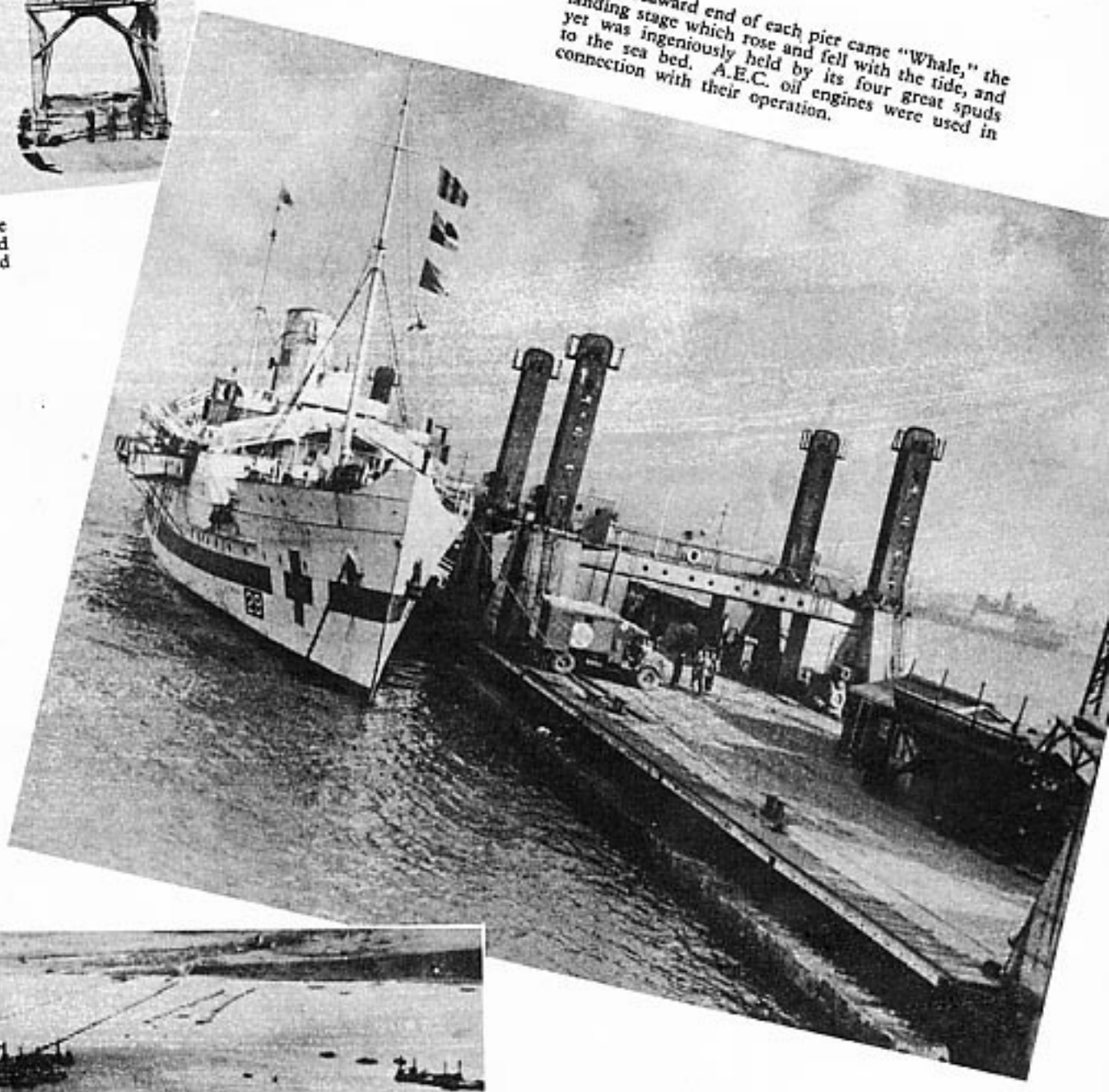


Large numbers of A.E.C. oil engines were supplied for Stothert & Pitt cranes depicted here. The cranes were kept fully employed on war-time loading and unloading.

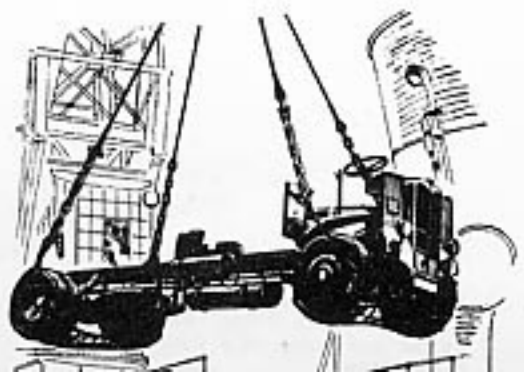


A.E.C. is proud to be listed amongst the many firms who contributed work towards that grand enterprise —the "Mulberry" Port. A.E.C. oil engined generating sets provided power, light and heat.

At the seaward end of each pier came "Whale," the landing stage which rose and fell with the tide, and yet was ingeniously held by its four great spuds to the sea bed. A.E.C. oil engines were used in connection with their operation.



A general aerial view of a section of the great "Mulberry" harbour.



Proceeding by aeroplane to Tripoli, visits were next paid to the Advanced Base Workshops where it was noticed that much of the machine tool equipment in use had been left behind by the Germans. At this place, the first battle casualties of the Mark I Armoured Car were inspected. Six of these vehicles had lost their front axles while crossing minefields, others had broken dumb irons while two cases of engine failure were reported. These defects turned out to be nothing more serious than a faulty injector in one case and in the other a blown cylinder head gasket which had been defective for so long that a groove had been burned in the cylinder block with a corresponding groove in one cylinder head.

As the Mark I vehicle was fitted with the " Matador " engine, it was an easy matter to draw a spare cylinder block and one head from the stores and it was thus possible to restore both vehicles to fit condition for returning to their formations after 24-hours' work.

Then travelling by car for 200 miles forward to the Mareth Line, a halt was made south of Gabes where heavy fighting was still in progress. Here a discussion took place with officers of two units who were actually using the Mark I Armoured Cars in battle. Both units had nothing but praise for the vehicles, their only regret being that they had not enough of them and that they had not been available earlier.

Before leaving for home, A.E.C.'s Experimental Engineer was shown a personal report from General Montgomery asking for the 6-pounder A.E.C. armoured cars to be urged, thus affording further evidence of the high esteem shown by those in high authority for the Company's wartime productions.

Referring to an entirely different kind of weapon, the Company played a very prominent part in the experimental development of land-mine sweeping equipment. This equipment was fitted to Matilda, Valentine and Sherman tanks and afterwards the combination was known as the " Flail Tank " and proved highly successful during the desert warfare. The idea of the land-mine sweeping flail is attributable to a South African Major who was sent to this country by his Government to assist in developing the equipment. While on his way to England the Major broke the journey at Alexandria and during his short stay there passed sufficient information about his invention to the Director of Mechanical Engineering (Middle East) to enable R.E.M.E. workshops to construct the flails. Later in collaboration with the Research and Experimental Department at Southall, the inventor worked on prototype apparatus which was developed in the Works and applied to a " Matilda " tank. The flail was driven by an auxiliary engine mounted outside the vehicle, the new combination being known as the " Baron." An application to the " Valentine " tank was known as the " Scorpion." The later application to Sherman tanks presented a marked improvement in that power to drive the flail was taken direct from the tank main engines, thus dispensing with the vulnerable external units as in the case of the earlier designs.

When the experimental and development work was completed, all the drawings and technical data concerning flail development were passed over to the Ministry of Supply, in order that large scale production of the components could be carried on at other factories, since the plant at Southall was already working to capacity. At the same time, the Company continued to act as the parent concern throughout the War.

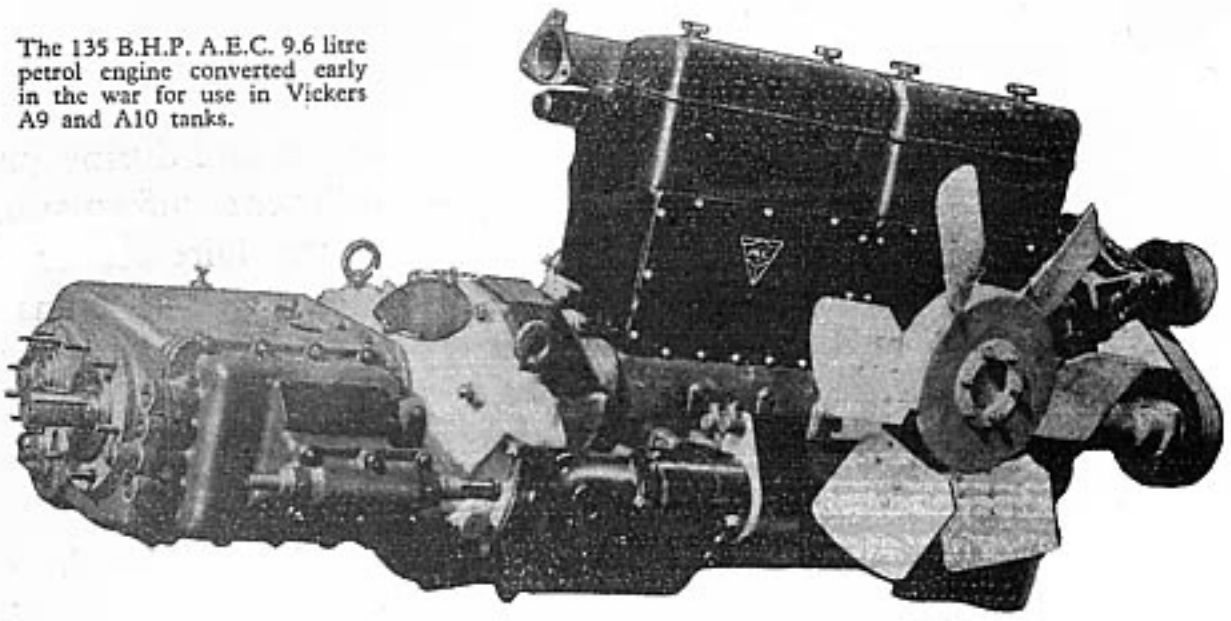
When the British Forces went back to France, via the Normandy beaches, they took with them new and devastating weapons. Among the deadliest were the flame-throwers, consuming men, armour and buildings in a holocaust of fire. Behind the ultimate efficiency of these machines lay two solid years of intensive development work.

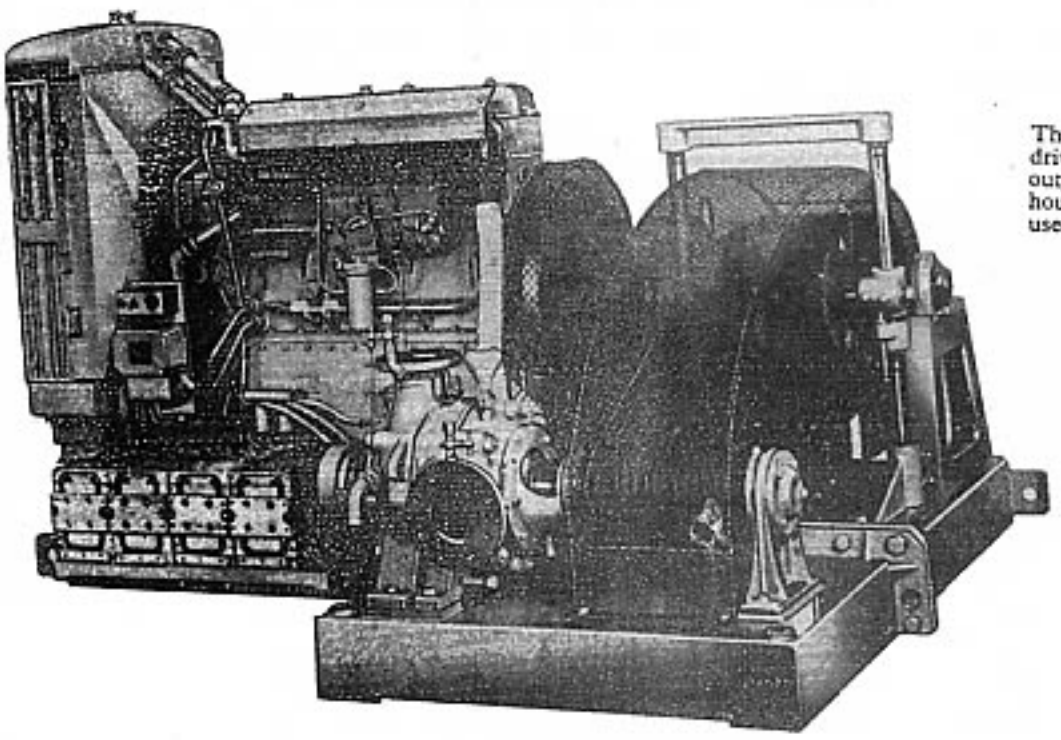
In that work A.E.C. engineers combining their efforts with the petroleum warfare department, under the direction of Col. Sir Donald Banks, K.C.B., C.B., D.S.O., T.D., took a prominent part. For it was at Southall that the first mobile flame-thrower unit was devised and fitted to an A.E.C. 6 x 6 chassis before the apparatus was developed on a larger scale for use on armoured cars and tanks. For this experimental model, a disused Napier " Lion " engine was used to drive the Mather & Platt multi-stage pump to force combustible liquid through the jets at the rate of 750-gallons per minute.

The next development in flame-throwers was the design and construction of a stationary unit suitable for installing at Naval Dock-

[*Continued on page* 69

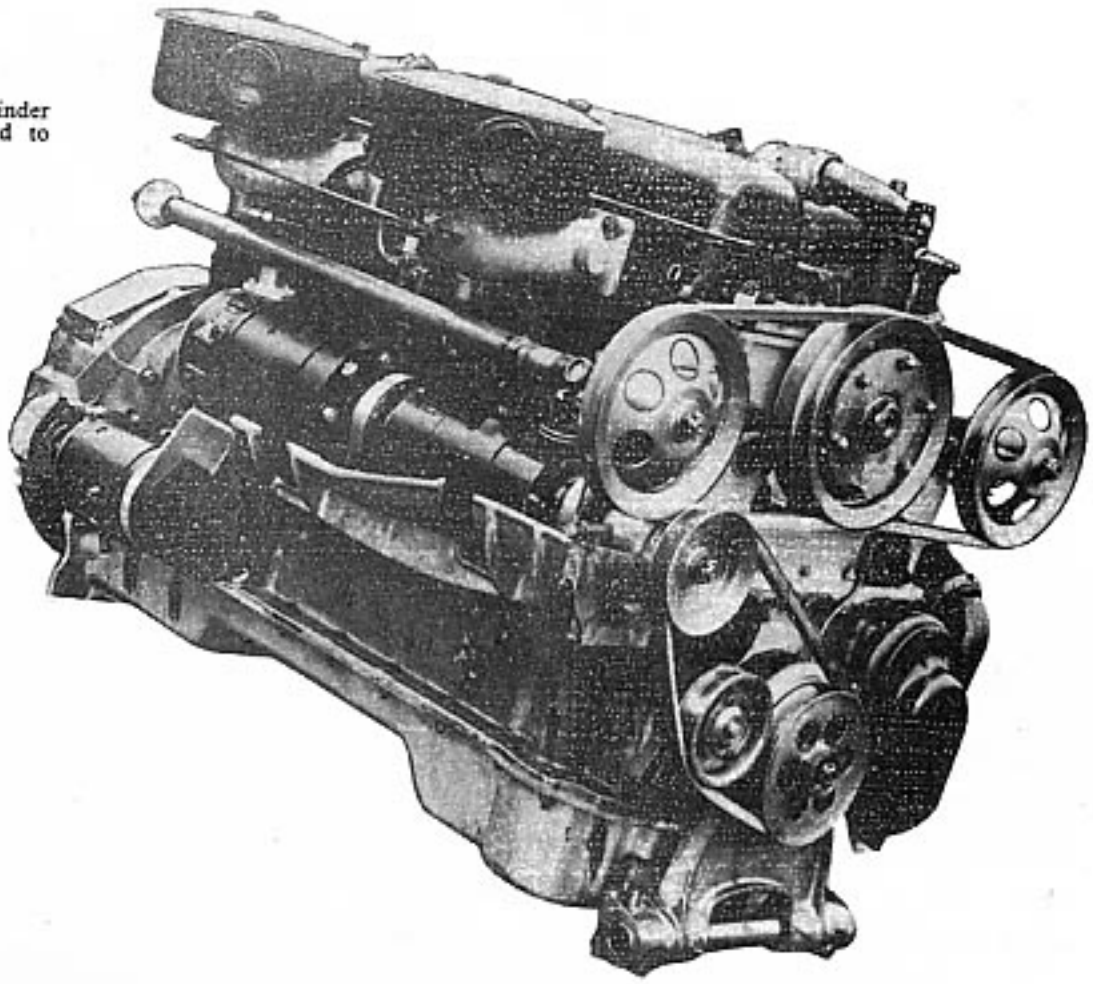
The 135 B.H.P. A.E.C. 9.6 litre petrol engine converted early in the war for use in Vickers A9 and A10 tanks.



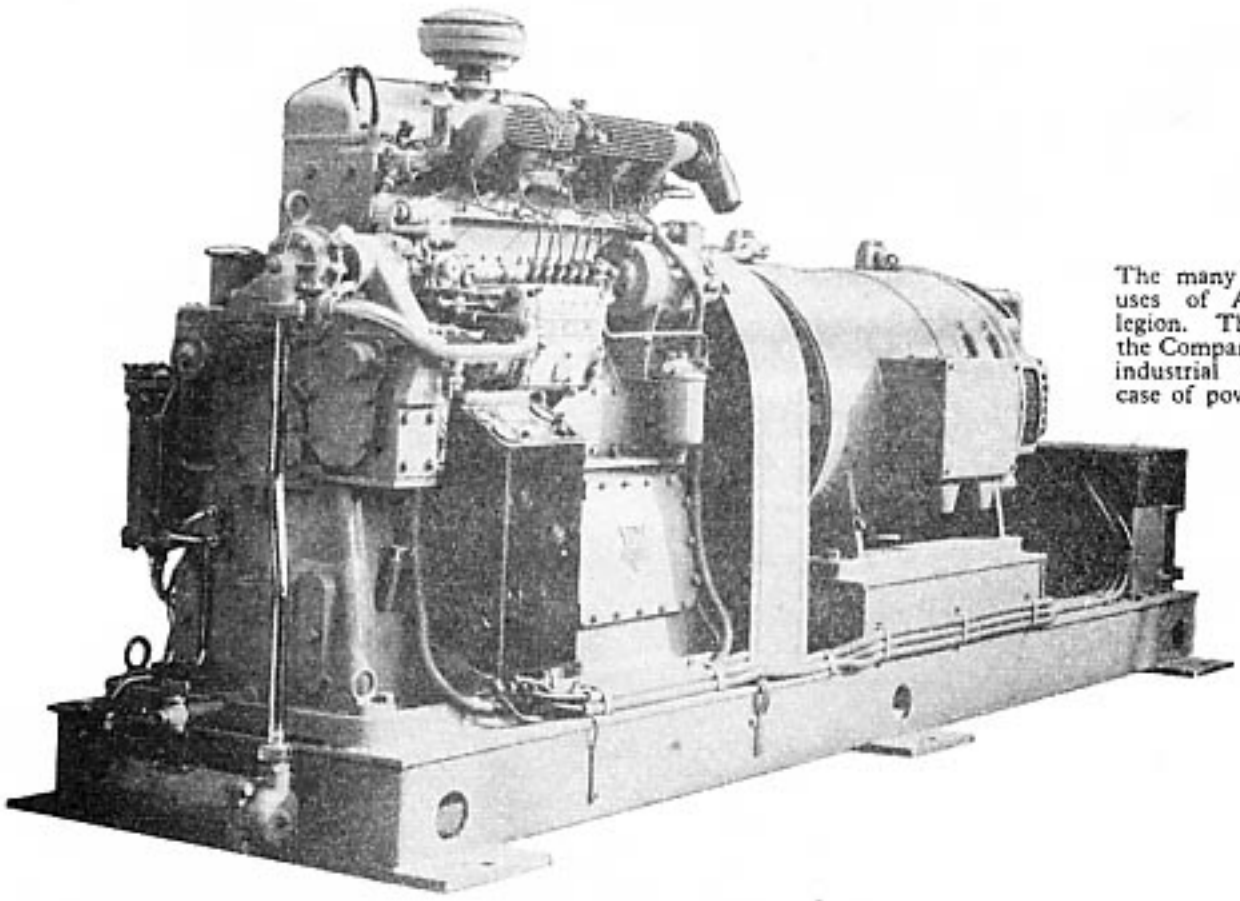


The A.E.C. industrial oil engine driving a Sulzer pump with an output of 2,400 gallons per hour. One of many such units used on the "Mulberry" harbour.

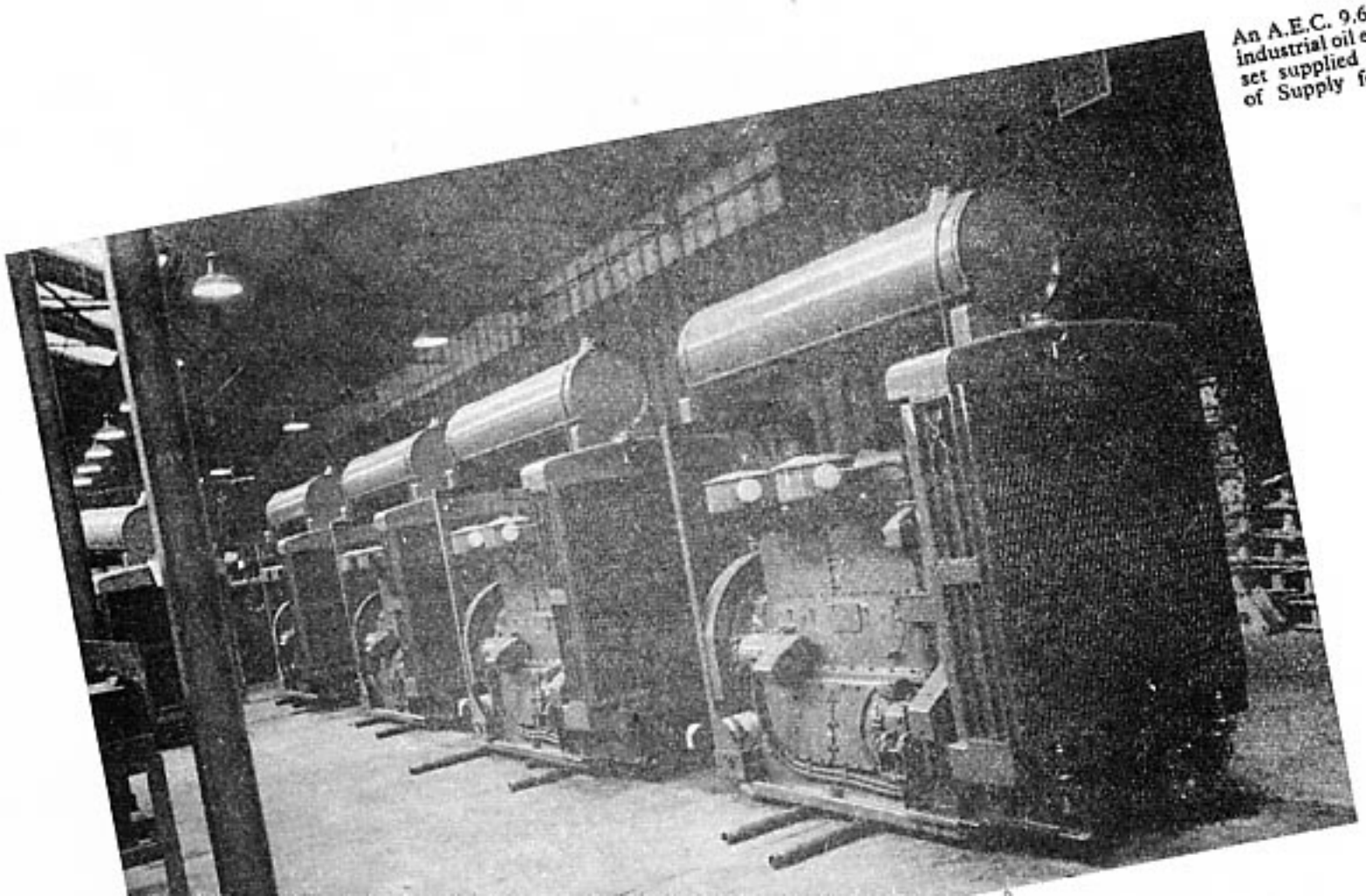
The A.E.C. 9.6 litre 6-cylinder 145 B.H.P. oil engine fitted to "Valentine" Tanks.



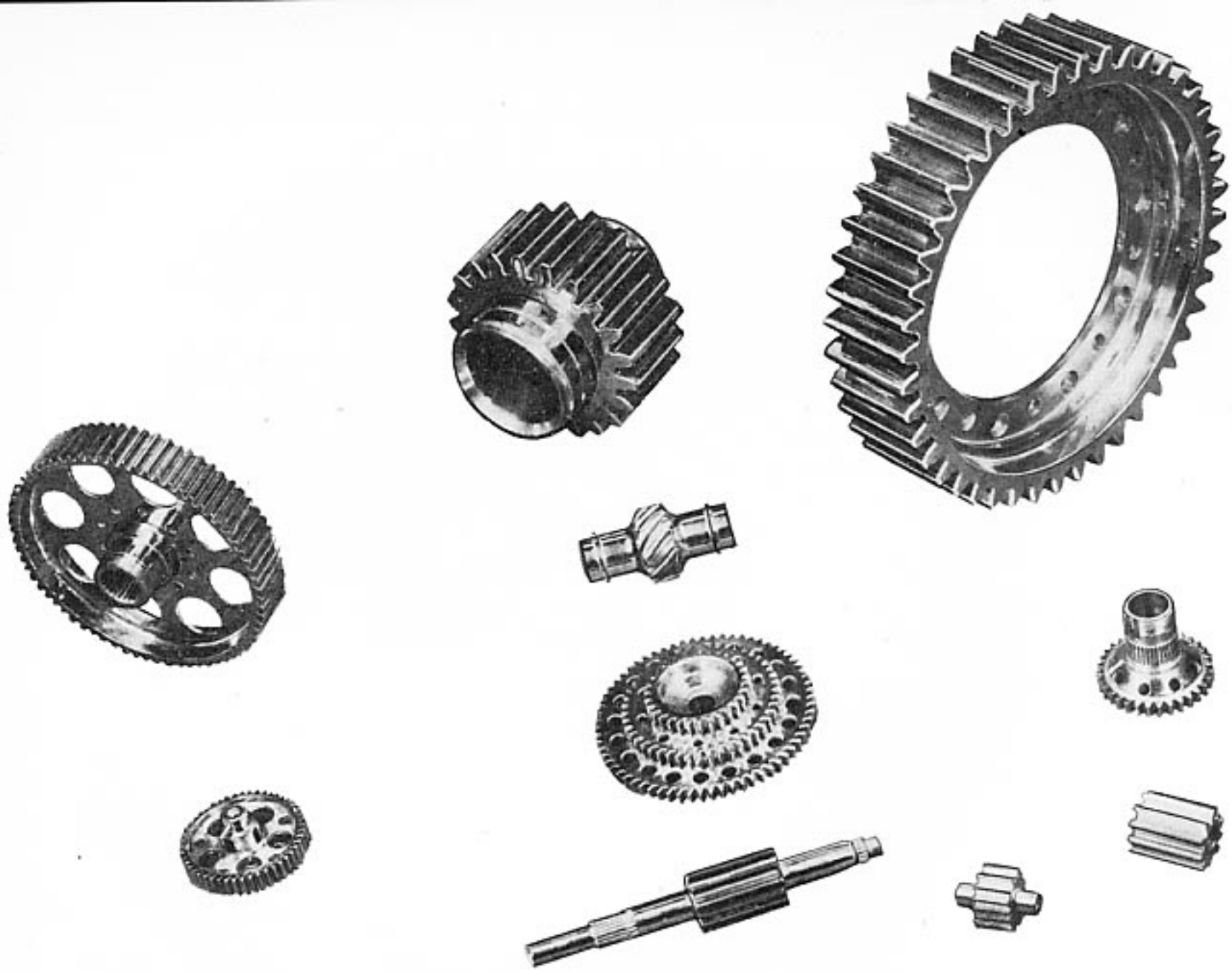
An A.E.C. 8.8 litre 6-cylinder industrial oil engine generating set for use as emergency current supply to London Hospitals.



The many and diverse war-time uses of A.E.C. oil engines is legion. This picture shows one of the Company's 6-cylinder stand-by industrial sets for operation in case of power failure.



An A.E.C. 9.6 litre 6-cylinder industrial oil engine generating set supplied to the Ministry of Supply for use in India.



A subsidiary company of the A.E.C., The British Gear Grinding and Manufacturing Co. Ltd., contributed important work that helped considerably to maintain Britain's air supremacy. Shown on this page (top) is a set of Rolls Royce "Merlin" gears ground by the above-mentioned company and (below) a "Merlin" 61 aero engine exhibited at the Southall works.

yards for defence measures and later in pill-boxes at the battle front against attack. The same make of pumping machinery was incorporated, but in this instance the power was provided by a Rolls-Royce " Kestrel " engine.

Later, A.E.C. engineers experimented with trailer units with flame-throwing equipment in very compact form for towing behind tanks, a design known as the " Crocodile." Finally, with the idea of employing flame-throwing tactics at higher speeds than had been possible hitherto, the necessary plant was installed in an A.E.C. armoured car. The machine was named " Basilisk " but it was only built in prototype form because the war came to an end before its manufacture in quantities was started.

Conducted under conditions of the greatest possible secrecy in sequestered parts of the country, the trials of these terrifying machines produced something akin to awe in the minds of those who witnessed the devastation they could effect, but the prevailing thought was " war is war " and the Company's personnel could not allow themselves to relax in any way with regard to the awful weapons they were ordered to produce.

A.E.C. Diesel-Electric sets provided main power, light and heat, and for operating the large winches for driving the 47-ton spuds into the sea bed for the Mulberry port that sailed across the Channel and enabled the Allied armies to storm the Northern shores of France, which history will record as the greatest engineering achievement of the war.

Conceived at Quebec in 1943, Mulberry A and B, two separate ports, each the size of Dover Harbour, and weighing in all 3,000,000 tons, were built and assembled within six months in the works and shipyards and the wind-swept estuaries of Britain. Neither winter, the blackout nor bombing was allowed to retard the task and on " D-Day " 6th June, 1944, 150 tugs towed to the Normandy coast the 146 concrete caissons, the 10 miles of piers and the 22 " Whale " pierheads that made up the first prefabricated port ever to be constructed.

Its subsequent history is well known—how on D-plus 13 the worst summer gale for forty years damaged Mulberry A so badly that it was practically abandoned, but Mulberry B in a more sheltered anchorage fulfilled the fateful hopes vested in it and by D-plus 20 had enabled 1,000,000 men to land at Arromanches.

Many will recall the statement of Mr. Ernest Bevin, when Minister of Labour, early in 1945, that the Mulberry ports must have saved Britain and America between 100,000 and 150,000 casualties

The number of firms that contributed in large or small measure to the making of Mulberry was legion.

Altogether fifty-seven of these diesel-electric sets were supplied for Whale pierheads. In each case the oil engine was of the A.E.C. six-cylinder Comet Mark III stationary type, developing 100 b.h.p. at 1,500 r.p.m., the set absorbing 57 kilowatts at 1,400 r.p.m.

It has since been learned from the War Office that several of the sets put up an average of 8,000 hours almost continuous running with no more attention than the usual adjustment of tappets. A further 80 A.E.C. stationary engines were used to drive the Sulzer pumps by which both water and fuel were supplied to many different points in the harbour area. These, too, mostly operated by unskilled labour, gave the same high standard of reliability throughout their many months of constant service.

Stationary engines for Mulberry by no means exhausts the number of ways in which these units were employed at different periods of the war. Minesweeping, standby power for Combined Operations Headquarters, combating the magnetic mine, supplying power for dockside cranes, operating the magnetic defences of a Scottish estuary—in these and other ways the A.E.C. stationary and auxiliary marine type oil engines have played their part whenever and wherever reliability has been a prime consideration.

So much for generalisation concerning A.E.C. marine and stationary power units and to deal more specifically, certain important applications in the war effort may be mentioned. For example, it was " nobody's business " as to what went on in the " Dynamo " at Chatham, situated at a depth of 100 feet underground, but early in 1939 an A.E.C. 100 b.h.p. diesel-electric plant was installed to assist in whatever was done there.

Mention of Chatham recalls how a fleet of trawlers was brought from Yarmouth and

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Formerly working in a sub-post office these women operatives are reconditioning injector nozzles.

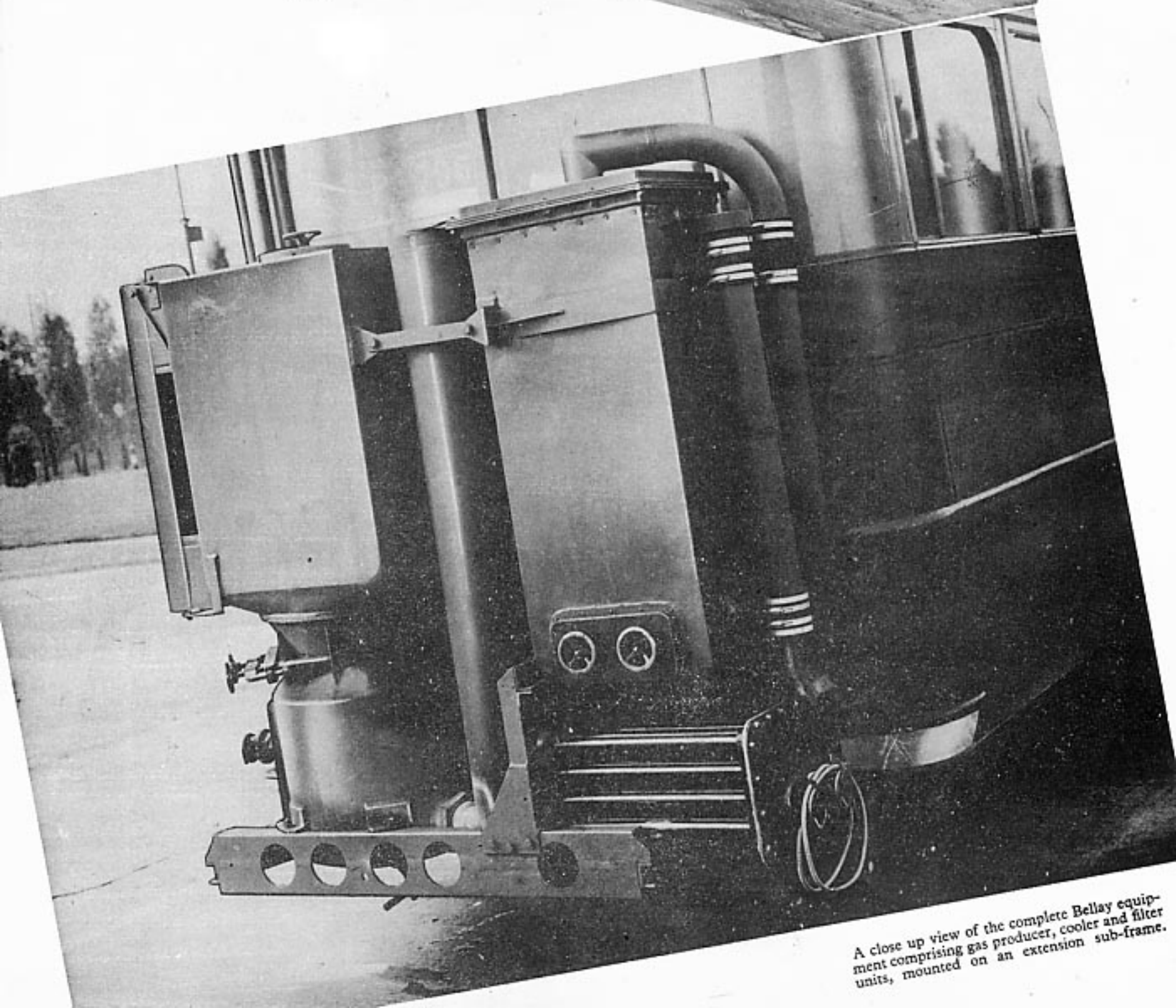
WOMEN AT THE WORKBENCH IN WARTIME

Testing injector nozzles.

Inserting studs in reconditioned cylinder heads.

Assembling reconditioned connecting rods

Gas producer experimental work was undertaken at the A.E.C. factory. The L.P.T.B. bus depicted here was equipped with the Bellay system.



A close up view of the complete Bellay equipment comprising gas producer, cooler and filter units, mounted on an extension sub-frame.

Lowestoft to be concentrated at the port for minesweeping purposes, utilising the ship's auxiliary type of oil engine for degaussing of these craft.

In 1940, at Killingholm, near Hull, an A.E.C. 58 b.h.p. stationary oil engine was supplied for operating a pumping set at this important naval refuelling station.

There was also a very large order for 365 A.E.C. six-cylinder stationary oil engine sets for special dockside mobile cranes, of 11-tons lifting capacity, built by Messrs. Stothert & Pitt, Ltd. These were shipped to Normandy and various rehabilitation centres as the war progressed and our victorious armies advanced.

A.E.C. stationary oil engines also played an important part as standby sets for generating electricity in hospitals and for various other requirements. No fewer than 200 of these power-generating sets were supplied to contractors for installation.

Many of the private yachts requisitioned by the Government were already equipped with A.E.C. marine oil engines and some of them completed after the outbreak of war were taken over as Government craft.

The Company, in conjunction with certain electrical firms, developed, under the direction of an Admiralty technical committee, of which certain A.E.C. staff were members, the diesel-electric equipment for 1 in 40 cycle mine sweeping equipment and produced in 1940 prototypes of these engines for H.M. sloop " Sharpshooter."

The design and manufacture of power units for tanks formed no small part of the Company's war work which was carried out in conjunction with the Ministry of Supply and Department of Tank Design. For the " Matilda " tanks, the A.E.C. built 381 pairs of twin oil-engines, together with certain transmission gear; 353 petrol engines of 140 b.h.p., and no fewer than 3,254 oil-engines were manufactured for " Valentine " tanks. Mention must also be made of the Company's work in connection with the development of tank suspension and general improvements in the fast-moving tank tracks which had an immense bearing upon the ultimate success of British machines in mastering the most advanced types of German fighting vehicles.

At this juncture further details of the work performed by the British Gear Grinding and Manufacturing Co. Ltd. call for attention. The company, a subsidiary of the A.E.C. then had its main works at Southall and a shadow factory at Hillingdon, Middlesex. Throughout the war many of this company's machine tools were engaged continuously in the precision grinding of gears for the Rolls-Royce " Merlin " and " Griffon " as well as for the Napier " Sabre " engines. The " Merlin " is widely known as the power unit of the Spitfire, Hurricane, Mosquito and Lancaster aircraft. It would be true to say that every Spitfire and Hurricane engaged in the Battle of Britain contained gears ground by the British Gear Grinding and Manufacturing Co. Ltd.

It was at one of the most critical periods of the war that the Rolls-Royce Company called for an additional 600 oil pump gear as spares for a Hurricane Wing sent to Russia. There was a fourteen days' time limit without prejudice to the normal production programme. The position was explained to the workers, everyone of whom put forth a sustained and determined effort, with the result that the order was completed in 10 days or equivalent to a 40 per cent. increase in output.

With the fall of France, the position of this company with regard to output became very serious. Machine tools ordered from the Continent and urgently needed to cope with the rapidly increasing " Sabre " engine production programme were suddenly and irretrievably lost. No alternative machine tools were available in England suitable for grinding the final helical reduction gears of this particular engine. The only solution to the difficulty was to copy one of the two machines possessed by the Company. Once again British engineering skill, resourcefulness and energy saved the day. Drawings were made, patterns completed, sometimes in advance of the finished drawings, and the first of the six new universal gear-grinding machines was built and delivered to the shadow factory within twenty-six weeks of starting the first drawing. Following this achievement, production plant was progressively increased to the ultimate extent of 300 per cent.

Collaboration between the British Gear Grinding and Manufacturing Co. Ltd. and D. Napier & Son Ltd. was constant and close, not only in essential matters affecting production but also in the development of " Sabre " gears and in tracking down and correcting initial teething troubles. Despite

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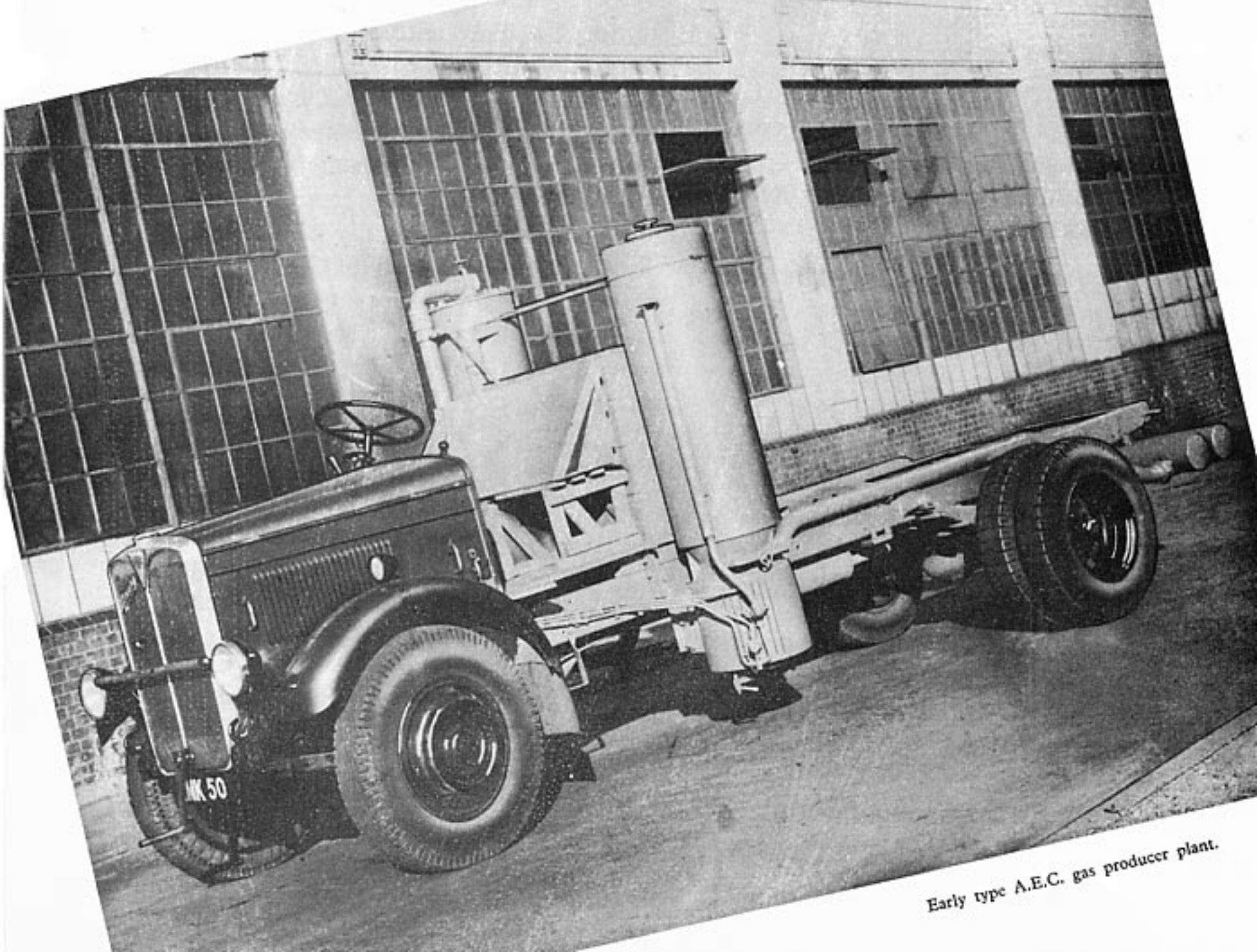
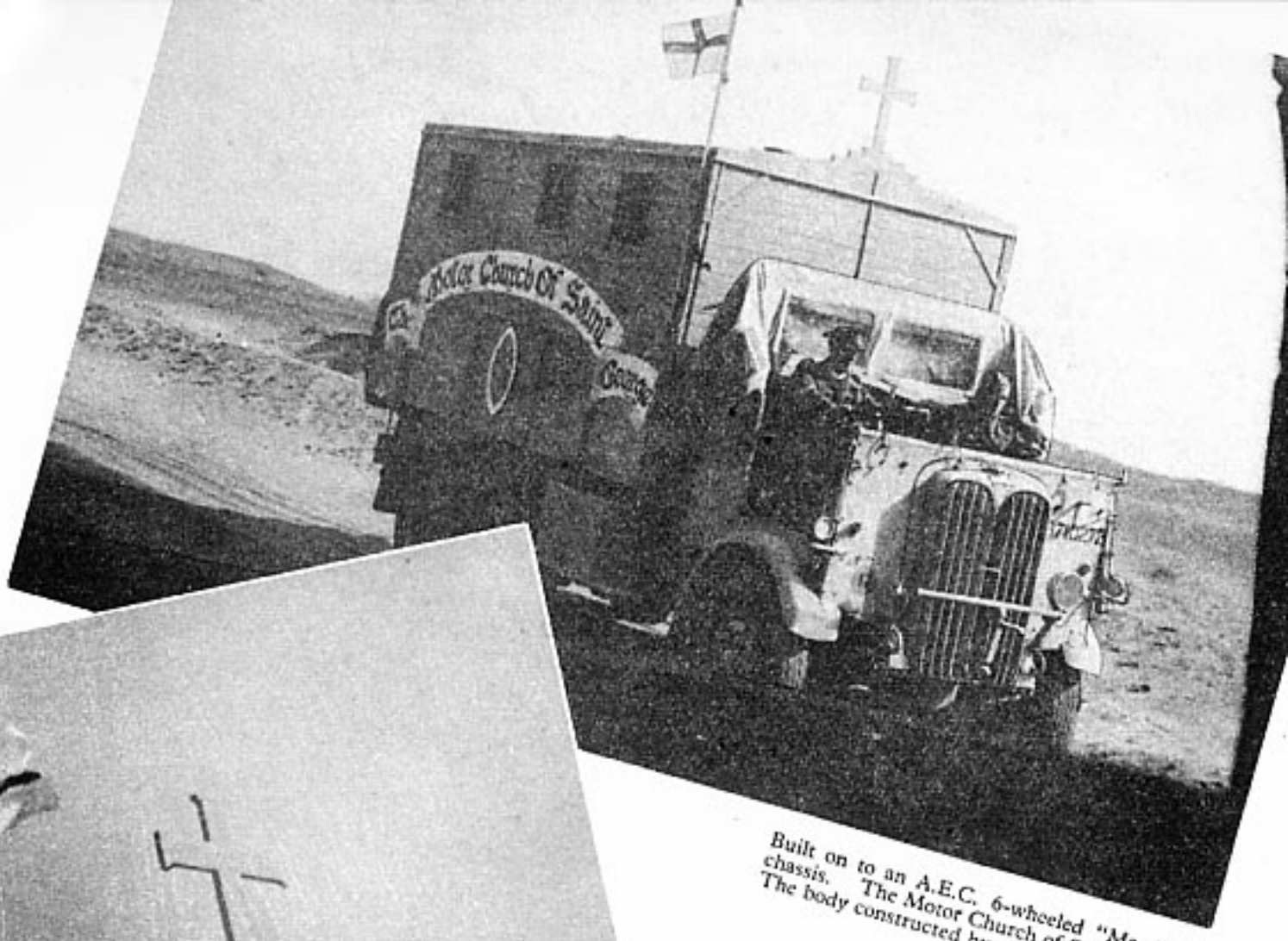
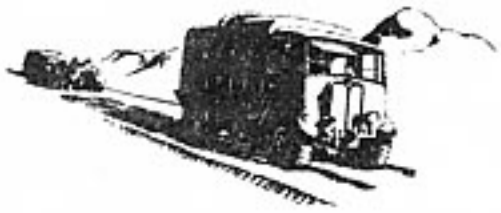
An A.E.C. "Mammoth Major" 8-wheeled tanker equipped with gas producer plant.



Early type A.E.C. gas producer plant.



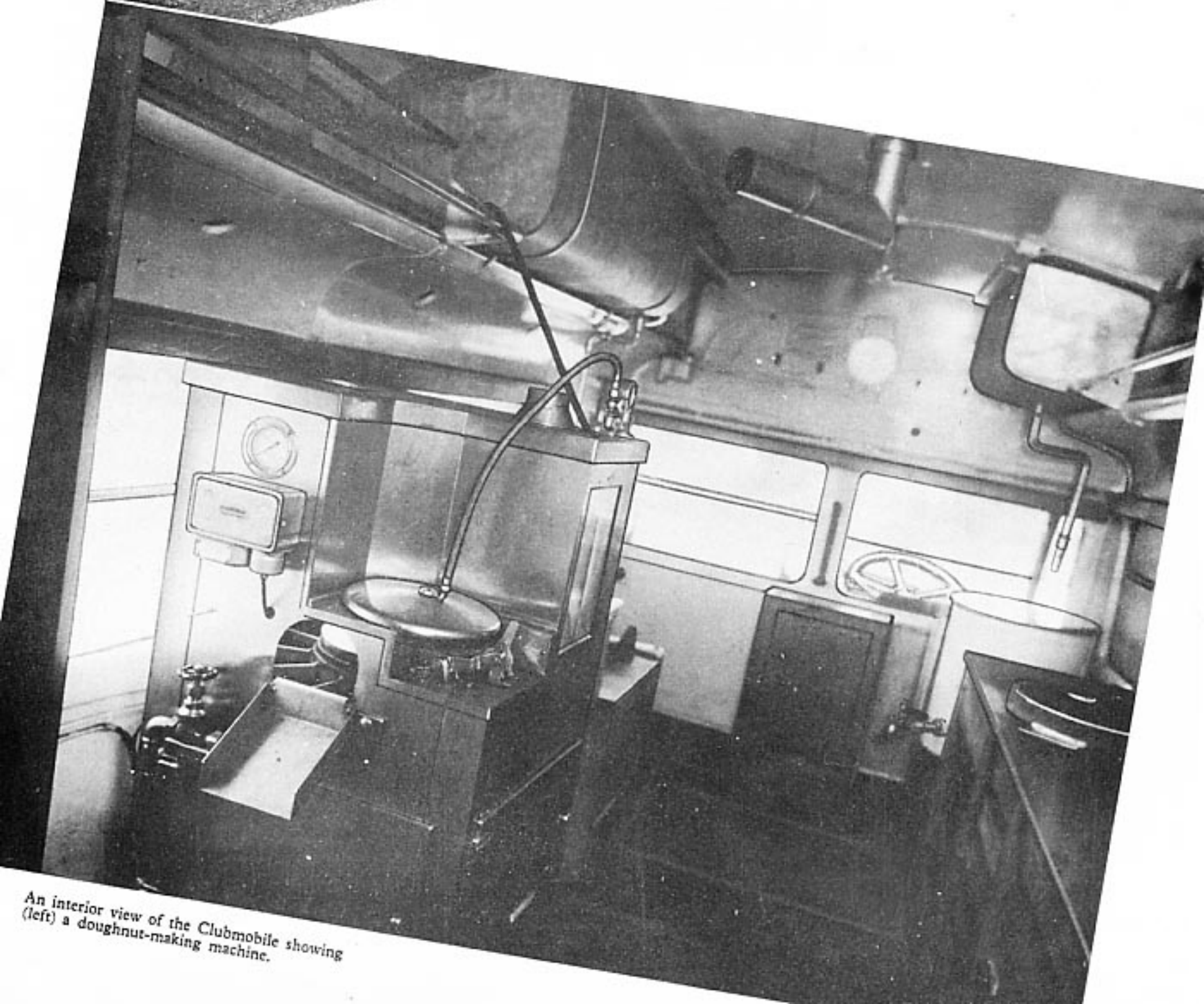
Built on to an A.E.C. 6-wheeled "Marshall" chassis. The Motor Church of Saint George. The body constructed by men of the R.A.O.C.



The padre, a skilled man at the wheel, drove his church over the worst of the desert roads.

Services were often held in the open air when coloured soldiers joined with white in common worship.

The American Red Cross took the club to the soldier. This U.S.A. Clubmobile "Mississippi" was in peace-time an A.E.C.-built London Transport Green Line coach.



An interior view of the Clubmobile showing (left) a doughnut-making machine.

ever increasing pressure of work there was never any lessening of investigation and research into new grinding and production technique.

On one occasion when it was discovered that certain German reduction gears had been produced by superior methods, no time was lost in converting a number of the Company's machine tools so that the improved technique could be applied to certain " Sabre " and " Griffon " reduction gears.

It is of technical interest to record that the British Gear Grinding and Manufacturing Co. Ltd. were the pioneers in this country of tooth root relieving and circumferential lapping by means of which the dynamic fatigue strength of highly stressed gears has been increased to a remarkable extent.

In contrast with the many new horrors of World War II came a new idea, conceived on a much higher level than death and destruction. It was the Motor Church of St. George which enabled many fighting men to attend divine service within a few miles of the fighting line.

Chaplains with the Eighth Army, fighting its way towards Tunisia, had to carry on their duties under innumerable difficulties, particularly in connection with divine services which called for many improvisations to create some semblance to places of worship in the desert.

Then the idea of the Motor Church was born and the Royal Army Chaplains Department approached the Royal Army Ordnance Corps with the result that an A.E.C. " Marshal " six-wheeled chassis and cab was placed at the Chaplain General's disposal and work on the Motor Church of St. George began.

The bodywork took the form of a large room containing an altar which could be used at the cab end of the body by small groups of men celebrating Holy Communion, or moved together with its hangings to the rear of the vehicle to serve as a sanctuary when large congregations attended open-air services.

Concealed lighting within the church enhanced the colours of the internal fabrics. Anti-fly gauze and black-out shutters were fitted to the windows, the roof was lined with thick kapok and to insulate the interior from intense heat or cold, the walls were of double construction.

Materials from many parts of the Empire were used in the construction of the bodywork and its interior appointments. There was beech from England, pine from Canada, rosewood from South Africa and plywood from Australia and New Zealand.

Built by the Army for the Army, the Motor Church of St. George was dedicated by the Deputy Chaplain General and then proceeded into the battle zones in charge of a padre who drove it over the worst of the desert tracks close in the wake of the Eighth Army as it advanced upon the retreating Germans.

At the end of 1942, the American Red Cross Society was experiencing considerable difficulty in providing canteens and other amenities for U.S. troops stationed in widely separated parts of this country until it was decided to put a number of mobile canteens, or " Clubmobiles " to G.I. Joe, into service.

In September of that year London Transport's A.E.C. " Regal " type Green Line coaches, many of them converted at the beginning of the war into ambulances and then put back into civilian service for a time, were finally taken off the road. It was a number of these vehicles which the American Red Cross Society acquired for conversion into " Clubmobiles " of their own design. As each was completed it was named after a state in the U.S.A. and when all the state names were exhausted, later vehicles were named after leading cities.

Fifty-five of these converted A.E.C. coaches served U.S.A. airfields and Army camps with traditional reliability that remained unimpaired despite the arduous work they had already done during the earlier days of the war and in the years of peace before that.

While the production of wartime requirements for military purposes made heavy demands upon A.E.C. manufacturing facilities, the authorities did not overlook the needs of people at home for whom transport to and from the places where they were engaged in the war effort was a highly essential service.

Contrary to any impression arising outside railway circles that the war would cause a temporary cessation of railcar traction in this country, the Company continued to produce railcars for the Great Western Railway, the latest models incorporating new and improved features. Among these may be mentioned the

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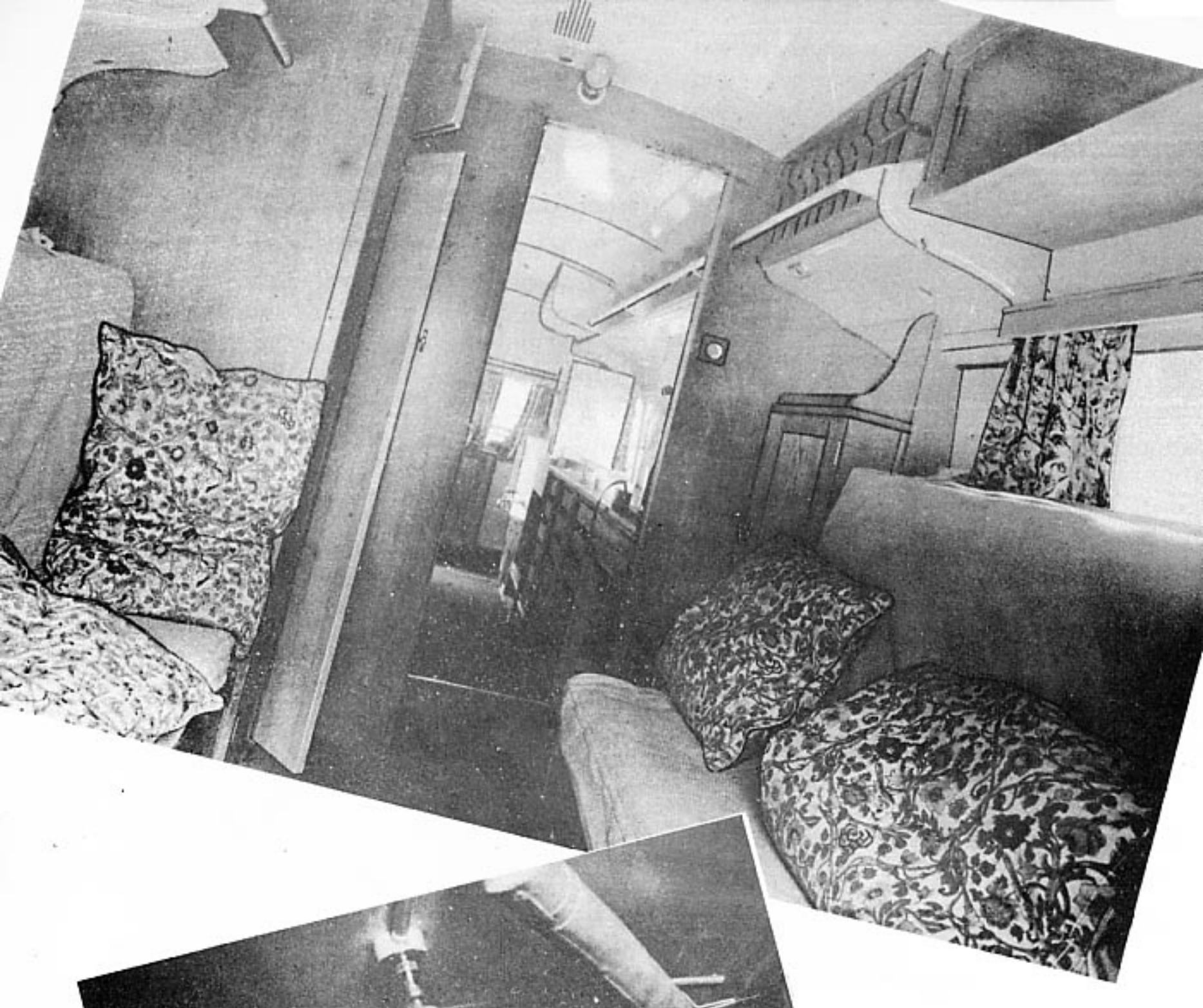
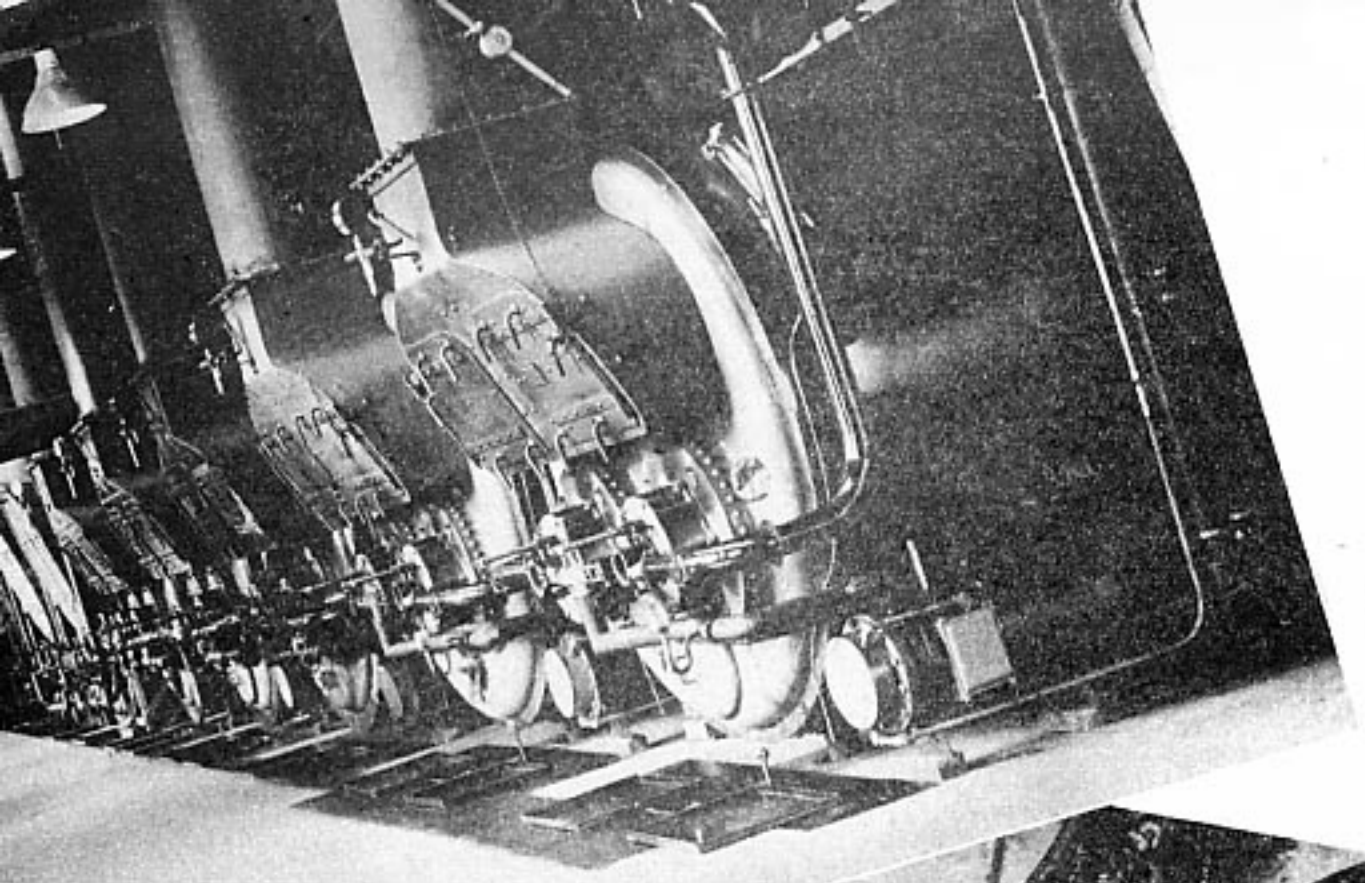
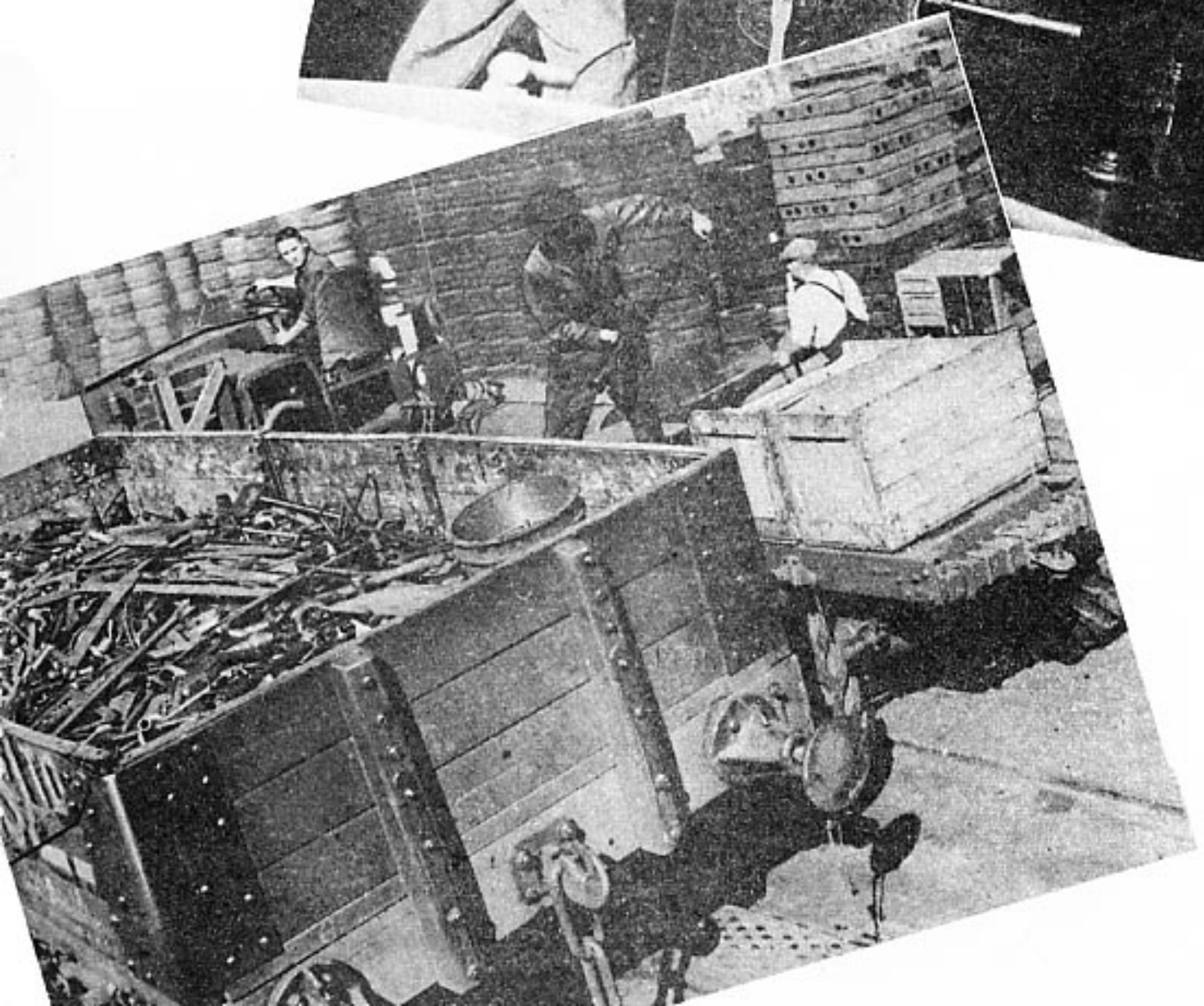


Other interior views of the Clubmobile.



The boiler house at the A.E.C. factory. During the war a change over was made from fuel oil to creosote pitch mixture. Thus the Company voluntarily helped to reduce the import of oil.

Salvage, even more valuable in war-time, is most carefully studied at A.E.C. This picture shows swarf beingput into separators for the extraction of oil.



Scrap metal being loaded for transport by rail.

Paper. All waste is salvaged and returned to the mills for repulping.

Steel. Turnings free from oil are returned by rail to the smelting works.

" staggering " of the engines which were of a new type with more efficient cooling arrangements, the placing of the radiator behind the engine and the use of de-aeration tanks, improved braking, and the adoption of electro-pneumatic mechanism designed to give more definite movements for all motive power equipment under control of the driver.

The engines for this type of railcar are of the A.E.C. six-cylinder direct-injection type having a bore and stroke of 120 mm. by 142 mm., and giving a combined output of 210 b.h.p. at 1,650 r.p.m. The transmission includes a five-speed pre-selective epicyclic gear box, bevel drive with reversing gears in the axle boxes and an auxiliary reduction gear box. Single cars capable of hauling two standard 60 ft. coaches have a top speed of 45 m.p.h., seating capacity of 48, and a large luggage compartment. Twin cars with buffet facilities and seating 108 passengers have a top speed of 75 m.p.h.

Added to all this has been recurring repair work on Service machines and the manufacture of standard A.E.C. oil engines, some of which were modified to suit individual requirements for fitting to Atkinson, Bristol, Daimler, E.R.F. and Maudslay chassis supplied to certain civilian operators under license issued by the former Ministry .of War Transport.

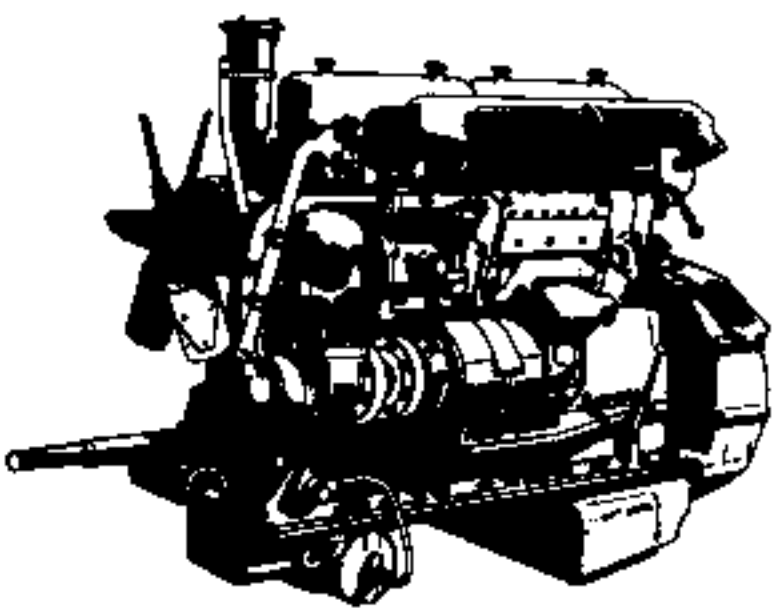
Throughout the whole of the war period the Company has ever been mindful of the fact that peacetime conditions must of necessity call for a great renewal of civilian A.E.C. vehicle service facilities, evidence of which is provided by the opening of the new Nottingham Depot in January, 1940. Plans for acquiring the new building were formulated in peacetime and, despite the outbreak of war, the work of adaptation was pursued without interruption. This, in itself, is a reflection of A.E.C.'s current policy which, among other things, aims at maintaining the closest contact with operators and meeting, as far as possible, their need for service facilities and the supply of spare parts.

The same motives actuated the Company with regard to the new depot at Bradford, opened in May 1941, for the special convenience of A.E.C. operators in Yorkshire and North-East England.

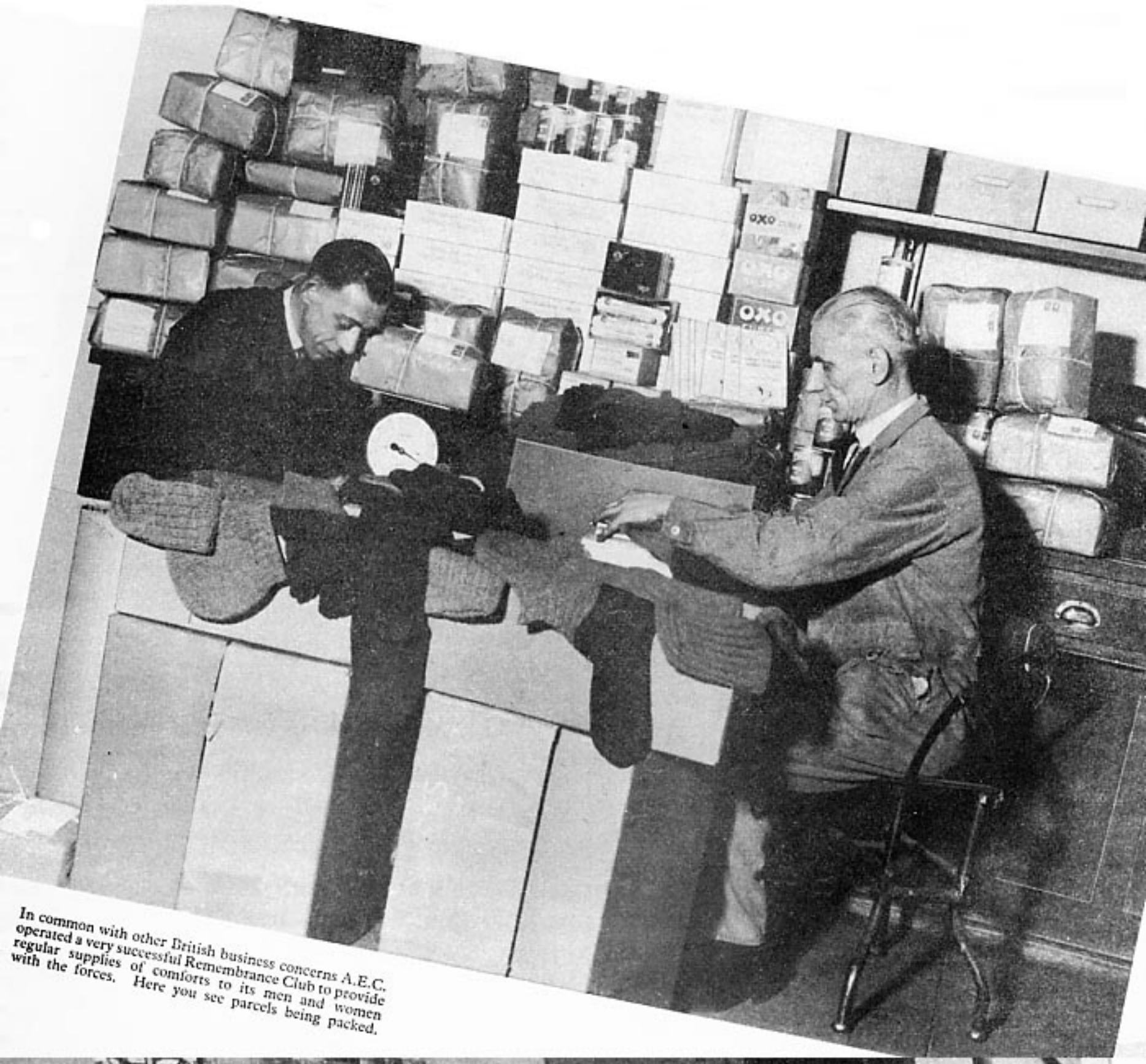
In the matter of supplying spares to the chain of A.E.C. depots throughout the country, the Company holds an enviable record for having maintained essential supplies of spares with consistent regularity and the shortest possible delays even throughout the blackest days of " certificates of need," " short supply " and other banes of wartime, now happily past and gone.

To enable the reader to summarise details of the great achievements of the A.E.C. the following list presents information concerning the types of the Company's wartime products and the quantities manufactured at Southall.

F.W.D. " Matador" Medium Artillery Tractors	8,612
R.A.F. 2,500-gallon Re-fuelling Tankers	1,514
A.E.C. Armoured Cars .. .	629
F.W.D. R.A.F. Float Lorries	417
A.E.C. " Marshal " Lorries	600
F.W.D. Command Vehicles	416
A.E.C. 6 x 6 R.A.F. Chassis with Coles Cranes	192
A.E.C. 6 x 6 Mobile Oxygen Plants ..	185
Four-wheel Drive 6-pounder Armoured Gun Carriers	175
A.E.C. 6 x 6 Armoured Command Vehicles	151
Models for Petroleum Warfare Department	3
A.E.C. 6 x 6 Tractors	2
	12,896



In the interest of War Savings appeals and other propaganda, A.E.C. donated its advertisement hoardings and factory poster boards for the use of the National Savings Committee and other Government bodies.



In common with other British business concerns A.E.C. operated a very successful Remembrance Club to provide regular supplies of comforts to its men and women with the forces. Here you see parcels being packed.

Royal Mail vans made special collections of parcels of comforts.

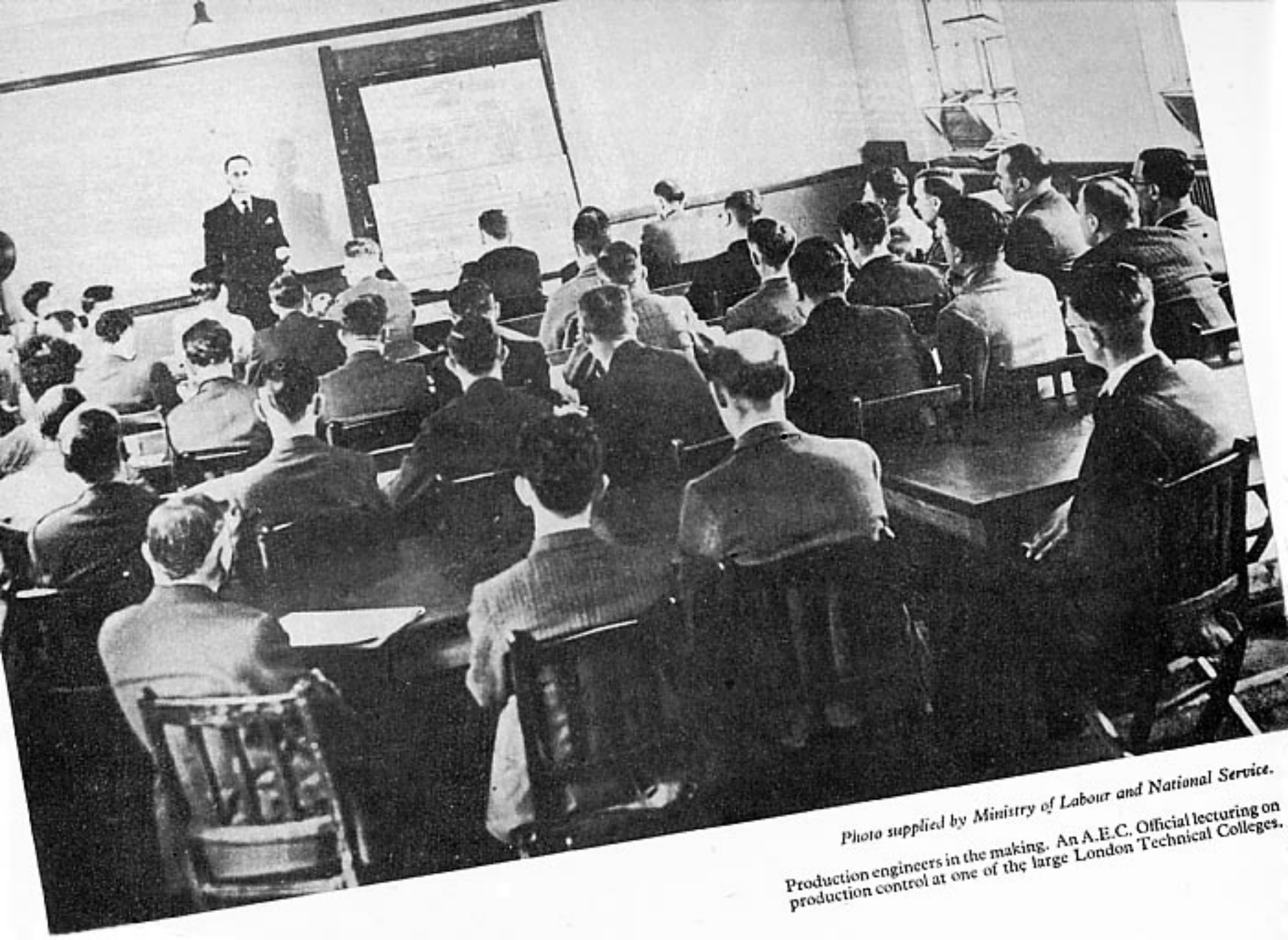


Photo supplied by Ministry of Labour and National Service.

Production engineers in the making. An A.E.C. Official lecturing on production control at one of the large London Technical Colleges.

An interior shop view at the A.E.C. shadow factory in N.W. London.

AID FOR THE MINISTRY OF LABOUR

As the reader will have gathered from the foregoing chapters, the task of manufacturing to so wide and extensive a range of wartime requirements kept everybody in the Company keyed up to maximum effort as individual members of a complete working team.

Nevertheless, the management remained fully conscious of its responsibilities for furthering the national effort in other directions. This is particularly true regarding the Company's attitude towards the general labour situation. The Ministry of Labour was seriously disturbed at the increasing difficulty in recruitng qualified supervisory staff, such as foremen, assistant foremen, planning engineers, rate-fixers, etc., for many new factories which were then in course of erection for the supply of the ever-expanding need of war-time products, and A.E.C. fully realised this.

Not that leaders of industry in this country had failed to encourage their employees to qualify for positions of greater responsibility as an accepted peacetime principle, but it soon became apparent that the training of staffs in the factories employing less than 500 persons, which up to a few years before the war constituted 95 per cent. of the factories in this country, was not suitable for the personnel required for the control of large manufacturing establishments, which might employ staffs from 1,000 to 10,000 persons.

Whilst in the years immediately preceeding the war, certain recognised institutions had endeavoured to give a recognised status to the position of foremen and similar ranks, only a small percentage of potential supervisors were attracted.

The tremendous wartime expansion of munitions production created a vital and growing need for adequate supervision and the Government recognised that to train such men was as important and difficult as to supply and train operative and technical labour for the factories. In this connection special importance attaches to one aspect of A.E.C. policy for the Company had long realised the essential need for adopting suitable measures to select and train its potential foremen and technical personnel. Having thus developed an exceedingly good system, the A.E.C. management decided that their accumulated knowledge on the subject should be offered as a contribution to the national war effort.

The first important step in this direction was made when the Production Control Manager, with the active encouragement of the management, held lectureships at both Southall and Acton Technical Colleges where young men who had already gained the Higher National Certificate trained for a period of six months, on two nights a week, during the last year of their apprenticeship at the age of 21 to 22 years, under a syllabus entitled "Workshop Organization and Management." They subsequently sat for an examination on this subject, which if passed received the endorsement of the Institution of Mechanical Engineers and exempted them from the written portion of the Institution's examination if, at a later date, they applied for membership.

As the result of such work these, and other colleges, together with certain recognised Institutions, already had the nucleus of a training scheme; this, after consultation with interested parties and the Ministry of Labour, resulted in the compilation of a syllabus to which suitable candidates were invited to become students over a course covering some twenty weeks, in two sessions per week, each of two hours' duration.

In order to confer professional status to this training, it was held under the auspices of the local technical college, the subsequent examination being conducted by the college and the examination results accepted by the Ministry of Labour for its endorsement.

In this work the Company's Production Control Manager took a leading part. As the number of factories reaching completion grew, the need for such groups of trained men increased accordingly and for some thirty months the Production Control Manager was engaged in training groups of men on five nights per week, Saturday afternoons and Sunday mornings, with seven distinct and separate classes, all taking the course at different stages.

Altogether some 910 lectures were delivered to over 2,000 pupils and it is gratifying to be able to record that a very large proportion of them, after passing the examinations, received appointments in supervisory capacities, thus helping to fill the ranks of suitably trained personnel for the new factories.

Not all these groups had access to a technical college and in such instances the facility for training was brought to them, the

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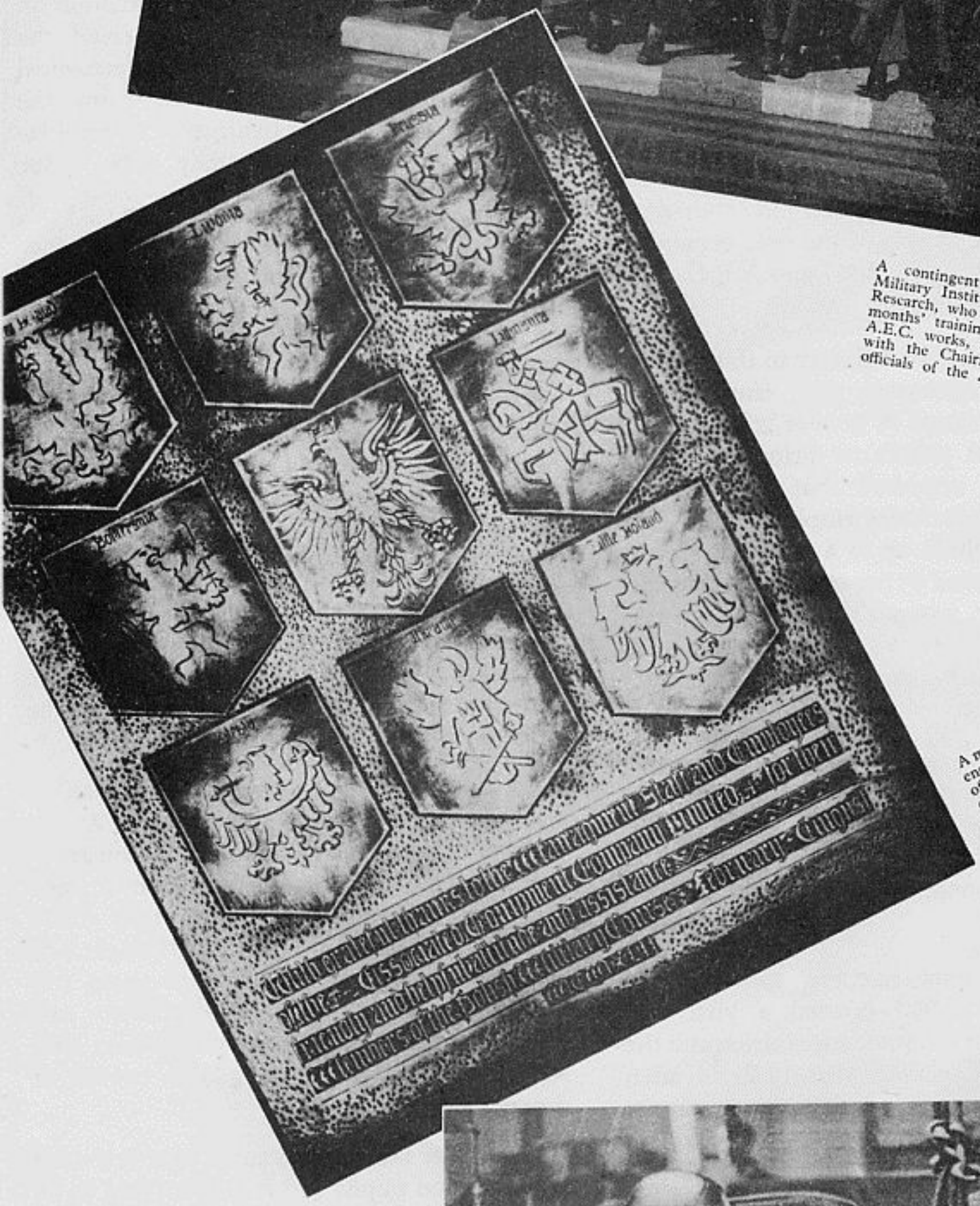
A contingent of the Polish Military Institute of Technical Research, who completed a six months' training course at the A.E.C. works, are here shown with the Chairman and other officials of the A.E.C.



A memorial to friendship. An engraved silver plaque, the work of Jan Tustanowski and presented to the Company by the Polish Officers after completing their course of instruction at A.E.C.

A visit by Russian Officers. Major General Lebeder of the Red Army (Armoured Car Division) with M. Olkhovsky of the Russian Trade Delegation with an A.E.C. official. From March, 1940, to May, 1945, 37,950 people visited A.E.C. mostly on war-production business.

England's first woman double deck bus driver, Miss Phyllis Thompson, who drove for Messrs. Felix Motors Ltd., Hatfield, near Doncaster, being congratulated by A.E.C.'s N.E. Divisional Manager.

The loan of provincial buses to blitzed London and the return of the compliment when circumstances demanded was an outstanding transport feature of the war. Picture shows a Halifax double decker near Big Ben.

London Transport (ex Tillings) A.E.C. "Regent" bus on service at Stockton-on-Tees.

A Leeds Corporation A.E.C. "Regent" bus at work in London.

classes being actually held at the works, often during working hours. On one occasion the management of a large factory, some twenty miles distant from Southall, applied for the course and the A.E.C. Production Control Manager travelled to the establishment twice a week, the lectures starting at 4.30 p.m. and finishing at 7 p.m.

Although at times the first one or two meetings of a new course were held in an air of suspicion and doubt, these elements soon disappeared and a good understanding was established between the lecturer and his classes made up from all grades of labour, including some very emphatic trade unionists.

Eventually all classes shared a common interest in the work the members were studying together and many illuminated addresses and letters of appreciation were sent to the Company as the result of these lectures, of which the following may be taken as a typical example :

The Production Control Manager.
The Associated Equipment Co. Ltd.,
Southall. Middlesex.

Sir,

We, the undersigned, students of Group 10, Ministry of Labour "M" Scheme for Foremanship and Management training, April 28th to September 10th, 1942, wish to record our sincere appreciation of your painstaking efforts on our behalf during this period.

Twice a week you have spoken to us in a language that we well understand, imparting knowledge, ideas and principles which, but for your unselfish action, we should still be lacking.

The feeling of good-fellowship which you have cemented will remain with us for all time and we will all cherish the memory of our happy association.

(Here follows a list of forty-two signatures, all being members of one very prominent firm from which a supervisory staff was subsequently recruited to start and control a shadow factory in the North of Scotland).

The Ministry of Labour in conjunction with the Ministry of Aircraft Production used the pioneering work conducted at Southall and Acton in this class of management for active publicity in other parts of the country. The text-book issued by the two Ministries jointly, entitled " Production and Engineering Bulletin," featuring the A.E.C. Production Control Manager, together with photographs of the classes in session, was reproduced in lengthy articles in the technical press and other publications.

A further course of lectures on Production Planning was evolved later and this series was also delivered by the same A.E.C. official the subject matter being based upon the system of production control inaugurated at the Southall Works and practised there for many years.

As soon as war became imminent certain members of the A.E.C. staff, as mentioned before, were loaned to control departments of the Government and some of the methods employed by the Company were adopted nationally in connection with wartime production systems.

At a later date, the A.E.C. had the privilege of taking members of Government control departments into the Southall Works for short courses of instruction so that they, in turn, might have an intimate experience in the work they were to undertake nationally.

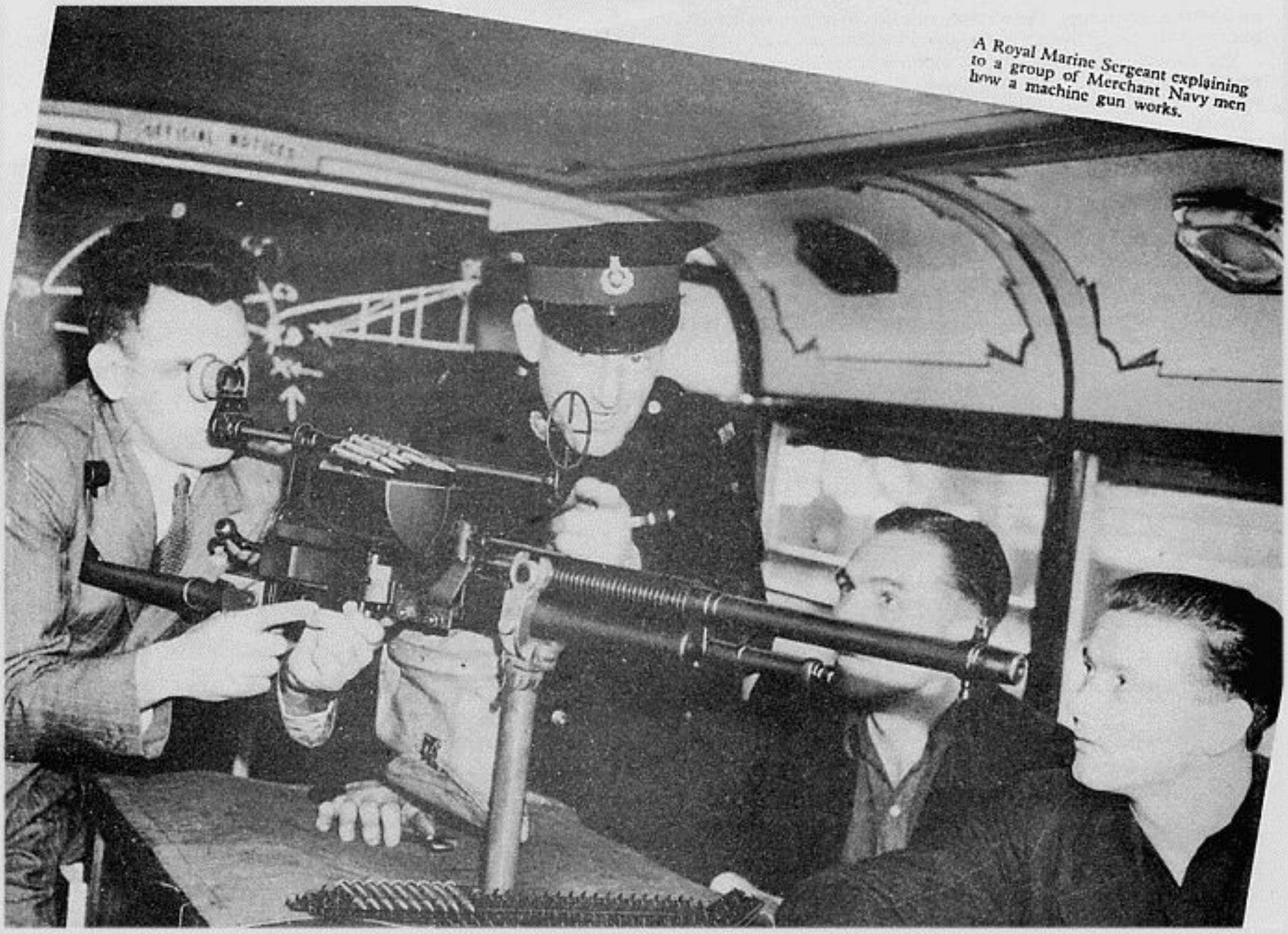
Here again, it is gratifying to record that amongst the letters received on completion of these courses is one from a Government official who had selected the individuals to take part in the training scheme. This reads :

" Certain it is that the men who have had the advantage of coming to you for a short period of training have subsequently turned out to be much better Progress and Production Control Officers than those who did not have the opportunity of spending a period with you."

By reason of the number of men loaned to Government Departments or who later joined H.M. Forces, together with the Company's own activities, it became necessary for the A.E.C. itself to recruit additional staff, composed of untrained individuals and as a consequence it was deemed wise to establish some permanent system to be adopted to meet these circumstances. Accordingly, a booklet entitled " The Organization and Control of Production " was printed and issued by the Company for the use of its own staff under training or such personnel as came to the works to be trained for other organizations. At the outset, some 100 copies were printed by the A.E.C. but later the Institution of Production Engineers asked permission to present copies to all its members. In response, the Company made a free gift of the book to the Institution for this purpose and since that time demands for the publication have been received from many parts of the world ; at the present time the work is the only one of its kind to have been produced in this country.

There is no doubt whatever that by sponsoring the above-mentioned courses of instruction and lectures the A.E.C. rendered a most valuable service to the country. By so doing it raised the standards of technical knowledge and organizing ability of men destined to control many hundred thousands of war workers at a time when the production of munitions was the only factor that could turn the danger of impending defeat into ultimate victory for the Allies.

An A.E.C. double decker assigned to the Navy for instructional work. It picked up seamen when their ships were in port and carried them to naval bases for gunnery practice.



A Royal Marine Sergeant explaining to a group of Merchant Navy men how a machine gun works.

INTO BATTLE WITH STANDARD A.E.C. CHASSIS UNITS

While perusing the foregoing chapters referring to the remarkable manner in which A.E.C. vehicles stood up to the storm and stress of battle throughout the war, some readers may have gained the impression that these machines were built up of specially designed chassis units that differed in essential characteristics from those employed in civilian vehicles.

In point of fact such is not the case as, with few exceptions, standard A.E.C. engines, gear boxes and other main units were used in the vehicles supplied to the Services; this, in itself, was an achievement of no mean character.

While in this chapter it is not proposed to describe features of A.E.C. unit design in detail, it would appear appropriate to present a brief résumé of the principal chassis units, for by so doing the reader should be able to derive still greater confidence in Southall-built vehicles which will steadily become available for peacetime civilian use.

With regard to A.E.C. power units, the type built into the greater proportion of the Company's wartime vehicles was the well-known A.173 type direct-injection 6-cylinder oil engine of 7.7 litres capacity. In addition to its employment in the famous "Matador," this engine powered the 6-pounder Gun Carrier, the 6 x 6 Fuel Tanker, the Mark I Armoured Car and the 4 x 4 Armoured Command vehicle, although as previously mentioned, some of these types were equipped with A.E.C. petrol engines for special reasons.

Long experience in progressive design and actual requirements of all operating conditions governs the design of this engine which rated at 41 horsepower by R.A.C. formula, is of 105 mm. bore x 146 mm. stroke and develops a maximum output of 95 brake horsepower at the governed speed of 1,800 r.p.m.

The cylinder block is cast in iron alloy and has wear-resisting cast iron liners pressed into the bores while large covers on the near-side afford access to the water cooling spaces for cleaning purposes. Of deep section, extending well below the centre line of the crankshaft, the crankcase is stiffened longitudinally by wide base flanges, the casting being robustly proportioned to give ample support for the seven-bearing crankshaft, thus ensuring long life between major overhauls. Housed in transverse partitions, the main bearing "keeps" have long bolts passing through the crankcase and these, serving also to secure the cylinder block, relieve the crankcase structure from combustion stresses produced in the cylinder heads.

The timing sprockets for the camshaft and auxiliary drives are enclosed at the forward end of the crankcase and the upper portion of the flywheel housing is formed at its rear. The bottom of the crankcase is closed by a cast sump containing the submerged oil pump and oil filter which are easily accessible for normal servicing operations.

The detachable cylinder heads are cast in two blocks of three and incorporate the valve ports, valve seatings and overhead rocker mechanism, so that the whole assembly can be removed for "top overhauls" or replaced by a previously serviced head to enable the engine to resume work with the least possible delay. Screens are formed on the inlet valves which are located by splines on the stems, the purpose of these screens being to direct the incoming air and create the optimum degree of swirl around the cylinder axis.

Very generous bearing areas are a special feature of all A.E.C. power units, as exemplified by the crankshaft of this engine, which is machined all over from a forging of heat-treated chrome nickel steel. The main journals are supported in steel-backed bearings lined with lead-bronze and white metal in the lower and upper halves, respectively. Lead-bronze liners in steel backed shells are used in both halves of the "H" section connecting rods, the main purpose of adopting this form of bearing being to ensure easy and economical maintenance, if and when any attention to the bearings becomes necessary.

Toroidal cavities in the piston crowns form the combustion chambers into which fuel is injected from spray type nozzles.

Situated high on the offside of the cylinder block, the four bearing, harmonic type camshaft operates the overhead valves through piston-type tappets, short push rods and adjustable rockers. Located at the forward end of the crankshaft is the helical gear engaging with the pinion of the oil pressure pump, all the other auxiliaries being chain-driven, except the camshaft which has a helical gear engaging with an idler sprocket

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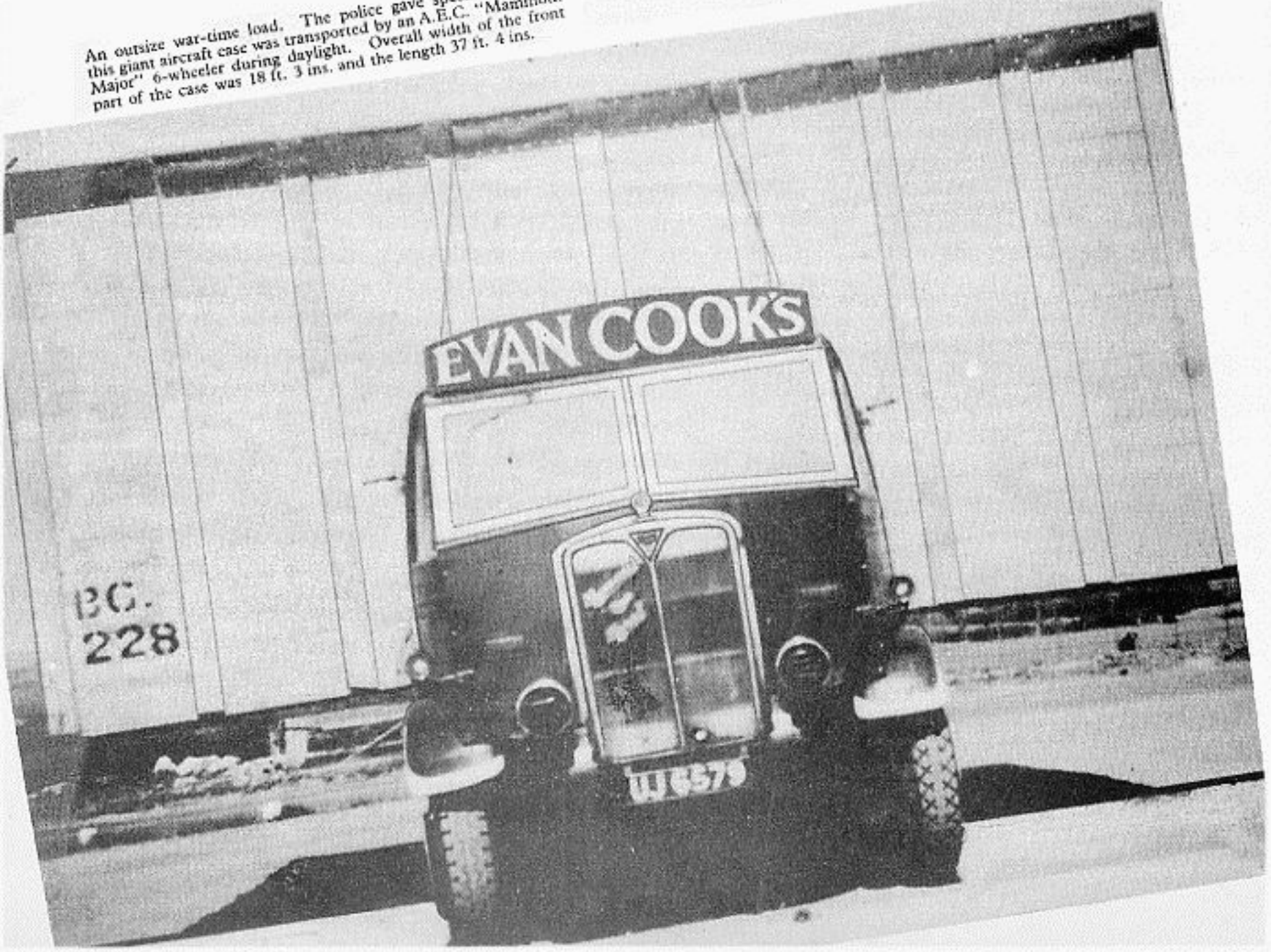
Huddersfield Corporation single deck A.E.C. "Regal" bus fitted out as a mobile theatre to take welcome entertainment to the troops in remote camps and on lonely sites.



An outsize war-time load. The police gave special aid when this giant aircraft case was transported by an A.E.C. "Mammoth Major" 6-wheeler during daylight. Overall width of the front part of the case was 18 ft. 3 ins. and the length 37 ft. 4 ins.

driven from the chain, the tension of which is regulated by an automatic device.

All auxiliaries, apart from the starter motor, are mounted on the near side of the engine, thus providing great accessibility to the parts needing periodical inspection or adjustment, an arrangement that every practical motor vehicle maintenance engineer will approve.

Cooling water is circulated by a centrifugal pump, fitted with a self-adjusting spring-loaded carbon packing. From the pump, water is delivered by an external pipe to the cylinder heads and projected across their water spaces, the flow passing round the injectors and valve ports. The cylinder water jackets are supplied by thermo-syphon action through passages in the cylinder heads. A bellows-type thermostat is fitted at the radiator inlet connection to maintain a uniform operating temperature for the cooling water, so that irrespective of working conditions the engine can be fully relied upon for maximum efficiency and fuel economy.

Full pressure lubrication is provided and included in the system is a gauze strainer of large area on the pump suction pipe mounted in a detachable cover in the rear well of the sump, while the pressure circuit has a detachable external filter fitted with a by-pass valve. The A.E.C. 7.7 litre engine, as described above, is of robust construction throughout, the whole layout having been conceived with a view to easy servicing and maintenance, its fuel economy in relation to the power output being one of its most prominent characteristics.

The other A.E.C. oil engine that figured in the wartime vehicle programme was the A.197 type, 9.65 litre power unit; the main difference between it and the 7.7 litre, apart from dimensional factors, lay in the injection system. For the 6 x 6 Armoured Command vehicles and Marks II and III Armoured Cars, maximum power was more important than fuel economy; this consideration justified the adoption of indirect-injection, now less favoured than the direct-injection principle for civilian use.

The 9.65 litre indirect-injection engine is, of course, a six-cylinder power unit of 120 mm. bore × 142 mm. stroke. Rated at 53.3 horsepower R.A.C. it develops 158 b.h.p. at 2,000 r.p.m. The main features of design and construction are similar to those of the 7.7 litre, the most notable exceptions being the adoption of the A.E.C.-Ricardo "Comet" Mark III combustion chamber, the camshaft located in the crankcase tunnel, as distinct from the "high camshaft" layout and the oil pressure pump driven by a vertical spindle from the camshaft. In the case of the Armoured Cars the fan was driven direct from the forward end of the crankshaft.

For its dimensions, this engine produced an amazing power output combined with what is termed in motor-racing circles "flashing acceleration" so necessary in performing the kind of work demanded of the Armoured Cars and Armoured Command Vehicles and manifested so faithfully at the battle front.

Typical of A.E.C. petrol engine design is the 80 h.p. four-cylinder overhead camshaft unit used in the "Marshal" War Office Subsidy six-wheeler, a vehicle intended for cross-country work to carry 3-ton loads or 5-tons on hard roads. Rated at 31 horsepower by R.A.C. formula, this engine has a bore of 112 mm. x 130 mm. stroke. With the exception of the overhead camshaft, this engine conforms to the general design of the two described above and the unit has served a very useful purpose during the war in places where it has been more convenient to store petrol than to supply stocks of diesel fuel in addition.

Whether under wartime conditions or when goods and passenger vehicles are operated normally, the clutch may be said to bear most of the brunt in transmitting the power of the engine to the final drive mechanism. For that reason, all A.E.C. vehicles employ a clutch assembly of the Company's own design and construction which is specially suited to withstand heavy duty and to the torque characteristics of their engines.

Of the single plate type, the clutch is housed in the steel flywheel, registered and bolted to a flange integral with the crankshaft. The driven plate is faced with rings of die-pressed bonded asbestos having an effective area of approximately 320 sq. in. Both the flywheel rubbing plate and the pressure plate are renewable and the driven plate can, of course, be refaced without removing the engine flywheel.

Having a riveted reinforcement at the centre, the driven plate is mounted on a broached hub sliding on a renewable splined sleeve fitted to the clutch shaft by a taper and key. The clutch shaft of nickel chrome molybdenum steel is formed with an integral main drive gear and is supported by a large diameter ball bearing in the forward wall of the gear box. The forward end of the clutch

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An A.E.C. "Regal" Coach, one of the large fleet owned by the Scottish Motor Traction Co. Ltd., conveying the first contingent of British prisoners of war, repatriated from Germany, from Leith docks.

An A.E.C. "Mammoth Minor" lorry conveying an R.A.F. rescue launch for use in a "Wings for Victory" savings drive.

shaft is piloted into a ball bearing pressed into a recess at the centre of the crankshaft flange.

Floating on three pillars passing through holes in the clutch cover plate, the pressure plate is loaded with fifteen helical springs housed in thimbles mounted on the cover plate.

Withdrawal is effected by three tangentially arranged toggle levers pivoted on brackets to the cover plate and having forked ends engaging collars on the pressure plate pillars. This tangential arrangement provides greater leverage than that obtained from the conventional disposition of toggles and thereby reduces the effort exerted by the driver on the pedal when the clutch is disengaged.

The pivot pins are relieved of side loading arising from the centrifugal tendency of the levers during rotation, by the provision of steady pins which bear against facings machined on the sides of the levers. Independent adjustment for the levers is arranged on the pillars and the setting of each is locked by a small spring-loaded plunger on the bearing brackets abutting a flat on the nut.

Withdrawal thrust is taken by a ball bearing mounted on a graphite-lined sleeve floating on the clutch shaft. Hardened studs are fitted to the ends of the levers with rollers at the ends of the actuating forks. Hard grease is used for the lubrication of the ball race, and for the convenience of application, a pipe from the ball race housing is extended through the enshrouding bell housing.

To avoid chatter, the assembly is held in contact with the operating fork by a pair of helical springs mounted in tension between the outer race housing and the spindle of the fork.

The standard A.E.C. four-speed gear box of the sliding type was used for the entire range of wartime vehicles, the only difference in one case being a slightly modified arrangement of selector lever on the Armoured Car. The gear box is arranged for unit construction with the engine and clutch, the one-piece casing integral with the bell housing having a long spigot that passes through the banjo suspension plate and registers in the flywheel housing on the engine crankcase.

The layout is of straightforward pattern having a direct top speed and constant mesh third speed train. Of compact design, the main and layshafts, machined from nickel chrome molybdenum steel, are relatively short and stiff. Both shafts are hardened and ground all over, including the splines.

The splined main shaft is positively located longitudinally from the rear ball bearing and is piloted at its forward end into a journal roller bearing located in the centre of the constant mesh shaft. Single row roller bearings support the layshaft which is end-located by bronze pads, each secured by a single rivet in the end covers, these rivets being placed eccentrically to avoid the possibility of the pad spinning in the cover.

All gear box bearings are held in position by studded flanges, while adequate oil sealing devices are fitted to the input and output shafts.

On the main shaft, the third speed sliding gear has internal teeth for engagement with corresponding teeth on the primary shaft gear to give direct top gear drive.

A common shift fork maintains the third speed train in constant mesh, and the layshaft gear which floats on a plain bearing has internal teeth to engage the second speed layshaft gear for third speed drive. The first speed gear is pressed and keyed to the hub of the second speed gear, forming a composite cluster which slides on the mainshaft and makes direct tooth engagement with the appropriate layshaft gears. Top and second speed layshaft gears are keyed and locked against a collar with a spacing bush on which rollers supporting the third speed gear take their bearing, while the first speed is formed integral with the shaft.

All gears are of the straight spur type, case hardened and ground on their profiles. The standard ratios provided are top, 1 to 1; third, 1.59 to 1; second, 2.69 to 1; first, 4.38 to 1. Reverse is obtained by an idler cluster sliding on a short auxiliary shaft and having a ratio of 5.33 to 1.

As an auxiliary gear box is included in the transmission line a speedometer drive is not taken from the main gear box. Provision is made for a power take-off and either alternatively or additionally, a tyre pump drive if required, and in the case of vehicles equipped with compressed air brakes, the compresser unit is driven from the same take-off.

Mounted on the left side cover plate these auxiliaries are driven from the constant mesh layshaft gear. The selector mechanism is a casing bolted to the right-hand side of the main box and is of straightforward design with three selector rods locked by substantial plunger-type spring detents. Remotely

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Used on National Fire Service work this A.E.C. was employed for transporting a mobile water dam and towing a trailer pump.

With a total carrying capacity of 500 tons, the first Foreign Service unit, composed of 40 heavy duty lorries were all A.E.C.'s. They were sent to the Western Europe zone to transport food and medical supplies on relief work after the war. Part of the convoy is here shown leaving the Nijmegen Bridge.

mounted at the right-hand side of the engine, the main gear box change-speed lever is connected to the selector lever by a single sliding and swivelling shaft. The lever is mounted in a spherically seated bearing in the selector casing.

When, as so often happened under active service conditions, drivers were forced to change gear without having time to observe ordinary and polite treatment of the gears. the robust construction of the A.E.C. gear box withstood shocks and stresses that might well have wrecked gear components of less generous dimensions, or made from material of lower quality.

Another outstanding example of robust construction is represented by the A.E.C. rear axle units. Used in the " Matador " and other models, the double-reduction heavy duty axle is of the fully-floating type with hubs mounted by roller bearings on the substantial horizontal banjo-type axle casing of alloy steel. Transmitting only the driving torque, the nickel chrome molybdenum steel axle shafts are splined at their inner ends, while the outer ends have integral dog flanges engaging with driving flanges which are registered and bolted to the hubs. To ensure a uniform distribution of loading, the large diameter splines are accurately radiused and ground. The shafts can, of course, be withdrawn readily without disturbing the wheel hubs.

A large nut retains the hub bearing on the axle casing and this is positively locked by two bolts. Passing through the flats of the nuts these bolts are selectively engaged in two of four slots in the end of the axle casing. Oil is retained in the hubs by packless metallic glands backed up by helical springs. A secondary oil seal is provided on each hub by a large diameter felt ring recessed into the brake shoe carrier and surrounding the inner periphery of the hub.

The double-reduction is obtained by means of a spiral bevel gear and a double helical spur gear drive to the differential gear housing. The spiral bevel gears are of nickel chrome molybdenum steel case-hardened and ground on the profiles. Solid with its shaft the pinion is mounted on two taper roller bearings supporting both the radial and axial loads in a detachable housing of cast iron bolted to the front of the gear casing cover. Shims fitted to the housing and the main gear cover provide for adjustment of the pinion and wheel mesh.

The bevel wheel is mounted with taper and key on the shaft of the double helical pinion for the second reduction. This shaft is carried on roller bearings and located by a ball bearing which takes the bevel wheel thrust. On the bevel wheel side both roller and ball bearings are of large diameter, being mounted on the hub of the wheel and carried in a common steel housing spigoted in the casing.

Nickel chrome molybdenum steel, also, is used for the double helical gears. The wheel is registered and bolted to the junction flange of the housing for the four star bevel-type differential gear.

As in the case of the bevel assembly, the spur gears are adjustable for depth of engagement by shims. With the combined reduction a standard ratio of 7.9 to 1 is obtained, but an alternative ratio of 6.25 to 1 is also available.

To assist the wartime supply position the Company produced an alternative form of final drive of the worm and worm wheel variety. Of conventional design, the fully-floating worm-driven axle has 7 in. worm centres and provides a ratio of 7.75 to 1. The casing is a robust drop forging of the pot-type with tubular extensions to support the hubs, a casting above the pot enclosing the worm and differential assembly.

At its forward end, the worm shaft is mounted on a single roller bearing, a double-thrust roller bearing being employed at the rear end. At the front housing of the worm shaft there is an oil seal of the lip type. The worm wheel is pressed on to a multi-tooth register on the differential casing, thus providing a positive drive apart from the bolts which secure the components together. The differential is of the four bevel pinion type.

Heavy duty taper roller bearings support the worm wheel and differential assembly, with shims provided to ensure correct centring of the worm wheel with the worm. The nickel chrome molybdenum steel shafts are of generous dimensions and, splined at their inner ends, terminate with dogged flanges for attachment of the hubs.

The hubs are mounted on parallel roller bearings to take both thrust and radial loads. At the rear end of the inner race, between it and the brake carrier, a bellows type of gland is fitted. The contact face of this gland bears upon a special rubbing plate incorporated with the inner race. The latter is retained in

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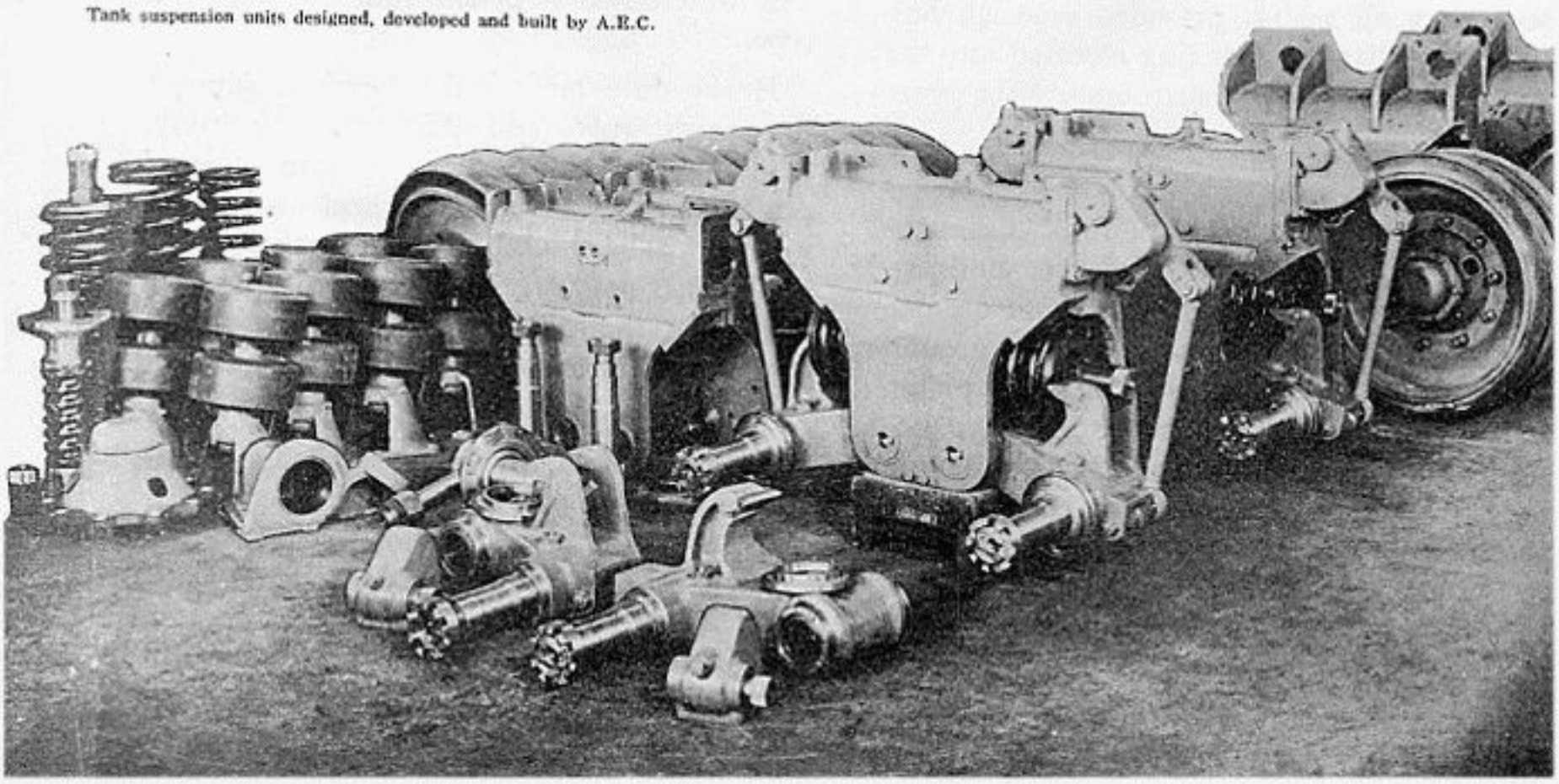
One of the many experimental vehicles produced during hostilities. An A.E.C. half track type vehicle built for the War Office.

Tank suspension units designed, developed and built by A.E.C.



position by a large circlip. Shims and the usual type of axle nut with two locking bolts complete the assembly. The races are lubricated through a flat hexagon nipple, raised above the hub flange by an extension piece to render it accessible for the grease gun. A large felt ring held within a recess on the brake carrier bears upon the outside of the inner end of the hub and provides a further protection for the brake shoes against oil or grease.

While it may be said that viewed from the standpoint of design alone, the A.E.C. axle mechanism is perfectly conventional, it is characterised by a wealth of refinement which, in conjunction with precision manufacture, renders the final drive mechanism immune from such troubles as broken axle shafts, defective bearings or brakes rendered erratic in action by oil leakages from the main casing.

Apart from correct geometry of the steering linkage and good chassis balance, the easy directional control of all A.E.C. vehicles is attributable to the design and construction of the Company's own worm and nut type steering mechanism. In this type a transverse rocker shaft carries a bronze nut which swivels on two trunnions and is operated by a worm formed on the lower end of the steering shaft.

The worm is actuated by the steering wheel, secured by a taper and key to the worm shaft, which is carried at its upper end in a ball bearing to take the vertical thrust. This ball bearing is not mounted rigidly, but is supported in resilient rings. These absorb shock and permit the slight rocking action of the worm shaft, caused by the bronze nut passing through an arc during its movement.

The rocker shaft is carried in three phosphor-bronze bushes, oil bath lubrication being provided for the worm and nut and for the rocker shaft bush in the steering box cover, whilst the two remaining bushes are lubricated through a grease nipple.

The steering drop arm is attached to the rocker shaft by a fine tapered spline which permits easy adjustment of the drop arm to the correct position. Connection to the steering lever is by means of a drag link of the ball and socket type.

The combination of the standard A.E.C. units in any of the Company's chassis ensures adequate engine power and acceleration, a perfectly reliable and long-suffering clutch, gears that are quick and easy to change, a back axle tough enough to resist any kind of stressing, and steering so light and accurate as to give the driver no worry at all.

THE A.E.C. ARMOURED CAR

It would be hard to conceive a more complicated set of conditions than those confronting the A.E.C. designers when they originated the plans for the Company's armoured cars. How well they succeeded is now a matter of history, but the achievement is worthy of more than passing mention, hence the following brief description of this remarkable fighting machine.

As already mentioned, A.E.C. technicians were firmly convinced that what the Army needed was a really fast and powerful *wheeled* vehicle of a highly pugnacious character and ability to fight its way into enemy positions through sand, mud, morass or boulder strewn terrain.

Therefore, by breaking away from conventional precepts, the designers pictured a heavily armoured and armed three-man fighting compartment or turret, a driver tucked away to allow full play for the guns and machinery to provide the motive power put in wherever it happened to fit.

When the ensuing headaches cleared, designs for the 12-ton A.E.C. Armoured Car began to take shape and shortly afterwards the largest and most powerful machine of its type built for and used by the British Army materialised.

The Company built some 520 of these armoured vehicles (designated Mark I, II and III) during the war period, the actual details being held on the Secret List until a very late stage of the War.

Several features of great technical interest characterise the chassis design and although of extremely unusual layout, the vehicle embodied many of the units and components designed originally for the Company's peacetime vehicles.

Carrying a 75 millimeter gun and a 7.92 millimeter Besa machine gun, axially mounted, together with a very complete range of fighting equipment, the Mark III vehicle is protected b· steel plate up to 1¼ in. thick and, weighin, 12-tons 14-cwt. in full battle order,

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However severe the weather A.E.C. road testing proceeded every day all through the war period. Here are an A.E.C. "Matador" and an A.C.V. 6 × 6 undergoing test over a snow covered route.

The first load to leave the A.E.C. factory in November 1942, after legislation was relaxed to permit the use of trailers in conjunction with heavy duty 8-wheeled freighters.

can attain a maximum road speed of 43 m.p.h. while being capable of traversing rough country at 18 m.p.h.

The armoured hull is divided into three compartments, the forward portion being occupied by the driver who uses periscopes when the roof is closed for action and radio inter-communication with the car commander. Fully enclosed in the rear compartment is the six-cylinder A.E.C. oil engine, while amidships is the fighting compartment surmounted by an electrically-operated turret accommodating a crew of three men, the guns and other essential equipment.

Protection for the chassis mechanism, adequate ground clearance, maximum depression for the gun, limitation of overall height and low centre of gravity are among the chief conditions governing the chassis layout. These have been achieved by mounting the engine in a relatively low position at the rear of the vehicle and inclining it in the frame, thus reducing the height of the fighting compartment floor and providing a straight-line transmission to the front axle by which the vehicle is driven for normal road travel.

In plan view, the engine is skewed relative to the chassis, thereby reducing the angularity of the transmission line to the rear axle, which together with the front axle, is driven by cardan shafts from a centrally situated two-ratio auxiliary gear box. The high ratio is employed either to drive the front axle or both axles as conditions demand, while the low ratio is employed for four-wheel drive only.

A notable feature of the layout is that the cardan shaft to the rear axle is arranged alongside the engine instead of below it as in the case of most four-wheel driven vehicles, thus permitting maximum ground clearance in conjunction with a low engine position.

The A.E.C. six-cylinder oil engine of 9.65 litre capacity, described briefly on page 93, transmits the drive through a single plate clutch and four-speed main gear box to the auxiliary gear box with suitable ratios to the front axle or both axles as required. The latter are of the fully floating double reduction type mounted no semi-elliptic springs. Actuating the front wheels only, the normal type of worm and nut mechanism effects the steering through specially designed linkage.

Bolted to the crankcase bell housing to form a single unit with the engine are the clutch and main gear box, both of which are standard A.E.C. units. All gears are of the straight spur-tooth type, case-hardened and ground on the profiles.

The auxiliary gear box, coupled to the output shaft of the main gear box, is situated in the middle of the chassis towards the off side and is controlled by two levers. One of these operates the auxiliary ratios and the other is used to engage four-wheel or direct drive to the front axle. For normal road travel, the main gear box drive is transmitted through the auxiliary gear box on its high ratio only, but the drive can also be distributed to provide four-wheel drive on both high and low ratios.

In both front and rear axles, the transmission mechanism is identical and comprises a bevel pinion assembly, a bevel wheel and helical pinion assembly, a helical gear and differential unit.

Motion is transmitted to each front wheel from the double-reduction and differential gear through an axle shaft splined to the differential sun wheel and supported by a ball bearing on a shoulder adjacent to the forked end for the " Tracta " constant velocity universal joint. This fork engages, through the spigot and slotted portions of the joint, with a short forked shaft splined to the bore of the front hub to which it is secured by a nut. The hub caps of both axles are shaped to act as bollards by means of which the vehicle can be lifted bodily with the aid of hawsers should the need arise.

Compressed air is used to actuate the foot brake system through internally expanding shoes in 17-in. diameter drums on all four wheels. Air is delivered via a Westinghouse valve unit to a duplex reservoir ; the smaller or service chamber of which is quickly filled rendering air at 65 lb. per sq. in. available for brake application immediately after starting up, while the main tank contains air at 90 lb. per sq. in. Depression of the brake pedal by the driver admits air to the brake cylinders with a force proportionate to the pedal travel. When the pedal is released, the control valve mechanism allows air to escape to the atmosphere thus releasing the brakes.

Mounted slightly to the rear of the front axle and centrally between the chassis side members, the short vertical steering column is of the A.E.C. worm and nut type, as described previously. Movement of the front road wheels from lock to lock requires approximately 6½ turns of the steering wheel.

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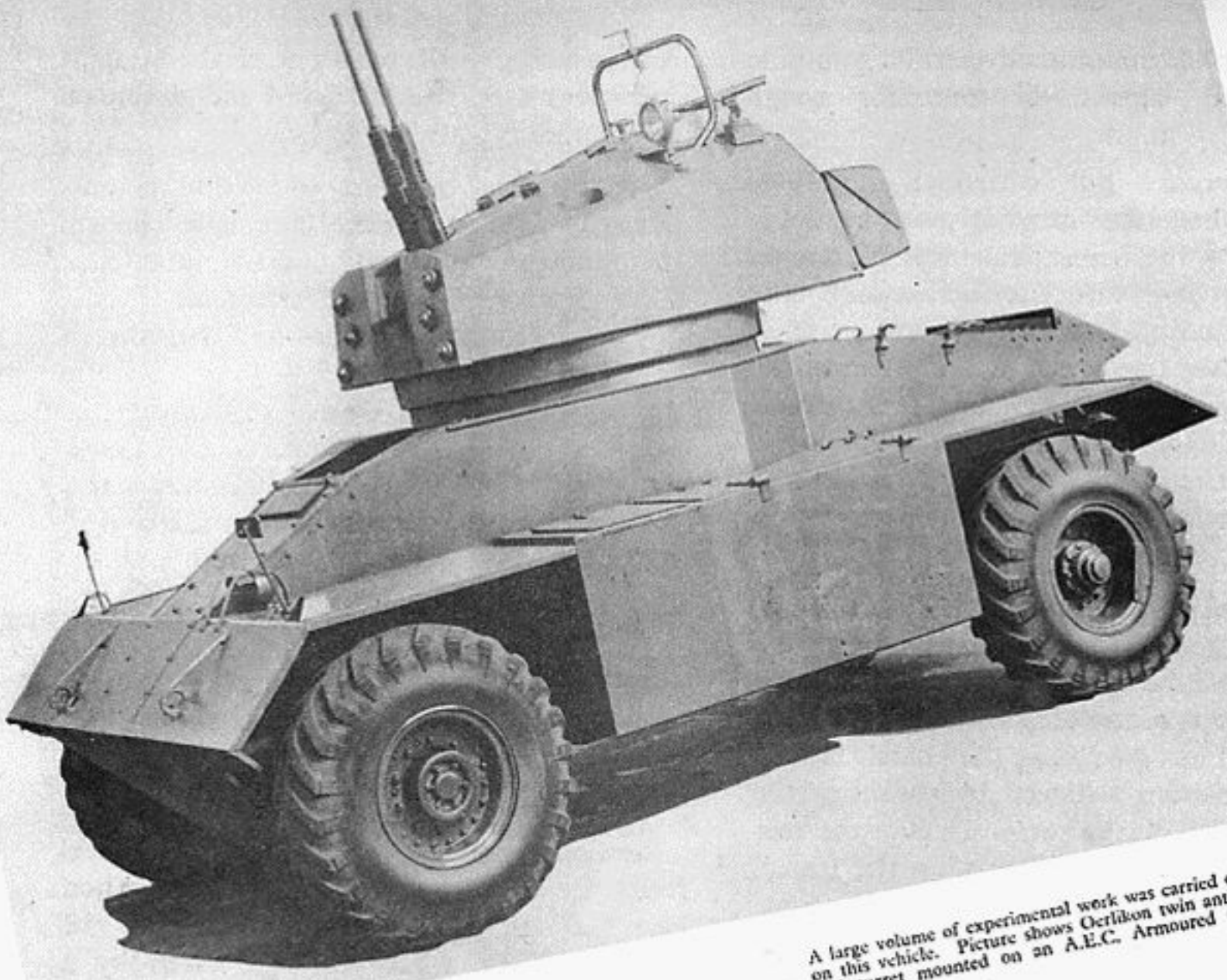


A large volume of experimental work was carried out by A.E.C. on this vehicle. Picture shows Oerlikon twin anti-aircraft guns and turret mounted on an A.E.C. Armoured Car Mark II.

A captured German tank (type P.Z.K.W. Mark II.) sent to the A.E.C. factory for examination and report. A complete strip and thorough technical investigation was carried out in the Company's Experimental Dept.

Although the general layout of the vehicle, together with its armoured hull, would readily lend itself to unit construction, the components are assembled on a composite frame for the convenience of manufacture, the chassis having been built at Southall while the hull was constructed in another factory. At the forward end of the vehicle the side members, which are parallel from front to rear, are of conventional design with front dumb irons. These members terminate a short distance behind the rear anchorage brackets of the front springs, where they are attached to stiff vertical girders. Attached to the lower ends of these vertical girders are the two low level sections of the side members which in turn are attached to two other vertical girders, the upper ends of which secure the two side member extensions at the higher level and continue to the rear of the frame.

This form of construction is employed to provide a low floor for the fighting compartment. Substantial pressed steel cross members of deep channel section are situated respectively between the front dumb irons, fore and aft of the centrally located auxiliary gear box and behind the power unit.

The hull which is rigidly mounted on the frame at fourteen points is of welded and riveted construction, employing armoured plates of varying thickness. Some plates are bolted to the main structure to allow access to otherwise inaccessible units for maintenance purposes. Of welded armour plate construction, the three-man turret may, when the driver's roof door and the engine compartment doors are closed, be rotated on a ball bearing assembly through 360 degrees, either electrically or manually.

Suspended from the turret and rotating with it is the platform supporting the seats for the crew, together with the ammunition bins. The 75 mm. gun, the Besa machine gun and a telescope are carried in a co-axial mounting in the front, whilst on the roof plate is a 2 in. smoke bomb thrower.

The output of the 24-volt service dynamo, mounted in the engine compartment and belt-driven from the engine, is regulated by a control unit operating on the compensated voltage system and located in the fighting compartment. The 24-volt starter motor is carried on the engine crankcase and four 6-volt batteries, with a total capacity of 150 amps. at 10-hour rate, are housed in an external storage box.

Ventilation is assisted by an electric fan mounted on the roof and protected by an armoured cowl, while the vehicle equipment includes periscopes, wireless receiving and transmitting sets and the various items of the comprehensive specification required for this class of military vehicle.

The A.E.C. Armoured Car Mark III has a wheelbase of 11-ft. 4¾-in. and its track measures 7-ft. 5½-in. for the front axle with a corresponding width of 7-ft. 1½-in. for the rear axle. The overall length measured over the projecting armoured plating front and rear is 18-ft. 5-in., while the overall width is 8-ft. 10½-in. When the vehicle is fully laden and in complete battle order, its overall height is 8-ft. 10-in., the minimum ground clearance under the same conditions being 12½-in. A turning circle of 60-ft. 0-in. on both locks provides for adequate manœuvrability.

If only huge numbers of this amazing vehicle had been available much earlier in the war who knows but that the tide of victory would not have turned far sooner than it did by carrying terror and defeat at tremendous speed into enemy strongholds.

APPRECIATIONS FROM THE FIGHTING FORCES

From Capt. J. W. Aggelton, B.L.A.

Dear Sir,—I was surprised to see—in Brussels—an A.E.C. "Marshal" with a W.D. body and canvas cab, painted in the once-familiar desert camouflage, being operated by a civilian. Upon making enquiries, I found that the vehicle had been captured from us in the Desert in 1941 or 1942, and had subsequently been brought back to Europe for us by the Wehrmacht. During the hurried retreat of the German Forces through Belgium last year, the present owner appears to have annexed it for his own use. It appears to have covered a goodly mileage, and is still fitted with desert-type filters, cooling apparatus, etc.

The extraordinary thing is, though, that the vehicle—although it has obviously had practically no maintenance for three or four years—is still in first-class mechanical condition, and running far, far better, than any other locally-manufactured vehicle for which servicing arrangements are laid on.

I am sorry I could not get the chassis or engine number.

When I asked the driver if it did not surprise him to observe the difference between his ex-Army, ex-Wehrmacht A.E.C. when compared with continental vehicles, he seemed quite indifferent, and said: "Mais, c'est un cannoir anglais," in such a tone as to imply that I should have known that a British vehicle would put up such a show. He added, "Il est par le fabricants le autobus de Londres,"—as if to qualify his first statement. So you see, you are known as the builders of London's buses even by the smallest of the continental back-yard haulage contractors.

I thought the foregoing might interest you.

From Lt.-Col. W. R. S. Windham, M.E.F.

MARCHING SONG OF H.Q. 1st BR. ARMOURED DIV.
Based on A.E.C. 6 x 6 and 4 x 4 A.C.V.'s.
By Captain H. S. BOURNE.
(to the tune of "Old Father Thames")

Over the Tel
Down to the Bir
No one can understand
How ACV 1 goes rolling aloeg
On through the driving sand—
Never upset
Always on net
And ready to take command—
ACV 1 controlling along,
On thro' the driving sand.
She never needs to worry
She never needs to care,
For when it's time to hurry
The ACV's right there—
Gen'rals may come—
Gen'rals may go—
Wherever the fates have plann'd
But ACV 1 goes rolling along,
On through the driving sand!

From Dvr. L. Davies, C.M.F.

I have been driving an A.E.C. 12-ton A.C.V. for three years now and it has brought me right through the desert and quite a good way up Italy without any trouble whatsoever.

[*Continued on page* 105

An A.E.C. 4-wheel drive "Matador" general service flat platform lorry at work on an overseas airfield.

A.E.C. 6-wheel drive armoured command chassis undergoing road test under severe wintry conditions.

From Gnr. W. Taylor, C.M.F.

I have been driving A.E.C. Tractors since the War began. In the sand and mud of Libya to the steep hills of Italy and Austria, my A.E.C. "Matador" has never failed in the task it had been put to, I would say it has played a great part in winning the War. I know that in future years if I drive an A.E.C. vehicle I will be driving the world's best.

From S/Sgt. H. Sowden, S.E.A.C.

From the C.O. downwards we all had nothing but admiration for the way those "Matadors" stood up to terrific punishment from N.W. India down to Central and South Burma. Pulling a 7-ton howitzer with almost a ton of equipment lashed on the gun and another six tons of ammunition, etc., on the vehicle itself, working in temperatures ranging from 108 deg. to 120 deg. F.—if ever there was a case of a "willing horse" it was provided by those "Matadors." They were just "tops."

I and my colleagues, often working in mud axle deep have rescued almost every type of vehicle imaginable, but I have never experienced a bogged "Matador." In fact, I had to use one an one occasion to tow out a massive American . . . six-wheel drive job which had scuttled its back end in soft sand. In my own Unit, the "Matadors" were unique for their rescuing capabilities alone.

Engine trouble rarely existed, although we had not even third-class operating and servicing conditions. My own job of keeping nine "Matadors" on the road at all times can only be appreciated by one who has experienced the shortage of replacement parts that existed out here a few months ago. All the drivers looked after their "Matadors" well.

A Regiment such as our own continually in and out of action, could not afford to have any of its gun-towing vehicles immobilized for more than an hour or so. A non-runner in our case was a dead loss. Only on one occasion was a "Matador" off the road, due to a completely sheared primary shaft in the gear box clutch housing. But the D.D.M.E. had a new one dropped by plane while we were still in action and in about five hours the "Matador" was in service again.

Concluding his letter S. Sgt. Sowden expresses to A.E.C. the thanks of himself and his colleagues "for turning out such a good and reliable piece of engineering."

From Lt. A. M. Klasnick, R.A., C.M.F.

Dear Sirs,—I am writing this letter from Italy to ask you if you could let me have some information and data concerning the "Matador" models in my charge.

As M.T. officer I have been with these vehicles and have seen them perform both in rough country and on good roads.

Not only have they given us the least trouble through Africa, Sicily and here, but have exceeded all expectations. To put it simply they are a first-class job . . .

From Elec. Lieut. E. A. Aust, R.I.N.V.R., Calcutta.

Everywhere I've been I've been reminded of the old firm "way back homeside" (as my Chinese friends would say), because everywhere I have come across that little triangular name plate and lined radiator, and in the Victory Parade in Alexandria the vehicles that led the mechanised procession were—"gun tractors." And the name plates were *not* painted over!!! They were cleaned up and the blue, red and chromium of the sign were just like new! Evidently the drivers were really proud of their charges. And so you see I simply cannot forget about the builders of London's buses and trolley-buses, and I can assure you that wherever I may be, whether in China, S. Africa, Egypt or India, I shall always put in a good word for my old firm. One day I hope to return and visit you again but in the meantime I send you, and "the triangle" the best of wishes. Good work, A.E.C., the stuff you're making is doing fine over here.

From Major E. B. Reed, S.E.A.C.

The "Matadors" put up a hundred per cent. better job than the truck which just goes to pieces on these roads. All the units who have them are extremely enthusiastic about them.

From Dvr. H. Hewitt, C.M.F.

As a driver of heavy A.E.C.'s over a period of 15 years, I have nothing but admiration for the wonderful machines you turn out of your works.

From Lieut P. C. T. Clark (E.), R.N.V.R., Herts.

Dear Sirs,—I have no doubt many stories have reached you of outstanding feats by the A.E.C. Medium "Matador" Tractor during the war, so that the story which follows will surprise you less than it did me at the time.

Early in 1946 the Royal Navy began to leave Australia, and in the course of this operation all transport under repair at outlying shore establishments such as Naval Air Stations had to be returned to the central workshops, to enable the outlying unit to close down. The resulting road convoys consisted of vehicles far from roadworthy, but "runners," towing others which were not even runners, and always the faithful "Matador" in the rear to collect any who might fall by the wayside.

On one occasion, the "Matador" was carring a smashed Jeep and towing a 4 x 4 3-tonner, whilst somewhere ahead in the convoy a 6 x 6 Re-fueller was towing a 6 x 6 Troop Carrier. Whilst the convoy was ascending the locally notorious Bulli Pass (gradient mostly around 1 in 10 with stretches of 1 in 8, length 2 miles), the 6 x 6 Refueller burnt out its clutch. In due course the "Matador" arrived; without hesitation the driver produced another towing bar and added the two stranded vehicles to his existing load; he then not merely towed the whole lot without trouble to the top of the Pass, but continued for nearly 50 miles into Sydney traffic to his destination.

I could scarcely believe my eyes when this astonishing cavalcade hove in sight, and unfortunately nobody had a camera. But you will readily understand the confidence I always felt when sending the "Matador" out to salvage a crashed vehicle, and the affection with which she was regarded by my salvage crew.

From Dvr. Alexander, F. L., C.M.F.

Dear Sirs,—I am just an ordinary driver serving with H.M. Forces overseas, but it gives me great pleasure writing this short letter to you on the wonderful performance of A.E.C. "Matador" 4489008 of which I was driver serving with a H.A.A. Regiment.

From the beginning of the N. African Campaign until a short time before the capitulation the A.M. vehicle did marvellous work and never once did I have any major trouble.

The people responsible for turning out such a wonderful job of work played a great part in bringing to an end the war in Europe. Soldiers of all nationalities have remarked on the "Matadors'" wonderful performance.

From 11,407,504 Day, F., S.E.A.C.

Dear Sir,—I am writing for six drivers of A.E.C. "Matadors." These tractors are used to tow the mobile equipment of a Heavy Anti-aircraft Troop, i.e. 3.7 mm. guns and radar equipment.

The tractors we possess in our troop are four 1942 models and two of 1940 vintage. The first four have a total mileage of 8,000 each. These were assembled in India in October, 1943, and have carried on through the most gruelling conditions almost trouble free.

The 1940 models were taken over from another A.A. unit which had been operating in Ceylon. These two tractors have kept pace with the four new ones and have upheld the A.E.C. record, each having a mileage of approximately 19,000.

These tractors have, when travelling, a 6-ton load plus a towing load of 9½-tons, making a total load of 23½-tons. They have proved to be the only tractor capable of doing the job. We have tried several different types produced by other home and overseas firms but the A.E.C. has proved itself the one and only tractor of its type suitable for towing our equipment.

Our six tractors, with others of the regiment, have just completed a journey from Western India to Central Burma, an endurance test for men and machines. The 2,900 miles were covered in 24 days, excluding 10 days interspaced for general maintenance, checking, greasing and personal maintenance.

The track surfaces varied from concrete strips which were few and far between to the more usual earth track with a 6-in. layer of dust and potholes anything up to a foot deep making convoy travel a nightmare. Gradients of 1 in 4 with hairpin bends, over ranges of hills often climbing to the regions of 9,800 feet above sea level were common.

On one run we climbed 8,000 feet in 24 miles. On the second stage of our journey into action the roads were just tracks bulldozed out of the hillsides and jungle and the day's journey is limited by the hard going to a distance of 15 miles.

From seven A.E.C. fans,
F. Day, G. Watson, B. Chedgay, F. Gooch,
L. R. Redyment, J. P. Sleet, T. W. Wilson.

From Dvr. R. F. Adams, S.E.A.C.

Sir,—I am very interested in the A.E.C. as I have had quite a lot of experience with the A.E.C. "Matador" during the war, and especially in this particular theatre. The "Matador" has always been an excellent and reliable truck. Due to your skill and craftsmanship never once do I remember us having any serious trouble.

We towed and winched 7.2-in. howitzers from Dinapur, over the "Hump" across the Imphal Plains, down the Kabaw Valley, and on to Mandalay and then Rangoon. Over terrain, jungle roads and hills, which to the ordinary person would look simply impossible. With the "Matador" we always keep the wheels turning, which is our motto, and get to our destination no matter where it might be.

One particular instance we encountered, I don't know if you will think this outstanding, we think it is. We came upon a Sherman tank which had stopped on a rather steep hill, and refused to start. We were asked if we would tow it to start it, it looked impossible seeing that the "road" was only made with a bulldozer. However, we tried it, and succeeded with one "Matador." Thanks to A.E.C., our trucks are still going strong. They are truck worths while driving.

From Capt. C. E. J. Pemberton, R.E.M.E., S.E.A.C., a member of the A.E.C. staff who joined up in 1943 and is now Technical Adviser to the No. 4 Corps.

His letter was directly prompted by the request of the "Gunners" that he should convey to A.E.C. on their behalf, their appreciation of the work accomplished by the "Matadors."

"I was lucky," he writes, "to be posted to a Heavy Anti-Aircraft Regiment because we had, as gun towers, a number of 'Matadors' and in the workshop store were A.E.C. 'Marshals.' We brought these vehicles from Imphal to the Irrawaddy over roads which, formerly no more than bullock-cart tracks, had been widened by bulldozers."

5,000 ft.—but the A.E.C.'s "Made It."

"The initial climb of 5,000 ft. across the saddle at Palel proved the downfall of many vehicles, but the 'Matadors' and the 'Marshals' were able to 'make it.' At Tamu the road ceases abruptly and the next 400 miles are merely an irregular winding track covered in alluvial dust. In one place, even a 15 cwt. truck was forced back in order to get round an abrupt corner. The effort involved in manœuvring a 'Matador' and gun is best left to the imagination.

"We came up the Irrawaddy, over 600 miles of the worst roads in the world, and I do not think that the 'Matadors' will ever again be subjected to such a test. Although the vehicles were four years old when the campaign began (some of them were at Dunkirk) they came through this stern ordeal magnificently."

From Dvr. G. McWinnie, S.E.A.C.

After having several debates with my mates, all drivers of "Matadors," we have all come to the opinion that the "Matador" is the only gun towing vehicle. I, myself, am driving a vehicle that has covered over 40,000 miles over some of the worst country and roads in the world.

[*Continued on page* 107

Army engineer mechanics servicing an A.E.C. 6-wheel drive armoured command vehicle.

An A.E.C. 4-wheel drive "Matador" medium tractor with a typical trailer war-time load.

From ex-Sgt. D. Richman, of Bath.

The difficulties of the country encountered by these superb vehicles ("Matadors") would have to be seen to be believed. They surmounted the boulder-strewn hills to reach places which seemed most inaccessible to even much smaller vehicles and guns; indeed, they gave one the impression of some prehistoric monsters dragging their prey after them.

The way in which they climbed over boulders and ditches—unfalteringly—was the cause of great admiration from the Commanding Officers and military personnel.

Our drivers were, without exception, expert fellows, though quite of number were mere learners when we left England in 1942. The utmost simplicity of vehicle control enabled them quickly to become experts and they were always able to surmount the most trying difficulties in all emergencies. It was often said by our Brigadier (in the early stages): "they cannot do it." But the Colonel had the utmost confidence in our A.E.C.'s and men and after magnificent demonstrations, any doubts as to the vehicles' astounding performances were quickly dispersed.

I can assure you that never have I experienced so great a pleasure as being responsible for the maintenance of such vehicles—they should have been named "Indefatigable."

And now I will give you some idea of the work the "Matadors" had to tackle immediately we arrived in India.

First they had to cross the Western Ghats, where no heavy vehicles had been before, but it had to be done and without delay. We climbed continuously for twelve hours to a height of over 7,000 ft., but owing to the short wheelbase it was rarely found necessary to have a second look at even the most acute corners. Often the superstructure was rubbing the cliff side, while at the other side was almost a sheer drop into the valley below. Many a time the road was barely track width, the wheels running along only on loose stones which kept up the road edge. All the A.E.C.'s were loaded to full capacity with ammunition and equipment, but they showed no sign of hesitation. After passing over these Ghats we had about 400 miles of tortuous roads to the Bangalore district. During the time we were stationed there, we carried out manœuvres and journeys amounting to many hundreds of miles through this same type of country.

I found that the cooling system was quite adequate, even in the hottest parts, and it was not found necessary even to remove the radiator blind.

When the time came for us to go into action, we made the complete journey to the Bombay district in record time, having had no more trouble than a tyre burst owing to the excessive heat. From there we crossed India in an upward curve to Calcutta where we embarked for Chittagong. When we reached there, we set off for the Arakan front, a distance of over 100 miles of exceedingly bad road in places. Then the Japs came from the north and surrounded Imphal, capturing Kohima where they were only a few miles from Dimapure. Having no heavy type of guns available on the latter side, we were obliged to send half our medium regiment in all haste to stem the tide.

Rescued from River Bottom.

The journey again was tortuous, yet all the vehicles kept up an amazing average of speed and I can truthfully say, "No trouble whatever" except that when the last vehicle climbed on the ferry to cross the river, the platform collapsed and the A.E.C. slid to the bottom of the river. It was standing almost vertical, but we recovered it and within a few hours the engine was running again.

Shortly afterwards the remaining half of the regiment was on its way again, so I was detailed back to see the A.E.C.'s over the Shillong Ghats. Well, there again my presence was unnecessary and every vehicle did its stuff and arrived without even an adjustment.

We had various mishaps at different times, such as road edging giving way and depositing a vehicle on its side, but we always rescued it and always it was found to be none the worse for its experience. Once when we lent an A.E.C. to fetch a heavy A.A. gun down a Ghat road, past Imphal, the driver had to make an emergency stop because of an Indian jay driver swinging around a bend in the centre of the road. The road had recently been cleared of muddy earth that the Japs had blown from the cliff side to block the road and the surface of it was like butter.

As a result the 10-ton gun just pushed the A.E.C. forward and over the side. Both gun and vehicle rolled over sideways nearly three turns and when about 100 ft. down the gun slurred round and arrested the A.E.C.'s descent so that all four wheels were in the air at right angles to the slope, which was about a 1 in 1 grade. The driver had jumped clear, but the mate was less fortunate. At one time he said he was half out of the window, but managed to pull himself inside again. He escaped unhurt as also did six Indian gunners who were in the body, together with the A.A. ammo. and charges boxes, etc. It must have been the centrifugal force coupled with the strength of the superstructure that saved their lives. Had the vehicle not stopped when it did, it still had another 200 odd ft. to fall before touching bottom. It took us almost a day to recover the A.E.C., yet when we finally got it to the road again we were able to drive it to our workshop over 70 miles under its own power.

The chassis was bent slightly edgewise from the gear box rear cross member, but I managed to straighten that with the aid of a 20-in. girder and chains and an 18-ton ratchet jack. We were fortunate enough to procure another body and cab from another regiment's A.E.C. damaged in action.

At the end of this job I left the Regiment.

From Dvr. V. J. Hackett, S.E.A.C.

I have been a driver of one of your famous A.E.C. "Matadors" for the past four years. In my opinion, this Tractor is the very best the Army has for its size. Our laden weight when we travel is about 24-tons and I have come all the way through Burma with it. The total mileage is 21,000. It has never seen a workshop and is not likely to.

From Sgt. A. O. Nash, B.L.A.

I have been engaged in training N.C.O.'s of the Military Police for duties with armoured cars.

It is fully realised that a manufacturing concern with a name such as yours needs no testimonials, but I feel compelled to inform you of the experience obtained from a number of A.E.C. Mark I Armoured Cars, equipped with A.197 C.I. engines.

Throughout the instruction period these vehicles gave excellent service and were most notably trouble free, no time being lost due to mechanical failure.

The engines were quiet and economical in operation, whilst they showed a marked ability to hang on in high gears over rough country and hilly ground.

The clutch was smooth and positive in operation, while the gear box was one that inspired confidence in a new-comer to heavy vehicles.

In closing it would only be fair to tell you that these vehicles despite threats from instructors, were ill treated and "hammered" and I can only look upon such treatment as an additional testimonial of the quality and durability of your productions.

From Gnr. T. Greenfield, Malta.

Since 1942 I have been driving various types of trucks in the R.A. but it is only in the last two years that I have been acquainted with the A.E.C. "Matador" gun tractor.

Prior to being stationed here at Malta I was in the B.L.A. from June 1944 until I returned to England in July 1945. During the whole of that campaign the "Matadors" of the Regiment I was in did admirable work across various types of ground and also variable climatic conditions and not once were the guns delayed from getting into action on time—thanks to the good sound workmanship involved in the construction of the "Matador."

No doubt you will be rather bored by reading the various ever-glowing praises of the A.E.C. "Matador" from all the different theatres of war that they have operated in and so I hope you will excuse me for telling you what is not exactly fresh news.

Once again I wish to thank all of you concerned for giving us Army drivers a vehicle of 100 per cent. endurance, dependability and general all-round performance.

From S. Sgt. C. E. Chun, G.H.Q., New Delhi, India Comd.

Since leaving England in 1943 I have travelled a considerable amount and had the pleasure of spending some days in Durban where I rode about in double-deck A.E.C. trolleybuses.

During 1944 I was stationed in Nairobi and other parts of East Africa and in 1945 in Ceylon and India and it is now some considerable time since I saw, let alone rode on an A.E.C. vehicle.

To-day, we had an A.E.C. "Matador" Service vehicle parked in the vehicle park of G.H.Q. and I could well imagine standing on the car park at Exeter amidst a group of "Regal" and "Renown's" of the Devon General or better still at a busy traffic centre somewhere (or anywhere) in the London area.

It is little wonder that the A.E.C. is well liked. During the day I've seen quite a few serviceman looking the "Matador" over and then turning to a comrade with a knowing wink, saying: "A.E.C.—eh! Just the job."

Some time ago I received leaflets from you about the "R.T." chassis and whilst stationed in Ceylon loaned them to the Director of Transport and the Commissioner of Motor Transport at the time when consideration was being given to the possible operation of D.D.'s in the island.

From Major D. N. A. James, I.E.M.E.

No doubt all vehicle manufacturers will benefit from the operating experience obtained overseas particularly those like my own whose vehicles were used for specialised jobs. I came across A.E.C.'s hauling Artillery and doing heavy recovery work everywhere I went. At one period the Armoured Brigade Workshop of an Indian Division in which I served had the job of helping to clear up the battlefield after El Alamein and the A.E.C. "Matadors" were in constant use hauling derelict tanks back to the tank graveyard.

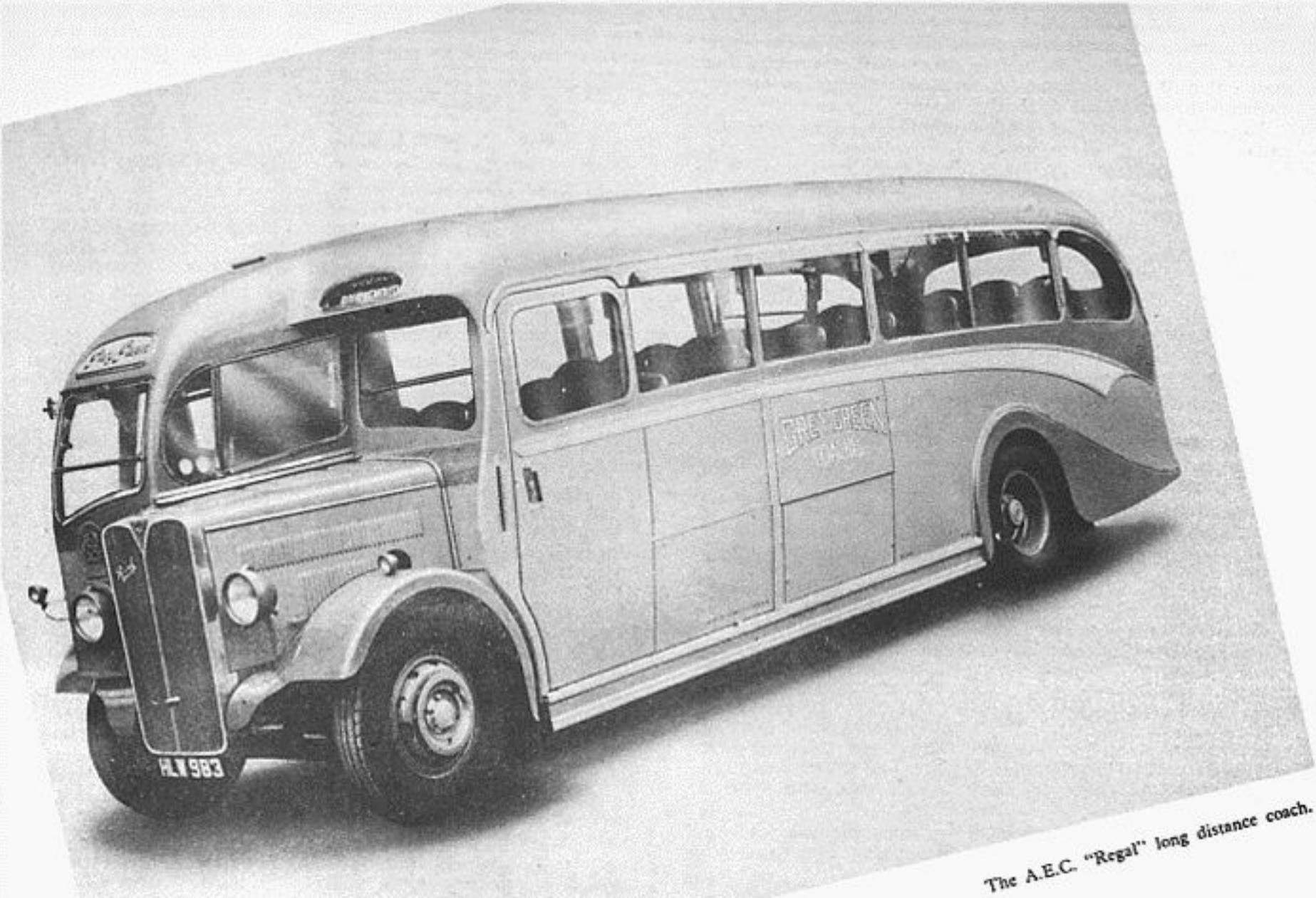
A.E.C. engines were used extensively in tanks, Armoured Command trucks and other specialist vehicles where a greater degree of reliability than normal was required if their work under exacting conditions was to be effective. That A.E.C. vehicles earned a great name for sturdy reliability and high performance is beyond doubt, and I always had a feeling of pride whenever I came across the familiar red and blue triangle even if usually it was smothered in camouflage paint.

From Lt.-Col. I. J. Wilson, R.A.

The performance of your A.E.C.'s throughout the campaign has been excellent: they have never let us down in any respect.

From Sapper V. J. Lee, M.E.F.

I must not say much regarding W.D. types, but I can mention the "Matador" as being one of the finest handled by Army drivers: they are always ready to speak of them in terms of praise.



The A.E.C. "Regal" long distance coach.

HERE FOLLOWS A RANGE OF A.E.C. POST-WAR PRODUCTS

The A.E.C. "Regal" single deck bus.

THE RETURN TO POST-WAR ACTIVITIES

This record of A.E.C. wartime activities, distinguished though it be, would be incomplete without a few remarks concerning the Company's plans and production programme for the immediate future.

It will be remembered how, at the outbreak of hostilities, the manufacture of civilian type vehicles virtually ceased almost at a moment's notice. Intensive production of special military chassis then began without any need for radical changes in the Works organisation. So with the return of peace, it became possible to resume normal manufacture with a marked absence of confusion or delay.

It is this characteristic adaptability in dealing effectively with changing conditions that inspires road transport operators with the lively hope that the war-weary fleets fast approaching mechanical exhaustion, are soon to be renewed.

Not that the task confronting all motor vehicle manufacturers at the present time is an easy one, for the aftermath of War has brought in its wake new and complicated problems.

Nevertheless, the A.E.C. backed by a sound organisation, resolute administration and a loyal band of workers, entertains no doubts as to renewed success in the manufacture, distribution and servicing of high quality vehicles in sufficient quantities, it is hoped, to meet the most pressing demands in Home and Overseas markets.

Such lessons as have been derived from wartime experience are being applied to the design and construction of A.E.C. post-war models, so that from clouded years the light of the silver lining is directed hopefully upon the future, when more and better vehicles bearing the familiar A.E.C. triangle shall serve the community on its lawful occasions.

How is it possible, one may ask, for a firm occupied for so long with military vehicles and equipment to produce " out of the hat," so to speak, the kind of bus so earnestly desired by a long-suffering public, compelled to travel daily in old and worn vehicles or those of the wartime austerity type ?

Perhaps the more observant of bus users in London may have noticed something strangely agreeable in the comfort and performance of certain new A.E.C. double-deckers during their daily journeys, while the drivers and conductors of these new vehicles seem to relish their arduous duties with new enthusiasm.

The answer to the first question and the reason for such observations as those recorded above, are to be found in the latest A.E.C. double-decker which, originally known as the " R.T." type was designed jointly by the London Passenger Transport Board and A.E.C. and was built for and operated by London Transport just before and during the War.

The post-war version of the " R.T." type, known as the " REGENT " Mark III, now in production, presents marked superiority over any public service vehicle previously offered to the passenger transport industry. It is characterised by extraordinary ease of control and high performance derived from an entirely new conception of air-operated pre-selective transmission, a greatly improved fluid flywheel and a new high-powered six-cylinder oil engine of 9.6 litre capacity mounted flexibly to provide a true axial movement and capable of developing no less than 125 b.h.p. as its maximum output.

Expressed in terms more readily to be appreciated by the non-technical reader, all this means that the A.E.C. " REGENT " Mark III double-decker bus has an amazingly smooth performance, largely because everything is made so easy for the driver. The immense reserve of power enables the heaviest passenger loads to be carried while the engine is still working smoothly and happily under light control, and the action of the compressed-air brakes produces a sense of safety that passengers must experience for themselves to believe possible.

In a word, this latest example of A.E.C. passenger vehicle design is destined to out-date all previous examples of its class, being regarded by those who know as the highest conception of public service vehicle technique so far achieved in this or any other country.

[*Continued on page* 117

With the return of peace A.E.C. will again apply its unique experience and manufacturing facilities to the urgent task of providing even more advanced types of passenger and goods vehicles and other products for the vital interests of transport by road, rail and sea. On the following pages are featured a few of the many A.E.C. manufactures for civilian use.

Two examples of A.E.C.'s most modern type double deck omnibus. The "Regent" Mark III.

A typical double deck trolley bus built by A.E.C. in conjunction with the English Electric Co. Ltd. Since this page was planned A.E.C. and Leyland Motors Ltd. have pooled their trolley bus manufacturing resources and a new Company has been formed entitled British United Traction Ltd. This Company will in future handle all designing, manufacturing and servicing of trolley buses hitherto built by A.E.C. and Leyland Motors Ltd.

60 kw. generating set utilising the A.E.C. 6-cylinder 100 h.p. industrial oil engine.

The smallest in the A.E.C. goods range. Two examples of the A.E.C. "Monarch" lorry. Capacity (12 tons gross).

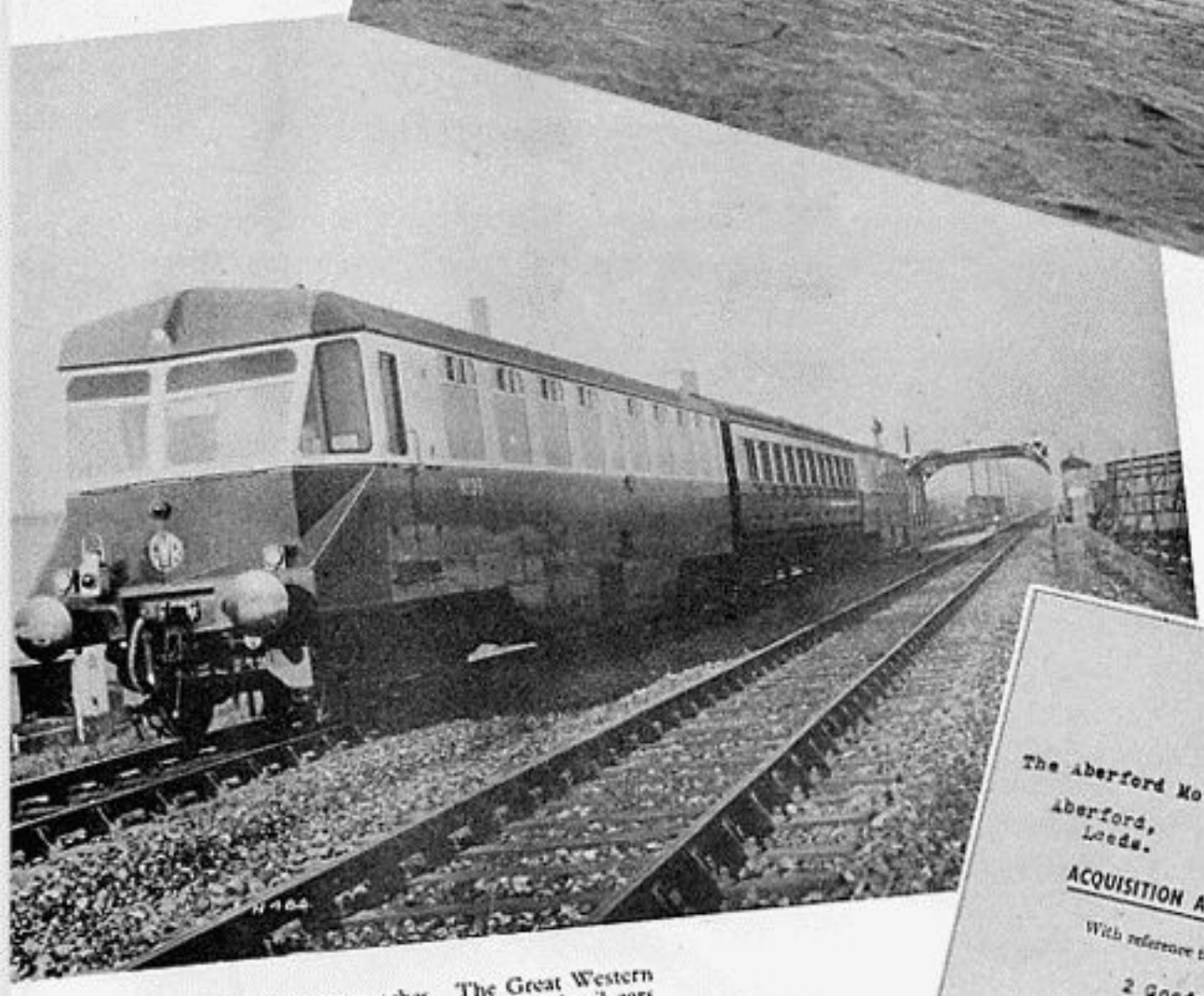
Two examples of the A.E.C. "Matador" (civilian type) lorry. Capacity (12 tons gross) and recommended for operation in conjunction with a trailer.

A.E.C. "Mammoth Major" 6-wheel tanker.

A.E.C. "Mammoth Major" 6-wheel flat platform lorry.
Capacity (19 tons gross).

Two of the largest vehicles in the A.E.C. goods range. The A.E.C. "Mammoth Major" 8-wheeler. Capacity (22 tons gross).

M.Y. "Seriola" powered by twin A.E.C. 6-cylinder 100 h.p. marine oil engines. The owner states: "After six years' Naval Service these two engines performed perfectly." (From a pre-war photograph.)



G.W.R. Rail Car with two trailer coaches. The Great Western Railway Co. operate a large fleet of A.E.C. oil engined rail cars of this and similar types.

Reproduced here is the first post-war licence to acquire A.E.C. goods vehicles. This was issued to the Aberford Motor Co. Ltd.

Reference 2Y. 19/2/7287
License No. 77346

MINISTRY OF WAR TRANSPORT

The Aberford Motor Company Ltd.,
Aberford,
Leeds.

2D, FITZMAURICE PLACE,
BERKELEY SQUARE,
LONDON, W.1

ACQUISITION AND DISPOSAL OF MOTOR VEHICLES ORDER, 1942

With reference to your application dated 11.1.45. for a licence to acquire

2 Goods Vehicles.

YOU ARE HEREBY LICENSED to acquire

2 (two) A.E.C. Monarch 7½ton trucks.

(which must not be fitted with tipping gear)

the conditions of this licence being that the vehicle(s)
(a) Will not be acquired at a price in excess of that authorised by the Manufacturers;
(b) (c) Will be used solely or mainly for the purposes specified in your application, and
(d) Will not be disposed of except with the consent of the Regional Transport Commissioner (North Eastern Region).

This Licence will cease to have effect unless the order is placed within one month of the date of the Licence.

Signed 17 MAY 1945
for the Minister of War Transport.

This licence should be produced for inspection by the person from whom the vehicle(s) will be acquired, and subsequently sent to the Council with whom the vehicle(s) will be registered. No acknowledgment of the safe receipt of this licence is desired.

P.T.O.

The first A.E.C. post-war vehicle delivered. A "Monarch" lorry being handed over to Mr. S. Gillatt (right) of the Aberford Motor Co. Ltd., by A.E.C.'s N.E. Divisional Sales Manager.

Nor is the supply of this excellent type confined to the use of bus undertakings at home, for the single-deck version, known as the "REGAL" Mark III, is being shipped in considerable numbers for operation in various parts of the world.

Special attention has, of course, been paid to the specification of the overseas model to comply with local requirements, such as left-hand steering, the grouping of all auxiliaries and exhaust manifold on the side of the engine away from the driver irrespective whether of left or right-hand control, frame dimensions, varying wheelbases, and technical details of minor but extremely important character.

So confident is the Company of the "REGENT" and "REGAL" Mark III superiority that manufacture of other A.E.C. pre-war bus and coach chassis has been discontinued, a bold policy that should influence wavering potential purchasers, in the fields of municipal or company-owned undertakings, that nothing but the best in the way of new vehicles can be accepted to provide new and better amenities for the millions who pay for such services.

Turning now to the goods vehicle side, after having earned the highest possible praise by military authorities, the civilian "MATADOR" chassis resumes its occupation in carrying the nation's goods, as it has done for the past seventeen years. As a solo vehicle the "MATADOR" will carry a 12-ton gross load, but its chief attraction is that of being able to make light work of additional freights hauled on a trailer.

Where loads not exceeding 12-ton gross are involved and the use of trailers is not convenient, the A.E.C. "MONARCH" is the ideal vehicle for the work.

It was generally supposed that the purely military four-wheel driven "MATADOR" would disappear entirely from civilian transport. In actual fact, however, quite a number of operators in various parts of the world look upon this four-wheeled load carrier as the only solution to problems arising where loads have to be transported over roads that are very imperfect or even non-existent.

Mention of transport in undeveloped countries calls attention to the special type of A.E.C. vehicles ordered by the Iraq Petroleum Company Ltd. These are of the six-wheel drive type, four-wheel drive being used for normal road work. Three forms of this chassis are to be operated, a bonneted model fitted with a power winch to form the tractor of an articulated vehicle with special semi-trailers to carry pipes or machinery. The two other models are of 10-ton capacity, one being a general-purpose lorry and the other an end tipper. These vehicles exemplify the Company's determination to really extend their technical facilities when confronted by clients' problems for which no previous solution had been found.

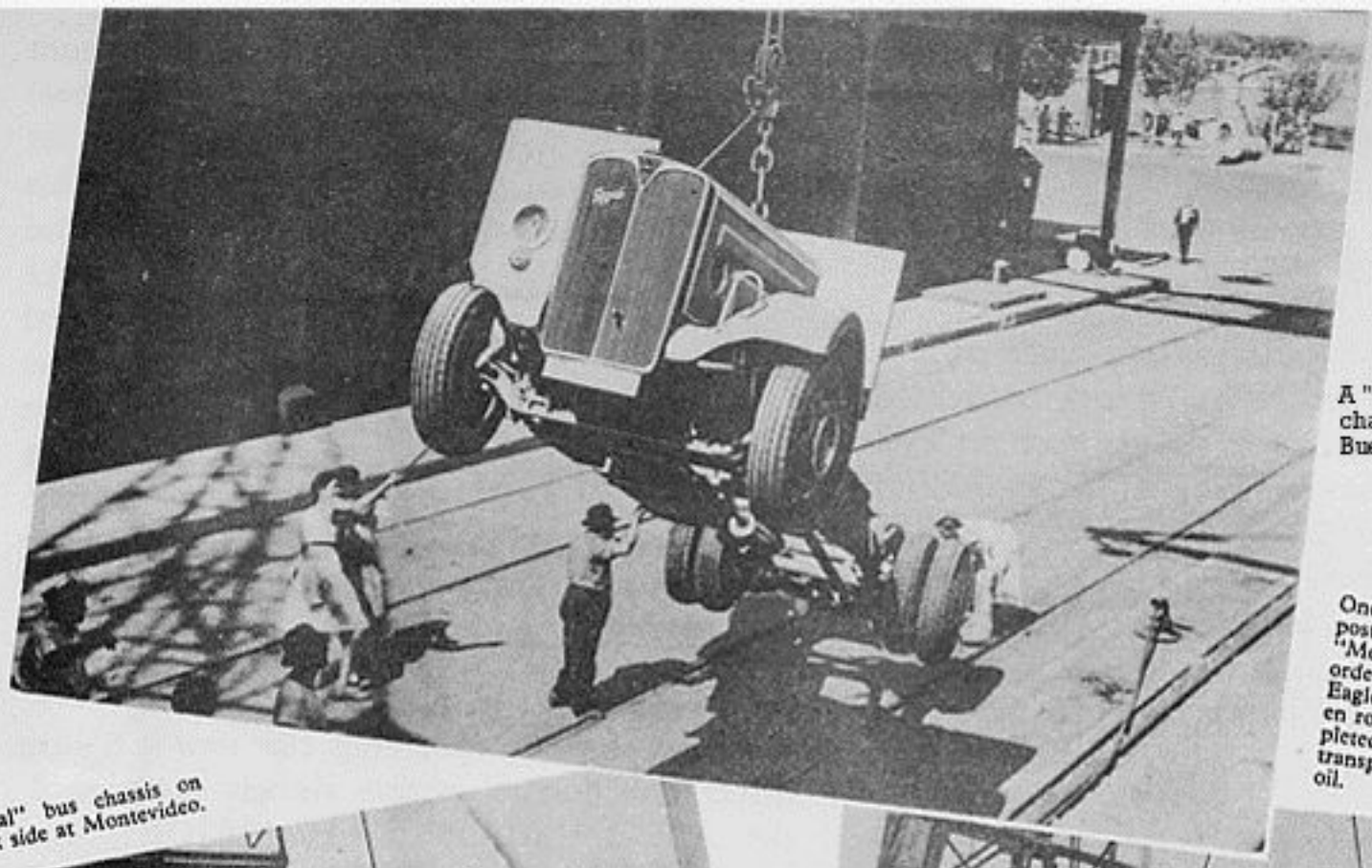
Except for incorporating the new 9.6 litre direct injection oil-engine already mentioned, the A.E.C. "MAMMOTH MAJOR" six-wheeled goods chassis is being produced largely in its original form. Capable of carrying a 19-tons gross load, the post-war version will undoubtedly enhance its long-established reputation, clean design, general all-round quality and efficiency assuring a long life of economical and profit earning service.

Also powered by the latest 9.6 litre direct injection oil-engine, the "MAMMOTH MAJOR" eight-wheeler, introduced in 1935, comes back into production to deal as of yore with 22-ton gross loads whether they be hauled over trunk roads in this country, across the sandy tracks of Africa or through the pampas of the Western Hemisphere.

Future development in Rail Car design is being carefully planned and the Company is paying every attention to all problems that affect this now popular type of rail-borne transport. For some years before the War, A.E.C. marine, industrial and stationary oil engines had been supplied for various types of service. The Company's post-war activities in this field will include engines incorporating many improved features, and these new power units are now in production.

These then, are the tools which the Company are placing in the hands of transport operators the world over. By doing so the A.E.C. will play its part in serving the cause of peace just as faithfully as in bygone days and with the same determination as when building vehicles which helped in no small measure to remove a horrible smudge from the face of the earth.

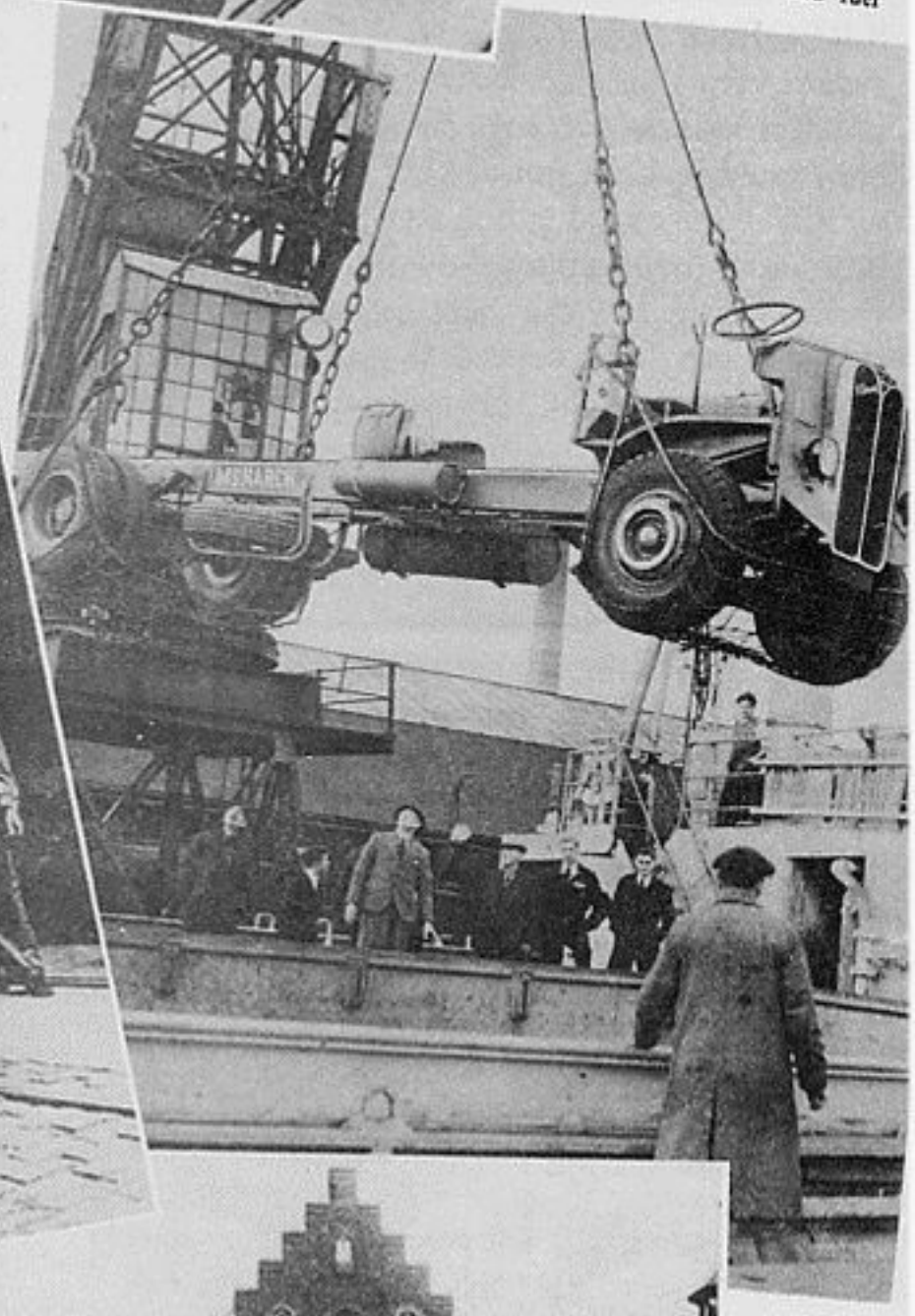
EXPORT

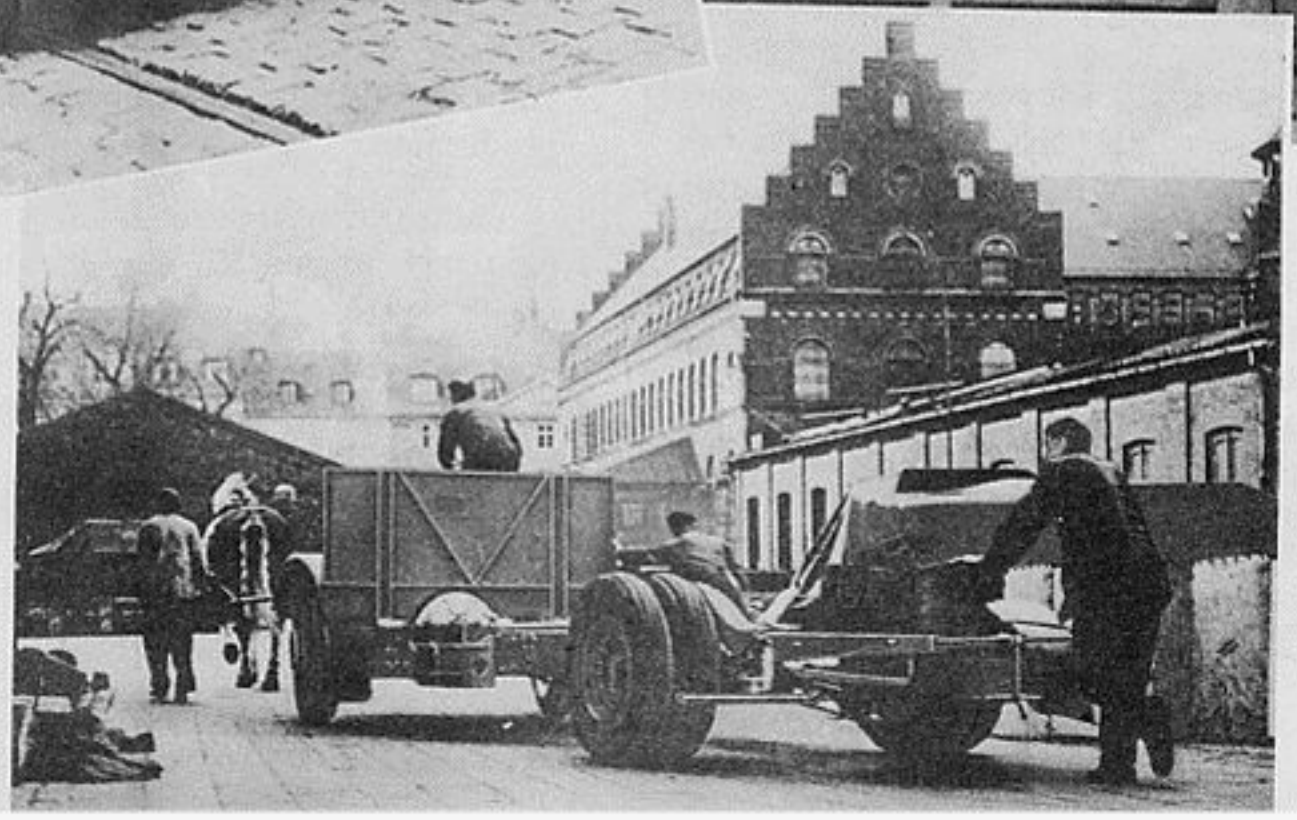


A "Regal" single deck bus chassis arriving in Buenos Aires.

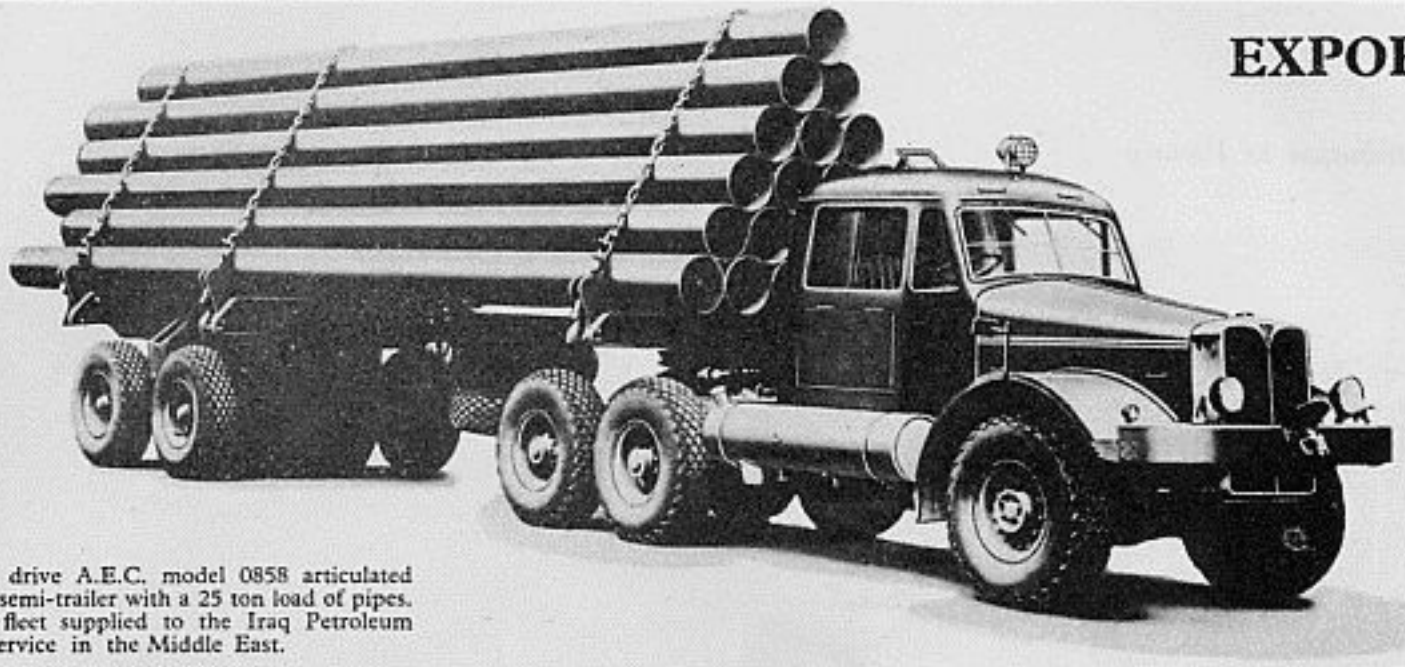
One of the Company's early post-war shipments. An A.E.C. "Monarch" chassis, one of an order for 14 received from the Eagle Oil and Shipping Co. Ltd., en route for Havana. The completed vehicles will be used for transporting gasolene and fuel oil.

A "Regal" bus chassis on the dock side at Montevideo.

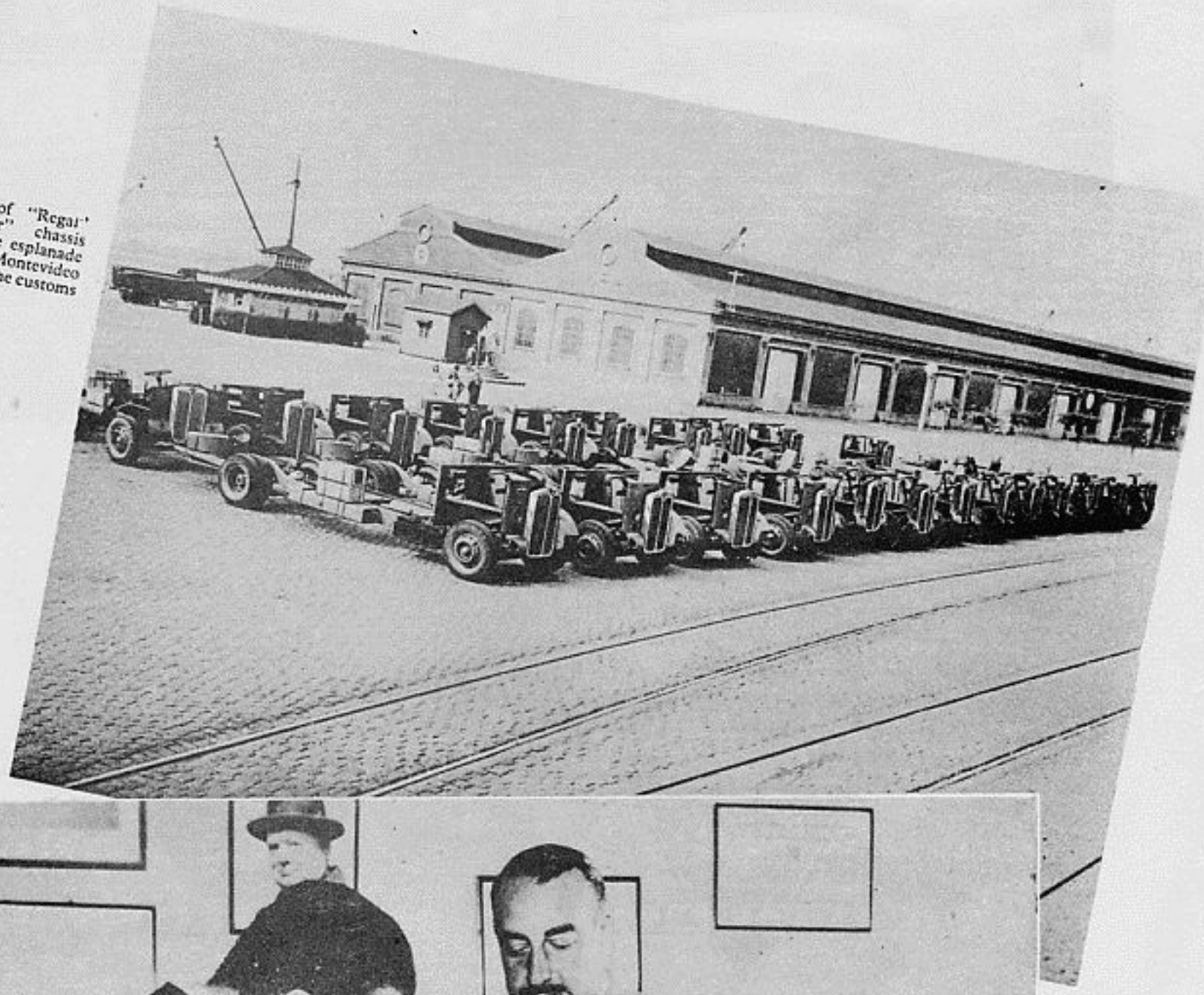




A.E.C. single deck bus chassis being delivered in Copenhagen, Denmark, where a large fleet of A.E.C.'s are now operating.

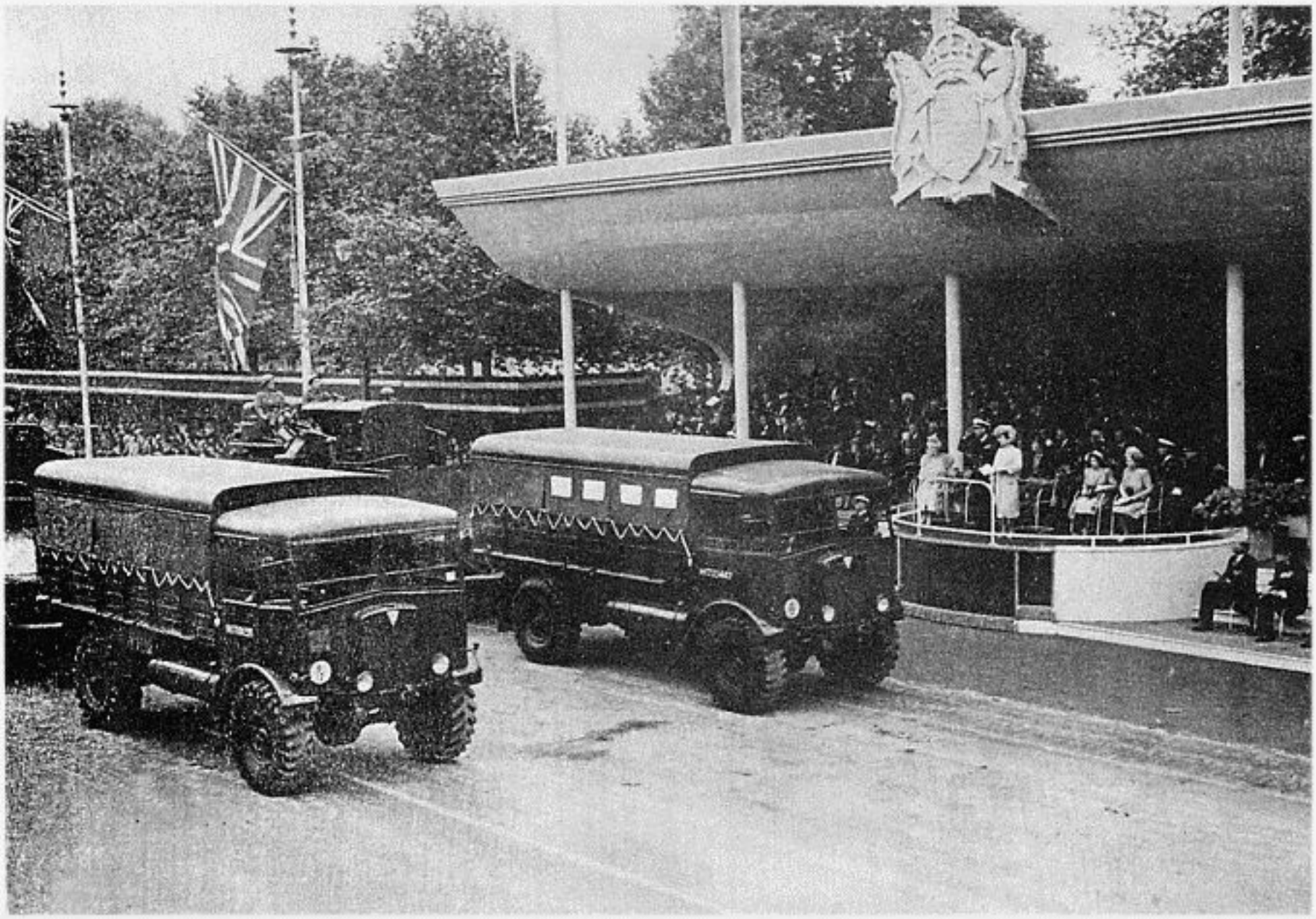


Special 6-wheel drive A.E.C. model 0858 articulated type tractor and semi-trailer with a 25 ton load of pipes. One of a large fleet supplied to the Iraq Petroleum Co. Ltd., for service in the Middle East.



A shipment of "Regal" and "Matador" chassis lined up on the esplanade of the Port of Montevideo before entering the customs warehouse.

A.E.C.'s distributor for Uruguay showing a Montevideo journalist a realistic model of the Company's single deck type of bus being supplied for service in Montevideo.



Left : the registered trade mark under which A.E.C. products are marketed in Gt. Britain and overseas countries, excepting S. America and Spain. Right : the registered trade mark under which A.E.C. products are marketed in S. America and Spain.