PEEMS
Pickering Experimental Engineering & Model Society

NEWSLETTER February 2021

Hello Gents. Welcome to the first Newsletter for this year. We have had a few meetings on the Zoom platform and I am very pleased we can use Zoom in the absence of physical gathering. The club seems to be holding together very well considering the circumstances. Our internet meetings run very nicely, unlike that Parish Council meeting that hit the news headlines when it descended into chaos.

Thanks to Mike Sayers, we had a fantastic presentation on Zoom about the manufacture of the Cylinder Block for his ⅓rd scale Bentley engine. A write up is on the following pages. Once again, I was riveted to the computer screen. If only a TV production company could come up with a series aimed at engineers, albeit steam, motor, model or whatever; I am sure it would be a success. I must have about a hundred TV channels to choose from, and often switch it off because there isn't anything worth watching. I have to admit a fellow club member gave me some old magazines a couple of months ago, and when I went to collect them there was 25 years' worth, so at least I always have something to look forward to reading.

I have not heard anyone say they have been bored. I have phoned a few people and vice versa, and the consensus of opinion is it will be nice when we can get together again and talk in person or as a group.

Who works in Metric and who is Imperial? I was educated in Imperial but my first year of apprenticeship was the first to be Metric so I consider myself ambidextrous. Obviously, our industry could not change overnight and all plant and machinery would remain Imperial. A couple of years later, when I was working with a fitter, he told me the stores were going metric and told me to go and get some 12.7 Whit nuts. Storemen are not known for their sense of humour and I was told to go away!

Has anyone else got any amusing tales from their training days that they would like to share? I realise that's from a few years ago now, but I bet if you think about it, there are some gems out there.

In case you have missed an e-mail or two, it was decided to mothball the Railway with a view to eventually disposing of it. If you would like to take advantage of a once in a lifetime chance to purchase a bargain, or know someone who does please contact me or David Proctor.

Pickering Experimental Engineering and Model Society (PEEMS) offers for sale their deployable 7¼" gauge passenger carrying railway. The railway comprises:

- 1 x Petrol-Hydraulic Locomotive
- 2 x Passenger Carriages each with 4 seats (total capacity 8 passengers)
- Approx. 85m of straight track
- A quantity of line side fence posts
- Tools and set-up ancillaries.

Stay safe, Jonathan.

Build Progress Of My '*Dos Amigos'* Model Ship By Stuart Walker.

I purchased a kit and started building this 1:50 scale model of *Dos Amigos* 40 years ago, but soon after building the hull I purchased a full size 1936 Thornycroft twin screw diesel yacht for restoration so put the model to one side to start work on the 48 foot long hull. It was a long project and others followed so the little model was forgotten about until the end of last year when I fancied a change from metal working and decided it would be an interesting short term project to complete.

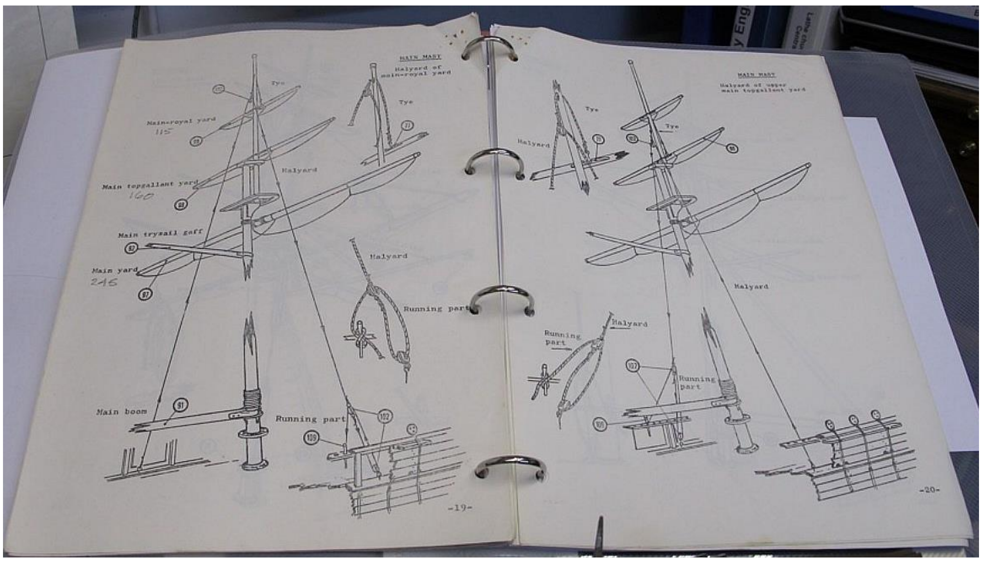
This is the second model I've built of this type so I'm aware of the time consuming challenges of such small scale intricate work which demands a good eye and a fine touch, both of which don't seem to get easier as time goes by. So far, I've completed all the spars and deck fittings and made a start on the rigging, as shown in my progress photos . Whilst the drawings are quite good I've found it necessary to consult other sources to resolve some of the details which are clearly missing. I've also spent quite a lot of time making little fabrication jigs and trying to find easier ways of doing things. As a case in point, I found it very difficult trying to bend and fit 0.5mm dia wire around the 2.8 x 3.7mm wooden pulley blocks that are shown on page 3 of the photos. I thought I needed to make some sort of jig but it all seemed too complicated until I suddenly realised it could be very simply achieved by using my small round tapered pliers and callipers to measure the wooden blocks, transfer the dimensions with simple pencil marks on the pliers. By using these marks, the thin wire can be precisely bent and fitted around the little wooden blocks. Most of the parts are fixed using superglue and yes, I have managed to stick my fingers together but brake cleaner came to the rescue and I've now learned to be a bit more careful!

Brief history of the ship: *Dos Amigos* is believed to have been built at Portsmouth, Virginia in 1830. She measured 83 feet in length, displaced 172 tons and was designed along the lines of the "Baltimore clipper" schooners, which were a popular choice for the slave traders. The design provided the ships with shallow draft, good manoeuvrability and fast passage that enabled slavers to ply their illegal trade in West African ports from where they needed a swift getaway to evade arrest, and then to rapidly transport their cargo.

Dos Amigos was a Brazilian slaver until she was captured by the British Navy ship *'Black Joke'* off the coast of Cameroon in 1832. She was renamed *'Fair Rosamond'* and taken to a British dockyard for a design survey and subsequent refit as a slave-catcher before being sent back to West Africa where she captured the slaver's *'La Pantica*' in 1834 and *'El Esplorado'* and *'La Mariposa'* in 1836. In 1837, drawings were made of the original rig of *Fair Rosamond* before she was altered and sold out of the Royal Navy in 1845.

1:50 scale model of the 1830 built *'Dos Amigos'* being constructed by Stuart Walker


Negrero


MAIN MAST
Main-royal yard
Main topgallant yard
Main trysail gaff
Main yard
Main boom
Halyard
Running part
Tye
-19-
-20-

Trials And Tribulations Encountered While Trying To Make A Cast Iron Fixed Head Cylinder Block For A 1/3rd Scale 3 Litre Bentley Engine ~ Mike Sayers.

This is a continuation of the previous talk about the manufacture of components for the 1/3rd scale 3 Litre Bentley engine. That talk is presented in the November/December 2020 PEEMS newsletter, and is titled "Machining Castings From Solid". In that, it was explained how and why the original full-size castings of engine components were machined from solid for the 1/3rd scale components. The parts discussed were a) the 3 Litre engine "turret" b) the 3 Litre engine manifold and c) the 1/3rd scale 1929 4½ Litre Bentley 'Birkin' supercharged engine manifold. Each of those components was machined from solid aluminium.

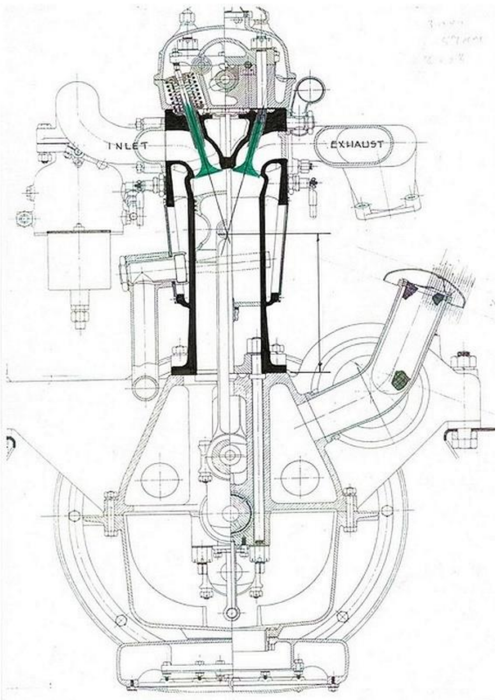
This talk is about reproducing, in 1/3rd scale, the cast iron fixed head cylinder block, and how and why certain decisions were made about the process of machining.

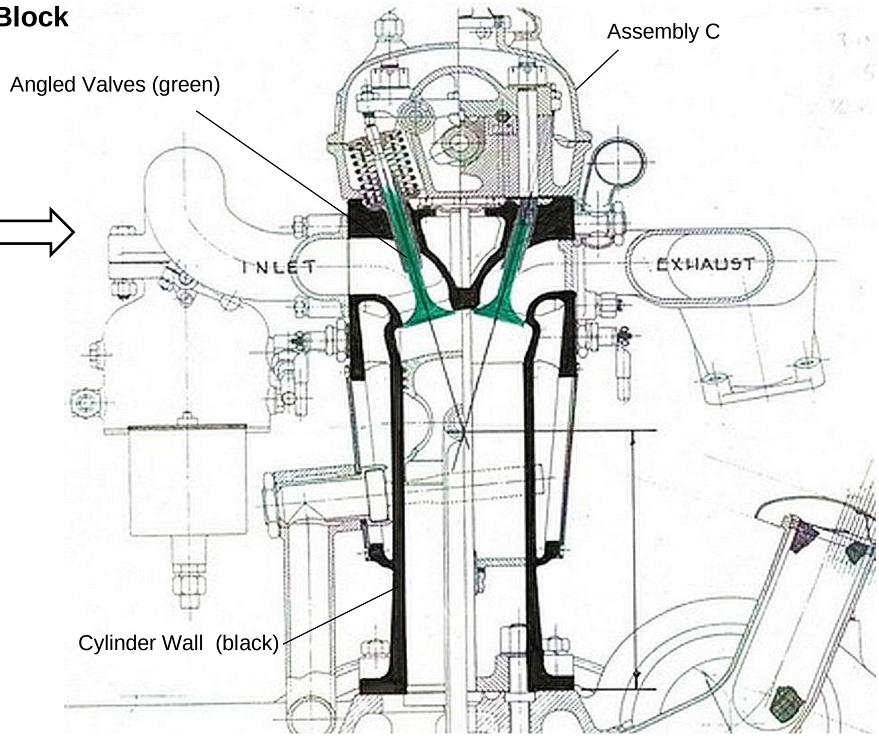
The following two photos show a 3 Litre cylinder block, recently dragged out of a friend's garage purely to illustrate what had to be made. It looks grubby, but it is 98 years old. It's had a very hard life. It was in a racing Bentley in the late 1950s / 1960s, and had been tuned up to a high degree.

The thickness of the foot (A), shows that at least a ¼" has been machined off the base to raise the compression, and a number of pieces (view B) have been welded in the side to increase the swing of the con-rod (because it had a long stroke crank in it). The bores have also been opened out. It's a miracle that it has survived.

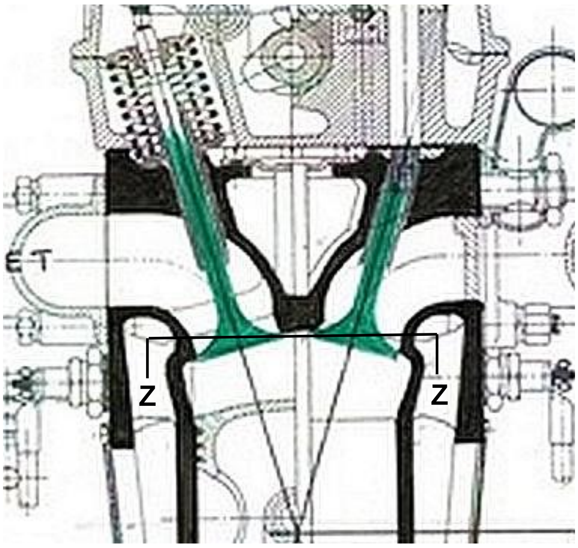
This is the item that had to be recreated in its standard form as a 1/3rd scale cylinder block. It has been the component that has given the most head scratching and self-doubt of any of the components that have been made to date.

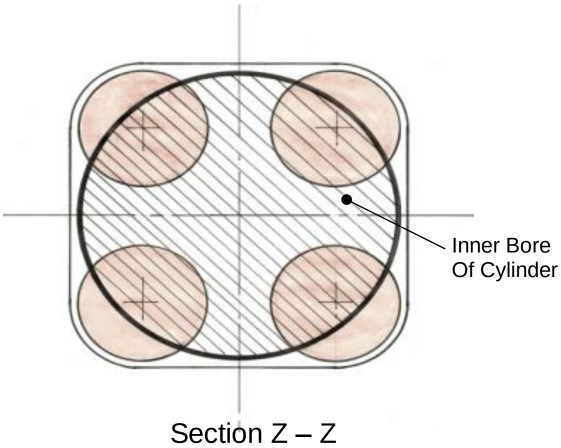
Vertical Section Through The Cylinder Block





The previous drawing is a vertical section through the Number 1 cylinder, and shows what needs to be recreated. As can be seen from the first two photos, the block is “open decked” all the way around, with water plates screwed on, so getting inside was fairly easy. The previous components discussed in the first talk were fairly complex shapes on the outside. This one has the disadvantage of being a complex shape on the inside. The valves are angled as seen, which creates a problem because you can’t get a cutter up the bore at the correct angle. The valves can’t even be removed without removing the guides, as when they are pulled down, the valve hits the side of the cylinder wall. Every time a valve is removed or repaced, the guide has to be pulled out beforehand. It’s a really tedious process. If the valves had been vertical, the machining could have been carried out from below.





Section Z – Z
Projected Area Of The Valve Heads

This sketch shows the projected area across the valve heads in relation to the inner bore of the cylinder. There are actually four valves per cylinder, and the section shows the valve heads ‘overlapping’ the inner bore. In fact, as they are tilted, they miss the cylinder wall when opening. But what this shows is how difficult it is to get in and machine the valves.

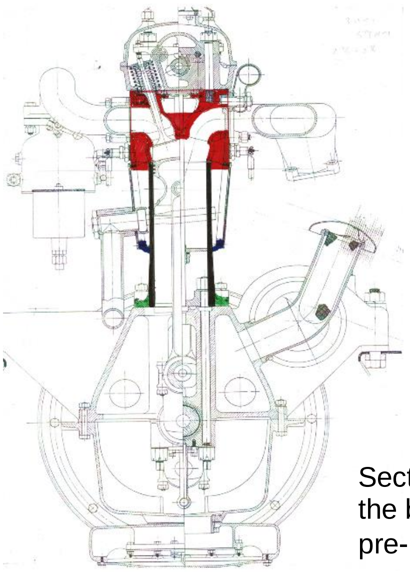
Why was it made like this? In the 1920s, this was the standard arrangement for high performance engines. It is a carry-over from the Edwardian racing cars and World War 1 in-line water cooled aircraft engines. It is quite a light arrangement. They also had the benefit of very skilled moulders and foundrymen to produce these complicated castings. A lot of these skills have been lost.

Mike had to figure out how to make this. His original idea was to try and make it out of a block of cast iron. The outside was fairly straight forward to machine, but he could not figure out how to machine the inside. The bore is 28mm and is 80 mm deep. Getting cutters down seemed impossible.

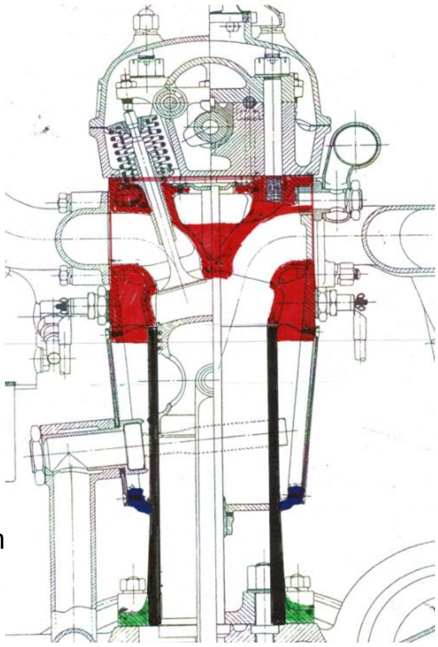
Four ideas were considered:

- Machining from solid, which was a failure.
- Make a detachable head. The whole component, however is designed in such a way that there is no way bolts can go through it, and besides, by doing that the final component would not be representative of the original.
- Make the liners separate and screw them into the top of the head. That idea was discarded.
- The last idea, which at first Mike doubted would work, but was considered the only way to go, was to prefabricate the whole component with pre-machined subcomponents of cast iron.

That was the method finally chosen. It took nearly three years to decide, during which the rest of the engine was being made. The crankcase and the top assembly (C) had been made, but doubts about the cylinder block nearly “killed” the project.



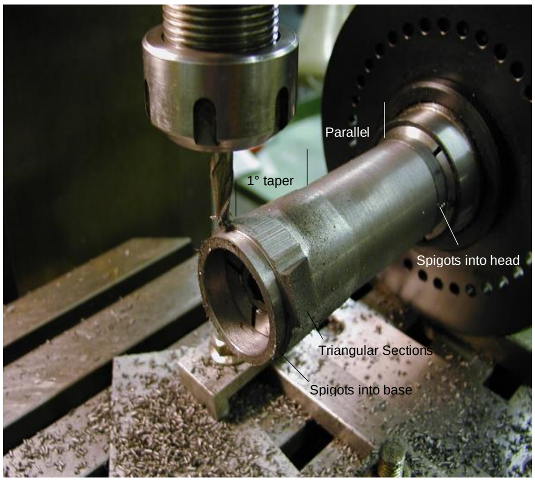
Section drawing showing how the block will be assembled from pre-machined separate pieces



These eleven subcomponents make up the cylinder block:

- The cylinder head (red).
- The four cylinder barrels (black).
- The bolted down foot (green).
- The base of the water jacket (dark blue).
- Four corner pieces for the block.

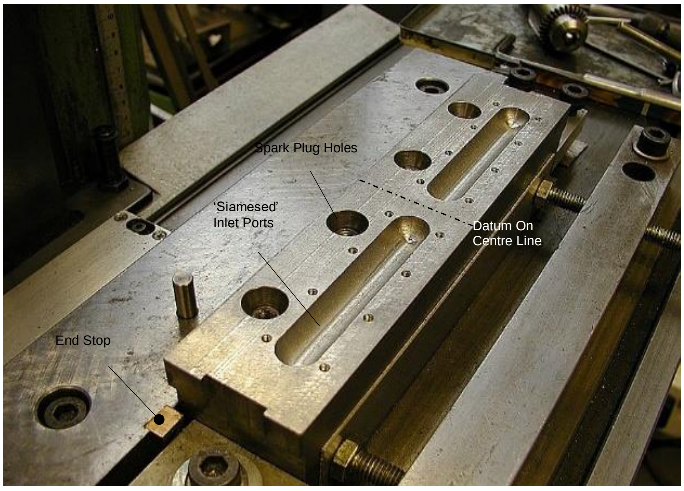
A few years ago, PEEMS had a talk by Keith Hales who owned ‘CuP Alloys’. Keith had been advising industry on soldering techniques all his life. Mike mentioned this project to him and he was very helpful and encouraging. He explained that if the project was approached in a careful and logical manner, there should be no problem, and with that advice the project went forward.



The first subcomponents to be made were the cylinder barrels. These are fairly short tubes machined from continuous cast bar. The inside bore was honed to a finished size, and the outside was machined. The outside is parallel over approximately half of its length with a 1° taper over the rest. Triangular features are incorporated at the bottom which made production a little awkward. The top of the barrel had to be a fixed size to spigot into the head, and the bottom had to be a fixed size to spigot into the base plate. Both these fits needed to be reasonably tight.

This photo shows the bottom section, with a tool post milling head finishing off the tapered section around the triangular features.

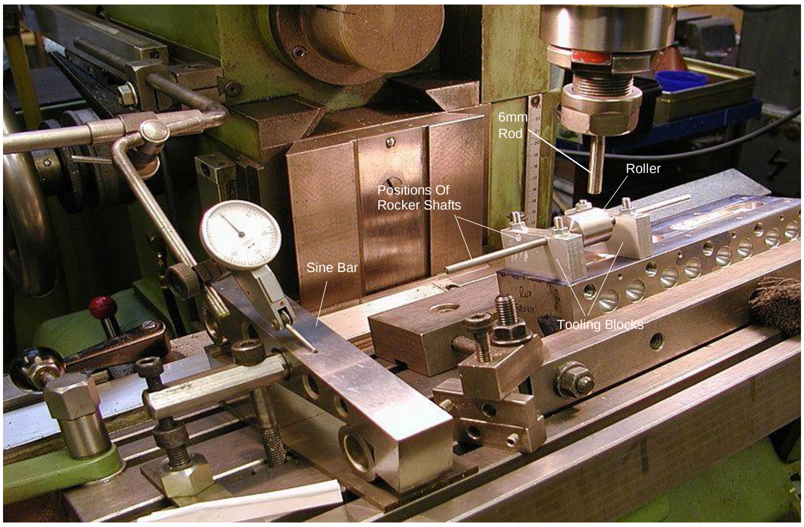
This shows the machining of the base plate of the block, shown green on page 6. All the bolt holes have been drilled, and the holes for the liners have been bored, with a decent fit onto the liners.

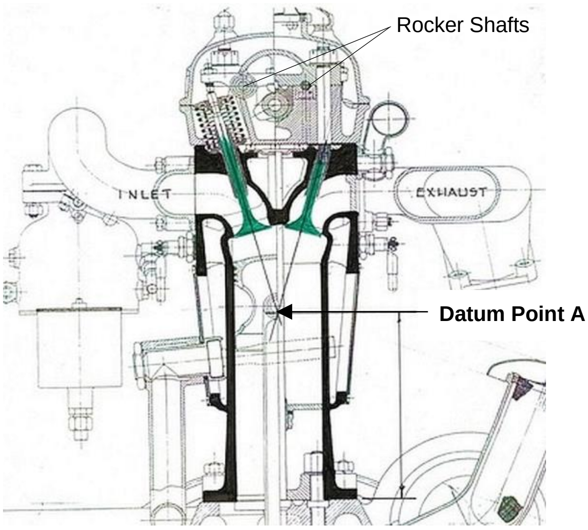


Beginning the machining of the inlet side of the cylinder head. Note the block of cast iron is located against the parallel bar and the end stop to allow repositioning. This is a solid block of cast iron cut overlength. There are slots cut both ways at each end, so that whichever face it sits on, there would be some gripping faces to clamp onto. This leaves the whole of the top surface clear for machining operations.

The parallel bar which spigots into the table provides a parallel edge to mount against. The end stop, which the job is pushed up against, allows a zero datum to be set up as described in the previous talk. The zero datum is in the centre so that whichever face the component is turned around on, the datum is fixed and co-ordinate drilling of details can be carried out on each face.

The spark plug holes have been bored, and the "siamesed" inlet ports machined, each of which serves two cylinders and four separate ports to the valves. At this stage, there is still work to do on the inlet ports. When the ports for the valves are drilled, they will be deepened, opened up and blended together.



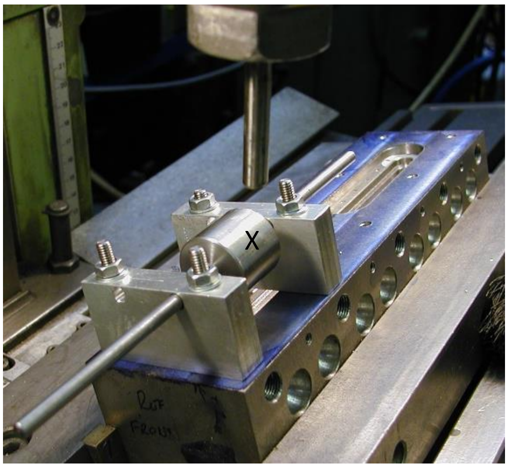


Setting up to drill and ream the valve guide holes using a roller of the same radius as the tappet movement.

Mike is quite proud of this setup because if the valve guide holes are drilled from the combustion chamber side, there is no datum for drilling. The original drawings show the positioning of the holes relative to datum point A, which is dimensioned to the base as shown. The valves are canted over at 15°15' to the vertical. When it comes to machining though, the difficulty is spatially determining point A, so a solution had to be found.

What was known was where the rocker shafts were, and how high they were. So these became fixed points. The radius of operation of the rockers were also known. These facts allowed the valves to be positioned from the opposite side to the combustion chamber.

The tooling blocks shown in the photo above, were made to bolt to the top of the head using the tapped holes which will eventually secure the cam chest. The rocker shafts can then be positioned exactly where they will be when the cam chest is bolted on. The roller represents the radius that the rocker works at.



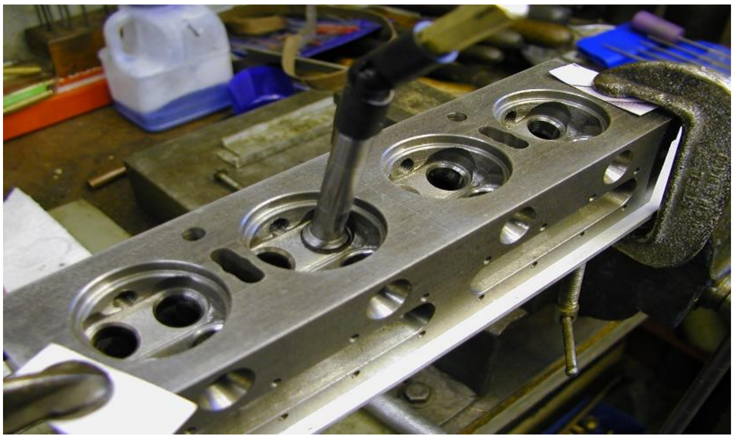
The table has been set at 15°15’ (the angle of the valve to the vertical) using a sine bar. The datum point is known because the block is set up against the end stop, so the valve positions are known longitudinally.

By using the 6mm round rod in the spindle, the rod can touch on the outer radius of the roller (at X), the roller removed, and then the spindle moved back half the diameter of the rod to position it directly over the valve.

Once the spindle has been set up, all the tooling can be removed. The table is now positioned longitudinally over the first valve position, which is then drilled and reamed. The spindle is then moved along to the next valve position which is drilled and reamed, until all eight valves on that side of the block are completed.

The set-up is then reversed with the table tilted the other way, and the roller is placed in the other side of the tooling blocks. The machining of the eight valves on the other side of the block are then completed in the same manner as the first eight.

The whole tooling set up ensures that the tip of the valve on the top is exactly where it should be when the rocker hits it, and the valve head is exactly where it should be inside the combustion chamber. This tooling system worked very successfully.

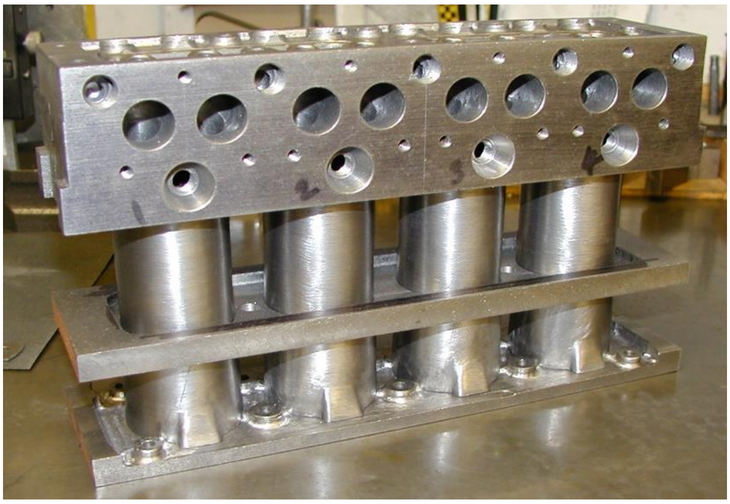


Lapping in the valves. The valves have been produced accurately relative to the combustion chamber and the spark plugs. All the inside of the combustion chamber is finished, with the valves ground in, and the seats checked before assembly.

Trial assembly of the base, barrels and the bottom of the water jacket.

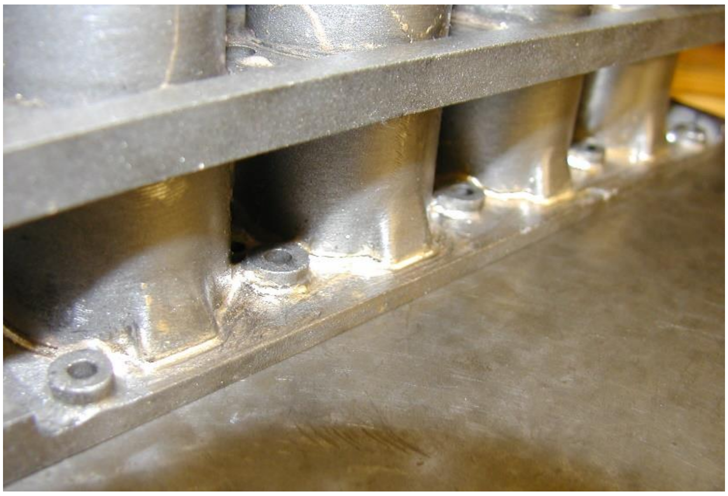
When talking about machining the barrels on page 6, it was mentioned that a reasonably tight spigot fit was preferred into the base plate, and into the cylinder head at the top. The intention was to have a self-jigging assembly, which once put together, would keep itself in alignment. This reasonably tight fit, however, is against silver soldering convention.

Some test pieces were therefore made in cast iron, with a similar tight fit, and silver soldered together. These test pieces were then sawn in half and polished. They were then inspected for full penetration. Full penetration was achieved.



Here the combustion head has been added for a trial fit.

First phase of silver soldering after cleaning and bead blasting. Advice given by Keith Hales was that silver soldering should be performed in stages. Silver solder flux will only stay active at its high temperature for a certain length of time. Especially with cast iron, the flux needs to be at its most aggressive so at each stage the work was cleaned, degreased and refluxed.

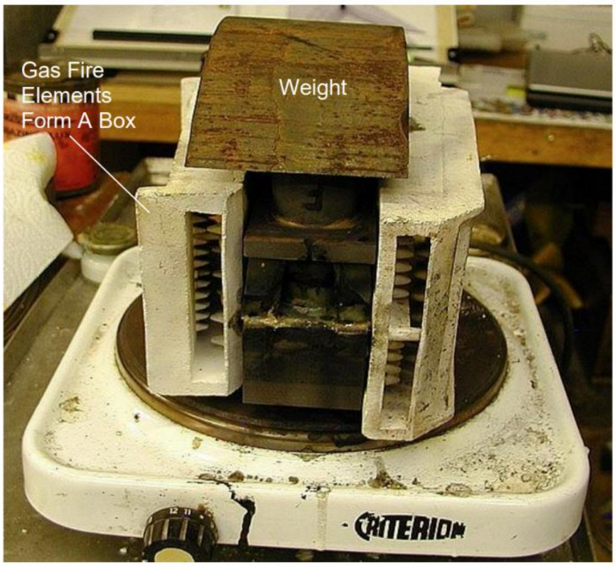


This photo shows the effectiveness of the silver solder around the base.

This is the second stage with the corner posts of the water jacket added. These corners have to be angled out 5° in both directions on both the left and right hand sides. There is evidence at the top of the barrels of the cylinder head being used to keep everything in line while the second stage silver soldering was carried out.

Preheating Of Components Prior To Silver Soldering.

At each stage of the operation the cleaned and fluxed assemblies were preheated on an old domestic electric hotplate . The job was left heating until the whole was at as near an even heat throughout, checking with a digital thermocouple. The max temperature that could be achieved on the hot plate reached the point at which the T5 flux just began to become transparent. It did not take a great deal of heat from an oxy-acetylene flame to reach the point where the 55% silver solder flashed round and penetrated all the joints.



In the photo the combustion head is being attached to the barrels and water jacket.

The components were then heated up on the hot plate. The weight seen in the photo held the various parts together during heating.

The components were then left for well over an hour in order for the heat to soak all the way through them. The parts were heated just to the point where the flux turns transparent. At that point, Mike used the oxy-acetylene torch to go around all the joints feeding in the silver solder. It didn't take a lot of external heat to get the solder to flow.

Mike wanted to use the minimum temperature that he could.

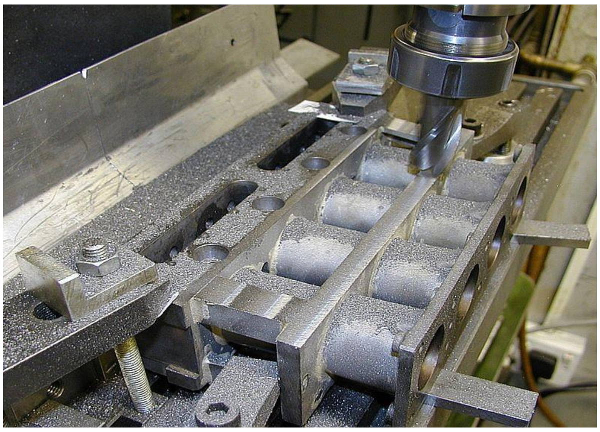
Keith Hales recommended a 55% silver solder which is fairly flexible when set. The whole system worked very well.

After each stage of silver soldering, a heat proof blanket was placed over the heater and contents, with some gas fire elements helping to 'box' the component. After every half an hour, the thermostat was turned down a notch, so that the cooling was gentle and gradual. It took most of the day to cool down so the component could be handled and worked on again.

Here is the final stage, after the cylinder head and corner posts have been silver soldered on. It is now ready for cleaning and bead blasting. The piece used for the weight is a piece of cast iron used to make the other components.

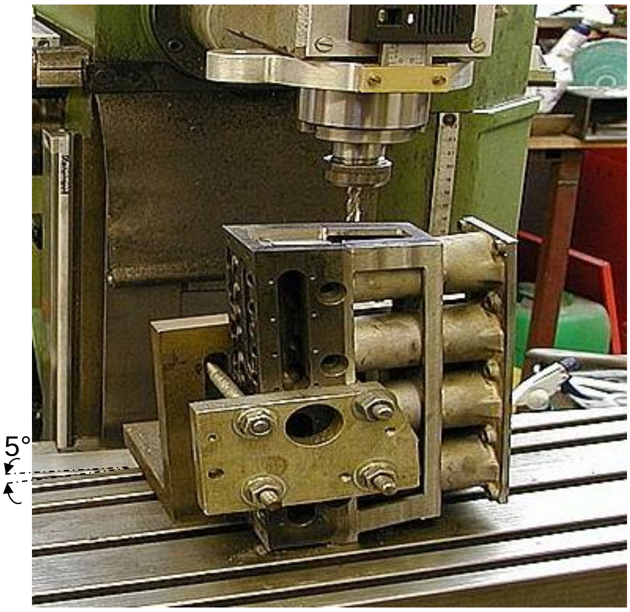
At the beginning, Mike was looking around for a decent piece of cast iron to make the components. One day Bill Milner wheeled in a 12" diameter x 3" thick slice of cast iron bar.

It was beautiful metal to machine, and being continuous the carbon is held. It silver soldered really well. The 4½ litre block was manufactured from the rest of the bar.

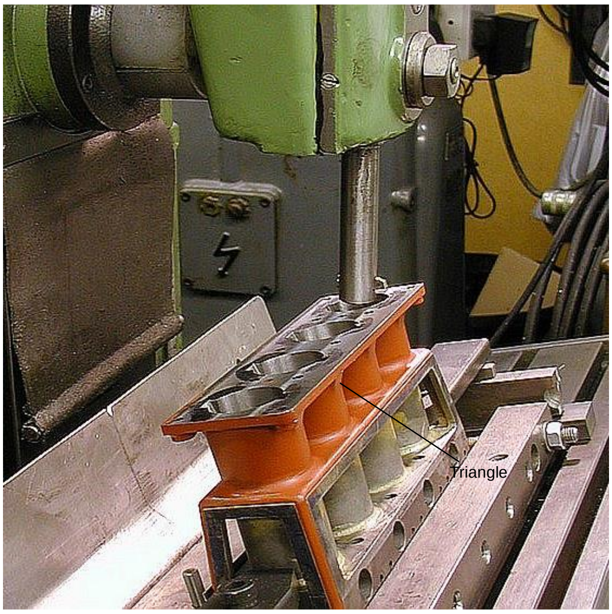


Machining the side of the water jacket to the 5° angle ready to receive the water plates: After all the silver soldering, the outside had to be machined because the water jacket is at 5° to the vertical. Everything is clamped onto the machine bed again.

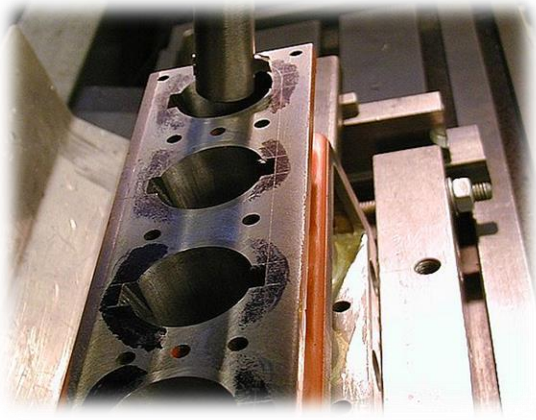
The machine bed is tilted at 5° top side out. A sine bar was not necessary for this operation. The table was set using division scales underneath the table.

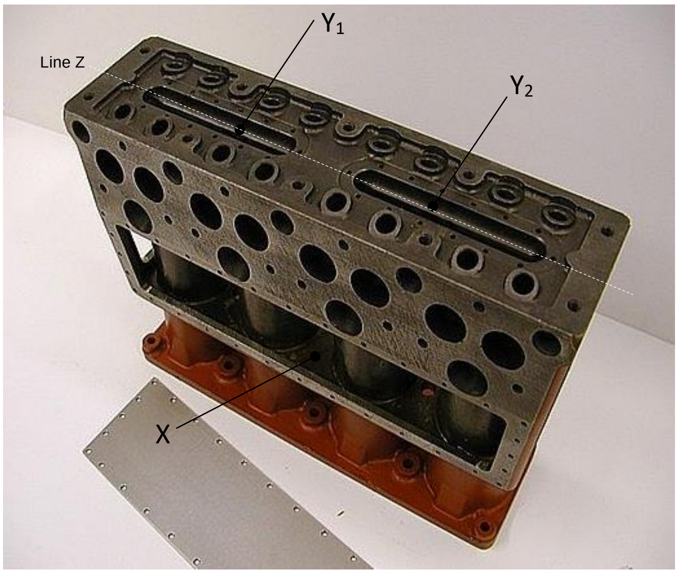


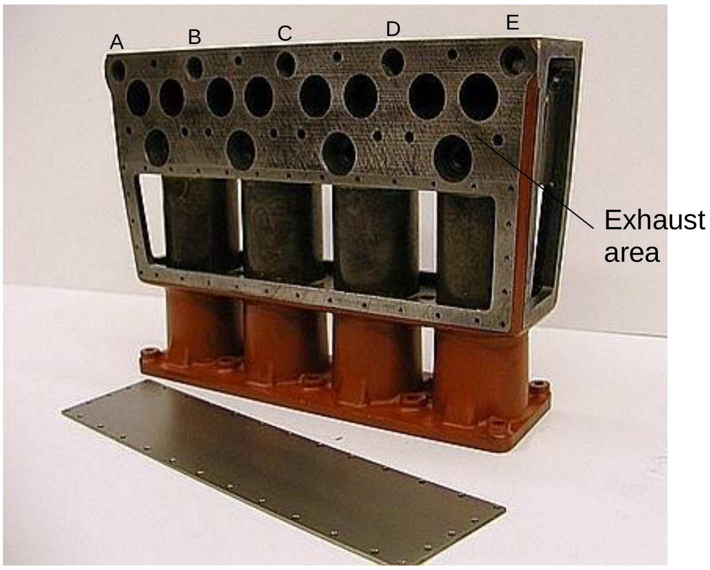
Machining the ends of the water jacket to the 5° angle. Note table canted at 5° to the horizontal: Here the ends have to be machined at 5° and the aperture for the front and rear water space milled out. It's very handy having a milling machine with a tilting table. It saves a lot of time using angle plates etc. This detachable table tilts in both directions.



Slotting out the conrod clearance holes with the table canted over at 15°. The miller is fitted with its slotting attachment.
This operation demonstrates why the triangles were left on the liners when machining operations began, otherwise the inside might meet the outside!!



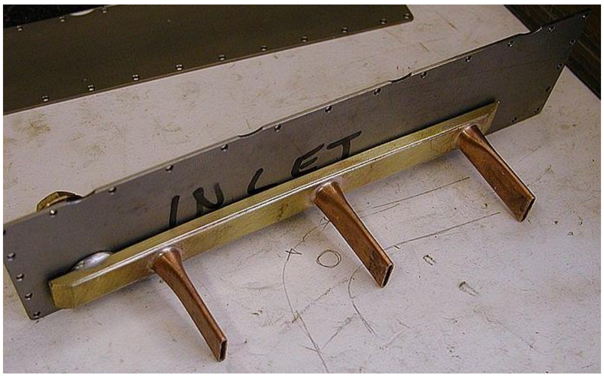




Here is the finished cylinder block with all the detailing in the top and all the screwed holes present. There are 148 10BA tapped holes in total. There are six water plates, two in the top, two in the sides and two in the ends. There are 32 tapped holes in the side water plates on each side, 14 in each of the two plates on the top and 28 in each of the two ends. No 10BA taps were broken in the operation, Honest !

When making a water-cooled engine, and fabricating it like this, one problem is getting the water to flow through the cylinder head, because all the internal coring is impossible to machine.

The cold water flows back from the radiator into area X in the previous photo.

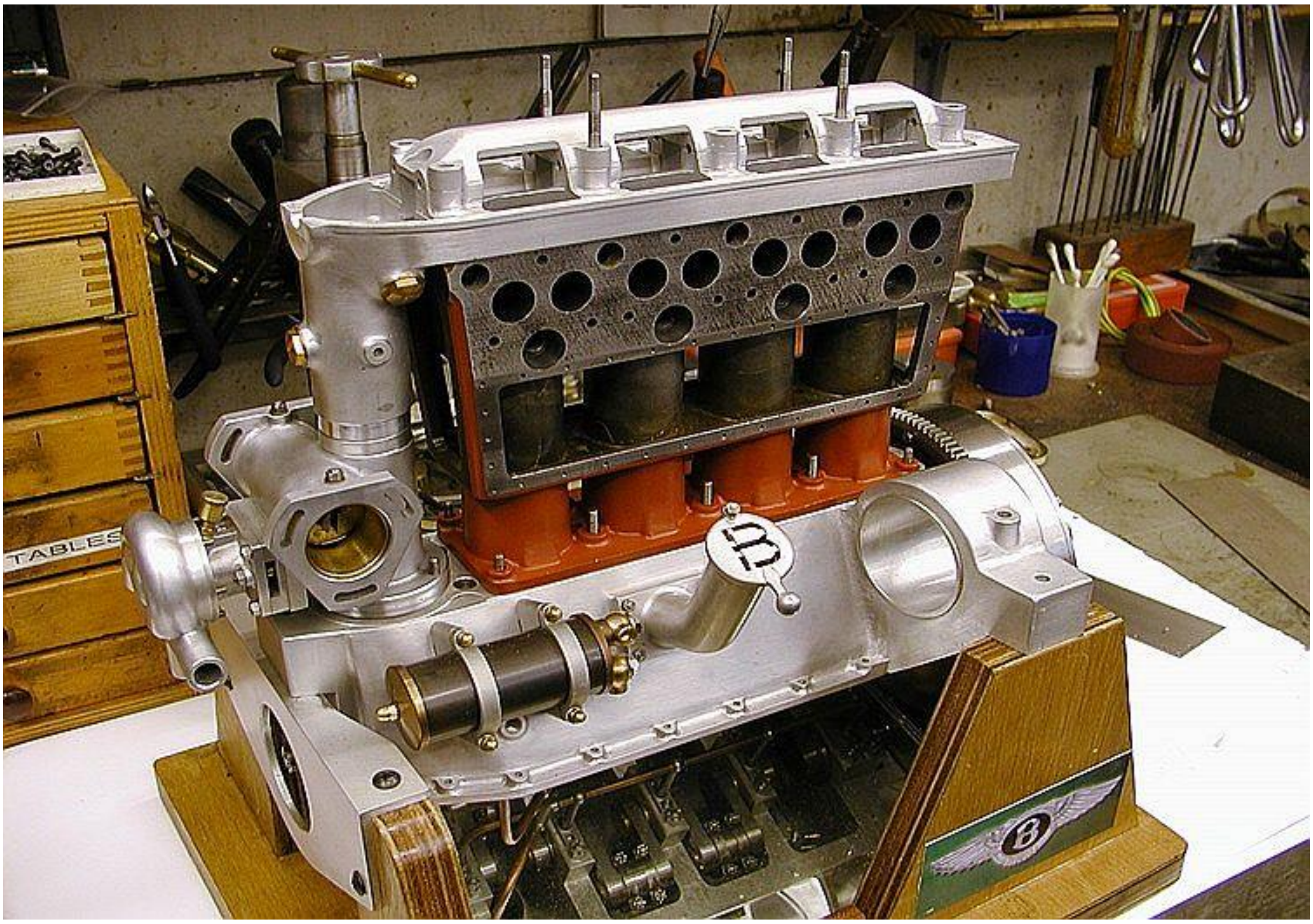


Here is the inlet side water plate and manifold. The manifold is manufactured from 10 thou brass shim**.** The three tubes fire water into the gaps between the cylinder barrels. The cool water then rises to around the exhaust ports where all the heat is, and then exits through the tapped holes A-E which are connected by an external water rail and then back to the radiator header tank.

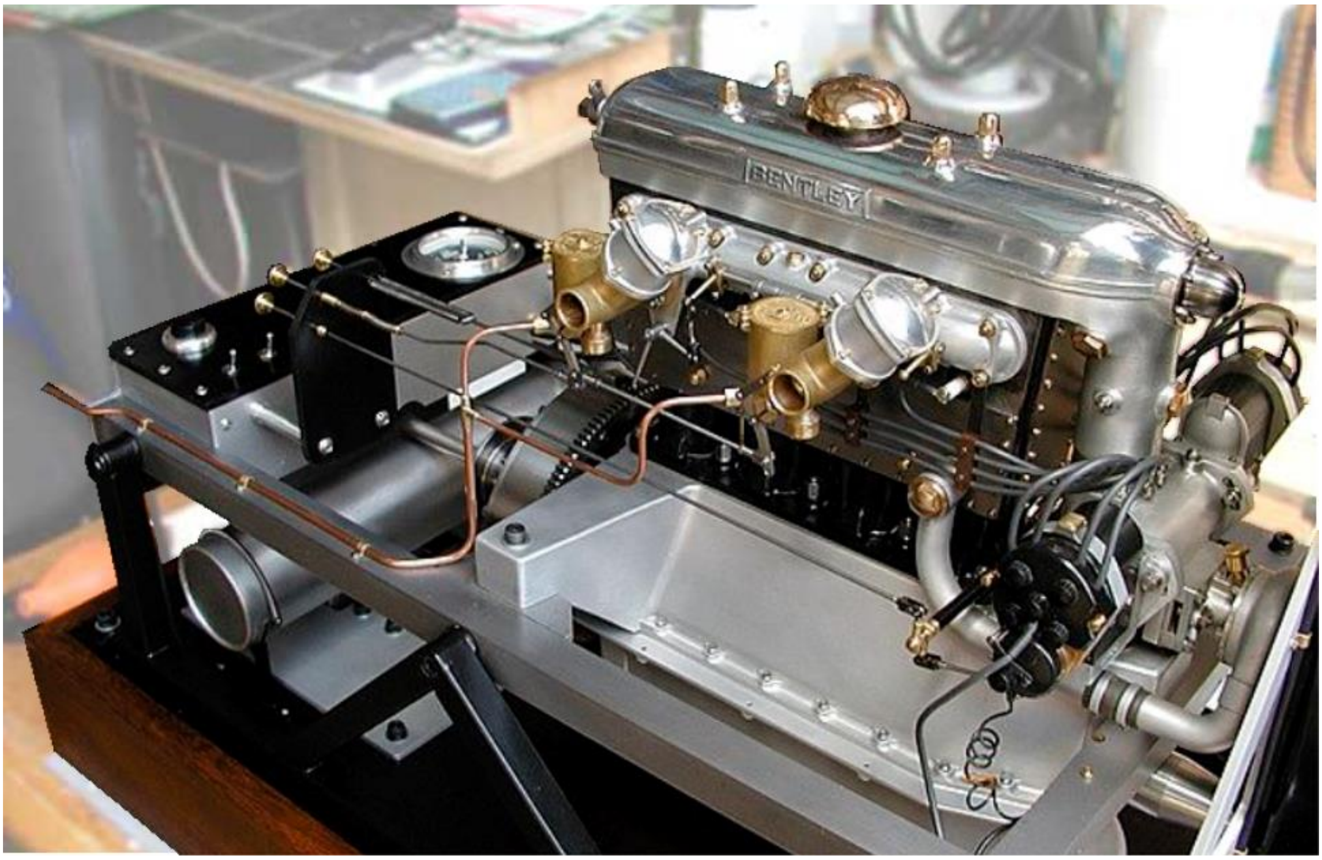
Mike was unable to reproduce all the complicated internal coring as in the original castings. The only thing he could do was drill up from area X into the two water spaces at Y. The ends were connected by a hole drilled along line Z and through the two water spaces Y_1 and Y_2.

This allowed the water to come right through the block, and out through the holes A-E into the water rail on the outside. It was the best that could be done, and has been reasonably successful. There is enough water going through the head to cool it, and it never got too hot running at exhibitions.

The full-size water plates were 3mm thick aluminium plates, so for 1/3rd scale they had to be 1mm thick. The plates had to be decent quality aluminium and very stiff. Obtaining high quality hard tempered aluminium that would stay flat and not bend and scratch is difficult. Also sourcing the small quantity required was virtually impossible. What was available was some 1mm sheet titanium that had been on the shelf for twenty years from a previous project. That is what the water plates were made from. The sheet is very rigid and doesn't scratch but is hard to cut. However, it does machine well if the tools are sharp. The titanium sheet was also used for the 4½ Litre scale Bentley engine.

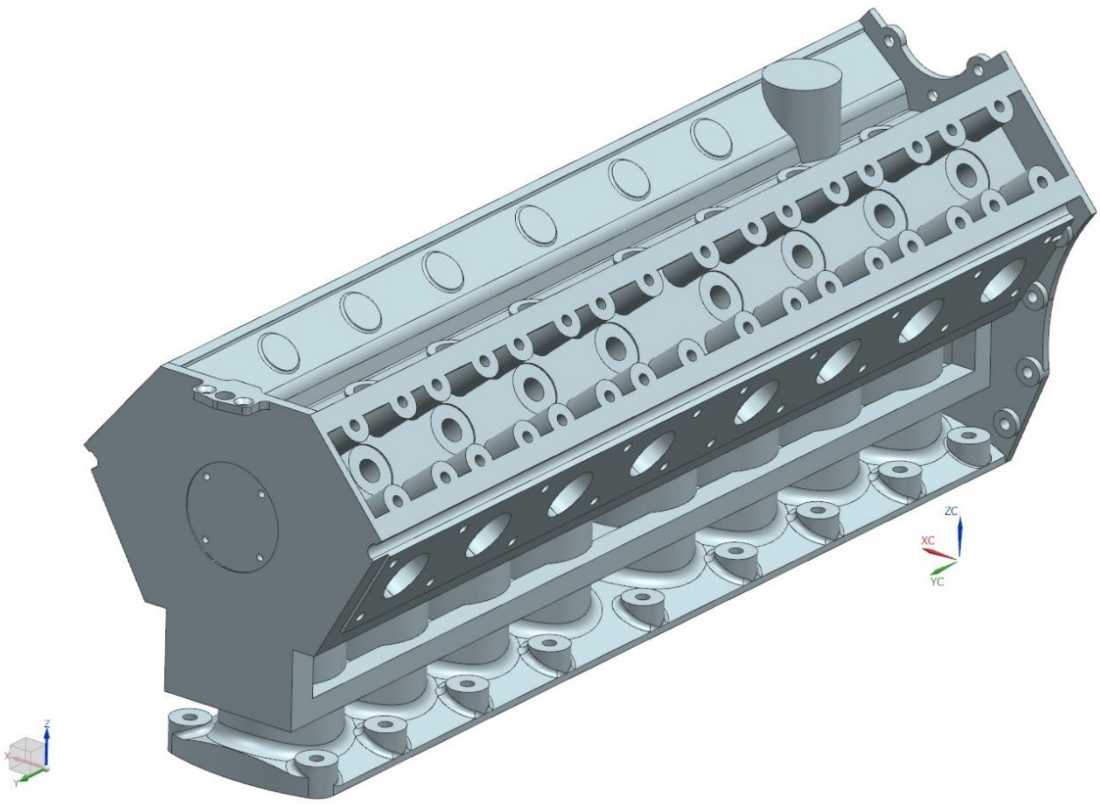


Thank Goodness it fits: This was the first fitting of the cylinder block. When tight fits were mentioned previously, it was because alignment had to be maintained. Here the block is held down onto the crank case at the bottom, and at the top, the cam housing is held onto the cylinder block. The bolts at the top and bottom have to be kept in correct relationship to each other throughout the prefabrication procedure. There was a concern, because the vertical drive in the front "turret" connecting the crankcase to the camshaft, had to be absolutely in line when assembling the various components from top to bottom. Fortunately, the small clearances around the top and bottom bolt holes allowed the vertical drive to centralise correctly.



This is the very first assembly ready to start. The purpose of this talk was to show how and why the components were machined and assembled in the manner they were in order to achieve success.

The Shape Of Things To Come!!! Or maybe the title should be: " Beware Biting Off More Than You Can Chew".



3D Model Of Delage Cylinder Block From Rear

Mike feels he has an obsession with making scale engines with fixed head cylinder blocks, and the reason probably is because he had success with the 3 Litre engine and that made him feel he could tackle anything. The picture on the previous page is the eight-cylinder block that he has to make next for the Delage. He is very close to attempting this.

These are the photos of the original block of the Brooklands car ** that Mike was allowed to measure up. He was allowed to dismantle it down to this stage. These photos don’t show a great deal, but were taken as detail shots of various bits for which there were no drawings.

** See October 2019 Newsletter.

october-2019-newsletter-.pdf (wordpress.com)

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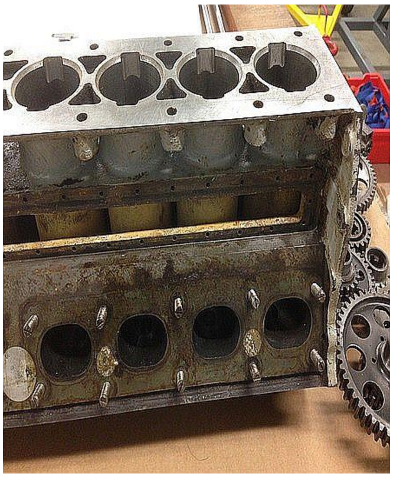
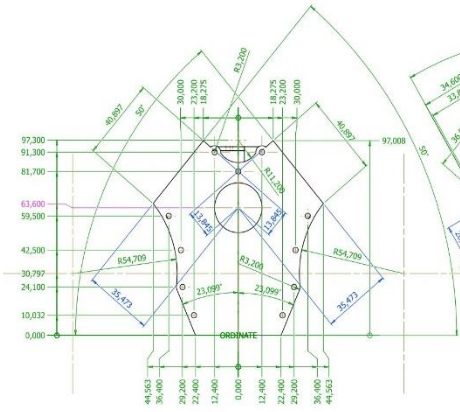
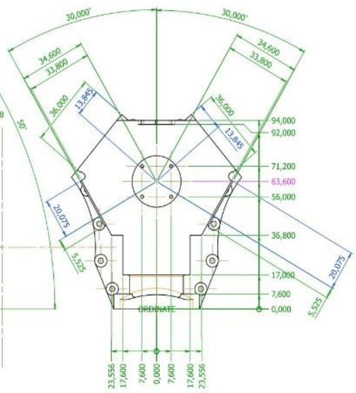


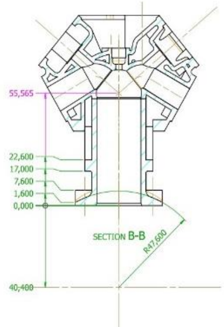
This is the same block upside down. While it is the similar configuration to the Bentley engine, it is a much more complex casting altogether.

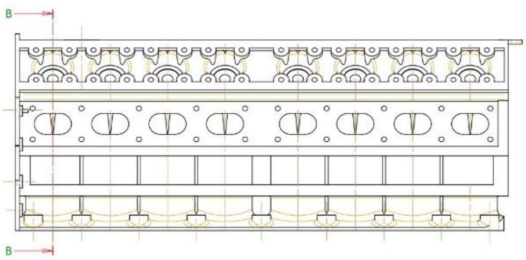
The construction will be tackled in the same way as the Bentley block using similar premachined parts.



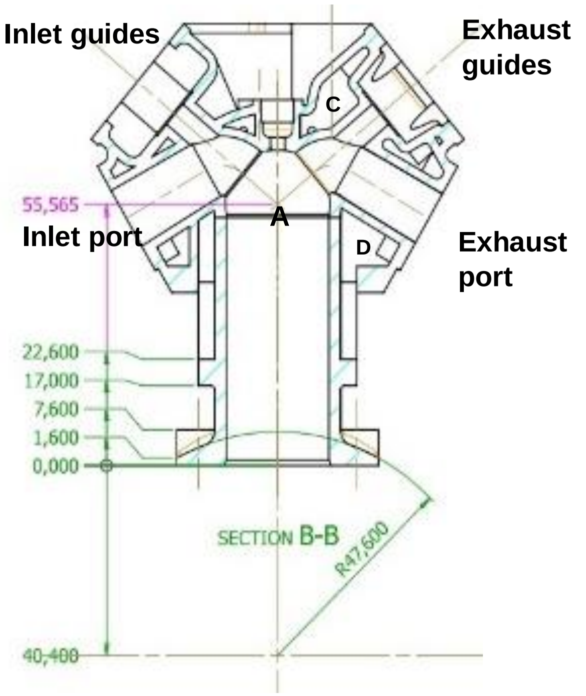


These are the first CAD layout drawings of the front and rear elevations. Mike is benefitting from the help of his stepson Paul, who took the original pencil drawings and sketches and converted them into really good CAD drawings. Everything is accurately dimensioned. When a CAD drawing is set up correctly any dimension required can then be accessed.





Side elevation and section through the front cylinder: Twin overhead cam engines always have a very bulky cylinder head. The ports are at 50° angles. It is a very awkward shape with no two faces parallel to each other and all at angles other than 90° making mounting for machining unusually difficult.



Mike's idea is to rotate the part about point A. The starting point will be a piece of cast iron roughly shaped to the section. Then a mounting diameter at point A, will be machined with a centre in it, at both ends of the block.

The block can then be mounted in the dividing head of the milling machine, and it can be rotated around axis A-A. Each face can then be brought to bear under the cutter. That will account for all the major faces and the hole drillings. The whole job can then be done in the dividing head between centres. It's going to be a complicated job, but it is achievable.

The only concern is the water spaces. On the inlet side hardly any water space exists around the port and, fortunately, there is little need for any on the model. On the exhaust side it is different. There are large water spaces at C and D. These can only be replicated by drilling the largest diameter holes that will not break into the exhaust ports along the full length of the block. Holes should then be able to be drilled between the cylinders to communicate with the major water spaces and outlet points.

All this is just a plan at the moment. Reality may require a change of tack!!

That is the approach decided upon. The block has a larger volume of material than the Bentley, so the preheating arrangement will be the gas barbecue which will be cleaned thoroughly, and also a digital thermometer to check the temperatures of all the metal parts.

The silver soldering will be done in the same manner as for the Bentley using oxy-acetylene. It will be a bit more awkward with the cooling down phase, being gas fired, but it will have to be done in the best way possible.

This is as far as Mike has got so far:

Questions and Answers

Q With regard to the cooling of the engines was it thermo-cycling?

Mike: These were racing engines and used efficient water pumps. Although the Bentley engines were considered high performance, they were really production touring engines. The difference between the production engines and the racing engines was that the latter were made almost individually, with only five being made at the start in a very extensively equipped tool room. There was nothing done for ease of manufacture, everything done was to enhance the performance of the engine whether that was difficult or not. I am finding that it is a completely different thing to make as a model.

Q What are the sizes of the bores on the Bentley scale engines?

Mike: It is 28mm on the 3 Litre and the 4½ Litre is 33mm**.**

Q After you did your silver soldering, were you able to do any compression testing to make sure it was sound before continuing?

Mike: No. I did a visual inspection with a borrowed borescope. I cleaned up the combustion chamber with the bead blaster nozzle, then put a light into each of the spark plug holes. Then, using the borescope, searched for the witness mark of the silver solder on the inside of each cylinder. Thankfully a nice continuous silver solder line was seen. In the photo showing the slotting of the conrod holes on page 8, you can see the witness line of the silver solder where the liners have been silver soldered to the base plate. I considered it fairly effective and everything worked well.

Q Why did you choose a Delage engine?

Mike: It is a very famous engine. They were built in 1926/27, and they only raced in the Grand-Prix in those two years. They won everything in those years. In 1927, they won so many events that the competitors didn't bother turning up. They were winning as teams as well.

They were only 1500cc engines, but were beautifully engineered and were known as "The Swiss Watches" of the Grand-Prix engines at the time.

I actually found the original at Goodwood three years ago. The year before, soon after the new Brooklands Museum had opened, the car was presented to them. They tried to compete in a sprint at Brooklands and put a rod through the side. They had the engine out and partially stripped, showing the damage to people, and trying to collect money towards its restoration. With the Blower Bentley almost complete I was looking for a project to follow on and the Delage looked a likely candidate if sufficient information could be found. There was then a series of coincidences.

I was looking at the engine and photographing it when someone tapped me on the shoulder asking me what I was doing. I told him I was interested in the engine and wanted to make a scale model. He said he had bequeathed the car to Brooklands and I should contact Allan Winn the CEO there. As Allan was a member of the Bentley Drivers Club, I rang him up, and he invited me down.

I spent three days in the archives, looking at the drawings. I subsequently met Eddie Beresford who has restored the only car that is absolutely original, which is now in the Collier Collection in the Revs Institute in Naples, Florida. He got to know what I was doing, and told me he would contact me after he came back off holiday. I asked where he was going and he said Robin Hoods Bay! He and his wife came over for tea to see the Bentley models, and he offered all his help. Everything had fallen into place!

I was invited back to see the engine at Brooklands, and eventually they gave me permission to dismantle the engine completely so I could measure and photograph all the components individually. Paul came along with me, and we had free reign to get all the details we wanted. They have even offered to take the car off public display and put it in the workshop for me to measure up the chassis details when the time comes. You can't attempt a project like this without access to reliable detail.

Other people have been very supportive. I wanted details of the carburettor, because Brooklands car does not have the original *Cozette* carburettor. I was advised to contact the Rev Institute in Florida, as they have records of everything. I e-mailed the library, and within two weeks they had e-mailed me the drawings of the smaller production carburettor. There were only five carburettors made especially for the racing engines, and they were much larger. Thankfully the Institute were interested in what I was doing. I asked for some measurements of the carburettor on their car, so I could "scale up" the production dimensions. Two weeks later I received sixteen photos. They had taken the carburettor off the car, dismantled it, photographed every part and pencilled in all the dimensions on the photos. And this is a car worth millions! I have been asked to send them progress reports of the build and to maintain contact.

In August there will be the 95th anniversary of the British Grand-Prix and they hope to have what remains of the original team of Delage cars at Brooklands, and they want the model engine there too in whatever stage of build.

The Latest Progress Report On Graham Sykes' Steam Rocket Bike ~ '*Force Of Nature*' By Paul Windross.

Happy New Year to everyone. Let's hope 2021 is kind to us all.

It's a big year for the "*Force of Nature*" Steam Rocket Bike.

We have been working with some great people over the last six months, and have made some major steps in the development of the new rocket motor. 'CPE Pressure Vessels' have made a superb new pressure vessel (see below) made specifically to requirements. The pressure vessel capacity has been maximised by having non standard end caps made in Germany.

The quality is superb, and the new vessel has been both Tig welded and the main seams and end caps have been welded using a RMD (Regulated Metal Deposition) process. It's been pressure crack tested and hydraulic safety tested to 80 Bar, and is now fully certified.

The new valves worked very well last year with no issues, and we plan to continue with the same valve set up. The bike will hopefully be able to show the true potential of speed and acceleration that super heated rockets can produce.

The rolling chassis, brakes, steering and parachute systems have now all been fully tested with last year's runs, so there's lots to look forward to.

The new vessel is 2.5 times larger and will generate around 3 times the power of the little rocket motor fitted for testing. We are hoping for around 2000lb thrust for 4 seconds. Obviously we will be starting with low pressures, low volume, and small nozzles, but the potential is definitely there, and all we need is good weather, good tracks and good luck.

Look forward to seeing you at the track this year and please make yourself known. In the meantime you can still buy *Force of Nature* T-Shirts , hoodies , cups and caps from: https://www.alteredteesapparel.co.uk

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