GARDNER

Engine Forum

Autumn 2017

www.gardnerengineforum.co.uk

No. 32

GARDNER Engine Forum

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Engine Application	Stationary	Road	Marine
Year of Manufacture			
Name Vehicle /Vessel			
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The treasurer will contact you with the banking details
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Gardner Engine Forum Philosophy

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

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Free for Members Personnel Ads
Trade ½ page
£25 per 2 editions

Cover Picture
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Chairmans Notes

Welcome to the Autumn Newsletter. I hope the summer has been good to you with regards to canal and engine rally's.

Firstly a big thank you to all involved with the organisation of our rally and the Lichfield Cruising Club for the preparation of the site, hospitality and support over the weekend. We were very lucky with the weather. It was good to chat with forum members and well done to Alan Imrie who had come down from Abroath, well done Alan. During the year I have attended various rally's. In May, Judith, Steven and myself were invited to attend a surprise 65th birthday party at the Hollies Cafe in Cannock for Alan Wilkes who has been a member since the inception of the forum. Alan's son Mark had managed to organise around 50 trucks representing the genre across the ages from the 50.s up to date, completely unknown to his father, there were a few Gardners amongst them. Thank you Mark. I met up with another of our members Jack Sandilands and his son at the 1000 engine rally a few weeks later at Astle Park in Cheshire, they had come down from Edinburgh with their 1L2. During our conversation we discussed Gardner sprayers (please note sprayers not injectors) and after my time in the centre lathe department, I moved to the "Dolls House". This was a small department in the main machining shop at the south end of the works. The foreman was Harry Fogg, his brother Bert looked after the buying of machine tools for the works and he was also in charge of the jig and tool drawing office where I worked for a period.

In the Dolls House the sprayer bodies and nozzles were drilled nearly all by by women along with Sam and Harry. As you can imagine I was well looked after! It was a delicate operation and required a light touch to drill the 0.009" holes. The machine tools were of Gardner design as were many others including the crankshaft turning machines. Lawrence Gardener founder of the firm in 1868 that went on to become the embodiment of the finest of British engineering practices. From modest beginnings, with just a few workers L. Gardner and Sons Ltd expanded to become one of Manchester's biggest employers with some 3000 employees by the turn of the century.

So to next year and the 150th anniversary of the founding of the company. The Anson Engine Museum will be having an opening day over the weekend of the 23rd/24th June, which will have a Gardner theme with interesting extracts from the Gardner Archive material. It is hoped to have an official opening by Paul Gardner. A Gardner commemorative calendar is being produced by the Anson Engine Museum and will be available before the museum closes for the winter. The committee had been looking to hold our rally at the same time. Whilst there is enough room to accommodate the number of boats that we have had at previous events, the obvious site for the vehicles and stationary engines, i.e the local playing field next to the canal, proved to be unsuitable as it is soft ground and has difficult access for commercial vehicles. The alternative of having the commercials and stationary engines at the Museum was felt to be unsuitable as it would split up the exhibits too much and would mean the exhibits sharing the car park area at a busy time. An alternative site that had been suggested was the Etruria Industrial Museum at Stoke on Trent (www.etruriamuseum.org.uk). A site visit was made and a meeting held with members of the museum. It was felt that this would be a good venue to accommodate us. After discussions at a full committee meeting, it was decided that we would hold our rally at this venue on **September 15th /16th** which is also their Heritage weekend. More details to follow in the next newsletter.

I would like to welcome new members:- Ronald Sigley, Jim Evans, John Gillian, Mark Dewhirst, Gary and Denise Fisher, Doug Whitfield, Ian Patterson, George Imrie, Tommy Flynn, Phillip Cotton, Alex Hamilton, Robert Pearson, Walter Stirling, and Norman Thomas.

John Naylor

2017 Rally at Huddlesford Junction nr Lichfield

This years rally at Huddlesford Junction on the Coventry canal was well attended by narrowboats, there being 21 in total. 3LW's being the most common power unit. On the field we had 1L2's, a size "O" gas engine and its half size model brother, exhibited by Paul and Jessica Pharoah who had travel down from Gretna Green for the event, plus the 3J5 on a 6LXCT powered ERF curtain side lorry.

We were short of commercial vehicles on the field, only getting 5 in total out of the 10 who completed an entry form. Richard Perigrine who has regulary attended the rally,was unable to drive his lorry after recent surgery, but was chauffeured by his wife to the event. It was good to see Henry Tuer with his ERF and 4LK powered Landrover, Henry is the only supporter of our rallies who has attended all of them with his vehicles, usually arriving during Saturday having driven down from the Lake District. Also from

the Lake District was David Reed. From the opposite end of the country we had Phil Comber with his tractor and trailer, who had travelled up from Sussex. Others who have been to most if not all rallies, were Edwin Fasham with his narrowboat Ferrous and Peter Freakley with his 4LK powered Morris Commercial.

A new exhibitor on the field was Keith Jones with a very rare 1HV from 1904. (This also features on the cover of the November edition of Stationary engine magazine)

Also on the field were a couple of 1L2's and an extensive display of vehicle badges which were coveted by many

The HF13 was also missing this year. Cliff and Tony were initially intending to travel to the Nuenen Stationary engine rally in the Netherlands as it was a Gardner themed event, but trouble with the braking system on the tractor unit proved to be somewhat problematic to repair. It was hoped that it could be resolved in time to get to Huddlseford, but this proved not to be the case.

Also on the field was the ironmongers clearance stall of our member Ian Gilbody. Such was the interest, that Ian had to lay it all out again on Sunday, despite intending to have the day off to enjoy the rally. Many visitors could be seen with hands full of goodies disappearing back to boats or cars.

The Friday evening saw many of us frequenting the licensed premises of Lichfield Cruising Club, whose facilities we were using. Real ale had been specially organised for the event. Also available were a mixture of hot meat pies, which had been organized and cooked by Neil and Helen Ecclestone. These went down very well and seconds were rapidly consumed.

Musical entertainment was once again provided by Jimmie, Helen and friends, with the occasional out of tune choruses provided by the assembled crowd.

Over the weekend we had the forum shop set up offering merchandise, including Gardner branded oil and fuel filters for L2, LK and LW at a discounted price. These are still available from the shop between rallies.

On sale for the first time were reprints of Sales brochures for the L2 and LW range, more details on page 18.

On Saturday evening we had our usual noggin and natter, this year in the form of a Hog Roast, with Vegetarian alternatives were also available. Dessert was in the form of various ice cream flavours served up from a Victorian style tricycle.

For the first time we were on an enclosed site where we could monitor the number of visitors. Over the two days we gave out 150 visitor badges, with a further 60 plus attendees, this brought the total onsite to over 200 people over the weekend. A very big thank you to all the volunteers who acted as stewards for us. It was good to see visitors Alan Imrie, Jack and Betty Sandilands, all of whom had made their way down from Scotland and Bernard Hales from Surrey.

I would like to extend a special thanks to Neil and Helen Ecclestone for their assistance in arranging the initial contact with Lichfield Cruising Club, organising the beer, meat pies and acting as harbourmaster. A big thank you to all committee members. As with all events the organising and setting up takes many hours of work and seems to be over in a flash.

Steven & Judith Gray

This article appeared in the Lichfield Crusing Club newsletter the Knot , and is reproduced here with permission of the author.

GARDNER RALLY WEEKEND 2-4 JUNE

by Bob Smyth

The recent Gardner engine rally at LCC was held over the weekend of June 2nd 3rd and 4th. Our members who visited were able to see a superb collection of boats and vehicles all with various Gardner engines including a Rolls Royce car, Morris Commercial lorry, and a Land Rover all being modified to have Gardner engines.

The largest Gardner was in the back of a ERF Lorry Gardner powered of course and was at times to be seen running, The engine was a three cylinder 2 stroke having been originally installed with a sister engine in a sea going yacht, The sister engine is on display at The Boat Museum on The Wirral

Of the various 23 boats which arrived, all Gardner powered of course, one boat of note was made by the owner Edwin Fasham and was named Ferrous. Edwin who has worked as an engineer in the foundry industry designed the hull including a round bottom and had the hull fabricated in Norfolk in 1974. After a brief empty shell test run in 1975, Edwin then made the super structure being, aluminium and painted to look like wood or metal.He then started to fit the boat out making all fittings himself even the kettle to boil the water. At first Edwin installed a 4 cylinder engine but as the engine suffered from a well known slight fault of a minute vibration on tick-over at 400 rpm and if running at 800 rpm he then swopped it for a 3 cylinder Gardner that does not have the vibration. The engine also serves as a table in the kitchen by placing a top on the Gardner, (not

every one can polish the heads while eating their dinner). Edwin informed me he has not yet finished fitting the boat out as he is now putting the final pieces together to help him use her single handed. At the moment he gets off at locks and drives the boat in and out of locks with a remote control but just has to finish the steering system so he can also control the rudder.

Another Gardner that had had some elbow grease was Steven Gray's boat, Steve's boat was moored on the pump out berth, Steve's Gardner was pure polished aluminium and cost him just £800 when purchased in 1988, in the same polished condition to replace a Perkins.

The most highly polished boat had to go to Neil Ecclestone called LODE STAR, I thought when I first saw her that Neil was also a railway enthusiast but no, his wife came up with the name after reading that LODE STAR was a term for a guiding star in Navigation.

On the BW field display we had several stationary single cylinder Gardner's on stands (some running) as well as several ERF lorries and one Foden 50 ton towing wagon complete with a rare Foden winch which is still in use mounted on the rear. As we did not have enough staff to serve meals for the Gardner group they decided on a meat pie on the Friday and a pig roast on the Saturday, Neil asked me where he could get a good meat pie and I was able to inform him that the best meat pies anywhere are made back home here in Wirksworth by a local baker named Steve Pepper, (LCC Derbyshire Discoverer

passengers may remember his cakes at The Stone Centre), so that was it, Neil ordered six dozen to be consumed by about 30 Gardner members, these pies along with some lovely cobs made fresh by Jan Hartshorne and friends in the kitchen ensured no one would go hungry, of course our members could also purchase any left over pies as well.

When they found out how good these pies were, very soon the stock was down to 12 left over (these pies were then claimed by Steve and Neil to be consumed for breakfast and lunch the next day), the odd ones left then went home with Steve and Neil. After the event, Neil informed me he could have sold at least another 50 pies if they had been available.

On both evenings various friends of The Gardner Group played folk music in the bar. One boater, an ex LCC member who used to have a boat here about 25 years ago called 2 Bob asked me if he could leave his boat at the club for a few days as his wife had had to return home and he did not want to navigate alone especially as he had to negotiate Hatton Flight, and was expected to depart by the following weekend. This of course was no problem as both Farne and English Rose are away. May I take this point to thank all members who helped with this event go so smoothly by helping in the bar and kitchen and apologise to any member who may have been put out of their normal routine when visiting LCC.

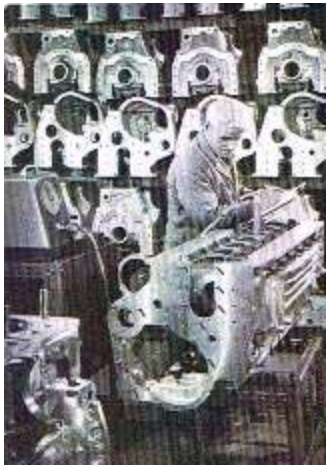
ONLY THE BEST IS GOOD ENOUGH

By: K H. LINDON

Craftsmanship and modern methods combine at the Patricroft diesel engine works of L. Gardner & Sons Ltd.

Reprinted from 'PRECISION". July 1965 published by The Automotive Products

In this era of extensive industrial empires and mass production, it is refreshing to discover a family business that has maintained its eminent Position in the world of engineering, by keeping abreast of modern methods while producing engines that are renowned throughout the world for their advanced design, performance and superb engineering. The company is the diesel engine manufacturer. L. Gardner & Sons Ltd of Eccles, Manchester, whose products are fitted to fishing boats, luxury yachts, passenger carrying and heavy duty road vehicles, compressors, cranes excavators locomotives and as auxiliary generating or pumping sets.



Careful inspection of main bearing housings bores, being carried out at Barton Hall Works, prior to the fitting of bearing shells

A brass plate proudly displaying the legend L. Gardner, Machinist' appeared on a small engineering shop in Manchester. The year was 1868 and from this modest beginning has grown the present company of L. Gardner & Sons Ltd, which enjoys a world-wide sale and a high reputation for the diesel engines which it manufactures.

Laurence Gardner and his Sons produced their first Robinson hot air engine in 1893, to be followed in the next year by their first oil engine. From the onset the firm's guiding principle was the production of precision engineered engines a maxim that is equally as sacrosanct now as it was when the firm first embarked in business. First-class workmanship paid off, and by 1898 the Cornbrook Works, to which the firm had moved In 1884, were too small and land was bought on the outskirts of Manchester at the site of the present company.

In the early days, with an approximate labour force of only 80 men, the company's products consisted mainly of small gas engines, hot air engines, dynamos, motors and the hydraulic and mechanical/hydraulic portion of dental chairs.

By 1902, a year after the company had been made a limited concern the firm produced the first practical engine for marine use. It was a vertical engine

running on paraffin, and its introduction into the fishing industry commenced an association for Gardner's that has existed to the present day. It has gone from strength to strength so that the most popular engine for offshore fishing is undoubtedly that produced by L Gardner & Sons Ltd. As actual propulsion units these engines are installed in fishing boats, yachts schooners and lifeboats throughout the world, while auxiliary generating sets and pumping sets, of various capacities, are to be found on many modern ships. Not content with their already well-deserved success, the company between the years 1903 and 1910 developed two further engines that were designated the V & F types. Such was the success of the engines and the added impetus which they gave to the business that by 1912 the labour force had reached approximately seven hundred.

Gardner have a long maritime association. This luxury motor yacht 'Neleh' built in Holland is equipped with twin Gardner 6LX engines providing a speed of 10 knots.

At the commencement of the first World War in 1914 the company's range of gas, petrol, paraffin and alcohol engines extended from to 200 hp, these being used for such varied purposes as marine propulsion and the provision of power for pumps, compressors and generating electricity. During the war many of the engines used to propel the newly invented tank were powered by Gardner engines made to the design of Sir Harry Ricardo and jointly developed at Patricroft,

Engines to this design were also constructed by four other companies and it is interesting to note that the crankshafts for all of them were made on specially designed Gardner machines, manufactured in the Gardner works; the same basic design of machine is used to produce crankshafts for today's modern engines.

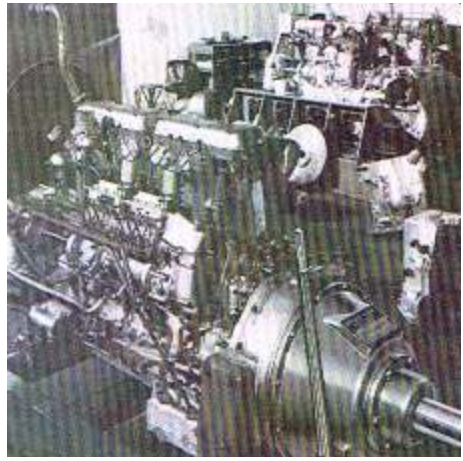
Following the Great World War, the company suffered, as many engineering firms did at that time, from the effects of a depression which existed in the late 1920s. Although the times were not good, the principals of the firm continued to develop and perfect various engines, and four new types of slow and medium speed semi-diesel and diesel engines were designed and produced during this

difficult period. It was these engines that spear headed the company's sales drive that brought them out of the period of the depression.

The engine assembly, shop of L. Gardner & Sons Ltd. Ltd

Having been mainly concerned with the supply of engines for marine and industrial applications, the company's energetic management now turned its attention to producing, in 1928, a completely new type of high speed hand-starting compression ignition engine. Designated the L2. this engine was-first introduced to the country in 1929 and was a great success. In the following year, an enterprising bus operator installed one of these units in a public bus. The engine, which ran at the then high speed of 1300 rev/min proved so successful for this purpose, that only after a months trial the bus was put into regular service, followed by several others.

Two years later a lighter and more compact engine of the same type was designed especially for the propulsion of road transport vehicles. Classified the 'LW model, this engine was adopted by many famous makers of buses and commercial vehicles, an association continued to this day in the supply of engines to Foden, Guy,, Daimler, Scammell, Bristol Commercial, Seddon, Dennis, Atkinson and E.R.F.



Complete with Borg ô Beck Rockford 14-inch twin plate power take off a Gardner 6LX Industrial type engine unit stands ready for delivery,

By 1939, thousands of high speed diesel engines were being produced annually, ranging in size from 1.4 litres to 24.15 litres. Some 2800 employees were now engaged in the production of engines at the Gardner Works, and the area of workshops had risen to cover 36,351 sq. yds, the land being available due to the foresight of the founders of the company when they moved to the old Barton Hall site in the 1898 development. During the War the company produced diesel engines for a multitude of applications, but no greater tribute could have been made to the quality of its products than

when Gardner engines were chosen exclusively for use in Midget Submarines, where 100% efficiency was absolutely vital. Gardner engines were also very extensively used to provide the power for searchlights, radar, magnetic mine sweeping, harbour defence launches, tank transporters and gun tractors. From its earliest days, the company has been quality conscious and has taken every precaution to ensure as near perfect a product as possible. In a recent visit to the works we had the opportunity of seeing the craftsmanship and the extreme care with which every engine is built. In order to ensure complete control of the vital basic parts of their engine, Gardner's have since 1912 produced in their own ferrous and nonferrous foundries, castings for engine blocks, crank cases and pistons, in addition to numerous gun-metal parts for water impellers, fuel and cooling connections

Left : Purolator filters connected by Lockheed-Avery hoses are fitted on Gardner engines for fuel and lubricating oil filtration.

The aluminium foundry produces a greater diversity of castings than any other similar foundry in Britain today. The company's policy is to produce at Patricroft as many as possible of the components required for Gardner engines. Those that are contracted from outside are nevertheless rigorously tested before being put into use. All connecting rods and forged crankshafts are flaw tested before machining, and at various subsequent stages, to the extremely high standards demanded by Gardner's. So accurate are the limits imposed in the final machining that we found it required only one finger to rotate a huge crankshaft, weighing many hundreds of pounds, in a newly built-up crankcase assembly.

Following a most careful assembly in which limits of 1/10ths of a thousandth of an inch are frequently quoted, every engine is stringently dynamometer tested in order to ensure that it conforms to power outputs and specific fuel consumption etc, at all engine speeds specified by the designers.; facilities are available for the purchaser to witness the test of any engine. During its history the company has been renowned for the outstanding and advanced designs of the diesel engines which it produces, and within the last three years a new engine has been developed for automotive, marine and industrial use. Known as the Type 6LX in

Purolator filters connected by Lockheed Avery hoses are fitted on Gardner engines for fuel and lubricating oil filtration

vertical form, and 6HLX in horizontal form, it develops at 1700 rev/mm, 150 hp. The most recent development is the 6 and 8L3B engines which were put into production a year or two ago. These engines are more powerful and more efficient versions of the highly successful 6 and 8L3 engines, and are rated at 200 and 260 hp respectively, and each possesses the unequalled thermal efficiency of over 40%. These have wide application, including locomotive and marine propelling purposes and general use in industry. To streamline production, the company now produces four basic types, the 4LK, LW series, (2-6 cylinders), 6LX (6 cylinders) L3B (6 and 8 cylinders).

In addition to manufacturing engines the company also produces the reverse and reduction gears, and controls for its marine propelling units. The supply of components for transmitting power in generating sets and pumping sets is entrusted to Borg & Beck Rockford power take-offs, and for the filtration of fuel and lubricating systems to Purolator. Lockheed-Avery hoses are also supplied for use on Gardner engines.

Some would observe that in remaining a family business L. Gardner & Sons Ltd contrasts with larger industrial groups, but the company's continued success is due to the farsightedness of management, specialisation and ready, acceptance of modern methods. The company has wholeheartedly embraced new techniques and installed new machinery, blending these with the craftsmanship so keenly displayed by every employee throughout the works.

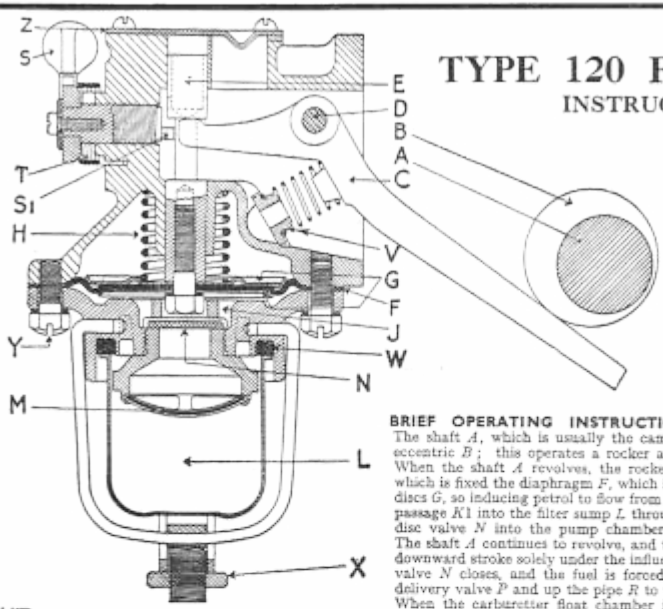
The reliability of Gardner diesel engines is recognised throughout the world, and as well as contributing indirectly to the export drive by supplying ng engines that are installed in boats and vehicles eventually finding their way abroad, the company also has extensive business in exporting its products directly overseas from the factory : in 1964 30% of the company's products went overseas.

Copy courtesy of the Anson Engine Museum archive

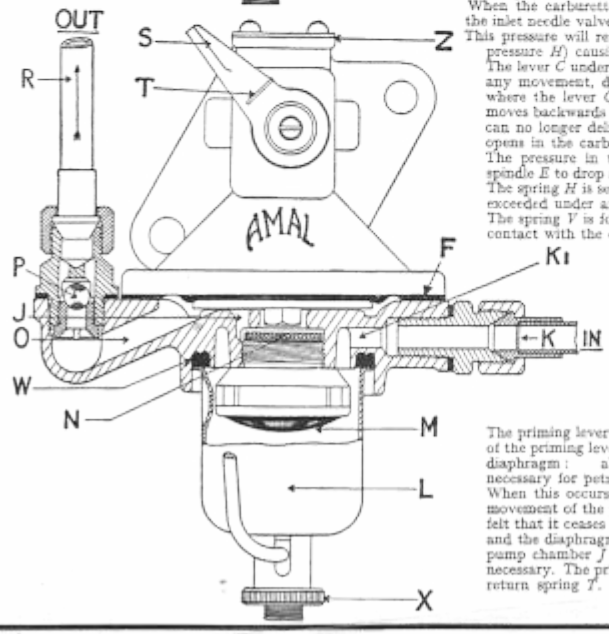
AMAL

NOVEMBER, 1970. LIST No. 304/3 (Issue No. 5)
(Supersedes List No. 350)

TYPE 120 FUEL PUMP
INSTRUCTIONS.



NOTE.—the filter "M" may be a unit construction as illustrated, or alternatively, the gauze "M" may be detachable and held in position by a brass ring screwed on to the adaptor, which is the non-return valve seating; this ring having projections which would contact an indentation in the filter bowl should it or the valve seating attempt to screw loose.



BRIEF OPERATING INSTRUCTIONS.

The shaft *A*, which is usually the camshaft of the engine, carries an eccentric *B*; this operates a rocker arm *C* pivotted at the point *D*. When the shaft *A* revolves, the rocker arm *C* lifts the spindle *E* to which is fixed the diaphragm *F*, which is interposed between two metal discs *G*, so inducing petrol to flow from the tank up the pipe *K* through passage *K1* into the filter sump *L* through the filter *M* and the suction disc valve *N* into the pump chamber *J*.

The shaft *A* continues to revolve, and the diaphragm *F* commences its downward stroke solely under the influence of the spring *H*, the suction valve *N* closes, and the fuel is forced along the passage *O* past the delivery valve *P* and up the pipe *R* to the carburetter.

When the carburetter float chamber is filled, the float will shut off the inlet needle valve, thus creating a pressure in the pump chamber *J*. This pressure will react against the diaphragm *F* (against the spring pressure *H*) causing it to remain in the " raised " position.

The lever *C* under these conditions, can no longer give the spindle *E* any movement, due to the fact that it is raised beyond the point where the lever *C* engages the spindle. The lever *C* then simply moves backwards and forwards idly, and when this occurs the pump can no longer deliver any fuel until such time as the needle valve opens in the carburetter float chamber to admit a further supply. The pressure in the pump chamber *J* then falls and allows the spindle *E* to drop and once more come in contact with the lever *C*.

The spring *H* is set at a pre-determined pressure, and this cannot be exceeded under any circumstances of the pump's operation.

The spring *V* is for the purpose of maintaining the rocker arm *C* in contact with the eccentric *B* to prevent noise, and it has no action on the fuel pump itself.

The inspection cover *Z* can be removed for examination of the correct setting of the pump, which is: the top of the spindle should be $\frac{1}{8}$" to $\frac{1}{16}$" below the top of the face of the pump in its highest position.

The filter sump *L* is removed for cleaning purposes by unscrewing the knurled nut *X*; the filter *M* can then be unscrewed, cleansed and replaced. The sump *L* is afterwards fitted and screwed up tightly so as to make an air-tight joint by means of the washer *W*.

The priming lever *S* is then operated by hand. This brings the part of the priming lever *S1* in contact with the spindle *E*, so working the diaphragm: about a dozen slow strokes is all that should be necessary for petrol to reach the float chamber of the carburetter. When this occurs, and the float chamber is full, the resistance to movement of the priming lever *S* will gradually diminish, until it is felt that it ceases to act. This means that the float chamber is full, and the diaphragm is raised under the pressure so produced in the pump chamber *J* and no further actuation of the priming lever is necessary. The priming lever *S* is held back, when not in use, by the return spring *T*.

P.T.O.

Amal Ltd - Holdford Road - Birmingham - England - B6 7ES
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AMAL

SERVICE HINTS—AMAL FUEL PUMP, TYPE 120

Do not entirely dismantle the pump unless it is necessary to examine the diaphragm and the spindle. Normal cleaning can be done under the headings Paragraphs A and B.

A.

For normal cleaning it is only necessary to remove the filter cup *L* by loosening the stirrup nut *X* and swinging the stirrup to one side, when the cup will fall away exposing the filter gauze *M*. The gauze *M* can be removed for cleaning, and if the adaptor on to which it fits also screws out, care must be taken not to damage or lose the suction valve *N*.

When replacing these parts see that the washer *W* is in good order, as any bad fit here would cause a leakage of fuel or even an air leak, which would upset the function of the pump. The nut *X*, when centred in the cup, should be screwed up firmly.

B.

If it is desired to clean out all the fuel passages, this can be done without disturbing the diaphragm and without taking the two halves of the pump apart, as all the passages are underneath the diaphragm.

1. Disconnect the fuel pump connections *K* and *R* from the pump and remove the pump in its entirety from the engine by undoing the flange bolts.
2. Remove the filter bowl as in paragraph *A* above and also the suction valve *N* and its seating.
3. To inspect the delivery valve *P* in the outlet pipe, unscrew the hexagon cage from the lower half of the pump : The ball valve seating with the screwdriver slot may be unscrewed from the underside when the ball valve will fall away.
4. All parts may now be flushed out with petrol and reassembled. It is to be noted that neither in the suction valve nor the ball delivery valve are there any springs, and nothing need be looked for in these types of valves but an accumulation of impurities.

THE PUMP CAN ONLY FAIL TO FUNCTION FOR TWO REASONS :

Firstly—actual mechanical breakage, which will be obvious, and hardly likely to occur, and :

Secondly—due to external air leaks, which should be examined for in the following order :—

1. The connection between the filter sump *L* and the pump. See that the knurled nut marked *X* is screwed up tight, and that the jointing washer *W* is in good condition.
2. Check over for air leaks in the inlet tubing between the tank and the fuel pump, making certain that all the joints and unions are tight, and that there are no cracks or leaks in the pipe itself.

The same remarks apply to the tubing between the fuel pump and the carburetter.

3. Examine the six bolts which hold the halves of the pump together, and make the joint for the diaphragm. These must be perfectly tight.

C. INSTRUCTIONS FOR COMPLETE DISMANTLING AND REASSEMBLING OF THE FUEL PUMP.

1. Disconnect the fuel pump as indicated in paragraph B.

2. To remove the diaphragm spindle *E* it is necessary to withdraw the priming cam S1. Therefore, to do this remove the small screw and washer from the priming lever *S*, unhook the spring *T* from where it grips the lever, and then prise off the lever itself and detach the spring. Lift the spindle *E* by depressing the rocking lever *C* and unscrew the priming cam S1 three or four turns.

3. **Removal of Operating Lever.**

If the pump is actuated by a plunger (not as illustrated overleaf), that is with the plunger operating on a short rocking lever inside the pump, remove the top plate *Z* and extract the spring, but if the pump is operated by a long lever protruding from the pump (as illustrated overleaf), there is no need to remove the cover plate *Z*. Next remove the split cotter pin holding the rocker pivot *D* in position, tap out the pivot pin *D* and remove the lever, and also the spring *V* if the lever is as illustrated.

4. To take apart the two halves of the pump, screw out the six securing screws *Y* from the circumference of the pump and gently separate the two halves which clamp the diaphragm together.

5. The diaphragm *F* together with the spindle *E* and the spring *H* can then be withdrawn from the pump. If it is desired to inspect the diaphragm leaves *F*, these can be removed from the spindle by unscrewing the hexagon headed pin, on earlier models this pin cannot be removed until the rivet through the spindle positioned about ¼" from the diaphragm has been knocked out, take care not to bend or bruise the spindle *E*. When the hexagon headed pin is removed the diaphragm leaves and the two supporting discs can be separated.

5A. After examination of the diaphragms or the fitting of new ones they can be reassembled, the diaphragms are shaped and must be fitted correctly, the larger recess is fitted uppermost (*see illustration*) to encircle the larger disc *G*, ensure when fitting the smaller disc underneath it fits properly into the recess on the underside of the diaphragm. Fit the washer under the hexagon headed pin and smear the thread with " loctite " prior to refitting.

Care must be taken before tightening up the hexagon headed pin that the bolt holes in the diaphragm leaves are aligned, to ensure correct registration a couple of screws *Y* may be put through the holes in the edge of the diaphragm.

6. When all parts are cleaned and ready for reassembling, see that the spindle is clean, slip over the spring *H*, and insert into position, and then place the screws *Y* through the bottom half of the pump, through the holes in the diaphragm, and then start them screwing into the top half of the pump. It is now necessary to reassemble the rocking lever *C* (see paragraph 9) and its return spring *V* on to the pin *D* when placed through its holes in the body and replace the split pin through the external boss of the bearing and through the pin itself, and having done this, proceed to re-fix the priming lever *S*. Now lift the spindle *E* by depressing the rocker arm *C*, and screw in the priming lever cam *S1* as far as it will go—then come back one or two turns and finally adjust in such a position that the spindle *E* moves freely up and down, with the cam pin *S1* sufficiently far forward to engage with the spindle and also with the flat on the end of the cam spindle in a vertical position so that the lever *S* with its return spring *T* can be re-assembled, and that the engagement stop drops over the stop on the body. The spiked end of this spring fits into a small hole in the casing and the hooked end is sprung over the lever.

Now continue to screw up the pins *Y* finger tight and then, by means of the priming lever *S*, draw up the spindle with the diaphragm to the highest position possible by moving the lever *S* over as far as possible in a clockwise direction, and in this position tighten up the screws *Y* securely. This ensures that the diaphragm is correctly fitted in its position. It should be verified that the rocker arm *C* will lift the diaphragm and that the diaphragm will fall easily under the action of spring *H* when the rocker arm *C* is released, also verify that the priming lever *S*, when operated, will also lift the diaphragm.

7. All parts should now be reassembled as noted in paragraph B.

8. If the inspection plate *Z* has been removed, it is possible to see the movement of the spindle under the influence of the priming lever or the rocking lever *C*. Unless the movement is free, the pump must be dismantled again and reassembled. All parts should be tight to avoid either fuel or air leaks, and the pump may be re-fitted to the engine.

9. If the pump is of the plunger type (not as illustrated), replace the rocking lever and its pivot pin *D* and then replace the spring for the lever in the hole under the plate *Z* which is then fastened down by the small screws.

10. The diaphragm spindle is lubricated from the engine.

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2m/11/70 W. Printed in England

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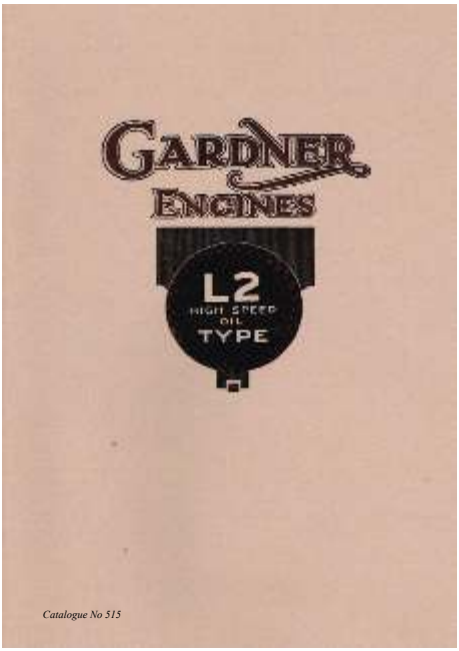

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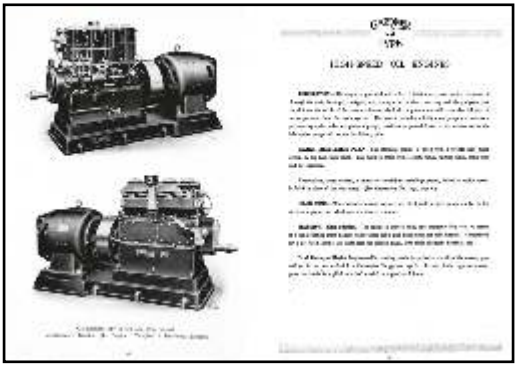

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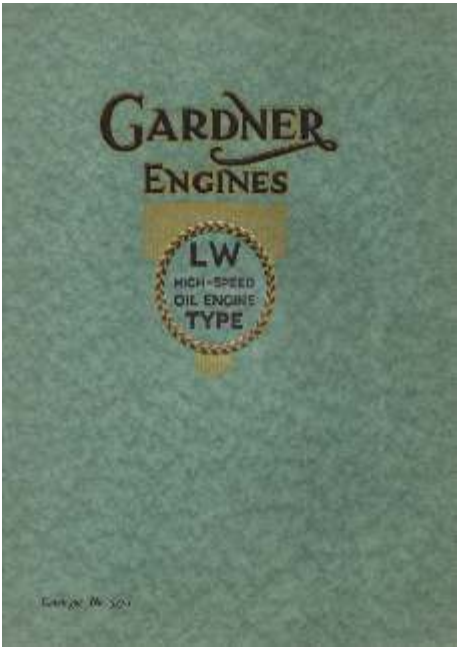

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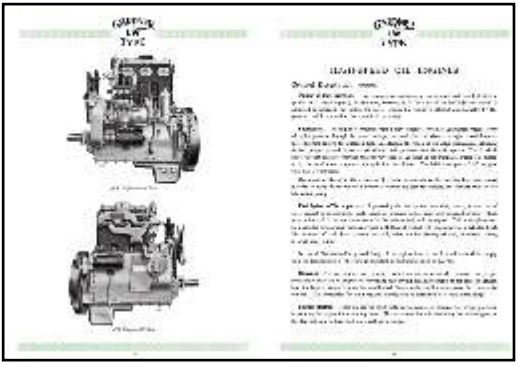

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