

# Top Link

Issue 2  
Winter 2001-2

*The Cartazzi axle  
comes together*



*Journal of the A1 Steam Locomotive Trust*

# CONTACTS

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Darlington Locomotive Works tours: Saturdays at 11 am, 12.30, 2 pm.

(All visitors need to purchase a Museum admission ticket.)

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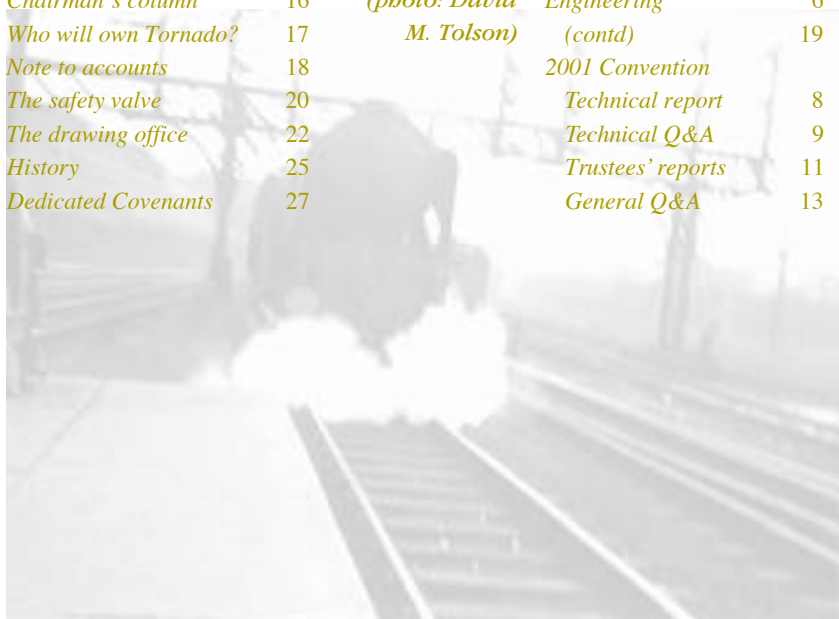
## Top Link

Issue 2: Autumn 2001–2

Editor: Gerard M-F Hill

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*Cover picture:* The Cartazzi axle-bearing retaining nut, with locking bar in place, seen at North View Engineering in January 2002 (*photo: Barry Wilson*)

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“For £1.7M this will be a splendid achievement and I’m glad I came today. We just need to get more covenantors on board.” (*John Hartley, 24 Nov. 2001*)

## EDITORIAL



First of all, may I thank everyone for their kind comments about *Top Link* - those who wrote or sent e-mails, and all those I met at the 2001 Convention on 24 November. If you were unable to get to Darlington on that day, you will find detailed reports in this issue. It was a good Christmas present to see the cover of *Top Link* 1 in the news section of *Heritage Railway*. If parts of this issue seem a little cryptic, it's because everything had to be trimmed to fit. To make room for a new item, 'The drawing office', the feature 'Know your drain cocks' has had to be held over to the next issue.

Even those of my readers who don't want to know what the picture is on the previous page are probably wondering why I printed it. (It isn't because I have a fixation with drain cocks.) Well, it shows 60160 *Auld Reekie* at Preston on 6 October 1951, restarting its northbound train - probably the 12.50 p.m. ex-Birmingham, a regular return working for the A1s at Glasgow Polmadie that worked the *West Coast Postal* in 1951-3. I believe the LMR crews found them very economical on coal and water in comparison to the Stanier Pacifics. Who remembers the A1s working out of Polmadie shed and can tell us more?

I do hope David Tolson won't mind my giving it such prominence - after all, I'm sure we all have one like it - but it seemed to me the archetypal child's Box Brownie photo: out of focus, over-exposed and framed at a drunken angle. We thought it would capture that exciting moment: how disappointed we were when it came back from the chemist's! I put it in for two reasons.

Firstly, to my mind, we are building an A1 not just for ourselves but so that youngsters in years to come can experience those same thrills we had of seeing and hearing a powerful steam locomotive at work on the main line, and feeling the platform tremble under their feet. They may even have the platform to themselves sometimes, as David did, if we can make it happen regularly.

Secondly, I am short of material on the Peppercorn Pacifics - and on the people associated with them, from Arthur Peppercorn downwards - and I'm especially short of photographs (in focus!) with captions. Either send a print, postcard-size or larger, or slide and provide for its return if you want it back, or e-mail a scanned image if the resolution is good enough.

Oh, and there was a third reason. This was the only way to make use of the photograph. If you are inclined to send material, do it soon!

*Gerard M-F Hill*

# NEWS

## 2001 CONVENTION

Reports of the Annual Convention on 24 November are on pages 8-13.

## BACHMANN MODEL

Due on the 11th, the model of 60163 arrived on 15 December by air, along with Bachmann's version for general sale, representing 60158 *Aberdonian*. They were put in presentation boxes, with brass number and certificate, and 250 reached us on 28 December. With the help of David and William Elliott, 205 were then boxed and despatched. More news of the model, with a review, in the Spring issue of *Top Link*.

## GIFT VOUCHERS

Gift vouchers are now available. You can give them as presents to family or friends. Decide how much you want to spend and choose from the list of dedicated covenants on page 27 - ask Alan Dodgson if you don't see what you want. In most cases you can pay in a lump sum or monthly.

You can buy this gift for anyone - they don't have to be a covenantor - as long as your monthly payment will last 36 months or more. (This is to satisfy Inland Revenue rules.) The person who receives the gift voucher then becomes a covenantor themselves.

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For your superb limited-edition Bachmann 00 model of 60163, send a cheque for £165 (payable to The Locomotive Construction Company), with your name and delivery address, to LCC, 24 Welling Close, Redesdale Park, Wallsend, Tyne and Wear, NE28 8TE, England. The price includes delivery (UK only: please enquire about overseas) and the trust benefits from every one sold. *(photo: Bachmann)*



# NEWS

## DATES FOR YOUR DIARY

Our Spring Day Out at the Mid-Hants Railway (the Watercress Line) is on Saturday 18 May. The trust's Annual Convention will be held on Saturday 5 October at Darlington.

## ACCOUNTS

The accounts sent out to covenantors were marked 'draft' as the auditors had not decided if the trust and Locomotive Construction Company (LCC) accounts should be merged to produce a set of 'group' accounts. In the end they decided the LCC results could be simply included in a note. (see p. 17).

## BRAKES

Whilst no final decision has been made on the design and type of air braking system to be fitted to 60163, we may well use the type fitted to other steam locomotives - pioneered by Keith Nicholson of the VAB (vehicle acceptance body) Interfleet Technology - and, with that in mind, we have acquired (from EWS via Ian Riley) a set of basic brake-control equipment from fortunately redundant Class 31 and 37 diesel locomotives.

This includes Westinghouse M8 driver's brake valve, air-to-vacuum proportional valve and a collection of timing reservoirs, isolating valves and reservoir automatic drain valves. We had to acquire all this now since

diesels fitted with it are being withdrawn rapidly. If we use another system, the equipment will be easy to sell.

Later we will seek AWS equipment compatible with the new TPWS (Train Protection and Warning System). Such equipment is fitted to a wide range of diesels and electrics, so it is not vital to buy it at the moment.

## DRAWINGS

A team went to the National Railway Museum with a scanner on 17 and 18 April 2001, to make 155 more scans. In some cases there were several copies of one drawing; only close scrutiny will determine the latest version. We estimate that we now have 95 per cent of the drawings for the locomotive.

Missing drawings have been recreated by measuring other LNER locomotives: these include those for the eccentric rods, return cranks and back steamchest covers. Gordon Best is producing an as-built general arrangement drawing of 60163 from scratch because it appears that no GA drawing was made for the Peppercorn A1.

## BOILER

We have not yet found an acceptable boiler designer/manufacturer in the UK, but last August we were approached by the Commercial Representative of the Deutsche Bahn works at Meiningen in Germany. They have

## NEWS

invited the trust over for initial discussions, at their expense. A meeting has been held with Heritage Engineering (our Railtrack-approved Vehicle Acceptance Body or VAB) and our proposed insurers to see if there are any insurmountable objections to using a German supplier. In fact, with recently introduced EU legislation, the process of certification may have been simplified. It should be possible to appoint TUV, the German pressure vessel inspectorate as the Notified Body (NoBo), whose approval of the boiler as a pressure vessel will be recognized throughout the EU without further tests or documentation.

A first visit to Meiningen, set for February 2002, will be made by one person from the Trust and one from the VAB. Meiningen was the main East German works and did main-line steam repairs into the mid-1980s. It overhauls metre-gauge engines and makes new boilers - currently for a Canadian-built 2-8-0 and a German 43 class 2-10-0. We are also pursuing other leads just in case.

### FRAMES

Virtually all the outstanding non-conformances on the frames have been dealt with and significant progress has been made on preparations for final fitting of the axle and cannonboxes. The coupled hornstays have been

hand-fitted to ensure a good metal-to-metal contact over the load bearing surfaces of the stays on the hornblocks. This painstaking, highly skilled work took 139 man-hours.

Once the hornstays were fitted, the hornblocks were faced, largely by hand-fitting. The faces are now flat within 2 thousandths of an inch and parallel with each other.

The Severn Valley team arrived on Monday 13 January and completed the optical alignment survey over the next four days. This allows us to complete the machining of the hornblock liners to ensure that the axles are in the right place relative to the cylinders and the length of the coupling rods.

The outside expansion link brackets have returned from North View and are held by temporary bolts. The permanent bolts are now being fitted.

### MOTION

The eccentric (return) cranks, finished by Ufone, fitted the square spigots on the crank pins with no hand-fitting. With the optical survey done, the drawing for the inside connecting rod can be completed, with the dimension for length corrected for 'growth' in the middle-cylinder casting. The reversing screw shaft bracket is ready to secure to the cab floor with fitted bolts. Barry Wetherell is pushing on, polishing the coupling and connecting rods.

## 2001 CONVENTION

Mark Allatt welcomed the 160 people at the morning session, and Andrew Dow introduced David Elliott, who update us on progress on the engine.

### *Recently fitted*

The bogie and outside slide bar brackets had now been finally bolted up, and the inside motion bracket fitted. The hornstays had been finally, and correctly, fitted: about 15 thou of extra metal had been sprayed onto the outer lug faces and Ian Howitt spent 2-3 weeks hand-fitting them with grinders, files and scrapers. They now rang when tapped, a sure sign that they fit.

### *Frame alignment*

We had had offers to measure the frame precisely, free of charge, if we designed and fabricated the fixtures to measure against. This would be costly.

The Severn Valley team - in the works as we went to press - had used their optical measuring equipment (similar to that used in the 1960s by BR) on an A4, so they have distance rods to fit an A1. The frame survey. will check wheel centres are in precisely the right position, so wheels don't bind and pistons don't push their way through the cylinder covers.

### *Non-conformances*

These were being put right as components were permanently bolted up, and 586 frame bolts had been checked

for tightness and fit, using a procedure agreed with the VAB. About one bolt in eight had needed some attention, usually just removing the nut, re-preparing the surface, putting the nut back and correctly tightening. If the bolt had to be removed and was in any way damaged, it was replaced.

The rear cross-stay had been modified to bridge the frame gap unaided, to eliminate the packer on one side. Packers under the buffer-beam gussets are no longer necessary, as the gussets now form a true right angle, not slightly less. We were asked to check if the buffer beam face was flat and true. Railtrack has no standard for this, so we have asked the VAB what 'flat' means for a buffer beam.

Horn faces on the first and second coupled axles had been trued up and were not as far 'out' as first thought. The most taken off the faces was 7 or 8 thou, by filing and scraping, with the aid of an engineer's surface plate and straight edge, to an accuracy of 2 thou ( $\pm 1$  thou). This had shown up some misalignment, 3/32" at worst (the third coupled axle, as traces of engineer's blue showed). The liners will be machined to allow for this.

### *Work being done elsewhere*

All parts for Cartazzi axleboxes were being machined and the large nuts to hold on the bearings were being made.



## AT THE WORKS

The expansion link bracket and forked reversing arm had been fitted temporarily. The eccentric return cranks had arrived. Drawing amendments for the reversing stand bracket were approved but there was no cab to put it in.

The cab was being modified to meet Railtrack's new height standard of 13' 0". Otherwise an A1 would be banned from certain stretches of line, for example, Gas Works Tunnel on the exit from Kings Cross. .

### *The Works*

The works had been completely reorganised. Machinery not in use had been removed, *Duke of Gloucester's* tender was back at Bury, dedicated areas had been marked out and drawings made for a pattern store over the office and this awaited building control permission; completion would safeguard valuable patterns and free a lot of floor space. One A-frame of the crane had been turned round, so it could move past the jacks.

David thanked all those who had worked so hard, especially: Barry Thompson and Barry Wetherell, who have come each Tuesday for some years; Terry, who takes visitors round; and Mike Wood, who comes each week to help with organisation.

Volunteers were now also fettling the connecting and coupling rods, and dressing up machining marks:

Barry Wetherell had done the first section, leaving 23 to do. We intended to have a 'volunteer week' in future to advance the project faster.

### PROJECT PLAN

Rob Morland drew attention to the project plan on display. It now showed an end-date of early 2004, based on minimum time for completion of all remaining tasks with all money to hand. This is more realistic and reliable than a basis of projected income, which would be intelligent guesswork.

### Q&A SESSION

After giving his update, David Elliott answered questions.

*Will Railtrack's new height limit affect the chimney?* Unfortunately, yes: we are altering the cab, but the chimney is an iron casting: we can't cut and weld it. We will have to cast a new one; we may raffle or auction the existing one.

*Who will take overall responsibility for construction?* [Rob Morland answered] David Elliott has always done this, but we need to beef up the management structure: not only is David now away part of the time but also we've been expecting too much of him. Work is being subcontracted, but it still has to be monitored. We need volunteers to help with paperwork and (where qualified) the engineering work itself.

## 2001 CONVENTION

### *When will frame stress analysis be done?*

For three reasons we need to recalculate frame stresses: we are using one-piece frames; 60163 has no stiffening plates as fitted by BR; and the bogie side bearer plates are no longer in the same position relative to the frames.

Calculations done early on in the project indicated that one-piece frameplates were the answer, but we always meant to do detail calculations in due course. BR fitted A1s with 4ft-long stiffening plates welded on the inside of the frames, from the back of the inside cylinder to the front of the front horns. We were very strongly warned against this, as welded plates in this configuration would almost certainly cause stress raisers. We decided to find a more elegant solution. This is likely to be an extra cross-member of T- or I-shaped angle bolted in place.

Calculations were made for the changes to the bogie side bearers by Heritage Engineering's forerunners but were mislaid by them in moving.

Finite element analysis can't be done until we fit the last framestay and have an as-built general arrangement drawing. Gordon Best is working on this. When the drawing is finished, we need to find a firm willing and qualified to do it, and get them approved by our VAB. Then the calculations can finally be done.

### *What news is there on the boiler?*

Beel of Lincoln downsized and no longer have the staff; we talked to a firm who were to manufacture it in Turkey, but we weren't confident this would get over the regulatory hurdles.

A joint proposal from North View Engineering and another local firm specialising in chemical plant design fell foul of the VAB, who felt they needed a chartered engineer with relevant experience. We are following up an approach by Meiningen Works, who recently built an all-welded boiler and firebox for a main-line loco, as it might make certification easier. There are 12 to 20 firms that could make the boiler, but we need to find someone to take responsibility for the design.

### *Would German standards be acceptable to insurers and rail safety bodies?*

There would be work involved in equating standards but, broadly, yes.

*Could we cut costs and build more than one boiler? A1, A2, A3, A4 and V2 have the same flanging shapes.* If anyone comes and asks us to build a second boiler, it would certainly cut costs; but there is no sign anyone is considering it or would have the money to do it.

### *A torque wrench was not used to tighten frame bolts: is this not fairly basic?*

There are different opinions on this: they were not used on BR steam. With

## AT BLACKWELL GRANGE

the same torque reading, you may get different tensions on the bolt depending on the mating surfaces, quality of thread and materials. For example, zinc-plated threads need a 15% higher reading than plain steel to achieve the same tension. However, we will be acquiring and using torque wrenches.

### *Are the Kylchap cowls too short?*

We are seeking more advice on this, as the chimney will now be lower. The stainless-steel cowls are similar to those fitted on two main-line engines, so we think they should be acceptable.

## AFTERNOON SESSION

In the afternoon the trustees gave their reports and then took questions.

### *Barry Wilson*

To 31 October, income was higher than in 2000, but only because of the wonderful start to the year. We spent £48,000 on the engine: 85% of income goes into metal. The call for an independent report cost £18,345, or about three times the cost of rectification work.

Because the earlier rate of growth was not sustained, we calculate we lost about 105 £5 covenants, worth £31,500 over five years, and we have lost management time costed at £150,000 (although all the directors serve on a voluntary basis).

### *Rob Morland*

In total, 59 non-conformances were rectified at a cost of £13,980; of these, 44 are done, 8 await drawing amendments and 7 are in progress; 21 others were corrected at no cost. Of 3,220 components, 176 (5.5%) were affected by non-conformance. The DTI say most companies would be 'over the moon' at 5.5%; Britten-Norman had a 10% target and never met it. Non-conformances are a normal part of manufacturing.

All 25 non-conformances that arose at Tyseley have been rectified and the trust has been reimbursed (or work done of equivalent value) for the £6,960 cost, including all the items on Vince Dunnington's list, which cost £6,400 to rectify. Two coupled-wheel cannon-boxes had to be recast at a cost of £3,860; rectifying faulty corrective work on the left-hand trailing box hornguides cost £800.

To put all this in perspective, the locomotive has cost about £700,000 to date and non-conformances represent 2% of that. If we cost and add diverted management time, that rises to 2.7%.

### *Andrew Dow*

That's how we got here - where do we go now? Unfounded allegations have been made about the locomotive: I hope everyone now believes there is no question of it being unsafe. Yes,

## 2001 CONVENTION

mistakes have been made, regulations have changed, but there has been no incompetence or negligence. Non-conformances are normal; only the hornguides were a serious problem.

We are building an A1 and also proving it can still be done. Hardest are the frames and boiler, some of the assembly, document control and certification. Senior managers in Railtrack, Adtranz and Bombardier say they find the same problems as us: quality control, documentation, build problems.

We need extra skills to strengthen the board and management: this is a job for professionals. New machines need certification with an audit trail of methods and materials. If, like Bachmann, we were building more A1s, we'd build a prototype first!

Non-conformances are part of life and the way to deal with them is to check each item against drawing at the goods inward stage, decide corrective action, discuss it with the supplier, arrange return of parts and agree costs. Not all works visitors are familiar with manufacturing; we will cope with that and tell you all we can via *Top Link*.

### *Wreford Voge*

Mutualisation of the company, while pursuing our aims with professionalism, was discussed with the Charity Commissioners. The A1 Steam Locomotive Trust, incorporated as a com-

pany on 12 August 1991 with Memorandum and Articles of Association based on the 71000 Duke of Gloucester Trust, was registered as a charity on 21 June 1993. Covenantors are not members of the trust.

The articles have been seen and approved by the Inland Revenue and Heritage Railway Association. The A1 Steam Locomotive Trust is a private company limited by guarantee; it has no share capital. The members of the trust are the present board and David Elliott, plus David Champion and Stuart Palmer as the original subscribers. The board is to consider the position.

The Charity Commissioners were happy with recent actions the board had taken. They emphasised the board could spend only on its stated aims, so no spending on 'mutualisation'.

A company's status has tax implications. For the Inland Revenue we had only to prove our covenants were valid. Our auditors felt the trust's income of £60,000 p.a. in covenants, gift aid and tax refunds might be liable to VAT, but exemption has been confirmed as covenantors gain no benefit (making it a charity). We are registered to reclaim VAT on purchases. The basis of the trust is still the same:

- best business practice, using professionals
- simple and affordable funding

# FINAL SESSION

- a single aim
  - no élites and no cliques
- The board will only make changes that will further the objectives of the trust, e.g., we need an engineer on the board and a head of quality control.

## *Mark Allatt*

The board would report in due course on all matters mentioned, probably in spring. Of the actions promised at the 9 June meeting, they had

- commissioned an independent inspection, printed and circulated it - an enormous task, which took Andrew Dow countless hours
- improved communications - as in these Q&Asessions and *Top Link*
- published accounts - circulated in draft form (in full when finalised)
- begun reviewing the constitution and organisation of the trust

We had a volunteer for quality control, organisation was being revised, but we needed twice the people we had.

## *General Q&A session*

After a break, the session was open to the floor. The first speaker, setting the tone, commented appreciatively on the quiet and friendly tone of the meeting.

### *Could anyone be a member of the trust? What of existing membership cards?*

The board had decided to let the few applications received lie on the table.

The seven existing members are entitled to attend and vote at an AGM: this is what the founders handed on.

People had membership cards, of the Peppercorn Pioneers Association for example, but none was issued by the trust as presently constituted. In the early days it was not made clear what ‘membership’ meant.

### *What of the misappropriated database?*

The board had advised the Information Commissioners, who took this very seriously. A copy of the database, taken without authorisation from the works, was used to circulate covenants. It is a criminal offence to misuse data: prosecutions could follow. Data should be returned or destroyed.

### *Was there still a place for the dissenters?*

We didn’t want this to go on and some things might need to change, but the dissenters rejected a proposed meeting to discuss all the issues. They would not meet, speak by phone or correspond; the former chairman had declined an earlier invitation to be vice-president. There was room for everyone, but only if they came to help.

### *Why were the accounts not published before? Why was this big report needed?*

Barry Wilson said the previous chairman had always refused to publish the accounts. The real reason the recent independent inspection (*contd p. 17*)



## CHAIRMAN'S COLUMN



I'd like to start by wishing all our volunteers and supporters a very happy and rewarding 2002. Although 2001 was our *annus horribilis*, it ended on a high note with a very successful convention on 24 November. You can read a detailed report in this issue of *Top Link*.

The trust has raised its profile recently, with positive articles in all the main railway magazines and the *Northern Echo*. A *Guardian* article on the day of the convention was one of the best national newspaper pieces we have ever had. The next week, I was invited on to BBC Radio 4's *You and Yours* to discuss the growing phenomenon of steam in the UK, and BBC 1's *Look North* in mid-January devoted several minutes to an update of the project. All this has generated a positive climate in which more people are becoming covenantors.

At the convention the trustees acknowledged the need for extra skilled volunteers, with defined roles and responsibilities, and we have been working on this. Several volunteers have come forward but we still need more in marketing, administration and engineering, especially in quality, inspection and document control. I am delighted to announce the appointment of David Burgess as Company Secretary of the trust and its subsidiaries. A Chartered Secretary by profession, he is Trust Manager of an international financial services organisation in Guernsey. This will be the first of many appointments in coming months. To regain the momentum lost last year, we have two sets of targets for 2002. First, to recruit 300 new covenantors: 100 by Easter, 200 by August Bank Holiday, and 300 by the convention. Second, to correct all known non-conformances, complete all paperwork, put new quality systems in place, have the loco fully wheeled (no springs) with rods, crossheads and pistons, order valvegear and reverser parts (subject to funds) and make a start on the boiler.

As usual, you can help by taking out an additional covenant (or dedicated covenant) yourself, recruiting friends or colleagues, or volunteering as part of our events team. I'd like to thank all of you for your continued support of the project and I look forward to seeing as many of you as possible at our Spring Day Out on 18 May on the Mid-Hants Railway.

Mark Allatt  
Chairman

*The big picture: Awaiting the 'Right away' (previous pages)*

No particular place, but note that GC Director 4-4-0. Eric Leslie, a railwayman, is best known for paintings of the Lynton & Barnstaple. *(Reproduced with permission)*

# WHO WILL OWN TORNADO?



At the 2001 Convention, a covenantor asked about ownership of *Tornado*. The locomotive belongs to The A1 Steam Locomotive Trust. When completed it will be leased to and operated by Tornado Steam Traction.

In a company limited by shares, its assets belong to the members. The A1 Steam Locomotive Trust, however, is limited by guarantee and also regulated by rules imposed by the Charity Commissioners. The company's constitution therefore bans anyone from benefiting from their membership of the company.

This also meant that special clauses had to be included in the constitution in case the company were ever wound up or its assets sold. Proceeds of sale of the assets, after meeting any liabilities, could then be used in one of two ways:

- if the charity were to continue, the proceeds could be reinvested in the objects of the charity - in our case, building another Peppercorn A1 Pacific
- if the charity were to cease, the proceeds could be transferred to another charitable institution (or more than one) having the same or similar objects and similar prohibitions on distributions (benefits) to members.

*Barry Wilson  
Finance Director*

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## 2001 CONVENTION

*(contd from p. 13)* was needed was the trust had asked David Elliott to do more than was humanly possible. Just recently he had been rectifying non-conformances in the works drains.

*Two engineers said extra human resources were needed: David Elliott had done a great job, but did we make use of volunteers with special expertise?*

The board realised that the trust was under-resourced in human terms and hoped to recruit specialist volunteers. Up to now they hadn't been rushing forward. In the past the trust had not been good at using volunteers in any

engineering work, but we now had a candidate for Volunteer Co-ordinator.

*The board needed strengthening, and quality assurance should not be just a paper exercise.*

Rob Morland (a Chartered Electrical Engineer) agreed with the questioner that the test for all we did was 'fitness for purpose'. There was seldom one right answer, as spot-facing practice at Doncaster and Darlington showed. The board did need a Chartered Mechanical Engineer. Final comments focused on our need to regain trust in the wider world. The day ended on schedule at 4 p.m.



## NOTE TO ACCOUNTS

*The Locomotive Construction Company is a subsidiary of The AI Steam Locomotive Trust. It does not file separate accounts, so the following note has been added by our auditors to the trust's accounts.*

### **Investments**

	2001	2000
	£	£
Subsidiary undertaking	100	100

The investment represents the cost of the entire ordinary share capital of The Locomotive Construction Company Limited, a company incorporated and registered in England. It provides engineering services to the owners of steam railway locomotives.

The result for the year and aggregate capital and reserves in respect of the subsidiary undertaking is as follows:

	2001	2000
	£	£
Turnover	60,175	8,896
Cost of sales	(71,637)	(27,525)
Admin. expenses	(4,604)	(3,066)
Interest receivable	240	18
Loss for year	(15,826)	(21,980)
Aggregate of capital and reserves at 31 March	(37,806)	(21,980)

*[Note ends]*

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“The locomotive has cost about £700,000 to date and non-conformances represent 2% of that” (*Rob Morland, 24 Nov. 2001*)

# ENGINEERING NEWS

## COUPLED WHEELSETS

Dummy rings have been fitted to the first coupled-wheel cannonbox, and measurements made to grind the adjustment rings to the finished size.

The rings will be fitted to test that the calculation method is correct, before rings for the other cannonboxes and axleboxes are ground. Cannon/axleboxes will be check-fitted in the hornblocks before final fit to the axles.

Work on the Cartazzi components is going well. Axle-bearing retaining nuts and locking bars have been made, the axleboxes are about halfway through machining, spacers and seal rings are complete, the spring guide and wedge assemblies are approaching completion and the machining of the hornblocks is under way.

## CAB

We have to shave one inch off the cab height and it has been moved to North View Engineering to have this done. While there, some distortion and inaccuracy in the cab sides and window frames will be corrected and the rear stiffening beading made and fitted.

## ENGINEERING LINK AUDIT

The audit by the Vehicle Acceptance Body (VAB) Engineering Link highlighted some process issues and other possible non-conformances.

We were already in the process of improving our goods inwards and inspection procedures and this work continues. We now have a precision tape measure with a certificate of accuracy, and we are in the process of acquiring a set of slip gauges.

These are high-precision steel blocks, accurate to better than 0.00005" (one twenty-thousandth of an inch). They can be used to check the accuracy of micrometers and vernier calipers, and also for accurate measurement of very small gaps such as piston-ring grooves.

Steps are being taken to borrow or hire torque wrench equipment of a suitable size to make sample checks on frame-nut tightness.

We have a meeting with our VAB scheduled for February to ascertain precisely what is required to address the non-conformance issues specified in the audit report.

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“When it steams out in two years’ time, *Tornado* is likely to be the finest locomotive at work on Britain’s atomised railways: an update of a machine designed just before the railways were nationalised. An echo of the glory days of British engineering, of working-class heroes, of achievements rather than accidents.” (*Jonathan Glancey, in The Guardian, 24 November 2001*)

# THE SAFETY VALVE

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

St Ives, Cambs.

Dear Mr Hill,

Congratulations: a well presented and well laid out magazine, though I found the paper a little too glossy.

C. M. J. Larke

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*[by e-mail:]*

I very much like the new magazine. As a relative newcomer to steam, I find it really useful to have the nomenclature of steam locomotive engineering explained. Please keep it up.

Gary Francis

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New Zealand

Dear Mr Hill,

I have been a covenantor for over ten years. As a professional engineer with experience of ISO 9000 quality assurance systems, I accept that defects will arise in a one-off project based on a specification fifty years old and I thought the Engineering Link report fair and balanced.

Though I have seen 60163 under construction only twice since 1994, I contribute willingly because I want to see an A1. Some fundamental quality assurance errors have been made, perhaps excusably given industry resources and the charitable nature of

the work. What is not excusable is the 'prima donna' attitude of some. I appeal to them to get on with the job of building an A1... or get out.

Stephen Williams

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Bradford-on-Avon, Wilts.

Dear Mr Hill,

Congratulations on *Top Link*. The news was well set out, the article on drain cocks and hornblocks was full of interest, the note on finance perhaps overdue and John Wall's article interesting.

The early history is largely new to me. Perhaps someone who knows the early 1950s might continue the series on 'A1s fifty years ago'? Good luck.

John Pearse

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*Ed: I will continue 'Fifty years ago' if someone writes it or supplies material. And now for something completely different . . .*

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Aston Clinton, Bucks.

Dear Mr Hill,

I wondered if you would like this photo. It shows Arthur Peppercorn in relaxed mood with his Goddaughter (me!) and, I believe, my toddler brother. I am not sure whether Uncle has sat on him! I am sure you knew only the business side of him. I enclose my small donation, which might buy a couple of bolts.

Joy D. Atkins

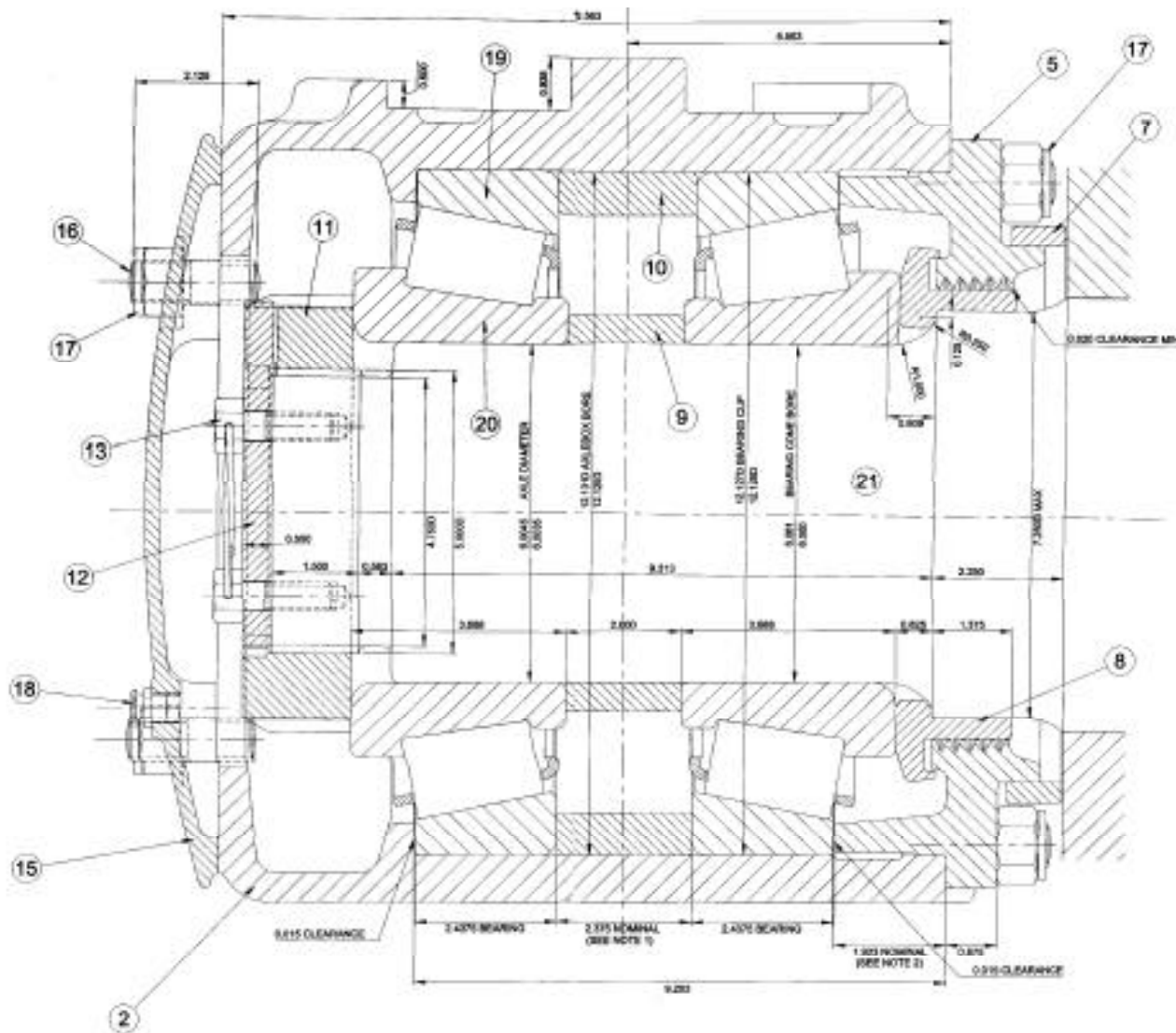
## NOW AND THEN

*Right:* Part of the optical measuring equipment brought by the Severn Valley Railway engineering team, this optical collimator is seen fitted in 60163's right-hand cylinder for precision measurement during the frame survey done in January 2002

*(photo: David Elliott)*



Thank you, Mrs Atkins! His charm and lack of self-importance seem to have made Arthur Peppercorn an easy man to work for, and help to explain how he achieved so much of lasting worth in a short time with everyone's support. *(photo: Joy D. Atkins)*



## TOLERANCES, LIMITS AND FITS

In the past, we have mentioned the absence of tolerances on most of the drawings copied from the National Railway Museum at York. What are tolerances and the associated limits and fits?

### Fits

Depending on the application, the fit between two mating components can be critical. The fit describes the interface between two components.

An everyday item like a gate- or door-bolt may well have a loose fit: you can see a clear gap between the bolt and its housing and catch. What is needed is easy sliding of the bolt whilst allowing for warping or settlement of door or gate.

The other extreme is an interference fit, where one component has to be driven or pressed into its mate. An example is a bearing bush which is pressed into its housing. The pressed fit is often the only thing holding the bush in the housing, so the quality of the fit is crucial for its security.

Part of drawing A1-06-011, showing tolerances for the Cartazzi axlebox. *(copyright: The Locomotive Construction Company)*

# THE DRAWING OFFICE

Another kind of fit is a running fit. A typical example is a shaft running in a bearing where sufficient clearance between the shaft and the bearing is needed to enable a lubricating oil film to form.

In all these cases, the required fit can be achieved by individual fitting of the components - removing small amounts of material from one component until it provides the required fit in the other. This was common practice in steam railway workshops and depots. However, it does not facilitate interchangeability of components.

To overcome this, a system of limits was devised: instead of quoting an exact size for a component (very expensive, or impossible, to attain), a range of sizes was given. An example of this is the fit of the inner races of the roller bearings on the A1's axles.

For the Cartazzi axleboxes for example (see excerpt from drawing A1-06-011), Timken give the finished dimension for the diameter of the hole in the inner race as 6.000" to 6.001" (six inches plus one thou) and recommend the axle be turned to 6.0035" to 6.0045", producing an interference fit.

In each case, the higher number for each dimension is the top limit, the lower one the bottom limit.

## Tolerances

The difference between the top limit and bottom limit is the 'tolerance'. It can be expressed in several ways, but typically it is given as a nominal size with a positive or negative tolerance, or a combination of the two.

Thus, the hole in the bearing race could be 6.000" + 0.001"/-0.000" and the axle diameter could be 6.004" +/- 0.0005" (plus or minus half a thou).

In the overall fit of bearing on axle, there are two 'worst cases'. One is the axle on the bottom limit and the bearing on the top limit: 6.0035" - 6.001" = 0.0025" interference. The other 'worst case' is the axle on the top limit and the bearing on the bottom limit: 6.0045" - 6.000" = 0.0045".

Thus the interference should lie between 0.0025" and 0.0045" to be acceptable to Timken without the need for prohibitively expensive machining.

For shafts running in bearings the principle is the same except that the difference is known as the clearance rather than the interference.

Some dimensions are given without tolerances. These are covered by a 'global' tolerance applied to the whole drawing, in this case +/- 0.005" (plus or minus five thou).

*David Elliott*

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"What we've heard has set our minds at rest" (*David Bate, 24 Nov. 2001*)

## HISTORY

We start in September 1965 with a photograph that John Tuffs took of 60145 *St Mungo* at Burton-on-Trent. Did any other A1 ever work this line? 60145 was in charge of the Warwickshire Railway Society's Pennine Rail Tour from Birmingham to Carlisle.

John says he understood that the locomotive worked the train between Birmingham and Leeds in both directions, and was a replacement for the

A4 60004 *William Whitelaw*, which had failed the previous day en route from Edinburgh.

Most steam locomotives in 1965 were begrimed and unloved, but *St Mungo* looks clean and well maintained, with no steam blows. As usual with an LNER Pacific, the visible exhaust consists almost entirely of steam, with only a hint of smoke. Book now to repeat that trip, chaps.



A1 60145 *St Mungo* heading north at Burton-on-Trent on Saturday, 4 September 1965. The reporting number seems to be 1X28: can anyone confirm the last digit, and perhaps explain what the code signified? In 1966 Geoff Drury negotiated to buy *St Mungo* for preservation but in the end concluded that it was more than he could manage, on top of *Blue Peter* and *Bittern*. If only . . . (photo: John Tuffs)

# HISTORY

## What's in a name? The A4 and A1 overlap

Geoffrey Hughes wrote to correct the statement - not John Wall's - that W. P. Allen was trades union representative on the Railway Executive. As Member for Staff and Administration, Allen was often in conflict with ASLEF, of which he had been General Secretary, and other unions; see McKenna's *The Railway Workers* (Faber, 1980). Dr Hughes added that Andrew Dow has documented naming of the A1s (the Editor consulted him) and "One seabird name not considered for the A4s was *Puffin!*"

## More A1s?

John Wall also had an article in *Steam Days* (Nov 2001) on the A4s. He kindly mentioned the trust on p. 105 of his book *First in the World: The Stockton and Darlington Railway* (Sutton, 2001). He queried the words "Had more Peppercorn A1s been built, as was at one time contemplated" - added by the Editor.

In his book on the BR Standards, E. S. Cox sketched the likely shape of things had the LNER not been nationalised. "Harrison would probably have succeeded Peppercorn, and the Gresley tradition would undoubtedly have been given a further lease of life". While developing diesel and electric traction "it would have been surprising if Harrison had not come up with a super A4 Pacific, or ... even had another look at Gresley's own 4-8-2 scheme."

Freddie Harrison told the Editor that in 1955-7, and then again when he became CME, he was among those who pressed for a pause in dieselisation and more construction of express steam. When asked what, Harrison replied, "More A1s for a start: probably another fifty or seventy. They were economical and reliable, and we knew they would do the job - with a diesel, you never knew - and maybe more Dukes." In the end the engineers were over-ruled by politicians.



Dirty exhaust? More will be revealed in History in the next issue. (photo: Stephen Williams)



## DEDICATED COVENANTS

To become a covenantor, or to start an extra covenant, a heritage covenant or a dedicated covenant, contact Alan Dodgson at **enquiries@a1steam.com** or 01325 460163, giving your name and contact details (phone/e-mail/address).

You can now give a dedicated covenant as a gift to anyone, not just to an existing covenantor, as long as the covenant lasts for at least three years. Items over £1,000 can be sponsored by an individual or a group of people. The right-hand column gives payments as a lump sum or monthly, or per item/assembly. Other components are also available: contact Alan Dodgson for details.

PS61M	Cartazzi axlebox pattern	£2,400/4 x £10 pm
PS75F	connecting rod (forging), L	£1,800/1 x £18 pm
PS85M	union link, L	£650/1 x £8 pm
PS119F	piston and rod forging, R	£1,200/1 x £18 pm
PS244C	radius link bracket casting, L	£1,800/1 x £18 pm
PS350-1	eccentric crank bolt/nut/locking pin - L, R	£60 each
PS356-7	crank pin nut/locking pin - L trailing, R trlg	£120 each
PS378-81	coupling rod oilbox cover - Mid/L/R, L/R trlg	£150 each
PS394-8C	piston valve spindle crosshead guide (5)	£60 each
PS394-8M	piston valve spindle crosshd guide - machining	£60 each
PS410	machining of inside motion plate	£600/1 x £10 pm
PS424	superheater cover plate, L	£900/1 x £5 pm
PS433-4	coupled cannonbox set castings (2)	£2,100/4 x £7 pm
PS441-2	Cartazzi axlebox casting - L, R	£800 each
PS443-4	Cartazzi axlebox machining - L, R	£1,600/1 x £26 pm
PS445	Cartazzi axlebox cover pattern	£500/1 x £9 pm
PS446-7	Cartazzi axlebox cover casting - L, R	£150 each
PS448-9	Cartazzi axlebox cover machining - L, R	£450/1 x £7.50 pm
PS450-1	Cartazzi axlebox backplate & machining - L, R	£950/1 x £16 pm
PS467-8	cab side screen safety glazing - L, R	£300/1 x £5 pm

*Back cover:* Darlington Locomotive Works, with 60163's coupled wheelsets, seen framed by the cab (dismounted to go to North View Engineering for adjustments to meet the new height regulation) in November 2001, at the time of the convention

*(photo: Fastline Photographic Ltd)*

