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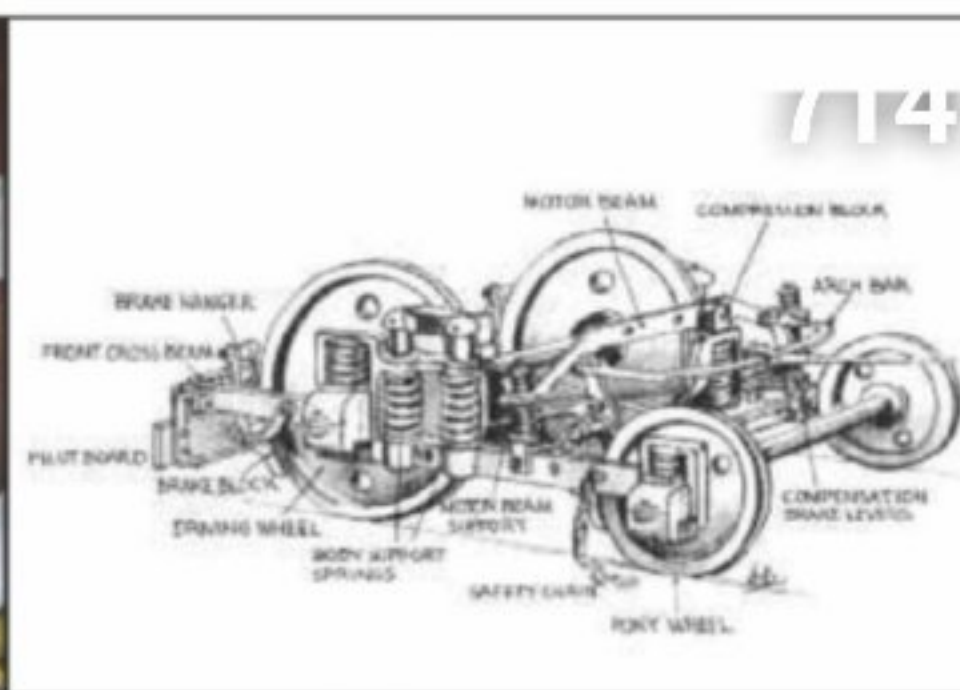
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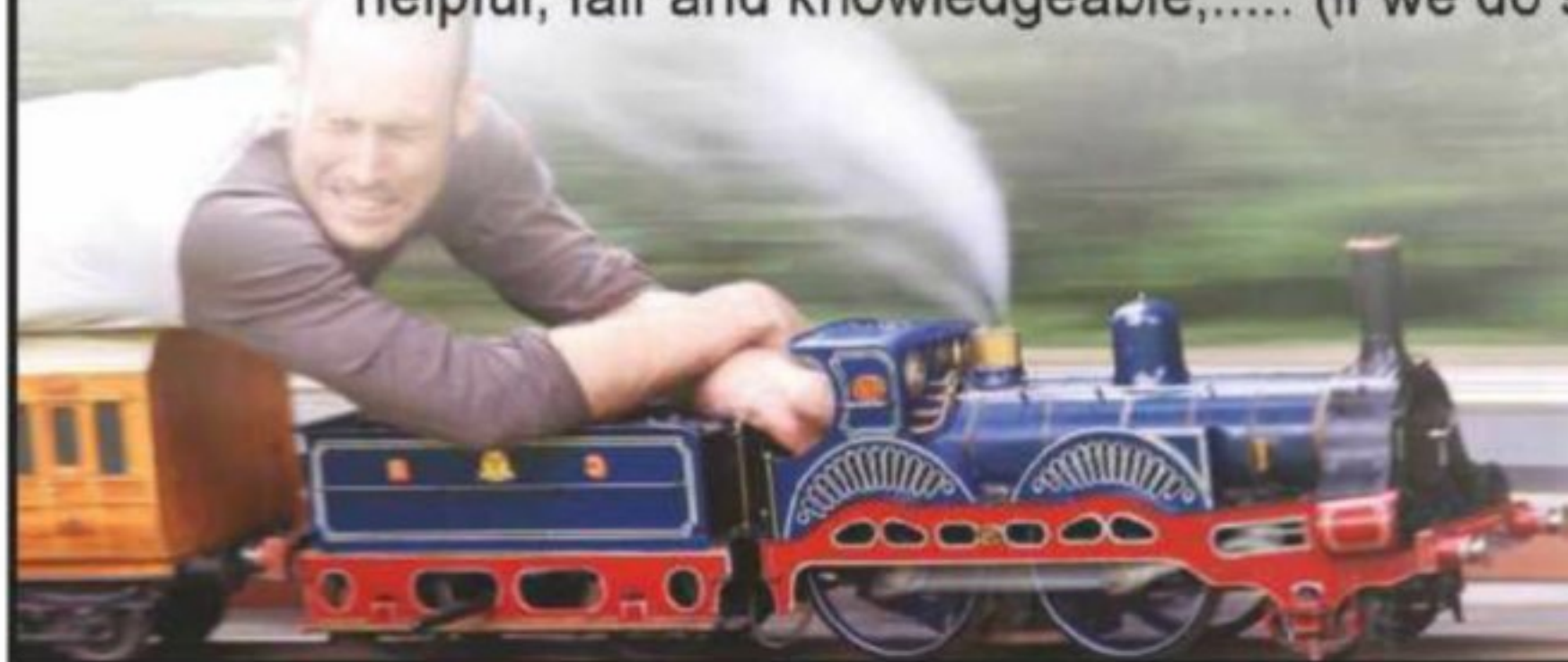
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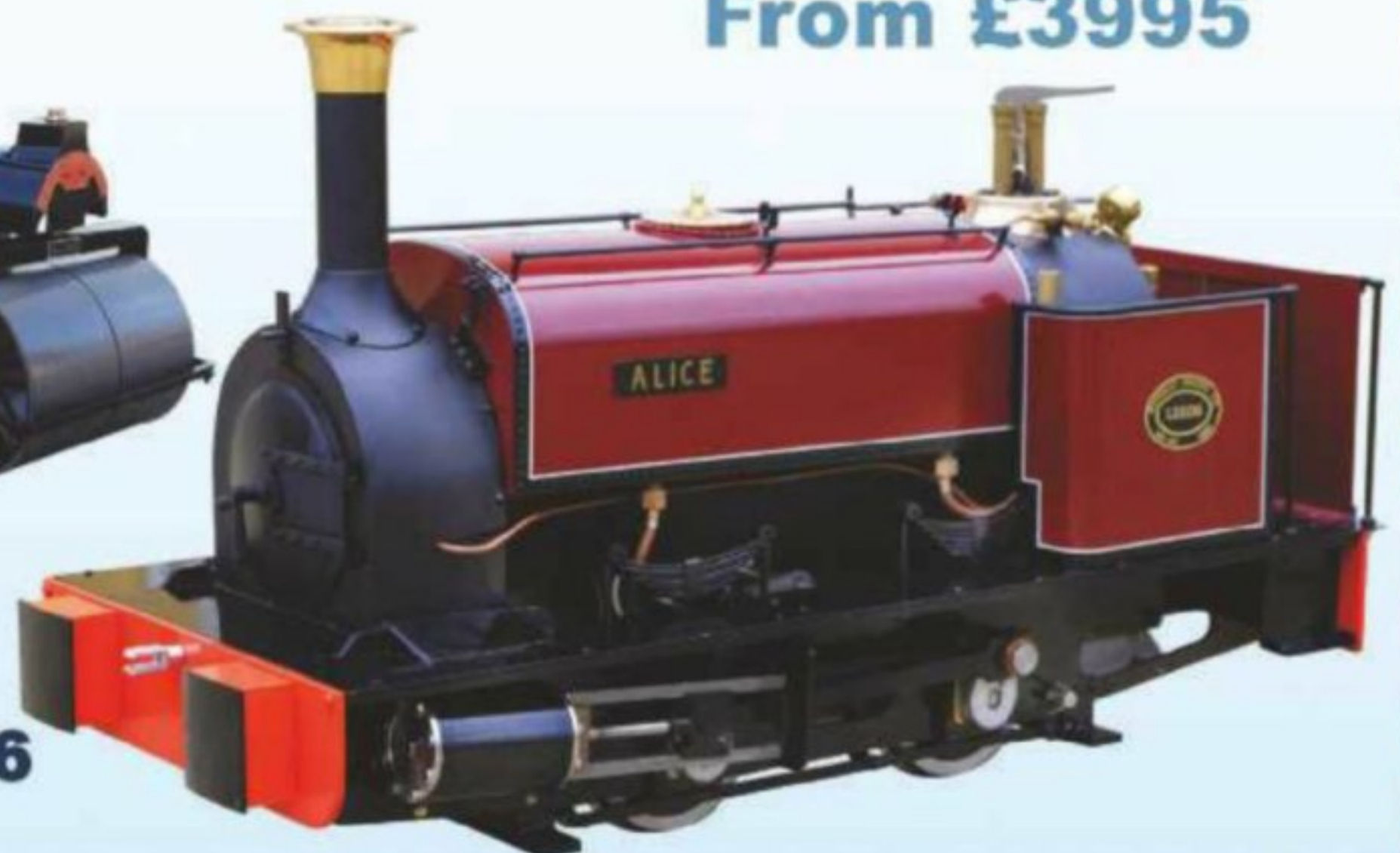
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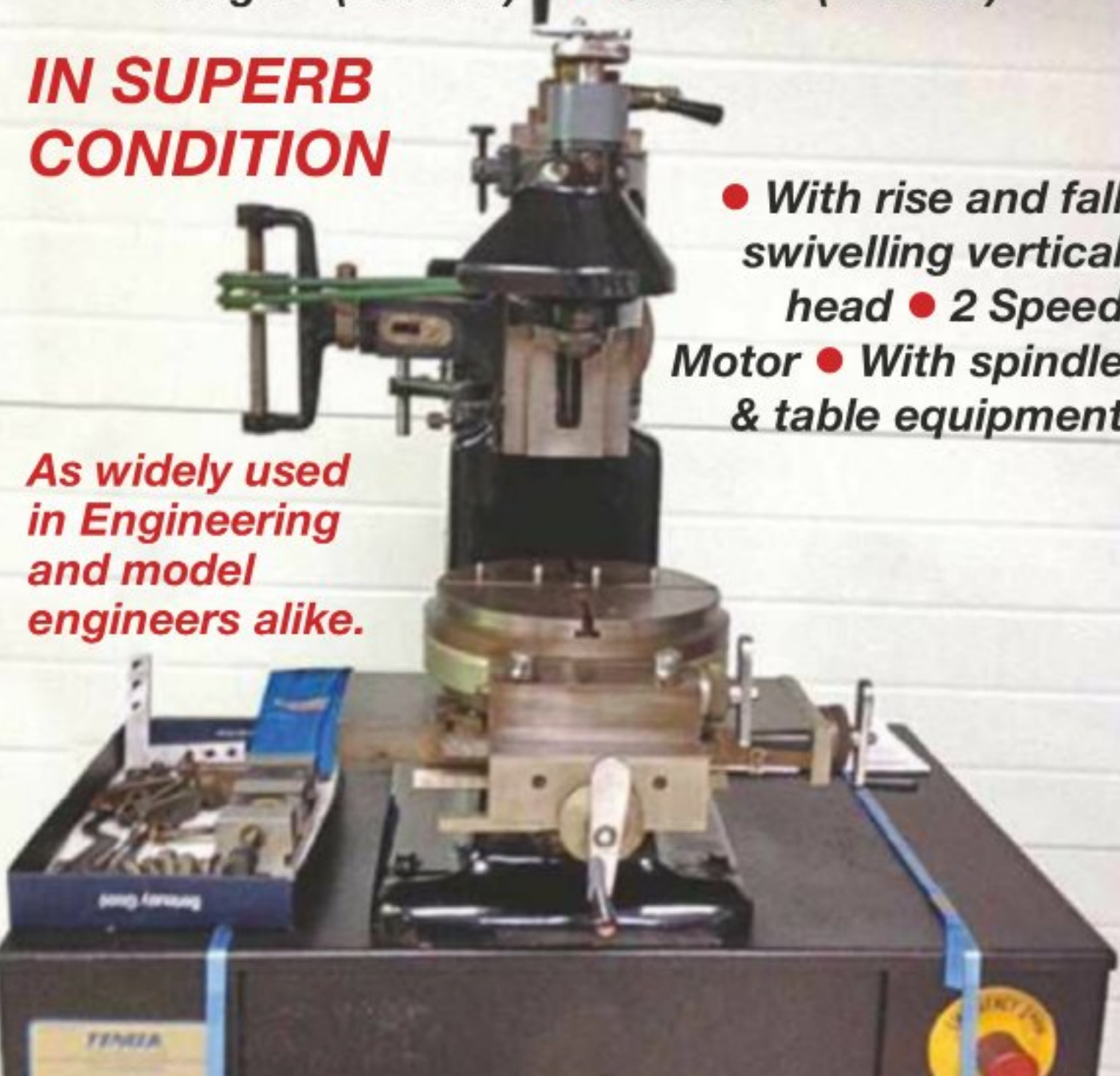
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LOWMEX and MMEX

As I write this I have just returned from the Midlands exhibition at Leamington Spa ('MMEX'), followed by the Lowestoft exhibition ('LOWMEX') – so quite a busy weekend!

Both were excellent exhibitions and I would recommend that you add both to your diaries for next year. The Midlands exhibition was well attended on the days I was there (Friday and Saturday) and there were a number of interesting items on display. For me, perhaps the most unusual was the 'violin automaton', made by John Moorhouse, a familiar contributor to this magazine. This *objet d'art* sits at the point perhaps where jewellery and model engineering meet. The enamelled violin, beautifully made, opens up to reveal two tiny birds, who sit up and begin to sing. What they are singing about, I have no idea, but the truly remarkable thing is that they sing at all! John will be writing about the construction of this automaton in our next issue.

LOWMEX was its usual quirky and very varied self. I decided I had to visit after reading Julie Williams' account of the show in *Model Engineer* a couple of years ago. So I went last year and enjoyed it so much that I went again this year. Even for a Suffolk lad

like me, Lowestoft was a bit of a long trek (East Anglia is a big place!) but well worth the effort. If you live 'Out East' I would certainly commend next year's exhibition to you. Julie will be reporting on the show, hopefully in the next issue.

Health and Safety

Many of you will have followed with interest the 'mini-series' on building a soldering iron timer, by Les Kerr.

Being a microprocessor based project it may be seen as a little bit 'non-steam' but, of course, our magazine was originally the *Model Engineer and Amateur Electrician* so perhaps we are not actually straying too far outside the 'zone'. In fact, I hope there will be more articles of this kind from time to time. After all, electrical engineering is part of the engineering world (I speak as an electrical engineer!) as is civil engineering (evidenced by our current series on concrete sleepers from Stephen Wessel) and possibly even software engineering.

Anyway, to get to the point, Les asks me to mention that to meet the official standards of electrical safety two modifications are needed in the soldering iron timer. The first is to use plastic screws to secure the circuit board and the second is to use a proper

cable gland to secure the cable entering the box, rather than a cable tie. This is of course quite right if the objective is to meet industrial standards of safety but I believe that we do not necessarily need to apply the same strict standards in a 'hobby' context, provided we can be sure that a sufficient degree of safety is achieved.

In the case of Les's timer I would say that a sufficient degree of safety has been achieved. Firstly, although the screws are conducting, the box is not, being made of plastic, so there is no risk of electric shock. Secondly, I believe that a cable tie, applied tightly around the cable, is perfectly effective, in this context, in preventing the cable being pulled out of the box and certainly sufficient for the purpose for which it is to be used. As always, health and safety are as much about common sense as about legislation.

Martin Evans can be contacted on the mobile number or email below and would be delighted to receive your contributions, in the form of items of correspondence, comment or articles.
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We Visit the Wrexham & District Society of Model Engineers

John Arrowsmith ventures deeper into GWR territory to find a club with a healthy younger membership.



The view from the station passing loop.

My next visit in this little series was to the Wrexham & District SME who are located at Gresford near Wrexham on a delightful private site adjacent to a local hostelry. I was given the usual warm model engineers welcome on arrival during their workday lunch break - a mug of tea. The conversations started, followed by a tour of the track and site.

The club have a dual 3½ and 5 inch gauge elevated track with all the usual facilities in a pleasant setting (**photos 1 and 2**) and an interesting layout measuring about 850 feet, so it is a good run and includes a short tunnel through an old, existing building. A spacious covered steaming bay provides a useful area for locomotives to be prepared. The area surrounding the track is attractively landscaped (**photo 3**) and adds to the overall atmosphere of the site.

My visit coincided with one of their work days and again it was good to see a 5 inch gauge locomotive and flat trucks being used to move used material and garden refuse around to the disposal area for unloading (**photo 4**).

The signalling system is a standard colour light arrangement but with a



Passengers' eye view leaving the station.



The view emerging from the tunnel across the adjacent boating lake.



The works train on its way to the disposal area.



*Access road from the steaming bays to the main circuit.
Note the full-size dolly signal.*



The small lever frame in the signal box.



The two-road station with traversers both ends.

couple of full-size signals present in the system as well (**photo 5**). Placed where they are, they fit into the layout very well, all controlled by a simple but nicely built lever frame (**photo 6**). A number of track traversers enable good use of the track by allowing locomotives and trains to be

moved onto or off sidings without having to disturb any running operations (**photos 7, 8 and 9**).

The well appointed club house (**photo 10**) has all the usual furnishings, like many model engineering clubs, including kitchen and library, and plenty of seating for the



The exit traverser from the steaming bays.



Traverser control box.



The club house, station and signal box blend in well together.



The mock station covered area.



Steve Carter preparing Foxcote Manor for a run round the track.



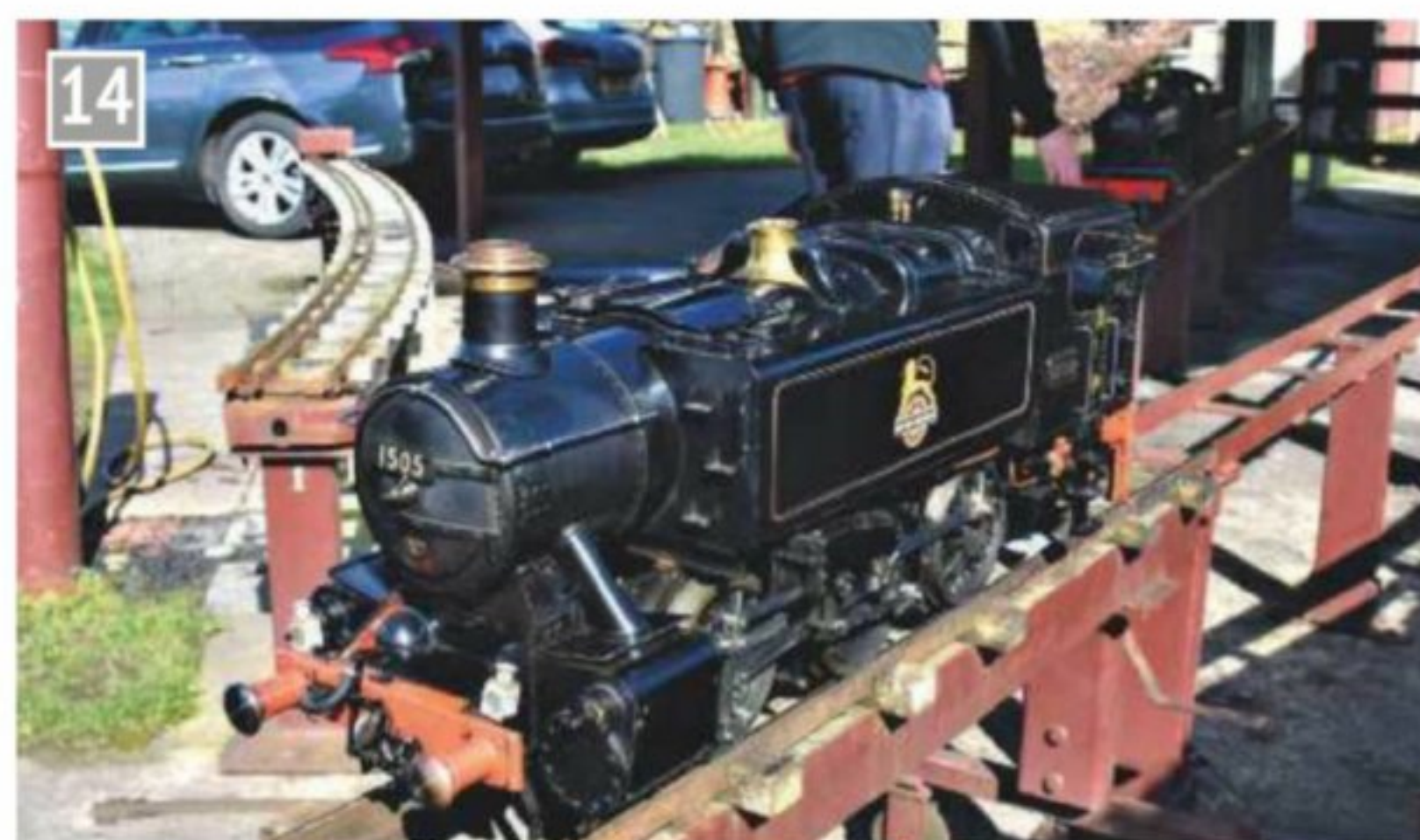
Preparing the City of Carlisle to be steamed.

members to relax into. A good-sized covered area (**photo 11**) provides protection should the weather be unkind and it is also furnished with some picnic tables for visitors' use. Its appearance is deceptive though because it looks like a traditional station frontage with doors, posters and signs as well as a station clock, but it is just a painted wall - there is nothing behind the doors except the wall. It fooled me until I was shown the way it had been set up - very clever.

I was impressed by the number of younger members they have. I was told that in a membership of 61 there are seven who are all in their early twenties, which these days is very refreshing, and one of them has a number of operating locomotives. This group is very much appreciated on public running

days, of which they have quite a number during the year. The site agreement they have means they cannot charge for rides, so to have a regular income they ask for donations and these are such that the club raises sufficient to cover all their requirements. It must be very rewarding for them to know that they are appreciated so much by the local population.

While I was there a couple of steam tests were being carried out and Steve Carter, my host, also steamed his superbly made GWR Manor class locomotive 7822 *Foxcote Manor* so that I could have a few laps around the circuit (**photo 12**). Seeing that locomotive in steam brought back a few childhood memories for me as it was the first Manor I saw at Welshpool when I was train spotting.



A well-built BR 1500 tank locomotive waiting to be tested.

Another member turned up for steaming and from the back of his car another superb model emerged in the shape of a Coronation Pacific 4-6-2 *City of Carlisle* (**photo 13**). This lovely model, built by Dave Wilson, looked an absolute picture in the warm spring sunshine. A well-made example of a GWR designed 1500 0-6-0 tank was

also under test during my visit (**photo 14**).

I really enjoyed my time with the members of the Wrexham club and thank them for their hospitality, particularly Steve Carter and Dave Wilson. It is a good set up they have there in a beautiful area and the members really seem to appreciate what they have.

Stephen Wessel considers the best way to achieve a stable and durable track bed for his garden railway.



Five Inch Gauge Garden Railway Design and Construction

PART 5

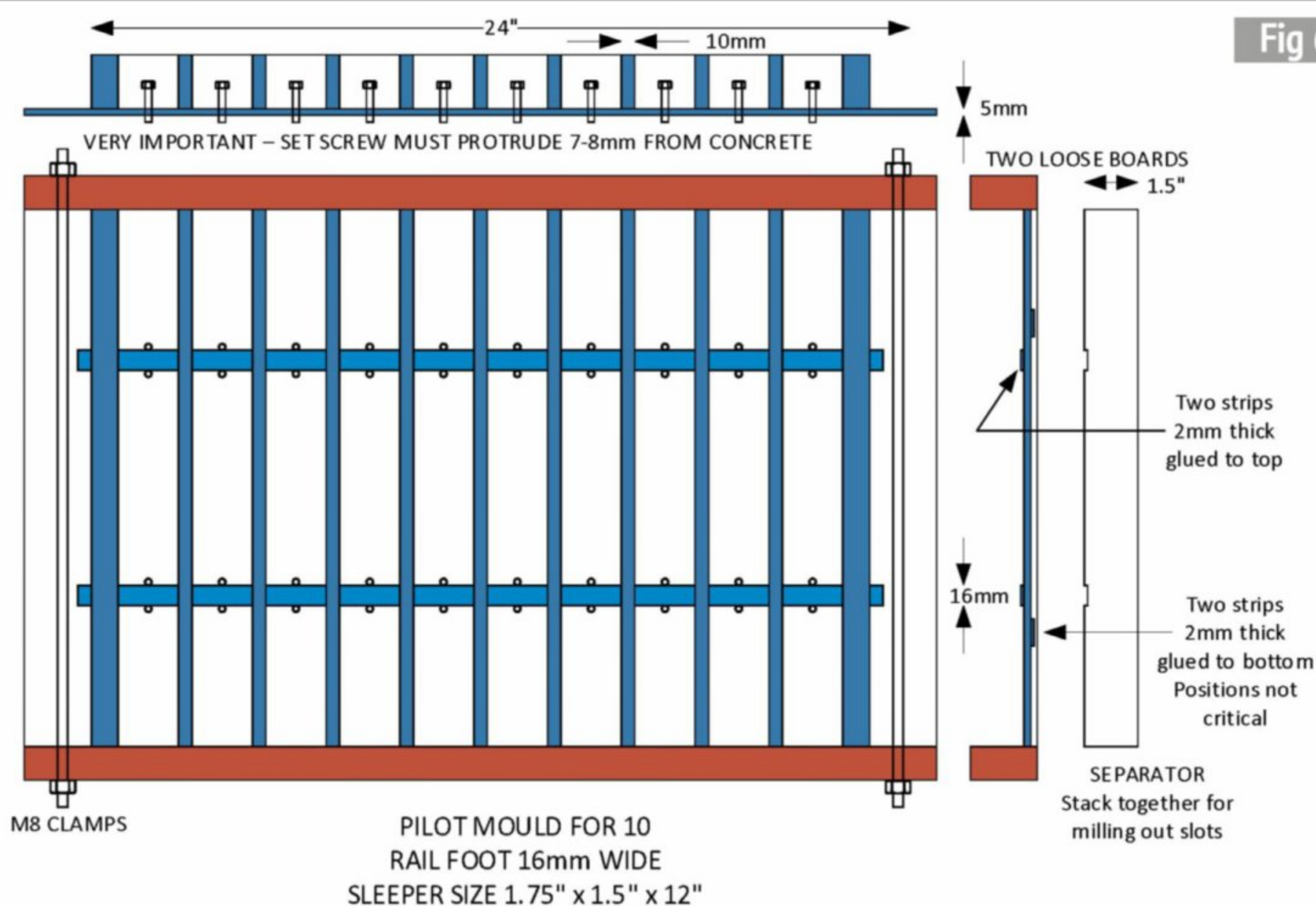
Continued from p.661
M.E. 4624, 25 October 2019

Moulds

We now come to perhaps the most important and tricky subject of all, namely mould design and construction, for what works at a small experimental level may not

be so practical when larger numbers are involved. For moderate production in the context of a small garden railway up to, say, 1000 feet in length one might wish to make enough sleepers for say 2 x

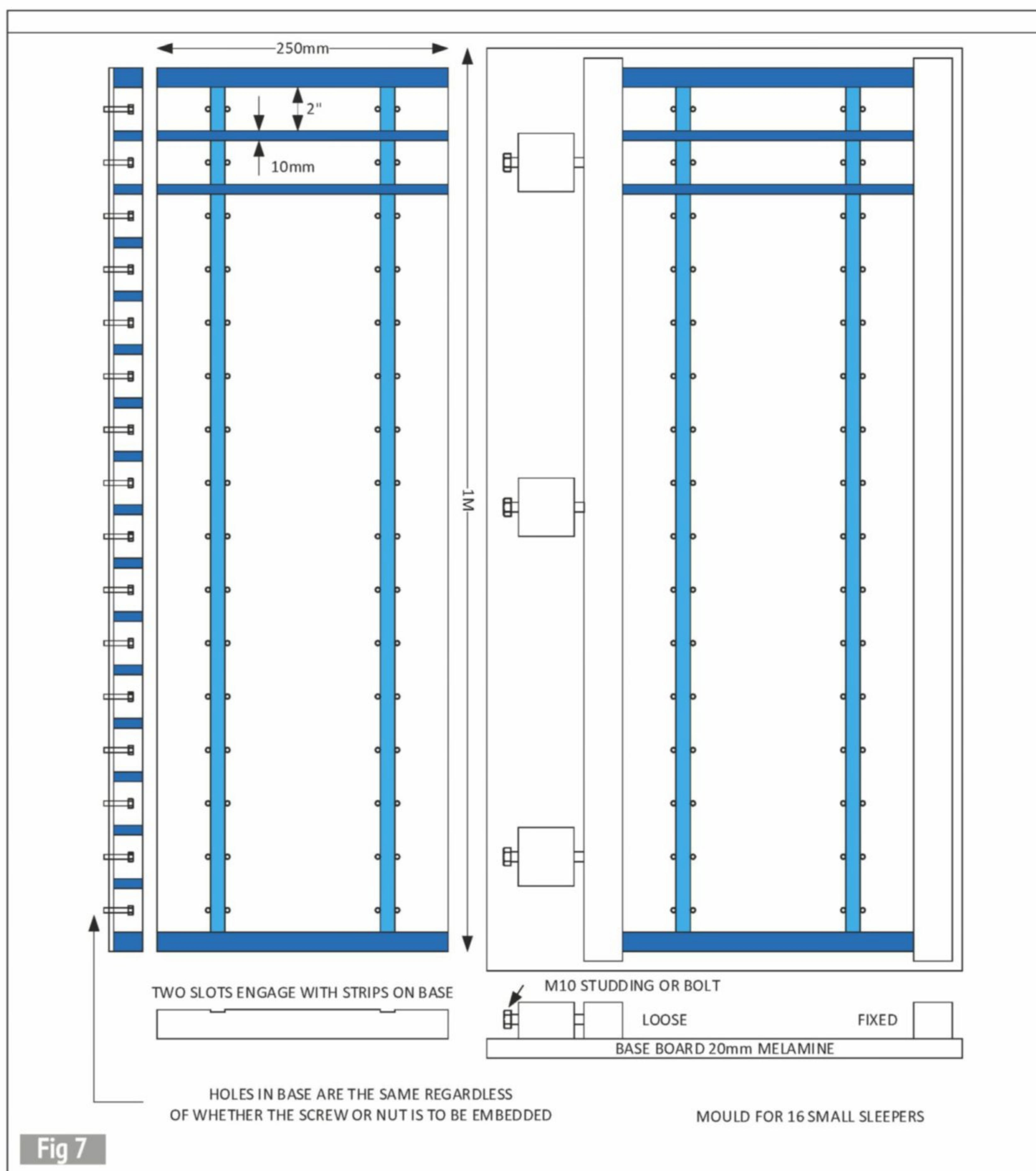
10 feet panels per session, i.e. 40. These could be demoulded after 24 hours during warm weather allowing the moulds to be used once a day. This work would take one man about one hour to prepare, mix



Method of Manufacture

- 1 Prepare base from 5mm thick PVC
- 2 Glue on the two upper 16mm strips at correct spacing
- 3 Glue on lower stud clearing strips
- 4 Prepare all separators and notch them for the 2 x 16mm strips (milling m/c)
- 5 Glue in all separators using the drilling jig to get the spacing correct
- 6 Glue on end blocks
- 7 Drill No. 9 holes through base
- 8 The edge boards could be made of hardwood lined with duct tape

The mould should be used on a clean baseboard of 20mm melamine chipboard or similar
All wooden surfaces should be coated with oil before use



and cast, followed the next day by another hour to demould, clean and prepare the moulds for another batch. One assistant might shorten this time (or lengthen it depending on the chat level!).

Obviously, more moulds and more people would lead to greater production but

set against that is the cost of the mould material and time needed to make them. For a pilot project I would recommend one mould for a maximum of 20 sleepers depending on their size.

Note that the designs are for 5 inch gauge only and only suitable for flat-bottom rail.

They could of course be scaled up for 7.25 inch and adapted for multigauge too.

I have given a basic design which makes use of PVC sheet in different thicknesses. This is the ideal material as no release agent is needed, although see below. It can be bought easily online and is best joined by

solvent cement. (NB: release agent *will* be needed however on any wooden parts and does help to keep the PVC clean.) Obviously the actual sleeper dimensions can be varied to suit requirements of gauge, rail size and type of foundation. All joints must be accurate and sound, remembering that

liquid cement can find its way into the smallest crevices and hinder demoulding. It is definitely worth building up a fillet all around joints with mastic or silicone. I used Nemesis Mighty frame sealant which is excellent and doesn't pull away during demoulding.

Making up the moulds for 20 – 100 sleepers at a time to the basic design I have provided should be straightforward, clean and enjoyable work for say two people. Material cost is significant but as the moulds can be reused over and over they will have a real value to future users (**figs 6, 7 and 8**).

I come now to the all-important discussion of ingredients for high strength concrete suitable for our needs. I have reached the conclusion that given the complexity of some mixes and the expense of the additives, it may not be necessary to aim for the highest strength possible. Recipes have been developed by the industry for much more demanding engineering situations than our little sleepers! So let's keep it simple. Several companies will be mentioned and the usual disclaimer applies to all.

The cement

Portland cement (OPC) is available in several versions but the type I now prefer is either the Blue Circle product, Mastercrete or the Rugby equivalent known as Premium. Both contain certain additives, the most important being an air-entraining compound which is supposed to provide resistance to cracking during the freeze/thaw cycle. Both these and the ordinary OPC have about the same strength. Both companies also offer a 'high strength cement' in 25kg bags but it is very difficult to obtain as individual bags so I have not been able to try it. It should go without saying that any cement needs to be fresh and used within a week or two of opening the bag.

The aggregate

In some ways this is the heart of all concrete so should be

selected very carefully. The makers of kitchen countertops usually stipulate 'dry silica sand', to my mind a vague term that says nothing about particle shape or grading, both of which are vitally important. General purpose concrete will make use of coarse and fine aggregates, usually of limestone with the larger pieces up to 20mm. An 'all-in' type containing 10mm stones down to very fine dust is frequently used for DIY projects of all sorts. I have tried this for the sleepers but the large stones are just too big.

Sharp or grit sand is available everywhere but may well contain a proportion of clay and other impurities unless it has been washed. Examine it under a strong lens. Ordinary builders' sand should *not* be used. The best I have found so far is 'Wareham 100% washed sand', available from my local discount merchant and probably all over the south of England, used by plasterers. The particles are irregular in shape but smooth, graded from about 0.3mm up to 3mm. It behaves beautifully when mixed, flowing easily into the moulds. Aggregates containing a high percentage of dust make a very stiff mix requiring more cement and water. Thanks to the huge geological variations across the UK we have a wide range of rock types and many of them have been rendered into aggregates, so users will have to source locally and determine the best

for their needs. To sum up, the maximum particle size should be no more than 6mm, the minimum should perhaps be a coarse 'dust', and all sizes in between strongly represented in the mixture.

Additives

The main one is called Superplasticiser. It should be the type designed for concrete, not mortar, and is different from the ordinary plasticiser used by builders. The function is to increase fluidity of the mix without the need for more water and a little goes a long way. The cost is insignificant. I have used PXR Max from Cemcraft and Flowaid SCC (self-compacting cement) available from www.source4me or eBay. Neither is likely to be found in builders' merchants.

Another additive that is highly recommended but very expensive is commonly referred to simply as 'polymer'. It is a blend of complex organic chemicals that work like a binder within the concrete matrix. It fills up pores making the material more water resistant but its main function is to lock in the water of hydration during the cure process. This means that instead of having to keep the castings wet for at least seven days after demoulding they can be stacked dry; this simplifies storage of fresh castings although they still need to be kept for at least 28 days before use. I found

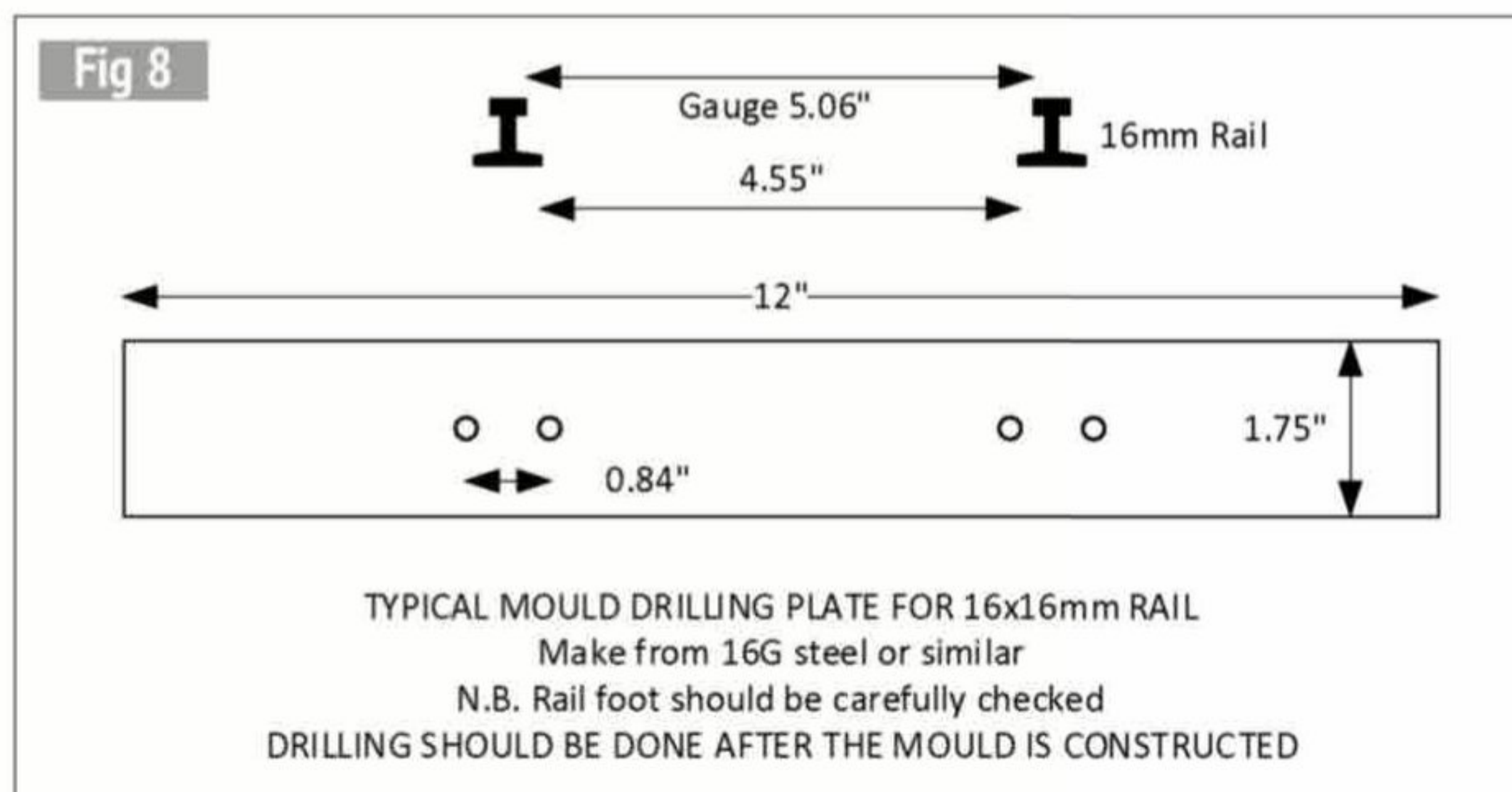
two sources of this in the UK: 'Polycure FT' by FibreTech and 'Flowcast' by Oscorete. I have used a free sample of the latter and liked the way it works but hardly consider it necessary.

A significant strength enhancing material is Silica Fume, also known as Microsilica. This is an extremely finely divided powder, far finer than cement, which combines with the calcium hydroxide formed as an otherwise useless by-product of the main curing reaction. It improves strength, fills up voids and is an all-round good thing, except for its price.

Finally, the glass fibre: This as mentioned before *must* be 'AR' or alkali resistant. It is available in large quantities like 20kg (best price) from Fibre Technologies International, or for smaller amounts ranging from 1kg upwards from www.fireplug.co.uk or eBay. This is the single most expensive ingredient of the concrete but there is no avoiding it. It is easy to handle and mix and far more effective than any kind of steel mesh. Do not be tempted to use *plastic* fibres for reinforcement. They are widely available and cheap but add no strength at all except during the setting phase.

Mixing

For small batches of 10 - 20 sleepers I use a paddle stirrer driven by a mains electric drill. The quantities are too small



to justify wheeling out the cement mixer and in any case, the action of a drum mixer is more of a slow stir suited to wetter mix. A heavy duty stirrer designed for this work can easily be bought (**photo 20**).

There are several conflicting theories about the order in which ingredients should be mixed but the important thing is that they are mixed thoroughly, having been accurately weighed out beforehand.

While acquiring experience of this work it is advisable that ingredients are weighed and not estimated by volume as would be done on a building site. Water can be the exception of course (1 ml = 1 gram). Once the quantities are being regularly repeated, however, it is actually much quicker to measure them out by volume in suitable containers. I put all the sand, cement and the water plus superplasticiser in together giving it a hearty mix, flinging the material hard to the side of the bucket. After about two minutes the fibre is mixed in as though it were egg white going into a soufflé, a slow folding action (yes all right I am right out of my field here! – **photo 21**).

The mix (**photo 22**) will seem fairly stiff in the bucket but it will be found quite easy to work it into the moulds with a wood block; a little bleed water will rise to the top during compaction.

Mould release agents

Having experimented with proprietary release agents as well as various oils and waxes I have concluded that there is nothing better than ordinary motor oil. In fact the PVC surfaces don't need anything but any wood involved certainly does, as do the temporary screws used for nut emplacement. The essential problem is that liquid cement slurry finds its way into the smallest crevices including threads; so these must be protected by an oil film. When the mould is ready with all screws in place, oil is brushed fairly liberally all over



Using a paddle mixer.



Mixing in the fibres.



This shows the stiffness to aim for. It looks too stiff but actually flows into the mould easily. Some bleed water then rises to the surface before being reabsorbed during setting.



Flexing the mould base loosens the castings. When the mould is inverted they drop out.

and allowed to drain off. There should be no puddles but a continuous film all over the screws where they disappear into the base.

Compaction

A good thumping of the whole mould bodily up and down on the bench will bring air bubbles to the surface and get the material to compact around the rail fixings. The action is best achieved by holding the mould halfway over the edge of the bench and then rocking it forwards and backwards fairly vigorously for two minutes. This can be followed by vibration from an orbital sander held somewhere underneath, although this isn't vital.

Demoulding

This mix will set relatively quickly, especially in hot weather. I have successfully demoulded after only 12 hours but recommend 48 in cool weather or 24 in hot. The mould base should be flexible enough to allow it to be curved away from the castings so breaking the light bonds between them and the sides (**photo 23**). Tapping the back of the mould

with a small mallet should release each sleeper quite easily. Little further treatment is strictly necessary although a few seconds on a belt sander would remove sharp edges. If cast-in studs are used then any cement adhering to the threads should be brushed off with a small wire brush at this stage. A rotary brush on a Dremel type tool is useful but an old die nut held in a home-made holder for the cordless drill will do a quicker job. On the other hand, cast-in nuts need no further treatment and much time is saved. Remember that at this stage the concrete has only a fraction of its ultimate strength so handle them carefully.

The moulds should be cleaned up and reassembled while the new sleepers are stacked in polythene and kept thoroughly damp for at least seven days. After that they can be put out in the rain for a month to carry on hardening, either loose or assembled into track panels. Or they can be stored in a plastic box containing some water.

The temporary M5 screws used to position the nuts can be quickly extracted prior to

demoulding using a power drill in high speed reverse. They then need a bit of cleaning and can be sashed around in a bowl of white spirit to remove grit before reuse.

Panel assembly

It is now that the advantages of concrete become apparent for the first time. My technique is to lay them all out at equal spacing and pop the rails in between the studs having made sure the rail foot grooves are clean. A washer is needed under each nut (or screw head depending on which method is being used) and this should be M5 Form C. Do not be tempted to use flange nuts as these have the annoying tendency during tightening to push the sleeper sideways like a rack and pinion. Much time is wasted. I used stainless for both nuts and washers but doubt it justifies the extra cost. A good economic compromise is to use an encapsulated plain stainless nut, a stainless washer and a BZP screw. I use a low torque setting but find that even a gentle hand tighten results in a very rigid panel. A stripped thread at this

stage means a scrap sleeper so go carefully. The foot grooves will keep the sleepers perpendicular to the rail.

I have now installed nearly 800 in the two patterns described. About 200 of these are laid directly in ballast (10mm limestone chippings) while the others are on the existing concrete bed with a single layer of pond liner underlay and ballast spread all around. No hold-down screws appear to be necessary. After many winter frosts I can detect no damage. They seem very tough and look surprisingly good. All have withstood people walking on them and loaded wheelbarrows – train loading by comparison is negligible.

Materials and suppliers

OPC or Blue Circle

'Mastercrete'

Washed silica sand. Should be 'sharp' and graded between about 0.3 – 3mm. Many other types could be used but avoid excessive dust and pieces larger than 6mm.

Superplasticiser. Flowaid SCC or PXR Max from Cemcraft

AR glass fibre cut strands 13mm long. Fibre Technologies International (for larger quantities like 20Kg) or www.fireplug.co.uk.

Or small quantities from eBay

PVC sheet.

www.directplastics.co.uk

Fasteners.

www.orbitalfasteners.co.uk

Recipe

The ratios by weight are as follows:

Cement: 1

Dry sand or aggregate:

1.25 – 1.5

Water: 0.3

Superplasticiser:

approx. 1% of the cement

AR glass fibre: approx.

1.5% of total weight of all other ingredients. NB this is lower than recommended by countertop makers but I believe quite sufficient.

As a rough guide, the actual amounts needed for 20 large sleepers, or one track panel, are approx. 10kg cement and 320g of fibre. The small sleepers need just over half these figures. NB: part of the water will be contained in the normally wet or damp sand. A sample should be accurately weighed, then dried and weighed again. Water content is calculated as a percentage and will be found surprisingly high. Be careful! Adding too much water is only too easy.

As a rough guide to quantities, about 6kg of cement is required for 20 smaller sleepers, i.e. one track panel. So one bag would be enough for 40 feet of track.

Costs

The most expensive ingredient is the glass fibre. The cheapest price I have found is £115 per 20kg including delivery and VAT from Fibretech. Based on this,



Resleeping old track in a confined space. These are the 'heavy' pattern laid directly in ballast. The old ballast was considered too large to provide an even support – hence the use of some pea gravel under each sleeper. The string was quickly abandoned in favour of a laser for levelling. Laying new track is easier than this!

plus cement at around £4 per bag, the cost per sleeper (large type) lies somewhere between 40p and 50p. The smaller ones work out at 20p – 25p. I have not included either Microsilica or polymer additives as I don't believe them to be necessary for this application and they are expensive for small quantities.

Softwood tile batten costs about £1 per metre. A 4.8m length usually yields 17 if large knots are avoided. Cost per sleeper is therefore about 28p. Real creosote will bump this up to 30p.

The best price I obtained during 2018 for recycled plastic worked out at 95p per 25 x 50 x 250mm sleeper. This was for a fair quantity, enough for 120 feet of track.

I have not priced hardwoods as they are so variable and expensive.

The cost of the necessary screws, nuts and washers does work out a bit more than for wood screws but as with everything else, if bought in

bulk, is fairly insignificant compared to overall costs of the railway.

Conclusion

So that's it (photo 24). GFRC definitely offers a cheaper and superior alternative to plastic providing costs of mould making are left out. Once the sleepers are made, track assembly is easier and faster while the result is permanent so far as anyone can see. Track stability is far better and they look professional and satisfying. When the time comes to sell up, as it surely will, I shall be able to offer viable track panels all ready to lay rather than a pile of scrap aluminium with firewood attached.

I hope this won't be the end of it and that others will carry on the experiments. I can't see any commercial potential in it but a club in need of a big project might consider the long term benefits of such an investment. ME

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● Home Foundry

Luker demonstrates how you can make your own castings at home.

● Aggregate Dredger

Michael Nicholson describes his 1:35 scale model of the *Seabourne Alpha*.

● Upscaling

Mark Rudall ruminates on the boundary between a model and the full-sized article.



Content may be subject to change.

ON SALE 22 NOVEMBER 2019

Building the Model Engineer Beam Engine

PART 12

David Haythornthwaite writes a series on how he built



the *M.E. Beam Engine*. This is an old favourite and construction of this engine to 1½ inch scale was serialised in *Model Engineer* back in 1960. Times, methods and equipment have now moved on and the series describes how to build this magnificent engine in 1 inch scale from available castings.

Continued from p.589
M.E. 4623, 11 October 2019

Governor arms and balls

The top of the governor consists of four arms, forming a diamond shape, the upper two pivoting from the top cap and carrying the governor balls at the lower end. The two lower arms pivot from the top of the governor slide at the lower end and the other end forms a fork which links to the two upper arms carrying the balls. The mechanism is such that as the engine rotates, the four arms are rotated by the top cap and as the engine speed increases, the centrifugal force acting on

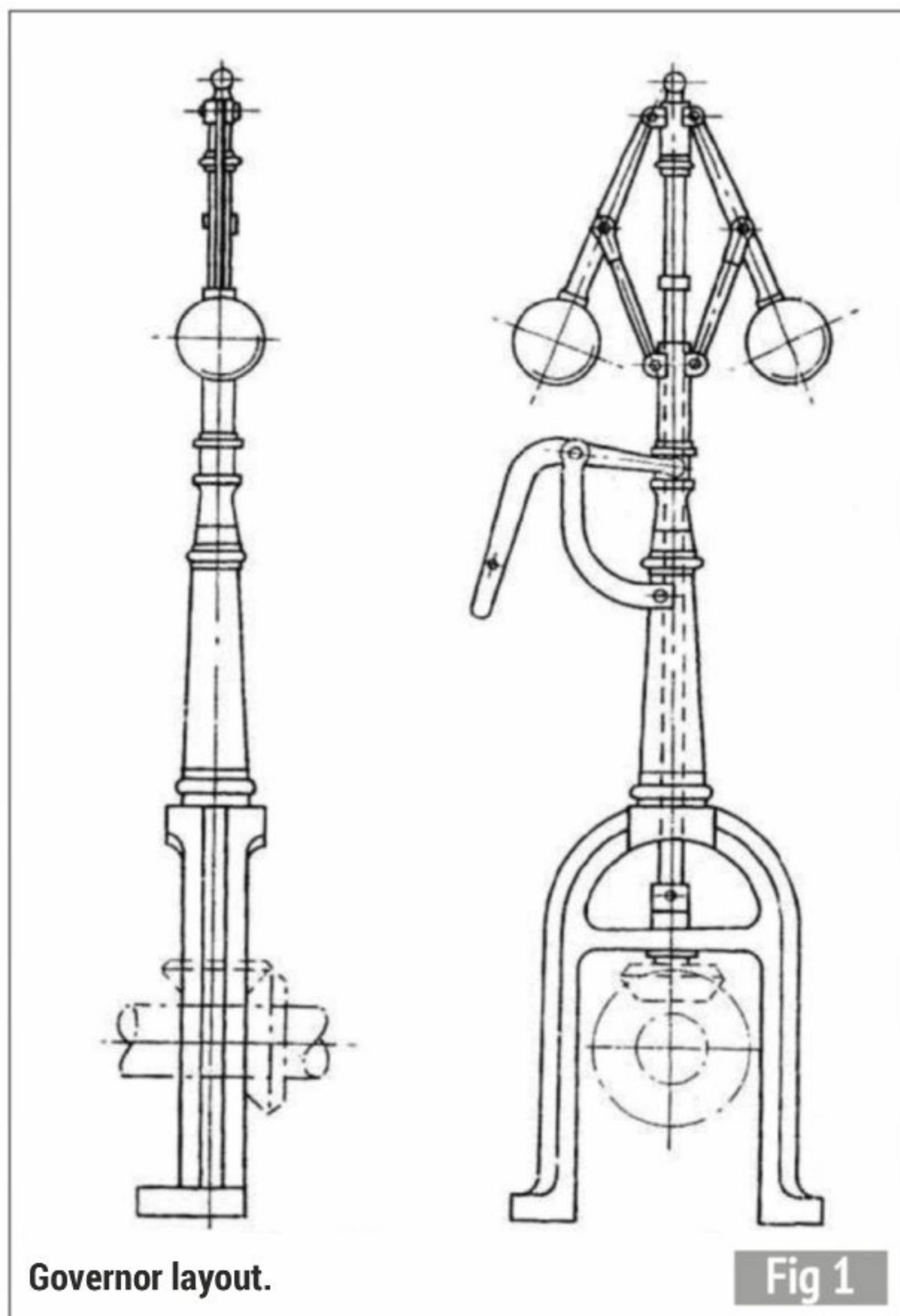
the balls causes them to fly outwards. This in turn causes the lower arms to raise the governor slide and a linkage is provided to transmit this movement to the throttle valve, thus restricting the steam input (**fig 1**).

As the governor straddles the crankshaft at the 'front' of the engine and the throttle valve is situated at the 'back', or cylinder end, the linkage is rather long and tortuous which, in my opinion, is the worst design feature of the whole engine.

I made the top two arms that carry the governor balls first and it is debatable whether to start with square or round steel in order to make these. At one end where the arm screws into the ball, the arm is round with a 5BA thread on it, whilst the rest of the arm is flat ¼ inch strip. I normally like to use steel of known provenance for my models but I did not have any new square strip of suitable section to hand, although I did have some 5mm square (just over ⅜ inch square) strip that had once been part of a roof rack locking device. Testing showed it to be moderately hard but okay to machine with care, so this was used.

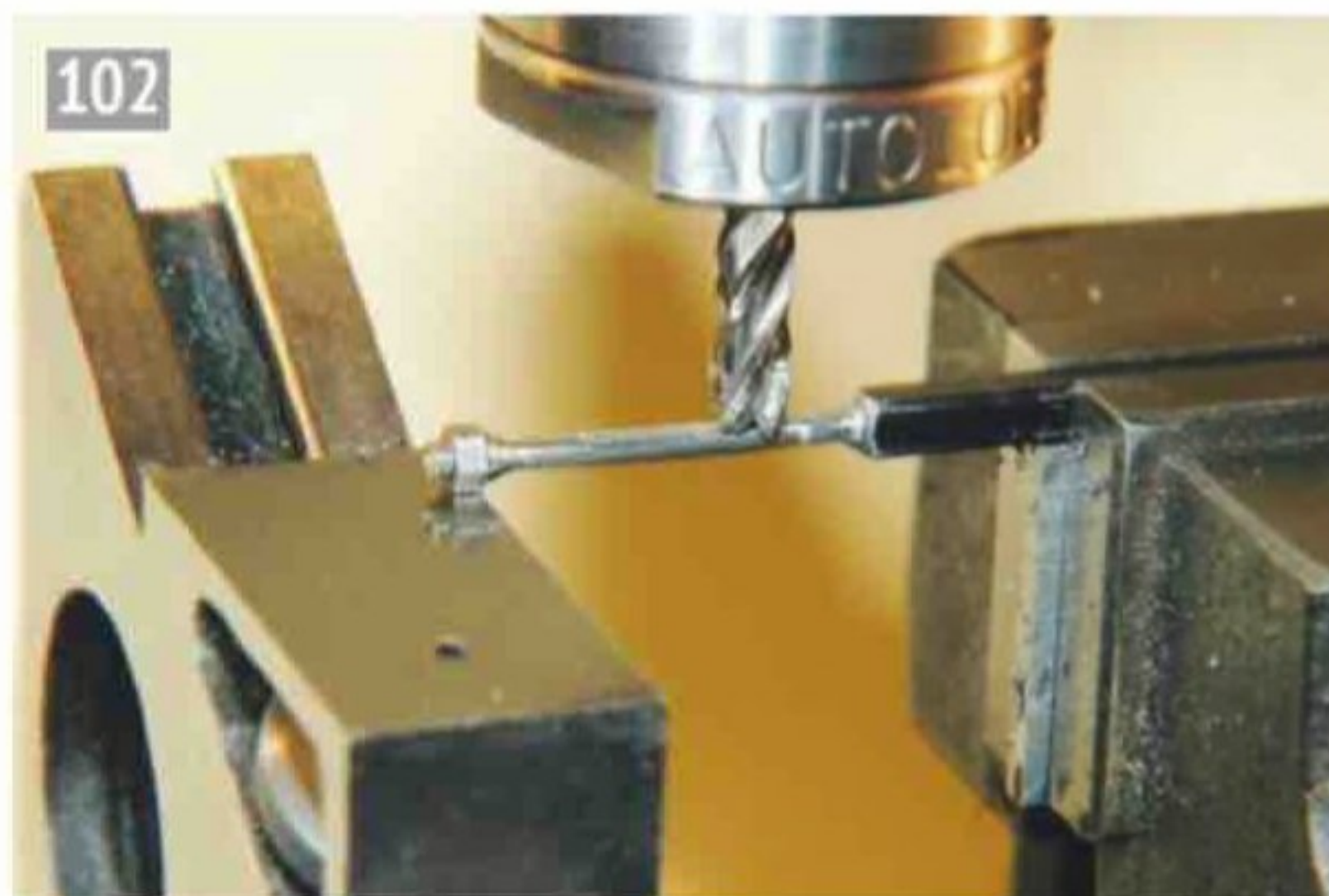
The square strip was mounted in the four jaw and accurately centred with 1.75 inch (45mm) protruding from the jaws and the end centred with a TINY centre. The end was turned to 0.126 inch diameter for a length of ⅝ inch (0.157 inch) for later threading to 5BA. The rest of the length was turned to ⅝ inch (0.157 inch) diameter which is the diameter of the flange adjacent to the ball. The fish-bellied shape of the arm was then formed by a mixture of using a profiling tool and some filing with the lathe rotating, using a very fine file and neat cutting oil. It is important to keep hands and clothing well clear of the four jaw chuck if you do this.

The end of the arm was threaded 5BA using a tailstock die holder and, as the die did not take the thread absolutely to the shoulder, the shaft was relieved up to the shoulder so that the ball would screw up to it. This is shown in **photo 101** where a tipped tool is being





Threading the end of one of the arms.



Machining the flats on an arm.



Tapping one of the governor balls.



Ball fitted to its arm.

used to form the relief groove. The arm was transferred to the machine vice on the milling machine table, resting the square material on a thin parallel and supporting the outer end on an adjustable parallel, using a 5BA nut to protect the thread (**photo 102**).

Use an edge finder to locate the shoulder where the ball will seat and zero the X dial/DRO. Remember to move the table by half of the probe diameter and zero again. Determine the centreline of the arm, again using an edge finder. Find one side, zero the dial/DRO, find the other side and then halve the reading. The zero reading will now be your centreline. Drill two holes with a No. 51 drill EXACTLY $\frac{3}{8}$ inch (0.375 inch) and $1\frac{1}{8}$ inch (1.125 inch) from the shoulder and EXACTLY on the centreline. Start with a fine centre drill and then follow up with a No. 51. Do use your dials/DRO for this. If your governor is to be in balance,

then the two arms must be of equal length from pivot to ball.

The thickness of the widest part of the arm at this stage is 0.125 inch and it needs to be brought down to $\frac{1}{16}$ inch (0.062 inch) thick, so 0.031 inch needs to be milled off each side. This is where the advantage of using square steel comes into play as you can use the square to index the machining and use the down feed dials/DRO to control the amount milled away. With all such jobs on tiny parts, try to arrange the machining so that the part can be left on the parent material until the last moment. This makes it easy to hold in a vice for finishing.

Two brass balls were supplied ready turned with my casting set and, as supplied, these only need to be drilled and tapped 5BA. Wrap a single strip of 80gm paper round the ball, so as not to mark it, and set it in the three jaw chuck as shown in **photo 103**. Centre drill then drill 2.6mm tapping size

for 5BA. Ensure that you drill both balls to the same depth to keep them in balance. I drilled both to $\frac{3}{8}$ inch deep. Follow up by tapping 5BA using a tap held in, or guided, by the tailstock chuck (**photo 104**).

The lower two arms are flat steel $\frac{1}{16}$ inch thick and $\frac{1}{8}$ inch wide for most of their

length, but have a fork at one end which is $\frac{1}{8}$ inch thick. Therefore $\frac{1}{8}$ inch square steel is the ideal starting place. I didn't have any $\frac{1}{8}$ inch square so you will see in **photo 105** that I milled some larger square section steel to the correct size.

The critical factor in these



Machining the groove in one of the lower arms.

arms is that, like the upper arms, they must be of identical length to each other, from pivot to pivot. Therefore, start by drilling the pivot holes either by careful marking out the pivot positions and then drilling with a No. 51 drill (1.7mm), clearance for 10BA, or simply drilling in the machine vice using the DRO/dials to get the holes exactly 0.875 inch apart. The fork joint, where the arm meets the top arm, may then be created by cutting a $\frac{1}{16}$ inch slot on the end with a $\frac{1}{16}$ inch end mill or using a slitting saw that is 62 thou thick or 1.58mm. As the upper arms and the lower arms do not meet at right angles, the bottom of the groove is angled and this was achieved by having the arm offset to the diameter of the slitting saw. This is shown in photo 105. The rest of the length of the lower arms was then milled down to $\frac{1}{16}$ inch

thick and the arms were filed to a pleasing shape as shown on the drawing. Again, leaving the arms on the parent metal until virtually all the work had taken place paid great dividends in ease of handling.

After careful assembly, using 10BA bolts, the governor should look like the one in **photo 106**. It is important that there is NO FRICTION in the operation of the top section. If the balls are held outward, raising the slide, then the slide and balls should drop freely when the balls are released. Any sticking at all will mean that the governor will not work. Please note also that the thrust collar has been fitted above the lower bearing and secured to the spindle with an 8BA bolt. A second collar has been added at the upper part of the spindle and secured with a 12BA bolt. The purpose of this is to restrict the amount

of vertical movement of the slide. Without this collar, the governor balls would be able to fly too far outwards and, at speed, the balls would impact the main beam of the engine.

All that remains to complete the governor is to fit the bracket and fork lever which will transmit the movement of the governor slide to the engine throttle. I say 'all' that remains – but in fact this is quite a fiddly job which, in my case, took a good deal of time that was out of all proportion to the size of the parts.

First, make the bracket and fit it to the governor column, before making the fork lever that rides in the slot in the governor slide. The reason for this, in my view, is that when creating and fitting the bracket to the governor column, it is almost impossible to guarantee that the pivot point at the top of the bracket will be

exactly $\frac{5}{8}$ inch from the centre of the governor spindle. This is not critical, providing that the fork lever is made to fit the actual dimensions, once the bracket has been fitted.

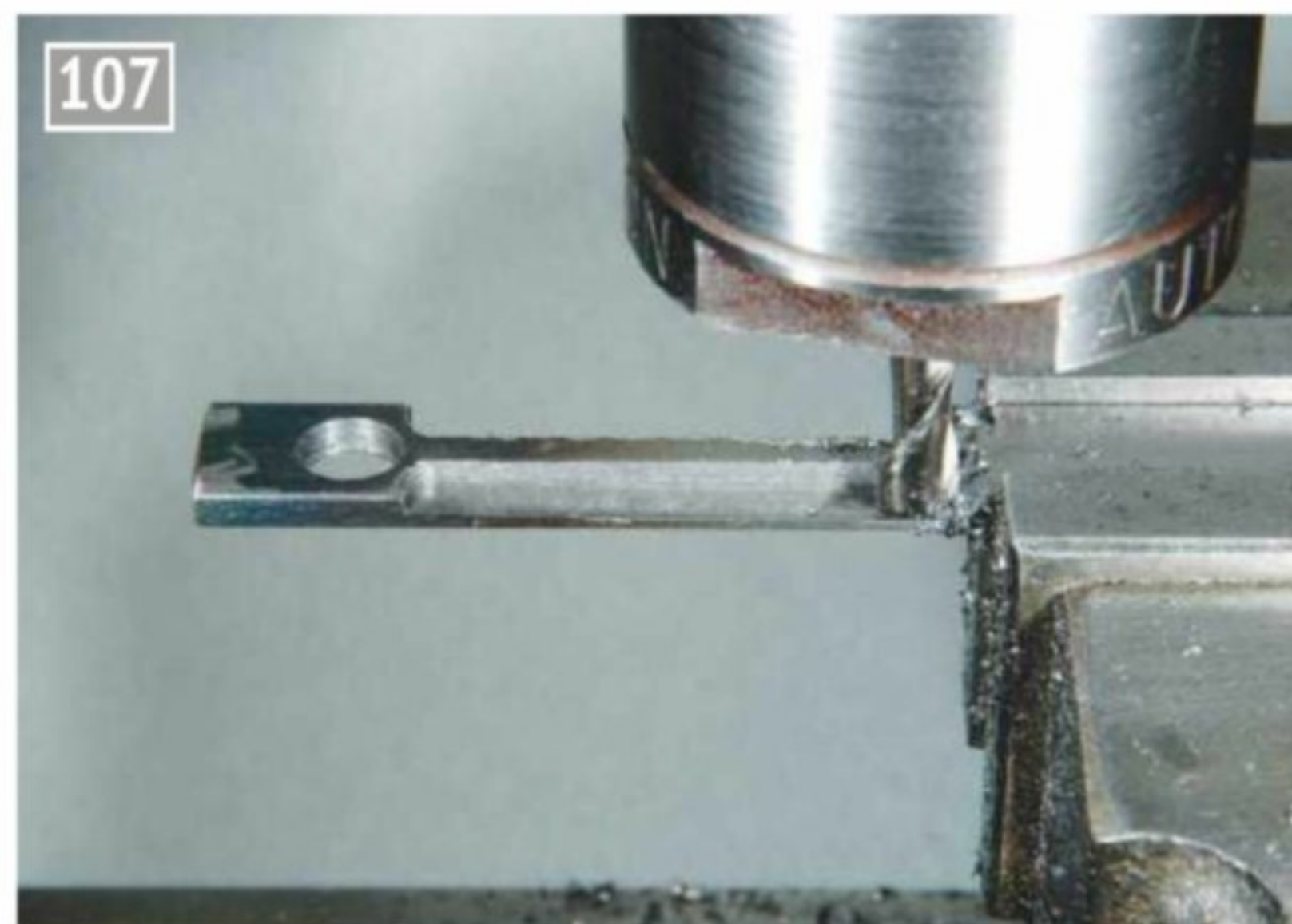
Governor bracket

I used some $\frac{3}{8} \times \frac{1}{8}$ inch bright mild steel for this. First drill a $\frac{9}{32}$ inch hole near the end of the bar to create the curved section which fits to the governor column. Then mill away the sides of the bar to leave a centre section which is $\frac{1}{8}$ inch wide. This is illustrated in **photo 107** where the nearside is milled approximately half of the way through. I prefer to mill with the end of a slot drill, rather than milling with the side of a cutter, wherever possible. The part gets fragile and light cuts should be taken to eliminate the risk of bending.

With the part still attached



The arms and balls are fitted to the governor.



Milling the governor bracket.



Putting the bend into the bracket.



The completed bracket.

For once, my drawer labelled
'Useful Short Stubs' actually produced
something that turned out to be useful!!

to the parent metal bar, it was clamped in the bench vice with a $\frac{5}{16}$ inch diameter bar to one side, as a former and using a vice jaw cover on the other side to stop the jaws from marking the bracket. The bracket was then bent to 90 degrees (**photo 108**). The drawing shows the bend to be $\frac{3}{8}$ inch radius and in a perfect world this would be bent round a $\frac{3}{4}$ inch diameter bar. In the real world, the bend always springs a little, which can be seen in the photo and I think that I used a short piece that was just over $\frac{5}{8}$ inch diameter. The resulting bend turned out to be just right. For once, my drawer labelled 'Useful Short Stubs' actually produced something that turned out to be useful!! Whilst most of the bend was created by levering on the parent bar, I did give one or two blows with a soft hammer, to encourage all of the bending to take place round the bending former. Just where to put the bend is a matter of guesswork. After sawing across the $\frac{9}{32}$ inch hole you can place the bracket *in situ* on the governor column and hopefully you have a $\frac{5}{8}$ inch gap between the top and the centre of the spindle. If the gap is way out, then go back

to 'GO' and try again - but if all is well, then shape the bottom of the bracket to look nice on the column and drill two holes 1.1mm (tapping size for 12BA) around the collar section. Cut the top to length and mill a $\frac{1}{16}$ inch slot in the top ensuring that you have the correct orientation. Drill and tap 10BA across the slot for the fork lever pivot. At this stage, I seuperglued the bracket to the column and drilled the column 1.1mm using the previously drilled holes in the bracket collar as a template. The bracket was then removed from the column - which proved to be depressingly easy - and the holes in the bracket were opened up to 1.3mm, clearance for 12BA. The column was tapped 12BA and the bracket fitted to the column with two 12BA setscrews. I ran a reamer down the centre of the column once again, to remove any burrs caused by the 12BA tapping of the column. The finished bracket is shown in **photo 109**.

The fork lever

I think that most people will make this in one piece but I decided to make the fork separate from the lever as illustrated in photo 109. The



The finished governor.

lever was cut and filed from $\frac{1}{16}$ inch plate leaving the top end too long for finishing to size. The fork was made from a short piece of $\frac{1}{8} \times \frac{1}{16}$ inch strip and was bent round a piece of 5mm bar. Filing the fork to shape is best done to soothing music and once that is achieved, the end of the fork arm can be trimmed to the correct length ready for silver soldering onto the fork. Hold the fork arm in a clamp or small vice with the top resting on a refractory brick and place the fork in contact with the end, having first cleaned and fluxed the mating parts. Bring both parts up to dull red and sparingly add solder to the mating joint. If your temperature is correct, then the solder will run down the joint by capillary action, giving a joint that is plenty strong enough for the task in hand and indeed will stand further filing without any complaint.

Photograph 109 shows the parts before soldering together. Close up shots of small parts, depressingly, show up every mark left by tools and it is easy to forget that the set-screws in the photo are only 1.3mm diameter. Well ... that's my excuse! I am not good with very small parts. When assembled, the fork was causing friction on the slider causing the governor slide to fail to drop, by gravity, as the speed of rotation dropped. Considerable fiddling was required to create a friction free assembly. **Photograph 110** illustrates the finished governor.

● To be continued.

NEXT TIME

We tackle the parallel motion.

Usk Show Steam Corner 2019

Graham Gardner takes a trip to the Usk rally to visit a long-established 'steam corner'.



The 'Steam Corner' was originally started by John Haining many years ago. John was famous for the 2 inch scale Fowler ploughing engine drawings and castings that he supplied since the 1960s and he also wrote the construction articles for them in *Model Engineer*. Later, he wrote under the heading of 'Countryman's Steam', describing various steam vehicles and other items. John was also a technical advisor for *Model Engineer* for many years and also wrote various books on model engineering. He was also the first president of the Model Steam Road Vehicle Society for about 10 years after its formation in 1985.



'Steam Corner' banner.

The Usk show has been held in Monmouthshire for the last 175 years and is mainly an agricultural show but as John lived locally he also played a part in running the show with

his wife Ann. He suggested a 'Steam Corner' marquee for model engineers to come and display their work and also to have live steam model road vehicles outside to show model



4½ inch Burrell road locomotive built by Keith Morris – here, seen receiving the John Haining Trophy from Tony Hall (right) chairman of the Newport MES.



Full size Foden steam waggon.



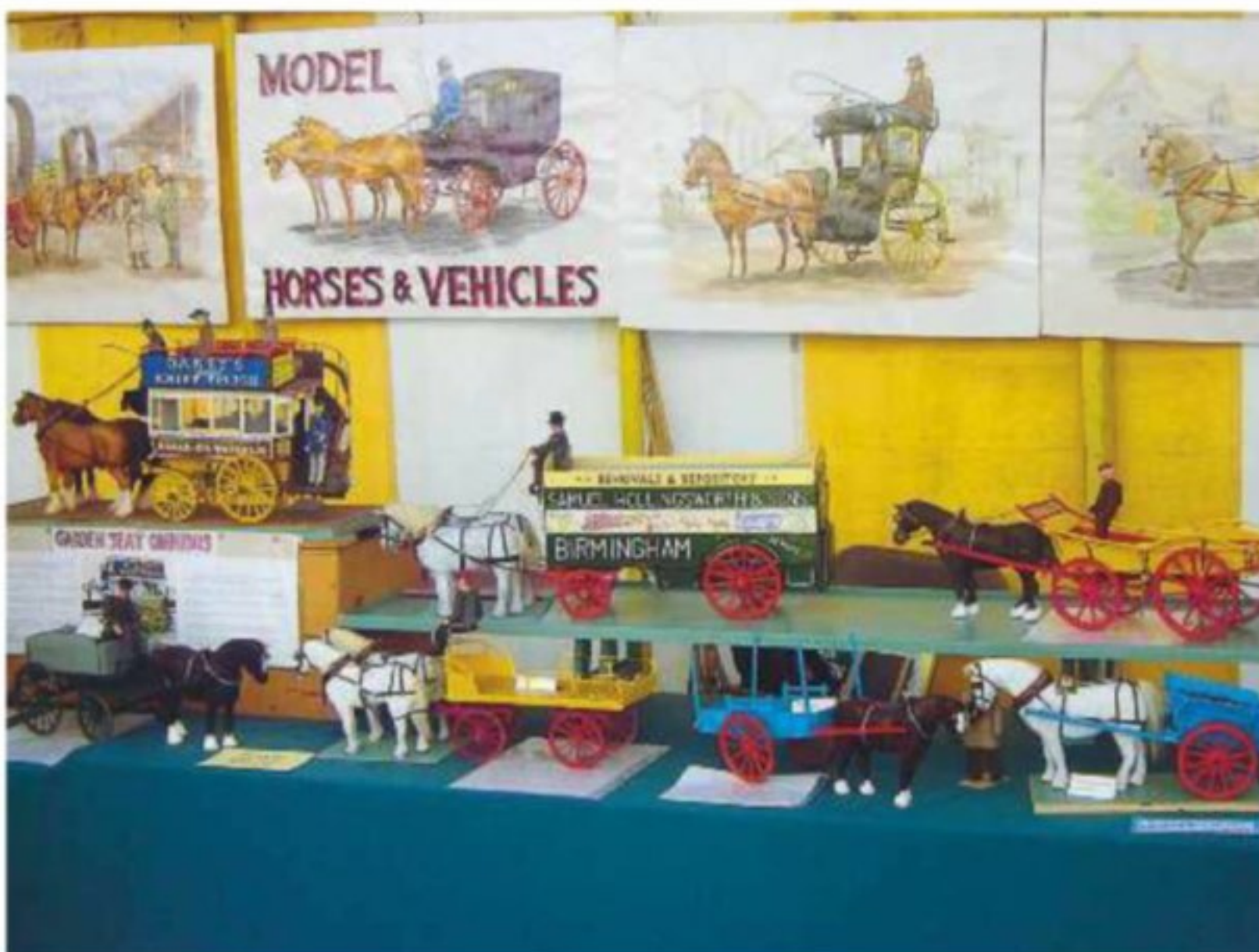
Stationary steam engines by S. & R. Thomas.



Matchstick models by Mr R. Markey.



7 1/4 inch Wren built by Bob Foster.



Horse drawn vehicle display by Brian Kerley.



1 1/2 inch scale Royal Chester, owned by Chris Lewis Cooper.

engineering off to the large crowds that attend each year.

The marquee has grown in size over the years and is now a major part of the show, together with live steam

engines and an outside display of stationary engines. It is up to the standard that you would find at a full-size steam rally.

After many years of running the 'Steam Corner' John

decided that he could no longer run it so it was handed over the City of Newport Model Engineering Society to run, which they do very well. After John passed away it was

decided to award the 'John Haining Trophy' in his memory each year to the best live steam road vehicle in show.

The Usk show is held on a Saturday in mid September



Display of 'Mamods' by James Tonen.



City of Newport Society of Model Engineers' portable track.



A very nice Bamford stationary engine.



A John Deere engine 'at speed'.



4 inch steam waggon owned by Chris Lewis Cooper.

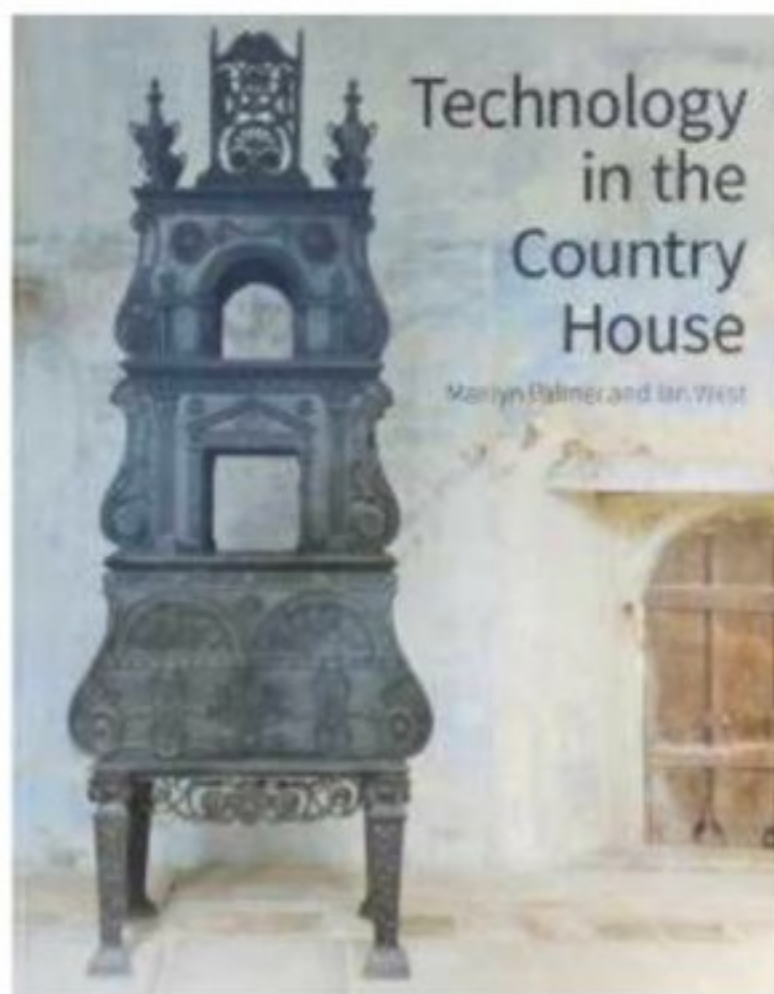
each year in the beautiful Monmouthshire countryside (NP15 1DD).

For more details please visit www.uskshow.co.uk

ME

6 inch Burrell traction engine waiting to be unloaded.





Book Review

Technology in the Country House

By Marilyn Palmer and Ian West

Perhaps the least studied engineering is that which surrounds us at home. Heating, lighting, water technology and fire safety all depend on engineering. This history is summarised in an excellent book based on over a hundred visits to country houses.

Home comforts and easy operation were not always a priority when owners' prestige and conspicuous consumption led the way. Keeping an old house up to date was difficult and expensive. Noël Coward summed it up when he wrote 'Tho' the pipes that supply the bathroom burst/ And the lavat'ry makes you fear the worst/ It was used by Charles the First'. James Lees-Milne was even less flattering about stately homes, describing them as 'caves of ice'. After all, there would always be plenty of low-paid servants, wouldn't there?

The country houses described include castles, new buildings from the 16th, 17th and 18th centuries and then 19th-century buildings built by the newly rich, finally incorporating creature comforts into the home as standard. They used industrial materials like cast iron, often without regard for 'authenticity' but they were often far stronger and lighter than what was used before.

Some owners did modernise. They installed water pumps, some of large size, or added water wheels to supply both house and gardens. They finally replaced antiquated waste disposal with proper sewerage systems. Vast open fireplaces were placed, first by more efficient Rumford stoves and then by central heating. Coal railways brought in the

quantities of fuel required, as at Tatton and Belvoir Castle.

Kitchens received cast-iron ranges and, later, Aga cookers as owners' tastes in food altered. Fashionable French chefs, as at Petworth, required new arrangements for their range of sauces. Refrigeration slowly came in, replacing ice houses.

Candles gave way to whale oil and colza (rape seed) oil lamps before some tried gas. Culzean Castle had its own seashore gasworks, one of the earliest in Scotland. Later country homes might have acetylene lighting.

The newly rich from industry often led the way. That pioneer of hydraulic power, William Armstrong, used electric lighting at his Cragside home where he had a hydro-electric power station. Some used steam engines to generate electricity but oil and petrol engines predominated. Battery backup was essential. Waddesdon Manor retains an elaborate switchgear room but for the Rothschild family owners no expense was spared.

Some houses were never properly modernised. *Canons*

Ashby retains its charm, as does *Chastleton*, a house where the aristocratic owners seemed in mental as well as physical decline.

In-house communications improved, first with bell wire systems and then electric bells and telephones. Isolation led to catastrophic fires so home owners tried fire safety engineering and acquired their own fire appliances. Richer owners had steam fire engines. There are beauties at Penrhyn Castle and Tatton that could also serve the locality.

Engineering improvements didn't only apply to the house. Estate buildings could be technically advanced. Many had sawmills with the obligatory steam plant or oil engines.

A thoroughly researched book, suitable for engineers and stately home tourists alike, even if it is rather expensive. It would be good to see the author's attention given to improvements that spread to more humble abodes. Domestic engineering benefitted all eventually but how much thought do we give it?

Roger Backhouse



19th century re-engineering in Petworth House kitchens where a new French chef required special equipment for his cuisine.

Historic England/National Trust, 2016. £60. 205pp. ISBN 978-1-84802-280-5.

Walchaerts Valve Gear For *Sweet Pea* PART 1

Frank Birchall explains how he upgraded the Hackworth valve gear on his *Metre Maid* to Walschaert's.

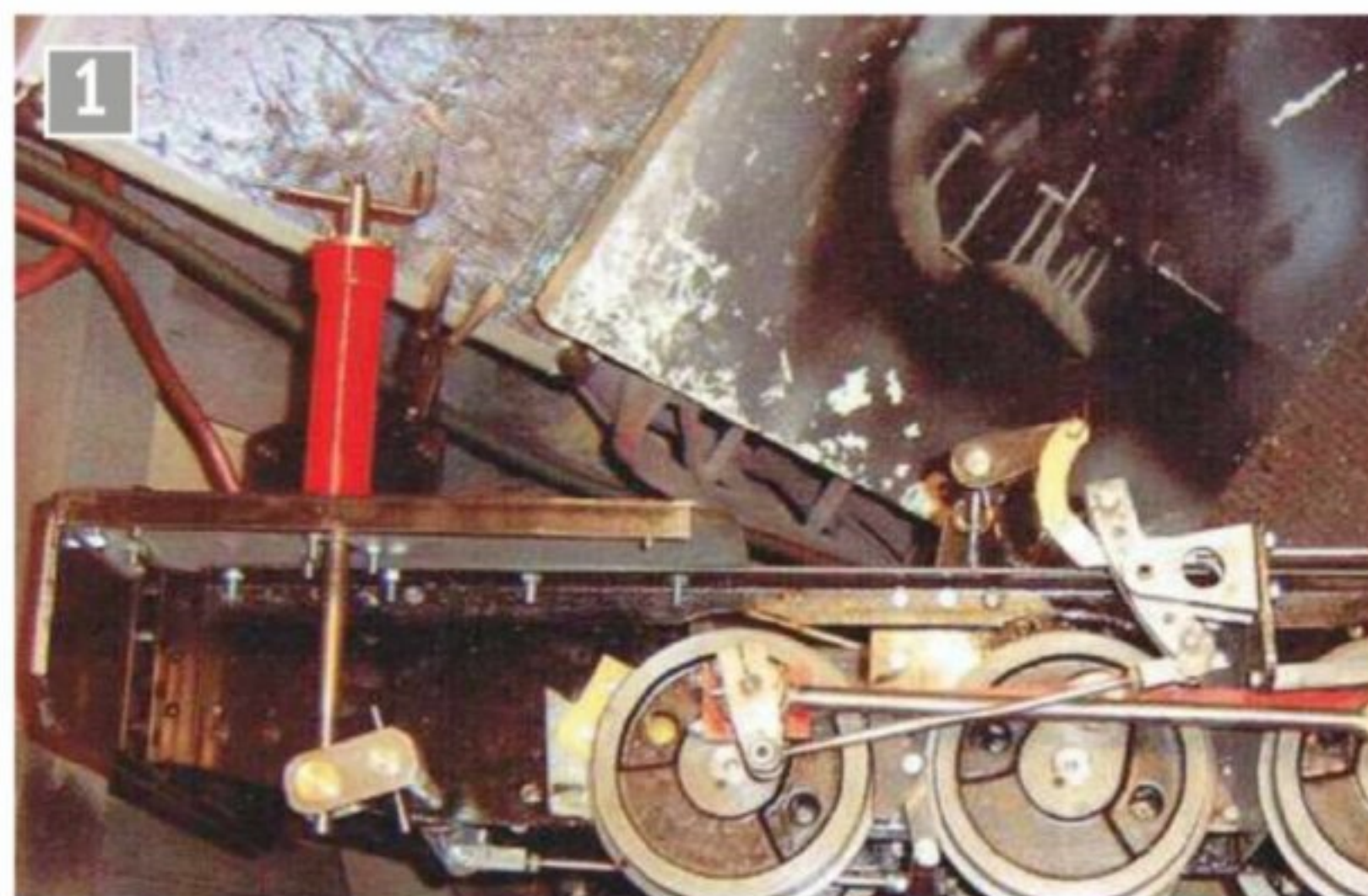
Initially, it was my locomotive friend John who gave me the idea of fitting a Walchaert's gear to his *Sweet Pea*, which is fitted with a Hackworth gear at present and doesn't run particularly well.

It so happens that I have a Walchaerts design which I developed for my 7¼ inch gauge engine derived from Romulus and named *Maggie*, which appears in the Blackgates catalogue. This design worked well in six of the engines I have built over the years and the design will suit *Sweet Pea* and also *Metre Maid*, using existing holes on the frame (**photo 1**). All that is required is to remove the Hackworth gear.

It is important to know the names of the parts of the gear and **fig 1** should help.

The parts fall into two groups: existing parts, to be modified, and new parts.

The existing parts to be modified are the crosshead, the slide bar and the reversing



Metre Maid fitted with Walschaert's gear.

lever and we'll deal with those first, followed by the new parts we need to make.

Crosshead

There is a change to the gudgeon pin holes in the crosshead (**fig 2**) and a new gudgeon pin is needed to hold the drop link in place, together with a screw in the 5mm hole tapped in the crosshead on the outside faces.

The slide bar (**fig 2**) is to be shortened or made new with a 5mm tapped hole tapped in its end. A four jaw chuck in the lathe will help to do this. A 2BA thread can be substituted but I prefer 5mm as I can get 5mm screws from F.W.B. (usual disclaimer), which are plated and made from high tensile material - and no stripping.

On **fig 3**, there is a small change to the reverser lever.

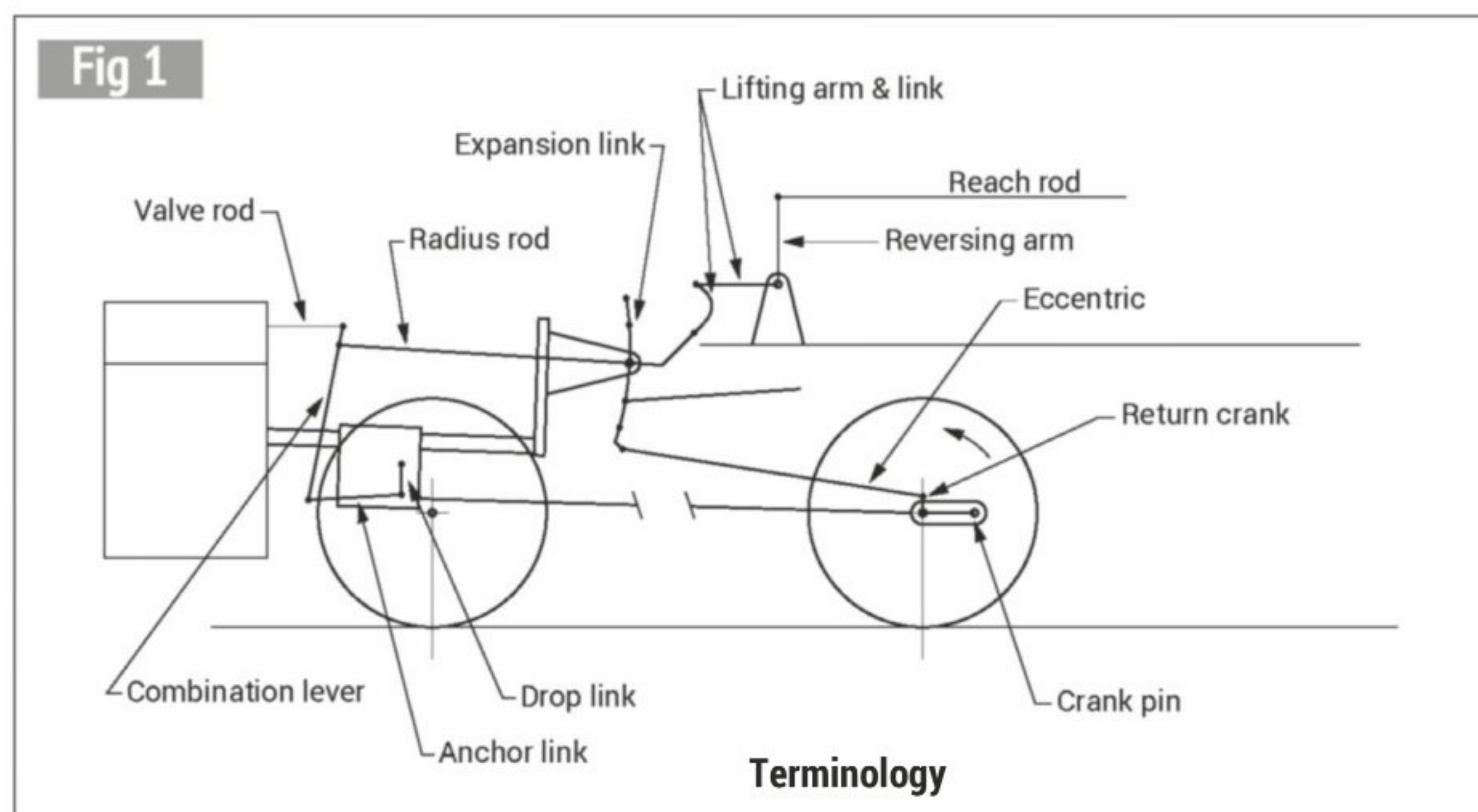


Fig 2

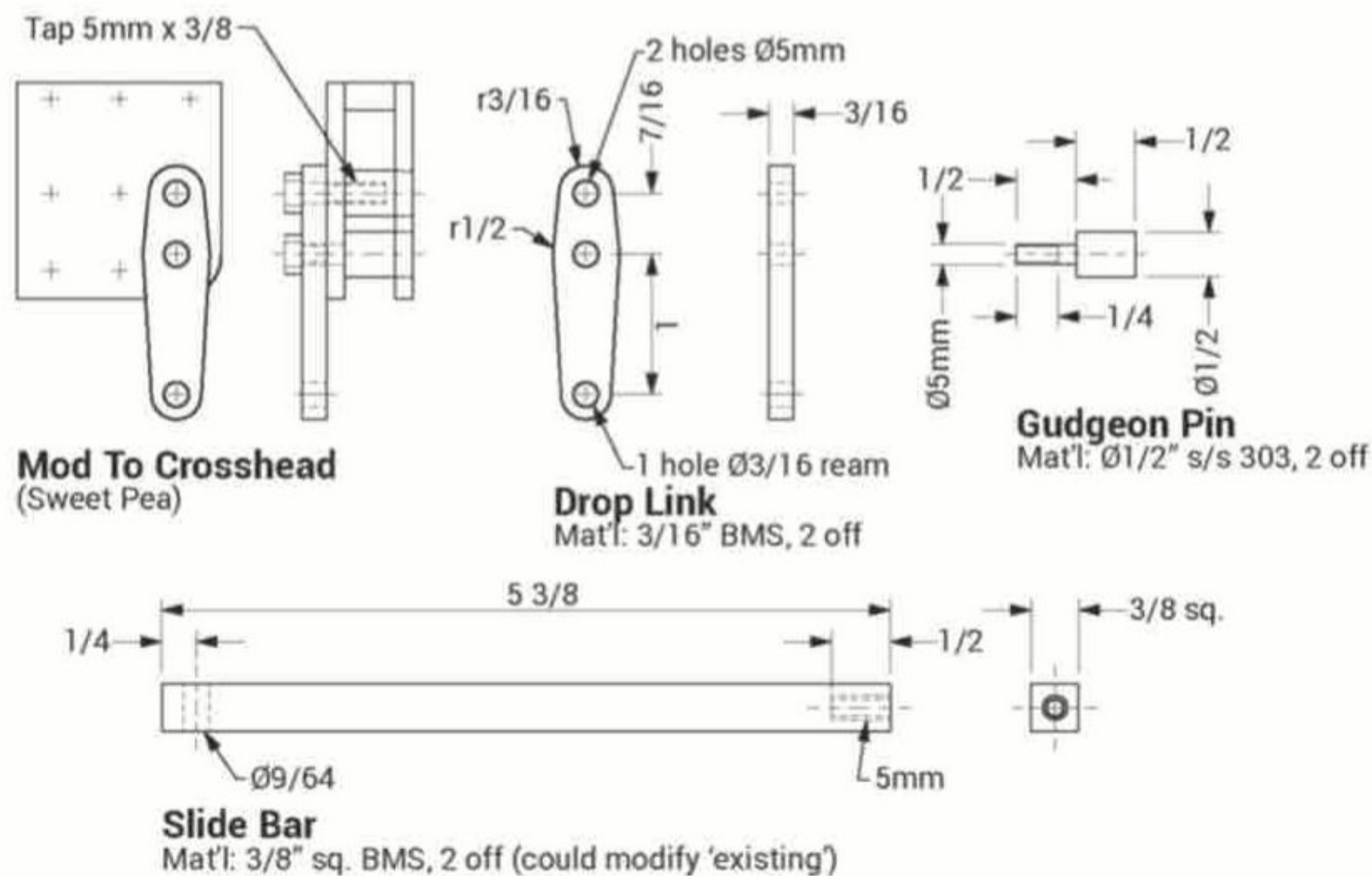
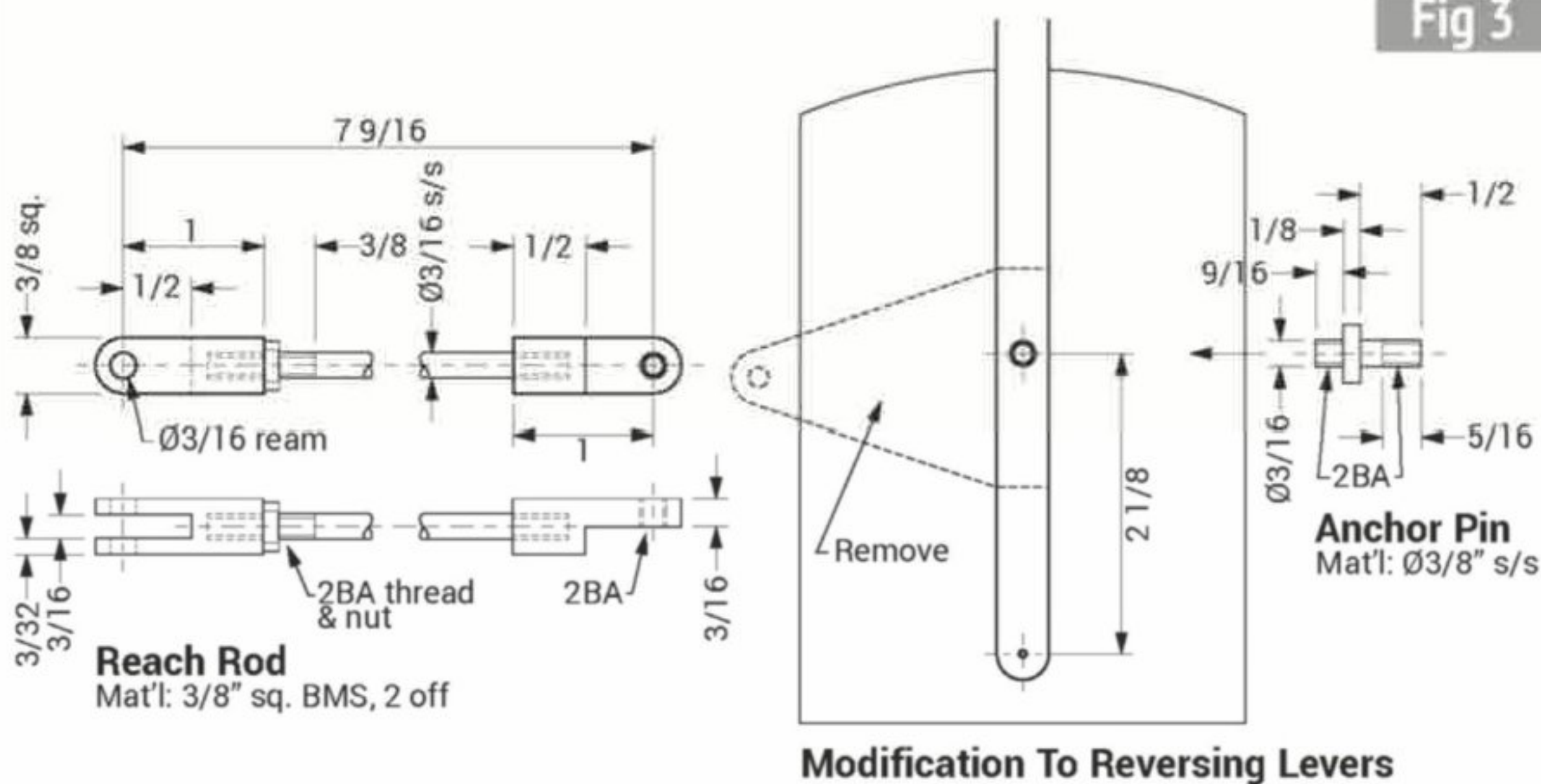


Fig 3

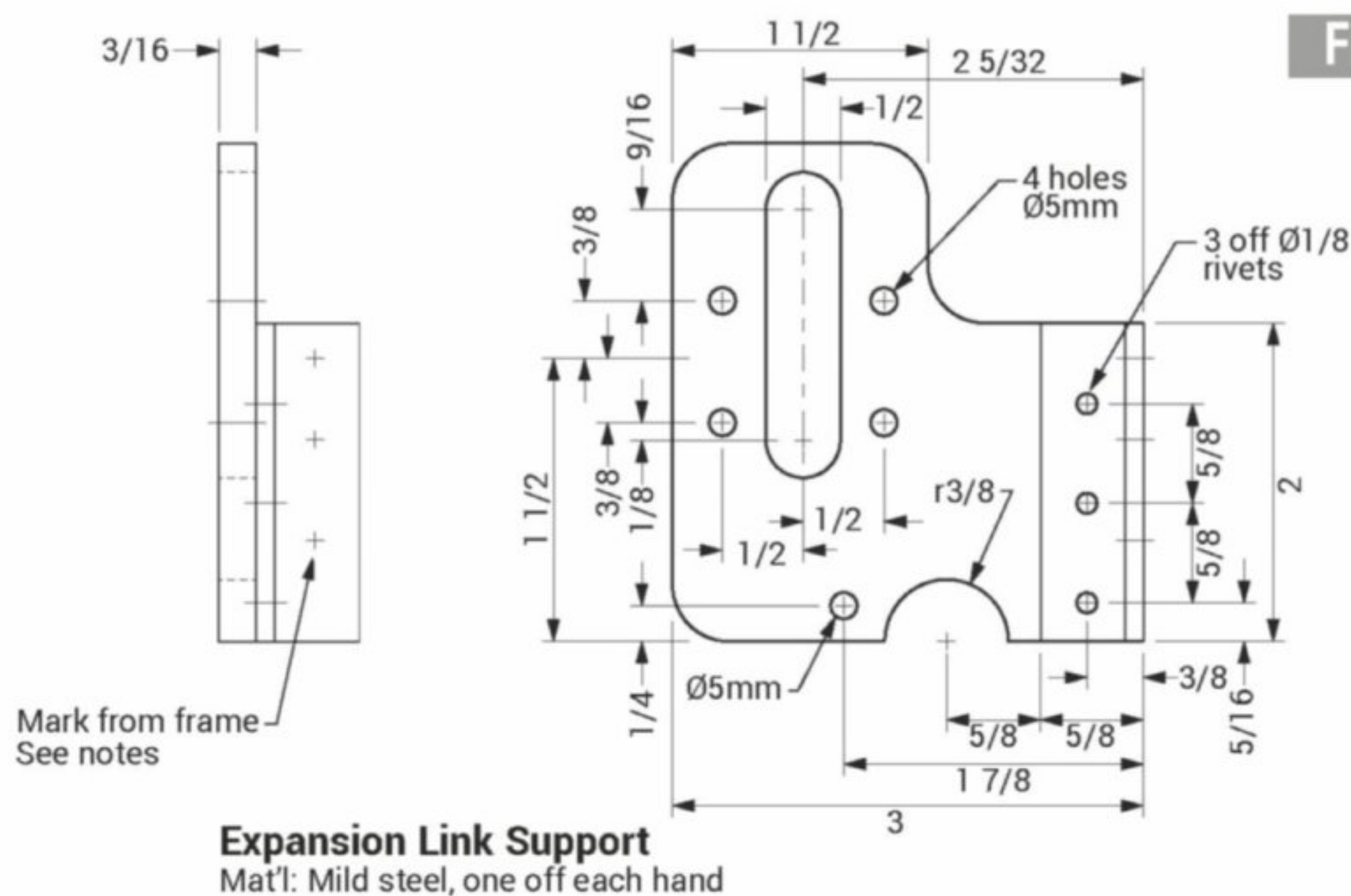


This is a simple change to the means of anchoring the end of the reach rod, which is also on this drawing and is relatively simple.

Expansion link support (fig 4)

This could be the next part to make and attach to the three holes in the frame currently holding the support for the slide bar. This will need to be removed. Once the support is finished, locate it in position by attaching it to the end of the slide bar. Clamp it to the frame and mark out from inside the frame the three holes in the 5/8 inch angle on the bracket, then fix. Some like to use marking blue but I prefer to spray with grey primer paint, which can be marked with black lead pencil.

Fig 4

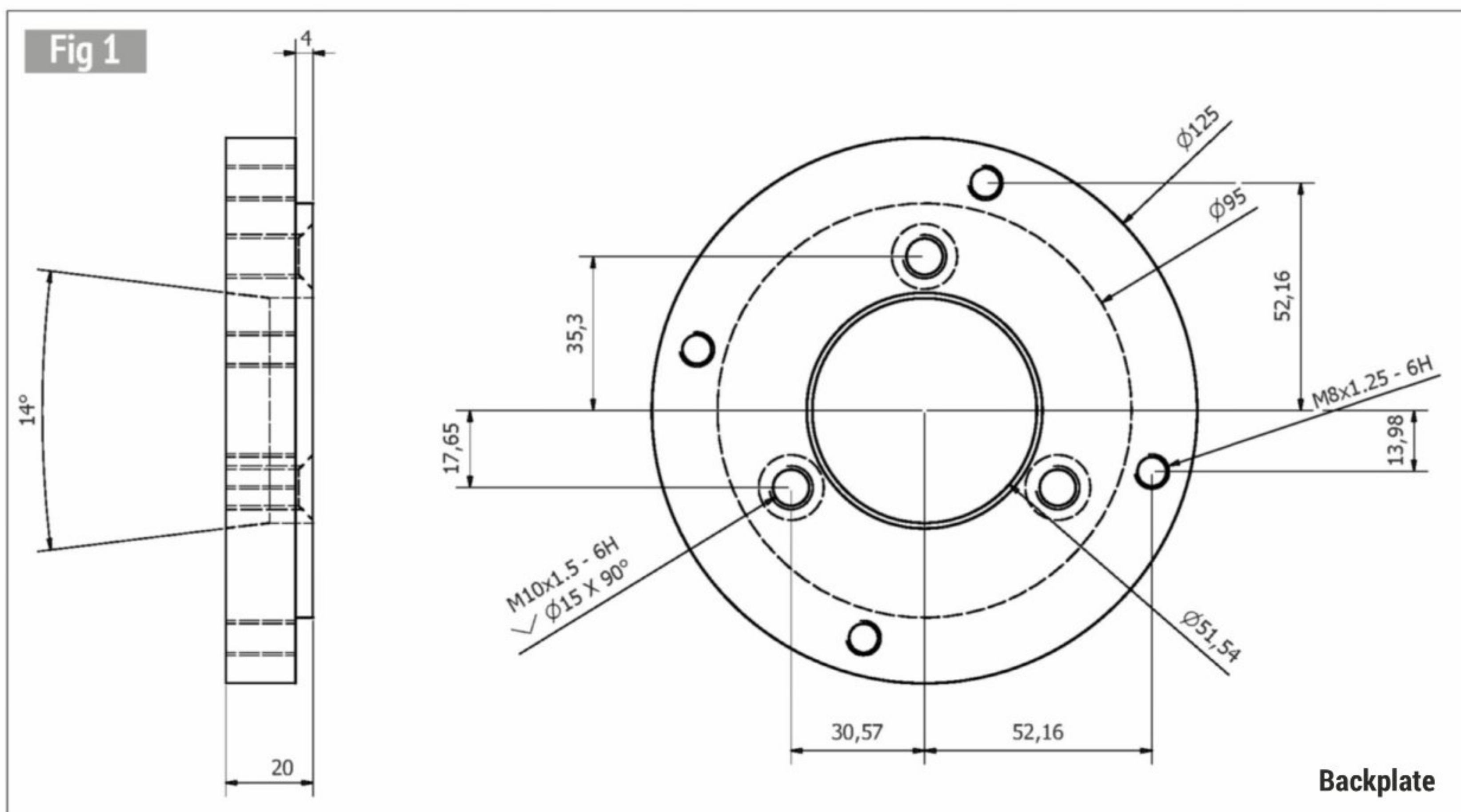


The expansion link (fig 5)

This is probably the most difficult item to machine and one or two methods for doing this have been published. In my case I was able to extend my 10 inch rotary table with a 3/4 x 3 x 14 inch steel bar so I could attach my material to machine at 6 inches radius. A computer controlled milling machine would make short work of it.

I started off with four pieces of 4 x 2 x 3/16 inch ENIA B.M.S. (bright mild steel) marked out as in fig 6. It is best to drill the





Backplate for Myford 254 lathe

Robert Walker finds himself having to make a backplate for a newly purchased chuck.

As a member of the Beeleigh Mill Restoration Group I had a requirement to make some square headed bolts with non-standard pitch threads to replace broken or missing bolts for the steam engine. See this website for further details of the mill and its engine: beeleighmill.co.uk.

The engine was made around 1830, hence the non-standard threads. A number of articles in *Model Engineer* discussed the usefulness of four jaw self-centring chucks so I decided to buy one to simplify the manufacture of the bolts. The problem I had was my lathe was relatively old and had the BS 4442 Type A small cone to locate the chuck with three studs and

nuts to retain it. As I could not find a back plate available commercially I had to make my own.

The starting point was to find the specification of the spindle nose. I was fortunate at this point as I still did some part-time university lecturing so I was able to access the appropriate British Standard via the university library. The Myford manual for the lathe also states that the clearance between the face of the back plate and the spindle nose flange should be 0.002 inch. The material I chose was 5 inch diameter mild steel, 1 inch thick. For the studs I decided to use three countersunk head set screws fixed with permanent Loctite 658. As it happened the screws were too

short so I used three M10 bolts I had in stock, with the heads cut off and machined flush to the surface.

The chuck I bought was 125mm diameter so a 5 inch blank would allow the outside diameter to be skimmed for appearance. On my existing chucks the tapered recess is 12mm deep and the cone on the spindle is 10mm high but to ease manufacture I replaced the recess with a hole as shown in **fig 1**. The recess in the back of the new chuck is 5mm deep and 95mm diameter therefore the chuck is located radially on a 95mm diameter recess and the face is between the 95 and 125 diameters.

The first operation was to face off both sides of the blank to about 24mm thick. I then

'blued' one surface and marked the centres of the bolt holes and the blank centre. This marking out was only to be a guide for clamping the blank on the mill and for rough drilling the centre hole and then all other tapped holes. I would rely on the DRO and the following tables for the co-ordinates of the holes, countersinking and counterboring where necessary. My logic was that I would then hold the blank on the lathe with an independent four jaw chuck, ensuring that the centre hole was on accurately on centre, thus guaranteeing that all the pitch circles are concentric with the centre hole. The marking out should help to avoid any silly errors while drilling and tapping.

Tables of hole positions are based on the centre of the plate being $x=0$, $y=0$, M10, tapping size 8.5mm, counter sink 20mm, counter bore 10.2 $\times$ 2.5mm in addition to counter sink.

X	Y
0	-35.3
17.65	-30.57
17.65	30.57

For M8, tapping size 6.8:

X	Y
-13.98	-52.16
52.16	-13.98
-52.16	13.98
13.98	52.16

The centre hole was drilled on the mill, finishing with a $\frac{7}{8}$ inch diameter drill, which is the largest drill I have that I can use on my mill. As can be seen in **photo 1**, the blank was clamped on a hardwood block as there is no position that parallels could be used and not damaged during the drilling operation. I tapped the holes on the milling machine to avoid drunken threads (**photo 2**).

I then clocked the centre hole in the independent four jaw chuck and bored the centre hole to size. This ensured that the pitch circle of the holes was correctly aligned to the turning operations. I then



The blank on the mill prior to drilling.



Completed drilling and tapping.



Setting the compound slide to the correct angle.



Completed backplate.



Testing the chuck assembly.



Two of the bolts in the mill engine awaiting assembly of the cylinder covers.

skimmed the face to ensure that the face and the hole were true and hence also the taper, which is the most critical part.

To set the compound slide accurately I removed the chuck, still holding the blank, and with a dial gauge in the tool post, ran the gauge along the far side of the spindle nose taper (**photo 3**). The standard defines the angle on the spindle nose to be 7.125°. When the top slide is set correctly, the DTI should stay on zero the whole length of the spindle nose taper. I also marked the chuck and spindle nose to guarantee that the chuck went back in the same place. The depth of cut I calculated to be 0.125mm on radius to finish the taper.

The taper was then machined and the back plate assembled with the bolts. To check the taper turning I removed the chuck complete with back plate and tried the taper on the spindle. On the first attempt there was too much clearance between the back plate and the spindle nose flange. One further cut and the result was good. If the taper had been too large I could easily have skimmed the face to give the correct fit. The blank was then fitted to the lathe and the 4mm high by 95mm diameter step that locates the chuck was machined, thus guaranteeing that the chuck location diameter was concentric to the spindle nose. The outside

diameter was skimmed for appearance (**photo 4**) and the chuck could then be assembled to the back plate.

When I tried to remove the completed backplate the taper had locked to the spindle nose in the same way my other chucks do, which was reassuring. Following assembly of the chuck and back plate the concentricity of the chuck could then be checked to ensure that the final assembly was to the standard defined on the chuck test certificate. Pleasingly it was - see **photo 5**.

I successfully used the new chuck and backplate to make the replacement bolts for the engine (**photo 6**), which will be in place soon.

ME

Brill 22E Tram Truck

Ashley Best describes an American design of tram truck that was widely used on British trams.



Continued from p.559
M.E. 4623, 11 October 2019

The typical British electric tramcar had become established early in the 20th century. Mostly they were double deckers on either four wheel single trucks or, for larger cars, a pair of four wheel bogie trucks. It is interesting to note that most of these trucks were American designs. Britain was only later to develop its own successful truck types. Of the makers that supplied these early trucks, the most successful was the Brill Company of Philadelphia. Their two most prolific products for the British market were the 21E four-wheel truck and the 22E maximum traction truck for eight-wheel cars. This latter design forms the subject of this article.

The model

The description that follows is of the construction of a standard Brill 22E EUREKA truck in $\frac{1}{16}$ scale. This is probably the smallest size in which all the main features of the full-size prototype could easily be replicated. It is intended to be a working model which makes certain compromises necessary. A static exhibition-standard model made simply for appearances would in many ways be simpler.

One sixteenth scale is the standard of the original models built by members of the Tramway and Light Railway Society and remains so to this day. Most early tramways in Britain used Imperial measurements, as indeed did the USA. In this, of course, the wonderful thing is that one inch full size simply translates to one sixteenth of an inch in



Typical trams.

the model. I shall therefore stick mostly with Imperial units for prototype dimensions but metric units will creep in occasionally in the use of tools and equipment. All the reference material I have used in researching the 22E truck is entirely in Imperial units.

I shall also use the nomenclature of the Brill drawings to describe most of the parts. However, this is not always possible as, over time, it appears that the Brill draughtsmen changed the names of some parts. I shall try to make the descriptions clear.

At this point, I would like to touch on a matter with implications for the rest of this article. By no means all of us who enjoy our hobby are equipped with expensive workshops or machinery. Indeed, speaking for myself, it has taken many years

gradually to acquire really useful engineering equipment.

That said, there does have to be a number of essentials without which it would be extremely difficult to produce satisfactory results. Readers will now start to infer that I am about to bang the drum for an emphasis on old-fashioned hand skills. Yes, to a degree, but what I hope to convey is that there are many ways to achieve satisfactory results. Therefore, in what follows I shall try to describe how I built the truck but at the same time make clear some of the other ways of achieving a result.

The truck which is the subject of this article has as many features of the prototype that I felt capable of including in a working example. A perfectly viable but much simpler truck is a reasonable possibility. I shall therefore indicate how such a working

Source for motors, gears, castings and plans:
Model Engineering Secretary,
Tramway & Light Railway Society,
9, Manor Close, Bognor Regis,
West Sussex PO22 7PN
Or e-mail: tlrs.mesecretary@tramwayinfo.com

truck, with adequate function and appearance could be constructed.

It is possible for a builder to acquire suitable electric motors, wheels and gears and I shall supply information as to where they might be sourced. However, I shall endeavour to describe a model truck in which no castings or finished parts were used. Essential tools and equipment for the project included a selection of drills with many of small diameter, which are very difficult to sharpen and are used frequently. Hand files, needle files, piercing saw blades, hacksaws, dividers, callipers and soldering iron are important, as is a hand-held model-makers' electric drill. An essential item is a scale rule which has to be made with care.

Of greatest importance is the capacity to silver-solder on a simple hearth or fire bricks. Silver solder preferably of high and low melting points will be needed, plus flux. Obviously needed are various types of small pliers and small screwdrivers. I use BA nuts and bolts but these are now being superseded at lower cost by small metric equivalents. A compatible tap and die set is

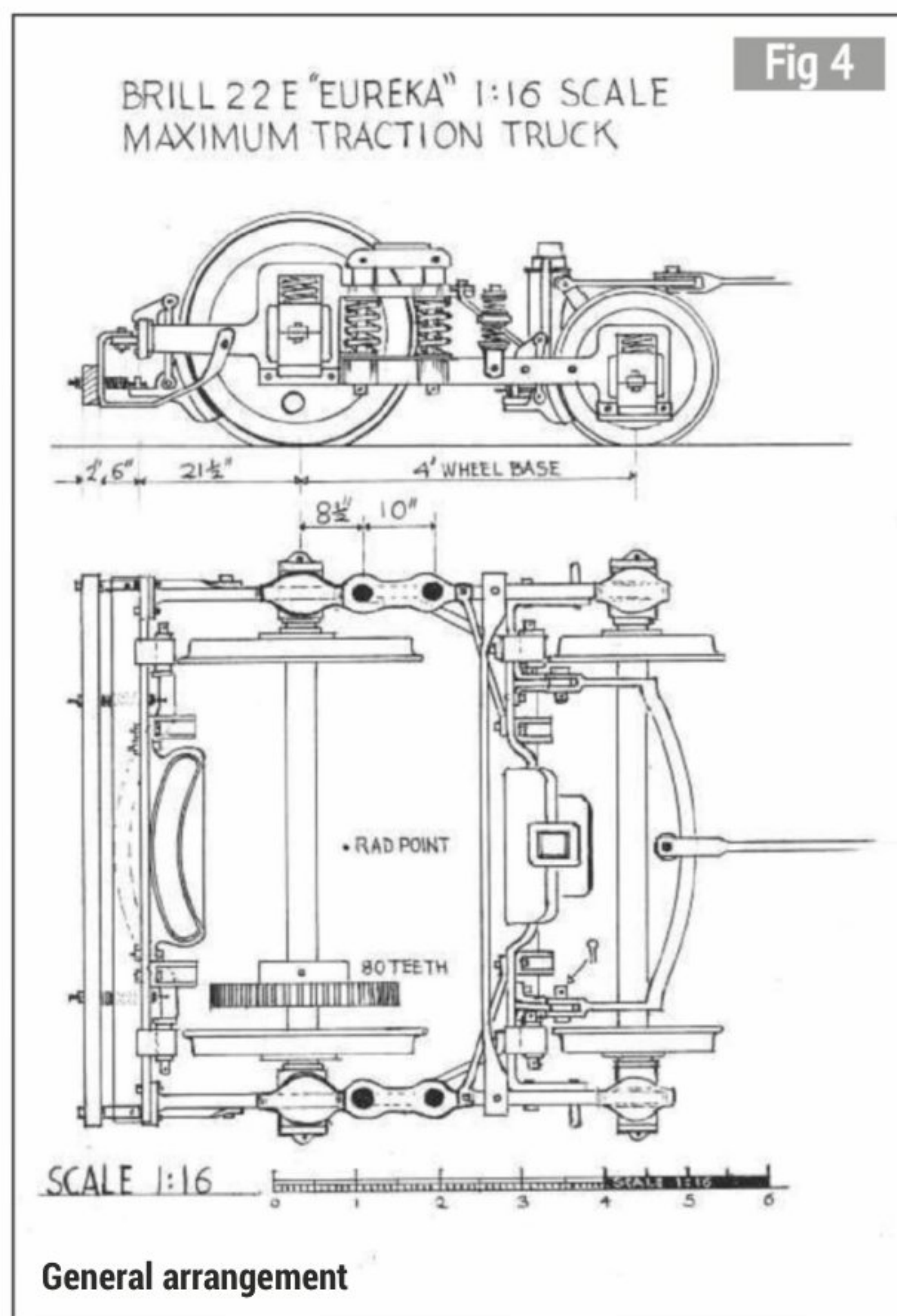
required and a set of broaches or reamers.

This list only touches on what most model makers will possess and is not exhaustive. The one absolutely essential machine, if wheels are to be made, is a lathe. A pillar drill is also almost indispensable. Useful, but it can be done without, is a surface plate or some sort of accurate flat surface - plate glass will do. If it is intended to cut gears, this will require a milling machine or apparatus applied to the lathe. As previously mentioned, gears, motors and wheels can be obtained from the engineering secretary of the Tramway and Light Railway Society.

Making a start

The article describes the making of a Brill 22E Bogie truck but, of course, one on its own would be useless as one is needed at each end of a tram.

The first and most important task I had to perform was the production of necessary drawings. A general arrangement drawing was sufficient for most of the subsequent construction (fig 4). The reference for the drawing was derived from multiple sources of official Brill catalogues and illustrations.



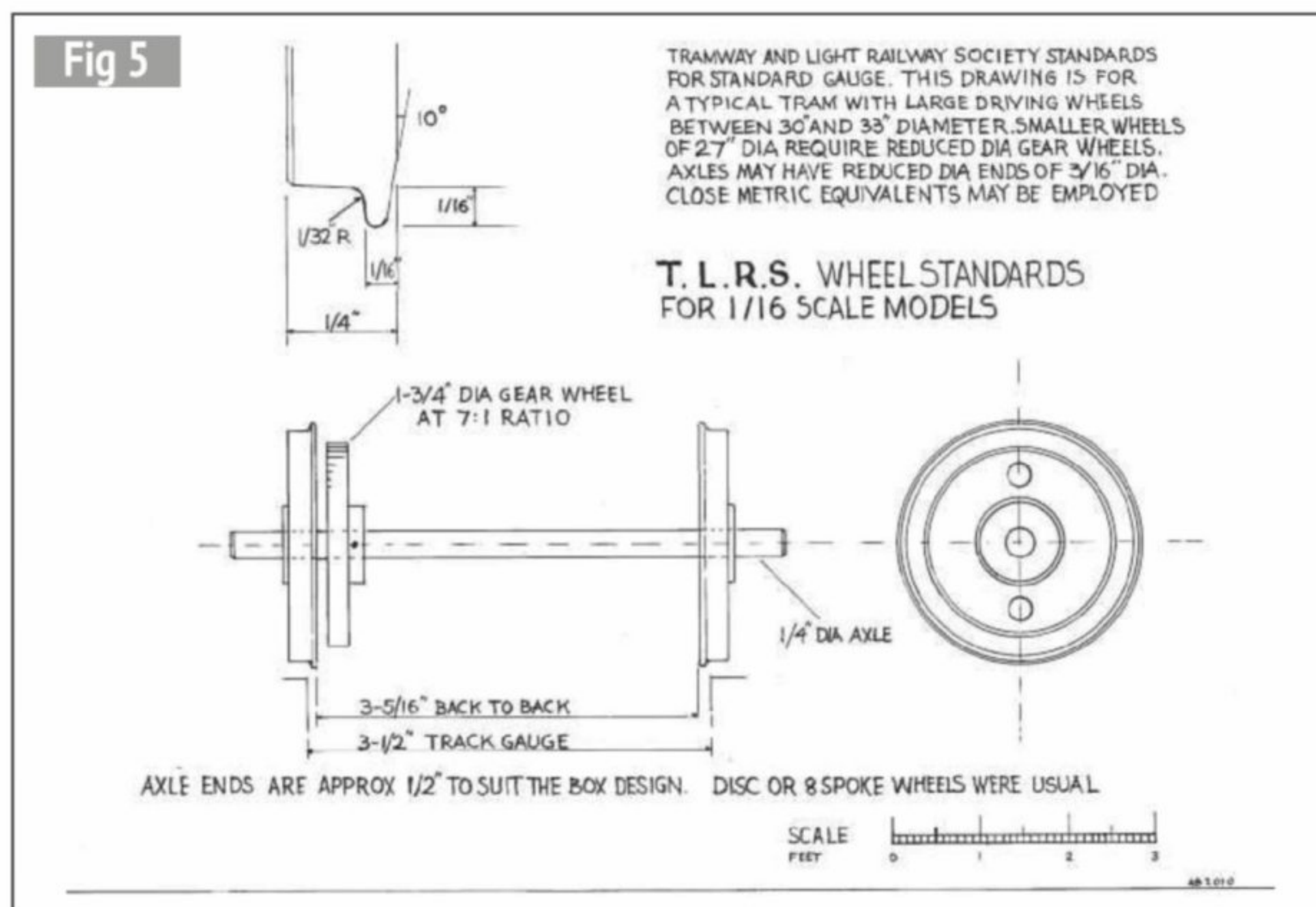
As mentioned earlier, there were many variations in these, showing how the design was altered and modified. I

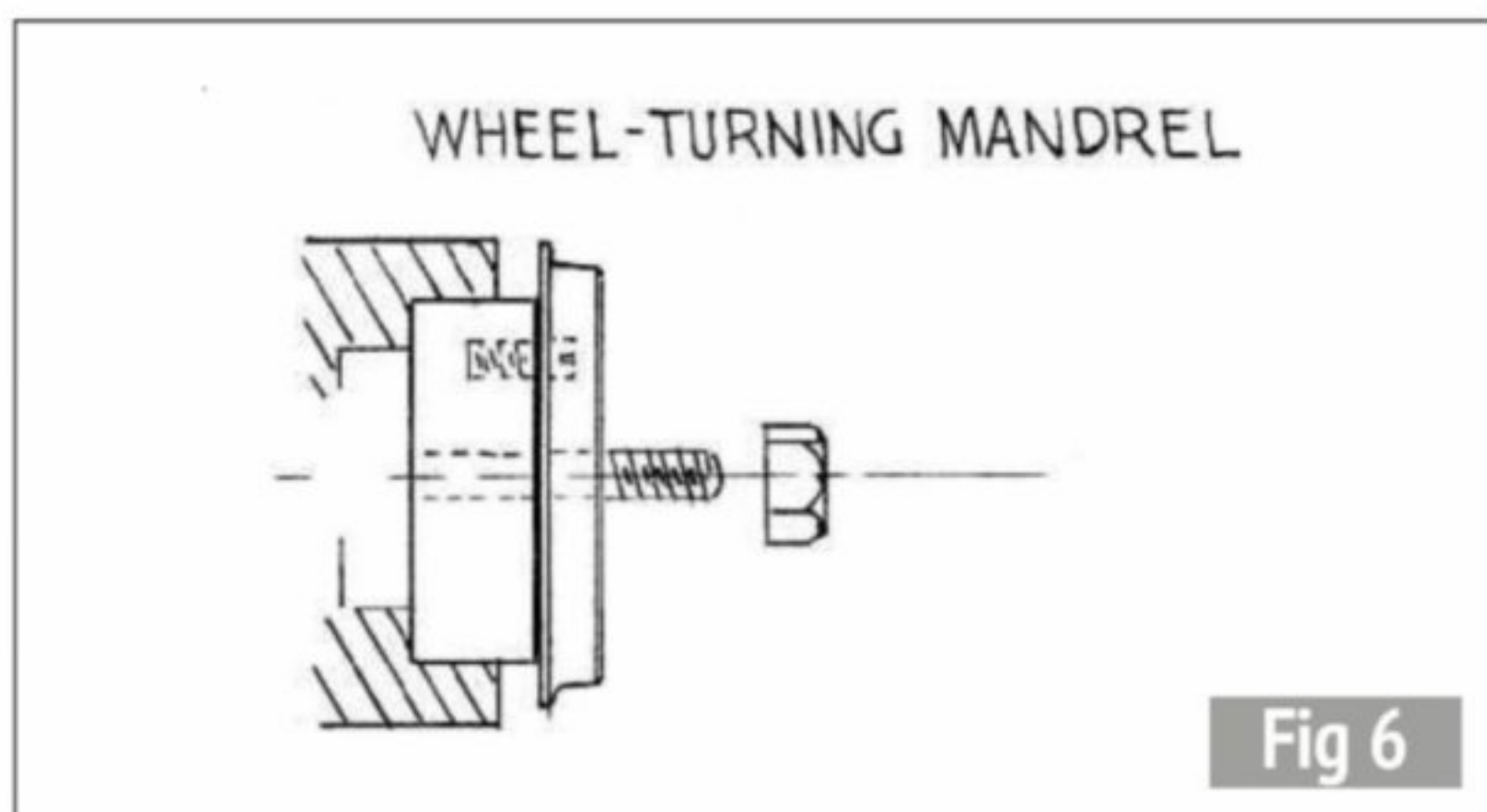
developed my own plans by extracting those features that remained constant and I had to bear in mind the constraints imposed by having to accommodate the larger than scale slow-revolution 5U electric motor.

This motor, which is the usual choice for working 1/16 scale model trams, is obtainable from the Tramway and Light Railway Society. It makes possible an almost prototypical gear ratio of 7:1 and thus a model that will move at a realistic speed. Truck dimensions were from the Brill drawing. Once the drawings were completed, construction could begin. I decided to start with the wheels and gears, followed by the side frames.

The wheels

The wheels were turned from mild steel discs to Tramway and Light Railway Society standards (fig 5). For axles, I





used ¼ inch diameter silver steel.

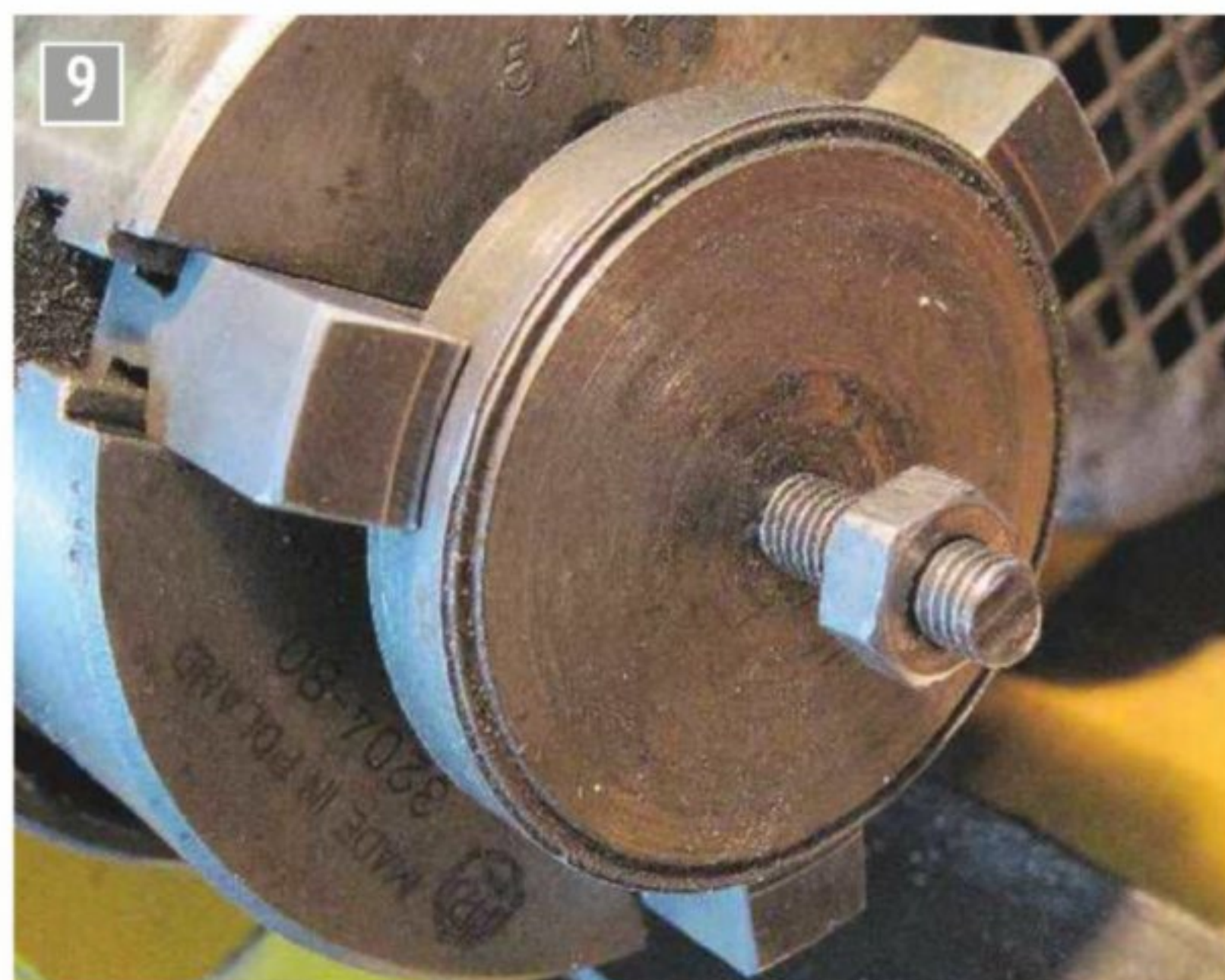
The larger wheels were made first. I made a mandrel as shown in **fig 6** and **photo 9**. This essential item, once made, will have further use for wheel-turning projects. The wheel discs were held in place by a well tightened nut on the threaded centre. It is also possible to provide the wheel blank with one or two holes as in the prototype wheels and this feature then allows a fixing screw or bolt to assist in securing the wheel while the flange profile is generated. Spoked wheels make this easier. A brass bush to fit the tailstock was also made (**photo 10**).

A wheel blank is first faced off in the lathe across the rear and then drilled in stages for the axle. This was then reversed and turned close to finished thickness and diameter (**photo 11**). For these stages, the chuck jaws were reversed. Turning the correct flange profile was then achieved on the mandrel, but very slightly oversize. Only then was the large gear wheel fitted and this was necessary of course *before* the wheels were set to gauge.

There is often a very tiny inaccuracy in a three jaw chuck and so, once the wheels were set to gauge, the three jaw chuck was used to grip the axle or wheel at one end and the other end, well-oiled, placed in the bush held in the tailstock. The wheel at that end was then turned absolutely true after which the set was reversed and both wheels brought to identical profiles. **Figure 7** makes this process clear, while **photo 12** shows this taking place. The wheels need to be very firmly fixed to the axles. Loctite or similar fluid can do this or even soft solder. The ideal of course is a perfect interference fit.

The pony wheels were made in exactly the same way but I made a smaller mandrel for them. The lathe should be run at a slow speed except when drilling for the axle. This should be done in stages and the final bore, slightly undersize, should then be reamed to provide an interference fit for the axle. This is not always easy to achieve. I drilled my wheels just undersize then used an expanding reamer.

Readers lacking reamers can get a satisfactory result by drilling the wheels then, in



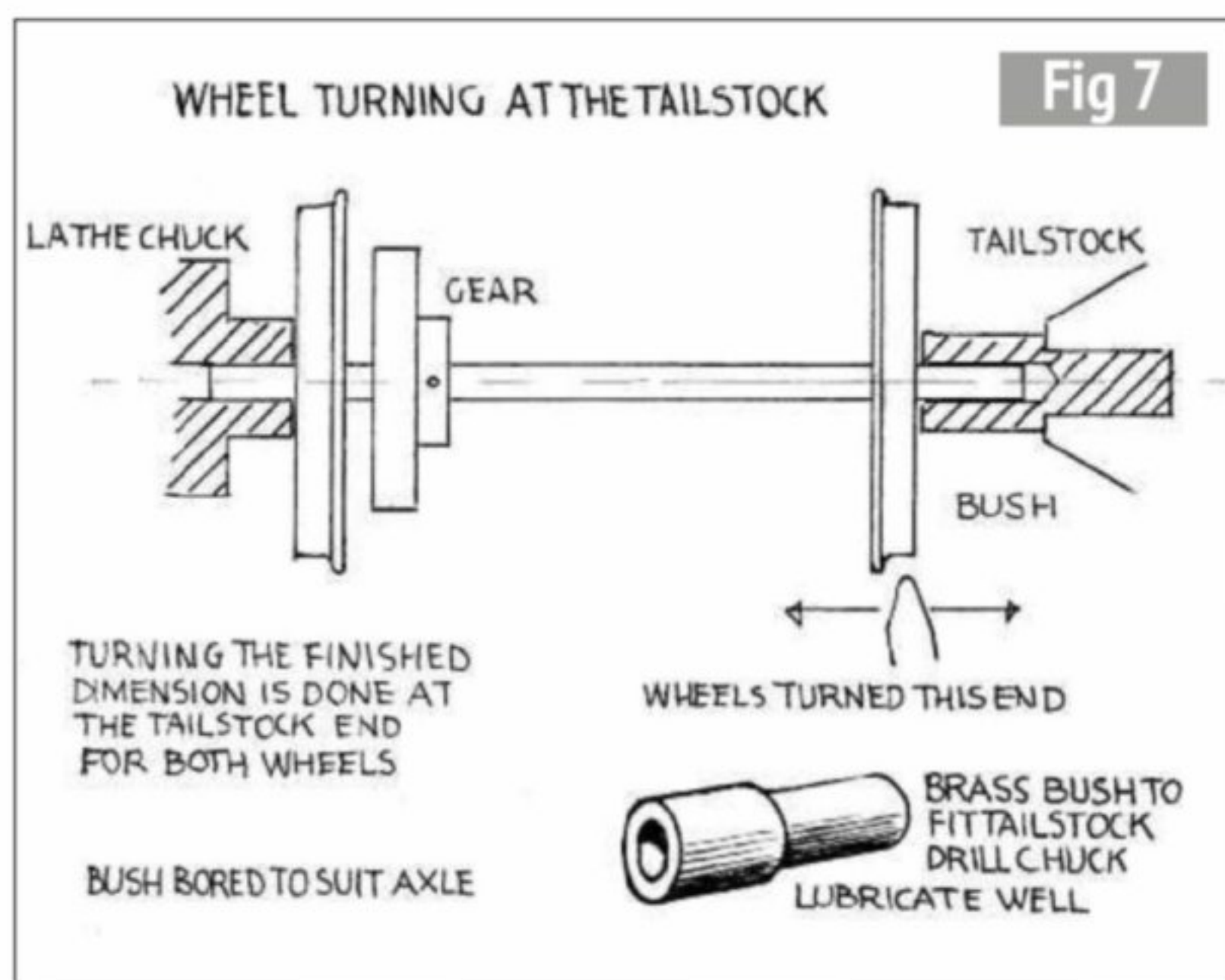
Mandrel.

stages, turning the axle journals down to size from rods of a larger diameter. This actually can have an advantage in the simplification of precise back to back wheel gauge setting. Once the wheel set is turned to the correct profile, the axle should have a journal length of approximately ⅞ inch at each end. Journals could be reduced

in diameter which might make the axle boxes a little easier to construct.

Gears

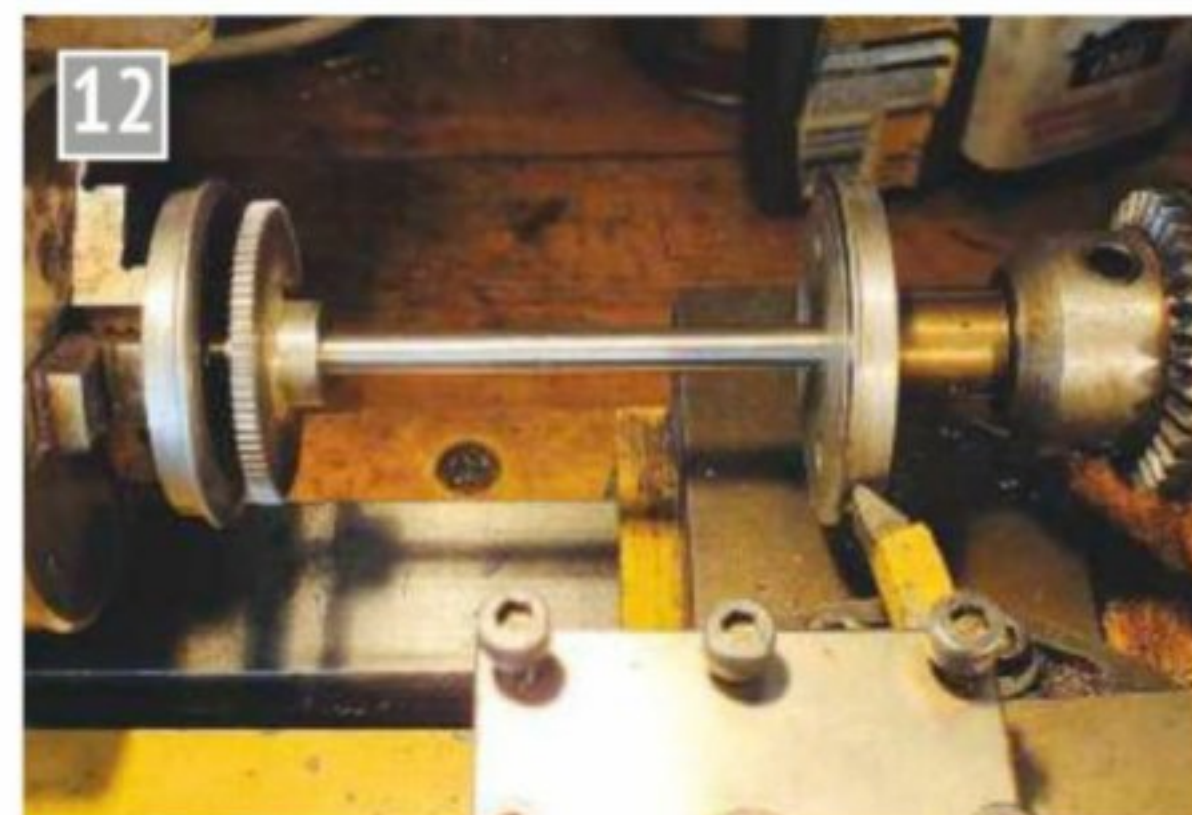
Ready cut gears are an obvious choice for many model engineers - all my first model trams used them but my eventual acquisition of a milling machine enabled me



Tailstock bush.



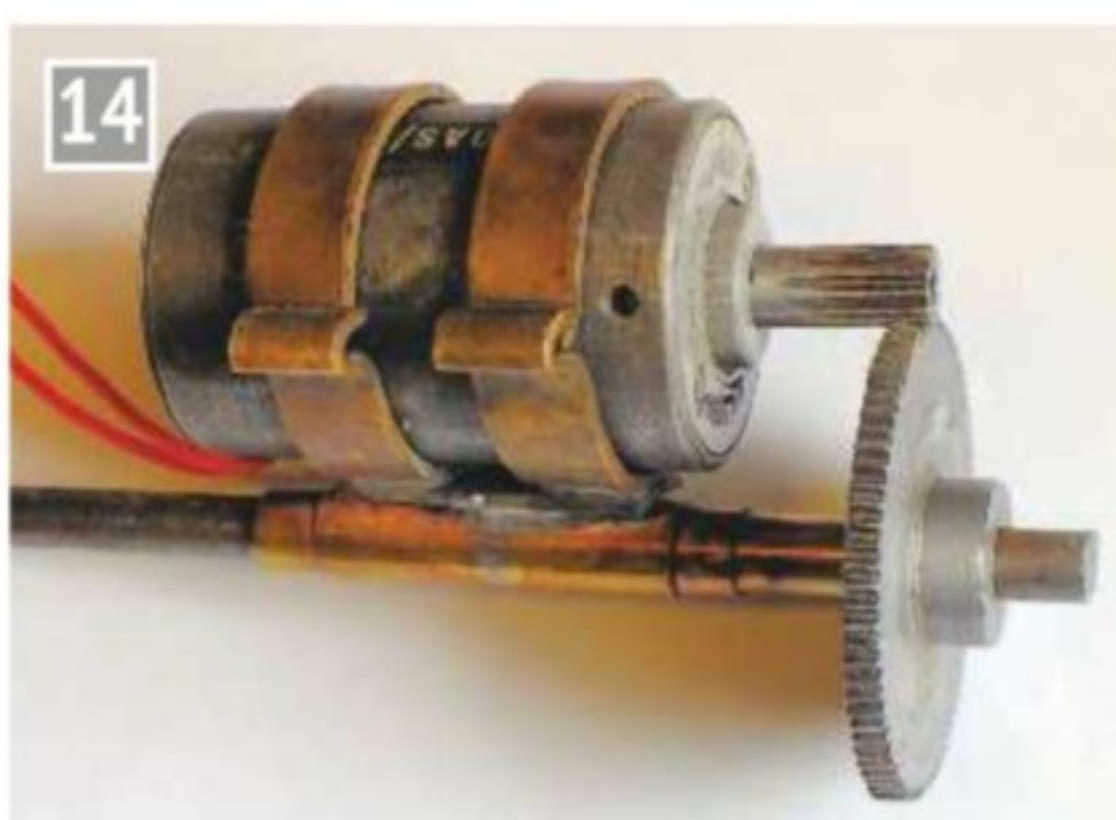
Wheel turning.



Flange turning.



Gear milling.



Gear testing.



Boxes.

to cut my own. For those not familiar with the process, I would strongly recommend first acquiring a good book describing the theory and practice of gear-cutting. I used Ivan Law's excellent booklet, *Gears and Gear-cutting* (Reprinted by Special Interest Model Books Ltd. (2003) ISBN 978-185242-911-2).

My 22E truck has 80 tooth main gears and 12 tooth pinions. This ratio size allows just enough room to accommodate the motor clear of the axle; of which, more later. A rotary table with clearly marked degrees had to be set up vertically and two disc cutters were purchased for a modest sum; a No. 8 cutter for the pinion teeth and a No. 2 for the main gear. Each needed an easily-made arbor to run in the machine. The main gear blank was drilled $\frac{1}{4}$ inch diameter and turned to an

outside diameter of 1.7 inches. An arbor was made to carry this blank and fit the chuck of the rotary table. Once the set-up had been established and checked very carefully, cutting could commence.

Teeth were cut as the table was rotated 4.5 degrees for each tooth (**photo 13**). The cutting speed had to be slow and this precludes the use of some commercial mini-mills as their speed range starts from too high a base. I cut my gears at around 75 rpm at first and increased just a little as I gained confidence, but always slowly.

The pinion blank has an outside diameter of 0.3 inch ($\frac{3}{32}$ inch) and first required a steel or brass rod to be turned to exactly the correct diameter, after which the hole for the motor spindle was carefully drilled 3mm. It would be difficult to do this after cutting

the teeth. The gear blank was then ready for the teeth to be cut. This was done with a No. 8 cutter at 30 degree intervals giving 12 teeth.

The teeth were cut only far enough to leave a short collar which could be drilled and tapped for an 8BA grub screw. In fact, I used a screw with a larger head for greater purchase for the screwdriver. A small flat filed on the motor spindle is also worth doing as otherwise the pinion is likely to work loose. An alternative is a hole drilled right through pinion and spindle and fixed with a taper pin. Once both the gear and the spindle had been made, they were put into a rough and ready test jig and tested for accuracy (**photo 14**).

Having cut the gears, turned the wheels and completed the wheel sets, I was then ready to make the side frames. Before doing so, I made a number of

boxes in which to store the multitude of small parts that would be required as the model developed. **Photograph 15** shows some of these boxes. Any small containers would do - match boxes are ideal but I make mine of various useful sizes also to accommodate some larger parts.

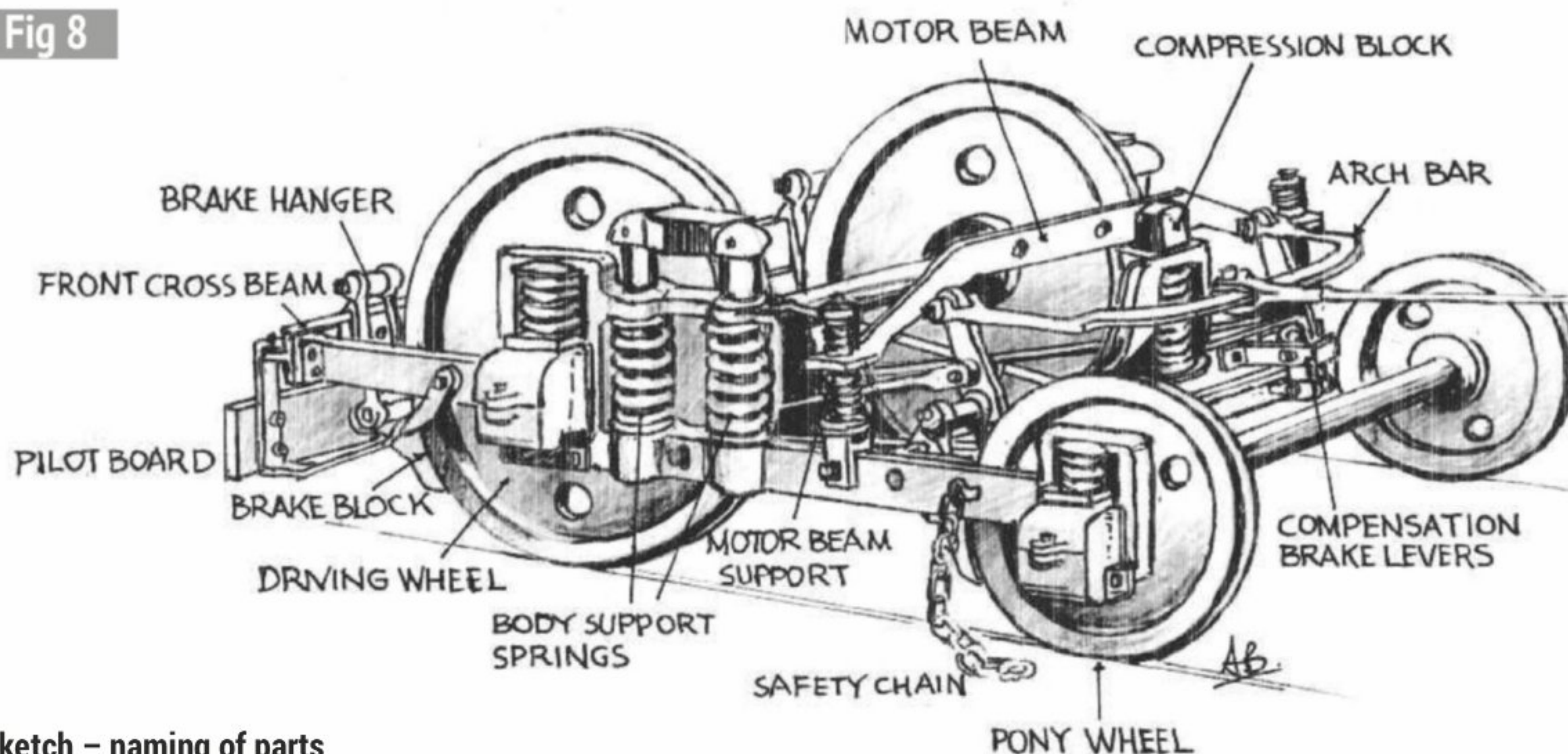
At this point, in the interests of clarity, I am including a sketch (**fig 8**) with some of the main features named according to the Brill Company's information. Only a few main parts are included as the Brill catalogues showed the truck with 72 parts and that was not all of them...!

●To be continued.

NEXT TIME

We make the side frames.

Fig 8



Sketch - naming of parts

Quarter Scale Bentley BR2 Rotary Aero Engine

PART 19

Mick Knights
completes his
aero engine.



Continued from p.586
M.E. 4623, 11 October 2019

Now for the finishing touch, the propeller. There is a drawing for what's described as a 'cooling club' with the Hodgson set of drawings. I'm sure that its effective in cooling the engine and would be relatively easy to produce from a suitable piece of timber but, to be honest, visually I didn't find it very appealing.

The general thinking on the subject, from those in the know, is that a 28 inch diameter prop with a pitch of 28 x 10 is the ideal configuration for this particular engine. Propellers of the same configuration and with a sympathetic profile to the WW1 originals are readily available off the peg from online outlets such as 'Prop Guy' for around the £70

mark. The only problem with a ready-made version is the diameter and thickness of the central hub, which are quite a bit smaller than the ¼ scale mounting hub on my BR2 and so would look totally out of place and would spoil the overall appearance.

There is a detailed drawing of the propeller for the Blackmore version. However, my woodworking skills do leave a lot to be desired and I wouldn't really know where to start in order to fashion such an intricate and complicated form - let alone have both blades in complete balance. I don't think that I'd want to be around any propeller that I'd fashioned, when the engine was running!

On the subject of balancing both blades, the Blackmore

build notes recommend adding extra coats of varnish in order to make the lighter blade heavier and thus bring both into balance - now that would definitely take me way outside my comfort zone.

A friend of mine who runs a joinery business did ask around amongst his contacts for a wood carver who might undertake the work for me. He did find one chap who was prepared to have a go at making a propeller from the Blackmore drawing but the conservative estimate was £400 just to carve it, leaving the finish sanding and varnishing to me. Initially I thought about using the hand carved propeller for display, while mounting an 'off the peg' balanced version on a smaller nose hub for running the engine. While pondering if this was the direction I really wanted to take I was given an introduction by a third party to Hercules Propellers, a propeller manufacturer whose business is producing the full size versions suitable for modern light aircraft and for powering vintage WW1 and WW2 aero-engines.

I must admit I didn't think it would be the type of project a business of such world renown would entertain but I had the introduction and I also sent a couple of photographs of the finished engine along with my initial enquiry. I was pleasantly surprised when the proprietor himself replied to say that it was entirely possible.

During the subsequent phone conversations with the extremely enthusiastic and helpful owner of the business it was explained to me the





complexities of designing a propeller for a vintage aero engine and that calculating the exact power output of the engine was crucial to the diameter, shape and pitch of the finished propeller and, as they had never made a propeller for an full size BR2 engine, they would have to start from scratch. If the finished propeller put too much load on the engine then of course the engine would be underpowered and would labour when running. If the opposite were the case and the load provided by the rotating propeller was too light then the engine would over rev, probably taking it beyond its recommended top RPM.

The laminated mahogany to be used would be identical to the type used by the RFC during WW1 while the propeller's profile would also be identical to the type that was used on the Sopwith *Pup*. By now readers must be aware that the cost of producing the propeller was going to be reassuringly expensive but, as I'd come this far over two and a half years of building the engine, I could see very little point in spoiling the overall

effect for a few hundred pounds more than I had been quoted to hand carve one – well, at my age what else am I saving up for?!

The necessary calculations for the power output were made by referencing the original Bentley specification for the BR2 engine, scaled down by a quarter to suit the scale of my engine. Then, a suitable propeller blade profile was CAD generated with a hub diameter and thickness to match the propeller mounting nose of my engine. A nice touch was to counterbore the front face of the propeller to accept the clamping flange, as would have been the case on an original WW1 propeller.

To ensure the prop completely matched the mounting hub on my engine I sent it to Hercules before any wood was removed. The final machining was carried out on their dedicated CNC profiling machine. The propeller was hand sanded and finished off by oiling.

Finally, with the propeller mounted to the engine I was glad I'd made the financial commitment to go the extra mile and have a bespoke propeller made by the experts.

I think I'm going to be hard pressed to find an engine for my next project, or indeed any future project that will have the same visual impact as the Bentley BR2, or provide so much productive workshop time as this build has provided.

In conclusion I have included a series of photographs of the finished engine, complete with its crowning glory, the bespoke Hercules propeller.

I hope this series has inspired some readers to build their own versions of this classic engine, either to an individual design, or perhaps a hybrid like mine, but also that some of the machine set-ups I've employed during this build series may help other engineers in machining complex components for their own individual projects. 'Chocks away!'

ME



Mission Impossible?

Graham Astbury eventually tracks down a book from his miss-spent youth.



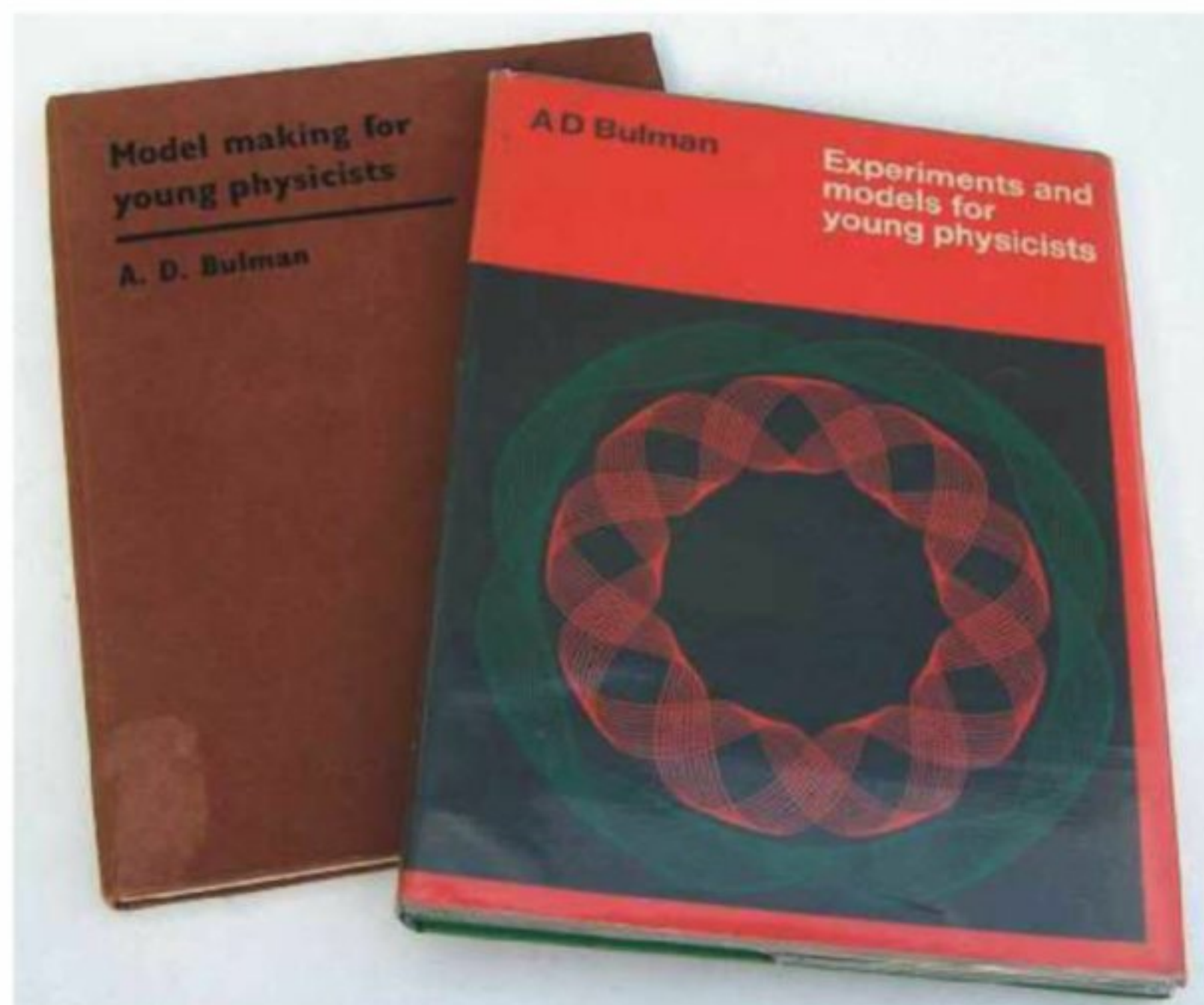
It started at Doncaster in 2018. On the York City and District Society of Model Engineers' stand, there was a Van der Graaf generator (no! not the rock band!) which had been built by Roger Backhouse. Having had a brief discussion with Roger about this, I mentioned a book which I had read more than 50 years ago in my local library which contained details of building a Van der Graaf generator using two aluminium pudding basins for the spherical top and plastic for the insulating supports. I asked Roger if that was the source of his design, as I could not remember the author or the title. He said that he had designed his himself using some information from the internet, but he did remember the same book as I did. However he couldn't remember the author, the title or the publisher either. I decided that I should try to acquire this book, if only I too, could remember the author, the title or the publisher! The challenge was on.

First steps

Slowly stirring the old grey matter (more like porridge between my ears), I remembered borrowing the book from the children's section of my then local library. This would have been around the early 1960s, probably about 1964 or 5. The book, as I recalled, contained details of building a Van der Graaf generator, a Wilson Cloud Chamber and a Tesla coil. The other things I remembered about the book were that it was definitely hardback and the pages were quarto-sized i.e. 10 inches tall and 8 inches wide. All in all, not much to go on.

The search starts

Having remembered these rather vague scraps of



Result! Two books found.

information, I naturally turned to the Internet to search for the book. This was difficult and searching for any of the items that I remembered were in the book brought up all sorts of interesting things but certainly didn't reveal anything about the book itself published some 50 years ago.

Roger suggested that I write to *Model Engineer* via Postbag to see if there were any like-minded people who might have a copy of the book – but would anybody actually confess to having a mind like mine? Despite our esteemed Editor publishing the letter (*Model Engineer*, Issue 4592, 3rd August 2018, page 250) there was a distinct absence of letters back giving me chapter and verse on the book.

The search widens

It occurred to me that I could search the British Library Catalogue (ref 1). This catalogue contains all the books held by the British Library, along with manuscripts, magazines and virtually every sort of written material – some 50 million items. It also included many

books of non-UK origin that the Library held. Again, it needed something to start the search and since I didn't know the author, title or year I was unable to search the catalogue. However, I found out that I could use the advanced search option and look for books catalogued under the Dewey System – universally used in libraries (ref 2).

I had a copy of a book, *Science Model Making* by Robert Hopwood, published by John Murray in 1961, which was similar to the book for which I was looking. Therefore, I looked up Hopwood's book in the British Library Catalogue and it was listed, but not with the Dewey Index classification. This led me to the British National Bibliography (ref 3), which contains details of every published item in the U.K., including books, magazines, periodicals, manuscripts etc. published after 1950, including their size and their Dewey subject classification. I therefore searched for Hopwood's book and found that it was under Dewey Classification

620 - 'Engineering & Applied operations'. Having found that Hopwood's book was under 620, I thought that the book for which I was looking was likely to be under 620, so I undertook a search, but this revealed nothing that resembled the book for which I was searching.

Back to the start?

At this point I had almost given up and got on with other things in the workshop such as rewinding an electric motor and building a drill sharpening jig. I did leave the book search 'on the back-burner' and occasionally had some other ideas for searching. Visiting Doncaster again this year reminded me that I still hadn't found the book so I decided to have another go. I found an American website, www.bookfinder.com (usual disclaimer) where I found that there was a drop-down menu to refine a search by date (ref 4). I could now search for all second hand books for sale worldwide (all 150 million of them!) but restricting it to those which were published between dates which I could set. There was still a requirement to put something in the title, author or publisher field – but it only one needed one entry. This seemed even better. The other fields that could be used to narrow the search were the cover – hardback or paperback – and whether it was out of print or not.

I started off assuming that the title would contain the word 'model' as the original book was aimed at children and a title containing the word 'model' would have probably caught my eye as a child. Also, Hopwood's book had the word 'model' in the title. Searching for 'model' gave 1052 books – still quite a lot. Many of these were clearly nothing to do with building Van der Graaf generators as many used the term 'model' to describe a particular item such as a specific car or motorcycle, so a certain amount of refining was needed. I tried several

other words such as 'science', 'physics', 'building', 'boys' etc in various combinations to try to find a title which seemed appropriate. Finally, the search for 'model' and 'making' seemed to be right as it reduced the total to 190 books which was clearly quite manageable.

Narrowing the results

Looking through these results was not too onerous as they were on one page in a simple list by author and title so I could scroll down the list quite quickly, rejecting books which were obviously not the right one, either by title or by obviously non-UK publishers. When I identified a book that looked like a possibility, I searched for it in the British National Bibliography to determine the year of publication and the height of the spine which gives the page size. Many likely titles ended up being the wrong size or softcover.

Eventually, I came across a book titled *Model Making for Young Physicists* by A. D. Bulman which seemed right. On checking with the British National bibliography, it was the right size, hardback, published in 1963 with 88 pages and the publisher was the same as that for Hopwood's book. However, it was in the Dewey Classification as 530 'Physics' – so not surprising that I had not found it whilst searching under Dewey 620. I emailed the bookseller in Germany to ask whether it contained anything about a Van der Graaf generator. However, they advised that it did not, but the bookseller kindly forwarded a scan of the contents page. Whilst there was no mention of any of the items in which I was interested, there were a few items which seemed strangely familiar and I did recall reading about them many years ago – in particular, a harmonograph, a hot air engine and a Crova Disc (look it up on the Internet!).

Success?

I considered that, maybe, the book for which I was searching may have been a later edition

by the same author so it was back to the British National Bibliography to search for books by this author. This revealed three – the *Model Making for Young Physicists* book I had already found, *Experiments and Models for Young Physicists*, published in 1966, and *Physics Projects: a book of Experiments, Models and Inquiries*, published in 1972. As I had moved from the area in 1970, I knew that the last title could not be the correct one. I emailed a bookseller of the 1966 book and the response was that the book did contain information about a Van der Graaf generator, so I ordered the book.

Whilst it did contain the desired information, the Van der Graaf generator did not seem quite as I had remembered it. It seemed likely that I was confusing two books. Looking through this book, it made reference to a simpler Van der Graaf Generator which was described in the author's other book, *Model Making for Young Physicists*, so probably that was the book that had the Van der Graaf generator that I remembered. I therefore decided to buy this earlier book despite the contents list not containing the Van der Graaf Generator. It duly arrived and was exactly the book that I had remembered. The chapter, 'A Generator of High Voltage' described the Van der Graaf Generator, so it is understandable that the bookseller did not think that it was the correct book.

Result!

Having now bought the two books, it was clear that my memory was not quite perfect as it was indeed two books

which I had read all those years ago, rather than just one. I thought of the verse in the Bible – '... seek and ye shall find ...' (Matthew, Chapter 7, verse 7). Maybe my late Grandfather had something to do with it as he was a Minister...

I hope that anyone else 'out there' who is looking for a book finds as much success as I did - persistence usually pays off, but it may take quite a time with a fair few disappointments on the way. All I have to do now is build a Van der Graaf Generator – which might be just a bit more challenging than finding the book containing the instructions!

Conclusions

- Trying to find a book where you have no idea of the title, the author, the publisher or the date is not as impossible a task as it would seem.
- Having too narrow a search will restrict the books found and may exclude the one for which you are looking.
- Too broad a search usually will list far too many items for ease of browsing.
- The current information technology available 'on the Internet' allows vague searches to be refined, if you know where to look.
- Sometimes the Dewey Classification may not be quite what you think it is, so it may be worth widening the classification search.
- Most second hand booksellers are very willing to answer simple queries.
- The Contents page of a book may not describe the contents particularly accurately, as I found out!

ME

REFERENCES

1. www.bl.uk/catalogues-and-collections
2. www.oclc.org/content/dam/oclc/dewey/ddc23-summaries.pdf
3. bnb.bl.uk
4. www.bookfinder.com



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Responses to published letters are forwarded as appropriate.

Jim Crebbin

Dear Martin,
The latest 'Smoke Rings' column was most touching - 60+ years since first meeting is a staggering event. When I joined the ranks of 1960s aspiring model engineers there were still people alive who remembered Jim Crebbin and I was told that *Cosmo Bonsor* was the ultimate in standards of workmanship.
Best Regards,
James Wells

Aero Engines

Dear Martin,
Readers of *Model Engineer* have proven ever resourceful at nutting out puzzles from the past and I'm hoping that some well-connected reader or else one with a prodigious memory might help me solve a great aviation technical mystery.

I am on the hunt for a French 'monster', two to be precise.

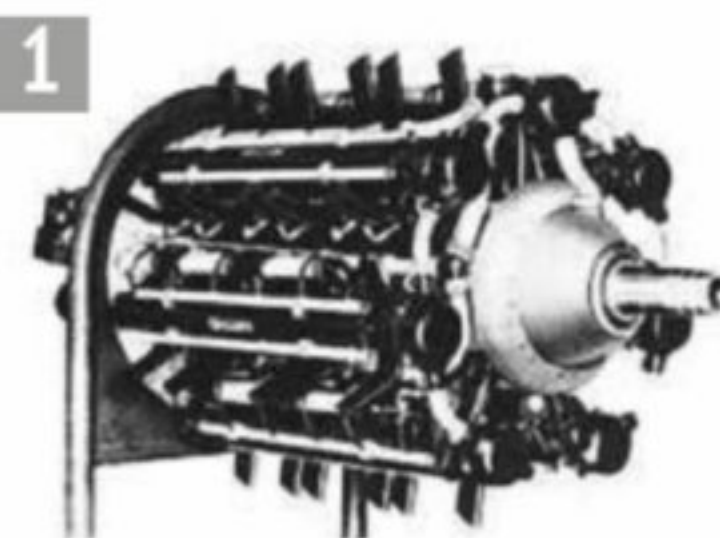
The object of the hunt is the MATHIS Vega 42 cylinder aero engine. Two prototypes were known to exist of this unique aero-engine that were under development in the late 1930's to early '40's which had progressed to both bench and flight trials. It seems to have been an initiative by the Strasbourg-based MATHIS company to anticipate an *Armée de l'Air* near-future requirement (the 'drums of war' were beating!), a private commercial venture not unlike the ROLLS-ROYCE PV-12 antecedent to the *Merlin*.

Here's where the mystery starts. Both prototypes 'disappeared' just ahead of the German invasion. To where, no corroborating document seems to have surfaced to attest to their fate.

One myth is that they were spirited across the channel and 'gifted' to the British Air Ministry as a French contribution toward waging air war against the Germans - in response to which the Air Ministry promptly pinched their noses and declared, *non merci!*

The other myth is that they were spirited away to the French Pyrenees - specifically, the narrative is that they were hidden in Lyon during the occupation.

There is also a third possibility, namely, that both myths are true - remember, there were two prototypes - and even a fourth, that both prototypes may have been destroyed ahead of the German invasion. We just don't know for sure. Emil Mathis claimed the Lyon concealment story but owner that he was,



MATHIS Vega aero engine.

he may have had private reasons for lying - who knows?

What is not in dispute is a persistent and disturbing lack of tangible evidence - not merely that two huge engines have disappeared off the face of the Earth but also not even a skerrick of documentation, e.g. test reports, blue-prints, asset registers, etc, etc. Thankfully, a handful of black and white pictures remain to attest to their having existed (see photo 1).

The Anglo-French Vega version of the myth has attached to it a tantalising piece of possible corroboration in the form of a book, 'Aircraft Engines of the World, 1946 Edition' by Paul Howard Wilkinson which includes a picture of the Vega (does anyone have a copy of that picture?). Allowing for long printing lead-times and the difficulties of immediate post-war communications - and no known pre-war publication of photographs (military/commercial secrecy) - the speculative answer is that he could only have obtained the photograph in England, meaning of course that the engine must also have been in England. The only likely place that it was probably stored is with the R.A.E., probably at Farnborough along with captured German aero-engines, for technical evaluation.

Post-war, who knows? It is not known to have re-appeared, been scrapped or perhaps repatriated back to France. We just don't know.

Can any reader shed light on the mystery and provide some answers to help solve the mystery? Old war diaries, old photographs, old conversations, documents, memories of sightings, etc, etc...

All information greatly appreciated. Far too much time has passed for this mystery still to persist.

Kind regards,
Andre Rousseau
(New Zealand)

One Giant Leap

Dear Martin,
The letter from Mike Gray about the Space Race was most interesting but I now think that the loss of public interest in the Space Race had a far more subtle cause.

After the Kennedy announcement with the 1969 moon landing becoming more of a reality, there were heady predictions for a landing on Mars by 1986. Of all the known planets Mars is the only such where the surface can be seen directly from Earth and there had been several estimates of the surface conditions on Mars. These had hovered around a surface temperature similar to the worst of Siberia, an atmosphere of CO₂, oxygen, faint traces of water vapour and a surface pressure of approximately 70 millibars.

What nobody ever seems to have predicted was the invention of the space probe, which could actually go and have a look at Mars before any attempt at a landing.

The initial Martian space probe results were a distinct shock, revealing a thin CO₂ atmosphere, no obvious oxygen or water vapour, a surface pressure of only 10 millibars and a surface temperature of minus 150 degrees Celsius. Perhaps worst of all was the lack of any surface detail that might be interpreted as being of intelligent origins.

One TV commentator described Mars as "a crater riddled, bitterly cold, dust ridden world with little atmosphere" and public interest in Mars, and space travel generally, declined fairly rapidly. Space probes, going beyond Pluto, and artificial satellites have proved a considerable success and it seems unlikely that funding for any kind of Mars landing will ever be made available.

Perhaps it's possible to suggest that the Mars landing got a different kind of 'rocket' from that originally expected.
Best Regards, James Wells

Efficiency

Dear Martin,
 Your editorial in issue 4622 on 'Scaling Models' and ultimately the efficiency of model steam locomotives raises some interesting points. The obvious starting point to increase efficiency is to follow Chapelon/Porta/Wardale and Waller ideas, such as compounding, large section steam pipes, streamlined steam passages etc.

There is another path that could be added but I have not seen it raised in model engineer circles. It was described in H. Holcroft's two volume book 'Locomotive Adventure'.

In 1927 Holcroft, of conjugated valve gear fame, was working on new locomotive design for Maunsell, CME of the Southern Railway. Maunsell had been approached by 'The Steam Heat Conservation Co.' about a new departure in the use of steam by recovering much of the heat loss.

Holcroft was sent to investigate and was taken to Surbiton power station where a plant had been converted to the new system. The plant consisted of Bellis and Morcom vertical reciprocating steam engines coupled to D.C. generators, each engine having its own water tube boiler with chain grate.

The engine was first tested for 48 hours exhausting to atmosphere, then for 48 hours exhausting to a normal condensing system, then for 48 hours on the new system. The plant was fitted with instruments to measure what was going on.

The new system showed a fuel economy of 30% compared with exhausting to atmosphere. But it must be borne in mind this was with an engine at constant speed and constant load.

Coal and Insurance

Dear Martin,
 I would like to raise two issues with you. You may publish the following but I feel support from *Model Engineer* in some way may be of benefit.

Future steam coal supplies for miniature steam models

I am sure most of us are aware that the government is planning to phase out the use of fossil fuels by 2025. This will inevitably result in the closing of most if not all coal mines in UK. Looking on the internet it appears Heritage Steam have been assured restrictions on using fossil fuels will not apply to them. The problem remains, however, with the availability of suitable fuel (coal). Full-size steam has the option of importing coal from Russia for example but the quality would be questionable for use in our much smaller models.

Perhaps we should be coordinating efforts to make sure model engineers with interests in miniature steam are not left out of any future planning relating to future coal supplies.

Live steam passenger hauling and insurance

It is becoming difficult for some clubs to continue using steam locomotives for passenger hauling due to the increase in litigation claims for so called injuries or damage to clothing from steam locomotives.

It appears that insurance companies find it easier to pay up on any claim rather than challenge it and simply increase the cost of insurance. This opens up the possibility of exploitation by unscrupulous members of the public! It would be interesting to hear from clubs who have experience with claims whilst passenger hauling embers of the public and what action they are taking. Also, insurance companies' comments/advice?

Yours truly, Harold Pearson (Coventry)

It seemed that it was certainly worth investigating and the SHC Co. was lent an N class 2-6-0 locomotive for conversion. There were many trials and tribulations but in the end they did get the engine to work and Holcroft said it ran silently. They had managed to turn the whole of the exhaust back into the boiler as hot feed.

However, the whole thing petered out; Maunsell retired, Bulleid took over, WW2 intervened and the Railways were nationalized so it was never followed up and a dedicated locomotive built. Bulleid did have some design drawings done for modifying one of his Pacifics but it was not carried through.

The system had started in marine circles in Glasgow and was Patented by H. P. H. Anderson the inventor. Exhaust steam was taken from the cylinders and passed to a cooler, which created what

Anderson called an emulsion. It was unstable and to keep it as an emulsion it was led down gradually decreasing diameter pipes until it came to a compressor that pumped it back into the boiler.

As there was no exhaust steam going up the chimney to maintain draught for the boiler there was a three-cylinder radial steam engine on the smokebox door driving a fan.

Seeing the system was almost a closed circuit there would be less precipitation of salts in the boiler, so longer between washouts and less damage to the boiler.

The above is just a quick overview - much better to read the book for the details. It would be an interesting experiment to build a 5 inch gauge version and to see if the efficiency of our model locomotives could be increased.

Anthony Mount

Dear Martin,
 I thought you'd be inundated with replies to your musings on the inefficiency of model locos, but perhaps not. I fear your speculation on boilers is not supported by experiment. As far as I can find there are two lots of experiments on model boilers reported in back issues of M.E. In August 1964, J Busbridge reported on a test of a 3½ inch *Britannia* - 5 tests with efficiency 70%, 58.5%, 77%, 69.5%, 65%. The 58.5% test was associated with having a black fire. Jim Ewins tested a locomotive with boiler efficiencies ranging from 78% to 85% (tests reported in Martin Evans's book 'Model Locomotive Boilers'). Typical full-size boiler efficiency is 70-80% (I'd need to go digging to justify that) so I think you need to look elsewhere to explain the difference.

Regards, Duncan Webster

Corporation Tax

Dear Martin,
 Approaching retirement, I have joined a model engineering club in the South of England. This club operates as a limited company, presumably to protect the general membership in the event of litigation.

I was surprised to see payment of corporation tax in the club accounts. The club derives revenue partly from membership fees, but mainly from train rides. With the experience of running several limited companies, I would have offset the income against legitimate running costs (provision of track, rolling stock, fuel, power, rent, insurance, etc.) to derive a zero corporation tax liability. However, the club treasurer insists that corporation tax must be paid.

I would be interested to hear, via the magazine, the experience of other limited liability clubs in regard to corporation tax.

Name and address supplied

Building Bridget PART 4

Jon Edney
builds the
chassis to
Ken Swan's
design.



Continued from p.599
M.E. 4623, 11 October 2019

Valves and ports

Bridget uses slide valves like many models. A bronze slider moves across ports milled into the bottom surface of the steam chest, alternatively allowing steam from the chest to pass to the cylinder and then directing expelled steam to the exhaust.

This requires a number of holes to be drilled and slots to be milled. The exhaust hole is fairly large ($\frac{3}{8}$ inch) and runs from the mounting face of the cylinder block and under the port face, which has a corresponding $\frac{3}{8}$ inch slot. This hole is fairly easy to drill with care but is quite deep at 2 inches (50mm).

The steam passageways connecting the cylinders to the steam ports are much more difficult to drill because they run at an angle from the end of the cylinder to the $\frac{3}{16}$ inch port slots. There are three passageways on each end, each 4mm in diameter. To drill these holes the block needed to be mounted at the correct angle, which I computed by measuring and re-measuring the blocks and comparing



Drilling a port in the cylinder block.

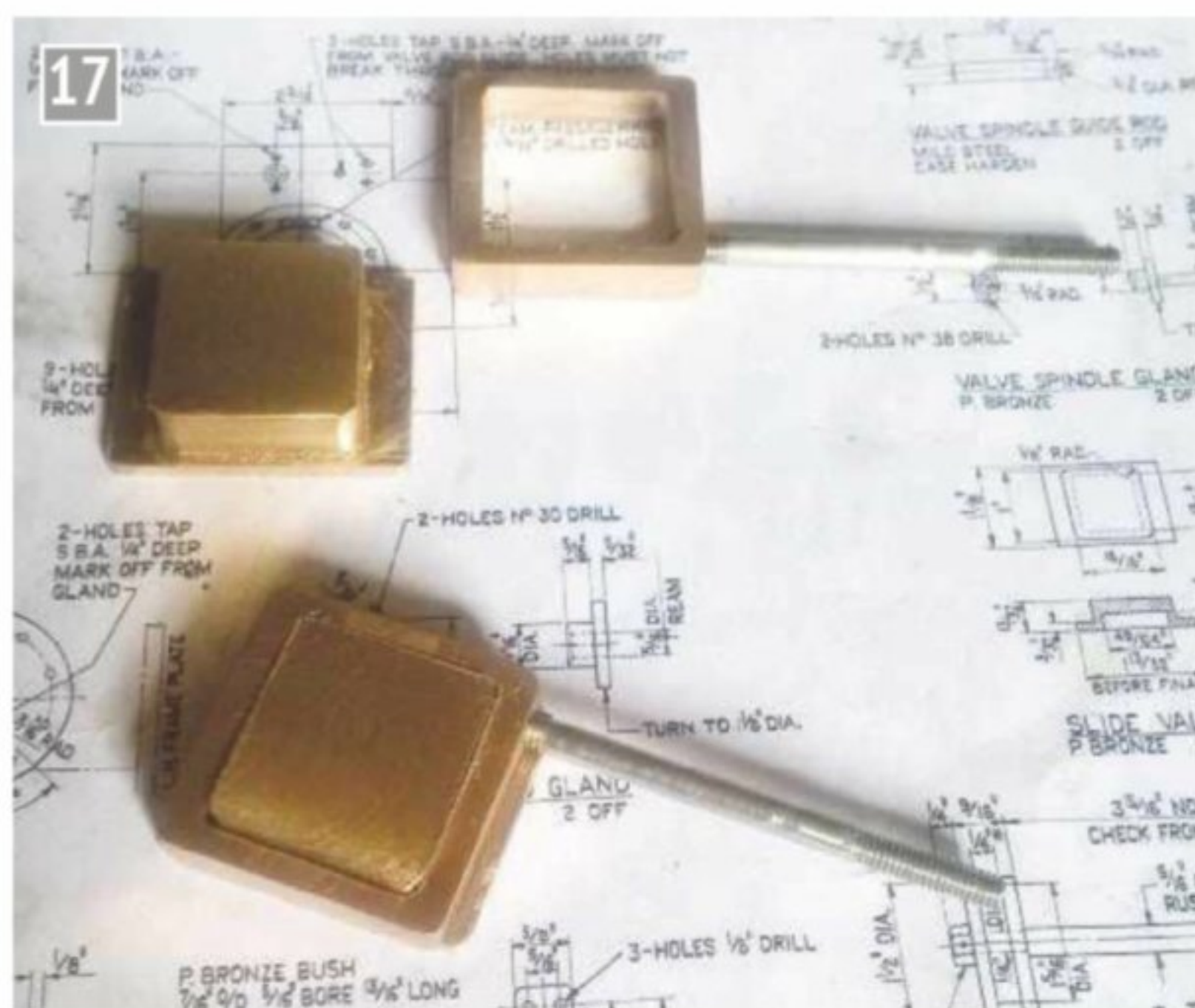
with the plans. Drilling these long holes is a journey of faith and seeing the end of the drill break into the port slot is a big relief! The process of drilling one of the passageways is shown in **photo 16**.

Steam arrives into the steam chest via a flange on the top of the cylinder nearest the mounting face. The steam then goes round a sort of 'U' bend

to come up in the corner of the steam chest floor. Not having a drill that will make a 'U' bend, it is necessary to drill three intersecting holes, two vertical and one horizontally, through the mounting face. The end of the hole in the mounting face is then filled with a bronze plug.

The slide valve is machined from a bronze casting along with a bridle that slips over the valve to push it back and forth. The bridle is not physically attached to the valve, which allows the valve to press down under steam pressure unencumbered. In principle, machining the valve and bridle is simple enough but these need to be a very good fit so that the valve can move freely but not slap against the bridle at each direction change. This took some time and patience to achieve. The completed parts for the valves are shown in **photo 17**.

The slide valve needs a gas tight seal against the port face. To achieve a good finish on the slide valve I used a thick piece of glass plate. First, I rubbed the valve on progressively



The valves and bridles.

fine carborundum paper, then moved to progressively finer diamond paste. The cast iron port faces in the cylinder are harder to do but at least the design of *Bridget* with a sloping lid to the steam chest makes access to the port face reasonably straightforward, as can be seen in **photo 18**.

I did my best using grades of abrasive and finally rubbing the slide valve against the face with diamond paste. You know you are getting there when the valve takes significant force to lift off the valve face (I did this before cutting the ports). I have read that some people use a scraper to get the final perfect surface but this was a step too far for me. Subsequent running on compressed air suggests it is good enough and, of course, it will 'improve with wear'.

Once the slide valve was fitted it just remained to mill out and drill the steam chest lid and fit with a gasket. The result before painting is shown in **photo 19**.

The valve operating rod comes out of the back of the steam chest with a 4mm stainless rod and a suitable steam gland.

Pistons

Bridget has 1½ inch pistons which are mounted on 8mm piston rods. The rough casting is shown in **photo 20** along with the first completed piston. This was a fairly easy machining task using the cast boss - the piston could easily be faced and brought to correct diameter. I did not attempt to make the piston rings - these came ready made with my original

purchase. I was able to use them to gauge the slot width, getting a 'firm' fit for two rings side-side, as specified. Once the end and sides were done I reversed the part in the three jaw chuck, brought the piston to correct length and drilled the through hole.

After the piston rod was made and attached I then stood with my heart in my mouth as I stretched the piston rings into position hoping they would not snap. These rings are pretty expensive, about £60 per set! Fortunately, they did not snap and I had two sets of pistons and rings ready to install. Inserting the pistons of course requires a ring compressor to squeeze the rings to the bore size as the piston is inserted. Doing this without a ring compressor is nigh on impossible. I didn't have a compressor but I made one from a small tin originally containing tomato puree. I cut the ends off, slit the tin down one side and then placed it over the rings with a large jubilee clip. I screwed the clip reasonably tight and then tapped the piston into the cylinder. *Eureka!*

Drain cocks

Of course, drain cocks are an important and necessary part of a steam locomotive but I have to say that making them and the associated linkages was a long and fiddly job! For one thing, they are very small by my standards. Now I realise that those who make 2½ inch gauge locomotives will be scoffing at this and I do hold in awe the people that make those tiny, tiny parts. But, for me, making these cocks on my



The port face before cutting the ports.

big Harrison lathe was a real challenge. The finished result is shown in **photo 21**.

The cocks use the standard approach of a tapered horizontal plug with a vertical hole that rotates to open or close the valve. The normal construction approach is to set the lathe up to make the tapered plugs all at the same setting and then also machine a tapered piece of silver steel which will become a cutting tool perfectly matching the plugs. When the piece of silver steel is placed in the three jaw chuck, a shim is placed under one jaw so that the plug is cut slightly off centre. This leaves a raised portion that can be part cut away to create a cutting edge after hardening. The result did not cut quite as well as I had hoped but it was

good enough to expand the pilot holes in the drain-cocks bodies to match the plugs. They do seem to work.

After the cocks were made there is a long fiddly linkage mechanism involving no fewer than four levers and rods to get the control back to the cab area!

The motion links

I had already made the coupling rods as part of the wheel construction and testing. Now I moved on to the main motion components including the cross head and bars, connecting rod, expansion links and the various parts of the Walschaerts valve gear linkages. There really are a lot of parts here so the only way is to take it one step at a time.



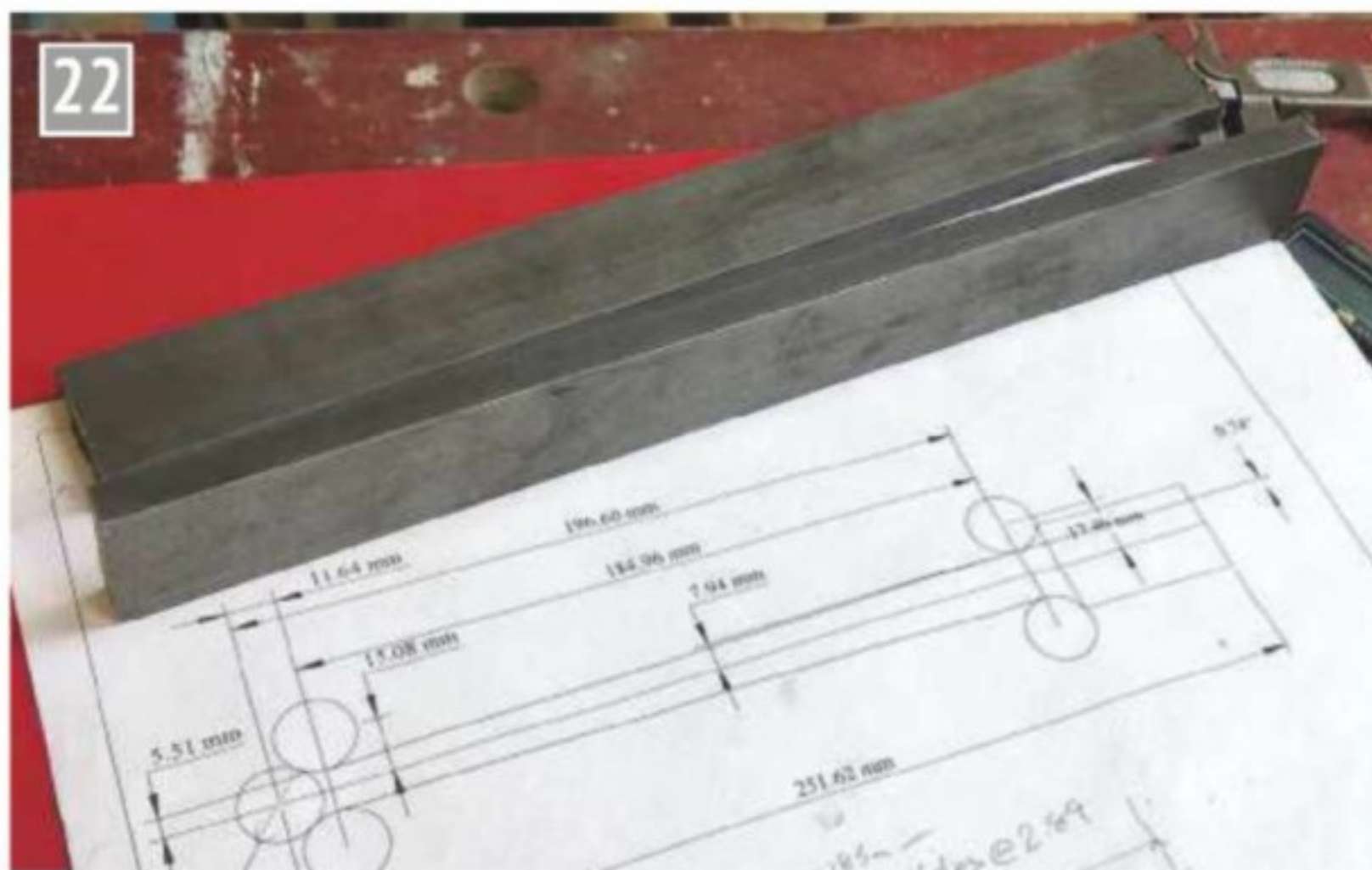
The steam chest lid is fitted.



Piston, before and after machining.



Drain cocks fitted.



Completed connecting rods.

Raw material for the connecting rods.

The largest items are the connecting rods. As I concluded when making the coupling rods, using laser or water cut parts would be a good idea but I just started with two bars of bright mild steel (**photo 22**). I did take the time to normalise the steel by heating to red hot to ensure they would not warp when machined out. These are quite large parts and I was unsure how to get them to, and hold them at red heat. In the end I used my large kettle barbecue, lighting charcoal as if I was going to cook burgers but then placing the metal in the middle of the burning charcoal. This seems to do the job nicely and the parts were nice and cherry red when I took them out.

To get the basic shape I made a CAD plan including all the key circles and marked these out using the DRO on the mill/drill machine. I chain drilled the sides of the connecting rod and milled smooth. I then had to surface mill to reduce the thickness of the rod part.

The end that connects to the crosshead has a simple hole with a bronze bush. The other end has a rectangular cut out that accepts a bronze bearing block that is split and then adjusted by a wedge block. The completed connecting rod is shown in **photo 23**.

The crosshead which connects the piston rod to the connecting rod was fabricated from mild steel and took considerable time. The completed part is highlighted in **photo 24**. The body is a single block and the piston rod

boss and union link mounting bar are silver soldered on. The upper section has a deep channel for the crosshead bar and phosphor bronze slips. The lower section is cut away and has a large cavity machined into it to fit the end of the connecting rod. A close-fitting cap with stub axle then passes through the connecting rod bearing and out where it is secured with a castellated nut. The oil cup screws into a small block, also silver soldered and with a rather serpentine path to deliver oil into the bearing.

The crosshead slides on a substantial bar connected between the back plate of the cylinder and the motion support structure. This bar has shallow oil grooves in the upper face and holes to pass the oil to the lower face. It is also case hardened.

The expansion links are made out of gauge plate so that they can be hardened. This is specified in the original plan although I am not quite clear why this is required since, while the link rocks back and forward, there is only occasional sliding of the radius rod up and down. I suppose that there is constant reversal of force against the sides of the expansion link even if there is little movement. The links are silver soldered to a swivel mounting with two bosses, as shown in **photo 25**. In order to harden the gauge plate the swivel mount has to be attached using high temperature solder so that the whole assembly can then be heated up to cherry red (without melting

the solder) and quenched to harden the link.

All the remaining links are unremarkable but each one is a little project in its own right. That is what makes the hobby so rewarding! The remaining hard job is to get the length of the eccentric rod connecting the driving wheel eccentric to the bottom of the expansion link. This affects the valve timing and the symmetry of the two sides of the motion. In an ideal case the left and right eccentric rod would be the same length but in my case they were different by a few millimetres. This requires much measuring and checking. To get it right I used a couple of pieces of scrap metal until I

had the length just right. I then transferred the hole positions onto the bar that was machined into the final links.

Every joint between the various links and rod either has a phosphor bronze insert or a hardened silver steel sleeve for long operating life. Ken Swan locomotives are well known for their long lives. A full view of the motion is shown in **photo 26**.

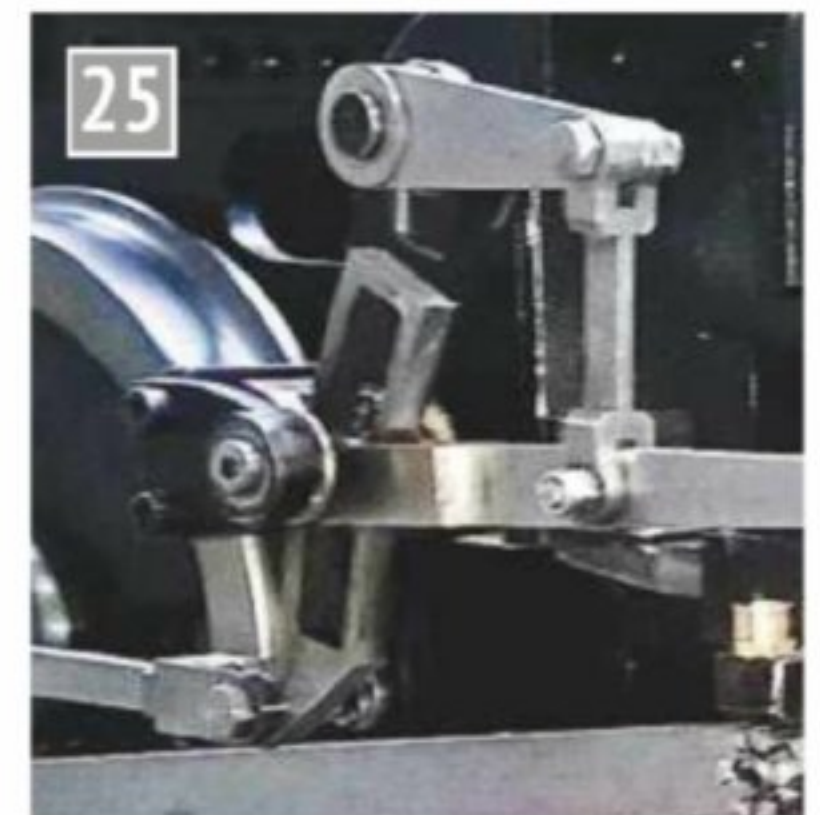
●To be continued.

NEXT TIME

I complete the chassis by making the smokebox and applying paint.



Crosshead.



Expansion link.



The complete valve gear.

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■ Model Engineer magazines dating from 1951 until 2010, free for collection. **T. 0161 439 1572. Stockport.**

■ 5" gauge Jubilee plans (A.N. Alcock), laser cut frames and valve gear, machined driving and bogie wheels. Complete, untested boiler. Tender chassis completed with some brass platework for body. Property of deceased engineer. Buyer to collect, £350 O.V.N.O. **T. 01630 657535. Crewe.**

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Making and Using Wax Chucks

PART 3

Tony Bird demonstrates an unusual but effective method for work holding.



Continued from p.659
M.E. 4624, 25 October 2019

Wax mandrels

It is unlikely but possible that the author invented the wax mandrel - certainly he has seen no reference to anything the same or similar.

Their creation and use started with machining of small components that had holes in them, such as big ends, eccentrics and their like. The first photograph shows a length of steel rod that is centred both ends charged with some shellac. On this particular job the centres are not used (**photo 27**). A connecting rod from a Stuart S50 is mounted on the rod (**photo 28**). A shoulder is then turned on the big end of the connecting rod (**photo 29**).

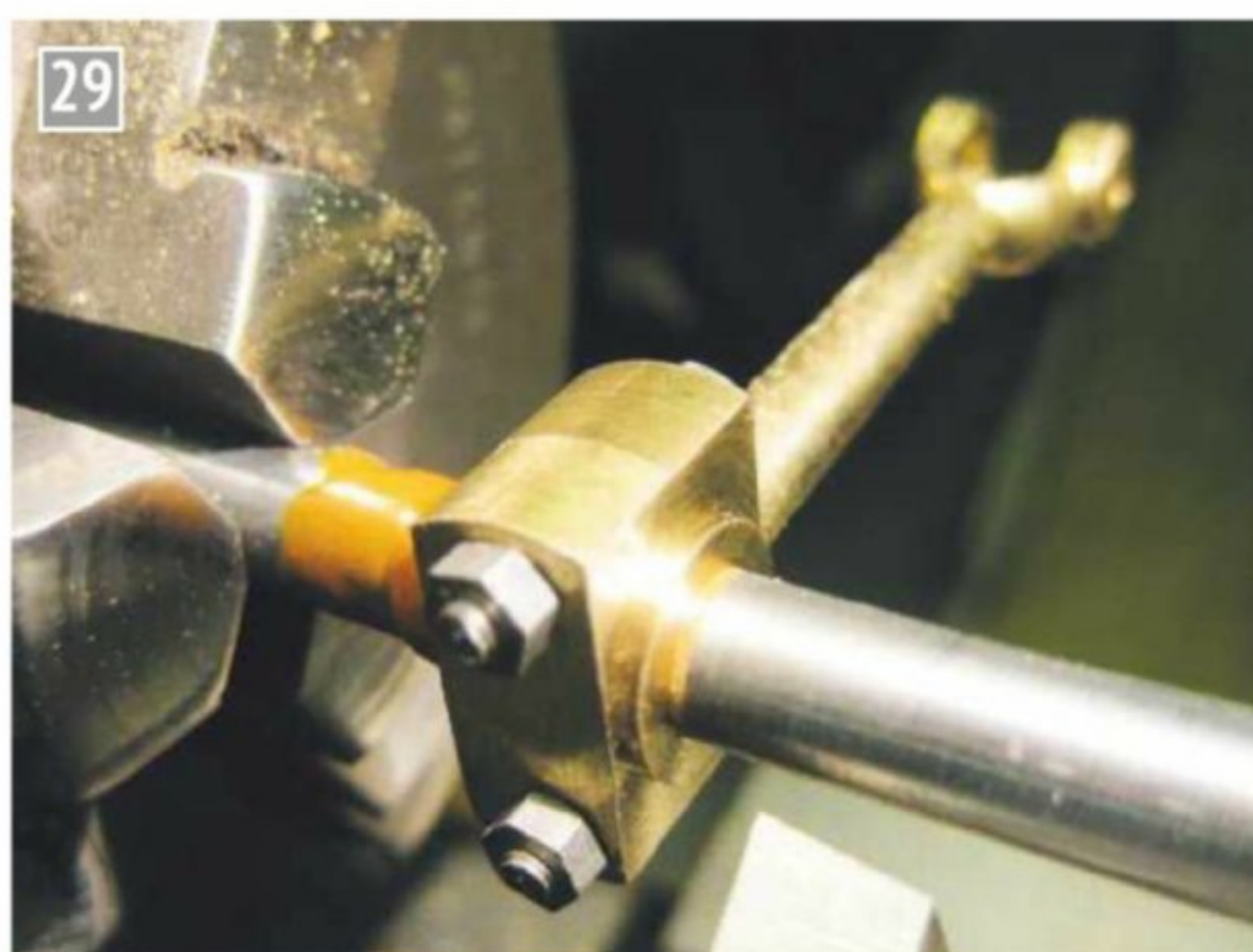
Photograph 30 shows another big end mounted on a stub mandrel. This particular mandrel is useful if the hole is very large; it is made from hexagonal stock so it can be taken out of the chuck and replaced in the same orientation.



Steel rod mandrel with shellac applied.



S50 connected rod mounted on the mandrel.



Big end shoulder turned.



Another big end on a stub mandrel.



The cylinder is bored and reamed.



Cylinders with completed bores.



Machining the cylinder mandrel.



Melted shellac on the mandrel.



Cylinder secured on the mandrel.



Machining the ends of the cylinder.

The author mostly uses a wax mandrel when machining cylinders. The bronze cylinders in the next couple of photographs that are being machined are for a Blackgates 'V' twin oscillating steam engine.

First the cylinders were mounted in a four-jaw chuck and their port face and cylinder ends were machined flat but still well over size. The machined port face was glued

to a wax chuck and small faces were machined on the opposite side of the cylinder so that a four-jaw chuck would have something parallel to grip. Alas no photographs were taken at this stage of the operation.

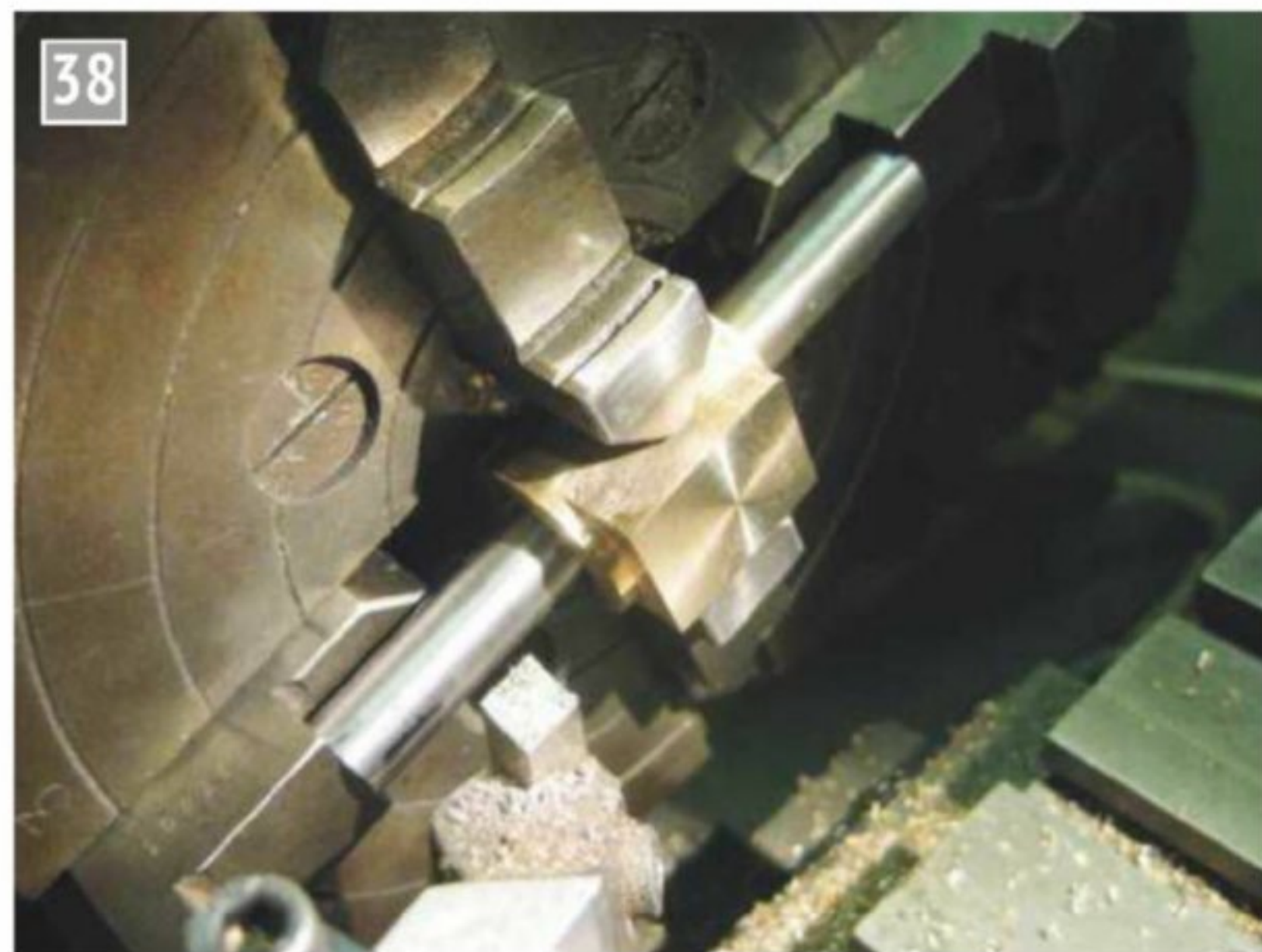
Centres were marked out and centre drilled in one end of each cylinder. Had the cylinders been hollow they would have been plugged with hard wood which the centres would then have been drilled

into. The cylinder is centred in a four-jaw chuck where it is drilled, bored then reamed (**photos 31 and 32**). A wax mandrel is turned between centres with its grooved raised centre section made a little shorter than the finished length of the cylinder. In turning the mandrel, the raised centre section is turned nearly to size, the grooves added then it is turned to fit the cylinder casting (**photo 33**).

With the mandrel held in a bench vice it is heated then charged with shellac and the cylinder pushed on to it so that the mandrel's raised section is in the middle of the cylinder casting (**photos 34 and 35**). The mandrel and cylinder are set up between centres and the ends of the cylinder are machined to length and diameter (**photo 36**). This done, the remaining parts of the cylinder ends are removed by



Completing the shaping of the cylinder by hand.



Machining the port face.



'V' twin cylinders mounted on frame.



Stuart S50 cylinder.



Mandrel for a Stirling engine displacement piston.



Finished piston.

hand using the lathe as a rotary shaping machine (**photo 37**). The mandrel and cylinder are removed from between centres and put in a four jaw chuck to machine the cylinder's port face parallel to its bore (**photo 38**).

Before heating the cylinder to remove it from the mandrel the burr between the cylinder's end and its bore is removed so the cylinder doesn't jam on the mandrel while it is being

removed. The author usually removes this burr using a graver resting on the tool and revolving the cylinder by hand. **Photograph 39** shows the part finished cylinders mounted on the engine frame.

The author uses this technique when making most of the cylinders for his model engines; finding it a quick and easy system to use which doesn't leave any chucking

marks particularly when machining bronze. Also, if necessary, the cylinder can be removed from the mandrel and replaced without losing any accuracy. **Photograph 40** shows a nearly finished cast iron cylinder for a Stuart S50 mounted on its wax mandrel.

Photographs 41 and 42 show another use for a wax stub mandrel; machining a displacer piston for a Stirling

engine. The mandrel has a hole drilled through it to let the air out when securing the piston blank. Note that a coarse thread rather than grooves has been used.

ME

An Engineer's Day Out

Farnborough Air Sciences Trust

Roger Backhouse spends a day at what was the Royal Aircraft Establishment.



Hawker Harrier is one of the aircraft displayed at the Farnborough Air Sciences Trust Museum. All aircraft displayed have had some association with the former Royal Aircraft Research Establishment.

Part shrine to pioneer aviators, part museum of the Royal Aircraft Research Establishment, Farnborough Air Sciences Trust runs a fascinating museum in historic listed buildings. Their enthusiastic volunteers point out that this is not primarily an aircraft museum, though there are aircraft displayed (**photo 1**), but it is about the role of science and engineering in aviation.

Early aviation

Following the American Civil War armed forces used ballooning for reconnaissance. The British Army set up a balloon store at Woolwich in 1879, moving to Chatham and later Aldershot.

It gained experience of using balloons during the Anglo-Boer War. The balloon school moved to Farnborough Common in 1906 where the Army also tried dirigibles.

This attracted American Samuel Franklin Cody, who persuaded the British Army to try his ideas for man carrying kites. Cody was something of a showman. He changed his name from Cowdery to capitalise on the success of 'Buffalo Bill' William Frederick Cody's Wild West Show.

Cody had physical courage but also developed a good understanding of aeronautics. He tested man carrying kites on Farnborough Common and his train of box kites reached a height of 14,000 feet in 1902, a British record. The following

year he towed a small boat across the Channel hauled by a kite. Kites could be towed behind warships giving greater visibility in pre radar days.

Seeing the potential of powered flight Cody developed the box-kite into a workable aircraft. In 1908 Cody made the first British powered, controlled and sustained flight in British Army Aeroplane No 1, managing 1390 feet and reaching a height of between 30 and 50 feet. This had a French 'Antoinette' engine. The museum has a superb replica of Cody's first flyer (**photo 2**). Materials included a cambric cover, bamboo, piano wire and pinewood. Cody used wing warping to control flight, plus front and rear rudders, which were in fact an early form of



2
Replica of Cody's first aircraft, which had a French built 'Antoinette' engine. Materials included cambric, piano wire, bamboo and pinewood.



3
Model of SE5A biplane made by the Royal Aircraft Factory, predecessor of RAE.



4
Caunter engine designed as a lightweight two stroke aero engine. Undergoing restoration.



5
'Farnboro' indicator devised at the RAE and made by Dobbie and MacInnes of Glasgow.

aileron. Cody improved aircraft but tragically died in 1913 when his plane broke apart in mid-air.

Alliott Verdon Roe made the first flight by an all British aircraft and British pilot at Walthamstow Marshes just a few months later using a British built JAP engine. Rail travellers from Liverpool Street to Chingford cross the viaduct where he had his workshop. Roe went on to found an aircraft company, later Avro.

Growth of Royal Aircraft Establishment

In 1912 the Royal Balloon Factory was renamed the Royal Aircraft Factory. It operated under that name producing over 500 aircraft until 1918 when the Royal Aircraft Establishment was formed. Its first designer was Geoffrey de Havilland. The First World War saw a rapid expansion in development and production. Many women were employed

and their role is commemorated in the museum.

Growth meant that the RAE had its own railway linked to the main line at Farnborough. It had one locomotive, a saddle tank called *Invincible*.

The RAE was noted for a highly skilled workforce with scientists, engineers and many technicians employed. RAE scientists developed carbon fibre here in the 1960's and this features in a display.

The museum has many models including several of early aircraft (photo 3).

Engines and the Farnborough indicator

Some early aero engines are displayed, like the Caunter light two stroke engine, now being restored (photo 4). Measuring their performance in the air led Squadron Leader Geoffrey Norman to develop the 'Farnboro' indicator in 1921. It was licensed to Dobbie and MacInnes of Glasgow and used until the 1960's (photo 5). There are several other engines displayed including the celebrated Rolls Royce *Merlin* engine used on many World War II aircraft, displayed part sectioned (photo 6).

Jet engines and gas turbines

Early work on jet engines was carried out by the RAE Engine Department under



6
Rolls Royce Merlin engine as used in the Hurricane, Spitfire and Lancaster aircraft.



7
Frank Whittle designed this jet engine, the W2 model fitted to the Gloster Meteor in 1943.



Rolls Royce Conway jet engine. Can be seen operating under electric power, one of several working models.



Open type wind tunnel brought in as part of war reparations from the University of Göttingen.



Concorde cockpit simulator built by museum volunteers.



Dr A. A. Griffiths with Sir Frank Whittle's Power Jets company making the first British jet engine (the W1) and then the W2 for the Gloster *Meteor*, the RAF's first production jet (**photo 7**). Much work on jet engines was carried out by the National Gas Turbine Establishment (NGTE) at nearby Pyestock. The collection recognises the significance of this research with considerable information about jet engines including a sectioned Rolls Royce *Conway* engine rotating under electric power (**photo 8**).

Wind tunnels

A wind tunnel is essential to test the dynamics of flight. Large wind tunnels are open for pre arranged group visits only but the museum has a smaller open tunnel brought in as part of war reparations (**photo 9**). It is still used for student projects. Many aircraft types were tested including unusual swept forward wings, adding to understanding of aerodynamics at supersonic and subsonic speeds (**photo 10**).

Concorde

RAE carried out considerable research into supersonic aircraft and contributed to *Concorde*, the first supersonic airliner. A *Concorde* structures test rig was set up at Farnborough. An *Olympus* engine and intake was tested at NGTE. The museum has a mock up of the cockpit as a simulator built by two museum volunteers (**photo 11**) plus a piece of rudder damaged in an accident, showing internal construction (**photo 12**).

Instruments

RAE worked on better instrument design and capabilities (avionics) from its early days. These included gyroscopes which could give aircraft heading, rate of turn and attitude information to the pilot. With an accelerometer these can form an inertial navigation system. Military combat aircraft now all carry heads-up displays (HUD) giving information to the pilot. The evolution of this and associated bombsights is shown in museum displays. It is a complex world in itself.

Weapons systems

Following the Second World War RAE conducted research on guided missiles. Some were drones like the *Stiletto* designed for high speed target practice from Royal Navy ships (**photo 13**). Another *Jindivik* drone target is outside the museum. More significantly, anti-aircraft missiles were seen as a priority in the Cold War.

The RAE also developed bombs, particularly focussing

Model aircraft with unusual wing configuration for wind tunnel testing.

FAR LEFT: Construction of Concorde rudder shown by an accident en route to America.

LEFT: Stiletto target drone used at Aberporth ranges. Royal Navy crews practised anti aircraft fire on fast moving targets like this.



Ariel satellite.



Rolls Royce test vertical takeoff and landing jet engine. The RB108 built in 1955. Work like this eventually led to the development of the Harrier jump jet. (Example outside the museum.)

on the aerodynamics. They had to ensure a bomb would not fly into the aircraft on release.

RAE became heavily involved in the design and launch systems for the British nuclear weapons programme starting in 1948. Euphemistically called *Blue Danube* the bomb would be carried by the *Blue Streak* missile developed in the Space Department. Two inert air launched bombs stand outside the museum on their specially designed trailer.

Although the American *Polaris* missile was chosen for nuclear submarine launches, RAE developed *Chevaline*, a multiple entry platform carried

as the payload. This used a decoy system so that in theory enemy defence systems would be confused. The museum has a complete *Chevaline* system. Given RAE involvement in new materials like carbon fibre it is curious to see the use of cork sheet here.

Space research

RAE's Space Department played a significant part in British space research, developing the *Blue Streak* missile, *Skylark* and *Black Arrow* rockets plus the *Skynet* military communications satellites. It contributed to the launch of the *Prospero* satellite

on the *Black Arrow* rocket in 1971, the first launch of an all British satellite on an all British rocket. Alas, Governments preferred to buy American equipment and cancelled the *Black Arrow* project (photo 14).

Vertical flight

The museum shows off RAE's interest in jet vertical take-off with a Rolls Royce jet engine designed for vertical take off and landing (photo 15). It also has several helicopters (photo 16) thanks to RAE involvement in rotor design with a good demonstration of a swash plate mechanism, adjusting the pitch of individual blades (photo 17).

Air accidents

Britain's Air Accident Investigation Board is still based at Farnborough and has carried out many investigations after crashes. One of the most important was when two early *Comet* passenger jets broke apart and fell into the Mediterranean without survivors.

AAIB had fragments lifted from the sea and pieced together the aircraft. This revealed that metal fatigue and cracking around windows

caused the disasters. The *Comet* was redesigned and operated safely thereafter, latterly as the *Nimrod* reconnaissance plane. A museum display shows a section of a *Comet* fuselage and information about the investigation (photo 18).

Closure

It is a sad story. RAE and space research was run down by several governments (photo 19). The final straw came when, as part of the Defence Evaluation and Research Agency, it was part privatised by Gordon Brown selling QinetiQ to an American company, a scandal that somehow avoided much public scrutiny.

Thankfully, Farnborough Air Sciences Trust acted to preserve parts of the site and the amazing archives. Their volunteers achieved wonders in a limited space but what might have been achieved if this had been fully funded?

Facilities

Besides a reserve collection of over half a million objects, there is an excellent research library with thousands of technical reports and books, open to researchers by appointment. Volunteers are also working with RAE's large collection of photographs, film and video recordings and making these available. Impressive as the exhibits are, this documentary side is arguably even more important for a museum.

There is a shop, well stocked with aircraft kits, and a small cafe. Parking is nearby or it is about one mile walk from Farnborough Railway Station.

Farnborough Air Show

Farnborough retains a role in aviation. It is still the base for the AAIB and various aerospace companies. The airfield is used commercially and the world's leading air show is held here every two years with the latest aviation developments, a legacy of Cody's work over one hundred years before when he too was pioneering.



Westland Scout helicopter used by the Army.



Swash plate mechanism used in research on helicopter rotor blades.



Comet display with fuselage section. Aircraft mostly use strong adhesives. Early Comet failures led to a major investigation by the Air Accident Investigation Board.



Faded glories of RAE Farnborough now represented at the museum.

Opening

The museum is open 10am-4pm on Saturdays, Sundays and Bank holidays. Parties are by arrangement on Tuesdays and Thursdays. Admission is free but donations are welcome (please use Gift Aid if you are a UK Taxpayer - it adds 25% to the value of your donation at no cost to you.)

Contact

Farnborough Air Sciences Trust, Trenchard House, 85 Farnborough Road, Farnborough, GU14 6TF. Tel. 01252 375050. Email manager@airsciences.org.uk Website www.airsciences.org.uk

Wind tunnel tours

Though not part of FAST, tours of the historic wind tunnels are possible, run by volunteer guides for parties of up to 20 people. Tours take around

2½ hours, usually on Tuesday and Thursday afternoons. A donation of £15 per head is requested. Details from Bob Gentry at bob.gentry@btinternet.com.

Further reading

Museum Guide (excellent £1 worth)

Bryan P Day (compiler), *RAE Farnborough: Space department - a history*, British Interplanetary Society, 2015 (available at the museum) £12.99.

Bill Howard, *Evolution of British jet engines 1926-1966*, FAST, 2016, 219pp. £18.50.

A wide ranging account of the different people and projects that developed the modern jet engine. Well researched and clearly written

Other engineering interest in the area

Museum of the Royal Army Logistics Corps
The Princess Royal Barracks, Deepcut, Surrey, GU16 6RW
www.royallogisticcorps.co.uk/heritage/museum
Tel. 01252 833371. Large collection relating to military transport and supplies. Includes Field Marshal Montgomery's staff car.

Tilford Rural Life Museum
Reeds Road, Tilford, Farnham, GU10 2DL
www.rural-life.org.uk
Tel. 01252 795571
Large collection of agricultural equipment, buildings and rural memorabilia.

Brooklands Museum
'Birthplace of British motorsport and aviation'.
Brooklands Road, Weybridge, KT13 0QN
www.brooklands-museum.com
Tel. 01932 857381

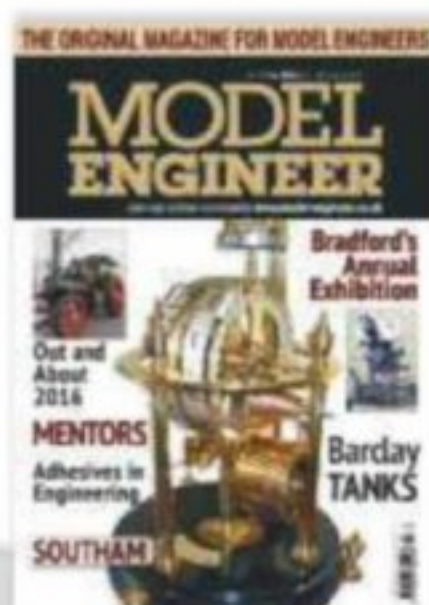
with plenty of technical detail. Though Frank Whittle was important he wasn't the only pioneer of the British jet. A remarkable book.

David Wilson, Richard Gardner and David Madgwick, *The Cody Flyer*, 2008 (available at the museum).

Peter Reese, *The men who gave us wings: Britain and the aeroplane 1796-1914*, Pen and Sword Aviation, 2014, £25.

Excellent account of key personalities and their achievements.

If you can't always find a copy of this magazine, help is at hand! Complete this form and hand in at your local store, they'll arrange for a copy of each issue to be reserved for you. Some stores may even be able to arrange for it to be delivered to your home. Just ask!



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Geoff Theasby reports on the latest news from the Clubs.



Lots of activity on the electronics front, but I will restrain my enthusiasm and relate only that I re-established a universally acknowledged truth, that a project - in this case, a Light Emitting Diode desk light - which worked admirably in prototype form, ceased to function when boxed for use. Reason and the judicious use of wire cutters, eventually prevailed at 5am. Of course, if I had obtained the services of Mr. Guy Hands, the businessman and his family, I could have succeeded earlier, because...*

I was pleased to discover a comprehensive catalogue of electronic components and raw materials suitable for modellers from Kitronics in Nottingham. Their prices are a little high but they offer quick delivery, being UK based. The catalogue is available electronically, in PDF form via their website, www.kitronik.co.uk

In this issue, a B1, flat land, a tractor, ice cream, unmentionables, 19th Century flat-pack buildings, Arts & Crafts disapproval, a Turner and Belarus.

I met a member of **Sheffield SMEE** at a radar museum event in Doncaster (as one does) and he told me that the charity day mentioned in the last Club News raised £3,000 for the childrens' hospital.

The Prospectus, September, from **Reading Society of**



Cliff Perry's M.N. at Reading. (Photo courtesy of Cliff Perry.)

Model Engineers, begins in a revelatory fashion; the identity of '61249' is exposed! After 10 years of writing about the modern railway and its vicissitudes, he is Cliff Perry, owner of a 5 inch gauge Tilbury Tank and his *nom de plume* was the number of a B1, *Fitzherbert Wright*. (An M.P. and cricketer, M'Lud, during WWI.) When he began his column about his life in the railways and how much he enjoyed every minute, he wrote; 'I did not earn lots of money, nor will I be knighted.' Then, in 2017, a letter arrived asking; Would he accept the award of an MBE for services to railways? So, he is not yet knighted but is on the ladder! Accordingly, to celebrate this award, here is a picture of Cliff's 7¼ inch gauge Merchant Navy, 35028, *Clan Line*, (photo 1). At a recent meeting, Network Rail's offer to

help the club was discussed. No further suggestions please! On a visit to the Rugby club to play Narrow Gauge railways, David Scott met the 'Rugby Club' Chairman, (Rugby Model Engineers... Oh well, please yourselves). The Rugby track is built on concrete posts - being Rugby, of course. (The town even has a cement museum.)

W. www.prospectparkrailway.co.uk

Robert McLuckie attended a wedding at which the **Edinburgh Society of Model Engineers'** portable track was running the *Wedding Belle* with Britannia 70021, *Morning Star*. I do like the headboard (photo 2). W. www.edinburgh-sme.org.uk

As I write this piece (13th September) **North Norfolk Model Engineering Club** is running its last event prior to dismantling the track and infrastructure, since the North Norfolk Railway, on whose land the club has existed for 16 years, wishes to expand. Chairman, Gordon Ford, says, 'The North Norfolk Railway hopes the club will be able to secure new premises that will enable them to remain in the local area to the benefit of all visitors and the town. We are looking for a parcel of land about 1.5 to 2 acres, fairly flat (in Norfolk! - Geoff) that we could fit our operation into, that may be available to rent in the North Norfolk area. If any other clubs who have experienced a similar fate could advise us on available



Wedding Belles at ESME. (Photo courtesy of Robert McLuckie.)

grants or funds that might help us move and relocate we would appreciate their help. We would like to take this opportunity to thank our members and public passengers for their continued support over the years and we are keeping our fingers crossed a new site can be found soon'.

Otago Model Engineering Society's *Conrod*, September, advises that a future talk by a member of Otago Maritime Society will take as its theme, 'A Brief History of Time, the Universe and Everything'. I wonder how much time has been allocated to this event...? Editor, Andrew Nicolson writes on electric motors, which are common to all modellers, being used for primary motion all the way down (or is it up?) to the blower used to encourage the fire in a live steam model. At a recent Engineering Group meeting, Des showed his self-destructing 'Kiwi dunny' to some amusement. (I know what a dunny is (I think) but this sounds intriguing.) That's two references to scatological subjects, so I won't mention the Ig-Nobel Prize just awarded to the investigators of wombat poo. And then, I swear this is not a figment of my febrile imagination, but a solid gold, working, 'throne' was stolen from Blenheim Palace, the following day, 14 September. Don't worry, all the jokes have been aired at length, in the *Best Possible Taste*. Lachlan Clark's bought A1/1 was revealed to be seriously unacceptable due to the use of soft solder and bodes in its construction. Therefore, a heart transplant, rather than heart surgery, is required. He was prepared for this, so it did not come as a surprise. It appears to have been made in 1948.

W. www.omes.org.nz

The Link, September, from **Model Engineers Society (NI)** reports that Chairman, John Mathews, has been in France, enduring the 35 degree temperatures, in the village of FA. (That really is its name, he says. Sweet!) A local friend is a keen modeller and is

currently building a Tich, G1 locomotives and a 2½ inch gauge Jeanie Deans. Secretary, David Heatley promotes a forthcoming talk on the County Donegal Railway, Ireland's largest narrow gauge network, which pioneered diesel traction in the British Isles and survived until 1959. The 55th National Steam Rally took place at Stradbally Hall, Co. Laois, in August. It celebrated the centenary of steam sawing, with 15 displays on that theme, as well as stone crushing and threshing. A friend (of a member,) Godfrey Greeves, visited from England, bringing his 1/8th scale crawler tractor. Taking 12 years to develop and complete, it is not modelled after any individual type, is radio controlled and has scale, working hydraulics. It is electrically powered but can be fitted with a model aircraft 'glow plug' engine as well (**photo 3**). This model was featured in *M.E.* 4586 (also photo 3) under St. Albans DMES and now appears to be complete.

W. www.mesni.co.uk

The Gauge 3 Society *Newsletter* for Autumn has arrived. They had a stand at Gauge 1 North as many members also model that scale too. Trevor Young writes on L & Y Diagram 21 'Tin Tab' brake van. (Digression) Many places had small churches built in corrugated iron, known as 'Tin Tabernacles'. Not having heard of these for over 50 years (I grew up near one) I went a-Googling. Wikipedia



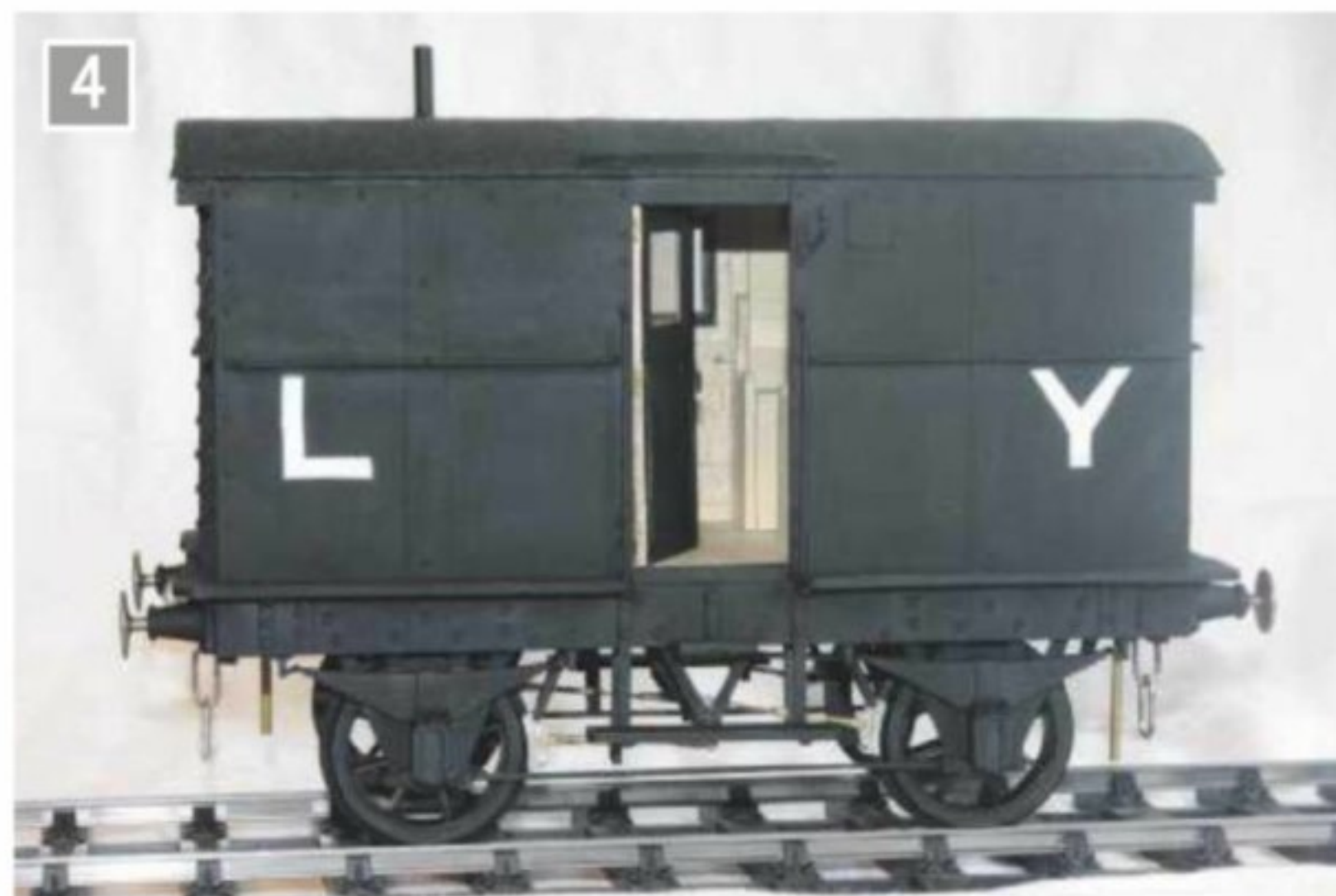
MESNI tractor. (Photo courtesy of Terence Aston.)

says, 'A tin tabernacle is a type of prefabricated ecclesiastical building made from corrugated galvanised iron. They were developed in the mid-19th century initially in the United Kingdom. Corrugated iron was first used for roofing in London in 1829. After 1850, many types of prefabricated buildings were produced, including churches, chapels and mission halls.' Needless to say, The Church of England, Augustus Pugin, John Ruskin and William Morris disapproved of such utilitarian edifices. Trevor

acknowledges the help of the L & Y Society, in particular, the General Arrangement drawing for this van is three feet long! Assembly is not entirely prototypical, miniature mortise and tenon joints being very difficult, so the frame was glued, but 300 sets of 14BA fasteners were used. A brake van being like a rolling house, different companies had their own ideas on interior layout. The L & Y created one end as an office and Trevor's van interior features working fittings right down to opening cupboard doors and drawers, a sliding internal door and working brakes and sanding gear. To facilitate the demonstration of these, the roof is removable and held on with magnets (**photo 4**). Mark Pretious lists several car paint colours which are a close march to the originals, all being available from Halfords.

W. www.gauge3.org.uk

Bristol Society of Model and Experimental Engineers sends the *Bristol Model Engineer Newsletter*, Autumn. Chair, Norman Rogers prints a photograph of young Tabitha enjoying an ice cream,



L & Y brake van. (Photo courtesy of Trevor Young.)



Andrew Hopper's pipe organ at HWMEC. (Photo courtesy of David Savage.)

possibly a bribe to allow Mum, Tanya to visit the railway, or perhaps a reward for helping to collect the tickets... (I bet she wasn't so clean and tidy 10 minutes later... I speak from experience! – Geoff.) Tanya was later photographed driving her father's, and his brother's, Rob Roy so the ice cream was value for money. Manager, Rebecca Strong writes of the church group providing holidays for children. They arrived in five coaches. 250 children and the chattering was deafening! Iain Holland has made some very small I/C engines, a half-sized Whippet of 1.6cc and a scratch built 0.677cc, for which Iain designed the variable jet carburettor and the spark plug and which runs on petrol at 22,000 rpm. He is currently developing a third of 0.343cc. Alan Church has built a G1 spirit fired Aster Merchant Navy, which runs very well. He says 'glsoas!' (nudge, nudge, know what I mean Squire? – Geoff.) It came as a kit, has over 1000 parts, three cylinders and three sets of valve gear, all of which work. Kevin Slater recently gave a talk on CNC, after which others spoke of their experiences in

this field. Derek Brown spoke of injectors at a later meeting and later still, Bernard North, who inspects towers and peals of bells for safety, discussed the restoration of the peal at St. Andrew's parish church, Blackwell. Further talks were on the De Dietrich replica and restoring a 1928 Sentinel Locomotive.

W. www.bristolmodelengineers.co.uk

Now, a bit about timing or serendipity. Having just run out of newsletters to review, I broke off for lunch and found *Criterion*, September, from **High Wycombe Model Engineering Club** on the doormat/under a gooseberry bush/in the jaws of a slaving Rottweiler, depending whether they are collected by a newsletter editor, a small child or a prospective burglar. The front cover is graced by a photo of an electrically driven, wooden pipe organ by new member, Andrew Hopper. It appears to be named *Albert*. (A prince among models? – Geoff.) That looks rather nice (photo 5). The recent Summer has probably been the most successful ever, selling just four short of 2500 tickets, plus 120 extended rides for the children of a local school as an end of term treat. Editor, David Savage, notes that *PS Waverley's* boilers failed on test and will cost £2.3m to replace. A similar sum was recently raised to prevent a Turner painting leaving the country. He points out that we have in the UK stacks of Turners but only one *Waverley*! In the June public running, Chris Gooch's steam driven miniature hay baler proved very popular amongst the children and 23 bales were sold (photo 6). A message from Belarus

was received via Facebook, from the Secretary of their National Museum stating that they had received a miniature steam tractor which had featured on the cover of *M.E.* in 1944. That magazine claimed it was made by a Mr. Jacobs of High Wycombe and could the current membership identify it? Following a flurry of e-mails, it appears to be a Henry Greenly 1 inch scale design of 1933, styled after a 7 nhp Davey Paxman machine. Drawings are still available and one of the UK dealers recently sold a similar model. No information on Mr. Jacobs has come to light so any further details about Mr. J, the model, where it has been for the past 70+ years and how it got to Belarus would be very welcome.

W. www.hwmecc.co.uk

And finally: sometimes, someone unexpected comes into your life. They appear as if from nowhere, make your heart race and change you forever. These people are known as the police.

* Many Hands make light work!

Contact:
geofftheasby@gmail.com



Chris Gooch and his hay baler also of HWMEC. (Photo courtesy of David Savage.)

NOVEMBER

- 6 Bradford MES.** Autumn auction (only members may bid), 7:30-10pm, Saltaire Methodist Church. Contact Russ Coppin: 07815 048999.
- 6 Brandon DSME.** AGM and meeting at The Ram Hotel, Brandon, 7.45pm. Contact Mick Wickens: 01842 813707.
- 7 Cardiff MES.** An evening with Tony Bird. Contact Rob Matthews: 02920 255000.
- 7 Leeds SMEE.** Meeting night – Members' hints and tips. Contact Geoff Shackleton: 01977 798138.
- 7 South Lakeland MES.** Meeting in the pavilion, 7.30pm. Contact Adrian Dixon: 01229 869915.
- 7 Sutton MEC.** Bits and pieces. Contact Paul Harding 0208 2544749.
- 8 Tiverton & District MES.** Club meeting at Old Heathcoat Community Centre, Tiverton, 7.30pm. Contact Chris Catley: 01884 798370.
- 10 Newton Abbot & District MES.** Running day at Lindridge Hill. Contact Ted Head: 07941 504498.
- 10 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-dusk. Contact Ken Parker: 07710 515507.
- 10 Sutton MEC.** Sunday track day from noon. Contact Paul Harding 0208 2544749.
- 12 Romney Marsh MES.** Members' social afternoon 2pm. Contact Adrian Parker: 01303 894187.
- 14 Cardiff MES.** Members' projects. Contact Rob Matthews: 02920 255000.

- 14 Sutton MEC.** Club night. Contact Paul Harding 0208 2544749.
- 15 Rochdale SMEE.** Talk: 'Steam in Rhodesia and Zambia' – David Thornber, 7.30pm at Castleton Community Centre. Contact Rod Hartley 07801 705193.
- 16 Westland & Yeovil DMES.** Track running day 11am – 4.30pm. Contact Bob Perkins: 07984 931993.
- 17 Newton Abbot & District MES.** Running day at Lindridge Hill. Contact Ted Head: 07941 504498.
- 17 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-dusk. Contact Ken Parker: 07710 515507.
- 17 Tiverton & District MES.** Running day at Rackenford track. Contact Chris Catley: 01884 798370.
- 19 Romney Marsh MES.** Ron and Mary Hyde in Canada, 7.30pm. Contact Adrian Parker: 01303 894187.
- 20 Bristol SMEE.** Themed topic evening - CAD. Contact Dave Gray: 01275 857746.
- 21 Leeds SMEE.** Meeting night – 'Advanced Steam in Miniature' – Nigel Bennett. Contact Geoff Shackleton: 01977 798138.
- 21 Sutton MEC.** Club night. Contact Paul Harding 0208 2544749.
- 23 Cardiff MES.** Steam up and family day. Contact Rob Matthews: 02920 255000.
- 24 Newton Abbot & District MES.** Running day at Lindridge Hill. Contact Ted Head: 07941 504498.
- 24 North Wiltshire MES.** Public running, Coate Water Country Park,

Swindon, 11am-dusk. Contact Ken Parker: 07710 515507.

- 26 Romney Marsh MES.** Members' social afternoon 2pm. Contact Adrian Parker: 01303 894187.
- 26 Wigan DMES.** Bits and pieces evening. Contact Kevin Grundy: 07877 634184.
- 28 Cardiff MES.** Talk: 'Railways Around Cardiff' – David Green. Contact Rob Matthews: 02920 255000.
- 28 Newton Abbot & District MES.** AGM. Contact Ted Head: 07941 504498.
- 28 Sutton MEC.** Club night. Contact Paul Harding 0208 2544749.
- 30 Bradford MES.** Annual exhibition and social, 12.30-6.30pm, Saltaire Methodist Church. Contact: Russ Coppin, 07815 048999.

DECEMBER

- 1 Guildford MES.** SMSEG open meeting 2-5pm. Contact Mike Sleight: pr@gmes.org.uk
- 1 Newton Abbot & District MES.** Running day at Lindridge Hill. Contact Ted Head: 07941 504498.
- 1 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-dusk. Contact Ken Parker: 07710 515507.
- 1 Sutton MEC.** Christmas dinner at Topolino's. Contact Paul Harding 0208 2544749.
- 4 Brandon DSME.** AGM and meeting at The Ram Hotel, Brandon, 7.45pm. Contact Mick Wickens: 01842 813707.
- 4 North London SME.** Festive gathering. Contact Ian Johnston: 0208 4490693.

- 5 Cardiff MES.** Talk: 'Foundry Experiences' – John Styles. Contact Rob Matthews: 02920 255000.
- 5 Leeds SMEE.** Christmas dinner at Drax Sports and Social Club. Contact Geoff Shackleton: 01977 798138.
- 5 South Lakeland MES.** AGM in the pavilion, 7.30pm. Contact Adrian Dixon: 01229 869915.
- 5 Sutton MEC.** Bits and pieces. Contact Paul Harding 0208 2544749.
- 6 Portsmouth MES.** Club night: quiz, 7.30pm, Tesco Fratton Community Centre. Contact Roger Doyle: doyle.roger@sky.com
- 6 Rochdale SMEE.** Auction night, 7.30pm at Castleton Community Centre. Contact Rod Hartley 07801 705193.
- 7 Tiverton & District MES.** Running day at Rackenford track. Contact Chris Catley: 01884 798370.
- 7/8 Bedford MES.** Santa specials – pre-book rides at www.bedfordmes.co.uk/santa-specials.
- 8 Bradford MES.** Santa special, 11am-3.30pm, Northcliff track. Contact: Russ Coppin, 07815 048999.
- 8 Guildford MES.** Public open afternoon 11am-3pm. Contact Mike Sleight: pr@gmes.org.uk
- 8 Newton Abbot & District MES.** Running day at Lindridge Hill. Contact Ted Head: 07941 504498.
- 8 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-dusk. Contact Ken Parker: 07710 515507.
- 8 Sutton MEC.** Sunday track day from noon. Contact Paul Harding 0208 2544749.



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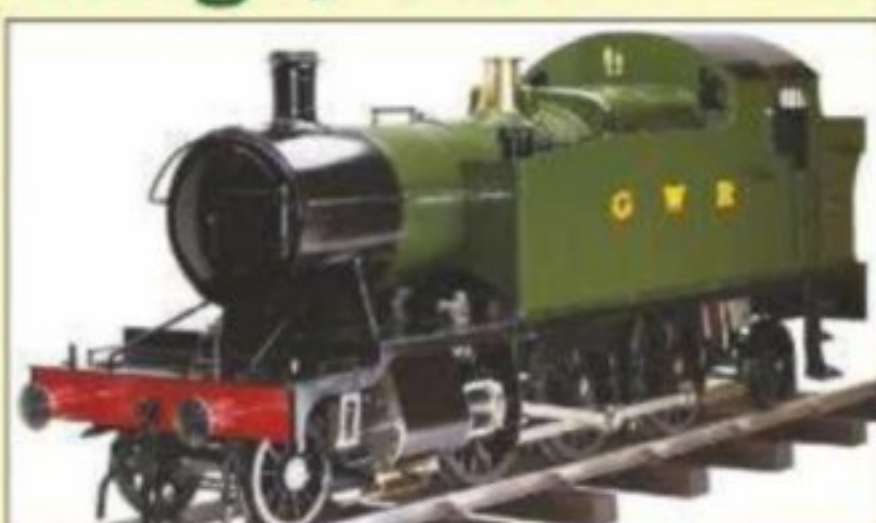


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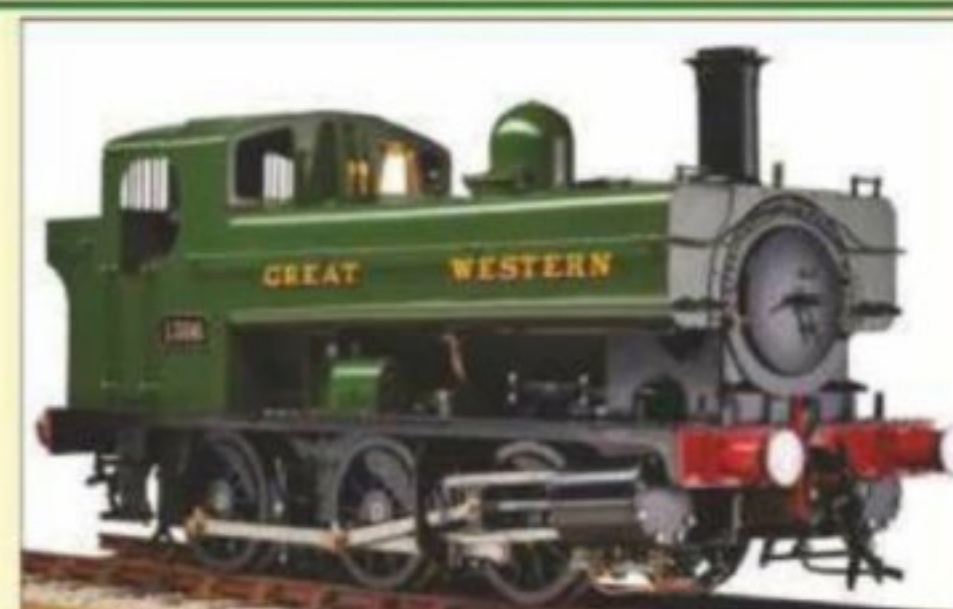
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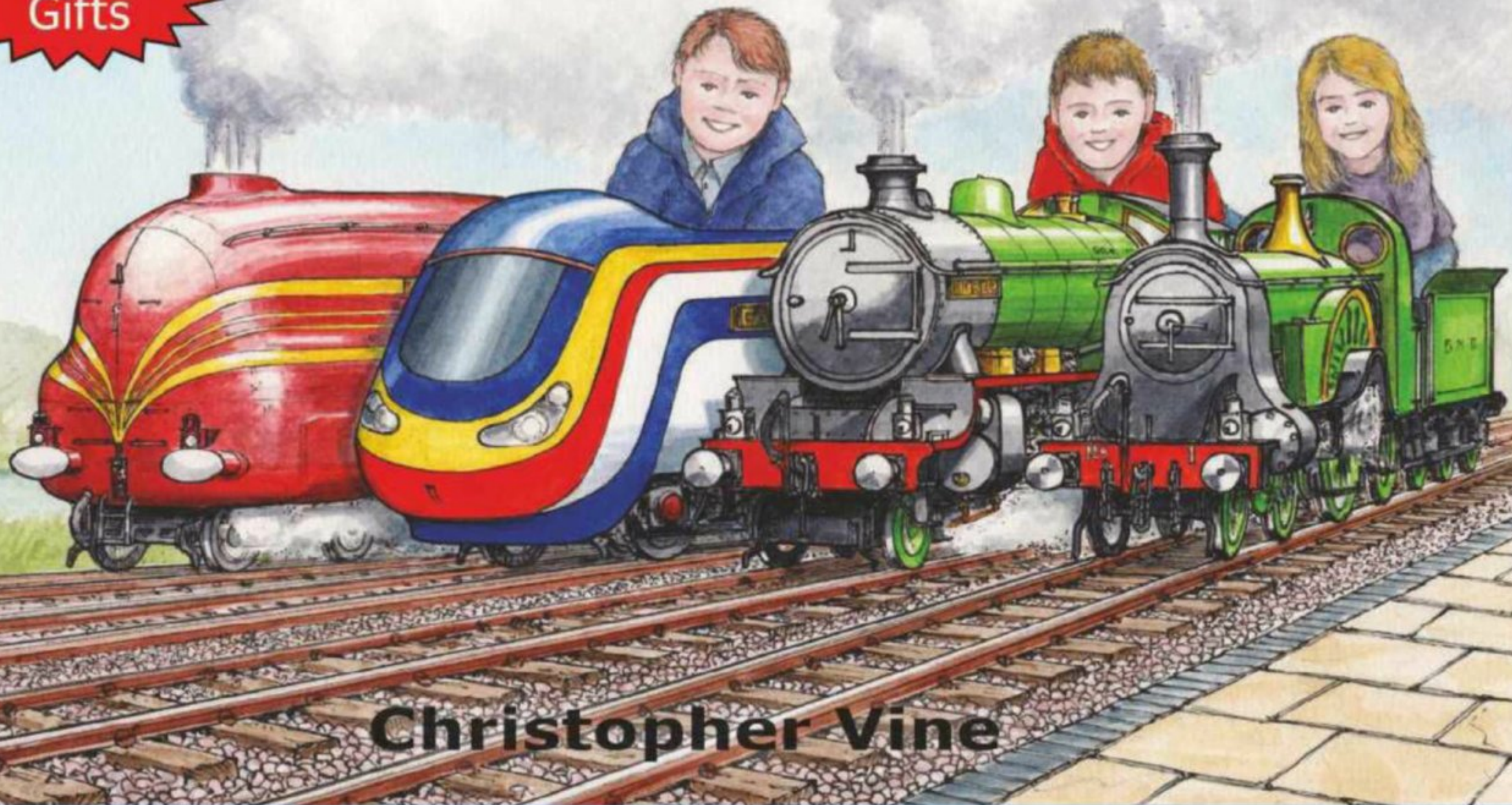


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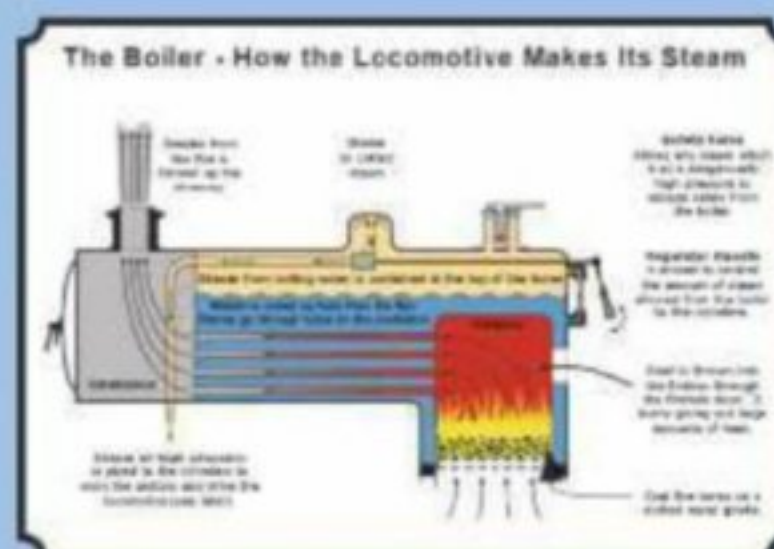
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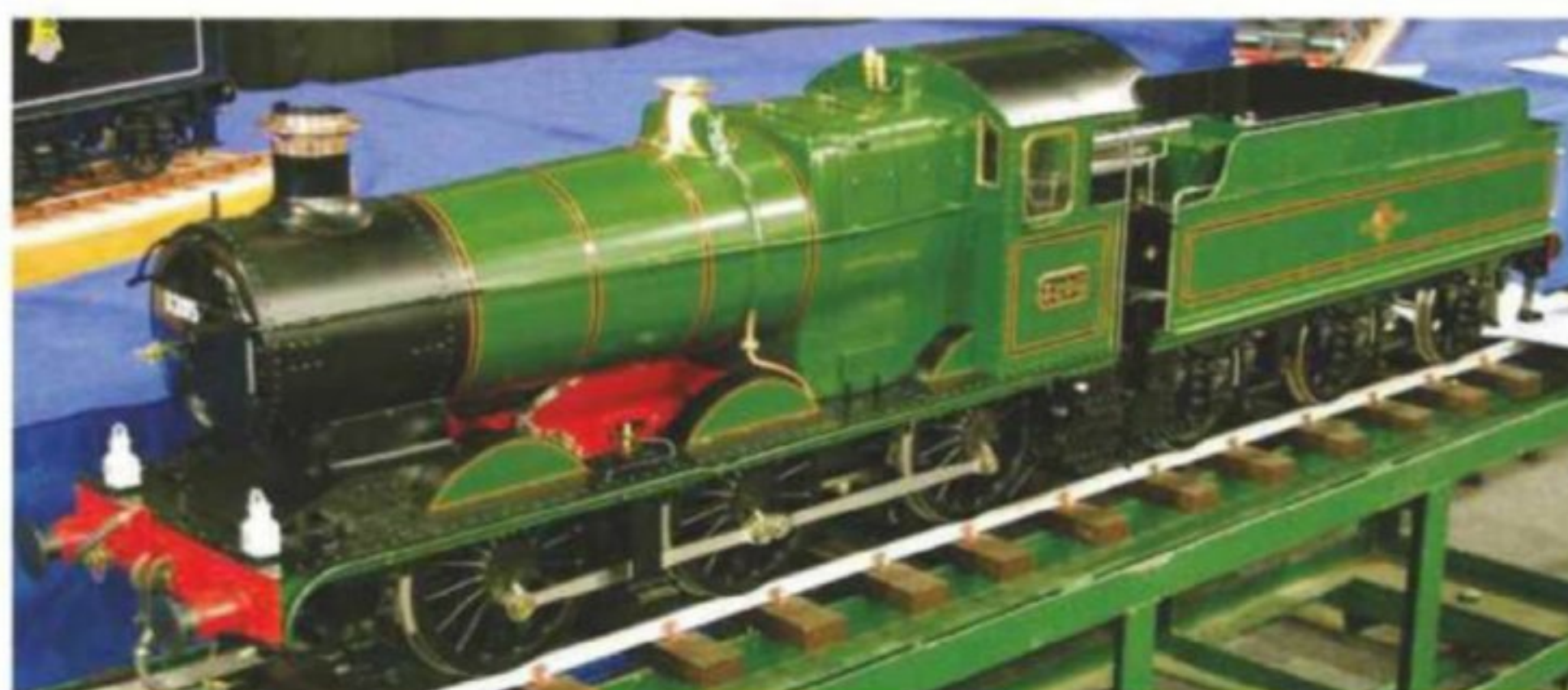


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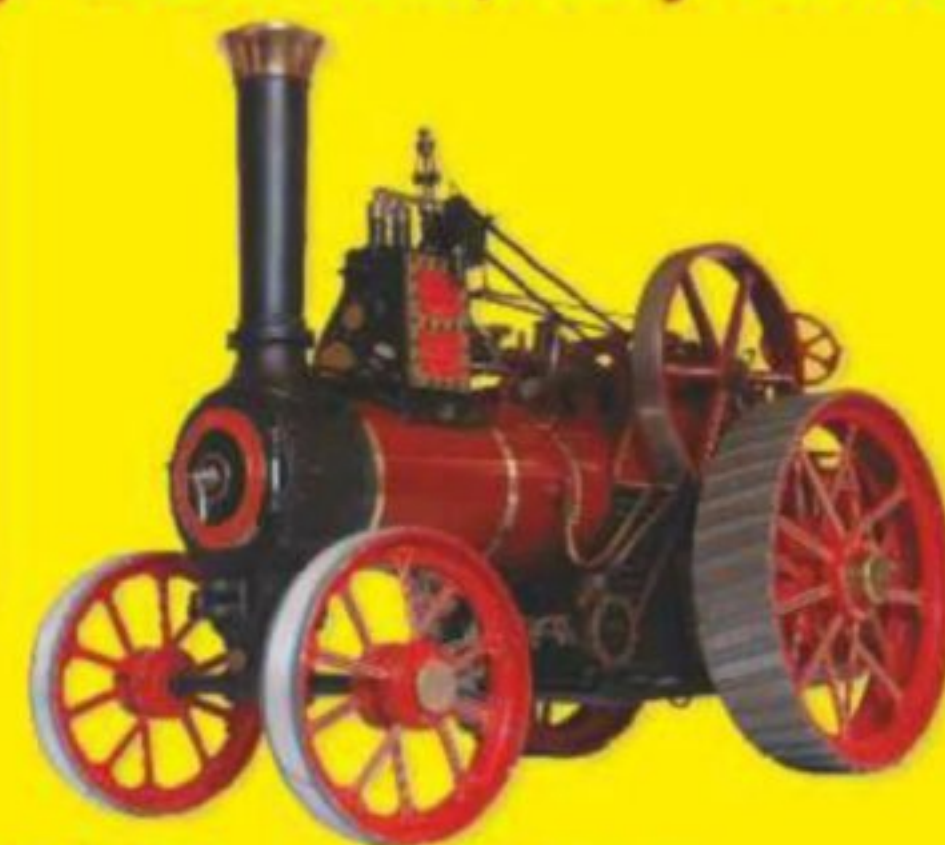
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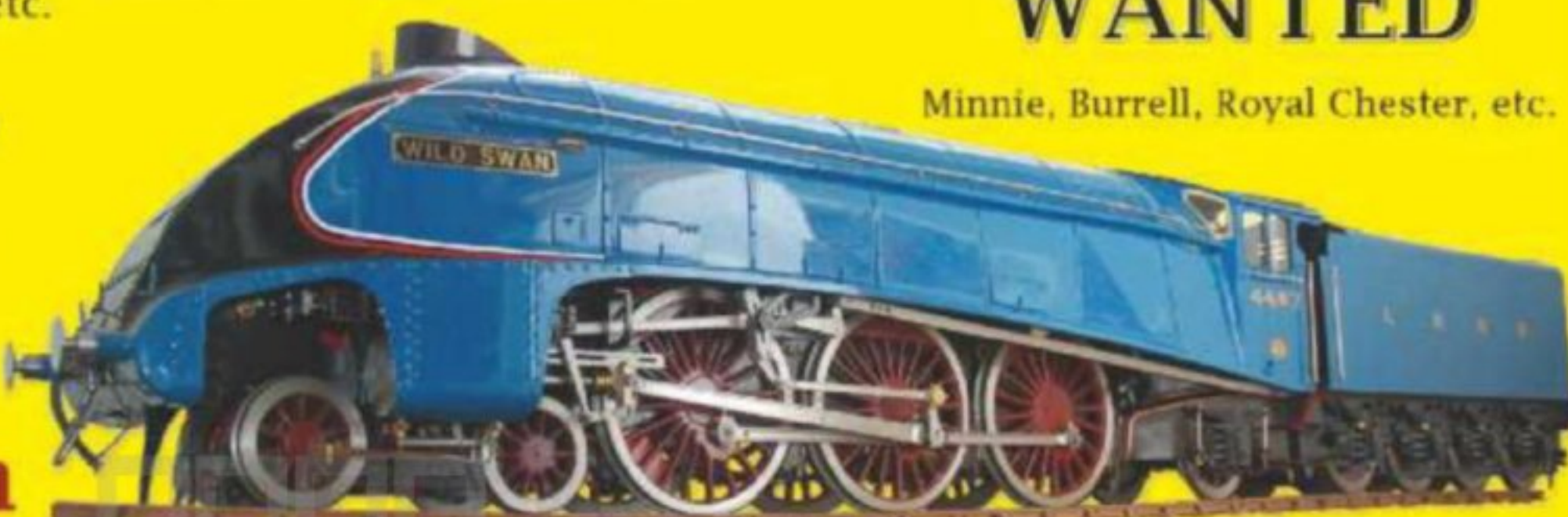
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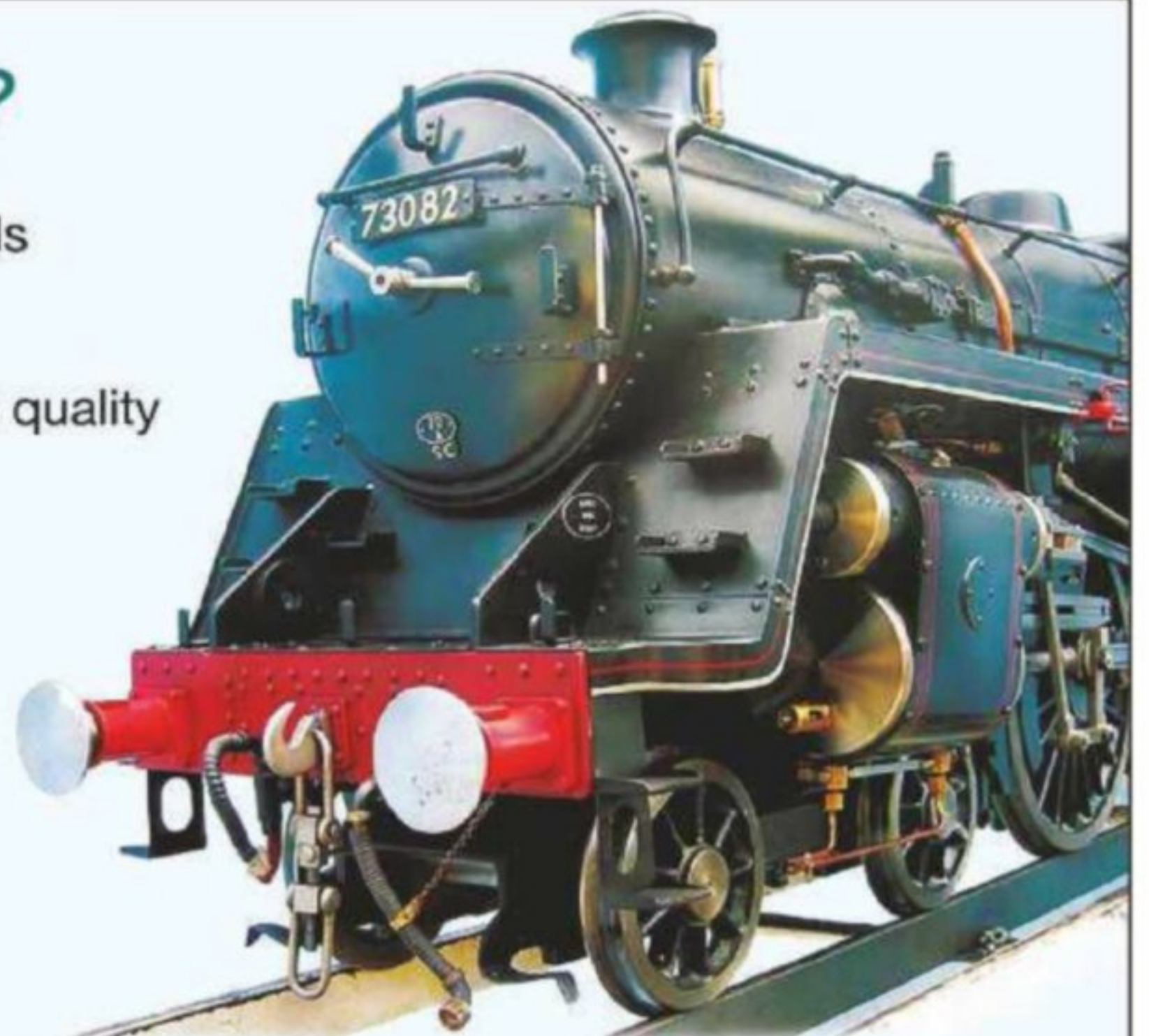
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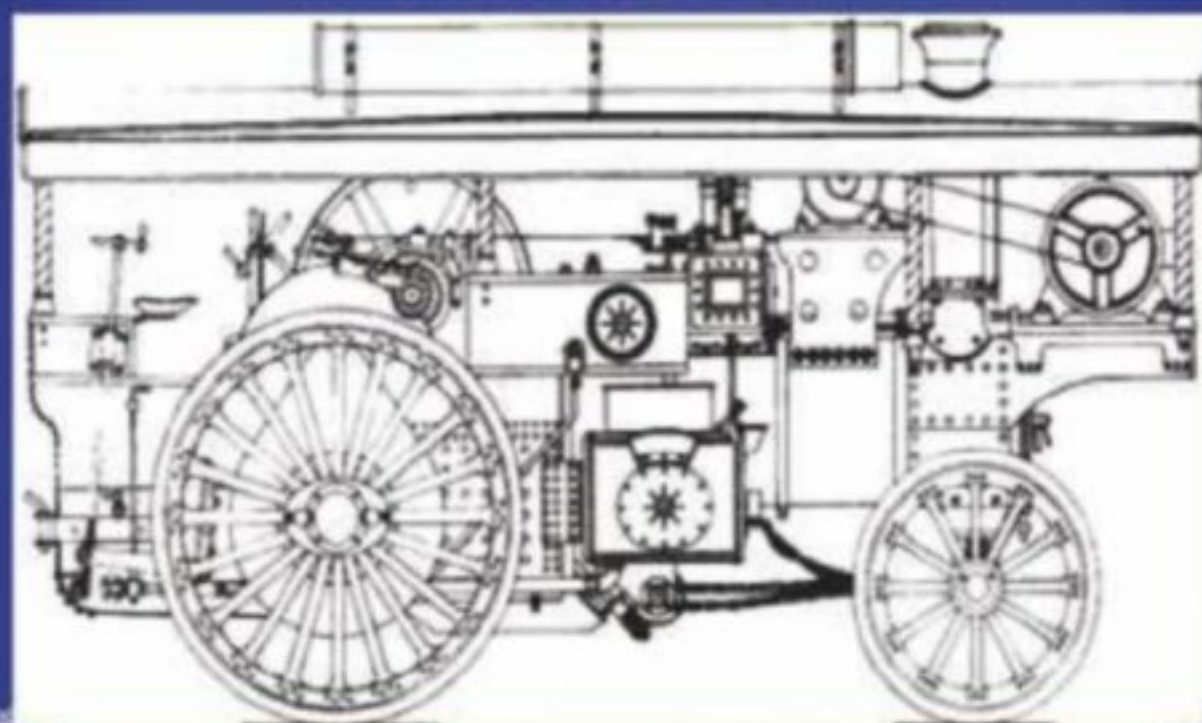
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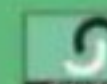
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