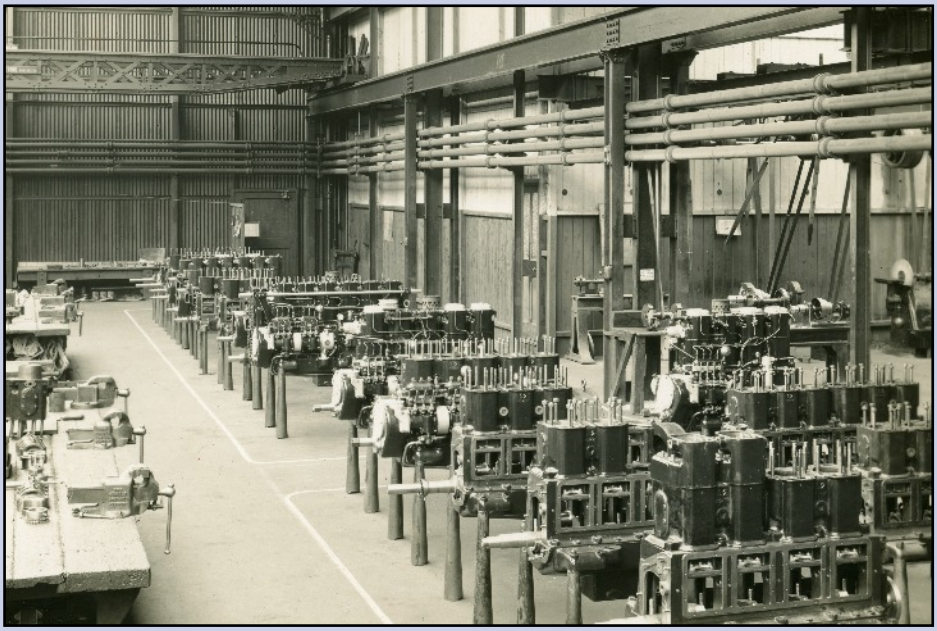
GARDNER

Engine Forum



Spring 2020

www.gardnerengineforum.co.uk

No. 37

GARDNER Engine Forum Membership Application

Title	Mr / Mrs / Miss / Dr / Other		
Forename(s)			
Surname			
Address			
	Post Code		
Telephone Number		Ex Directory	Yes / No
Mobile			
Email Address			
Engine Model			
Engine Serial Number			
Engine Application	Stationary	Road	Marine
Year of Manufacture			
Name Vehicle /Vessel			
Signed		Dated	
Any Other Info			

This information will be held on a computer database

Membership fee £10.00 per annum
Renewable on the anniversary of joining,
Payable by cheque, electronic funds transfer or standing order.
For electronic payment please tick the box ☐
The treasurer will contact you with the banking details
Cheque's payable to:- Gardner Engine Forum
A complete application form can be downloaded from the website at www.gardnerengineforum.co.uk/subscribe
Please complete the above and send to
Mrs J Gray
29 Verity Walk
Wordsley
Stourbridge
DY8 4XS

Gardner Engine Forum Philosophy

The aims of the Forum are to promote and foster interest in all Gardner engines"

Forum Officers

Chairman:
John Naylor.
Thatched Folly.
Lindow End, Mobberley.
Knutsford. WA16 7BA
Tele 01565 872222

Secretary. Linda Kemp
See below for contact details

Treasurer.& Membership Secretary
Judith Gray 29 Verity Walk
Wordsley Stourbridge West Midlands DY8 4XS
Tele 01384 827745

Editor-Webmaster-Vice Chairman.
Steven Gray 29 Verity Walk,
Wordsley, Stourbridge, West Midlands. DY8 4XS
Tele 01384 827745

Andrew & Linda Kemp.
Korna Cottage,
Works Lane,
Barnstone,
Notts.
NG13 9JJ
Tele 01949 860867

Contact email address
gardnerengineforum@blueyonder.co,uk

Contents **Page**

Chairman's Notes 2
An Early Electric Car

2020 Rally at Bugsworth
A.G.M Notice 4

Gardner Diesel's
Rise and Demise 5

British Tank Engines of
World War 1 11

Items for sale 17

Merchandise 18

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Cover Picture

L2 Erecting Bay

Circa 1931

Chairmans Notes

I first thought about my Chairman's notes on 02/02/2020. This was our only palindromic date in our lifetime. There can evidently only be 12 such dates. I learnt this from my paper, so now you know!

A week has now passed and storm Ciara is flowing in. I hope none of you have been affected and if you have, I can sympathise with you as we were flooded badly in my part of Cheshire at the end of last October. This was mainly caused by the lack of proper maintenance of the Highway drains.

We hear and read about Climate Change and the future of transport. This brings me on to electric vehicles; you may well ask what does this have to do with L. G. & S.

On December 8th 1897 my Grandfather W. S. Naylor was an electrical apprentice and was invited by the inventor of an electric car to go to the inaugural luncheon of the Royal Automobile Club in the car.

My Grandfather moved up to Eccles, Salford in 1900. He had obtained a position at Chloride Electrical Power (Exide) at Clifton Junction and progressed through the company, eventually becoming Chairman.

The family home was in Ellesmere Park, Eccles and their next door neighbour was a Mr. Joseph Gardner and his family. I was reminded about this when I read the obituary of Commander John Lorrimer who died on December 1st, 2019 aged 97. He was a sailor who in his midget X craft submarine helped to put the Tirpitz, a mighty German battleship out of action.. You will all know the engines in the X craft were 4 LK's and the batteries were manufactured at Chloride Clifton Junction, as were batteries for the larger submarines.

I have recently read an article about the fuel for historic diesel engines? I would be interested to hear your thoughts.

The rally will soon be upon us and I look forward to seeing you at Bugsworth.

I would like to welcome new members. David Taylor and Howard Evans

John

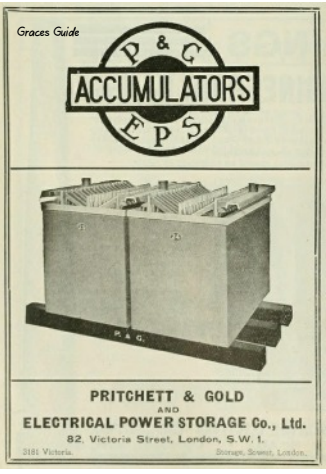
An Early Electric Car By W S Naylor

Exide Express Feb 1950

The editor has asked me for a few notes about the illustration on the next page. It is a photograph of a quaint little electric car which was running about the streets of London more than 50 years ago, The style of headgear, the driver,and the passenger (the writer) is sufficient evidence of the period. The inventor of the car Mr C.P Elieson managed a small accumulator company under the name of The Elieson Accumulator company in Camden Town London, where the batteries for the car were made. The chassis of the car was of a tubular construction something of an enlarged tricycle in use at the time .The most original part of the car was the driving mechanism which consisted of a sprocketed wheel on each end of the motor spindle which engaged a heavy bicycle type of chain, the latter having some of its piviot pins extended about one inch on each side of the chain. A drum attached to each back wheel was encircled by two leather bands spaced

apart slightly more than the width of the chain, the chain ran between these bands and the extended pins rode upon and gripped the bands by friction. The idea was to eliminate a differential gear which would automatically slip when turning. It was a pretty theory which worked on the level but the chains had to be kept very tight and sometimes needed attention en route in wet weather, as I well remember. To provide impressive publicity, the car once climbed Haverstock Hill from Camden Town to Hampstaed, which in those days was a recognised test hill .The motor was made by the firm of Immisch the pioneers of electric launches and powered by E.P.S batteries.

The photograph of the car was taken when setting out for the inaugural luncheon of the Royal Automobile Club in Whitehall Court on December 8th 1897. This function took place some twelve months after Emancipation Day November 14th 1896, which marked the abolition of the man with the red flag walking in front of a mechanically propelled vehicle on the public highway*. Another trip I remember is taking the car to Paris. In those days the cross channel transportation of cars was by no means a routine affair and it was with a great relief after watching the car dangling in mid-air to have it safely deposited on the deck of the steamer The Elieson Company also built two electric vans, one on a chassis similar to the car to carry half a ton and the other known as the "large" van with a channel section chassis which was claimed to be capable of carrying a ton. Like many other pioneer ideas the cars were not a financial success and the only sales were when the concern was sold up. It may be of interest to record that at the sale the small van was purchased by Messers , Prichett and Gold and I drove it for them to to their works at Feltham in Middlesex, I little thought that I should have a much closer connection with the firm of P and G at Dagenham many years later.



* From 1st of July 2019 all New Electric and Low Emission Vehicles will have to have an Acoustic vehicle alert system (A.V.A.S) which sounds like a traditional engine when travelling below 12.5 mph either forwards or reversing

2020 Rally at Bugsworth. 6th & 7th June,

Plans are slowly developing into place for the rally, Insurance obtained, event application and risk assessment forms completed and submitted to Canal and River Trust, who if they follow past performance won't produce the necessary paper work until a few days before the event. The latest information from C &RT on the water supply, following last years problems with Todbrook Reservoir, is that if we have a dry spring, then there may be an issue from about the middle of June, so hopefully we will be done and dusted before there are any issues.

So far entries for the rally have been encouraging on the canal front, but a little disappointing in regards to stationary engines and commercial vehicles. Hopefully this is down to the forms being sent out before Christmas and that the 2020 rally season was a along way off. So if you are planning to attend please let me have your forms back. Forms are available from the website at www.gardnerengineforum.co.uk/Events.html if the original has been misplaced.

Attendees to the Etruria rally will remember that there were additional exhibits in the form of non Gardner stationary engines and classic cars. This was deemed a success by all who offered an opinion by the end of the rally. As Bugsworth is quite a large site, the committee decided that we should try to encompass this again. Contact was made with Macclesfield Vintage Machinery Club who had been the main contributor to the Etruria stationary engine display and they have agreed to bring some engines and form a display over the weekend.

Efforts are being made to encourage more entrants from the commercial vehicle and classic car side, but contact details are difficult to come by, so if any member can help by distributing posters at other events in the vicinity it would be appreciated.

Just as a reminder, the Navigation Inn is also holding a "Buggy Bash" over this weekend, which will include live music, children's entertainment and a craft fair on Sunday. This will be taking place on the land adjacent to the pub (see rally poster).

Currently we still have places available for the Sunday evening meal.

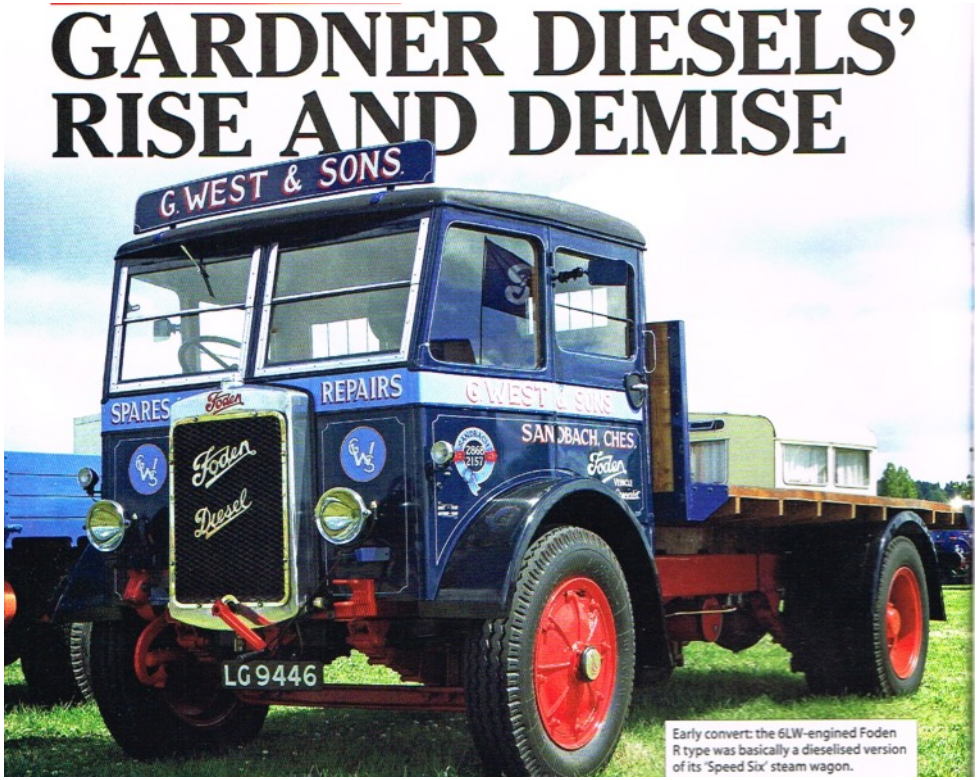
Contact Steven or Judith Gray if you need more information. (details at front of newsletter).

Annual General Meeting

The Annual General Meeting of the Forum
Will be held at Bugsworth Interchange Basin
Nr Whaley Bridge in the Peak District. SK23 7NE
On Sunday 7th June at 11.00am
Items for the Agenda to be with Mrs Linda Kemp
Korna Cottage, Barnstone, Notts , NG13 9JJ
Or by email to gardnerengineforum@blueyonder.co.uk By May 24th

This article first appeared in the August 2019 edition of Heritage Commercials and is reproduced here by kind permission of the author, Ed Burrows.
Note: Due to space limitations not all of the original photographs have been included.

GARDNER DIESELS' RISE AND DEMISE

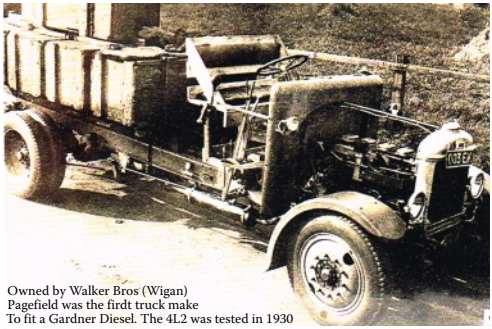


Early convert: the 6LW-engined Foden R type was basically a dieselised version of its 'Speed Six' steam wagon.

2019 marks the 90th anniversary of the first Gardner road vehicle engine, the four-cylinder 4L2. Revolutionary in every sense, it was the precursor of a series of diesels that put Gardner at the heart of the North West's premium heavy trucks industry.
Ed Burrows recounts the history of an engineering dynasty founded 151 years ago, which won international respect for its marine and industrial engines long before it built commercial vehicle diesels.

For the best part of 40 years, the North West trio of moderate production volume premium truck makes - Foden, Atkinson and ERF - had a co-dependent relationship with a fourth member of the region's automotive cluster, L. Gardner & Sons. The former Patricroft, Manchester diesel manufacturer branched out into road vehicle engines with the introduction of the L2 series. Also designed for marine, light rail, industrial applications, the first road vehicle installation was a Lancia single-deck bus in 1929. The first known to have been fitted to a commercial

vehicle - the 15th L2 built - was a four-cylinder 4L2 installed the following year in a Leyland, replacing its original petrol engine.



Owned by Walker Bros (Wigan)
Pagefield was the firdt truck make
To fit a Gardner Diesel. The 4L2 was tested in 1930

To put diesel commercials into the context of the time, Leyland was developing its own range, Foden's first diesel chassis was a year away, Atkinson was in its infancy and ERF'S emergence was still three years off.

L. Gardner & Sons traces its history back to a jobbing machinist's business established by Lawrence Gardner in 1868. Its premises were in the cellars of four adjacent houses in Hulme, Manchester. Demand for the firm's services led to moving to a new factory close by in 1884.

The 4L2 test was overseen by (L to R) Thomas Gardner, W Parkinson (the vehicle's owner) and Joseph Gardner

Paths cross many times. In the same year, and a matter of a few hundred yards away, Henry Royce started the electrical and mechanical engineering business that became Rolls-Royce and although via different corporate manoeuvrings, in the 1980s, both Gardner and the automotive diesels side of Rolls-Royce were subsumed into Perkins.

Before its first internal combustion engines appeared in 1894, as general precision engineers, Gardner manufactured products including sewing machines, equipment for moulding rubber tyres, bread dough mixers, box-making machinery, coffee roasters and hydraulically adjustable dentist's chairs.

More significantly, in 1892, Gardner began manufacturing - and exporting - dynamos for electricity generation. Concurrently, it began the sub-contract manufacture of components for single-piston hot air engines. These very rudimentary power units ran on coke or town gas.

1894 saw the first Gardner internal combustion engine. Running on town gas, it was designed and built by Lawrence Gardner's sons Thomas and Edward. An Otto cycle four-stroke with a single horizontal cylinder, it produced one horsepower at 350rpm and drove a dynamo producing electricity for lighting an area of the factory Within a year, output rose to 2.7- to 3.5bhp. Around 100 units were built during the first two years of production.

Internal combustion engines were the new big thing. The Gardner family recognised that the next move needed to be into motors fuelled by liquid rather than gaseous hydrocarbon. Initially, these ran on paraffin oil, and subsequently on petrol, which offered the advantages of being lighter and more consistent in

quality than less-refined crude oil distillates. Gardner engines were available to suit either fuel type, though in the years before the First World War, oil was more popular as petrol was less readily available.

The pace of development was such that Gardner's annual output grew from 21 engines in 1894 to almost 300 units four years later. Production was spread across 12 different cylinder capacity variants, including the first two-cylinder design introduced in 1896. In the same year, the first land - three acres - was acquired at Patricroft, a few miles from Hulme. As the 20th century dawned, production at the new Patricroft site was up and running. Demand driven by the quality and all-round performance of its engines. To protect its reputation, Gardner was committed to self-sufficiency, including cylinder block castings. Business boomed to the extent that by the outbreak of the First World War, the Patricroft complex occupied 24 acres. (At its peak during the 1950s/1960s, the sprawling complex employed over 3,000 people).

In 1898, production of the initial series of small engines switched from horizontal to vertical cylinders. Five years later, the design of what by then a range of five sizes (1.7- to 10bhp), was changed to incorporate an enclosed rather than an open crankcase Larger horizontal engines for industrial applications remained available until 1942.

From 1903, the engine range was expanded to include the M series of industrial and marine engines. M series units were what today would be described as modular, available in single-, twin-, three-, four- and six-cylinder configurations. This set the pattern later applied to road transport diesels.

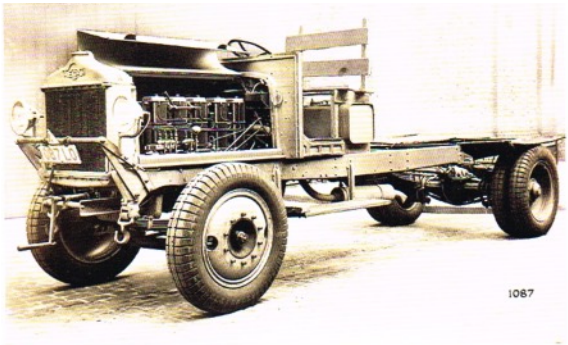
Cylinder capacities of series units eventually extended from 5- to 35bhp at a common 800rpm. M range units were produced until 1933.

Aside from a discarded experimental petrol engine for cars, Gardner's second engagement with vehicle power units (as distinct from stationary and marine engines) was the TS petrol engine. Designed for First World War tanks by Ricardo, Gardner was one of a number of firms awarded production contracts. It also produced crankshafts for the other manufacturers selected by the Government.

Just as the M series foreshadowed the modular principle applied to Gardner's later automotive engines, a six-cylinder high-speed marine engine introduced in 1918 for motor torpedo boats saw the firm pioneer the use of aluminium alloy engine components.

Immediately before the First World War, Gardner introduced the first of its VT (and later T type) slow-speed compression ignition semi-diesel oil engines for marine and industrial applications. Continuing in production until 1938, config-

urations 4two-, three-, four- and six-cylinders had outputs ranging from 36bhp at 450rpm to 300bhp at 290rpm. T series engines could be fitted with reverse gearing and a reduction gearbox.



▲ Although AEC developed its own diesel engines, a Gardner five-cylinder 5L2 found its way into an AEC in 1936.

It will now be evident that with the combination of multi-cylinder modularity, the pioneering use of aluminium alloy, and an unsurpassed reputation for reliability, economy and longevity, Gardner had the foundations in place - and possessed the engineering talents - for its move into automotive diesels.

The first - the 4L2 - was revealed in 1929. Genuinely revolutionary - though in reality designed for marine and industrial applications rather that automotive use - the prototype survives. It is a permanent exhibit at the Anson Engine Museum, Higher Poynton, Cheshire.

Anson Engine Museum volunteer, Gardner specialist and Gardner Forum Chairman John Naylor comments: "In the bus that became the first-ever road vehicle powered by the four-cylinder L2, the unit replaced a petrol engine. The performance was sensational. MPG was doubled - and in those days, at two pence a gallon, diesel was a third of the price of petrol.

"In spite of the clear advantage in fuel economy, the Gardner family members that designed it - principally Joseph and his sons Hugh and John - recognised the L2 was too heavy for automotive use. In 1931 - just two years after the L2's introduction - the first of the LW series was put into production. It was purpose-designed for road vehicle use. Weight was saved by the extensive use of aluminium castings"

John Naylor's career with Gardner was forcibly curtained, but it's a case of once a Gardner man, always a Gardner man. He progressed from an early-1960s day-release course student apprenticeship to service engineer. Then family circumstances intervened, forcing him to leave and take over the running of a relative's engineering business. In retirement, he's been able to pick up from where he left off. He is deeply involved with curating the Anson Engine Museum's comprehensive collection of early Gardner oil and gas engines, and subsequent diesels. The museum is also the custodian of all manner of Gardner artefacts and the Patricroft factory archives.

"Apart from their weight, earlier diesels were low revving, which made them unsuited to road vehicle applications. With the L2, the Gardners' genius was in

creating a higher revving compression ignition four-stroke engine with direct fuel injection:' John Naylor explains. "For an engine of a size suitable for automotive use it was a genuine world first. The L2 had variable valve timing as well - though not as it's known today, actuation was by a lever on the head of each cylinder"

The Patricroft team pursued the development of direct injection for several reasons. Although they had previously proved the practicality of indirect injection using a cylinder head chamber system, it had disadvantages. The solution was perfecting a system in which atomised fuel was introduced by multiport injectors into a hemispherical bowl combustion chamber in the piston crown. This offered the potential of reduced heat loss, superior fuel-air mixing and smoother firing, together with a more efficient exhaust cycle. Although early L2's had a shallow dished combustion chamber in the piston crown, experimentation quickly led to the switch to the 'hemi' type.

To function as intended, the combustion chamber had to be made with extreme precision, and combustion had to be perfectly timed. Precision was Gardner's forte. The system utilised the then-new Bosch jerk-type fuel injection pump in combination with a Gardner cam-box. Interestingly, before the design of the L2 was finalised, Gardner experimented with two different types of two-stroke. (The idea of a Gardner two-stroke was not new. The firm's VT series of two-stroke, slow-speed semi-diesel oil engines for marine and industrial applications was introduced in 1913. Incorporating hot bulb/surface type ignition, the largest four-cylinder units produced 120bhp at 290rpm).

Advertised as a high-speed diesel, the L2 had a cylinder bore of 4.5in and the stroke was 6in, giving a capacity per cylinder of 1.4 litres. The four-cylinder unit developed 50bhp at 1,300rpm. The basic modules were single and twin blocks, allowing one-, two-, three-, four-, five- and six-cylinder combinations. Cast singly for each cylinder, each head incorporated inlet and exhaust valves, motion levers and injection ports. Each cylinder had a decompression lever. Crankshafts were machined from solid forgings, flanged to carry the flywheel at one end, and housed in a top and-bottom split crankcase. Opening panels on the upper crankcase allowed access to the con rods, which were machined steel forgings drilled to carry lube.

Early road transport vehicle customers included Crossley Motors, Foden, Guy, Karrier, Leyland, Peerless Lorries, Scammel Thornycroft and Tilling-Stevens. L2s were variously fitted in new vehicles or were retrofitted to replace petrol engines.

"It's wonderful to be associated with such a pivotal piece of automotive history:" says John Naylor, who tends the Anson Engine Museum's 90-year-old prototype and with reverential care maintains it in perfect running order.

Gardner's response to the reception given to the L2 by vehicle manufacturers was the LW. Evolved from the L2 series and sharing bore and stroke dimensions, fundamental differences included the LW'S weight-saving cast aluminium alloy sump and one-piece crankcase. This in itself was innovative; in the motor industry in the early 1930s, the use of aluminium was still a novelty. In metallurgy much as combustion system design, Gardner was at the cutting edge. The change from cast steel components resulted in a weight saving 20 percent. Other departures from the L2 were larger main and big-end bearings, aluminium alloy pistons and two- and three-cylinder heads rather than an individual head for each cylinder.

▲ One of only two built, this full restored 100 Tonner's record gross train weight was 165 tons – thanks to a 196-to-1 bottom gear.

First into production was the 6LW. On the first day one went to Scammell and another to Karrier. Foden which at the time was still committed to steam wagons -took delivery of the sixth engine built. By the time the 1931 Commercial Motor Transport Exhibition opened at Olympia a few weeks later in November, sufficient 6LWs had been built for them to be a highlight of several manufacturer's stands. Peak revs of LW engines were increased to 1,700 per minute from the L2's 1,300, and maximum output was 17bhp per cylinder. Overall MPG proved even better than L2 units.

As a 'six' the LW produced 102bhp. This was accepted as adequate - astonishingly, it was not unit 1968, 37 years after its introduction that the 6LW20 development raised output to 120bhp. The '20' suffix indicated output was increased to 20bhp per cylinder. In four-cylinder form output was 68bhp compared to the 4L2's 50bhp. Comparative figures for the five-cylinder variant were 85bhp. The top-of-the-line 8LW straight-eight version, introduced in 1946, produced 140bhp - and a torque maximum of 458-lb.ft at 1,000rpm. LWK series developments in 1950 raised output per cylinder to 18.7bhp across the range.

were petrol-engined, the Gardner 6LW powered Scammell Pioneer tractors and Foden 10/12 tonners.

To be continued in the next newsletter.

British Tank Engines of World War I

This paper was presented by Trevor Owen at the Anson Engine Museum, Poynton on Thursday 24th September as a combined Imarest/IDGTE event.*

This paper traces the history of the development of engines for British tanks which were used during World War I. The initial engine selection was strictly limited as there was only one petrol engine in production in the UK that could provide the required minimum power within an acceptable size. The diesel engines of the era were too large and underpowered.

The initial selection proved to be a liability in service with a significant list of problems which affected its performance and reliability in action, including the production of clouds of blue smoke that gave warning to the enemy forces of a pending attack.

It was therefore necessary to develop and produce a replacement engine on a top priority basis. Harry Ricardo was engaged to undertake the task commencing in October 1916 and he was assisted with the design and production work by George Windeler, Chief Engineer of Mirrlees Bickerton and Day (who later became President of DEUA). The new engine was in volume production by April 1917 having previously met all the onerous design requirements during the prototype testing phase. It was the first engine to be manufactured in volume by multiple engine manufacturers within the UK with full interchangeability of parts. The paper incorporates feedback on problems and service results from various publications and also from some unpublished notes by Ricardo.

The initial Ricardo tank engine was so successful that further derivatives were produced before the end of the war for later tank designs. As a result of this work Harry Ricardo became established as a leading consultant on internal combustion engines and fuel technology, and this had significant benefit to the development of engines in the UK in subsequent decades. The work undertaken with the tank engines probably also influenced the design of the smaller high speed diesel engines which were released in the 1920s.

Introduction

This paper evolved from an earlier IDGTE heritage paper on the Ricardo tank engine development of World War I to include details of the Daimler Knight sleeve valve engine which powered the first four generations of British tanks. The idea to extend the paper came about following the acquisition by the Anson Engine Museum of a complete Daimler Knight sleeve valve tank engine. Research was undertaken on the Daimler Knight engine and the associated sleeve valve development. Also additional material came to light on the Ricardo tank engine which has been incorporated into this paper. The paper is based on a presentation made at the Anson Engine Museum in Poynton, Cheshire on 24th September 2015, but including additional information which has come to light in the interim period. Whilst the engines concerned were all petrol powered, the design and manufacture involved many of the established UK diesel manufactur-

(*The Institution of Diesel and Gas Turbine Engineers)

ers, and the developments highlighted general design issues of the period which could apply to either diesel or petrol engines. In addition, two of the main engineers involved with the tank engine development from 1916 onwards were both involved with the DEUA and one became President for a four-year term during World War II.

The time period for development and production of a new engine for the British tanks in 1916/7 was incredibly short with no modern aids such as computer aided design and modelling available to assist designers. The fact that it met the specification requirements from the outset and required few subsequent modifications was also remarkable. The Ricardo engine was the first development in the UK which involved standardised volume production of components and complete engines by a number of manufacturers at various locations within the UK.

The author's interest in the subject was first aroused in the late 1960s when he was presented with an original copy of a book dated 1919 showing the production of tanks engines in the Mirrlees works at Hazel Grove. The book was handed over by an employee who was retiring and who wanted the document to be preserved. He confirmed that he was employed at the factory during the last stages of WWI when copies of the book had been presented to all employees as part of the end of war celebrations.

Background to the 'Landship' development

The first UK development in the use of powered vehicles for military applications came in 1902 when enquiries were issued for a heavy oil tractor and this was followed by a trial in 1903 when the only vehicle competing was a twin cylinder oil engine tractor manufactured by Richard Hornsby. This design was a direct development of a steam traction engine and was of limited use in muddy conditions.

The next development was a chain track tractor powered by a paraffin engine as demonstrated by Richard Hornsby in 1907. This was more successful as a means of moving guns and other heavy objects across the battlefield and eventually three oil engine versions were supplied for military use.

The next development was the formation of the Admiralty Landship Committee in 1915 when William Foster and Company were co-opted to develop a 'tank' in high secrecy. The workers were told that the development was a tank for carrying water. A prototype was produced within 37 days in August 1915 and testing commenced which showed up problems with the caterpillar tracks. Further developments took place resulting in the Mark I tank being demonstrated on 2nd February 1916 and full scale production commenced shortly afterwards.

Engine supply limitations

At the time of the development of the first tank design there was only one engine design available which met the requirements for producing the required power of 100bhp plus within a small package. The diesel engines of the era were too large and underpowered and hence petrol was the chosen option. There was an ongoing debate on the best design practice amongst manufacturers of smaller high powered engines as used in automobiles and trucks as the industry was so

new.

Amongst the issues being pursued was the best valve design for the air and exhaust control on four stroke engines. The poppet valve systems of the era suffered from poor quality valve springs, with regular failures being a major issue and with spare springs being an essential operational spare to be carried at all times, even for motor vehicles. An alternative concept was the sleeve valve which had been developed and promoted by Charles Knight in the USA. A number of advantages were claimed for this alternative valve design including better reliability and the design was offered to various manufacturers across the globe in the mid-1900s.

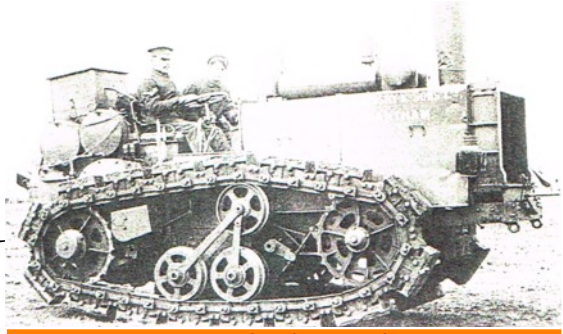


Figure 1 Hornsby chain track tractor

Daimler in the UK adopted the Knight sleeve valve design under the terms of a licence issued by the Knight and Kilbourne Patents Company, and first exhibited vehicles fitted with the engine in 1908. The Daimler Knight engine range included a 105bhp six-cylinder version which was used for large tractor applications with William Foster and Company of Lincoln. Many other manufacturers also adopted the sleeve design including Argyll, Daimler, Kelvin, Minerva, Panhard, Peugeot, Rover, Vauxhall, Voisin and Willys-Overland-Crossley.

The debate on which design was the better solution continued into the 1920s, with a number of papers being published to compare results. Daimler continued with the design until the mid-1930s and the company was one of the last to continue volume production of the sleeve valve engine. By comparison Rover only continued with the design for three years before reverting to the poppet valve design due to operational and manufacturing problems.

It was claimed that Daimler-Knight engines of various outputs were fitted to 2,600 London buses by 1914 with reasonably good results in service. In addition, the 105bhp engine was being supplied to Fosters for a military version of their tractor with production commencing in December 1914. It was a natural progression that the 105bhp engine was adopted for the first tank designs as no viable alternative was available and it continued as the standard engine right through to the Mark IV tank.

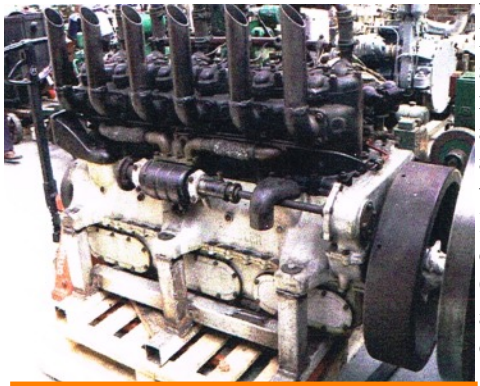


Figure 3 Exhaust side of Daimer Knight engine at the Anson Engine Museum

Production of the engines in volume caused some problems for the Daimler Company, in particular it was difficult to achieve acceptable tolerances with the double sleeve valve and piston assembly.

Operational problems with the Daimler Knight engine

Once the first tanks went into active service in 1916 feedback from the front line indicated significant problems with the engines. These can be summarised as follows:

a) Power

The engine was underpowered and inadequate for the duty.

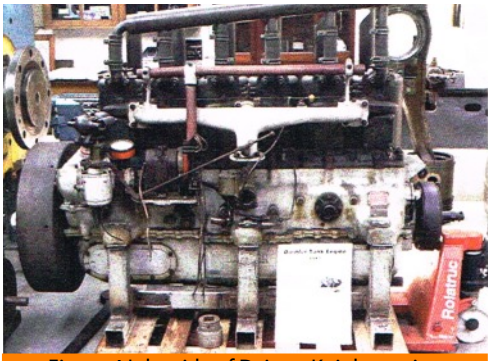


Figure 4 Inlet side of Daimer Knight engine at the Anson Engine Museum

b) Stalling

The engine would often stall during gear changes

c) Smoke emission

The engine had a distinct disadvantage of emitting vast clouds of blue smoke due to the amount of lubricating oil carried over into the exhaust. As a consequence, lubricating oil consumption was high requiring regular topping up in service.

d) Reliability

The engine reliability suffered mainly as a result of using a trough type sump with splash lubrication.
This resulted in bearing failure under heavy load or when operating at an inclined angle. In addition, the double sleeve valve system was prone to seizure due to the lack of lubrication dhder such conditions

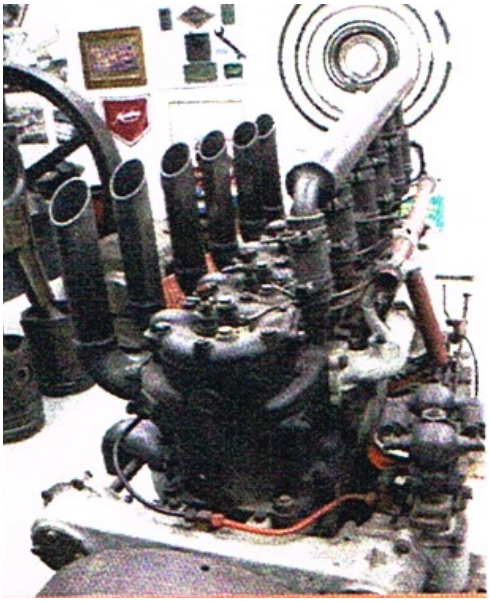


Figure 3 Exhaust side of Daimer Knight engine at the Anson Engine Museum

e) High wear rate

High wear rate on the double sleeve valve assembly

As a result of this feedback the Tank Supply Committee decided that an entirely new engine was required on an

urgent basis. Several manufacturers expressed an interest in building the engines but none were willing to undertake the design remit as they had insufficient experience with this type of engine and most were also busy with existing government contracts.

As regards the problem of blue smoke from the exhaust it was reported that when tanks were first used in battle the Germans sent up spotter planes to watch for any more tank attacks. They quickly realised that this was a waste of valuable air resources and that they would get ample warning from the plumes of blue exhaust smoke along with the noise of the tanks advancing. In spite of the significant limitations of the Daimler Knight engine credit must be given for the fact that this engine was in service in 1,470 tanks in World War I. The published production figures for the first four generations of tanks design are as follows:

Mark	150
Mark II	50
Mark III	50
Mark IV	1,220

There would been a significant volume of spare engines, major assemblies and individual components supplied for replacement in the field.

Harry Ricardo Involvement

Harry Ricardo first became involved with the war effort via the Air Ministry in developing engines for aircraft at an early stage in the war. In early 1916 he was also asked to assist with the requirement to load tanks with greater accuracy onto trucks and rail wagons where the overall size of the complete unit was close to the maximum possible for UK tunnels and bridges. He was able to assist with resolving this issue.

It was at this point that he was invited to prepare designs for the new tank engine. He had observed the limitations of the existing engine design at various tank demonstration trials in the UK. Design work was already underway on a 200bhp six-cylinder aircraft engine through Engine Patents Ltd, (a company which Ricardo had formed in February 1915) and it was originally proposed that this preliminary design might form the basis for the new tank engine.

To be continued in the next newsletter

LLANDUDNO TRANSPORT FESTIVAL

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LLANDUDNO TRANSPORT FESTIVAL cannot be held responsible for any cancellations of the advertised events.

Items for Sale

I have recently retired. Worked for many years reconditioning and installing new Gardner engines. Have some parts and manuals for sale but due to size, delicate nature and specialised audience having problems selling them. Would like for them to go to a good home and local if possible to North Manchester as the buyer would need to pick up.

I have three fully reconditioned heads (lxb/lxc/lxct)

Two cam shafts (complete with timing chain wheel, fuel pump gear and water pump drive, 1 x reprofiled set of cams also other items and would be free to let you know of the full list of parts. Feel free to contact me if you have any questions and wish to know more. contact:- roncollins1952@gmail.com

From Mike Mazurkiewicz

I own a very iconic locomotive built in 1956, purchased 2 years ago to rebuild into full working order, this has involved complete rebuild of Gardner 8L3 engine, as part of this process batches of parts have been purchased to allow specific individual items to be acquired.

I have for sale as individual items or job lot specific items that are Gardner Marine application specific, as follows:

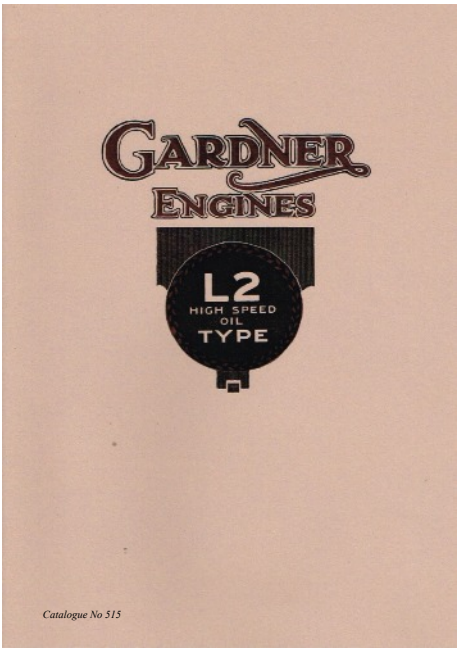
Gardner 8L3 Engine Sump with main bearings and housings (marine).
Gardner 8L3 Crank shaft - requires work (Marine).
Gardner 8L3 Engine Back plate with 2 starter motor ports.
Gardner 8L3 Engine Oil Cooler and related pipes (marine).
Gardner 8L3 Water Pump and Drive (marine).
Gardner 8L3 Front Engine casing and Timing Gears with Chain.
Gardner 8L3 Fuel Pump Drive and Lower Fuel Pump housing and Internals with drive for oil cooler and oil pump.
Gardner 8L3 Cam shaft and Followers (marine).
Gardner 8L3 Con Rods up to 5 items.
Gardner 8L3 Dry/wet liners up to 5 items.

My contact details are email geoscenics@btinternet.com or telephone 07811 673341

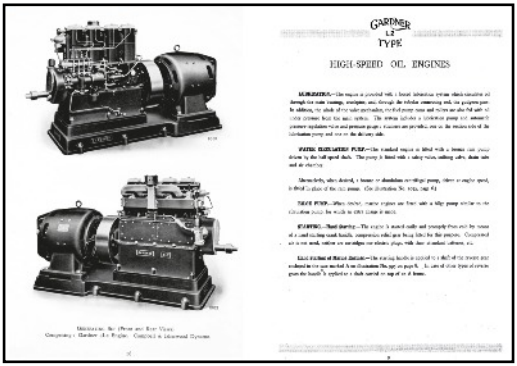
Also for sale – I have a 6LXDT 290 Bhp for sale. It would make a good restoration project or good for spares, it hasn't run for some years and will need a full strip before it does. It requires some external's, turbo, inlet manifold, water pump etc. It's a project that's proved to big for me and I'd like it to go to good use and not to scrap and be another engine lost.

I'm open to offers and I'm realistic that its not worth much but I want it to be useful to someone, ideally a forum member or someone you know that would use it. Contact Ian on 07834 884443 for more details.

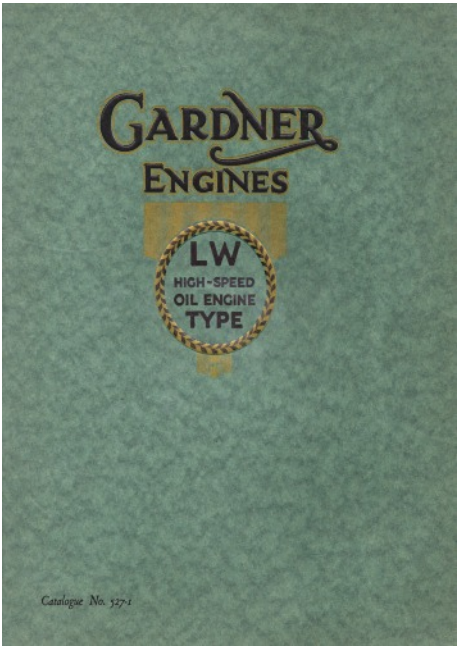
Merchandise



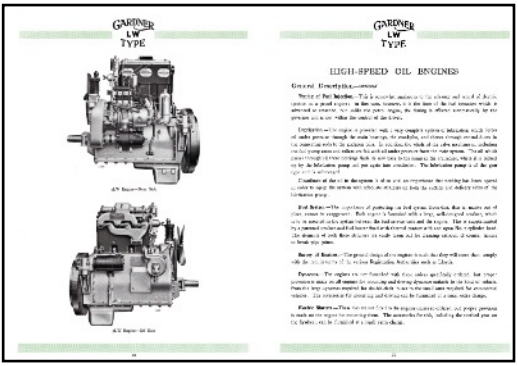
Reprint of sales catalogue 515, scanned and cleaned up from an original circa 1930 edition.
24 pages detailing the available range of 1-6 cyl engines with installation and outline drawings.
Printed on good quality paper and slightly enlarged to A4



Both publications are available at £7.00 each plus £1.50 for P&P



Reprint of sales catalogue 527.1, scanned and cleaned up from an original circa 1935 edition.
32 pages detailing the available range of 3-6 cyl engines highlighting the qualities and advantages of the engine.
Printed on good quality paper and slightly enlarged to A4
Original copy provided by the Anson Engine Museum



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