GARDNER

Engine Forum

Autumn 2012

www.gardnerengineforum.co.uk

No. 22

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 (UK) £18.00 per Annum (Overseas)
Renewable on the anniversary of joining,
Payable by cheque electronic funds transfer or standing order.
Standing order mandate is available at www.gardnerengineforum.co.uk/subscribe

Please complete the above and send to
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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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Cover Picture

8LXB at Bugsworth Rally

Photo by S Gray

CHAIRMAN'S NOTES

It has not been a very good summer so far has it? The boat moving scene has been a bit quiet too, but this enabled Yvonne and I to join a BCN Society Cruise around the northern reaches of the BCN; the Tame Valley, Walsall, The Wyrley & Essington and the Anglesey Brach.

The Anglesey Brach was most interesting as it was one of the last coal loading points for narrow boats on the BCN. We attended the BCN Rally at the end of this Cruise and discover: 1. a leak on the boat's hydraulic drive system and 2. there was diesel bug in the fuel tanks. 1. was solved on site at Tipton's Slasher Park but 2. was a month's job at home cutting holes in fuel tanks and fitting a new super fuel filter – all this after using fuel treatment regularly!

I have been offered a number of engines lately and details appear elsewhere in this magazine and in Joe McCool's Google groups forum on the internet.

Next year's gathering will be held at Wrenbury on the first weekend in June. (1st & 2nd) Lorry men note that this does not clash with Gaydon, so you have plenty of notice. See you then.

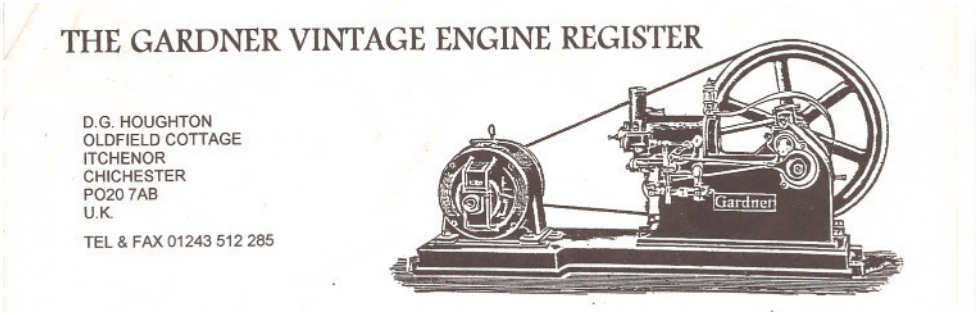
Mike

Note :- Rally entry form will be distributed with the next newsletter and will be available from the website at the end of December

Gardner Engine Register & The Gardner Engine Forum

Many members will probably be unaware that the Gardner engine forum grew out of the early rally's which had been organised by our founding chairman Colin Paillin, prior to this Colin had been in contact with Dion Houghton who had been the Sales director for L Gardner & Sons before his retirement.

Dion started the Gardner engine register to gather information on engines out in the field. Colin recently passed on some of the correspondence which is reproduced in full or part as appropriate



Dear Mr Paillin 14/9/94

Thanks for your letter of the 7th Sept in connection with the proposed rally.
June is always a very busy month down here but I will endeavour to keep the Sunday free-no promises!
The man you want is Paul Gardner, great grandson of the founder of the Co who was Technical Director until the Perkins sellout.
There were only 1 ½ "6LK's" built i.e one in Hugh Gardners Lagonda and a pile of bits, all of which Paul now has, He has also got his farthers Jag XK150 with a 4lk which did 90.5 Mpg at an Oulton Park economy rally. My Mk9 Jaguar only did 72.4 or something like that.
I will get in touch with Paul and see how he is fixed to attend and award prizes. His assistant Eddie Raynor, a real Gardner stalwart with diesel oil in his veins & has some sort of vintage vehicle with you know what engine in it,and he might come along,also the Northern Preservation Society has a number of Single cyl horizontal engines from 1898 or so

I'll keep in touch

Regards

Dion Houghton

Dear Colin 16/10/98

The delay in replying to your letter of the 7th is due to me lying in the sun in Rhodes. Thank you for the copies of the register which doesn't compete with mine as I now have 56 pages of engines and owners, I really need engine No's before I add them to my list.

Re the L2 heads with small injector holes, I haven't come across this before, but the answer is that you may have got some 1 LW heads although I don't know from where.

A lot of oil companies, universities, & technical colleges adopted the 1L2 for laboratory work because it was the most efficient small diesel. We raised the speed from 1000 rpm to 1600 rpm and a steel (not iron) flywheel.

The cylinder head had various orifices for temperature and pressures & the LW sprayer was marginally better than the L2 so I imagine that is was used.

Hence the 1LW was born,and probably 25 or so were made, LW sprayers are still available but L2 are not

The first Gardner internal combustion engine was tested on the 5th May (not April) 1894 & Iv'e got the test results,it was numbered 81, presumably because we had been making hot air engines since 1890 or so. We had previously made engines and parts for Robinson's & it was this that gave Gardner's the idea of going into the engine business
Turning now to engine types and when they were made,this is A major subject. In 1910 there were 120 different variations of engines in production. The list is prodigious & how the small works coped with the design and manufacture I shall never know.

On 31st December 1899 engine no 1566 was tested,engines were strictly in rotation & that continued right up to 1990 but from engine number 300 to 1000 only even numbers were used,presumably to fool competitors .but they were able to sell all they could produce so they reverted to consequential numbering.

Enclosed is a copy of a list of engines giving dates of first and last engines,this tells only a quarter of the story,for instance the 'M' type was introduced in 1902 but there were MV's, BM's, DM's, FM's, KM's, NM's, SM's, FHM's, FRM's, KRM's, BCM's, & DCM's all in various numbers of cylinders, a 2BR was made for motor cars but never tool off.

We made a 'V' air cooled engine 2 cyl's known as a 2WT
There were lots of CR types CR, ACR, BCR, CCR & DCR all in various numbers of cylinders.

A 6RC was an all aluminium engines 6 cyls for toperdo boats in 1918

The TP series was made in 4,6,8 Cyls in 1908

We also made FD's and KD series but I can't find much about them

2 sizes of TS engines were made for WW1 tanks

There were 8 sizes of VT engines with single cylinders and 13 sizes of multi cyl engines

We also made 4 different series of marine reverse gears in various sizes.

In addition we made VP stern gear,dynamo's water pumps,air compressors

And gas products as well as machine tools.

As I said above the list is prodigious-that's a good word look it up in the dictionary

Regards

Dion Houghton

These letters have been reproduced from the original hand written letters

With thanks to Colin for passing them on.

Most of the information is expanded on in Graham Edges book

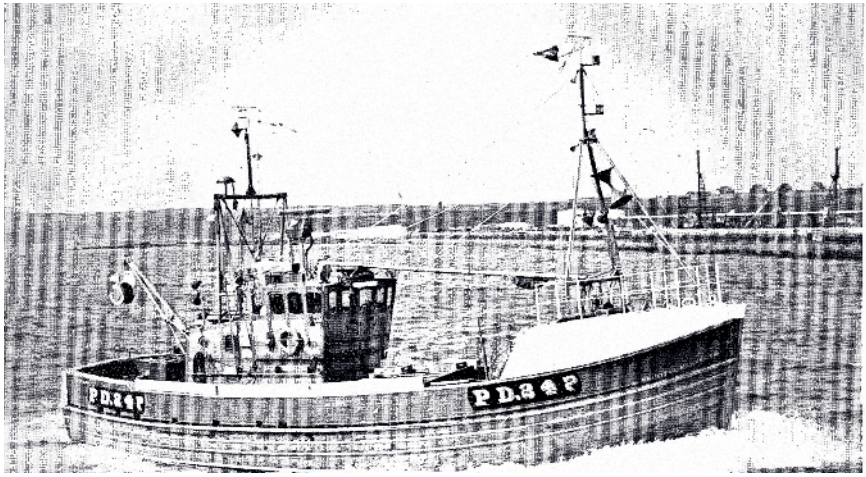
L Gardner & Sons Limited

Legendary Engineering Excellemce first published in 2002

Reprint from Commercial Fishing August 1976
Supplied by the Anson Engine museuem from the Gardner documentation
that was passed on when Gardners closed at Patricroft

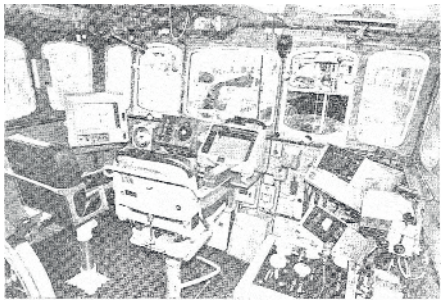
FRUITFUL HARVEST III - Peterhead Skipper Builds Ideal Vessel

SUCCESSFUL OUTCOME TO CO-OPERATION BETWEEN DESIGNE BUILDER AND SKIPPER



FOLLOWING EXPERIENCE WITH EARLIER VESSEL

Now in operation from Peterhead is the 65-ft long wooden seiner Fruitful Harvest **III,** built by the James Noble boat yard at Fraser- burgh for skipper Robert Reid, one of the most well-known and respected fishermen at the Buchan port. This new vessel is notable not only because of its unusual size at a port where the average new vessel is in the 80-ft class but also for the many simple design features based on the skipper's experience over the past few years. Over this period Robert Reid has built up a reputation as a first-class fisherman, as witnessed by the suc- cess he has achieved. Some fishermen achieve success by a ruthless and often danger- ous operational technique. Others base their operations on well-thought out and planned technique with just as much determination, yet with a much better life-style for the crew aboard the vessel. This particular skipper belongs to the latter class and it is with such a background that the building of the Fruitful Harvest **III** was planned. Earlier Robert Reid had operated a 72-ft boat, then one of 40-ft. This switch was to provide the experience upon which he was to base his future plans and his



next vessel a 52 footer - was to help him confirm those future require- ments.
A good proportion of Peterhead fishermen have renewed their old type vessels with ultra-modern, multi-purpose craft capable of pursuing various fisheries around the coasts. If continuous and concentrated operations are required all year round, vessels of this class, averaging 80-ft in length, are a necessity. But the cost of such vessels today is up to the £½ million mark, far greater than the average fisherman is prepared to go.
Robert Reid decided that he would work the offshore grounds in summer and the inshore grounds in winter. This would put the least pressure on the men aboard the vessel, both physically and mentally. For such he considered a 60-ft long vessel would be the best size, big enough to venture out in the offshore waters in the good weather months yet economical enough to be able to operate on the inshore grounds during the bad weather months.

G.L. WATSON DESIGN
He commissioned the well-known Glasgow naval architects G.L. Watson & Co. to draw up plans for the type of boat he wanted. The boat was built in 1972 by the Noble yard at Fraserburgh and from the success of his second-hand 52-ft *Fruitful Harvest* he named this vessel *Fruitful Harvest II.* The vessel was a transom stern design with a 22-ft beam and 230hp Gardner propulsion unit.

Now, with three years experience with the' vessel he has built a repeat, again designed by G.L. Watson and built by the Noble boat yard. The *Fruitful Harvest **III,*** apart from an extra 5-ft in length, is the same dimensions as its predecessor, yet its layout and equipment show how Robert Reid has used logic and common sense to produce what must be very close to the ideal fishing unit for a good proportion of our current fishermenowners.
GENERAL FEATURES

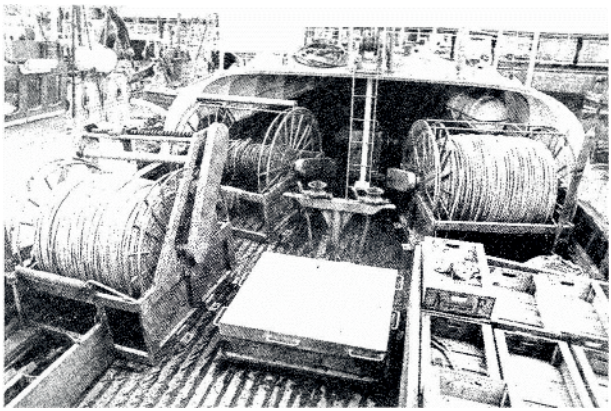
The *Fruitful Harvest III* is of larch on oak hull construction with a full-width transom stern and steel beams in the engine room. Her whaleback is aluminium while the remaining superstructure is all of steel. Main dimensions are as follows:-

length overall	65.00ft	19.81m
length bp	62.00ft	18.90m
breadth	22.00ft	6.70m
depth	12.50ft	3.81m
tonnage (Pt 4)	47.89	

EFFICIENCY AND ECONOMY

There were two things upper most in Robert Reid's mind when putting together the specification for this new vessel; efficiency and economy. To a certain extent he had these in his previous vessel but is continual desire to improve his performance led to this latest vessel.

Here he has allied his two overall requirements to simplicity. With more and more sophisticated equipment being fitted to the present day fishing boat there was often a surplus of items, all of which could either go wrong on their own or help something else to malfunction.



So wherever possible he specified the most simple requirements, allowing only absolute necessity to persuade him to deviate from this plan.

ENGINE ROOM

This is seen very clearly in the engine room. In his last vessel he had a 230hp Gardner engine with a 30hp Lister auxiliary. The winch and power block pumps were driven from the fore end of the main engine.

By a simple re-design of the equipment here he has made some important advances. In the new vessel the main propulsion unit is once again a Gardner 230hp diesel but for auxiliary power he has a Gardner 6LX 120hp diesel. The auxiliary is used to power all of the deck machinery,

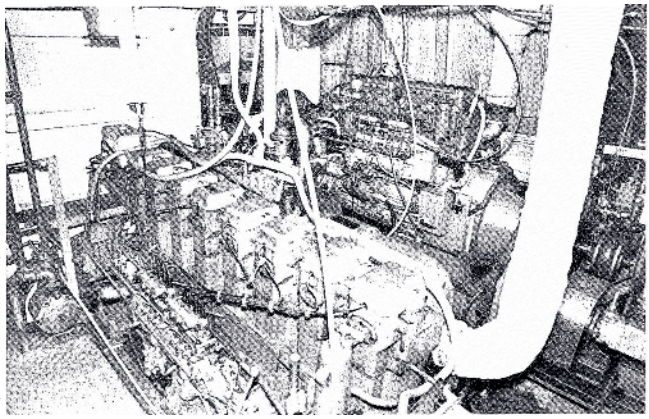
The main propulsion unit driving a GGG two-inch bilge and general service pump and Transmotor 125 alternator. This arrangement, with the Dowty hydraulic power pack being driven from the smaller engine, requires less space than if it were driven from the main unit, and the four feet saved allows for a bigger fish room than in the previous vessel.

MAIN ENGINE DETAILS

The 8L3B engine is coupled via a Twin Disc 4.5:1 reduction gear- box to a Bruntons 64 inch four- bladed propeller. In the last vessel there was a 3:1 reduction. This change, together with the. light workload on the main engine, is estimated to provide the boat with up to 50% more towing power although there is of course no difference in steaming power. Despite
the fact that the new boat has fuller bilges aft and has a steadier role, she attains the same speed of 9.8 knots.

From this engine are driven simply a Transmotor alternator and a GGG two inch bilge and general service pump. All the electrics are 24V for simplicity. A CAV AC90 alternator is powered by the auxiliary for charging the starting batteries only, there being three sets in all.

The auxiliary drives two small Vickers hydraulic pumps for the rope drums and the power block while the Dowty high-speed, low torque hydraulic pump drives directly through a Borg-Warner clutch to the similar type motor on the seine winch. By using a high-speed pump and motor there is no need for a high ratio step-up box and therefore less potential trouble in the engine-room.



MORE TOWING POWER JUST ONE OF CONSIDERATIONS

This is the first major improvement. A second advantage comes with greater power availability, especially when closing the gear. At this point of time the need for power is the greatest, yet it is at this time that the seine net winch is operating at its optimum, taking the greatest amount of power from the main engine. Thus the engine is not able to give the maximum
power output. If the winch pumps are driven by the auxiliary, then the main engine is completely separate from the deck machinery and can be used for propulsion duties only. This is how it is effected aboard this ves- sel and not only does it provide the maximum power available but also allows the skipper to tow a slightly bigger net.

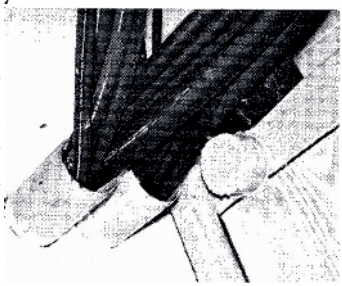
FUEL CONSUMPTION

But these are not the only advantages from this new arrangement. Fuel consumption is one of the most important considerations today and in this new vessel the skipper is finding the fuel consumption roughly the same as in the last vessel, despite the fact that both engines are running all the time. He has a wheelhouse control for the auxiliary also and when the full revs are not required he can simply throttle it down to idling speed. The main engine is not pushed as much either, so the system is fuel saving in practice. With both engines running total consumption is about 6 gallons per hour.

Despite the two engines the engine room is exceptionally roomy with ample space for servicing machinery. Fuel oil tanks either side have a capacity each of 1000 gallons and in order to obviate the necessity of carrying numerous lube and hydraulic oil drums scattered around, two extra tanks, each with a 100 gallon capacity, have been built in flush with the main fuel tanks. Fresh water tanks aft have a capacity of 450 gallons and a Stuart Turner pressure system is provided.

UTILISATION OF WASTE ENERGY

Robert Reid has looked hard into the wastage of energy aboard ship and has made several interesting moves. Firstly he has fitted keel-cooled engines. In his last vessel he had to keep one of the GGG pumps running all the time for engine cooling. Central heating is another source of extra energy consumption and here the skipper has devised a novel system for heating the accommodation and wheelhouse spaces. Fresh air is forced several times around the exhaust system and then pumped into the accommodation. A grill type control is provided for adjusting the air flow. As an emergency or whenever the engines are silent there are Superser gas heaters provided. Noise is often a problem with auxiliary engines but here again Robert Reid has attacked this and with the result that the vessel is one of the quietest in the fleet. The reduction in engine noise was effected by having the exhaust system from the auxiliary identical to that of the main engine.



One interesting feature is that all the hydraulic piping is taken from the engine room to the deck machinery via the fish hold within a simple plastic drainpipe. The couplings are all either in the engine room or forward of the fish hold. Thus if there is a failure in this system it

can only be in one of two places and these are both easily accessible.
Three electrically-driven ventilation fans are provided for the engine room and the funnel is off- set atop the deckhouse to allow for stowage of one of the inflatable life rafts without impairing the vision aft from the wheelhouse.

DECK LAYOUT

The deck layout is more or less conventional but there is as much working space as in some of the SO-ft wooden vessels. Much of this is because of the wide transom where the gunwhale has been raised in way of the quarters and the stern to a full 39 ins. in height. This gives better protection for the crew in that they have something to hold on to to prevent them being thrown about.
Even with the three rope drums on the foredeck there is plenty of working space. This is because the seine winch is right forward and the two forward drums tight behind the whaleback. The layout of the leads is very sensible and has been effected only by not fit- ting a coiler. From the winch the ropes lead forward to rollers ben- eath the whale back and then back to the guide-on gear of the drums at a very light angle so as to put as little strainas possible on this gear. The seine winch itself is able to be situated right forward as it is not needed for landing. A small Lossie hydraulic cargo winch with wheelhouse control is mounted atop the whaleback. The seine winch itself is one of the latest designs from the Northern Tool & Gear Co. Ltd. of Arbroath and is powered by a Dowty high speed, low torque hydraulic motor. This new winch uses the simple worm and worm system to provide a smooth- running operation. When the winch is started each time there is none of the sudden jerking that often happens and this is of course better for the gear.
The three Lossie rope drums have each a capacity of about 14 coils of 3 ins. rope and the third drum is used for turning the ropes but also serves as a stand-by should anything happen to one of the others.

Robert Reid had rope bins in his last vessel but would not look at them again. Like most fishermen now he accepts the fact that bins are suitable only for boats that are switching often from seining to another type of fishing. For a boat that is seining for most of the time the drums are the ideal system. The deciding factors were the wear often met with when using bins and the necessity for the crew to be continually splicing the ropes and the splices catching on the coiler. Now the only time they splice is when a rope breaks. It is also much easier for everyone. With he skipper having full control of the drums and winch from the wheelhouse no-one

is needed on
deck. Both for shooting and hauling Robert Reid has a special fold away seat at the starboard side of the wheelhouse. From here he can see the after deck and also the fore deck. To hand immediately are the main engine and winch/rope drum controls, as also the intercom, the vhf and main radios, and a tiller steering position. In addition, for use in emergency, there is a stop button for the auxiliary engine which of course stops all the deck machinery also. The only control for the forward deck machinery locally on the deck is an emergency dead-man stop control beneath the whaleback.

On the after deck there is a Lossie 24 ins. power block fitted on a long-reach single-arm slewing derrick. Chalmit floodlights are fitted for deck illumination.

The fish hold is served by a single hatch with a wooden cover. There are just two ice scuttles in the deck and these are watertight. The seine rope leads from the seine winch are by AF Engineering of Peterhead and of a very simple type that can easily be fixed if they seize up. The hold itself is insulated on the after bulkhead and also on the deck head with expanded polystyrene. It has a total capacity of over 500 boxes and the sides and deck head are all white-painted to give maximum reflection from the lights.

ACCOMMODATION

The crew cabin below deck aft benefits greatly from the full-width transom stern. There are seven berths in all with plenty of storage space. A domestic refrigerator is also located here.

The deckhouse aboard this vessel is a foot further forward than the last vessel and this was done to allow the messdeck and galley to be located beneath the wheelhouse. There is ample room here and the galley is equipped with a calor gas cooker and hot water heater. The location of the galley here also allows the after section of the deck house to be relatively low compared with the wheelhouse.

WHEELHOUSE

This allows the skipper excellent viability from the wheelhouse. The layout in the wheelhouse is one of the best features of the vessel and is as near perfect as possible. Robert Reid took great pains to have all the equipment on a low profile so chat wherever one stands in the wheelhouse an excellent view is afforded all-round. This is helped by large-size windows, some of which have been moulded into the wheelhouse corners to

give the best vision. There are thus no blind spots from the wheelhouse with the exception of the funnel exhaust.

The wheelhouse is very fully equipped and has two helmsman's seats in addition to the folding seat for hauling and shooting, yet there is still sufficient space in which to move around. One of these seats is a Bostrorn chair while the other is fixed.

The electronic equipment is nearly all from Decca and comprises a Decca RM914 radar, Decca Super 101 radar, Simrad SL sonar, two Mk 21 Navigators and a 350T Track Plotter. The two Navigators reflect a trend in this direction for vessels working well off the Scottish coast and into the fringe area of their normal working chain. The second Navigator is used to check their position from the Norwegian chain.

Steering is hydraulic by Tenfjord, model H100E8G and is coupled to a Decca 450 autopilot. For fish finding there is a Kelvin Hughes Kingfisher bottom lock echo sounder. Communications are handled by a Sailor 400 watt SSB and a Sailor RT 144 vhf while there is a Simrad R W watch receiver. A Sony tape recorder is provided for recording fishing reports while the skipper is busy and cannot find time to write down co-ordinates, etc.

The large-size wheelhouse windows are by Iver Christensen of Denmark and there are several spring loaded opening windows.
Wynstruments window wipers are fitted to one of the forward windows and to the window overlooking the after deck and each of these is
also fitted with window washers for clearing salt or other scum. A Francis searchlight is fitted to the wheelhouse top. One useful feature in the wheelhouse is that the main engine control console and that for the auxiliary engine are quite a distance from one another. Thus if an alarm goes off thereis less chance of confusion as to what is at fault.

The wheelhouse is also fitted with a stereo music system and the result of all the thought put into the wheelhouse layout and design by the skipper is that it is not only first-class and functional for working operations but it is as comfortable and relaxing as possible for those on watch. Morep rubber matting is fitted to the floor for greater comfort.

This is just one of the many almost-perfect features of a vessel class that could well become popular in the future. For with the continual inflation in building costs the larger 80ft class vessels might well prove too costly for a good number of skippers with older type 70-footers and who will have to be considering new tonnage .before long.

4 LW ? Powered Fordson Major Tractor. Is this the only agricultural tractor with a Gardner power plant?

In Newsletter 21 we asked this question

Alan Imrie sent in these photographs taken in June 2002 at the Lister Tyndale Rally of a 6LW powered Model N Fordson tractor

Alan also knew of an International TD9 that had been fitted with a 4LW in the mid 1950's

So at least 2 other tractors that have been converted to Gardner power

Continued from page 20
Newsletter 21

GENERAL DESCRIPTION (*continued*)

Quick-Starting Burner.—These are small burners permanently attached to the engine, used for the preliminary heating of the Domes on the Combustion Chambers. In principle, the burner consists of a small spray of petroleum or gasoleum, across which blows a current of air derived from the compressed air system. The burners are lighted just the same as, and as instantaneously as, an ordinary gas burner, consequently the time necessary for starting is simply that of heating the domes, which takes about three minutes. In effect, the engine can be started from cold, ready for full load, in three minutes from the word " go." The burners are then instantaneously extinguished. No hand lamps are used. (*Illustrated on page 9*).

Electric Starting.

As an alternative to the use of burners, we have developed a system of electric ignition by which the engines can be started instantaneously from " dead cold " without the necessity of pre-heating the domes.

In this system, there is fixed in each dome an electric plug or igniter at the inner end of which is a small helix of wire embedded in a matrix of refractory material. When starting the engine, this coil or igniter is heated to a bright red by a current of electricity at 12 volts and is so placed and disposed as to ignite instantaneously the fuel charges as they are injected into the combustion chamber. Considered as a laboratory experiment, the system is extremely simple and now belongs to ancient history, but to convert it to a really reliable system for use in everyday life is a vastly different problem, for the igniter must always operate with certainty and precision when in service and, when not being used, it must be able to live in the highly-heated atmosphere of the combustion chamber without deterioration, always ready to operate when required.

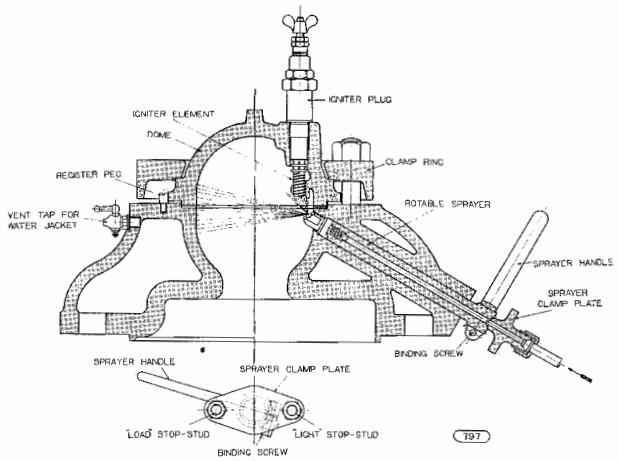
Igniter Plug

The task of fulfilling both these conditions has been particularly arduous, demanding much time and patience, not to speak of the cost, for the cogent reason that there is no way of making tests for endurance and effectiveness other than that of putting the igniters to work **under actual working conditions,** in engines running at full load, all day long, for weeks and months on end. It is only by such tests as these that we are enabled to recommend the system with such confidence.

GENERAL DESCRIPTION (*continued*)

Electric Starting (*continued*)

The development of the Gardner Electric Plug or Igniter has been greatly assisted by its unique combination with the Gardner Rotable Sprayer, which has enabled the igniter to be placed in the most effective position in the combustion chamber as regards certainty of ignition,



Cylinder Breech showing the Igniter Plug and Rotable Sprayer. Two positions of the Spray-form are shown : one for starting and the other (the lower one) for running at full load

while being, at the same time, in the most " sheltered " position for durability when not in use as an igniter, that is, after the engine has been started.

When speaking of the durability of the Igniter Plug, we refer more particularly to the Igniter element, the life of which, it will be conceded, is necessarily shorter than that of the body of the plug. We have therefore produced an Igniter element which can be renewed by the user at an insensibly small cost, in case of necessity.

Renewable Igniter Element

The current for the Igniter Plugs is derived in a manner similar to that employed for electric starters on Motor Vehicles, namely from a dynamo fixed on and driven by the engine and which charges a 12-volt battery.

GENERAL DESCRIPTION (*continued*)

Electric Starting (*continued*)

The **Standard Equipment** comprises everything necessary, as specified in the following :

1. Charging Dynamo fixed on the engine and driven by a chain belt with belt-tightening gear.
2. A 12-volt battery.
3. A switch-board or switch-box containing all the instruments necessary for the automatic charging of the battery, including also a circuit available for lighting the engine room.
4. Bus-bar on the engine.
5. Small switch-box to each cylinder for independent control of the Igniter Plugs.
6. Igniter Plugs, one to each cylinder of the engine.
7. Shunt and Fuse-Block with Ammeter for the circuit from the battery to the bus-bar.
8. All necessary cables and connections.
9. Spare Igniter Plugs, spare igniter elements and the tools necessary for replacing the same when necessity arises.

In effect, the equipment contains everything required or desirable, leaving nothing for the user to provide.

The apparatus is very simple and easy to use. When ready to start, each igniter is switched into action and in 30 seconds the elements are sufficiently hot to ignite the fuel charge while all is " dead cold." The engine is now instantaneously started in the usual way, by a puff or two of Compressed Air.

After starting, the charging dynamo automatically " cuts in " and at once begins to charge the battery.

The dynamo and battery feed a 12-volt circuit. Each igniter, while in action, takes 19 amperes ; thus for a four-cylinder engine 76 amperes are necessary.

Electric Lighting.—The capacity of the dynamo and battery is not only ample for starting, but has a reserve sufficient for a few 12-volt Pilot Lights about the engine room, a provision which we find to be much appreciated. As already stated, the main switch-board of the equipment is provided for such a lighting circuit.

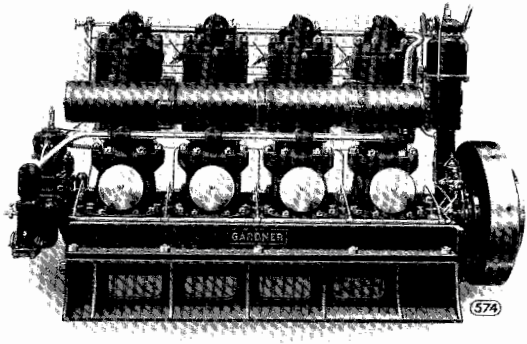
It will be gathered from the preceding that our system of starting by Electric Ignition is long past its experimental stage and that we are able to recommend it with the utmost confidence.

Our standard engines are equipped with Quick-Starting Burners. The Electric Starting equipment is fitted only when expressly ordered and is subject to an extra charge.

Exhaust System.—The exhaust gases pass from the engine cylinder into a large water-jacketed manifold pipe built in sections, one to each cylinder, with special provision for the difference of expansion between the inner shell and the relatively cold outer shell. The gases then pass through an expansion chamber (commonly called a silencer) apart from the engine.

FOR STATIONARY ENGINES, the exhaust chamber is of cast iron of the usual type and is included in the price of the engine.

GENERAL DESCRIPTION (*continued*)



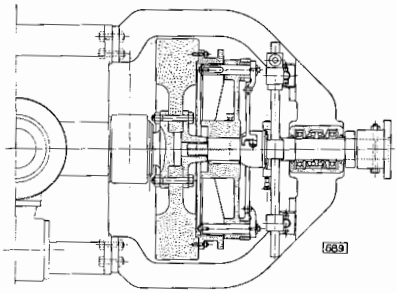
Rear View of Engine, showing exhaust manifold, pump, and service pipes of circulation lubrication

FOR MARINE ENGINES, the exhaust chamber takes a variety of forms to suit each installation. It is generally built of galvanised sheet steel, sometimes water-jacketed, sometimes provided with water injection, and sometimes made in the form of a ship's funnel. Under these circumstances the exhaust chamber is treated as being part of the installation and so is not included in the price of the engine.

Water Injection is **NOT** used on these engines.

Clutch and Thrust Bearing.—For Marine Engines. This is a unit used for all reversible engines; that is to say, for all engines of three or more cylinders. It consists of a clutch and a thrust bearing carried on one frame, bolted to the engine bed. The clutch case is bolted directly on the flywheel.

For engines of less than three cylinders the above is replaced by a Gardner Transmission Reversing Gear combined with thrust bearing.



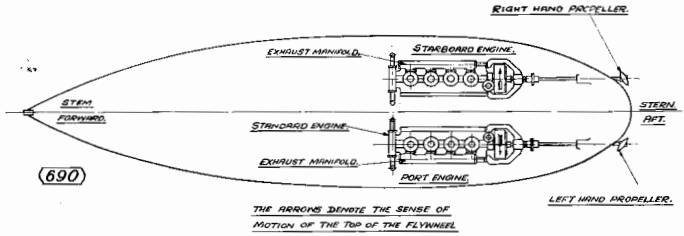
Pipe-Work.—All the pipe work on the engine is of polished copper or brass with brazed joints. Each engine is complete as regards its pipe-work and fittings. The pipe-work external to the engine proper is considered as forming part of the installation and so is not included in the price of the engine. External pipe-work means, for example, the compressed air pipe-work between the engine and air reservoirs, the pipe-work between the engine and the fuel tanks, and so on.

Regulations of Lloyds', Board of Trade and British Corporation.—All engines are built according to the latest rules of these authorities whether they are to be surveyed or not. In case of complete survey, the makers undertake all work in connection therewith, including tests of materials and inspection. When not explicitly mentioned in the contract, the fees of the survey are charged to the purchaser.

Sense of Rotation.—This is best described by saying that the sense of normal, or ahead, rotation adopted by the makers is such that the top part of the flywheel moves always from the injection (or admission) side of the engine towards the exhaust side as shown in the figure below and also on pages (52), (53), and (54).

Port and Starboard Engines.—All engines are built in two types, port and starboard (left or right hand), so that when engines are installed in pairs the motion work and manœuvring gear are situated in the one alley between the engines. This disposition is shown diagrammatically in the figure below.

As a consequence of the two preceding paragraphs it will be evident that the sense of rotation desired for dynamo or other drives determines the choice between port and starboard engines.



Diagrammatic Arrangement of Twin Marine Engines, showing Senses of Rotation

PROPELLING MACHINERY AND INSTALLATION.

This is designed and manufactured in our own works, in a department set aside for the purpose, directed by Marine Engineers of long experience, whose services are willingly placed at the disposal of our clients.

CYCLIC VARIATION OF SPEED.

This refers to the variations of speed which take place during one complete cycle of the engine, that is, during one complete revolution of the Gardner T Type Engine. Following the general practice in England and the Continent, the variation is measured as follows :

If N denotes the maximum speed at any moment during one revolution,
and n denotes the minimum speed at any moment during one revolution,
and C denotes the co-efficient of cyclic variation,

$$\text{then } C = 2\frac{N-n}{N+n}$$

Example.—N=302 revs. per minute.
n=298 revs. per minute.

$$C = 2\frac{302-298}{302+298} = \frac{1}{75}$$

All engines are " flywheeled " to suit the co-efficient demanded.

SPARE PARTS.

Spare parts for engines of current types are kept in stock, ready for immediate delivery, and, as a rule, the same applies to engines of an earlier date. Spares for old types of engines are not, as a rule, kept in stock, but are made at very short notice. We make it a principle never to " let down " a user of an obsolete Gardner Engine for want of spare parts, no matter how old the engine may be. It is quite a common occurrence for us to supply spares for engines that we sold thirty and more years ago.

To Be Continued

"For Sale"

I have been contacted today by a Mr Johnson (no relation) from County Durham, who has for sale 3 Gardner engines as follows:

1. A 6LW with generator (running).
2. A 6LX.
3. A 6LXB

Prices around scrap price.
Phone No 01914406325.
(Advert via Mike Johnson)

I have been clearing out my shed and have come across the following bits which may be of use to someone
6LXB Alloy Inlet manifold with hood in good condition.
6LXB Cast Exhaust Manifold outlet central and facing downwards, some surface rust but in good condition
6LXB Fuel Pump appears complete and in good condition.
If anyone is interested please contact me, I will take reasonable offers
I live near Edinburgh.
Many Thanks
Bob Clunas anneclunas@btinternet.com
(Advert via Mike Johnson)