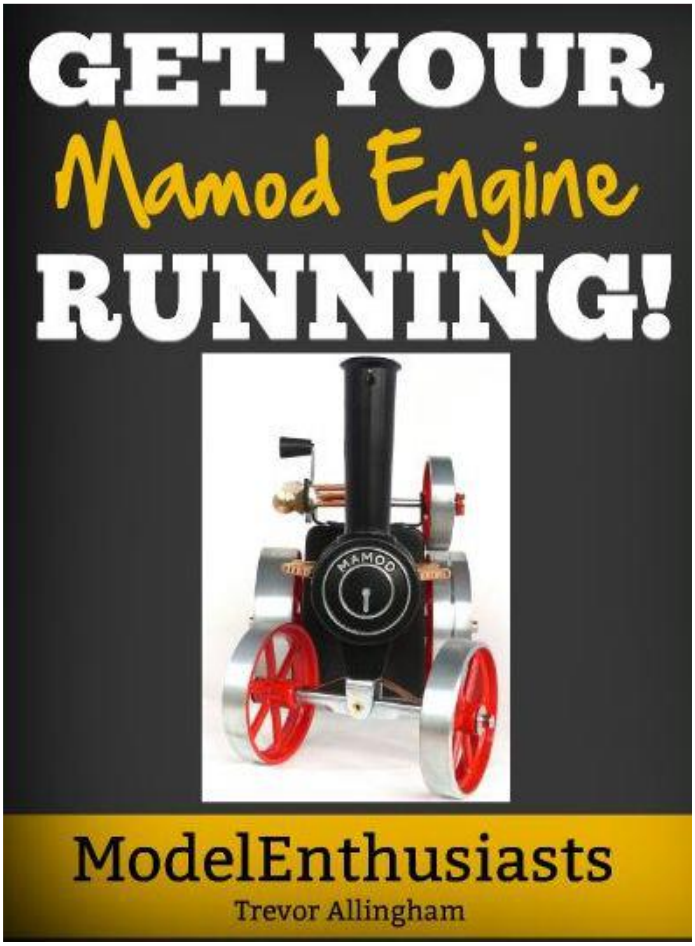
•MODEL ENTHUSIASTS•



Contents

Before you start here's a quick peak

Four best kept *Quick Start* secrets *will* get your engine going!

Yes, just ***four*** actions that will get your engine going again.

Change all four washers:

- Water Level Plug (3/16 inch. fibre)
- Safety Valve (¼ inch. and O ring)
- Whistle (¼ inch.)

Fit a better piston/ cylinder:

- A worn piston will not hold back the steam.
- A better fitting piston usually works.
- A less worn piston/cylinder assembly is the best solution.

Oil piston / cylinder with WD40

- 1. Squirt WD40 into cylinder.
- 2. Spin flywheel a few times.
- 3. From then on use steam oil from a small dropper bottle.
- 4. If no steam oil use car engine oil as this has correct viscosity.

INTRO

HOW DO I GET MY MAMOD ENGINE RUNNING?

Find out here.

What do you want to know?

You have just unearthed that long forgotten Mamod steam engine that you stored in the loft all those years ago.

Now you have more time to tinker and here is that dear old engine again.

It used to run OK. But now .....

Or.

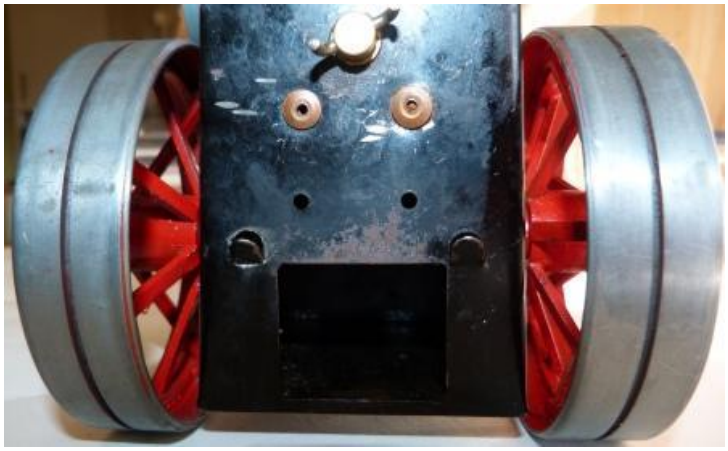
Late night purchase on eBay? You got the engine but the blinking thing won't run.

Ok, we've all been there. So let’s now look in detail at what makes a Mamod steam engine go.

What's all those bits on the engine?

It may help to look at and understand those components that make the engine work. A Mamod Traction Engine is used here as our example.

Working from the back of the engine.



There is a big hole at the bottom of the **firebox** where the **burner tray** goes. The burner tray can be either made for **solid fuel tablets** or methylated spirits.

Above that is either a **water level plug** or a **sight glass assembly**. Both are methods of knowing if the water level is correct before the fuel is ignited.

On the top of the **firebox** you will see the **whistle** that is screwed into the **boiler**. Two types were fitted. You will either have a spring-loaded arm or it will be a twist lever type as shown here.

If the **whistle** is revolving instead of tightening, the solder holding the threaded collar for the **whistle** has failed - you ***must go to page 16 now***!

Moving along the top of the **boiler**, you have the engine **face mounting bracket** that incorporates the **flywheel**, **cylinder**, **piston** and **steam pipes**.

Through the side holes sits the **crankshaft**.

To the **crankshaft** is fixed the **flywheel** with its pulley. Attached on the other end is the **piston rod**.

Screwed onto the other end of the **engine face mounting bracket** are the:

- **forward / reversing lever** and **cylinder / piston assembly**.

These two are held very tightly by the **trunnion screw/spring/washer**.

Close by and screwed into the **boiler** top is the **safety valve**.

This relieves excess steam pressure inside the **boiler** and so keeps the engine safe to operate.

To pour water into the **boiler** unscrew the **safety valve** and then replace it. Tighten only with your fingers.

Let's look now at what happens to the steam being created inside the **boiler** when the ignited fuel is in place.

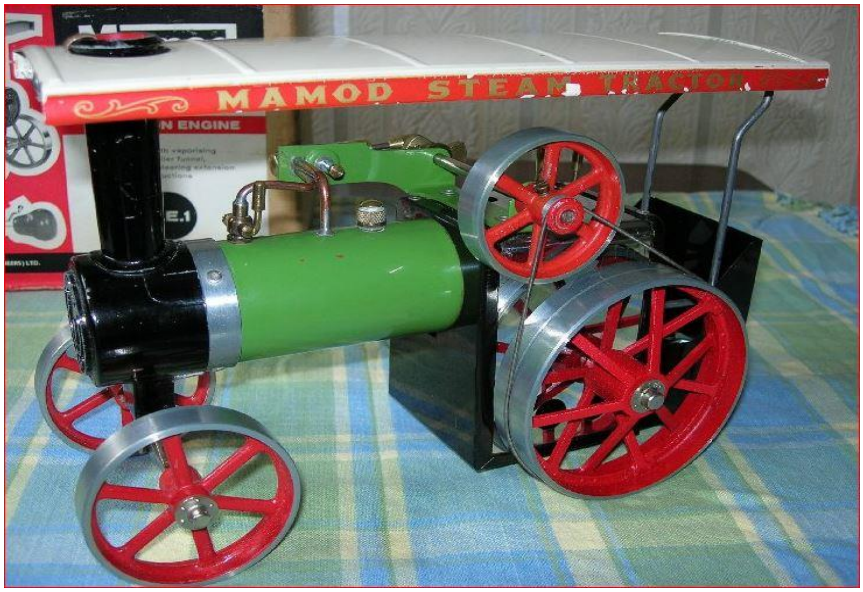
There are three copper pipes soldered to the **engine face mounting bracket**. It is the middle pipe that brings steam, at around 12 psi, into the cylinder.

As the **cylinder** oscillates, steam is forced in, this pushes the **piston** outwards, the **flywheel** momentum then pushes it back, and the spent steam is sent into one of the pipes leading to the **chimney**.

These pipes are not soldered to the **chimney**.

If you read enough about getting these engines going you will eventually know everything. So here we go again, looking at the task of getting your recently acquired engine steaming from the **chimney**. You know; smell of burnt fuel mixed with steam and hot oil! Lovely.

Next, prepare your mind for the perfect steam-up!



First time steam up

- You will need to have a Mamod engine before you can get one going! These can be purchased fairly cheaply on eBay and if you look there over a period of a month you will see many different types in various states of repair.

- If you are buying an engine, you will have to decide upon either a **stationary** or a **mobile engine**.

- At this point, let's say you have purchased a second-hand engine, dug yours out from the attic or purchased one brand new.

- There are some basic things you need to know before trying to get it running.

- Two basic things at least are now needed. Water and fuel.

- Water is to be carefully poured into the boiler through the hole in the top where the **safety valve** is located. Do not completely fill the boiler.

- On the boiler back plate, either look at the **water level glass** or as with older engines, the **water level plug** hole, and stop filling when the correct level is reached.

- If you have a **water level plug** type and the water is dribbling out, this is the time to screw it, finger tight, back into the hole.

Which Fuel?

Now let's look at what to do about fuelling up. There are three types of fuel.

Gel fuel

Here it is squeezed from a floppy plastic container into a standard Mamod burner tray.

The incredible thing about this gel is its ability to stay where it's put. So even if tipped upside down, it will not fall out.

Solid Fuel Tablets

This was the standard method that Mamod provided for decades. MSS are now the only trade supplier for this type of fuel in the UK.

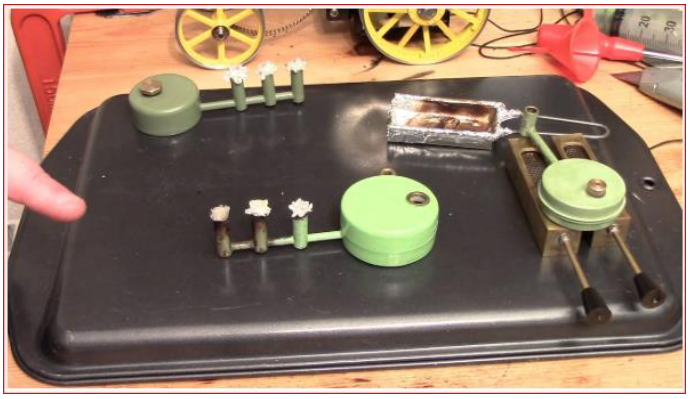
Two tablets are placed into the standard burner tray and are ignited with a match before placing the burner tray under the engine boiler.

Since 2024 Solid Fuel Tablet users must obtain a British Government Home Office license which is costly and onerous to obtain.

Methylated Spirits

With these old style burners, methylated Spirits is poured directly into the top of the burner through the gauze. Use your judgement as to how much. Lighting up is slightly more difficult that you might at first imagine as it certainly does *not* burst into flames! You may find that some ignited liquid is spilt, be careful.

If you have an old stationary engine it may have a round tank burner with wicks numbering one, two or three. Again, just fill up the tank through the filler hole and refit the brass screw cap finger tight.



Now you are nearly ready to fire up. But wait, you need to squirt oil onto the moving parts. To put it simply, any component that moves requires plenty of oil. A little bottle of steam oil is a convenient way to apply the right amount.

Although any oil is better than no oil! You *can* use car engine oil if you have some handy. Don't use grease as it will not flow and will not lubricate properly.

Tip: Make sure you drip some oil inside the cylinder (with piston fully in)!

Now check that your **safety valve** is finger/thumb tight and your water level is correct and that the water level plug is screwed in tightly (if you have one).

Spin the **flywheel** using your finger to get the oil around a bit and to ensure everything runs smoothly.

Place the burner close to the engine and ready to insert under the boiler. Just practice this once before light up.

And then, the action begins! Using a match, or a butane fire lighter, ignite the fuel in the **burner tray** and place it neatly under the **boiler**. From now on, do not leave your engine until the burning process is completed and the hot **boiler** is not in harms way.

Gradually the water will begin to get hot and then raise a head of steam. Steam will begin to hiss in the area of the **piston** and **safety valve**. Now you can gently flick round the **flywheel**. It revolves in an anti-clockwise direction (if there is no forward/reverse lever) as seen when looking at the **flywheel** side of the engine – unless of course a forward and reverse lever is set to reverse.

Everything should now be running smoothly and you can let it run until the fuel runs out. If you want to stop it running very temporarily you may place your finger onto the flywheel to restrict its movement.

If you do that, the **safety valve** will fizz with steam and water until you allow the **flywheel** to run again. This is not a dangerous thing to do and can be quite fun but just be wary of the very hot spitting steam!

When you've had enough of running the engine, ensure that all water is emptied out of the **boiler**. Store with the **safety valve**, **whistle** and **water level plug** (if fitted**) left loose with a drop of oil on the thread** (this will prevent any corrosion and stuck threads). Then just put it away - clean it if you want to but it's not absolutely necessary.

Just a little tip at this point, you can use T-Cut car polish to clean both the boiler and pipes along with the painted surfaces. Take care though because any cleaner is an abrasive and that will eventually take its toll. So, clean or oily? You decide!

Buying Guidance

When considering whether to buy brand new or second-hand you need to decide if you want a "challenge" or a ready-to-run model. As with most purchases, the more you spend, generally the better the value for money.

Most engines exchange owners on eBay. You will get pretty good value for money, with some engines being rare and immaculate. Of course you will get what you pay for and will always need to spend good money to get something that is ready to run or maybe needs a small amount spent on it to make it run properly.

A modest amount will get you, for example a Mamod Minor 1 (shown below) whereas a deeper pocket will buy a Traction Engine.

Since the upheaval of the marketplace following Mamod Ltd demise during 2024 the shock of the event seemed to create a slow down in the availability of second-hand items which required a greater degree of patience to find a required item. Of course, perseverance carries its own reward.

A word of wisdom and experience: Be prepared to be disappointed with your purchase from eBay and if that should happen don't lose heart because 90% can be fixed. If your engine turns out OK you have got yourself a lovely model like kids enjoyed over 50 years ago.

Mamod parts wear out if the engine has been run extensively, and so if you find the **safety valve** does not allow adequate steam pressure, or the **piston/cylinder** is losing a lot of steam, replacements needs to be found.

Parts can be obtained from eBay sellers or from a handful of web sites.

Model Enthusiasts offer a **free advice service** which can be a lifeline for the new Mamod enthusiast.

Warning

Be careful when using Methylated Spirits because it easily spills and so can catch fire and burn where not intended. In sunlight the flame cannot always be seen. The same is true with Gel Fuel.

Do not let young children near a hot engine because little fingers can get hurt or in the worst case, burned. If a steam pipe comes loose there will be a small jet of scalding steam. Be careful.

Make sure that when you refill the burner device (solid, gel or liquid) that you also always refill the boiler. If not, you could melt the sight glass.

Starting the engine – important things to know

Oil your engine - everything that moves including *into* the **cylinder** barrel.

Half way through the run, oil again. Don't pick it up - it will be very **hot**!

Some oil will splash from the **cylinder** so don't wear your new white shirt. If your engine begins to slow and grind a bit – OIL!

When raising steam look at the **safety valve** and you may notice fizzing water at the top or at its base. Usually that will clear up within half a minute so long as it's screwed in finger tight.

However, if you see a lot of steam from the top or base of the **safety valve** you will need a new **O ring** for the top and a **washer** for the base. The O ring is a bit fiddly to fit but with ***a bit of brute force using your thumb and forefinger of each hand it can be forced on***. A tiny amount of washing up liquid helps.

Always satisfy yourself that the **safety valve** is in good order. Check that the spring operates freely. This component ensures your engine runs safely.

To get a mobile engine to move along the ground, if your engine has a **forward and reverse lever** you should push it either to the front or back. With that engaged, flick the **flywheel** and off it will go.

If you have a very old Traction Engine with no **forward and reverse lever** (forward motion only), move steam **regulator** lever to release steam from the **boiler** to the **cylinder**.

To see its maximum rpm you can disconnect the **drive band**, flick the **flywheel** and it should run at 2000+ rpm.

Using a digital tachometer

Some of the most frequent problems.

"My engine gets up steam OK but it won't go properly"

Causes

- Flywheel loose on Crankshaft Oil needed into the cylinder barrel.
- Piston wobbly in the Cylinder owing to wear.
- Steam-in pipe blocked with crud or solder.

"My engine only runs forwards"

Causes

- That's because it is a TE1 with forward motion only.
- One of the exhaust steam pipes is blocked.

"My engine rattles inside the boiler"

Causes

- Don't let that worry you. It's a rivet or brass threaded collar that dropped in during a repair. Rattling doesn't do any harm.

"The engine drips water from under the chimney"

Cause

- This is steam condensing inside the chimney and this is normal.

"My Traction Engine wanders when running on the ground"

Cause

- The steering axle needs turning through 180 degrees which tightens the bottom nut under the chimney.

More complex problems

Should you encounter any complex problems then we are on hand to see if it's fixable. Most issues can be resolved over the phone.

Next follows some solutions to fix awkward engines.

Melted sight glass

Sight glass Perspex can melt from time to time but it can be resolved. Firstly you will need to locate a new part which will include a perspex sight glass, screws* and a rubber seal. Remove the screws (or rivets) and then the melted sight glass assembly. Be careful when doing this as you want to avoid damaging the paintwork on the firebox.

Now, clean the gasket seating recess. Do not be rough in doing this because the end result has to be a seal has to be perfect to avoid leakage. Make sure all the remnants of the former sight glass and rubber seal have been removed. Place the new gasket/ sight glass on the clean surface making sure the protective coating has been removed. Simply screw (or rivet) the brass assembly in place. There is no requirement to use a gasket sealing solution.

Attention:*
If your engine has rivets here instead of screws, they must be drilled out and new copper rivets used. This can be one of life's challenges. However, there is plenty of help around to get knowledge for this job. You can ask us.

Falling pressure in the boiler

You can carry out a number of checks if you losing pressure in your boiler. Problems can range from a leaking **whistle**, **safety valve** or a worn **piston**.

A leaking **whistle** and a leaking **safety valve** can allow steam to escape and the pressure to fall. Normally the solution is to replace the seals (**washers**). We supply them.

Steam leaking past the **piston** means better one is required and that is a very simple job once you have the replacement part.

Sticky cylinder

If the engine has not been run for a long time, a sticky **cylinder** can be the problem. This is resolved fairly easily. It usually occurs because the toggle spring and **forward/ reverse lever** is not freed up to work properly.

To fix this, simply pull the cylinder away from the engine face a few times to release the spring, apply WD40 and all will be well.

Mobile engine producing steam but not moving

This can be one of the most frustrating things. Everything seems to be running smoothly but the engine won't move far along the ground. To examine operating efficiency it's a good idea to put the engine up on wooden blocks to get the wheels off the bench and check how well it runs. That idea works, but you generally won't get an accurate assessment until you put it under load.

- Sometimes, when placed on the ground a mobile engine fails to do much. This is because there's not enough steam pressure to punch the **piston** out powerfully enough. Many times, the solution is to change the **piston**.

- A more difficult problem is when a steam pipe is partly blocked. Put it simply, it's a good idea to get some thin wire and rod them through.

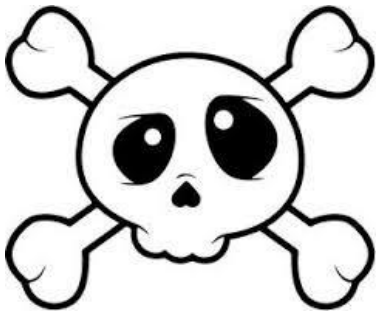
That's two things to think about:

- Changing the **piston** for one that is not too worn.
- Cleaning the inside of the steam pipes with thin wire.

Most likely solution is to change the **piston**.

Note: Also make sure the drive band is the correct type and not too tight which can cause friction resistance.

And now …..Not for the faint hearted!



The plague of the Revolving Whistle

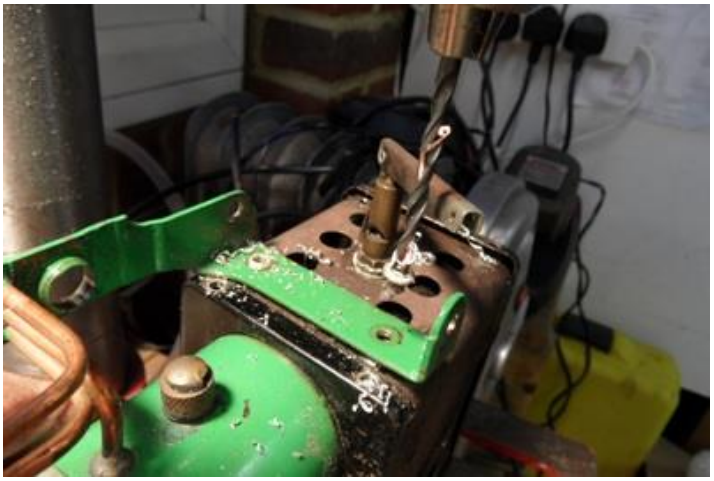
If you are gung-ho about trying to fix things or are an experienced practical engineer, you will, as an enthusiastic Mamod owner, eventually, as day follows night, find an engine with a revolving **whistle**.

Your whistle won't tighten up but spins around when you try to screw it in.

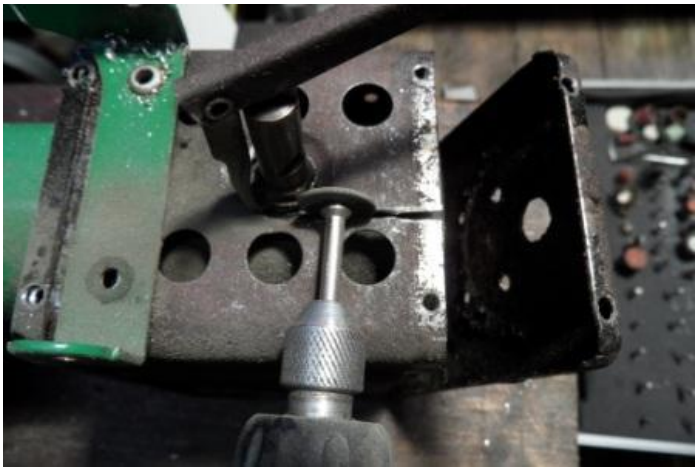
Here is how you fix it:

- Remove the **rear wheels:** Pick off just one of the **hub caps**. There are a couple of ways to do this depending upon how difficult yours are to remove. The thing to avoid is damaging the red paint. We have use a small angle grinder to erode the **hub cap** top, and pliers and snips to keep pulling and twisting. Bear in mind that when you grip with pliers you are potentially tightening it onto the axle.

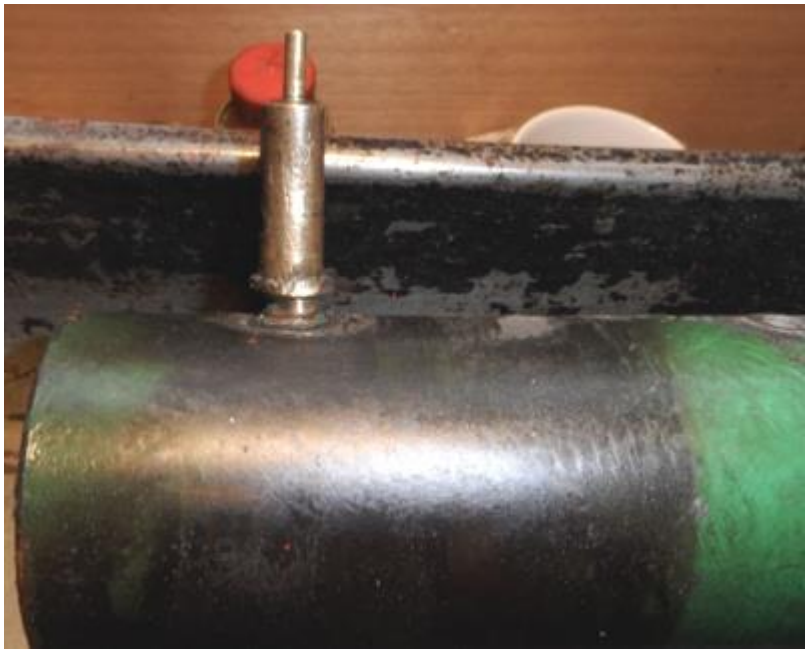
- Drill out the rivets holding the **engine face mounting bracket** to the **engine cowl**. Drill out the copper rivets in the back of the **firebox**.



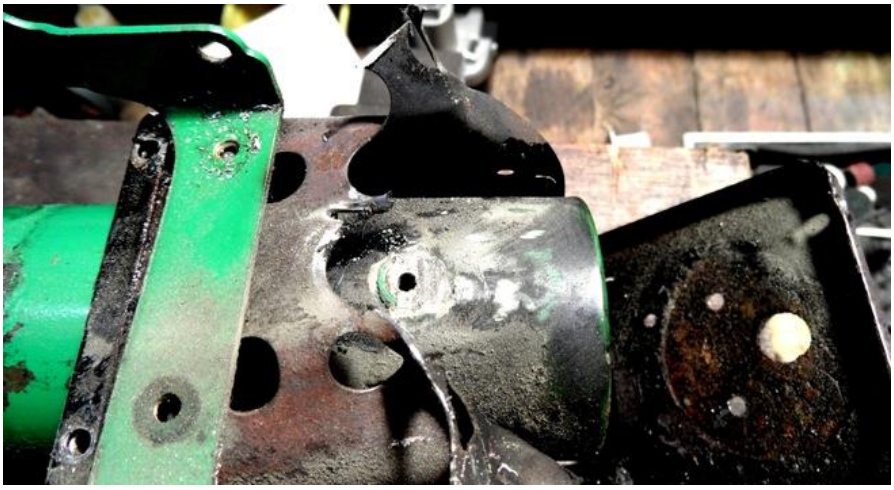
- Using tin snips or a small rotary cutting disc, cut the **engine cowl** so it can be removed and scrapped. There is nothing advantageous in using a rotary cutting disc; it's just an alternative method we used in this instance.



- The **boiler** now removed from the **firebox**.



- With a hacksaw, cut off the **whistle.**
- **Big point to be aware of**: Pay extreme attention to the cutting process because it is easy to think you are just cutting the whistle when in fact the hacksaw blade has wandered onto the boiler. The boiler brass is very thin and easy to cut into. That would mean some awkward patching up or at worst, destroying the boiler. Pay attention!



- When the **whistle** has been cut off, heat the immediate area and allow the remnants to fall into the **boiler**. They will stay there forever.
- Remove the old **engine cowl**.
- Clean the area up ready for soldering.
- Solder a new **collar** into the hole with its rim on the outside this time.
- Reassemble the engine with new parts and rivet everything in place.

List of items you will need:

** Engine Cowl

** Hub Caps

** Rivets

** Brass collar

** Whistle

The tools and extras you will need for this job are as follows:

Tin snips. Riveter. Electric drill. Drill bits 1/8th 3/32nd and 3mm. Micro butane torch. Flux. Multicore solder. (Never use silver solder). See page on soldering.

- You cannot use an electric soldering iron owing to inadequate heat.
- Don't worry about making a wonderful cosmetic job of the soldering as it won't be seen when the engine cowl is in place.
- You can buy everything you need on eBay.

Scary?

We couldn't agree more!

This shows you that the repair project is not an impossible task and really worth doing. The alternative is a useless engine and nobody wants one of those.

Still Not Enough Power from your Mamod Engine!

Steam is produced from water being heated by a flame and we should start there. So work through these questions:

- Using ageing **solid fuel tablets**, are they too old to work properly? They can dry out. If so, switch to Gel Fuel

- If a meths burner is used, are you using meths and not something else such as white spirits? White spirits will not burn hot enough and will blacken your boiler. And don't use coal!

- The answer is of course to use gel fuel. Care is needed because gel fuel burns almost invisibly, but does not drip even when the burner tray is turned upside down!

- Is the **safety valve** working properly - is the small 'O' ring under that top riser intact? Is the **washer** between the **safety valve** and the **boiler** holding in the pressure or is it spitting a lot of wet steam?

- Is the **whistle** stuck open very slightly – that will reduce the steam pressure.

- Is there loss of steam from the base of the **whistle**? See if the **washer** is perished.

- Is the **piston** running freely in the bore? If not, spin the **flywheel** many times with WD40 in the bore and then re-oil with **Mamod oil**.

- Are all of the moving parts oiled nicely? Use Mamod engine oil or car engine oil. You *can* use 3-in-1 to get it going but not for the whole run as this will not provide good and proper lubrication.

- Is the **steam-out pipe** on top of the **boiler** soldered in properly and showing no signs of leakage?

- Is steam being lost around the **cylinder** area? This is where most problems reside.

- Is there any loss from the steam-from-boiler pipe where it is soldered onto the back of the **engine face mounting bracket**?

- Is there a loss of steam from between the cylinder face and **the engine face mounting bracket**? This is often the culprit.

    * A scoring of the cylinder face may cause significant loss of power.

    * If bent it cannot be corrected and needs to be replaced.

- Is there loss from within the cylinder bore past the **piston**? You will need a new **piston**.

- Is the **drive band** too tight to allow the **flywheel** to revolve when under power? If so it is the wrong type.

- Does the engine simply need to be run-in after years of no use? Get out the WD40.

Comments about running-in a new piston/cylinder

- When fitting a replacement piston cylinder assembly you may need to run it in. That is, free up the piston's movement in the bore by squirting thin oil in there and running the engine for a minute. Without doing this you may find your engine runs but lacks power. A newly fitted **cylinder/piston assembly** can run at just 75% power. That is enough to stop it being able to drive along the ground initially.

- The oil thickness should be the same as car engine oil.

- And after all of this, it will still improve over the years as it beds in nicely.

Anything that is NOT obvious can be pointing to the **engine face mounting bracket** (the surface the cylinder is bolted to). They cannot be repaired if bent or scored and would need to be replaced.

Just remember, any problem you have with your engine has been solved by hundreds of other Mamod enthusiasts before you!

So now you are able to fix simple problems with any Mamod steam engine. The principles are the same throughout the Mamod range.

Buying on eBay- a shot in the dark?

The secret of eBay buying is to *ask the seller these questions*:

- Are there are any steam leaks from the **washers**, the **steam pipes** and the **cylinder / piston assembly**?
- If it is a mobile engine, does it run well along the floor or does it fail to run after a short distance?
- Is the **sight glass** clear and not melted?

When you receive your eBay purchase and there is a problem and one you have asked about in writing prior to parting with your hard earned cash, you have a cast iron case to claim a partial or full refund.

eBay Customer Protection will help you if your pre-purchase questions were asked via eBay messaging.

- We all know that sometimes our heart rules our head. Especially on eBay after midnight and so when you do receive your unexpectedly-beat-up Mamod engine but you still want to keep it you will now know what to look out for and how to go about fixing the problem.

Painting – is it worth it?

To paint or not to paint? It's your choice but don't rush into it.

You may wish to create a superb example of an old Mamod engine fit for any display case or sideboard. The challenge and the fun will be in the hours of cleaning off the old paint, treating the surfaces with rust inhibitor, applying both a primer and undercoat followed by a beautiful final spray job. Oh, and then buffing to a mirror finish.

Perhaps you are particularly mechanically minded and are happy to be part of the clean-with-an-oily-rag brigade. Our experience in chatting with hundreds of Mamod steam enthusiasts is that most fall into this category. They just want to see the engine working.

Either way, you may wish at some time to improve the overall appearance by painting just the boiler. Not a bad idea although it does require a complete dismantling of the engine.

Whether you will just paint the **boiler** or indeed the **wheels** and **firebox** as well, which paint should be used? The big issue is to ask yourself what you want the finished job to look like.

To paint the Firebox you will need very high temperature (VHT) paint.

To help you with the task of painting your Mamod or other steam engine, we have put together some advice which should de-mystify the finding of "correct" paint. Firstly, there is no "correct" paint for most restoration projects. If you are a purist needing to get a perfect original match, you should really be going off to your local automotive body shop and discussing matching up.

For most people, an approximate similarity is adequate. You can do this quite successfully by popping along to Halfords where you will find a large number of colours or, as we tend to do, nip into B&Q and finding a suitable colour there.

The paints shown in our photograph were obtained from B&Q and our local car parts shop. **S**o the choice of approach is yours. But, for the semi-purist the following may be helpful:

- **Red**: Ford Rosso red is good.
- **Green**: Apple Green is one of the Mamod well known original colours, and then followed by Emerald Green and now British Racing Green.
- **Black** on the firebox must not be gloss but VHT paint with no primer or undercoat. Gloss can catch fire.

VHT paint will always have a matt finish, unless of course you line the inside of the firebox with fireproof rope when you can then use gloss.

Mamod colours available are as follows;

Cream	Gloss	Ral# 1015
Red	Gloss	Ral# 3020
Green	Gloss	Ral# 6005
Burgundy	Gloss	Ral# 3005
Yellow	Gloss	Ral# 1021

Blue	Satin	Ral# 5015

Ral is a matching system used in Europe.

If you do have a go, you will be amazed how much better your engine will look – so long as you are a bit of a perfectionist!

Save loads of money soldering!

Would you take your car to a garage if you could fix it yourself and save 67%? Well that's what happens when you fix up your Mamod engine yourself, and we'll look at that now.

Soldering ……..

Quick Start Instructions - Soft Soldering of copper to brass

Attention:
Silver solder is not required when soldering Mamod engines unless they are specifically described as higher pressure boilers running above 12 psi. Mamod double acting piston engines run at around 25 psi. and are silver soldered.

Silver soldering requires a much higher temperature and if you try that on a soft soldered engine it may **melt** other good joints.

Clean the two surfaces to be soldered with ***clean*** emery paper. That will clean them and rough them up nicely.

Using a mini blow torch, heat up the area generally so the heat does not run

Butane torch / flux/ solder wire

rapidly elsewhere by heat transference.

Use multicore solder wire 1mm – 2 mm thickness as you would use if doing an electrical wiring join.

Apply plenty of flux paste with a small brush to the two contact areas avoiding getting it on places you do not want any solder.

Place both surfaces together, heat up both, apply the solder gently and gingerly to the hot join (not into the flame) causing it to melt and flow and then immediately withdraw the heat. It will be solid in seconds.

Detailed Instructions:

Encouragement: There is nothing particularly difficult about soldering; it is just a matter of getting the methodology right. Like most things in life, if you don't try it you never will succeed. And when you succeed, practice a bit more and you will be amazed at your results. So, here we go.

Your first attempt will be a complete failure. Please pick yourself up and try again whilst checking out additional instructions on the internet from places such as YouTube.

Let's not beat about the bush. A botched soldering job is a real eye-sore so, it's as well to get some practice in - on scrap bits or non-critical jobs. The main fault is likely to be (apart from a dry joint caused by using insufficient heat) an excess of solder used on the joint resulting in it flowing all over the work.

This can be removed when molten with a solder sucker.

The secret of good soldering is as follows:

Ensure there is a close-fitting join prior to soldering.

- Making sure the work is **CLEAN** before starting - break this rule and you will have to do it again.

- Cover areas that should not be heated (and damaged) using a wet cloth. This is to dissipate excess heat to avoid damaging other areas.

- Flux the work thoroughly (using the right flux: simple, basic paste found in B&Q and eBay).
- Using the correct amount of solder (and size of wire; 1.5mm -2mm) for the job- try not to get it in places it shouldn't be.
- Applying the solder at the correct time and place - not into the flame.
- Controlling the flow of the solder - pull it back to reduce the amount being melted
- Many people will encircle the two pieces to be joined - like fitting a ring of solder wire around it and then applying the heat. This works very well and is recommended where that is possible.
- If you can, use gravity to let the solder flow around the job by turning the items over. This could stop solder flowing away from the area.

It is absolutely essential that the joint faces be quite clean and oil-free to obtain a sound joint.

YOU CAN USE "**SPIRIT OF SALTS**" TO CLEAN THE SURFACES - ITS 32% SULFURIC ACID AND SO DOES A GREAT JOB - BUT BE CAREFUL!

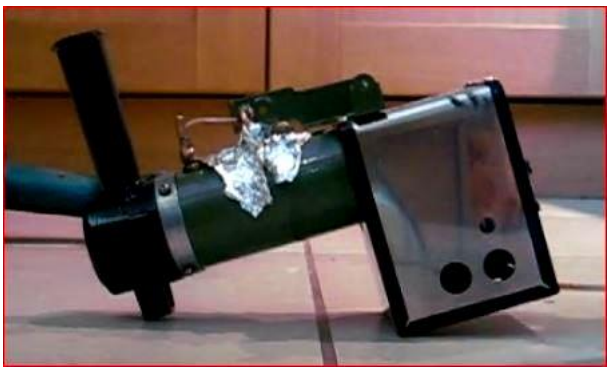
The solder will not flow across nor bind to a dirty metal surface. All joint faces should be cleaned with emery and/or wire wool to brighten the metal surface.

Always wear eye protection. Hot stuff can spit.

Regarding the use of flux. Make sure all joint faces are thoroughly coated and dribble some extra along the joints to make be sure. The first application of heat should be gentle to vaporize any moisture and still leaving the flux intact; then gradually increase the heat until it melts.

The inexperienced will soon discover that sometimes it seems you need a surprising amount of heat to make the solder flow and that is owing to the heat sink effect of adjoining metal.

The first sign that you are nearing the required temperature is when the flux turns to a brown sticky goo - suddenly; it will change from this appearance to a light-amber mobile liquid as the correct temperature is reached and it will seem to crawl all over the surface of the metal.

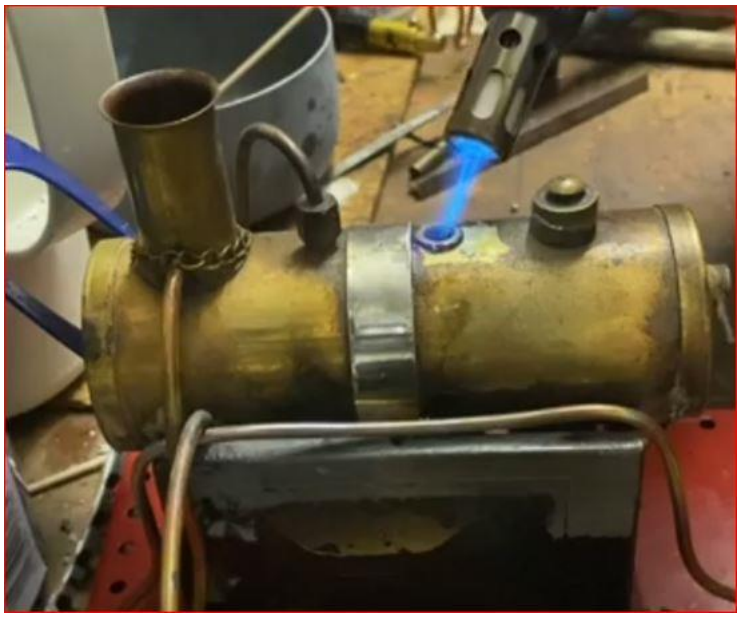


Protecting the boiler paint during soldering by using kitchen foil

When you think the right temperature has been reached move the flame away from the work and just touch the solder wire to the joint, it should immediately melt and flash around - if it doesn't then the work is not hot enough.

On NO account should you have the solder wire poking into the flame whilst you are applying heat, not only is it likely to melt and a blob will fall off and stick just where you don't want it, but you are likely to end up with an unsound joint through lack of heat even when it appears to flow.

It is the hot metal that should melt the solder.



Tip - as already mentioned:

With fine solder wire, snip a length off and wrap it round a joint before heating; but if you do this put the solder on first and cover it well with flux, then heat the work indirectly - i.e., don't blast the flame at the solder but to one side of the joint. When it's hot enough the solder will melt and flow normally.

Solder Definitions:

soft solder - solder that melts at a relatively low temperature.

solder – alloy (usually of lead and tin) used when melted to join metal surfaces.

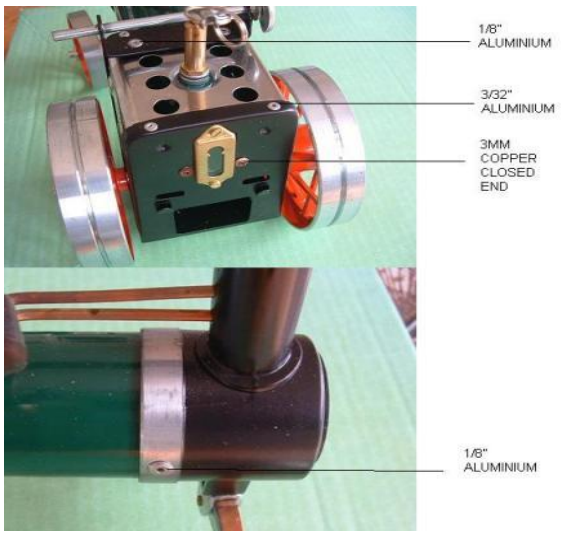
And Now …….

Which Rivets ?

To renovate or repair a Mamod Steam Engine it is often necessary to dismantle fitments and then reassemble with renovated or new spare parts.

It can seem a puzzling task if not carried out before. The most often asked question is *"What size rivets are required?"*

There are only three rivet sizes for a Mamod Steam Engine repair.



Traction Engine or a Steam Roller example.

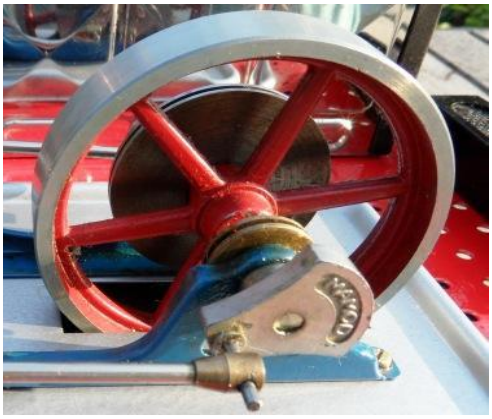
1. Aluminium Pop Rivet 3/32 inch.
   Four of these are used to hold the Fire Box to the Engine Cowl.
2. Aluminium Pop Rivet 1/8 inch.
   Two are used to hold the Engine Frame to the Engine Cowl
3. Aluminium Pop Rivet 1/8 inch (alternatively use 3/32 inch).
   Two are used to secure the Smoke Box to the Boiler.
4. Copper Closed End Rivet 3.20mm (also known as 1/8th inch)
   Two are used to connect the Boiler to the Firebox (water level end).
   Two extra used if rivets are required instead of screws on Sight Glass.

Rivets used with a full engine renovation.

Tip:
When you rivet the Fire Box and the Engine Cowl please make sure they are held tightly together first otherwise the end result will be one wonky assembly that will look horrible upon completion.

And now …….

How to Renovate



If you own a Mamod engine there may come a time when that love of your life is tired or even busted. And there are those "great" eBay buys that turn out to be duds.

We have decided to show you how we do some of the jobs. We are not experts - we don't have time to be. But we do produce a pretty good job and you can too.

First of all you'll need some tools. Small hacksaw, long nose pliers, ordinary pliers, small screw drivers (flat end and posi.), butane torch, emery paper, files (flat and triangular), riveter, vice, Brasso and Brillo pad. There will be some other things too.

Number one. You will need a bench to work on, almost any bench will do!
It can be tidy - or like this one.

We all know that buying an engine on eBay is like Russian roulette and your engine may look like any of these.

Plenty of rust, dented chimney.

Ideal for a complete strip down and respray.

The Water Level Plug hole has been bunged up with "something".

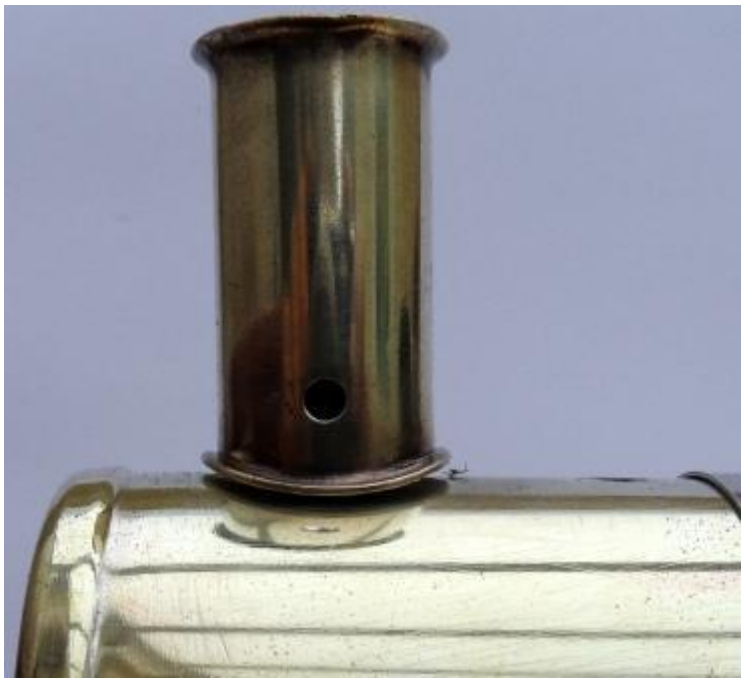
A fine bit of soldering and some zinc oozing from the brass boiler.

De-zincing generally means that an old boiler is on its way out and may leak. You may want to look for another boiler if it is bad enough.

That's no way to treat a chimney!

Not quite so bad but still needing the dent magician.

Oh flip ... what is this supposed to be?



And one loose chimney that revolves.

These are just some of the renovation projects that have landed at our door. Some came from an eBay purchase which does sound a bit of a warning eh!?

Here's a thought for you……..

Would you benefit from buying a second-hand small air compressor? We purchased ours on eBay and it has been invaluable for those quick pressure tests and mechanical tests prior to firing up.

It has to be said that it does save a lot of wasted time and heartache when it comes to wondering if the work we have done is sound. Why not get one in due course? You will need to spend £60+ at least.

Let's now have a look at how some of the jobs we do are tackled. The point being, that YOU too can do all of these jobs using some of our experience. Nothing is difficult. Just a bit fiddly and if you have the willingness to be patient and try again if necessary, you are already half way there.

Tightening up your loose chimney. Well, in truth, this can't be done - you do have to remove it and start again. You'll need to firstly drill out the wonky rivet. Then pick up your riveter.

You will notice ours is scrubbed down to reduce the diameter of the nose by a couple of thousands of an inch. This is to ease its progress into the chimney.

Keep going……..

Our riveter

Then insert the copper (closed end) end rivet into the tool and rivet the chimney back into place. Make sure you seat the chimney properly around the curve of the boiler and press down quite firmly to obtain a tight join.

Riveter at work in a tight space

Here's something that you will meet occasionally if you do many renovation projects. The piston may be binding owing to lime-scale or dirt. On the basis that lime-scale and dirt is less hard that brass, it is OK to get a bit brutal. Place the piston rod end into a drill that can be run slowly. Here we are using a hand-held battery driven variable speed drill/ driver. Rotate slowly adding a little oil into the cylinder if dry.

Running-in a piston

Give it a couple of minutes of SLOW running working the piston in and out to cover the internal working surface of the cylinder. You don't want it perfect at one end of the cylinder only.

How do you solder up a pipe join when you thought everything was fixed and finished and the paintwork is soft, but looking good?

Simple. Without burning the paint!

Let's think about it for a minute. Paint burns when it gets too hot. What is too hot for paint? A flame burning at 1400 degrees centigrade - that's too hot. All you have to do is to protect the paintwork using a wet thick rag. You can get quite a lot of stray flame on a wet rag without it burning and more to the point - without it damaging the paint.

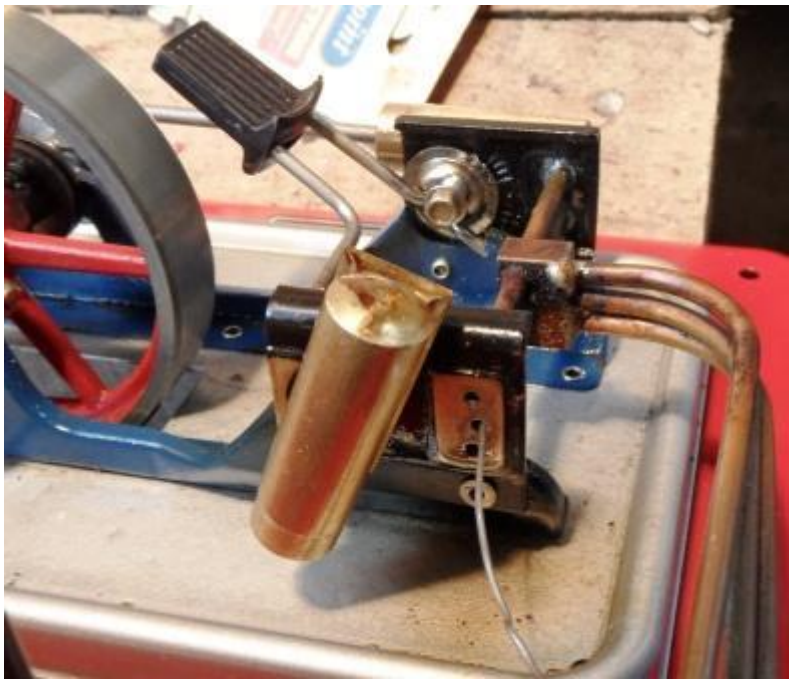
Here's how we do it: An old wet rag saves the day!

There is one problem in particular which sometimes catches out even the most experienced "solderer". It is the copper pipe filling with solder.

It's a pain because you can't see it happening and you don't know about it until you either test the engine with compressed air or more normally, fire it up.

You can have the problem amplified by renovating an engine such as a Mamod SE3 or an SP5 which have several pipes.

Also, we found there was a problem of accurately lining up pipes to the back of the cylinder. A bit of a nightmare for us initially until we found the "secret".



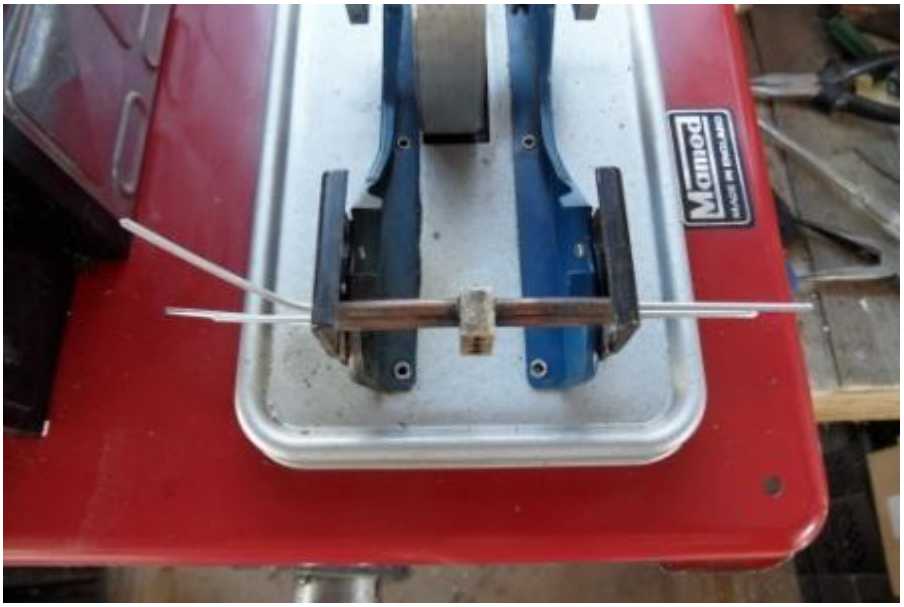
The secret

It's not really a secret, but in discussing this with several very experienced Mamod engineers none of them came up with a clear answer or solution. So we thought about it and wondered if we had any garden wire lying around. Yes!

So we cut some off the roll and fed it into the cylinder hole and through into the pipe we were trying to join in the right place.

As you apply the heat and solder it is best to wiggle the wire a bit to ensure the wire doesn't get soldered in place. Really important that bit.

If you have multiple pipes to do, it will look like this as you work through the assembly operation:



Multiple rodding of pipes prior to soldering

Removing hard solder from the pipes

Continuing with the renovastion:

Removing items that are riveted on should be drilled out. Hold the item being drilled firmly (in a vice if available), and run your variable speed drill very slowly at first.

If not in a vice, just imagine the drill bit slipping - and don't put your hand there!

Think worst case scenario (scare yourself) and you should be safe as houses.

Choose the correct drill size.

It will either be 2.5mm for 3/32” rivets

or 3.00mm for 1/8th” / 3.2mm rivets.

Gentle drilling

Before any paint prep work can start the base must be free of any parts or rivets. If you are feeling brutal, you can use an angle grinder. We just happened to have this one next to us at the time.

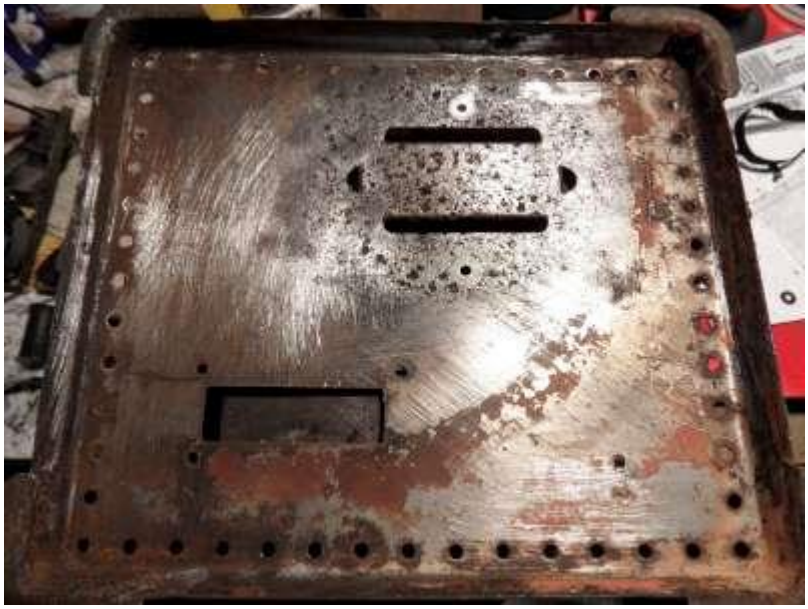
Angle grinder at the ready

And here is the result. If you choose this method wear glasses and be as gentle as a cat's paw. Here is the outcome.

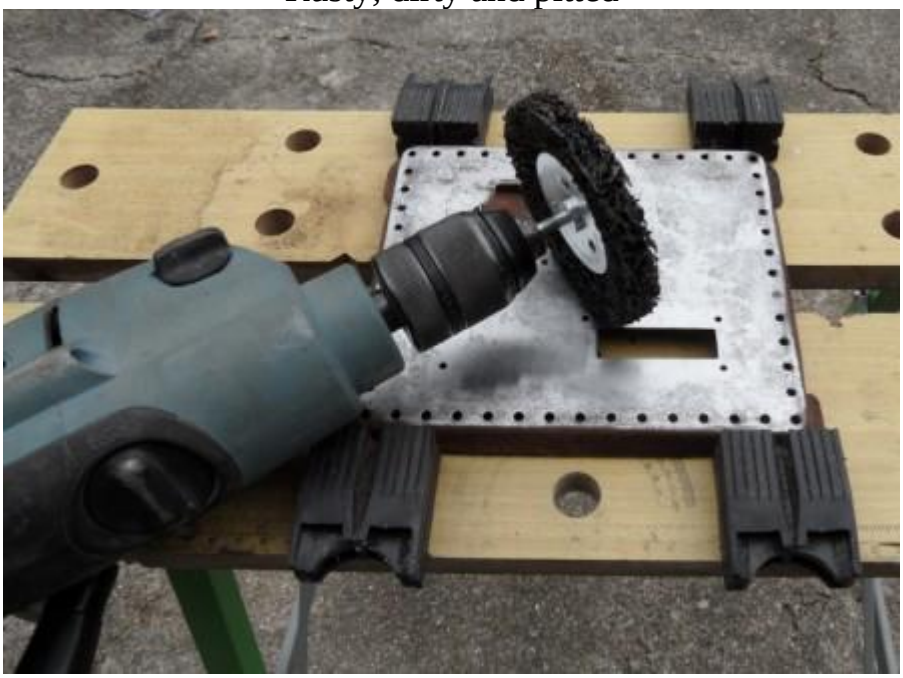
Rivets gone - quick and easy

Painting a Mamod base or other components seems to be a hurdle for many people. Not surprising really when you think how difficult it is to get a great finish to resprayed car bodywork. Thankfully, Mamods are not motor cars and so a lower level of competence is required.

Here is another beast of a base that we had to work on to get it ready for painting.



Rusty, dirty and pitted

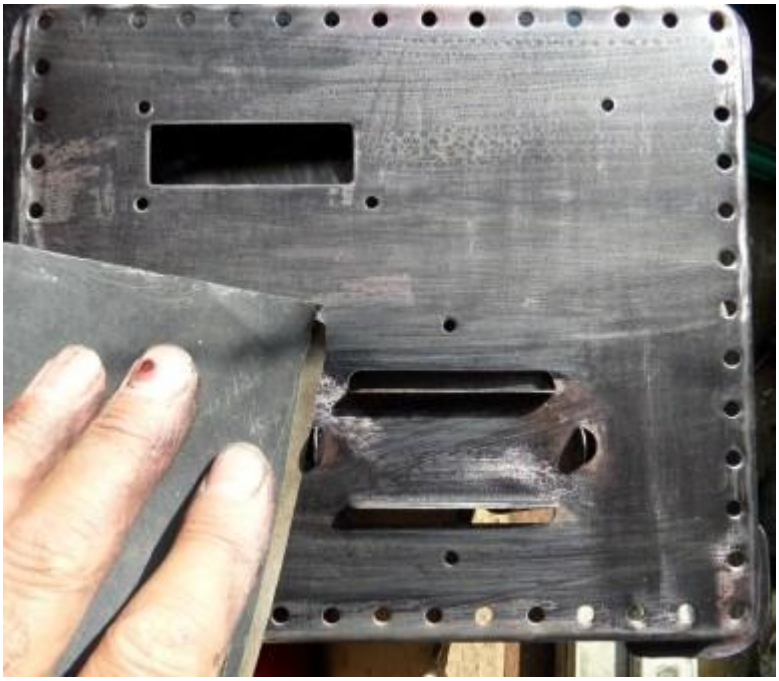


Now here's a quick way to scrub it clean-ish

Hooray for Kurust - from Halfords store

A generous helping of rust treatment

Using a disposable small paint brush cover the entire surface of the base even where there is no rust. It will not only kill all remnants of rust but also start to smooth off the surface a bit with its coating. Don't worry about any over-applied spots (thicker than the rest) because the next job will level it all off nicely.



Give the base a gentle rub down using medium emery paper and when you are happy with the feel of it (yes - the feel of it) wash it down with warm water and washing up liquid and immediately dry off – **immediately and totally**.

Use some heat to do that like a radiator or a halogen lamp at close quarters.

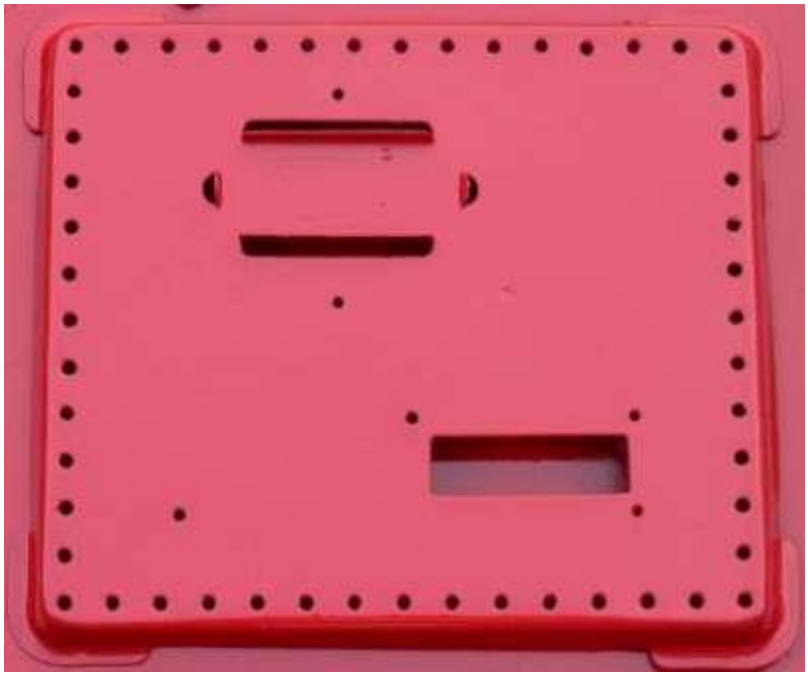
Please note that unpainted mild steel will start to rust very quickly and so a primer coat should be applied when the surface is absolutely dry.

So in summary, we use a combination of caustic soda, paint stripper, a wire wheel on a fast drill and finally hand held emery paper. We sprayed on the combined undercoat/primer with two good coats.

We normally apply *at least* three top coats with a fine rub down on all except the last one and wash with warm water and washing up liquid between coats.

This not only gets rid of the loose paint and grit from the emery paper but also degreases the surface each time. You really do need to do that if you want a smooth finish and for the paint to stay on.

To get a great shine use some car paint polish but be very light handed otherwise it will remove the paint which remains soft for about 3 weeks. Leave the job indoors in the summer sun or in the airing cupboard when the weather is cold.



Almost finished

The dent was still there but not the blackish areas. The camera does lie!

And now it's the turn of the Engine Frame. Let's make sure it is cleaned up properly in those awkward places. First of all, I would say you need an efficient way to clean those hard to reach places. You can use folded up emery paper. Or you can use one of these. Not expensive on eBay or even at Halfords.

A poor man's Dremell

The tool box

This is how you do it. Not too difficult although please be aware that touching your skin is not a good idea although in reality it does not cut but burns and so you will be quick to move!

The other health and safety issue is that the felt polisher can suddenly grip the item being polished and launch it across the workshop at 100 mph. Oh, and one more thing.

The revolving disc/polisher should be tightly held in the chuck - it can get loose and end up orbiting the workshop at eye level!

So always wear some form of eye protection if it's only a pair of glasses.

And don't let little kids close by during this operation!

Do the usual Kurust treatment, make sure it looks smooth enough for your satisfaction, wash and dry and then *bish-bosh-bash*, quickly get it painted up with several coats to give it a nice deep colour.

The first undercoat/ primer.

You will need to ensure you have scraped out the crevices otherwise upon close inspection the great job you will have done on all other parts of the engine will be made almost null and void. It will look shoddy and crusty and reflect very poorly upon your level of care on the whole of the project.

Not the original colour – sorry!

The green paint is now satisfactorily being applied and this part of the job can soon be put to rest. Again, the reflections do not allow us to show it at its best.

But just look at how it started life with us.

No - I can't believe it!

Anyway, loads more work went into the job and it ended up looking like this.

Same engine - not so bad now eh!

And Now!

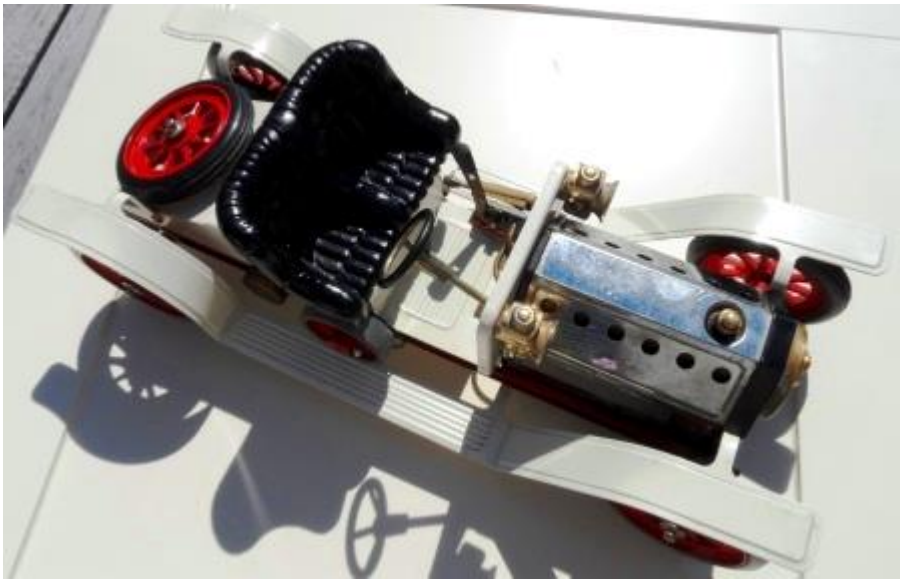
Fix up a Roadster - (does the pain ever stop?)

I was asked to repair a non-working Mamod SA1. That's a steam driven single cylinder car. These are attractive cool looking engines that should nip along the ground quite quickly. I say *should*, because this one didn't.

So you join me with the car on the bench. I could see that the **water level sight glass** had been leaking badly. A customer's "great" eBay purchase. So the offending part was removed by drilling out the rivets. I cleaned the area and it looked good.

It was just a matter of fitting a new one and it looked and operated just fine. No leaks. As you can see it ran really nicely. All was well. Or was it??

Looking good with the new seat fitted. I screwed that in underneath as trying to use the washer fittings was too difficult.



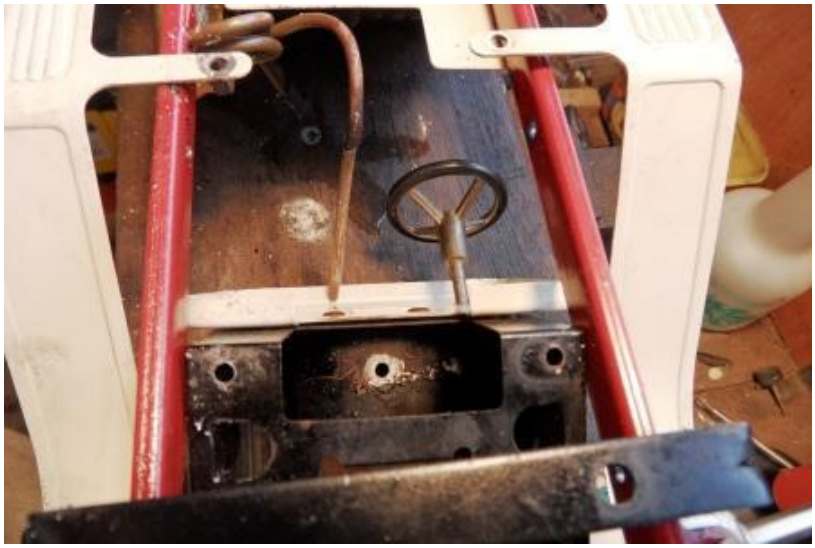
When the customer got it back he found it would not propel itself on the ground for more than 2ft. So back it came into our workshop. This was now a mystery. I was told that I could do pretty much whatever to make it go. Change the boiler, the piston/cylinder - whatever. Wow.... I fired up the car again in our workshop and found the same problem - it ran OK with the wheels off the ground but that was all. The decision was made to rebuild the engine using all brand new parts.

But, before I did anything I chickened out. So I concentrated on the brand new drive bands. Were they too tight? Too loose? The important thing I found was the drive band to the rear wheel did not fit into the brass pulley groove. See picture. So what is the answer? Open up the pulley groove of course! Well, that made absolutely no difference to the lack of grip on to the pulley. One wrecked brass pulley. **Blast!**

Next step then was to fit another brass pulley and it seemed to be OK. It's from a new SP4/5 engine. The drive band still did not fit snugly but at least it gripped reasonably well.

The performance still was pathetic and no amount of frustration on my part put it right. So, in that frustration I decided to renew everything that might be the problem. Hey, let’s change the boiler.

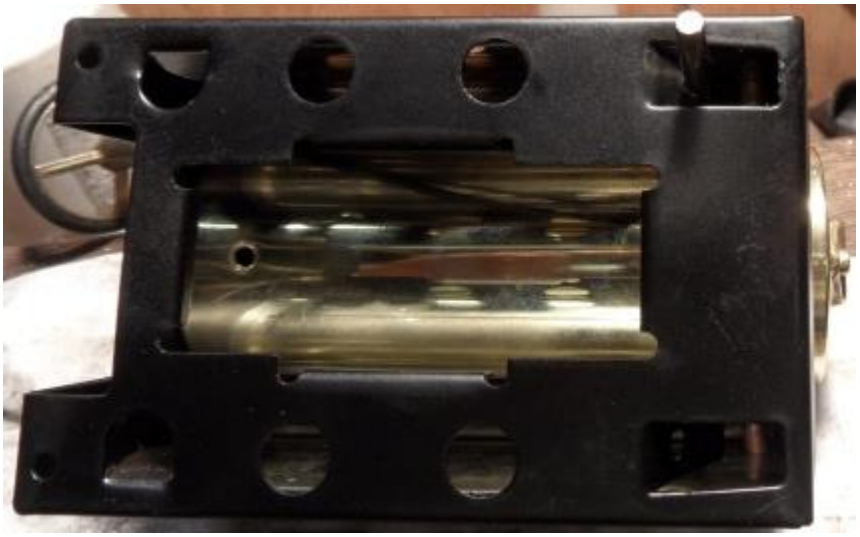
Turning the car upside down I applied the heat of a butane burner torch and sweated off the solder and pulled out the long pipe.

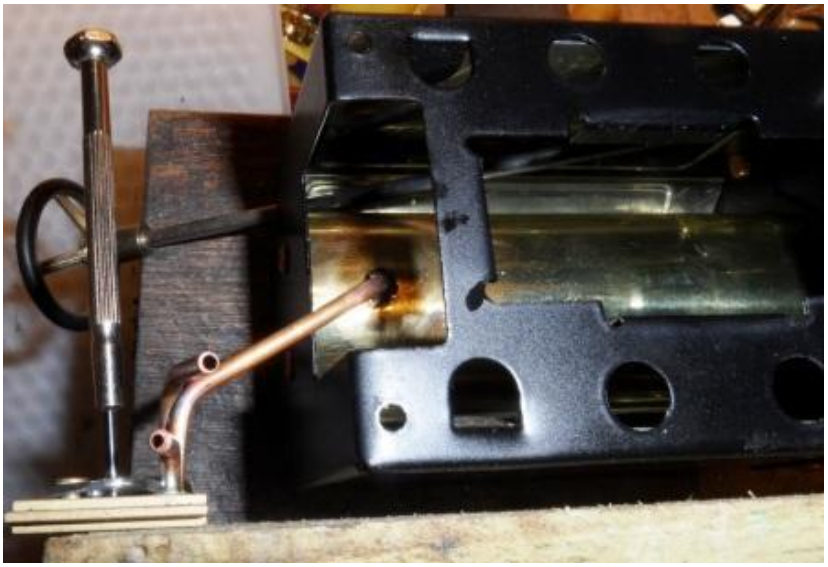


Above shows the pipe withdrawn from inside of the boiler by dropping the boiler.

Here you can see the drilling out of the rivets so that the firebox and engine cowl can be removed and changed.

This is the new boiler, firebox and engine cowl all assembled. But notice the steering rod. It has a retaining tab which must be bent a bit to accept the rod. This is not difficult.





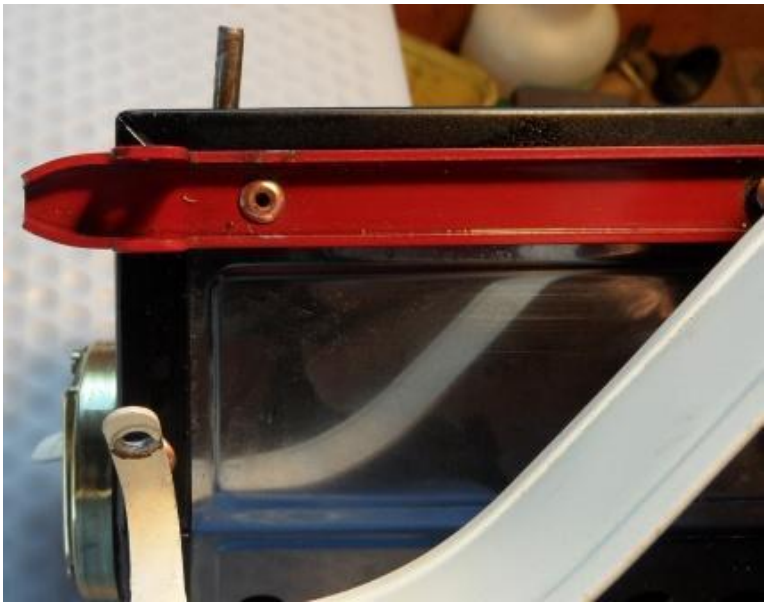
Here you will see a method of successfully inserting the pipe and then holding it in place ready for soldering. There is a block of wood sitting next to the firebox to which is pinned the new engine face. This idea works really well unless you have three hands in which case you won't need to do this.

The assembly is underwater here so that when the compressed air is fed into the boiler any leaks can be detected. None were found.

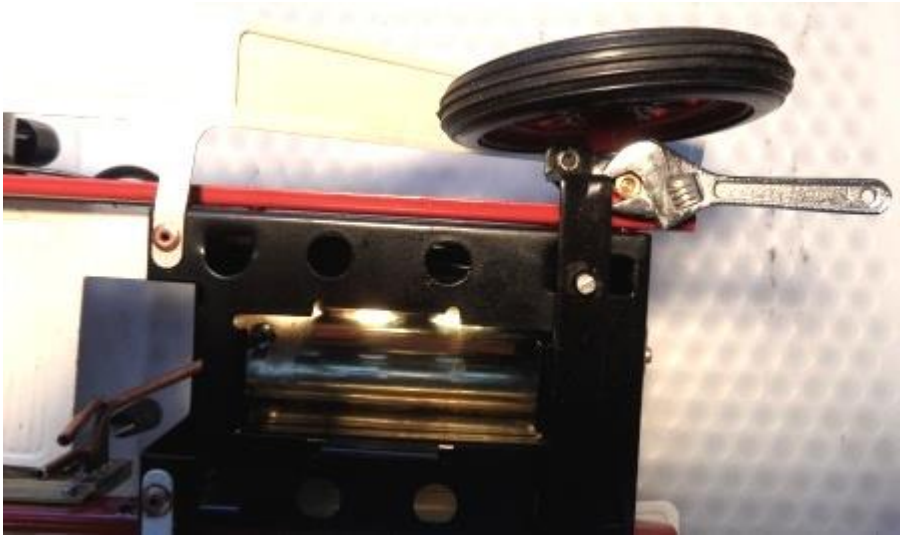
Now the engine face (the brass block) needs to be riveted in place on the chassis. This shows the two rivets in place and ready to go. You do need wide and strong hands for any riveting work on Mamod engines. Hod carriers and bricklayers would probably find it easy. Take a look at the riveter and what has to be done to get the riveter head seated into the chassis. Basically the width needs to be reduced using a file.

It’s narrowed on two sides using a file.

At last. The final rivet to go into the chassis. The firebox and engine cowl are now firmly held onto the chassis rails.



There was this last job. I had removed the wheels and steering mechanism for a clean up although not necessary it does give a clearer view and make it easier when fiddling around with the boiler. So here is the final nut tightening to finish the re-assembly. Nice small adjustable spanner.



Was it all worth it? **There is a twist to this tale**.

With the car completely renewed and properly assembled and with drive bands that were the correct tightness, the car **would still not run on the ground!**

Nothing had changed. Much running-in took place particularly as I had fitted a brand new piston/cylinder assembly. It was run-in with very light oil and under compressed air. It ran OK with air because that delivered probably 25lbs psi rather than the correct 12lbs psi. when under steam power.

However, when using either meths or solid fuel this car would still not produce enough power to propel it. I changed the plastic axle grommets, properly oiled everything that moved, but to no avail. I even changed the crankshaft.

My final conclusion was that I was looking at the wrong end of the car. It was not the problem with the power but a problem with the holes through which the crankshaft was fitted. The holes must have got bigger over time and some how caused a movement that does not allow a free revolving motion. There is no other explanation. The car remains inoperative to this day.

Post script added some weeks later:
Further thought on this problem seems to point to the fact that the copper steam pipe that enters the boiler from underneath is pushed in too far and so has ended up very close to the top of the boiler leaving insufficient room for the full steam pressure to enter into this pipe that then leads to the cylinder.

I can't be sure if that is the answer as the car is no longer ours and so has not been run here to test it. Seems plausible though and a solution favoured by the Mamod Ltd engineer. So on this occasion we didn't spot the probable problem.

Post script added some years later:
A customer had the same problem and despite throwing money at the problem, his Roadster would not run on the ground, only with the wheels running free, just like this one.

The solution was to purchase a gas burner (£80+) and dispense with solid fuel and meths as they could not supply enough volume of steam to keep the revs going. This is not at all usually necessary but in this case that got it going and running very strongly on the ground. Whoopee!

Safety.....

A Mamod Steam Roller was on the kitchen table with the drive band disconnected from the rear wheel.

My 5 year old grandson was enthralled as the flywheel raced round at 2000 + rpm. Then without notice the cylinder came off sending out a jet of steam.

Young children are at the same height as the 12 psi steam pressure contained in the boiler.

Although he was not hurt it served to remind me of taking sensible precautions like them not standing too close, or in the case of an enthusiastic young steam engineer, wearing eye protection.

If It Still Won't Run ……..

Ouch !

Problem starting your engine?

Won't run for long?

Runs too slowly?

Leaking stream and water?

Whatever your problem, we can help or your money back. **Guaranteed**.

We wouldn't expect you to pay us for NOT fixing your engine would we?

Are you are flummoxed (**bewildered or perplexed**) and don't know what to do about getting your engine working properly?

Enough said? Basically your engine is a pain and you can't get it going properly.

It's a Miracle ……..…

We can reckon we know enough to get your engine running properly!

* You will still have to explain the ins and outs of your engine and the problem. We will tell you what to do and what to replace, so there is some money involved.

* But hey, you may have to invest a bit to get your beloved running. Very often it is trial and error to reach peak performance.

* Don't worry if you don't know what to say to us, we are used to asking all the right questions!

* So give us a call and we'll chat your engine back to peak performance.

Four things that will usually get your engine going!

Yes, just four actions that can put the smile back on your face.

- **Change the all four seals**

- Water Level Plug (3/16 inch. fibre)
- Safety Valve (¼ inch. and O ring)
- Whistle (¼ inch.)

- **Fit a new piston**

- A worn piston will not hold back the steam.
- A new piston will soon mate with the cylinder.

- **Oil piston / cylinder with WD40**

- This will overcome all friction – once started, stop and oil again.

- Phone Trevor on 0777 552 1452 if your engine is still not working.

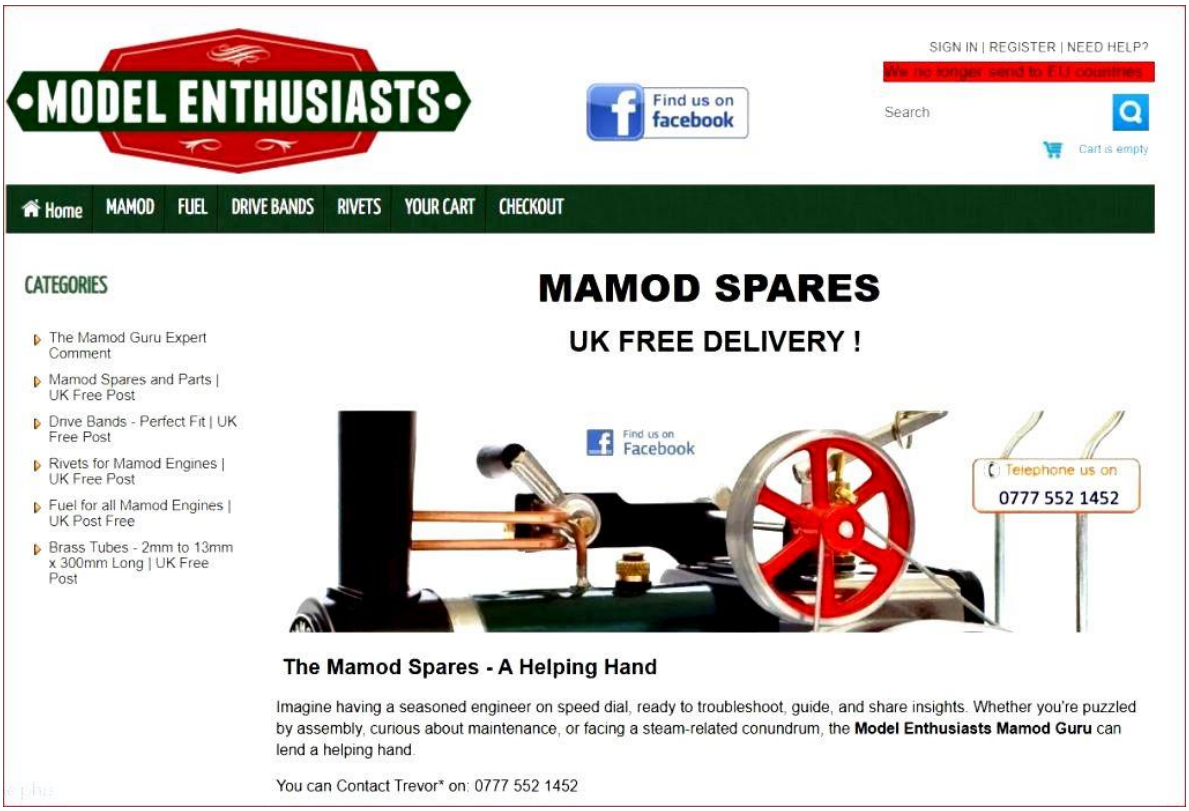
And now *your* lifeline:

For your lifeline call
Trevor on 0777 552 1452

At Model Enthusiasts we specialise in helping people get their Mamod engine running again and how we got to be the world's largest seller of Mamod spares.

Our **free** technical advice is second to none, a service that combined with our hands-on experience has enabled several thousand enthusiasts get their engines running properly since 2004.

You can find us here…….



Special item that you won't find anywhere else

TE1A STEAM TRACTION ENGINE KIT
ASSEMBLY INSTRUCTION

This helps you understand ***any*** Mamod TE1A engine kit or otherwise.

Off we go…..

Take the Firebox and the Chrome Cowl and assemble together.
You can spread the Firebox sides to allow the Cowl to fit down into the four corners. If you don't do that you won't be able to assemble them together.

Not like this: look at the bottom position

But like this: nicely uniform at the bottom

See what I mean?

Squeeze the two sides closed (a hard squeeze) up against the Cowl. The brass screws need now to be inserted into the four holes. Do this by diagonally fitting them into the holes and not on one side first. It helps to have a bradel/drill bit/rivet to pop into one hole on each side to line it all up. If not, you may struggle to insert the brass screws.
Splayed to get a good fit.

Now the brass nuts can be offered up to each screw. Use a finger and a screw driver.

Boiler time.

Remove these two brass screws from the Boiler

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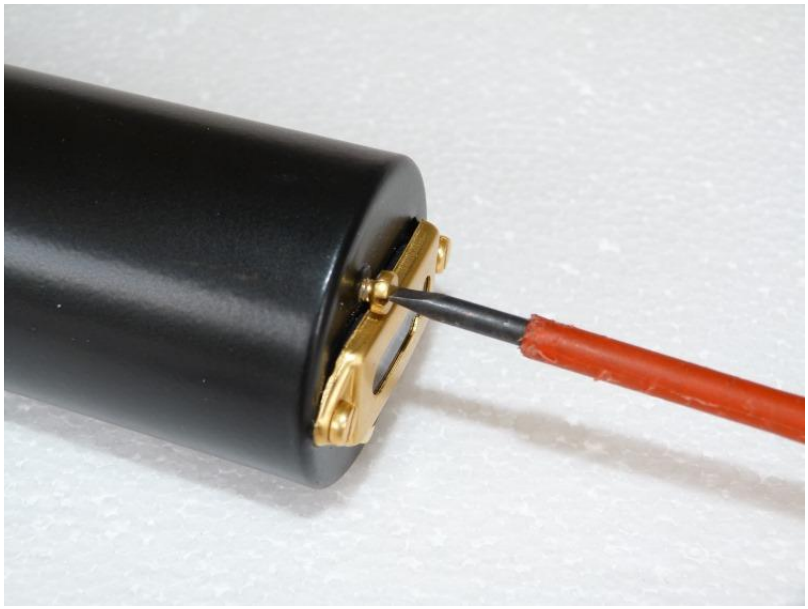
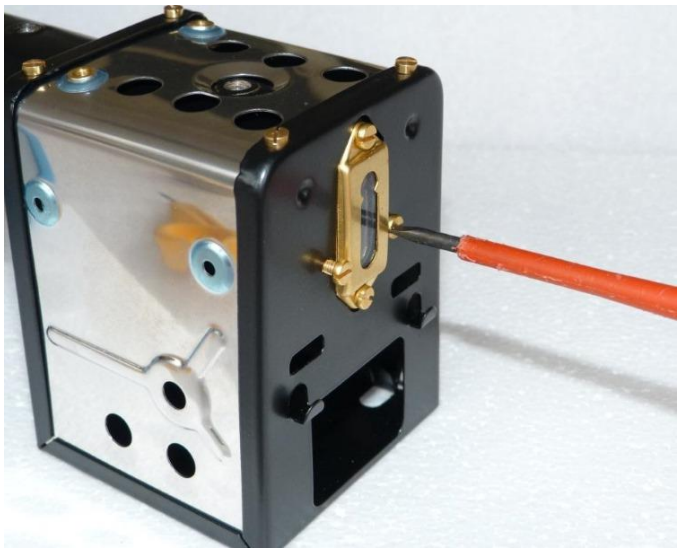


It’s taking shape now.

Feed the Boiler into the Firebox assembly so that its Water Level brass surround fits neatly into the shaped hole on the other face. Now use the two brass screws to secure it to the Firebox. Don’t scratch it by allowing your screwdriver to slip – be gentle!



It’s taking shape now.

Front Axle Time:

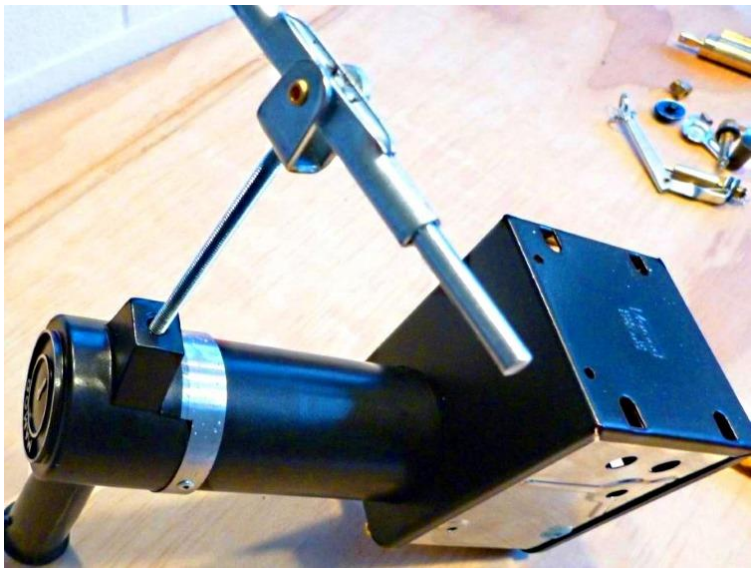
Take the square nut and place on top of coiled spring.
Assemble both into the box shape which is at the bottom of the Smoke Box.

The nut must be above the spring (with the engine the right way up) and then the Front Forks are screwed into them and then immediately through the threaded hole. As you screw in the Forks the nut will eventually get drawn down to tighten the steering.

The above task is a little fiddly.

With that ready, assemble the Front Forks threaded shaft up through the Smoke Box/Chimney assembly.

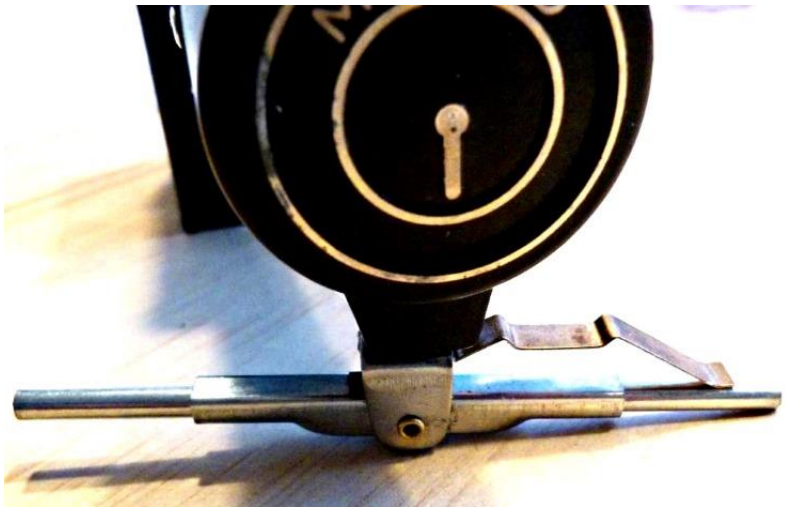
Next you will see the order of assembly of the nut and spring.



Screw the Forks assembly until it is in contact with the Smoke Box base thread.

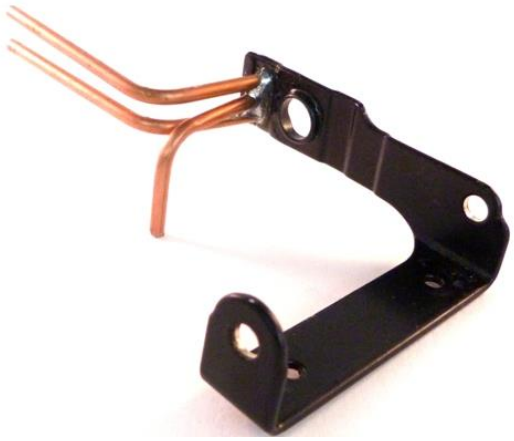
Leave it tight enough that it doesn't flop around. It can be tightened further when the whole task is completed. The purpose of tightening is to ensure the engine doesn't wander from one direction to another when running on rough ground.

Find the Copper Leaf Spring. Fit it onto the Forks axle like this:
Push through to centralise.

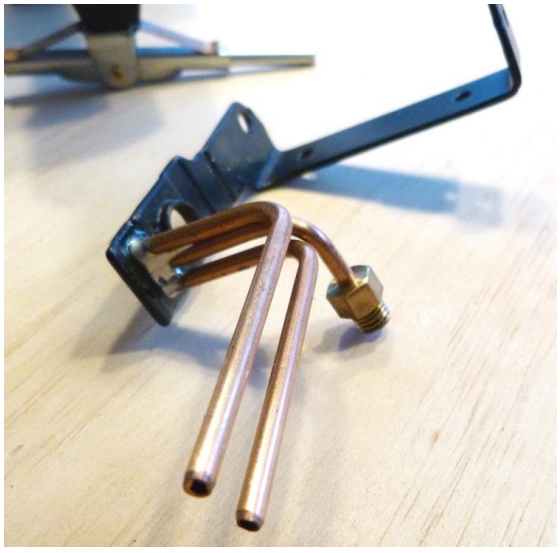


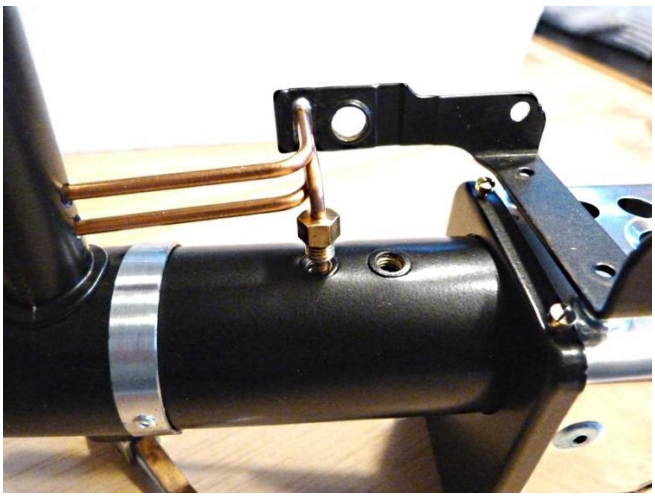
Now do this:

Pick up the Engine Face Mounting Bracket (bit of a mouthful) and do what you see in the following pictures.



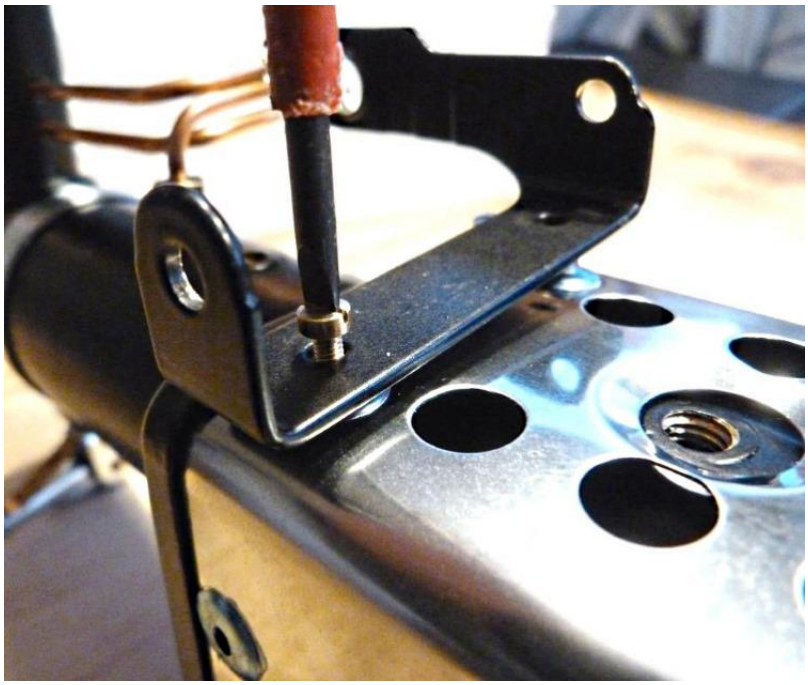
Feed the Copper Pipe onto the Union nut.



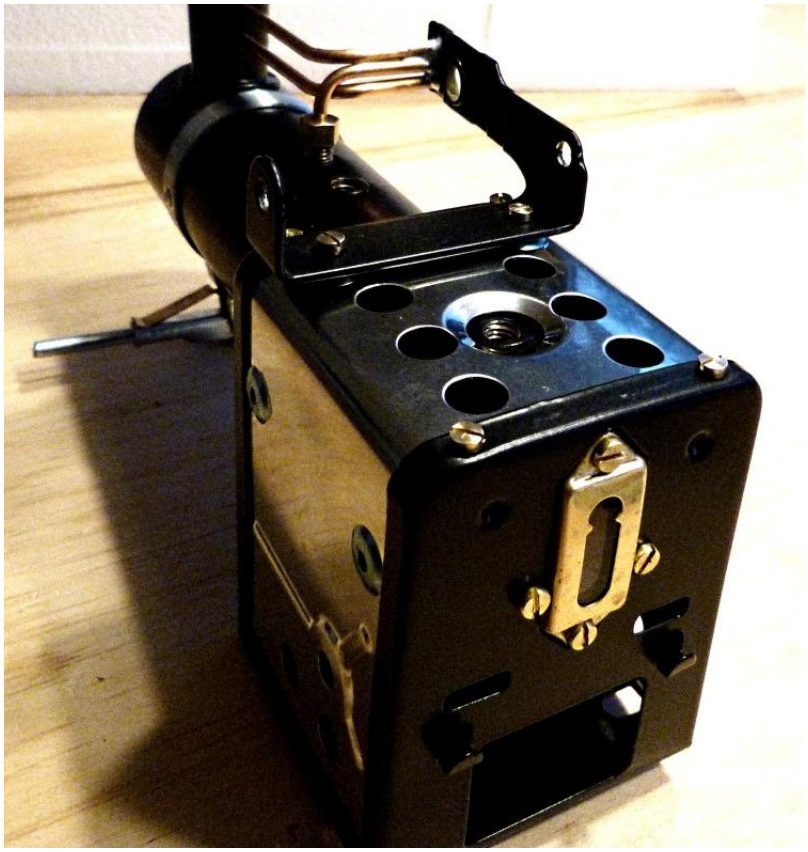


You may have to “persuade” this Engine Face Mounting Bracket to get the three pipes in their correct place.

Use your muscles – gently.



Screw down onto the two pre-fitted nuts.



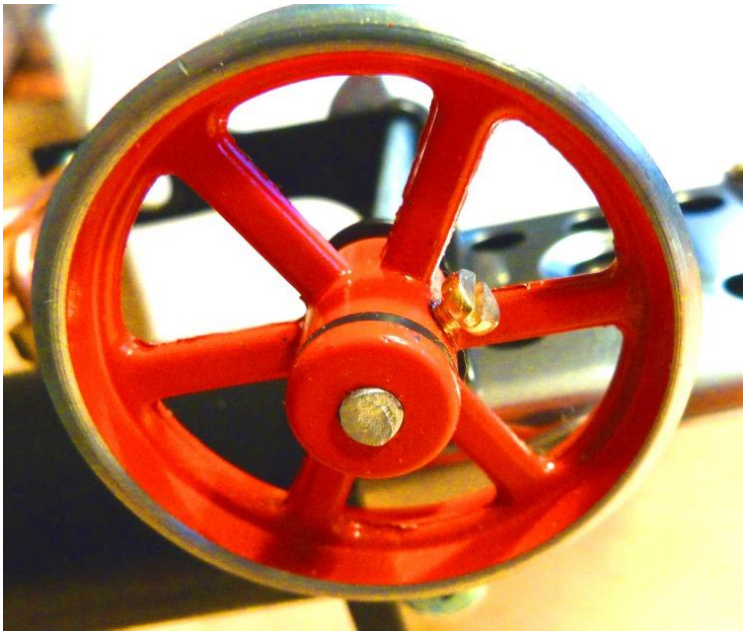
Then it will look like this. *Coming along nicely*.

It’s best to put a drop of washing up liquid on the pipe end to allow an easy non-damaging fit into the top of the boiler.

When you finally tighten the hexagonal nut do so only enough to stop any steam leak and not to bolt down hard. Easy does it.

Get the Crankshaft and do this:

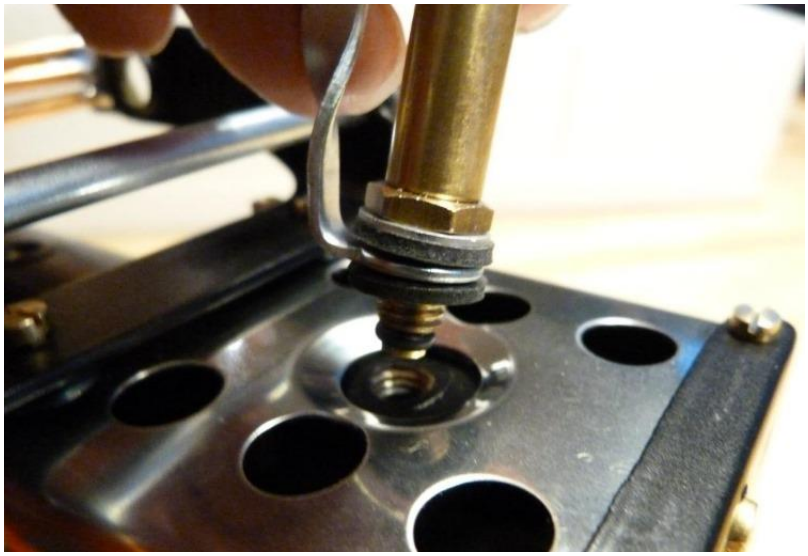
Don’t forget the brass spacer, and then fit the Flywheel and tighten the brass securing screw.

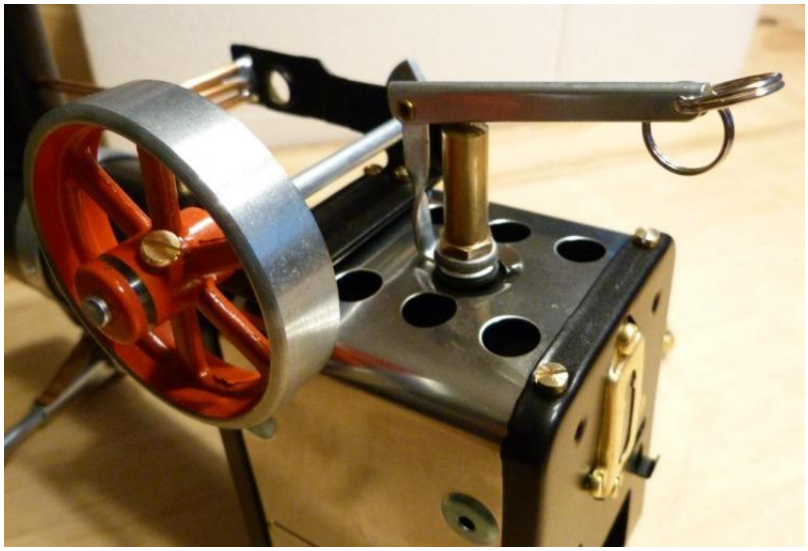


The Mamod instruction refers to a grub screw. You may find that a brass screw now replaces that.

Put a tiny amount of 3 in 1 oil on the Whistle thread. Always do this when not using the engine for any length of time

Assemble the Whistle by gently turning the hexagonal whistle body.





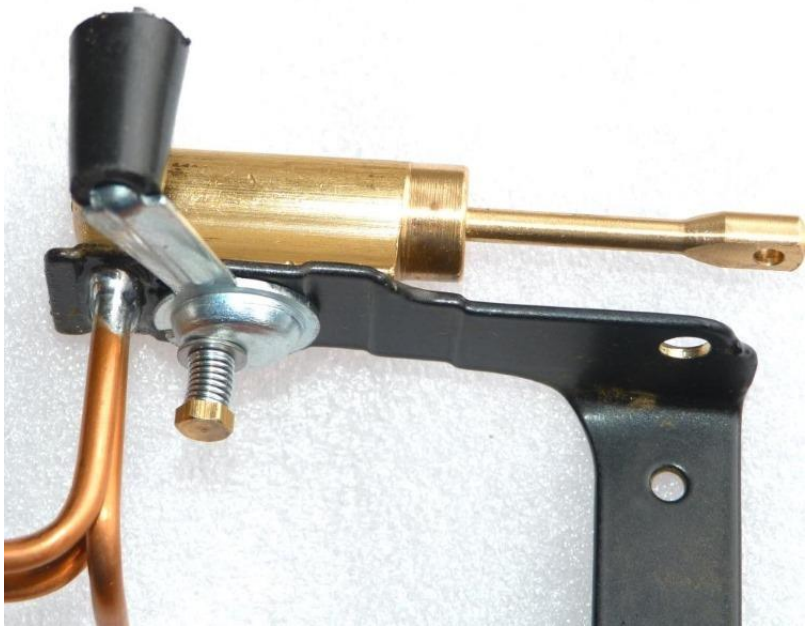
You are now about to perform the most awkward part of this assembly.

Assembling the Piston/Cylinder to Engine Face Mounting Bracket

You must make a supreme effort not to let the Trunnion Screw etc. suddenly ping off into the ether. It happened to me and so it can happen to you. Try to make sure any fly-off ends up in your lap. A life saving tip!

The Nasty bolt/spring/washer and Forward/Reverse Lever…….
as just mentioned!

Below, is what you are aiming at <u>on the engine</u>.

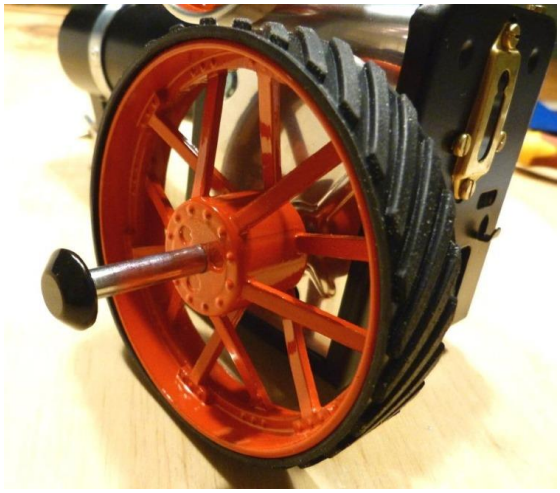


Getting excited now?

The final furlong …….

Fit the wheels onto the front and back.

Fit the black Hub Cap onto one end of the rear axle, insert through the Cowl axle hole and then fit the other wheel and Hub Cap (bit of a hard push).

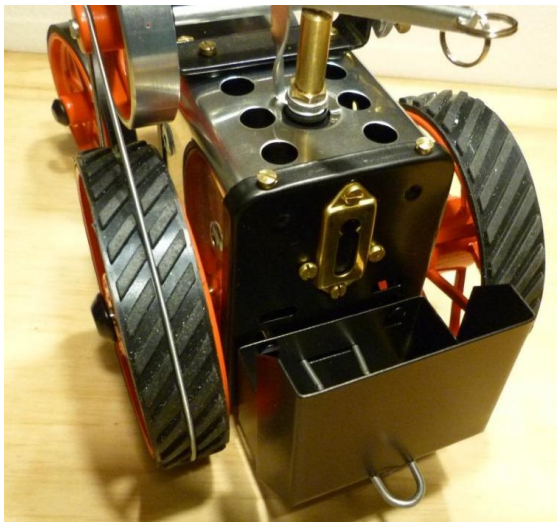


Fit the front wheels and hub caps

You are just about finished.

Fit the Drive Band, Burner Tray and Scuttle to the engine.

With the Burner Tray you may have to be aggressive(!) to get the handle through the Scuttle slots.
You can fit the black handle onto the end now – if you want to.



Screw the Safety Valve into the boiler top. This is the hole for the water.

When you are ready for the Drive Band,,that can be fitted. **Last job**!

Sit back, make a cup of tea and when you are ready, you can place the engine on a level surface, and set about getting it running.

1. Remove the Drive Band.
2. Remove the Safety Valve.
3. Remove the Burner Tray.

4. Pour warm water into the Safety Valve hole no more than the maximum level as indicated by the Water Level gauge and replace Safety Valve.
5. Oil Piston/Cylinder including into the Cylinder barrel plus the Crankshaft.
6. Put two solid Fuel Tablets into the Burner Tray and ignite.
7. Place the burning tray fully under the boiler. Wait about 2 mins.
8. Push the Forward/Reverse Lever in the direction you want it to run and flick the Flywheel in that direction and off it will go!
9. Refit Drive Band for self propelled action.
10. Bench run time is about 7 minutes.

Another Special Item that you won't fins anywhere else

No-Riveting Revolution!

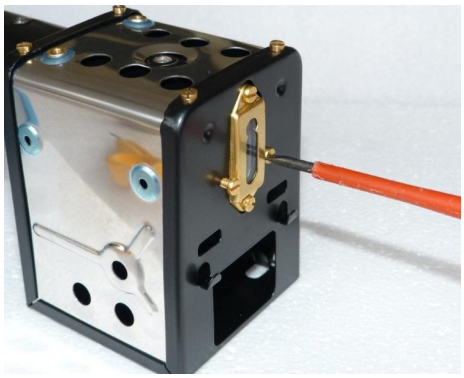
For over 60 years, major Mamod renovations/repairs have required riveting and soldering.

Here we go…….

Assembling the Firebox/ Engine Cowl/ Crankshaft Bracket.

You can see here the screws being tightened instead of using rivets. Notice also the other six screw positions.

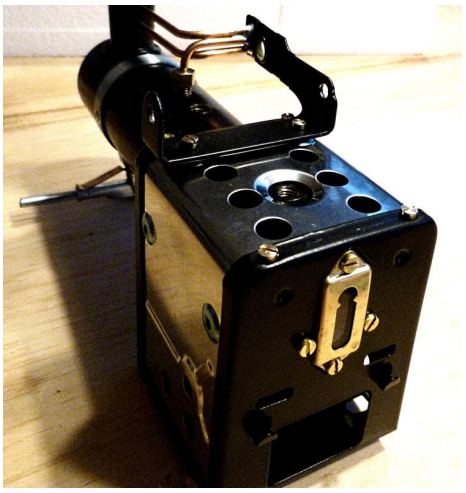
It would be wrong to call anything like this "easy", but it sure is a lot easier and more certain of a good first time outcome than riveting.



The issue about riveting is that sometimes, just sometimes, it goes wrong and there is a need to re-drill the offending rivet to remove it. We know that "re-" anything can make things worse. For example, the worse case is when removing a rivet from the back of Firebox/Boiler. It can spin instead being drilled through and although it can still be removed, what a flaff!

The less time a hole has a drill in it the better. Using screws, well, that is not going to happen.

What could be better?



This now concludes the No-Riveting Revolution tutorial.
…….……II……

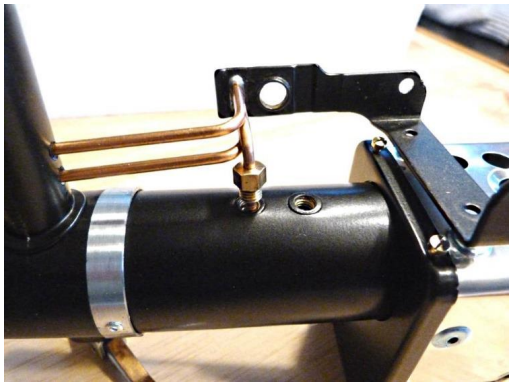
No-Soldering Revolution!

No soldering required for the boiler steam-out pipe? What!

One of the hardest jobs to get a great finish is when soldering the boiler pipe. It can end up leaking owing to insufficient solder, or looking less than wonderful.

The dream way to get it looking good is to fix it into the boiler using our Union Nut that simply screws into the pre-threaded insert with O ring.

Take a look.



This is truly a breakthrough for those looking to make a really good job of that major renovation repair. Like it?

And that's concludes the No-Soldering Revolution tutorial and also comes to the end of your book, **Get Your Mamod Steam Engine Running!**

The best and most useful tutorial ever written?

Based on experiences from over 20 years of hands-on Mamod engine problem solving.

Written by Trevor Allingham owner and founder of Model Enthusiasts.

Find us by searching for the "Mamod Guru"