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Top Link

Issue 7
Spring/Summer
2003

Special feature on volunteering
Bond issue to go ahead
All motion parts now forged

Journal of The A1 Steam Locomotive Trust

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DEDICATED COVENANTS

If you don't see what you want in the list of Dedicated Covenants below, just ask. There are other components to sponsor at prices to suit most pockets. You can get together with other covenantors to share the cost (cash /per month in the right-hand column). In all cases, contact Alan Dodgson at **enquiries@a1steam.com** or ring 01325 4 60163, giving your name and contact details (phone/e-mail/address).

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Buy your bit of history – from £7.50 per month!

Back cover: A banner put up by GNER Trains at the main-line station (once known as Bank Top), advertising Darlington as the home of the A1 Project. *(photo: David Elliott)*

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Top Link

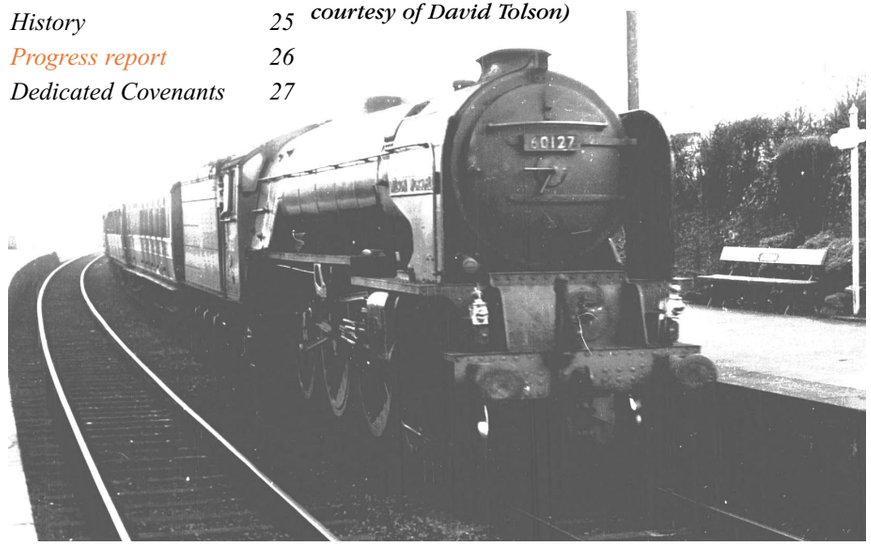
Issue 7: Spring/Summer 2003

Editor: Gerard M-F Hill

JOURNAL OF THE A1 STEAM LOCOMOTIVE TRUST

gerard@a1steam.com

Front cover: With a dmu of the same era as that on page 5, this Ian Allan postcard was captioned "An up express headed by Class A1 No. 60147 'North Eastern' arrives at Durham as a multiple-unit leaves for Newcastle." *(© V. Welch/Ian Allan Ltd, courtesy of David Tolson)*



Peppercorn A1 60127 ***Wilson Worsdell*** at Joppa, near Edinburgh *(photo: A. R. Cockburn)*

EDITORIAL

What's that diesel doing in *Top Link*? Well, it's really a picture of Barry Wetherell, doing volunteer work *(see p. 12)* on a dmu (Class 107, I think) at the Wensleydale Railway, with whom we are having a leaflet exchange. Theirs is enclosed with this issue. This 22-mile ex-LNER line, just 17 miles from the works, has seen an A1 *(see p. 25)*, carries army traffic and will run passenger trains from 4 July.

Our project needs volunteers too, in different ways. This issue outlines the A1 way *(pp. 17–18)*, with job opportunities and experiences *(pp. 10–13)*. Try one for size! You don't have to get your hands dirty or live in Darlington.

Still four issues a year, *Top Link* was delayed to bring news of the bond issue. This looks very promising indeed and the chairman has more news *(see p. 16)*.

New in this issue is a Progress Report *(see p. 26)* on *Tornado*. This will be a regular feature from now on. Our Spring Day Out was to the North York Moors – real LNER country – with on-train dining and works visit. Alas, I couldn't go, but so many of you did that the latest Gresley coach had to be added to our rake.

Many thanks to Chris Scott for the Big Pictures *(see p. 21)* and everyone who sent photos. Keep your letters and pictures coming: I'll squeeze in all I can.

Gerard Hill

Above: Barry goes painting in Wensleydale in his spare time *(photo: Barry Wetherell)*

NEWS

BOND NEWS

There has been an excellent response to the letter sent out with *Top Link* 6, asking for financial support to build the boiler and complete *Tornado*. Already Wreford Voge reports over 150 positive replies, together pledging over £130,000 in loan capital.

As a result the board intends to go ahead with the bond issue, as soon as legal and reporting work is completed, on the basis of ten-year loans with fixed interest.

The board is also grateful to those who were unable to offer extra financial support at present but wrote back 'with regret'. Their numbers help give a more solid basis to our financial projections.

TORNADOS IN THE DESERT

The trust is linked with RAF Leeming. At least 14 of their Tornado F3 fighter aircraft were operating over Iraq from bases in Saudi Arabia during March and April, as part of Operation Resinate South, supporting the invasion of Iraq.

First formed in 1915, the two squadrons – 11 and 25 – re-formed at Leeming with Tornados in 1988 and 1989 respectively. Each squadron has normally 16 aircraft on its strength.

Tristar tankers based in Bahrain provided in-flight refuelling. At the time of writing, Tornado GR4s from RAF Lossiemouth had returned and it was understood that Leeming's aircraft too were on their way home.

ON THE SHOP FLOOR

At a trial fit of the Cartazzi axleboxes, newly bolted up in their hornguides, it became clear that 1949 roller-bearing A1s were not assembled in quite the way the drawings suggested.

The A1's Cartazzi axleboxes (when mounted on their wheelset) are meant to have free lateral movement of 3″ either side of centre. Ours, represented by the dummy axle described in the last issue of *Top Link*, were found to move about 1″ either side and jam solid. This was obviously not acceptable, so David Elliott did some computer modelling, using the CAD system.

This showed that the 0.025″ clearance shown on the original drawing was not enough, which we knew, but nor was the 0.050″ agreed with the VAB. To achieve 3″ sideways movement, we would need 0.228″ or nearly a quarter of an inch in old money (see diagram).

Working tolerances

At this point David decided to check other Cartazzi axles, using the 'mark 1' eyeball. V2 *Green Arrow* was found to have in the order of 0.060″ clearance and A4 *Mallard* approximately 0.080″.

The key difference between them and *Tornado* is the use of roller bearings. When *Mallard* and her ilk need

the Cartazzi wheelset to move to anything like full lateral translation, such a locomotive will be moving very slowly.

As their axleboxes reach our jamming position, they twist on the axle end, first using up the typical 0.0150″ to 0.020″ clearance in the bearing (created to allow the oil film to be established) and then continuing to twist on the journal, lifting the bearing brass off the journal proper and resting on diametrically opposite corners of the bearing.

At speed, such behaviour would be catastrophic; at very low speed it results only in local bruising of the white metal, with little effect on bearing life.

Now consider our roller bearings: maximum radial float is of the order of 0.002″ to 0.003″. Thus, to all intents and purposes, there is no room for the bearing to twist on the axle. Once the axlebox starts to jam in the hornblocks, the roller bearings are put under rapidly increasing load. Ultimately, one or more rollers would fracture.

A little local difficulty

It seems likely that the erecting shop at Doncaster found the same problem and made some local adjustments. Because the five roller-bearing A1s were an experiment, this probably never got back to the drawing office.

The basic problem is the Cartazzi arrangement itself: it aims to emulate radial axlebox movement (with its rubbing faces ideally machined in a curve) by an approximation using flat surfaces.

David Elliott was not happy for the Cartazzi axleboxes to start life with nearly a quarter of an inch clearance, so further work was done on the CAD programme, resulting in a compromise.

Following approval from the VAB, North View Engineering machined a further 1/16″ (0.063″) off the Cartazzi axleboxes' front manganese-steel liners and also a facet, tapering from approximately 0.112″ to nothing, over about one-third of the rear liners. In addition, a small facet was machined on each of the two front hornblocks.

This has the effect of limiting the clearance between axleboxes and hornblocks to about 0.113″ on straight track whilst maintaining a wide contact surface between axleboxes and hornblocks to minimise the wear rate.

Tornado now has the required 3″ of clear movement either side of centre on the Cartazzi axle.

MOTION

The forging of valvegear components is now complete and they are due to be heat-treated shortly, prior to delivery. We then intend to make a start machining radius link parts and eccentric rods.

Meanwhile, Ufone have begun machining the inside connecting-rod and strap, now that we have been able to calculate the precise length to correct for the growth in the middle cylinder and the final position of the crank axle.

Hardy Non Ferrous at Middlesbrough have cast the gunmetal liners for the inside valvegear eccentric, and are now casting the long gunmetal nut in the cab reverser stand. They are also supplying patterns and castings for the cast-iron housing for the nut.

Back at DLW, we measured up the crank pins in order to finish-machine the coupling-rod bushes. Unfortunately, these measurements (which can be made accurately only now, with the cannonboxes finally fitted) showed up inaccuracies in the distances between the axle centres and crankpin centres, in the worst cases about 0.016″ – compared to the nominal figure of 0.005″.

Had they all been the same, the errors would have been of little consequence, but some of the worst errors are over the nominal figure, some under, so corrective action is required. This has been drawn to the attention of the contractor responsible for fitting the crankpins, who has been asked to rectify the non-conformance.

Reassuringly, although the crankpin throws have been found to be out of tolerance, the 120-degree quartering from one side of the locomotive to the other seems to be well within tolerance.

In anticipation of fitting coupling-rods and valvegear, large nuts and special bolts have been ordered from North View Engineering to fit the crank pins, return cranks and reversing gear.

Right: Our Spring Day Out on the North York Moors Railway on 5 April used Gresley coaching stock, seen here with David and Mark on the move. *(photo: Alan Dodgson)*

WHEELSETS

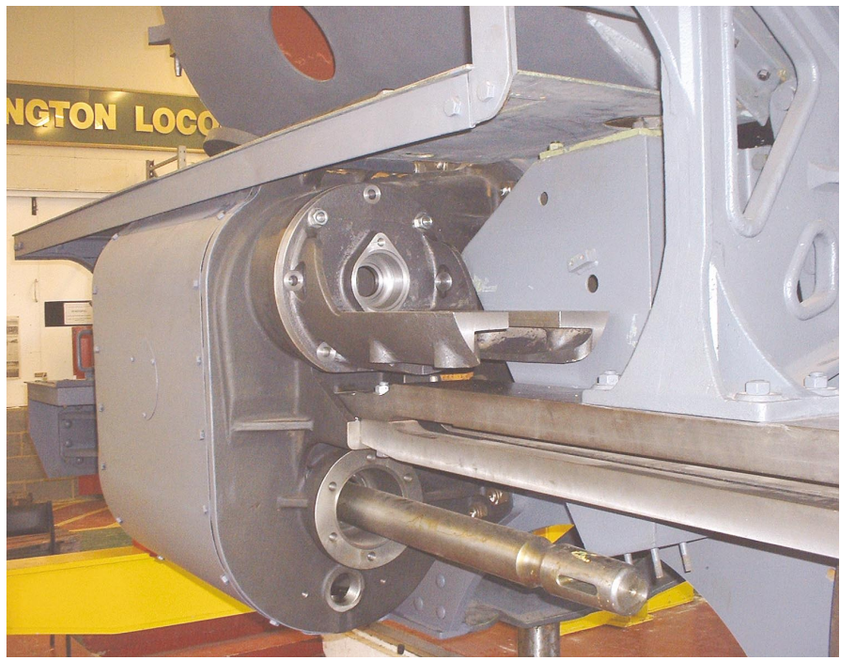
All cannonboxes and axleboxes for the coupled and bogie wheels have been finally fitted to their bearings.

They should not now need to be dismantled until the locomotive's first overhaul, and then only for inspection. The coupled wheelsets have been reunited with the frames, ready to have coupling rods fitted.

The Cartazzi wheelset has had the bearings and spacers pressed on to the stub axles, and we expect to press on the axleboxes in the very near future.

Bogie

The bogie hornblocks need final fitting, though not to such demanding standards as the coupled-wheel hornblocks, which took several months of hand-fitting.



Above: Trial fit of the rear steamchest cover, April 2003 *(photo: David Elliott)*

The bogie frame is now on North View's Elga Mill, a milling machine with a very large table. This will enable the sides and faces of the hornblocks to be machined in a fraction of the time it took to hand-fit the coupled hornblocks.

When the horns are accurate, the manganese-steel liners will be welded on, and the process repeated to true them up. The frame will then be returned to Darlington Locomotive Works to have the hornstays fitted.

This will essentially complete the bogie frames, but there is much work to be done on axle and side-control spring gear and on the bogie side bearers between the engine and the bogie frame.

CYLINDERS AND VALVES

The rear steamchest covers have been delivered by Kings Heath Patterns and one has been trial-fitted *(see opposite)*.

An order has been placed with Ufone to machine the six cast-iron valve-chest liners. They can then be shrunk into the valve chests using liquid nitrogen. It is hoped to start machining the front valve-chest covers shortly.

Work has started to prepare the crossheads for uniting with the piston rods. Then the whitemetal bearing surfaces that move in the slidebars will be machined to profile and the slidebars set up on their brackets and the cylinders.

Material is now on hand to start making the cylinder drain-cock linkage.

CAB

A rivet press was made by Ian Howitt and trial rivets were fitted to the window beading to fix optimum length. Ian has now made enough rivets on his CNC lathe for all riveting of window beads, to be done by our small but dedicated volunteer force led by Mike Wood.

WORKS

Ian Howitt has fabricated a 'beak': a steel frame fixed on the forklift truck's forks and used in lieu of a crane to lift objects up to a half-ton beyond the reach of the forks. He has also made a load-spreading beam to assist in lifting and fitting coupling – and connecting-rods.

Secondhand pallet racking has been acquired. Cleaned, painted and erected by volunteers, this has greatly helped to clear floor space and tidy the stores area.

We have bought a 3″-stroke 50-ton hydraulic ram. With some specially-made press gear, it will enable us to do almost all press assembly 'in house'. It has already pressed on the Cartazzi bearings and will soon be used to assemble pistons and crossheads, and press in coupling – and connecting-rod bushes.

Works visits

Please be sure to check beforehand that the works will be open on the day and at the time you intend to visit, and that no engineering work is going on that might preclude your visit: ring 01325 4 60022.

PRESENTATIONS

Accustomed as I am ...

I started giving presentations about 1995. My local model engineering society wanted to know about the A1 Project. People from other societies asked me to repeat the story at their meetings – and so it grew! We have averaged eight presentations a year since then, to local model and railway societies and to professional institutions. The A1 website gives contact details for any society that wants us to speak.

I have covered much of southern England, from Devon to Essex, mainly south of the Thames. Others cover the Midlands, East Anglia, the Pennines and the North-East, but we always need more people – who will want to know how these presentations work.

They really do work, too. Among recent presentations in the North of England, one given by Keith Crabtree in Wakefield resulted in the largest donation the trust has ever received at such an event.

As well as encouraging new covenantors, I always ask for a donation to the trust, based on our slogan "a loco for the price of a pint". People typically give about £2, though in conversation I always ask for £1.5m to finish the loco. No success there, but you never know!

How do they work? The presentation is based around a series of slides. It starts with a brief history of the design and Arthur Peppercorn's position in the LNER and later BR. There is a short section on the way the project is managed and how funds are raised. I emphasise at this point the value of a covenant. There is a little advertising that highlights the help we have had from industry, and then slides of original drawings and the parts made from them.

I use the slides as prompts. The audience can easily read the captions so there is no point in reading them out. Instead, I have a 'script' for each slide, which by now is effectively memorised. Where possible I include small anecdotes on certain features or I describe what they see on a drawing compared to what we have actually built.

My presentation style may be described as 'animated Italian' – I use my hands a lot to emphasize my words. I have been known, in my enthusiasm, to catch a finger behind my spectacles and throw them at the audience! Even this animated style has not prevented one or two of the audience occasionally falling asleep. I put that down to (their) increasing years and a large dinner!

I conclude with the picture of 60156 *Great Central* that was retouched as 60163 *Tornado*, saying this is what will emerge from the works, and then a final picture of an A1 in full song with clouds of smoke and steam flying on the main line saying "… and that's what we'll be doing with it!" Spontaneous applause is not unknown.

ON-TRAIN MARKETING

The evening concludes with questions from the audience. I'm always aware though that some answers cannot be given because of commercial confidentiality. I usually get a briefing from David Elliott on the latest state of things. Sometimes I have to say I don't know the answer; I never make one up! The current big question is how and where we source the boiler.

When the journey is long, I may ask for a little help with the petrol, and I may need to stay overnight. Rather than add the expense of B&B, I have frequently been accommodated in the home of the organising secretary. This has always been pleasant and, as they too are always enthusiasts, given me the opportunity to give them a little more detail on the project.

That's all there is to it. If I can do it, perhaps you could do it too. If you live in London or the Home Counties, you will be especially welcome because this would give us both an easier task. Mark is exceptionally busy as chairman and marketing director, and has a career too; and I need to reduce travel time.

If you feel you could join the team and give a presentation, we will provide materials and help you get started. You won't be expected to take on more than you can manage. If you can help, please contact me at bob@a1steam.com: you will be most welcome.

Bob Alderman

Free travel

We need volunteers to travel on steam-hauled trains! Some operators of charter trains have offered to allow two of our people to travel FREE on each of their trains, to distribute leaflets and talk to passengers about *Tornado* with the aim of attracting new covenantors.

John Larke has just taken over from Alan Dodgson the task of co-ordinating our on-train marketing.

John writes: "I appreciate that several people have already volunteered, but – to make sure – I would be grateful if anyone who can help would send me their details, even if they have previously contacted Alan".

This is what John needs to know:

- your name and address
- telephone/fax number
- e-mail address
- area of country where you can help
- how often you can help
- any dates when you are not free

You can contact John either by e-mail at john.larke@a1steam.co.uk or you can ring or write, using the Darlington hotline or postal address.

Either regular or one-off help will be valuable. The more people we talk to, the more covenantors we shall get and the sooner *Tornado* is finished. You won't be sent out unprepared: John aims to ensure that everyone knows what they're doing. Go on, have a day out!

Wensleydale and the Works

Every week I look forward to my volunteer days. Sometimes the work is challenging (all right, 'hard'), sometimes it's exciting, but it's always rewarding.

Day One is Tuesday, my 'day in' at Darlington Locomotive Works (DLW), a warm, dry building renovated in 1997.

Day Two is Friday, my 'day out' at Leeming Bar station yard – often a cold, wet or windy place, with a goods shed ripe for renovation – on the Hawes branch, now the Wensleydale Railway.

At the works I've hand-reamed bolt holes, fettled connecting rods and countersunk hundreds of holes for cab rivets, as well as making an extra pair of hands on other jobs. Soon I start riveting.

At Leeming Bar we've just finished renovating a buffet car. Now we're busy preparing the works train, mending or replacing timber, repairing and adjusting brakes, fitting brake pipes, checking axle bearings, cleaning and painting.

The picture shows the works train, consisting of diesel crane and bogie match wagon, Lowmac, four Dogfish ballast hoppers and Shark ballast plough brake van. Out of shot are a Salmon rail bogie and BR brake van. Shortly a 1929 Walrus ballast hopper is due to arrive. Should be interesting!

It's all in a day's work, whether you're building a locomotive or building a railway. Why not try your hand?

Barry Wetherell

The East Anglia group

There are about ten of us in the East Anglia group – none of us knew each other before *Tornado*. We cover an area from London to Norfolk, as far west as Bedfordshire. Actually anyone could join in – but we hope people will form new support groups.

We meet informally every three months to talk about progress. We air suggestions how we can help and plan for activities, meetings and days out.

What else? We have done a lot of work on *Tornado*'s cab, and we intend to continue with that and other work as it is identified. We have taken part in on-train marketing, represented the trust at events and given talks. John Larke is helping with marketing sweatshirts for covenantors. Our most recent social activity was driving and firing the B12.

Our group has skills in joinery, draughting, pipework and engineering quality, but the trust particularly needs people with abilities in organisation, project management and engineering manufacturing, or people with useful contacts. Rapid completion of *Tornado* will require as much effort organising as in making things: there's plenty to do.

What we have done, others can do. Money isn't the only way to help. If you are an 'armchair supporter' – how about it? Contact me (01473 658334) or anyone on the trust's management team.

Alan Lusby

Graham Nicholas

Among new names on the engineering team is Graham Nicholas, who was recently appointed as the trust's Railway Quality Consultant.

The regulatory structure now in place means that, before an organisation does anything on the railway network, it has to keep abreast of constantly changing standards and provide certification to show it has met them. This is the job Graham is doing for the trust.

Like everyone in the trust who has a specific task, Graham is a volunteer: he is volunteering his professional skills and knowledge.

Over the last sixteen years he has been responsible for management of day-to-day operations, fleet maintenance, certification, safety and finance, managing hundreds of people and budgets of over £10 million per annum.

He is a chartered engineer, who is now Vehicle Acceptance and Standards Engineer for EWS Railways with personal signatory status. He is specifically responsible for rolling stock and gained ISO 9001:2000 certification for his department and its documentation.

Graham was born about the time the A1s were being withdrawn. Since 1988, he has lived and worked in Lancashire. His wife and two children live with his interests in cinema and musicals, as well as steam and railways. They kindly lend Graham to us as often as they can.

Marketing Director

To allow Mark Allatt to focus on his job as chairman, the trust is seeking an experienced, professional marketer to head all its marketing activities, including PR, events, advertising, publications and the web, and manage a small team of volunteers. Can be based anywhere in the UK.

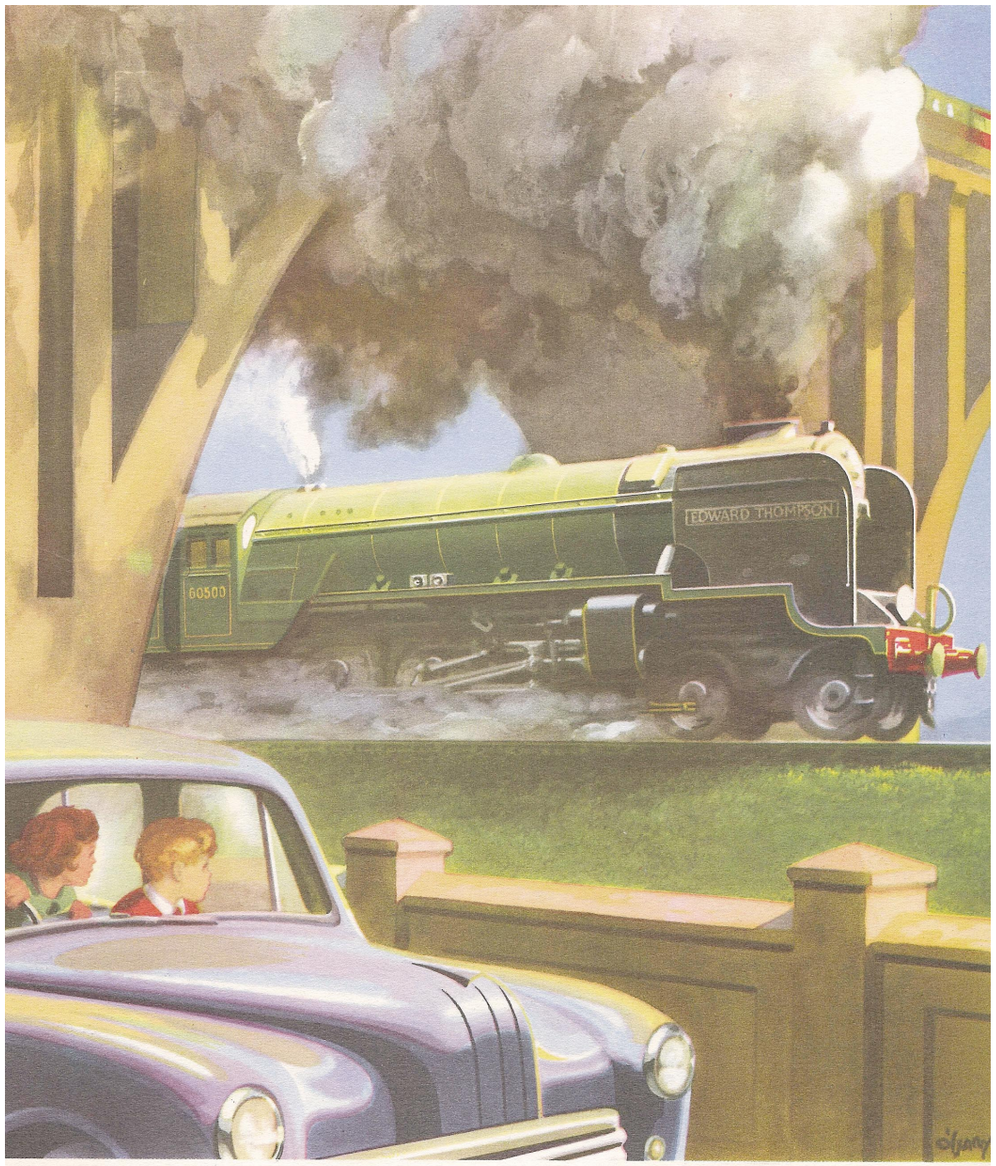
Administration Director

To head all its administrative activities, including covenanting, database management and dealing with *ad hoc* correspondence, and to manage a small team of volunteers, the trust is looking for an experienced, professional administrator, based within easy reach of Darlington, if possible.

Doncaster

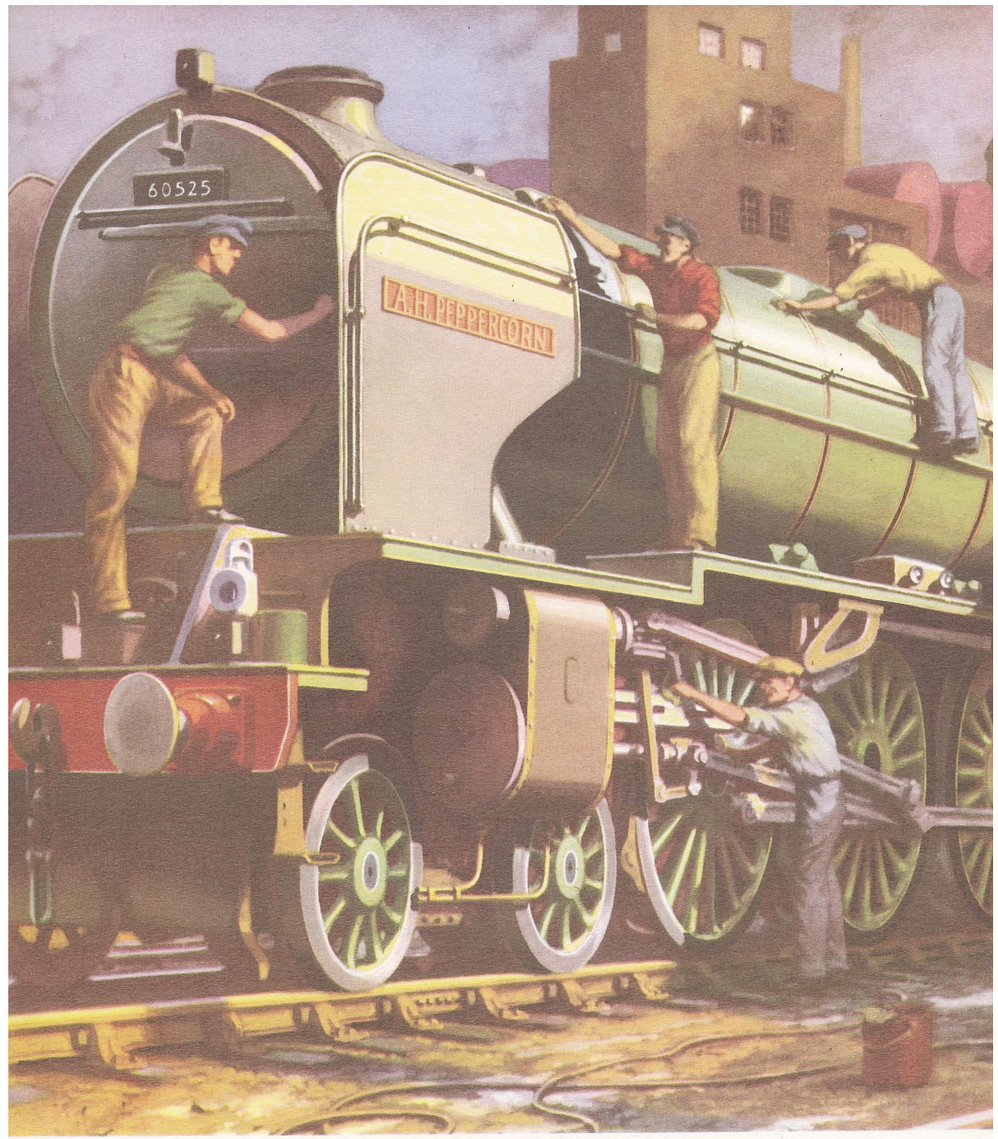
As at Crewe, the trust will be represented at 150 Years of Doncaster Works, celebrated on 26–27 July. We need you for part of either day, to tell the public what we're doing and persuade as many as possible to sign up as covenantors. If you can help, e-mail alan@a1steam.com or ring 01325 4 60163.

The A1 stand at Crewe *(photo: Mark Allatt)*



No. 60500, " Edward Thompson ", A2/3 Class Locomotive

" Why, what a long engine, John ! " exclaimed Gillian, as a sleek modern green train thundered past. They are looking at one of the latest locomotives of the Eastern Region.



Cleaning Locomotive No. 60525, " A. H. Peppercorn "

If you were an engine-cleaner you would soon learn all about locomotives. Every part has to be cleaned and kept in good repair. If you got on well, you could rise to be a repair-man or perhaps a fireman in an engine.

CHAIRMAN'S COLUMN

When reviewing this issue of *Top Link* with Gerard, I felt it was crying out for the sub-title 'Getting all our ducks in line'! This issue is indeed all about preparing for the accelerated completion of the locomotive. The groundwork covers two fields: money and manpower.

Money: As you will read elsewhere in this issue, we have to date received pledges of over £130,000 for the proposed bond issue. Barry Wilson is now leading the team putting together the bond issue and we will be writing to you again just as soon as this is ready. Andrew Dow is leading our discussions with financial institutions regarding a loan and substantial progress has already been made.

On the more traditional route of recruiting covenantors for the trust, Paul Ambler continues to enhance our website, now the source of over 100 hits a day and about 200 downloads of the Prospectus every month; John Larke has taken on the job of enhancing our presence on steam specials; Bob Alderman co-ordinates talks on the A1 Project to interested groups; GNER has helped with the erection of banners at Darlington station *(see back cover)*; and Alan Dodgson, with the help of many others, has organised our presence at the Crewe and Doncaster open days. All these activities are starting to bear fruit.

Manpower (and let's not forget womanpower!): Elsewhere in this issue you can read about some of the covenantors who have stepped forward to take a more active role in the project *(pp. 10–13)*. You can read *(opposite)* about how you too can become more active and help us to accelerate the completion of *Tornado*, with details of specific vacancies on page 13.

All this is happening as steady progress continues to be made on the 'bottom half' of the locomotive.

There's a lot more left to be done – why not lend a hand?

Mark Allatt

If you have not already registered your support for the Bond Issue, please write to Wreford Voge – not to the works, and not by phone or e-mail – at 5 March Pines, Edinburgh, EH4 3PF. Otherwise, please always use the works phone or address.

The Big Picture (pp. 14–15)

The paintings by Galbraith O'Leary for the book *British Trains* [undated, 1950?] show the A1's immediate ancestors, the final types of LNER A2, named after their designers: A2/3 60500 *Edward Thompson* and A2 60525 *A.H. Peppercorn*. The Hillman Minx Mk IV appeared in November 1949. *(© G. O'Leary/Juvenile Productions, courtesy Chris Scott)*

VOLUNTEERING

I'm often asked what role volunteers can play in building *Tornado*, so I have put pen to paper in the hope of encouraging many more supporters to step forward and give their time. The A1 Steam Locomotive Trust is different in many ways from any other railway heritage project. That includes how volunteers can best help. The trust was founded around four principles, which remain as valid today as in 1990:

- The trust would be run using the best business practices, by people experienced in the appropriate areas.
- Funding would be simple, understandable and affordable by virtually anyone.
- With the enormity of the task, the project would have to focus on a single aim, expressed in its mission statement, all proposed action to be judged against this.
- The rules of the organisation would prohibit cliques and any form of élitism. Everyone would achieve recognition based on effort rather than size of chequebook. This would enable all efforts to go into the building of the A1.

A nationwide, voluntary management team was put together, including an engineer, accountant, banker, marketer and other appropriate professionals.

Consequently, the trust has secured a reputation as a thoroughly professional organisation, supported by a wide range of experts and enthusiasts from all walks of life, united by one mission: *To build and operate a Peppercorn class A1 Pacific steam locomotive for mainline and preserved railway use.*

So how can we best bring more volunteers on board whilst remaining true to these guiding principles? It has been said that building an engine is 80% engineering skills, whereas repairing one is 80% good DIY skills. With some notable exceptions, a volunteer workforce usually has more DIY skills than craft skills.

Professional engineers have built almost every part of the locomotive built so far. They work in a highly controlled environment of design, drawings, materials selection, process control, inspection and approval. Their involvement is vital if the locomotive is to be certified to work on the main line.

Our experience with volunteer-made items has been mixed. The cab seats and windows (made by the East Anglia Group) are excellent, as is the considerable amount of work done by Barry Thompson and Barry Wetherell, particularly on the motion, but some other volunteer work has been defective, requiring reworking.

We have to set the benefit of cheap or 'free' work against issues of quality control, recording, and delivery times. If volunteers live 100+ miles away, someone else has to travel to advise, supervise, inspect and accept. This is a hidden cost.

Clearly it is hard to fit together voluntary labour and commercial construction. Voluntary work is rarely warranted. However, there are ways you can help.

A WAY FORWARD

Management team

There are still roles that need filling in our marketing and administration teams *(see p. 13)*. These need experienced professionals who do, or have done, these jobs for a living and are willing to give a good deal of time on an on-going basis.

Covenantor recruitment

Alan Dodgson organises our attendance at events like Doncaster Works Open Day *(see p. 13)*; John Larke co-ordinates on-train marketing *(see p. 11)*; Bob Alderman is responsible for talks *(see p. 10)*. In each case we need volunteers to talk to people about the A1 Project and persuade as many as possible to become covenantors.

Darlington Locomotive Works

Mike Wood and his small team of volunteers have done an enormous amount of work to transform DLW. There are still development and maintenance projects that need suitably skilled volunteers, especially in joinery, plastering and electrics.

Working on Tornado in Darlington

Mike Wood is looking to pull together a group of volunteers to work with the paid contractors on *Tornado*: one or two mates would support a craftsman or engineer. This would avoid the need for paid mates, motivate the volunteer workforce with interesting work and ensure that any work done is of the required standard.

A volunteer mate could become skilled over time and eventually perhaps act on their own or with less supervision. This style of working is evolving at Darlington and existing volunteers indicate it is working well. Some basic relevant skills are desirable, or the paid professional spends too much time providing training.

This could happen not just on Tuesdays (volunteer days at DLW) but on other days when a contractor is in Darlington. It would need a firm commitment by volunteers as the contractor would plan work on the basis of the mate being there! Also we would like to look at organising a series of Works Weeks, where volunteers who live further away could spend a few days working on *Tornado*.

Working on Tornado away from Darlington

One group has pioneered this way of working, on cab seats and windows. Provided issues of quality control, documentation and so on, can be overcome, we are keen for other groups to come forward to work on jobs off the project's critical path.

If you can help in any of the ways mentioned, e-mail enquiries@a1steam.com or phone the hotline on 01325 4 60163 with details of your skills and availability. A member of the management team will get in touch. We all thoroughly enjoy working as a team building *Tornado* – we'd be delighted to welcome you aboard!

Mark Allatt

THE KINDLY TAXMAN

The British taxman doesn't give grants, but tax reliefs give us a disguised subsidy. The rules used to be more complex: when covenants started in the 1920s, they had to last over six years to qualify – reduced in the 1980s to four years. In the 1990s the scheme was extended to one-off gifts of £600 or more. Since April 2000 any donation is tax-deductible if the donor has signed a Gift Aid Declaration (GAD).

The trust still asks donors for a covenant, because some assurance of future income is important for cash-flow planning. It will be essential if we seek outside finance repayable in instalments. The trust now holds a GAD for almost all donors, showing they pay UK income tax. If they no longer pay UK tax, it is up to them to tell the trust. If they pay tax at 22%, a £100 gift – whether monthly or one-off – brings us £128.21, because it is treated as 'after tax', in other words as the 78%. If you fill in a self-assessment form, enter the amount in the appropriate box.

Higher-rate taxpayers (an expanding breed) can get further relief, but only if they claim it on their self-assessment return. The further 18% tax means that the trust receives £128.21 from a higher-rate taxpayer's gift of just £77.

If you make payments via The Charity Aid Foundation or your own charitable trust, you send a sort of 'cheque' to the charity, which fills it in and 'applies' for payment. GAYE (Give As You Earn) is a similar scheme for employees. They decide how much to give and the employer deducts the amount and passes it on. It helps us because refunds of higher-rate tax are paid straightaway instead of 15 months later. Also, the government (until April 2003; it may be extended) pays 10% extra to the charity, and some employers also top up gift aid. In one case, the 'top-up' is 200%! One drawback with GAYE and CAF is that money just appears at the bank: it can take months to track down donors.

The taxman can help in the hereafter too, because legacies to charities are free of Inheritance Tax (IHT), which is 40% of the estate over £250,000. With rising house prices, IHT may be a problem if the main asset is the house and there is no cash to pay it. So do consider a legacy to the trust in your will to get *Tornado* up and running. A £10,000 legacy costs the estate only £6,000 if IHT is payable.

Even if you never change your will, you can leave a legacy. Up to two years after death, with consent of the executor(s), you can be deemed to give a legacy by Deed of Variation. If a son or daughter inherits £150,000 but inserts a £10,000 legacy to the trust, their share is still £144,000, with tax relief. An 'Eternal Covenant' lets donors of legacies over £1,000 have their name inscribed on a roll of honour at Darlington Works and, if they wish, their ashes scattered on *Tornado*'s fire.

Wreford Voge

Whence came the A1? Unlike Minerva, it did not spring fully formed from the brow of Jove – not even from the brow of the jovial Arthur Peppercorn – but it did come of good stock.

The conception was certainly the work of Nigel Gresley: LNER pacifics were part of his 'big engine' policy. The first three were actually Great Northern pacifics – no. 1472 is still with us – noted at the time for their large boilers.

This wasn't new either. The Gresley 2-6-0s of 1920 had the first British locomotive boiler over 6′ diameter at the front, but his predecessor, Ivatt, had already opined that "The measure of the power of a locomotive is the boiler". He was consciously echoing Sturrock's phrase about "its capacity to boil water".

Ivatt's 1902 atlantic had a big boiler and wide firebox, the latter an American idea that dated from 1877. Gresley's 1922 pacific had more adhesion and a bigger boiler.

The wide firebox was accommodated by the Cartazzi axle, another GN tradition. A bogie was the usual way of giving the chassis stability at speed.

The atlantics did wonders with two cylinders; why bother with three? The obvious answer was that cylinders, whether inside or outside, could not be made much wider. To use all that steam, more cylinders were needed.

Actually, when Gresley decided to rebuild atlantic no. 279, he tried four cylinders with divided drive, as on the GWR and GCR. Unconvinced, he turned to three cylinders, a feature of the NER and MR.

Gresley steered clear of compounds, perhaps put off by the LNWR's three-cylinder efforts, but he evidently liked the NER three-cylinder simples, which in turn seem to have stemmed from four GCR shunting tanks built in 1908 for Wath yard. From shunter to Streak!

The big-boiler, three-cylinder 4-6-2 that Gresley conceived for the GNR became class A1 when the LNER was formed, while the short-lived NER pacifics became class A2.

The locomotive exchanges of 1925 demonstrated that *Pendennis Castle* had something the LNER engines didn't: long-travel valves. Before long, the pacifics got them and became class A3, their coal consumption was cut by 25 per cent and non-stop running between Edinburgh and London became possible.

When an even bigger engine was needed for Edinburgh–Aberdeen trains, Gresley built *Cock o' the North*, in 1934. The P2 2-8-2 has been judged a 'near-miss' or even a failure, not so much for its many unusual features as because the operating department made such poor use of it. All six P2s were 'rebuilt' as pacifics by Gresley's successor, Thompson, who perpetuated on his own pacifics two features of the P2: its boiler and the 50 sq. ft grate of its firebox.

Remarkably, for someone who had big plans for standardisation, Thompson produced four different pacifics in four years. What they all had in common was divided drive, outside cylinders behind the bogie, a good boiler and bad riding.

LNER pacifics first used a bogie that Ivatt had brought from Ireland but in 1932 Gresley tried a bogie designed at Darlington for the D49 4-4-0; this took the weight on the centre. With stronger side control and LMS-type check plates, it was fitted on all Gresley pacifics. Thompson's bogie, used on the B1 and later pacifics, including Peppercorn's, took the weight on side bearer plates.

The A4 was a refinement of the A3 with higher boiler pressure, streamlined casing and 'internal streamlining'. Four A4s, including *Mallard*, were fitted from the start with double Kylchap exhaust. So effective was this arrangement that one Peterborough engineman said that this was what they needed, not diesels!

Even before Thompson retired, his senior assistants had secretly started drawings for the Peppercorn pacifics, with outside cylinders back in the usual place. Divided drive was retained and the lack of hot axleboxes in service seemed to justify this decision, when compared to Gresley engines.

In one final rush, design features tried and proved over fifty years on the East Coast Main Line were combined in Arthur Peppercorn's respected pacifics.

A1 60136 *Alcazar* on the East Coast Main Line, early 1950s *(photo: Geoff Chandler)*

The Editor welcomes letters or e-mails from covenantors, especially if they are succinct and polite, but reserves the right to edit for length and content.

by e-mail

Dear Gerard,

Congratulations on a nice job on *Top Link*. After a brief look at issue 6 and the accelerated build plans, here are a few thoughts. I have a concern that the trust's income will drop after 60163 is completed. No-one will become a covenantor on the basis of 'Help pay off our debts' and some existing covenantors may pull out in favour of new projects such as the P2.

Surely a second tender is 'nice to have' but is not part of our minimum requirements. How often are we going to be allowed to do non-stop runs, bearing in mind that there is still the possibility of the engine 'running out of breath'? *Tornado*'s speed (assuming we are allowed to use it) could still be an asset with one tender, allowing faster/longer sprints between pathing stops and therefore more ambitious pathing.

Isn't it possible to hire *Bittern*'s second tender, as the Flying Scotsman group are planning to do?

If a tender is to be made in the shape of a coach, would this not be better as a separate project (and Heritage fund application), to be compatible with as many main-line engines as possible?

Is there any merit in trying to get Heritage funding for the boiler design, perhaps by making a joint application with the *Blue Peter* group and/or the Doncaster P2 group, on the grounds that the design allows the replacement of vintage boilers for the continuance of main-line steam?

Best wishes

Beresford Dickens

Ed: On the question of funding, experience from other groups shows that support increases dramatically as completion nears. It may flatten or dip thereafter, but by then the locomotive will be earning its living on the main line.

The second tender is an essential part of our marketing of Tornado*. It will give much more flexibility in route planning, avoiding the need for extra watering or additional traction.*

This means the second tender is an integral part of the project. However, the Heritage Lottery have already told us they will not fund the locomotive, or any part of it, because they define it as a replica. On p. 23 of issue 6, I explained why it won't be feasible to use Bittern*'s tender.*

Chorley, Lancs.

Dear Gerard,

Two things concern me: tolerances and the second tender. I am not a qualified engineer but have had quite a lot of experience in building and running miniature railways, and there are some important similarities. Whether at 12″ to 1′ or less, a steam locomotive with non-compensated chassis is very sensitive. I have seen beautifully built miniature locomotives with 'scale' tolerances run over a slight hump in the track and derail because a main axlebox rose to accommodate the hump but did not come down quickly enough. I am sure that *Tornado* will behave perfectly most of the time, but will it be able to cope with indifferent track?

Does the water-carrier have to be a tender? The appearance of this superb locomotive will be ruined by having two tenders – just as *Flying Scotsman* was! LNER locomotives were the most pleasing of any; why spoil the finest British 4-6-2 ever built?

Is it quite impracticable to use some form of coaching stock? I think 5,000 gallons of water weigh about 23 tons. Would not two road-tanker bodies fit within the envelope of a coach on heavy-duty bogies? The Pullman car *Pegasus*, recently rebuilt to comply with Railtrack's regulations, runs very well indeed on two re-sprung Gresley-type bogies at over 40 tons. Are my thoughts worth considering? Yours sincerely,

Don Fifer

David Elliott provided a response to Don Fifer's comments, and opposite is an edited version of his letter.

Dear Mr Fifer,

I can understand your concerns. However, the effects of dynamic and static friction ('stiction') are far more critical when axle-loads are measured in ounces or pounds rather than tons.

There are two reasons for the small clearances between axle/cannonboxes and hornblocks (0.006″ to 0.012″ in line with 'Limits and fits for use in locomotive work' published by the Locomotive Manufacturers Association).

Firstly, the steel-faced hornblocks and axleboxes fitted to most A1s were equipped with tapered adjusters on one side to take up wear. Like the other roller-bearing A1s, *Tornado* is fitted with hornblocks and axleboxes lined with 11–14% manganese-steel plates, which are hard to start with and quickly work-harden to an even harder state, after which wear is very slow.

No adjustment is possible except by the time-consuming process of fitting shims under the liners. Thus it is firmly in our interests to keep clearances as low as realistically possible when new. It should also be borne in mind that the horn faces are mechanically lubricated.

Secondly, full-size practice differs from miniature. On models, reciprocating forces are generally not balanced as the forces are so low.

In reciprocating engines there are two out-of-balance forces to consider: centrifugal forces, created by the mass

of the motion parts acting on the crank pins as the wheels rotate, and reciprocating forces resulting from the pistons, crossheads and a proportion of the weight of the connecting rods, all of which have to be accelerated to maximum forward speed and stopped, then accelerated to maximum speed in the opposite direction and stopped again every revolution.

The rotational centrifugal forces can be balanced out completely by weights on the wheels, but reciprocating forces pose a different problem.

One can use bigger balance weights to counterbalance fully the reciprocating forces – but the reciprocating forces are only fore-and-aft: there is no up-and-down component. The result is that, with full counterbalancing, the balance weights are much heavier than required to balance the rotational forces alone, and will inflict heavy vertical forces on the track, known as hammerblow.

In comparison to a two-cylinder locomotive with cranks at 90 degrees, a three-cylinder engine with cranks set at 120 degrees almost completely cancels out the reciprocating forces. (This is why three- and six-cylinder engines are smoother than fours.)

In practice, in order to moderate hammerblow on two-cylinder engines, only a proportion of the reciprocating forces is counterbalanced. This is why certain two-cylinder engines with low reciprocating balance (including those of Great Western origin) have strong fore-and-aft motion, which is transmitted to the train.

Tornado has divided drive so, even though overall the reciprocating forces are cancelled, in effect the A1 has a two-cylinder engine driving on the middle coupled axle and a single-cylinder engine driving the leading axle. This leads to fore-and-aft forces at the axleboxes of over 30 tons at 90mph.

To alleviate this, typically 40 per cent of the reciprocating forces are balanced. Even so, there is still a significant fore-and-aft hammering force between the first and second axles.

If the clearances in the hornblocks are large, this will cause the engine to ride roughly with the axleboxes banging in the hornblocks. Thus it is desirable to keep clearances between axleboxes and hornblocks to a minimum.

Finally, as was explained on the letters page of *Top Link* 6, no decision on the type of water carrier has been made, but the weight of such a vehicle is likely to be at least 70 tons, which precludes use of coach underframes and bogies.

However, there are high-speed freight vehicles of this capacity, and it may be possible to disguise one using side and roof panels from a passenger vehicle. I hope this reply is of help.

David Elliott

Barry Wetherell writes to say that 60138 *Boswell* was seen in Leyburn in the early 1960s with an excursion to Edinburgh. Does anyone have details of the working or know of other Peppercorn A1s up the Hawes branch? Barry points out that the track still has a 22.5-ton axle load!

Locomotives of the LNER mentions A1s at Cleethorpes and Scarborough, but not west of Northallerton. Can anyone enlighten us? Perhaps with a picture?

Corfe Mullen, Dorset

Dear Mr Hill,

Many thanks for reproducing (part of) my letter in *Top Link* 5. The super back cover picture does create a mouth-watering prospect of what might be possible when *Tornado* is ready to roll.

I suggest the A1 in the background is almost certainly 60151 *Midlothian*, which was adorned with red-backed plates whilst allocated to Gateshead. It is probable that 60152 still had blue-backed nameplates, a legacy of its time in Scottish Region (to September 1964).

By the way, when I saw The Big Picture featuring the painting of 60117, it seemed familiar. Sure enough, I have a copy of the postcard obtained when it was in circulation originally. Some things do make one feel rather old!

With best wishes,

Pete Cooper

Brookmans Park, Hatfield, Herts.

Dear Mr Hill,

Alongside the photograph on page 21 of *Top Link* 5 you query the location. I am almost certain this is a view from the lineside path about a half-mile north of Potters Bar station, the location of many published photographs. The trees are on Potters Bar golf course, where Tony Jacklin was pro in the 1950s. I enclose a picture of my own taken from the golf course at that point.

Yours sincerely,

Roy A. Smith

Roy's photograph was printed on page 3 of Top Link *6. Allan Garraway wrote, from the LNER's furthest extremity (seen from Kings Cross), to fill in a few gaps in the story of 60123 down the bank at Lincoln. I hope to be able to print some more of his photographs eventually.*

Rt: Tender of 60123 *(photo: Allan Garraway)*

PROGRESS REPORT

01 Frames
Over 98% complete: virtually finished. Additional bracing work may be required following detailed stress analysis of frames between middle cylinder and leading coupled wheels.

02 Cylinders and valves
Over 75% complete: valve pistons, liners, covers all cast; rear valve chests finished, fronts being machined; crossheads fitted to piston rods, white-metal areas being machined; special bolts ordered for final fitting of slide-bars.

03 Boiler and smokebox
11% complete: mainly smokebox; boiler spec. largely complete.

04 Motion
Over 50% complete, quartered: all forgings made; inside con. rod and strap now machining; radius links/eccentric rods to machine soon; coupling rods, crankpins, return cranks and reversing gear to be fitted soon.

05 Coupled wheels, axles, axleboxes and springs
Over 99% complete.

06 Bogie and Cartazzi axle
Over 95% complete: bogie and coupled-wheel cannon– and axle-boxes complete; Cartazzi axleboxes and bearings fitted; bogie hornblocks being machined, horn liners to be welded on/hornstays to be fitted shortly.

07 Running gear
Over 5% of work done.

08 Fittings, boiler mountings and pipework
About to start: drain cocks/cyl. relief valves. Boiler fittings awaiting final design.

10 Platework
Over 55% complete: cab riveting under way.

11 Miscellaneous
9% of work done.

12 Tender
1% of work done.

The remaining categories are Tests and trials (0%), Paintwork and finishing (0%), Technical management (51%) and Drawing-office work (70%).