RE ENGINEERING THE MAMOD LOCOMOTIVE

Peter Jones describes how to upgrade this popular mass-produced locomotive

Part I

The main purpose of these notes is to describe the way in which the Mamod steam locomotive can be significantly upgraded in performance. But there is more to it than that. Although this will give the dimensions and sequences of operations to the experienced model engineer, it has been written with the beginner in mind; someone who has modeled and worked with materials and enjoyed the work. But specifically it is intended as a gentle first exercise for someone who has recently acquired a lathe and who may still be a bit nervous of using it.

The operations can be carried out on any lathe, right down to an inexpensive miniature one. The writer uses the Hobbymat MD65, and it seems just right for the task. On the other hand the whole job was done by an experienced machinist on a Myford ML7, in no time at all.

As well as a lathe, you will see that several tools are called for. These have been kept to a minimum and all of them will give long and faithful service on a variety of projects in the future. If you have a table of equivalent drill sizes, you will need to consult it. Various dimensions are given in various types of measurement. This reflects our habit of using the most convenient scale at the time.

The garden gauges offer a whole range of interests, and many of these are fairly light hearted affairs which call for little serious input. But there are times when we need good old-fashioned accurate machining. One place where good quality work pays dividends is when it comes to uprating the Mamod steam locomotive.

The manufacturers are most helpful, but point out that their product is aimed at the toy market and that they must work to a competitive price. By the enthusiast's standard, the locomotive is very simple and performance is poor. But as well as the many cosmetic improvements, there is fortunately a *modus operandi* which will turn it into a respectable little runner which pleases our engineering soul.

The first thing to do is to identify the individual shortcomings. The locomotive as bought will exhibit some or all of these inconsistently, but if we are going to upgrade the beast, we might as well make a decent job of it. Hence problems are likely to include:

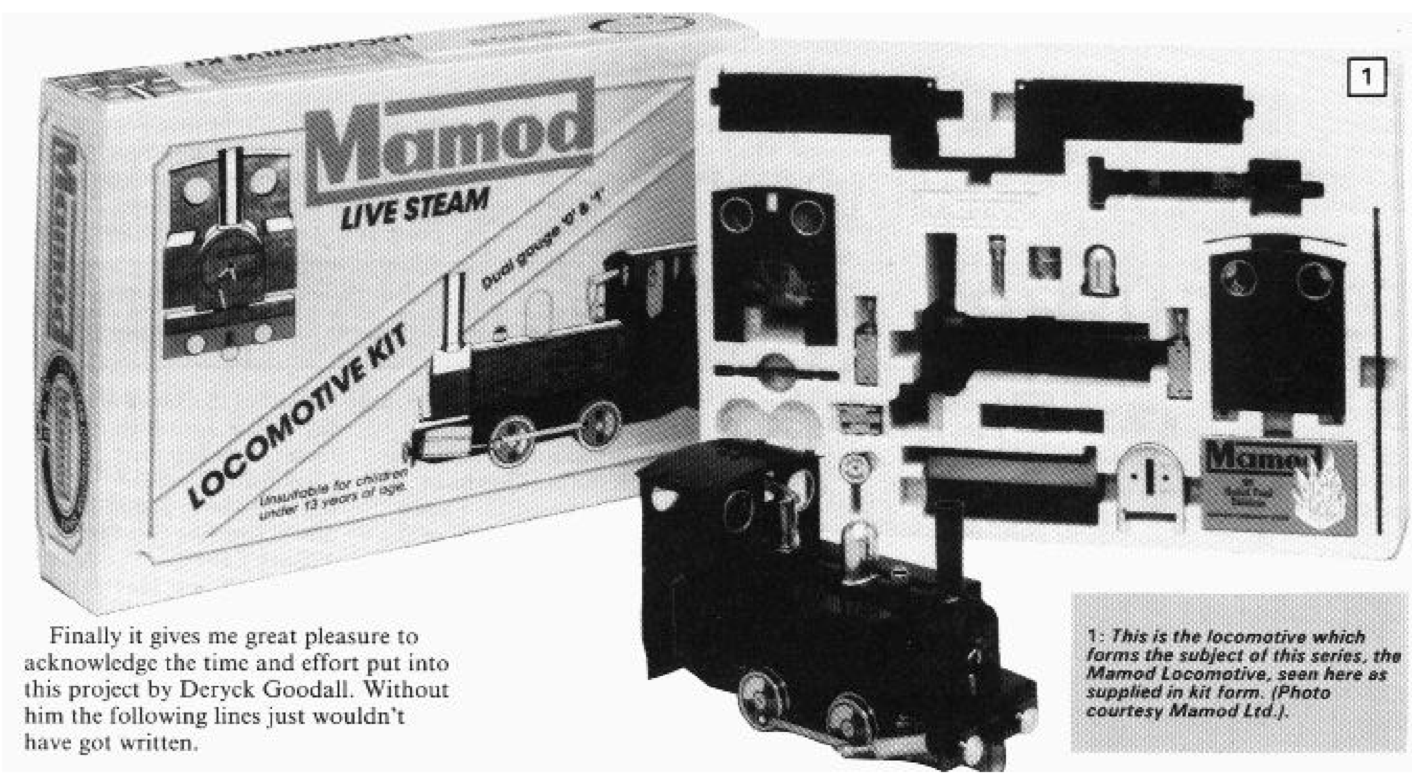
Wheels poorly secured on axles and occasionally slightly eccentrically mounted;
Crankpins not properly secured to wheels;
Steam Valve leaking;
Cylinders leaking steam;
Piston leaking;
Lack of gland on rear cylinder covers;
Cylinder pivot pin a slack fit in the valve space.

This is quite a collection, but they can all be overcome. I'll be describing the work through the medium of the locomotive as sold in kit form, but the notes are readily adaptable to redeeming a ready-built version.

Special Tools

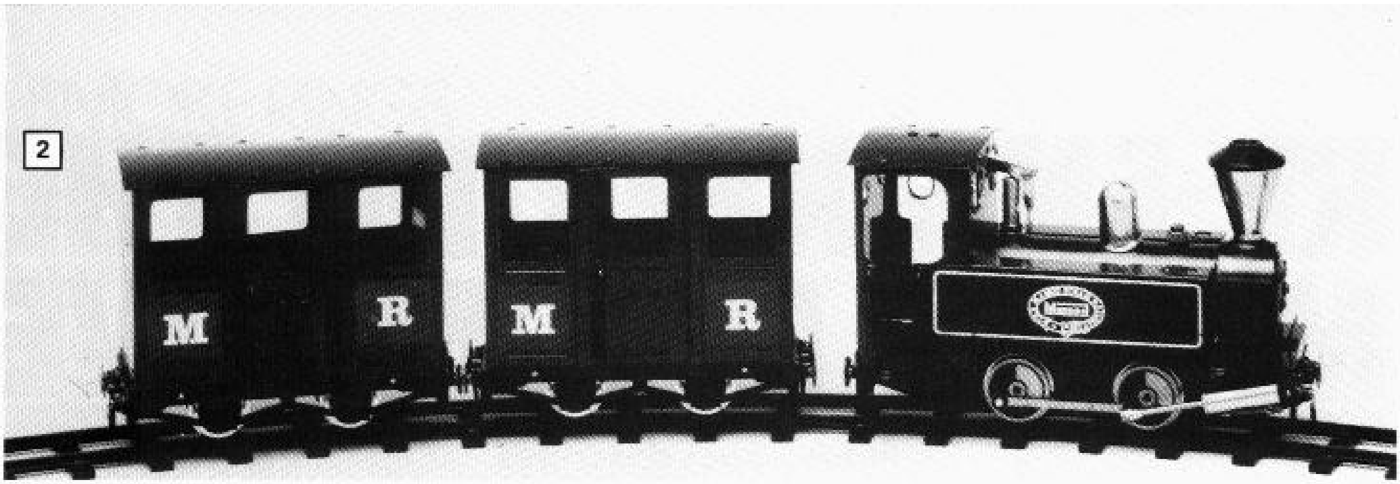
We need to make a couple of simple jigs. The first is made from a bar of YB in. X 3/8 in. mild steel and is shown in Fig. 1. You will find plenty of uses for this little tool anyway. Actually the dimensions of the bar aren't all that critical, but those given make the tool useful for other jobs.

The second tool needed is a punch as shown in Fig. 2. The dimensions of the turned shoulder are critical. We need to

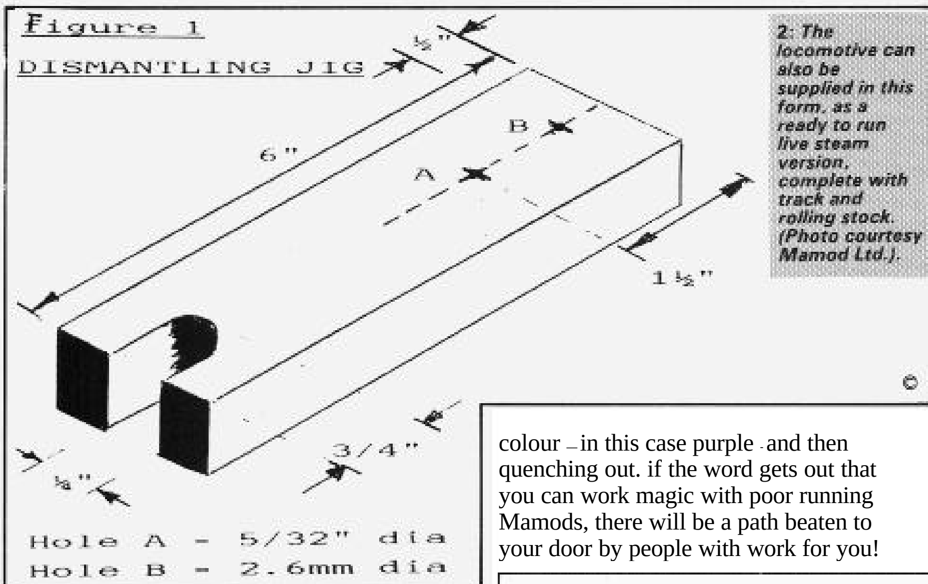


Finally it gives me great pleasure to acknowledge the time and effort put into this project by Deryck Goodall. Without him the following lines just wouldn't have got written.

1: This is the locomotive which forms the subject of this series, the Mamod Locomotive, seen here as supplied in kit form. (Photo courtesy Mamod Ltd.).

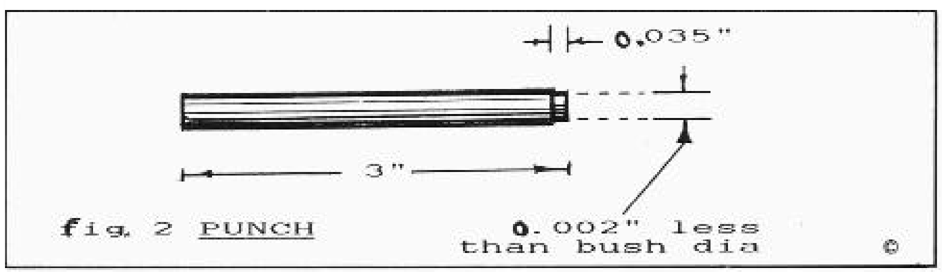


2: *The locomotive can also be supplied in this form, as a ready to run live steam version, complete with track and rolling stock. (Photo courtesy Mamod Ltd.).*



know the diameter of the small shoulder of the axle bush. It is important to check all four with a micrometer and use the smallest size for reference. The depth of the 0.035 in. cut is best measured on the lathe scale, but the diameter needs to be exactly 0.002 in. less than our micrometer reading, so take time to get this right.

If only one locomotive is being rebuilt, then the hardness of the silver steel will be sufficient. But for more than one, some hardening and tempering will be called for. The newcomer will find this an excellent introduction to the subject. the job is just a nice size for heating up until the metal is cherry red, quenching, polishing and reheating to a specific colour – in this case purple - and then quenching out. if the word gets out that you can work magic with poor running Mamods, there will be a path beaten to your door by people with work for you!



The purpose of this punch is to CLOSE UP the holes in the main frames so that the bushes are a snug fit. This seems a contradiction at first sight; punching a hole smaller. What's more it is a technique which doesn't often appear in print. We need a decent anvil. This doesn't mean something that looks like one and is very expensive. Nor does it mean one of those dainty little things on sale at shows, etc., these days (although they have their uses). Nor does it mean the lathe bed! What we want is a big flat chunk of metal. The underside of an old smoothing iron does nicely. Incidentally, for some jobs, a shoemaker's last is handy to have around. But many things can be pressed into service provided that they are flat and have enough mass to give the job some "bounce".

The punch is held vertically over the frame and given a sharp tap with a decent sized hammer. The action of this is to force metal downwards and "fill" around the space of that shoulder. If our 0.035 in. dimension was right, the punch should now just touch the anvil. The hole will be smaller and there is a slight depression on the outside of the mainframe.

Punch the other three holes in a similar way. Immediately the 4th one is punched, mark the mainframes left and right, as this depression means that they are now handed. Just touch the outside of these holes with a 90 deg. countersink to make sure that the bushes will have an easy entry when they are pressed in.

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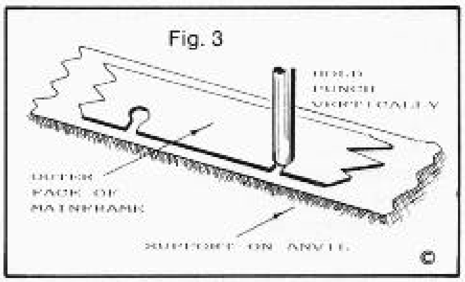
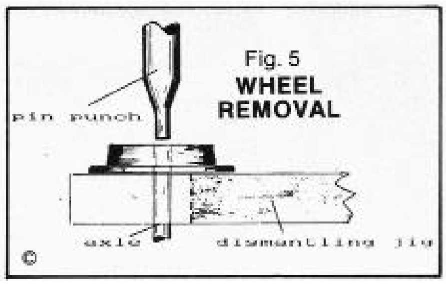
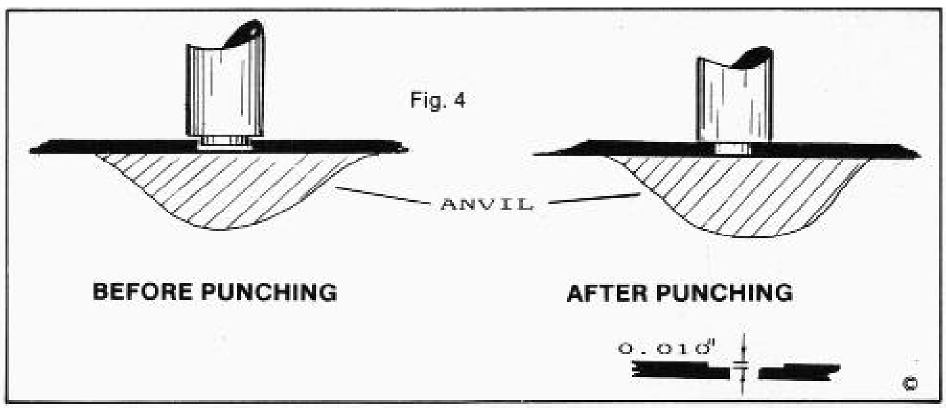
We can now put the frames to one side and turn our attention to the wheel assemblies. Put the jig in Fig. 1 into the vice, with the U shape projecting out from the side. Use a 2mm pin punch to tap the axle out of the wheel, whilst the assembly sits in the cut out portion. If you don't have such a punch, it is a very, simple turning job for the beginner to make. Turn a 2mm parallel portion on a length of 3mm dia. silver steel, leaving a generous radius on top. Harden and temper as described in Part I.







Don't let the other wheel/axle drop onto the floor. It was written in the stars that, if it does, the bushes will slide off the axle and be lost to mankind for evermore. With all four wheels separated from the axles, turn each one upside down, put the crankpin into the hole at the other end of our jig, and tap them all out as well. Be warned that crankpins are even better than bushes for disappearing

Note that there are two short crankpins and two long ones.

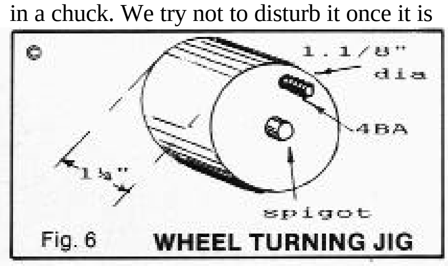
The wheels need to be drilled out to 3.9mm diameter. The alloy is quite soft and, illogically, this makes the need to drill the holes truly even more important. A hand-drill invites problems. We need a drilling machine or the job done in the lathe. I am afraid that you are going to need to buy a small tool here; there is just no way round it. The beast in question is a 5/32 in. dia. hand reamer. It will see a lot of use in this job and will find plenty of gainful employment in your later model engineering career.

From the back face of the wheel, enter this reamer slightly. You will see that a parallel hand reamer has a slight tapered portion at the business end. This is important for our needs. The tool is entered just enough for 1/16 in. depth of the hole to be opened out to 5/32 inch. It isn't as fiddly a job as it sounds. The purpose of all this is to give a perfect press fit for the wheels onto the axles.

Wheel Turning

The next task is to turn the wheels true and improve their profile. For accurate machining, we can't rely on the chuck alone. We can muddle along, doing all sorts of jobs in a haphazard sort of way, but soon or later we come to a job that has to be done right; and this is one of them.

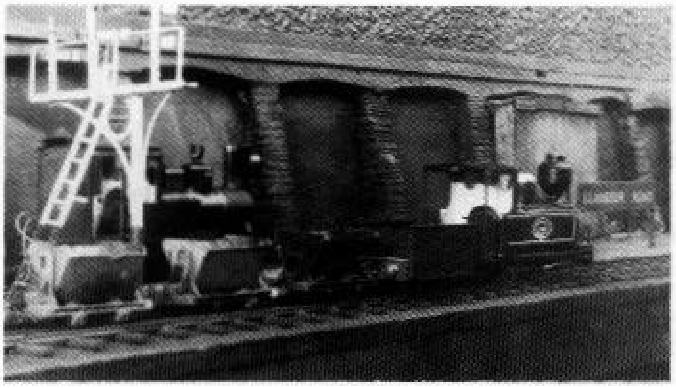
All wheel turning needs to be done on a mandrel - a little jig (Fig. 6) which is turned in a chuck. We try not to disturb it once it is in place and, if we have to, we make a little mark on the bar, adjacent to Jaw No. 1 on the chuck. This way we can take the jig out and put it back in exactly the same place. This ensures that we continue to eliminate any error in the chuck. Work held in one position will always run truly to the spindle of the lathe once it is turned true.



The mandrel is made from a piece of l 1/8 in. dia. mild steel, about 1¼ in. long. Turn the end face true, whilst you are cutting away metal, leave a short spigot projecting from the centre. This projection only needs to be 1/8 in. long. With that pop mark made against No. 1 jaw of the 3-jaw chuck, we can remove the job with confidence that it will go back in the right place.

Push a wheel onto the projection. The Mamod wheel has two lightening holes cast into it. Mark the face of the jig through one of these, (this is referred to as "spotting through"). Remove the wheel so that you can drill and tap 4 BA at this point. The drilling sizes for all threads are given in tables. Mine are the much thumbed back pages of an old A.S.P. Plans Handbook. The jig can now be returned to the 3-jaw, lining up that pop mark. The wheel is pushed onto the spigot with a short piece of 4 BA studding projecting through one of the holes. This will provide a positive drive to the work.

The tailstock is brought up and a revolving centre presses the job tight to the jig. If a live centre is not available then a simple little tool can be turned up as shown in Fig. 7. This is a pressure pad and will do for us if we are only doing one locomotive. It will need lubricating with EP oil.



A Mamod locomotive, re-engineered according to the guidelines set out in this series, on the Author's well detailed 16mm N.G. Compton Down Railway. Seen here passing through Llanbedr Road Station with a train of side tipping mineral wagons.

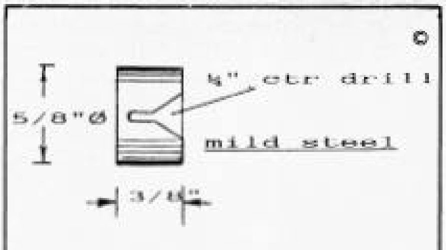


Fig. 7 **PRESSURE PAD**

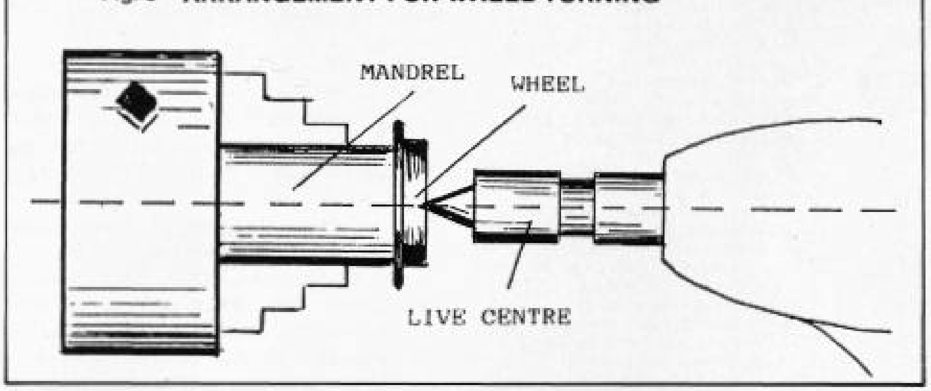
We are going to true the wheels up and turn them to a better profile. In real life, narrow gauge eschewed a common standard magnificently. In model form, this tradition is being upheld. For the serious engineer it seems peculiar that there is no common wheel standard. There is vigorous debate about the subject in the 16mm Society, but that doesn't help us much at this stage! However, I take courage in both hands and offer you Fig. 9. The dimensions shown should give a good all round performance on most narrow gauge tracks.

Check through your wheels and find the one with the thinnest flange - they can and do vary, so check with the micrometer. Mount this wheel in your jig and set the lathe topslide over to 4 degrees. The tool needs to be ground so that it will give a front face to the flange which is at 10 deg. to the vertical. This tool is wound into the work until the face of the flange is cleaned up. Note the reading on the topslide and wind in the tool slowly until the wheel has been profiled.

At this stage the topslide is wound back and the cross-slide handle is not touched. The first wheel is removed from the jig and the next one replaces it, making sure that all four wheels are the same is now just a question of winding in the topslide until we have reached our reading. When all the wheels are done the tip of one flange is skimmed and, without altering the setting of the cross-slide, pull the tool away from the work. Then repeat the procedure for the other wheels. Finally, with a file, just round off the tip of the flange and break the edge of the front face of the wheel. Using a small file for such a light job in a spinning lathe is nearly good engineering practice, but don't tell anyone I said so. For safety's sake ensure that there is a handle on the file, a tang can give a nasty injury.

We are going to need new axles. These are made from 5/32 in. dia. silver steel or precision ground mild steel. Fig. 10 shows that we just file a slight taper on each end and radius the corners off a smidgeon. this will make the axle just the right push fit into the wheels.

Fig. 8 **ARRANGEMENT FOR WHEEL TURNING**



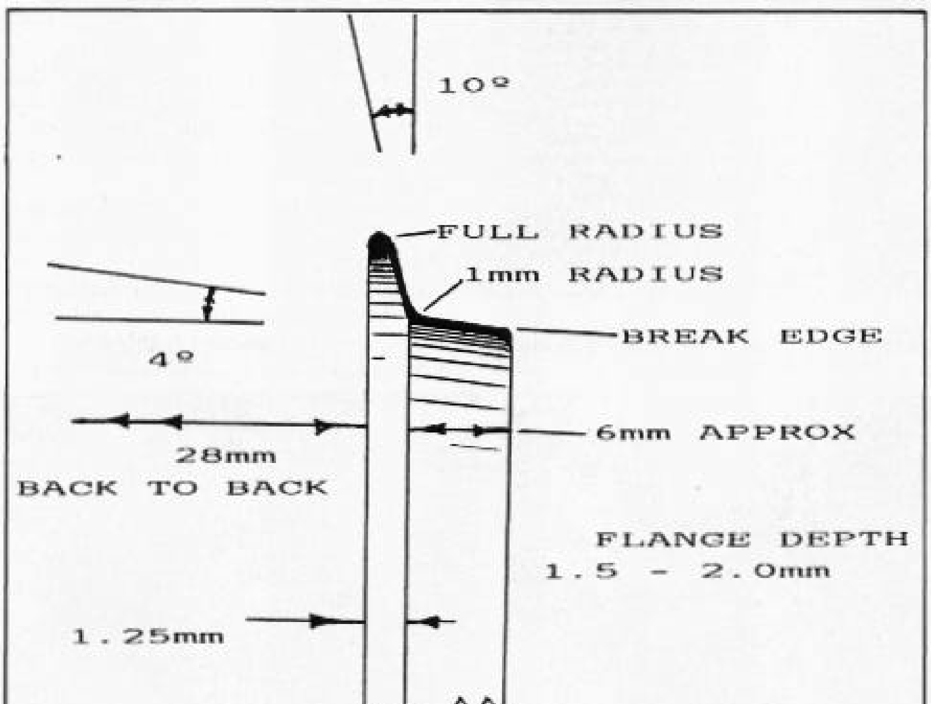


Fig. 9
16mm NARROW GAUGE – SUGGESTED WHEEL STANDARDS

Fig. 10 **AXLES** - 2 off

For a really deluxe job we can drill the ends of the axles about 1/ in. dia. X /16 in. deep. A 1/64 in. hole is drilled radially to meet this hole. By means of an hypodermic syringe the bushes can he lubricated. It is worth keeping this idea tucked away for projects in years to come. See Fig. 11 for details.

OPTIONAL OIL HOLES

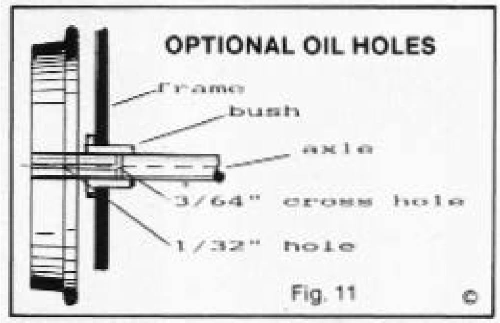


Fig. 11

Next time we will deal with the crankpins and reassembly of the wheelsets.

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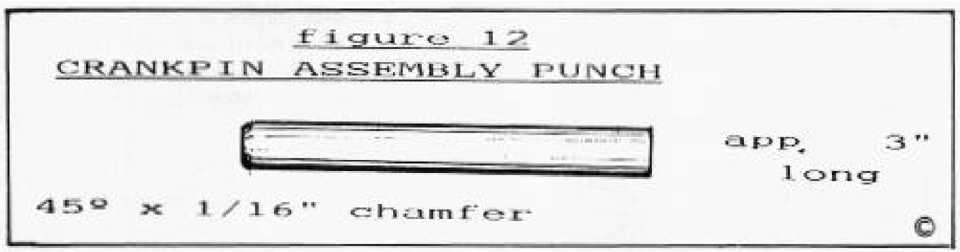
The crankpins, even though they have been tapped out from the wheels, will have belied ends and this will need attending to before we can replace them. Fortunately the 3-jaw chuck seems to have been invented expressly for this purpose. The pin is held in the drill chuck, which is held in the taiistock. This is then brought up until the other end is located in the 3-jaw, now all that is needed is a small tightening of the jaws and the job is done – see Fig. 13.



The pins are a slack fit in the crankpin holes and need securing with Loctite "Nut-lock" or similar. Now, provided that you haven't lost them, the circlips need to be put in place on the crankpins. This is important at this stage; otherwise when you come to rivet the pins in place, the circlip groove may collapse.

A 2.6mm dia. hole is drilled somewhere in our "dismantling jig" (Fig. 1). A little pip of a punch (Fig. 12) gives the first stage of riveting – you will note that the wheel has to be packed out from the jig. The second stage of riveting is to peen the ends out using a more conventional punch. If you wish, you can turn up a punch of such a shape as to do both operations in one go, as shown in Fig. 14.

Remember when you refit the wheels, that those on one axle have *short* crankpins and the other has the *long* ones. Yes, I know it's obvious and you won't need reminding, but.

The wheels are reassembled on the U-shaped cut-out on our jig. The area of the frames adjacent to the axle hole must be supported well and so the work is done at the deepest part of the "U" (Fig. *15).* Also remember that the wheels carrying the long crankpins go at the front end of the frames.

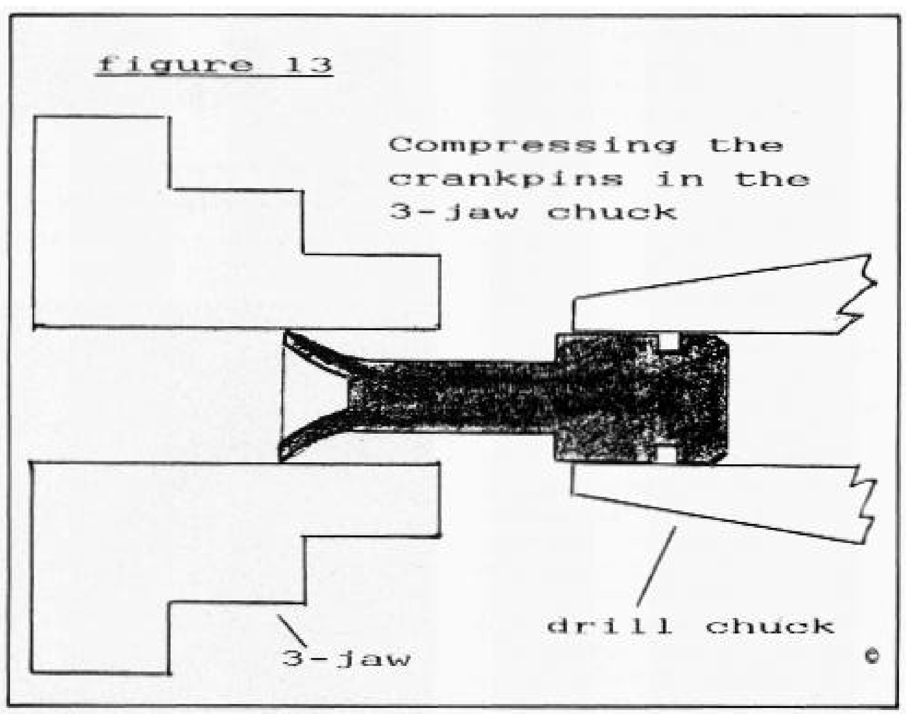
Insert 2 pairs of wheels in one frame and then fit the bushes into place. The bushes are tapped in place with a hammer and a 1/2 in .dia. brass drift, see Fig. 16.

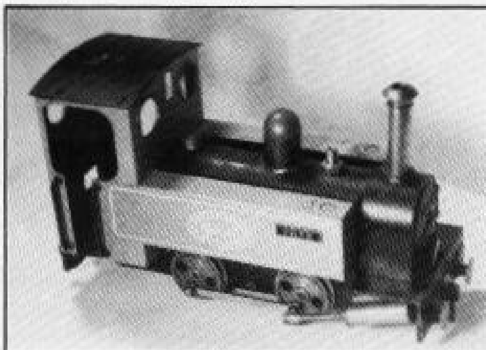
We now have two frames held together rather tentatively by the axles. This needs to be improved on rather promptly and so the middle spacer tube is screwed in place. The chassis is stood on a flat surface and checked for wobble. Rectification at this stage is easy. One of the screws holding the frame spacer is slackened off and slight pressure downwards on the assembly will force the frame square. Without removing the pressure, the screw is tightened up again. If only all model locomotives could he trued up as easily as this.

Crankpin Check at Quartering

Before proceeding further, let's check that we have nothing in the wrong place. The two front wheels have the long crank-pins and one frame isn't upside down relative to the other. Nothing has been said about quartering the wheels until this stage, but now is the time to tackle it. Again, it turns out to be a very simple task. Place the coupling rods and washers on one side only and slip the little circlips into place. Now try to fit those on the other side. Unless "someone up there" thinks very highly of you, they won't fit. Take the trailing axle and rotate the wheels against each other until the crank pins are set at 90 deg. relative to each other. The perfect tools for this job are a couple of circlip pliers, but long nosed pliers will also do. You could make up a couple of little tools yourself. These would simply consist of handles with a couple of pegs a push fit into the body of the tool.

You will find that because you have got the axles a really good tight fit in the wheels, you will just be able to move them, but at the same time, once they are set right, they won't move again on the working locomotive. The front axle is now attended to. With a little trial and error, a position will be found where, once the coupling rod is slipped on, all four wheels revolve without binding. At this stage slip the rest of the fittings onto the crankpin. Could I just remind the reader that whilst

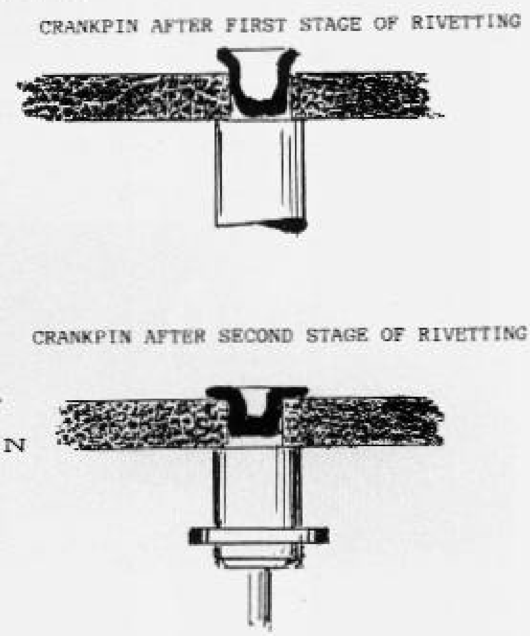




This is the product that you are aiming for, externally not vastly different from the standard version, but the increased performance makes all the hard work worthwhile.

RIVETTING CRANKPIN

figure 14



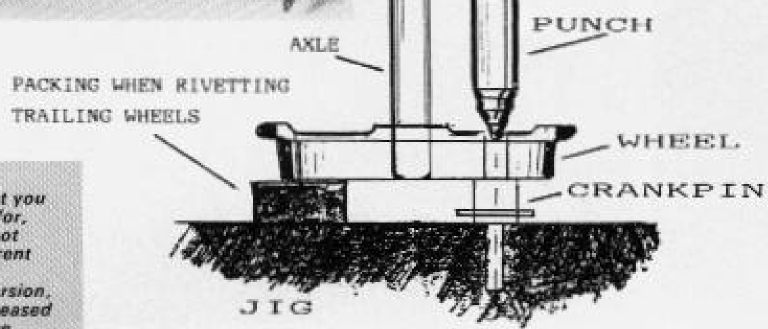


figure 15

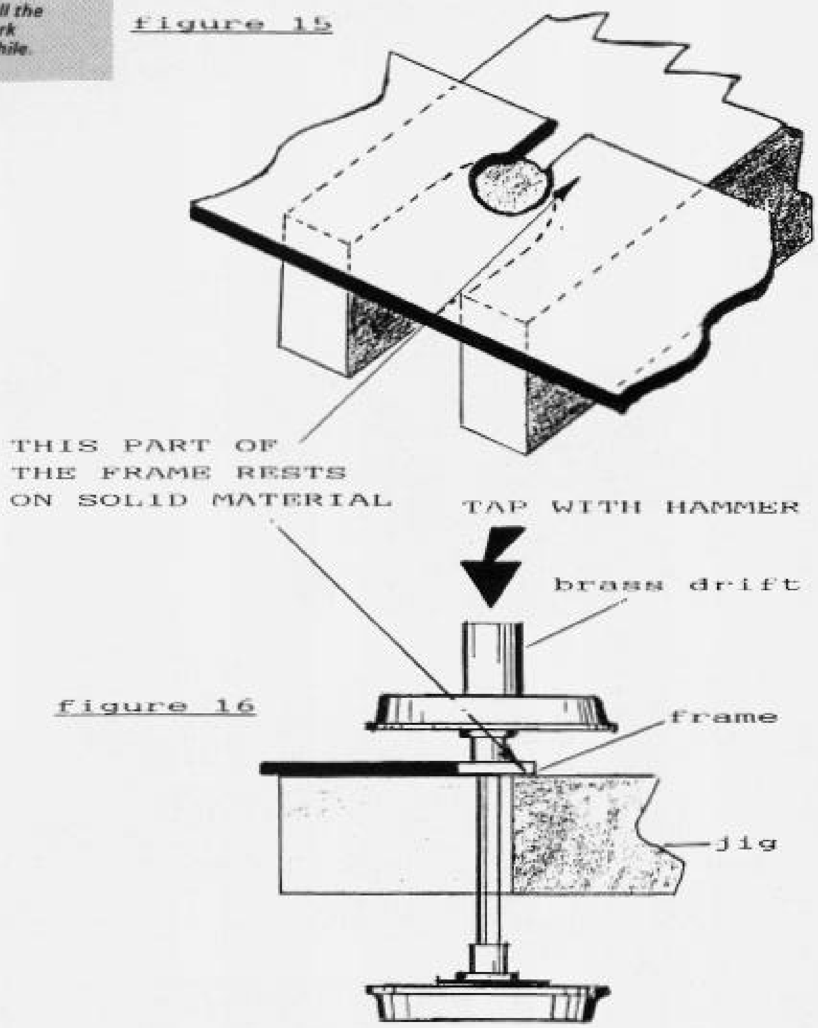


figure 16

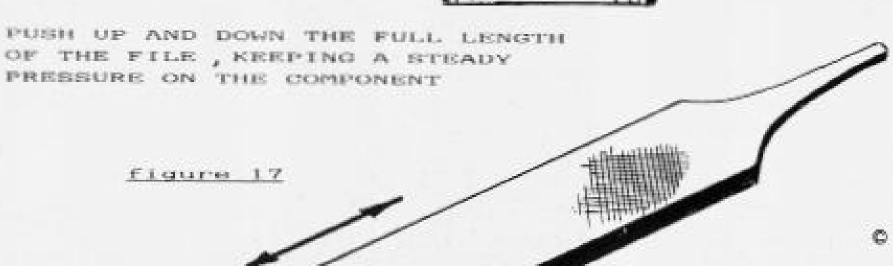


figure 17

quartering should mean that the crankpins on one side should be at exactly 90 deg. to the other, one degree more or less won't make any difference. It is primarily the fact that the angle should be the same on both axles that counts. This work leaves us with a rolling chassis, with coupling rods fitted, that will run up and down a piece of track "nice and sweetly".

Truing-up the Reversing Block

Let us now turn our attention to the reversing block. As supplied, it is anything but flat and will usually spill steam at an alarming rate. To true this up a surface plate is the ideal tool, but failing that a 10 in. smooth hand file will do the needful job quite nicely. Lay the file down and work the face of the two components up at down with a steady pressure (Fig. 17). This is a traditional method used by brass finishers and gives a good finish in its own right. Keep inspecting the job. What you are looking for is the surface covered entirely with the fine scratch marks. When this is achieved, the face is true, although still rough. Glue or tape a piece of 880 grade wet and dry paper to a flat surface, again it can be a piece of glass. The paper could be taped to a drilling machine table if one is available. Actually, white Melamine faced Contiboard gives a nice true surface provided that it lays flat on a bench. I usually keep an offcut handy with a couple of self-adhesive sanding discs stick down. This, combined with fine wet and dry, makes a very useful tool in the workshop.

To clean up the scratches on the faces, just work the job up and down on the abrasive paper (rather than the usually suggested figure of eight motion). Once more, keep inspecting the job. Once the last of the scratches has disappeared, the job is done

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Part IV, from page 293

In this part, the Author gets to the heart of the problem, by modifying the valve and cylinders.

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Before going further. there is a small modification to he done to the valve itself in Figs. I8 and 19. You will see the two semi-circular channels have rounded ends. We want to extend these into points. There is no need for any precise machining here as we are not working to an exact dimension. The only thing to hear in mind is that we should only extend the openings by about 1/16 in. or so. The best tool for the job is a penknife. This carves the shape nicely and we could finish off with a small oval file.

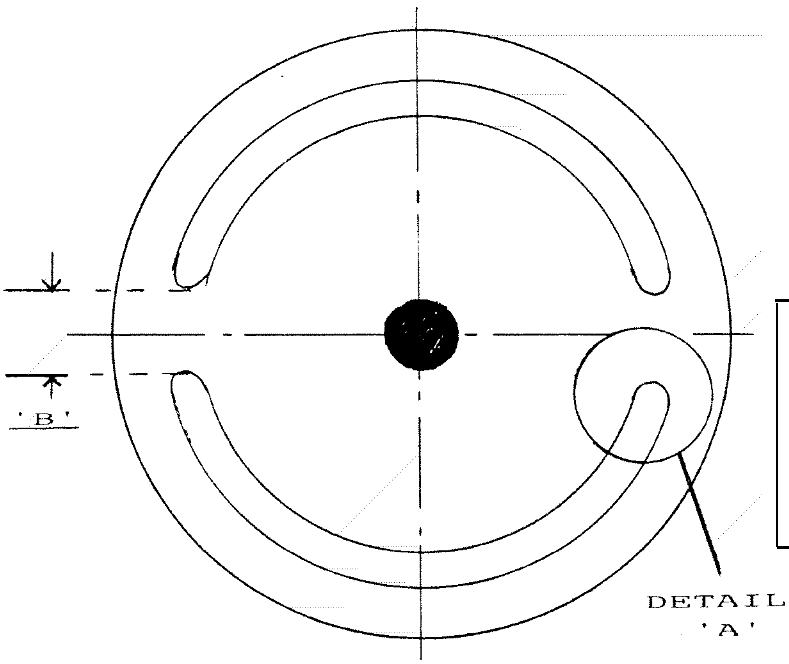
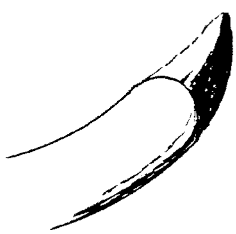


Fig. 18
VALVE AS PRODUCED BY MAMOD

(Note that dimension "B" should be 1/64 in. greater than the diameter of the hole on the valve block. Check with job).

Fig. 19



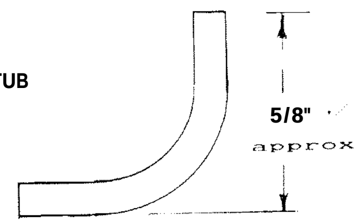
RUN OUT THE SEMICIRCULAR INTO A POINT

The purpose of this job is to give a less sharp entrance to the channel as the valve rotates. This will give us a slightly more sensitive throttle opening. Touch the face of the valve on the wet and dry to remove any slight protrusions we might have thrown up whilst hacking away.

As made, the Mamod valve lifts off at 12-15lb./sq. inch. If we want to upratc the boiler pressure, we will need to improve on the reversing valve springing. To do this run a 5 BA die down the valve bolt. It runs down for a distance equivalent of the thickness of the die. and so is easily measured as we cut threads. Assemblc the valve dry in order to hcd the two components together. Finally. peen over the end of the bolt and then screw backwards until it jams on the valve.

The exhaust system is modified by cutting the pipe back to a stub 5/8 in. long, see Fig. 20. Slip a piece of silicone tube over this. The top should come just below the top of the chimney. The effect of this small modification is to give us a nicer show of steam from the chimney and less condensate dribbling down onto the track.

Fig. 20
EXHAUST STUB



With that slightly cosmetic job done, we now turn to the heart of the project - the cylinders. Engineering miracles are not called for, but we will want to take our time here. It would be useful. perhaps, to list the various faults - some or all of which may be present:

Lack of flatness on the valve face.

Oversize pivot pinhole which causes heavy knocking.

Valve ports which cut off steam before the engine has reached the top of the stroke, and don't open to steam until the piston is well past top dead centre. This last is usually the main reason for poor performance. Indeed, if it weren't for steam leakage past the piston and valve faces, the locomotive would barely run at all.

We start the job by putting a stub of 3/4 in. dia. bar in the vice. We want a 6mm dia. pin punch next (again, a nice little turning job), We strike the punch down into the

Fig. 21

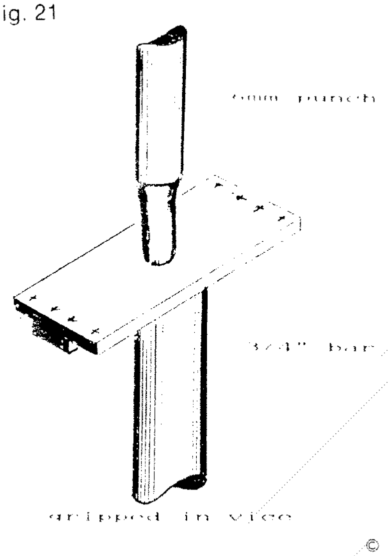


Fig. 24

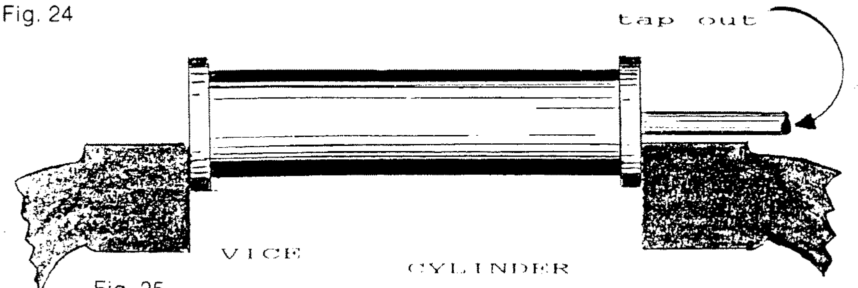
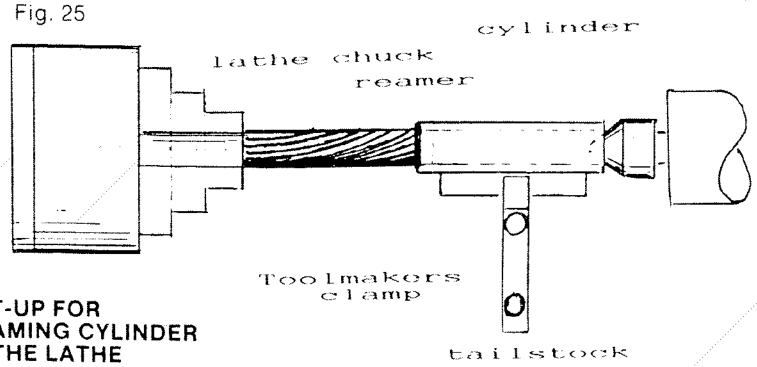


Fig. 25



SET-UP FOR REAMING CYLINDER IN THE LATHE

spring recess. This closes up the hole slightly, until a ⅛ in. dia. reamer will not pass through. This treatment may distort the block slightly. This is soon taught "good manners" with a couple of taps of a hammer, with the block on an anvil, using a piece of steel twixt hammer and block as shown in Fig. 21. Check for flatness against a straight edge.

Drill out the four ports to $^{3}/_{32}$ in. diameter. File away the centre portion of the face by about 0.010 inch. This will leave two raised "lands" or faces, each having two ports drilled in them. The centre hole is now reamed ⅛ in., Fig. 22. It is now necessary to make both portions of the cylinder unit flat, and this is done exactly in the same way as we tackled the two components of the valve – using a fixed file and then the wet and dry. But there is no need to lap the gasket face smooth, the slight file marks will give the gasket something to bite into.

Fig. 26

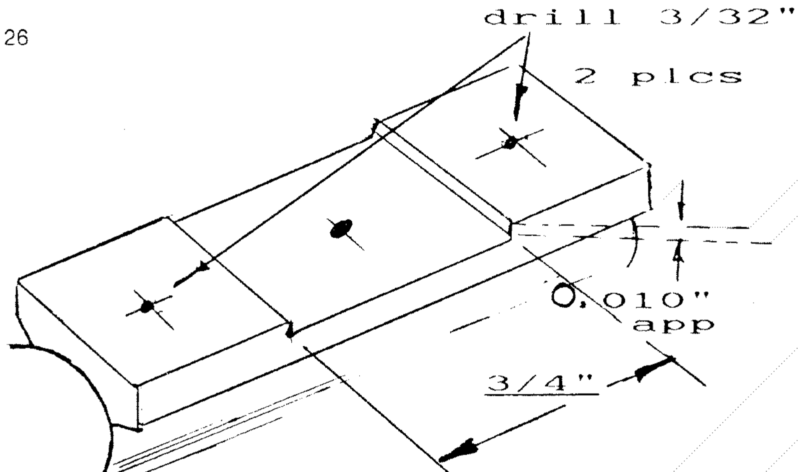


Fig. 22

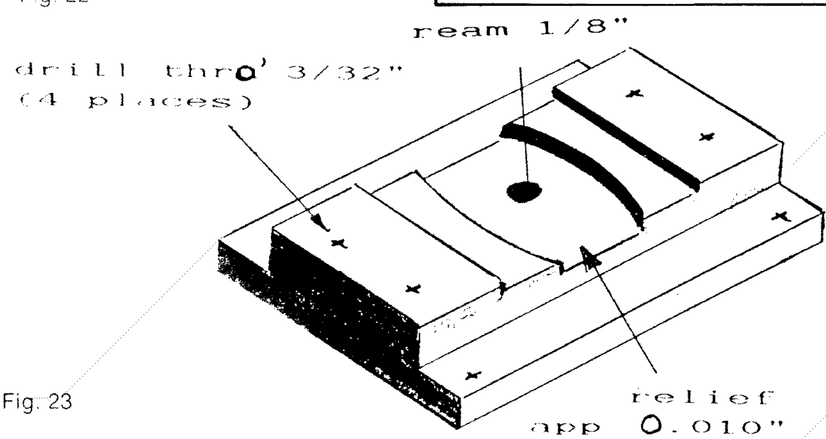
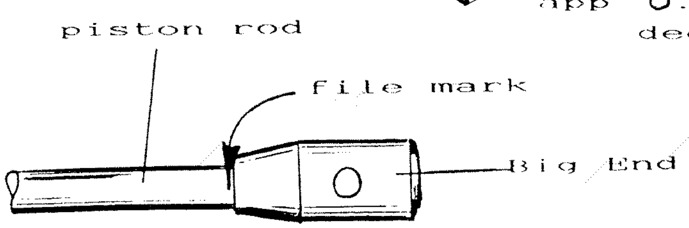


Fig. 23



To start work on the cylinders themselves, we first have to look at where the big end screws into the piston rod. Make a mark on the piston rod so that the big end can be pushed back home accurately, later on. The big end is only a push fit and to remove it, the exposed portion of the piston rod is gripped in the vice, whilst the big end is gently twisted off with a tommy bar through the crankpin hole.

Grip the cylinder in the vice, as shown in Fig. 24. Gently tap the piston rod and this will knock out the front cylinder cover. You can now tap the piston back down the cylinder, using a drift, and knock out the back cover. Drill the ports out to $^{3}/_{32}$ in. diameter. There is no need to drill right through, about $^{1}/_{16}$ in. is all we need. Finally, file a 10 thou relief as shown in Fig. 26 and then lap the two lands smooth, as before. Run a 10mm reamer through the bore – as in Fig. 25 to improve the finish and as a check on a parallelism.

To be continued.

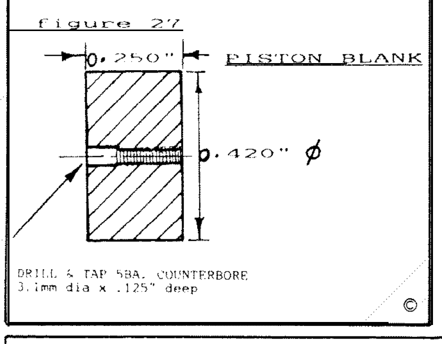
RE-ENGINEERING THE MAMOD LOCOMOTIVE

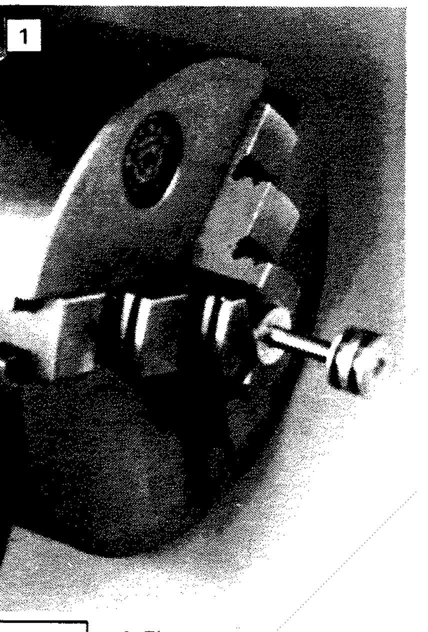
Part V, from page 437

Peter Jones describes how to upgrade this popular mass-produced locomotive

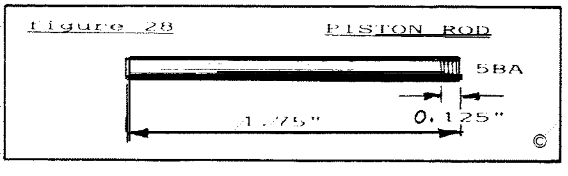
In this part of the series, Peter describes how to refurbish the cylinder units on the Mamod locomotive, by making most items afresh on the lathe.

We will make a new piston and piston rod. These will be screwed together and not allowed to 'float' as per the original Mamod system. Various materials have been tried for the piston - bronze, aluminium, PTFE. etc. but given the circumstances of very light loading and irregular lubrication, brass has proved itself to be the best.





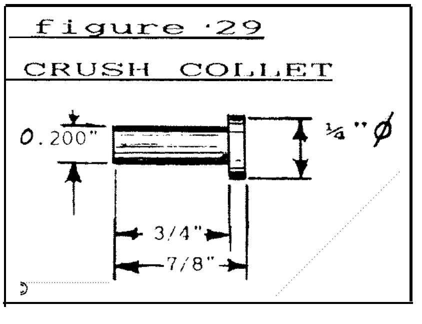
1: *The piston, mounted on its rod held in the "crush collet" in the three jaw chuck.*



Making New Pistons and Rods

Fig. 27 shows the dimensions of the piston blank. After turning a 1/4 in. length of brass rod to 0.420 in. dia., it is drilled and tapped 5BA. This is then counterbored 3.1 mm dia. X 0.125 in. deep. All of this is done without disturbing the job in the chuck. The piston rod is made from 1/8 in. dia. ground stainless steel. The 5BA thread needs to be cut accurately using the tail-stock dieholder. and is 1/8 in. long, see Fig. 28. The piston rod is now screwed tightly into the piston.

The next job has to be done accurately. This is to turn the piston true to an exact diameter. This time the 3-jaw just isn't good enough. But, inevitably, there is an easy way out .We will make a little device which has been around since Noah turned up the thrust bearings for the Ark. My pet name for it is a crush collet and it goes something like this:- Fig. 29 gives the dimensions of a simple shouldered shape made from 1/4 in. dia. brass bar. make a centre pop opposite number 1 jaw of the 3-jaw. Face the end across and then drill and ream 1/8 in. dia. through it. This little device will now crush under a tightening chuck and grip the piston rod on an accurate centre. The piston rod is pushed in and gripped with the piston just about 1/8 in. clear from the chuck jaws. With a well sharpened knife tool. turn the piston down to 0.394 in. diameter. Pull back the tool-post and, without disturbing the piston, offer up the cylinder. It should just fit and no more, it is all to do with the feel of the thing really. The best description I can give is that it should push on with light hand pressure, but without a trace of wobble. If it falls in it is too slack and you will have to make another. Time and material arc cheap enough to us. but without apology I repeat the dictum that when turning metal, it is easy to take it off but much harder to glue it back on! The fit we are looking for is called a sliding fit. The piston is turned finally to a length of 6mm. Repeat this job with the second cylinder. Note that the packing groove is NOT turned at this stage. The piston rod is now gripped in the chuck by only a few millimetres; the rest of the rod and the piston is standing right out in the fresh air. Apply a little oil to the piston and then take a cylinder and work it backwards and forwards on the piston. After only a few minutes of this you should have a beautiful fit of components - a really silky feel in fact.

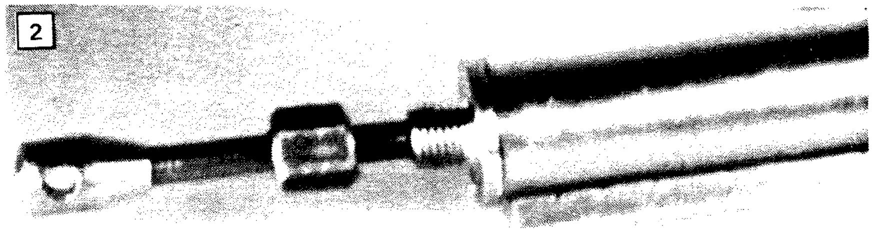


Rechuck the piston rod deep in the bush and turn a groove away. This calls for a parting tool ground to a width of 0.050 in. wide. A groove is turned to a depth of 0.047 inches. Don't forget that this counts double when turning a bar and, in fact, the diameter of the grooved portion will now be twice 0.047 in., i.e. 0.094 in. less than the diameter of the piston.

Piston Groove Packing

The groove is packed with 1/16 in. round graphited yarn. (Which can sometimes be obtained by unravelling a larger section twist) Packing a piston is easy, provided that you go about it the right way. The aim is to get what looks like a continuous diameter of piston with the packing exactly flush with the outer brass portions. At the same time the groove must be comfortably packed full. The trick is to wind the packing around the groove until it just stands proud of the piston diameter. You then take a flat piece of steel and roll the piston with it on to a flat clean metal assembly like the lathe bed or the drilling table. This rolling process tends to cut off any surplus, but an overpacked groove might need a touch of excess cut off and then try rolling it again. Once you have packed your first piston this way, you will wonder what all the fuss was about and You are set up for life in this department.

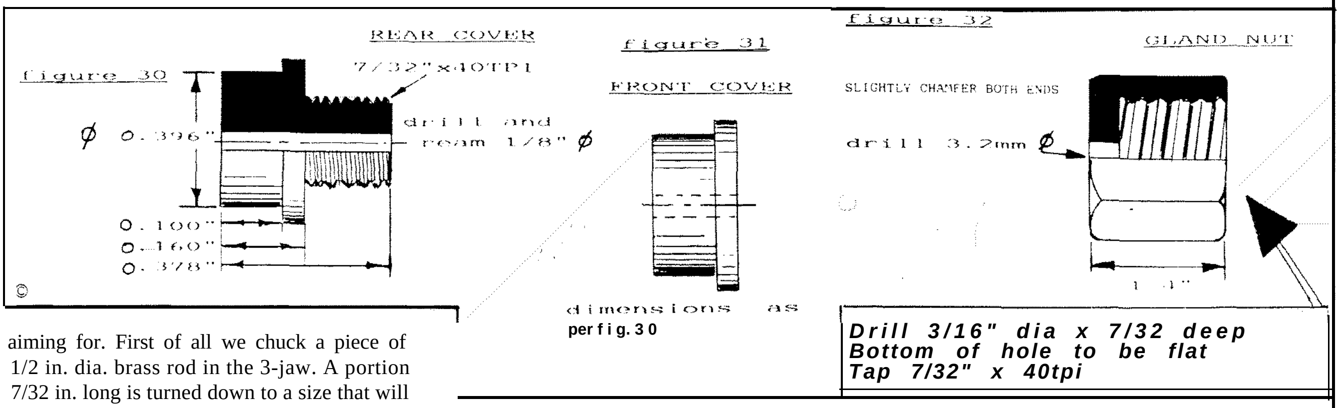
Should the packing still be slightly fat. provided that it is well rolled, pushing it into a cylinder may well shave off the excess anyway. Once more we need to work the cylinder up and down on the piston until it feels right. This technique virtualIy guarantees perfect running, without leakage. '0' rings may be the becs-knees these days but everyone should bc able to pack a gland or cylinder.



2: A re- worked piston and cylinder. seen here partiaiiy re-assembled.

Replacement Cylinder Covers

It is necessary to make the new rear cylindcr covers.complete with glands. These have to be accurately turned. but if you work through the job **in** the right order, it becomes very difficult to get it wrong! Fig. 30 shows just what we arc aiming for. First of all we chuck a piece of 1/2 in. dia. brass rod in the 3-jaw. A portion 7/32 in. long is turned down to a size that will let us cut a 7/32,in. dia. thread thereon. Centre and drill a hole 3mm dia.. 7/16 in. deep. then open up the hole to 1/8 in. dia. using a machine reamer. Turn that portion mcntioncd above 7/32 in. x 4OTPI (M.E. thread). Turn the cylinder register to 0.396 in. dia. using a parting tool. Now part off the job, leaving that register 0.100 in. long. As you are parting off, just break the sharp edge to allow for an easy entry for the register into the cylinder.

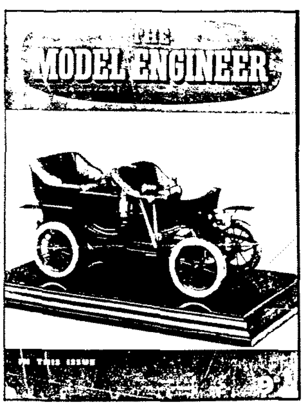


After making the back covers, the front ones are a 'doddle', and are made as per Fig. 31.

The final component in this section is the gland nut, set Fig. 32. This is made from 1/4 in. A/F hex brass. This is put in the 3-jaw and drilled 3/16 in. dia. x 7/32 in. deep. The bottom of the hole is flat and this will call for a simple reamer/broach. This can be commercial or home brewed. The internal thread is, of course, 7/32 in. x 40 TPI and you will need a second tap that wil1 run a thread down to the bottom. A hole 3.2mm dia. is drilled through the 'end wall' and a very small chamfer is put on both its ends. Job done!

To be continued

CAN YOU HELP?



1 I wonder if you can help me? I am trying to locate the Lea Francis car model shown on the cover of the *Model Engineer* dated 12 March 1953.

This model was built by the motor industry Jubilee Exhibition of 1946. Maybe you could provide me with some leads. I know it may by now be rather impossible.

I am a life-long Lea Francis enthusiast. I have 3 vintage Lea Francis cars, two 1929 "P" type 12/40 h.p. and a 1932 "P" 12/40 so you see. I would be happy to see or even purchase this, or a similar model, of this the first Lea Francis and incidentally, it was also the prototype first Singer car. So full size car exists as far as is known. only an engine. The cam rods are over 3 ft. long!

G. *Jolley*
Nr. Sunderland. Tyne & Wear

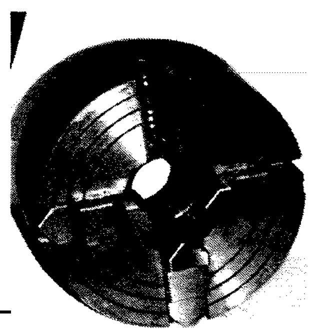
2 Can anyone assist me with the address of an agent for a lathe chuck which I have.

The chuck is made in India and has no other information than the name Guru.

As I was given the chuck as a present when I retired and the person has since died. I have no idea where he obtained it.

I would be most grateful if anyone could give me any information.

G. *E. Matthews*
Inverurie. Aberdeenshire



3 I recently purchased, second hand, a Pryor Interchangeablc Steel Type Letter and Number Set. On checking the set. I find that some of the interchangeable letters and numbers are missing. 1 would very much like to purchase the missing Items. but I cannot get in touch with the manufacturer.

The makers name. Edward Pryor & Son Ltd. of Sheffield, is in the box, together with a telephone number. but the telephone Iine is dead and there is no one at the address.

I wonder if you could tell me if it is possiblc for me to replace my missing items from anywhere and does the Pryor firm still exist?

R. W. Bell
Underwood, Notts

RE-ENGINEERING THE MAMOD LOCOMOTIVE

So far in this series the Author has covered modifications to the frames, wheels, crankpins and cylinders on this little locomotive. This time we move on to deal with gland packing, final work on the cylinders and finally the safety valve.

Would-be builders are reminded that a major supplier of Mamod products are Messrs. Kittle Hobby, 24 Penard Road, Kittle, Gower, West Glamorgan, SA3 3JF.

Peter Jones describes how to upgrade this popular mass-produced locomotive

(Part VI (conciusion), from page 551

The piston rods now have to be turned off to length to match the old ones. But before the latter are consigned to the useful scrap box transfer those little marks. which Indicate the position of the big ends. to the new ones. Press the rear cylinder covers in place. Try the piston and rot for fit. It should move silkily up and down. Press rhc front covers on. If you have got the dimensions right. these covers should be a tight enough fit to withstand cylindcr pressure without any further assistance. Should you get one that blows out then Loctite should retain them. The new Loctite *454* is particularly good as it is less pernickety about virtually sterile joint preparation. If you don't want to trust to an adhesive which might fail when overheated, a taste of soft solder will do the trick.

The gland is packed next. A piece of graphited yarn is wrapped round the piston rod *4* or 5 times. the excess cut off and then the gland nut is screwed up. If you are going to make a mistake, it will inevitably be in screwing the thing up too tight and draining away the powcr of the locomotive. Be it a Mamod or a 4 ft. 8-1/2 in. gauge Pacific. glands should he just tight enough not to blow and no more. It happens that. in the case of the latter large engine there is a lot more power available to overcome the friction of a tight gland.

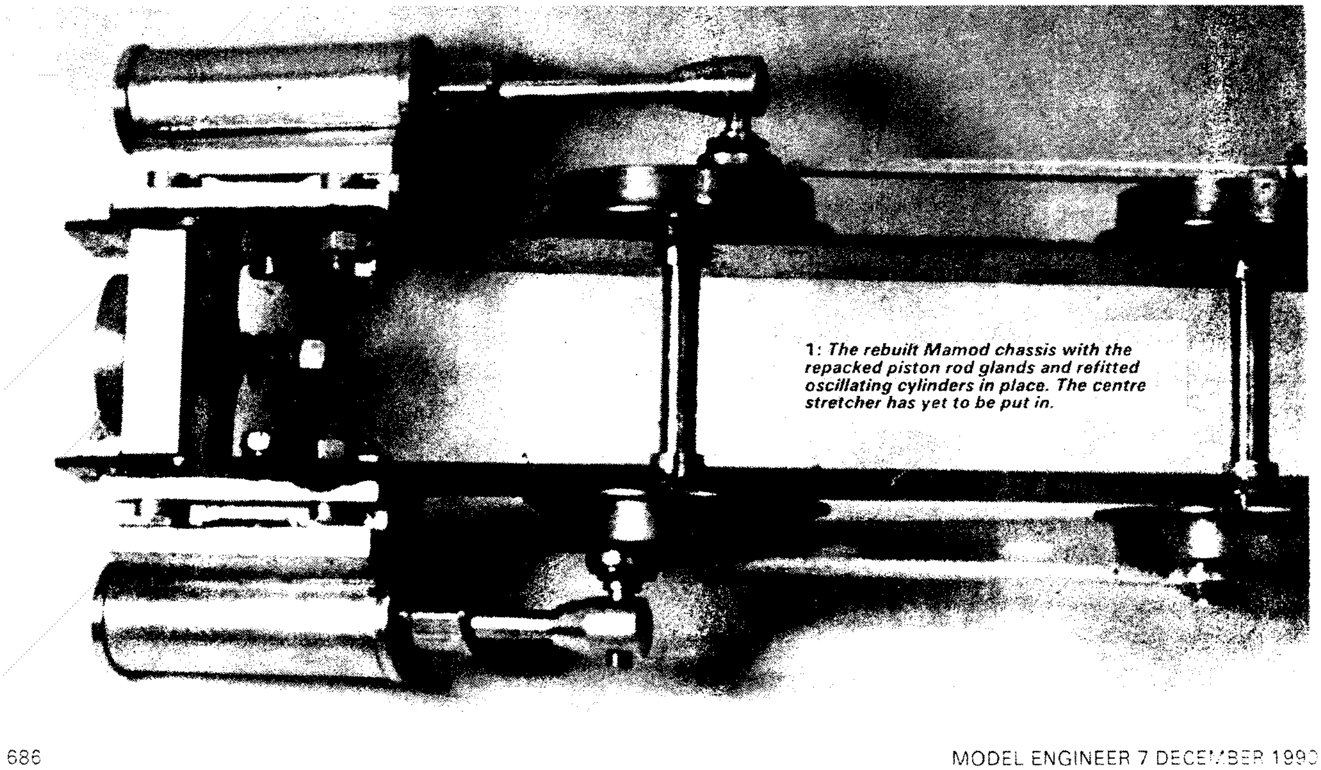
The cylinder pivot pins now need to be shortened so that the cylinders when the spring is fully compressed do not lift more than 1/64 in. from the face. For once. this is a trial and error process. Start by putting two more threads (5BA) on the pin. Then file off the end of the pin so that three threads remain. Try this out. If it is still too loose. cut another thread and file one off the end of the pin. On no account overtighten the thread. Not only can we not spare the power to overcome the tightness, but it is possiblc to cause distortion.

Finally Assemble

We now come to final asscmbly. Place a gasket between the cylinder port face and the mainframe and secure the assembly in place with a couple of screws. nuts lightly tightened. Smear the sides of the valve block with silicon sealant (sold as bath sealant) making sure that the steam passageways are clear. Insert the four securing screws. Note that. during assembly. the big ends need to be placed on the crankpins. Because we now work to tighter tolerances. we can no longer simply "spring" the big ends in place.

If possible. try a steam test here. Something like a Mamod stationary boiler will do – particularly if it has been fitted for a higher pressure of around 20psi (see conclusion). The engine will probably turn over quite slowly at first - expect it to be a bit stiff. But after 1-1/2 - 2 hours running it will be as sweet as the proverbial nut. During this running-in period put plenty of oil everywhere: oil is cheap. cylinders aren't.

This completes the engineering of the chassis and the rest of the locomotive can be assembled. But to do justice to our work. there are some improvements to be made in other departments. Messrs Mamod are obliged to use solid fuel pellets as a fuel. A spirit burner gives a better heat throughout its burn (whereas the pellets



1: The rebuilt Mamod chassis with the repacked piston rod glands and refitted oscillating cylinders in place. The centre stretcher has yet to be put in.

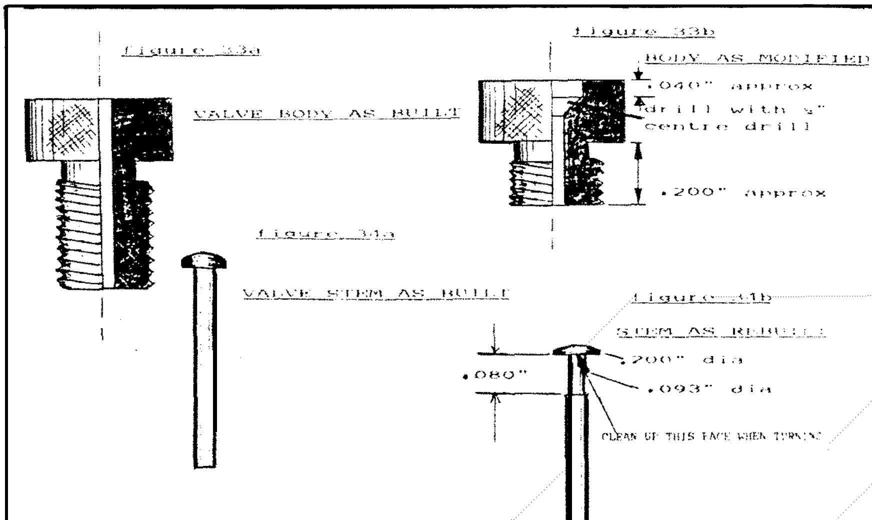
drop in cfficicncy as they burn through). If this is combined with a Goodall Valve a loco can be kept in steam permanently. For lubrication the simplest method is to get hold of a really thick steam oil. *(Many of our advertisers sell this in small tins - Ed.).* A couple of drops of this are placed on the cylinder/portface joint. As the engine gets hot the oil thins and runs down onto the faces. It is not aesthetically pleasing but it works. Obviously a proper lubricator would be a better solution.

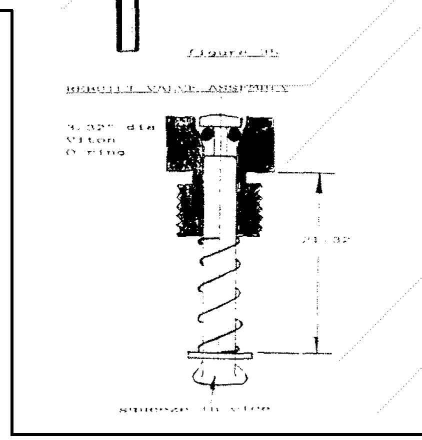
Revised Safety Valve

One last job that we can tackle easily is to uprate the safety valve. The thought of this can send cold shudders through an experienced engineer, but in this case we are quite safe. Replacement safety valves are available commercially but it is quite easy to do it ourselves. Mamod themselves. quite rightly. say that they do not hold themselves responsible for any engine that has been altered -particularly in regards to fuel and boiler pressure. They are in the business of supplying the children's market amid some tight safety regulations.

The modification to the safety valve will uprate it to blow off at about 20 psi which will make the steam exhaust upwards. rather than sideways. The valve is dismantled by sawing off the valve stem just above the crimping. This is another of those glorious opportunities for components to fly off into oblivion: in this case the spring and the washer. Put the body of the valve into the 3-jaw, bottom outwards. and shorten the threaded portion to 0.200 inch.

Put a scrap of brass in the chuck, drill and tap 1/4 in. BSF in the centre. Now screw the body into the tapped hole. You will now need a 1/4 in. dia. centre drill. This is used to drill into the top of the valve body. You will need to go in just far enough to give a short parallel opening which is 0.040 in. deep. The shape of the centre drill will take care of the rest of tht hole (see Fig. 33). Run the lathe at about 200rpm when drilling this hole. and enter the drill gently, It is essential that there are no chatter





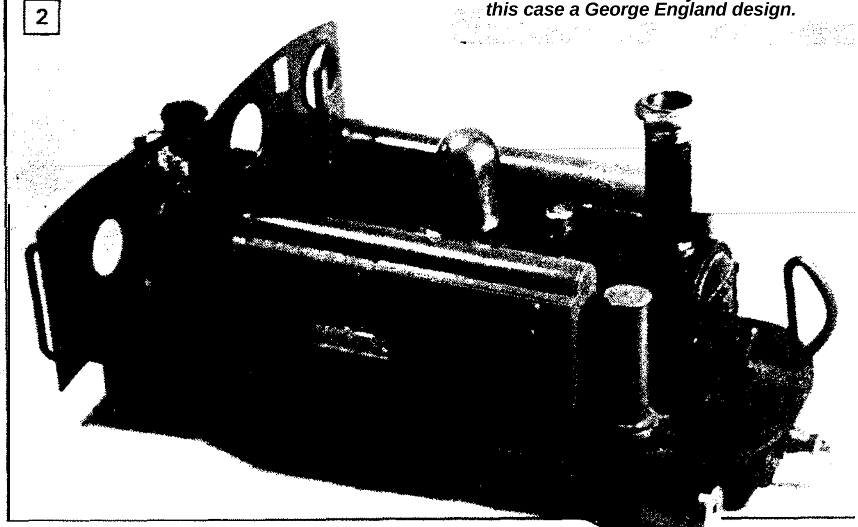
marks on the newIy cut surface. The stem is now modified as per figure 34. It is a simple turning job and calls for no comment.

The valve is reassembled using a 3/32 in. dia. "O" ring - this must be in Viton or similar to withstand the heat. Using the existing spring and washer. as Fig. 35, you will now have around the 20 psi in the boiler before the valve lifts. this will uprate the available power quite considerably.

Conclusion

The engineering is now complete. It may well be that you can think of various further improvements. But those we have tackled in these notes will give you a model improved out of all recognition in performance.

The newcomer will have realised by now that accurate machining onIy calls for doing things in the right order. and taking time to do each job steadily Medals are not awarded for speed: mode1 engineering is a gentle occupation. you soon get into the swing of it. If you have managed to do the jobs described in these pages. there is no limit to what you can build: it is just a case of tackling things one step at a time.



2

2: With driver on the footplate. the attractively styled narrow gauge 16mm locomotive Albert ready for the track. In this case a George England design.

As well as the many home-made improvements that can be made on the Mamod steam locomotive, it is useful to be aware of the many commercial products to be had; such as the Goodall Valve which replaces the whistle and allows a boiler to be refilled under pressure, using a disposable syringe.

Several small firms produce replacement safety valves of increased pressure. Likewise replacement spirit or gas burners are available. Lubricators and regulators are also available. Messrs Kenversion produce a range of cosmetic improvements - including complete drop on fabricated bodies which look very well indeed. Information is available via the 16mm Association. details below.

A combination of some of the above components and a re-engineered chassis will turn a toy with mediocre performance into an attractive looking model which will haul a steady load all day. Perhaps mention should be made too of the bolt-on radio control outfits available.

Anyone taking an interest in Mamods wouid be well advised to join the 16mm Association. This splendid organization teems with upgraded and rebuilt Mamod locomotives. At the AGM there is a section of the modelling competition devoted to them For mcmbership details contact

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ST19 Great Britain. 8