JETHRO TULL'S P.A.

Nigel Jopson reports on the vast sound systems used by one of the most popular bands.

Jethro Tull sell literally millions of albums, and every time they go on tour hundreds of thousands of people want to get to hear them live: this means that they have to play very large venues every gig — especially in the States — places like the Tampa Stadium in Florida, which has a capacity of 60,000. The physical difficulties of bringing a band's music to that many people are rarely appreciated by the listeners: all that actually registers is a band, their amplification system and the sound. At a large venue, most of the audience are so far away from the stage that the group are only a visual focus for the sound that they're hearing; if the sound is 'bad' — remote, confused and generally distorted in dynamic content by the P.A. and the venue's acoustics — then it's a *bad gig* for the majority of the audience, and the unfortunate band have very little power to carry the show by imposing their own presence in performance. Because of this, it would be natural to assume that all top rank bands have their very own sound system and operators, in order to make damn sure that every gig they play is a good one. In fact the reverse is true, and Jethro Tull are amongst the very, very few major bands who have their own full-blown, up to date concert system. Most groups prefer to opt out of the massive hassles involved in touring to a tight schedule with a huge sound system, in the belief that it is easier and more economical to leave the mechanics of operation, transport and rigging to a hire company who possess the volume of equipment required.

The problem with this is that hire companies' operating procedures are geared to cater for many bands, not one; it would be unreasonable to expect hire company personnel to be as aware or as sympathetic to changes in material, performance and presentation — to have the "edge" that comes from being personally attached to a band, living, eating (?) and breathing their music. A hire company is, of course, engaged to provide a service that suits the band; if they do not 'come up with the goods' they may, in theory, be dismissed or asked to modify their facilities. In practice, however, it is virtually impossible to drastically alter anything major once a tour has started; if something goes wrong, or if the equipment is not flexible enough to perform a certain task, then it just has to 'make do' — the show must go on — and even if someone is paying £6,000 for one gig with a system, there invariably just isn't time to get the right sound if it involves modifying something.

It was with this all important factor of flexibility and versatility in mind, combined with really top quality performance, that Cadac were commissioned by the firm of Salamander & Son to manufacture a mixing console for use with Jethro Tull. The layout and provision of facilities on the mixer

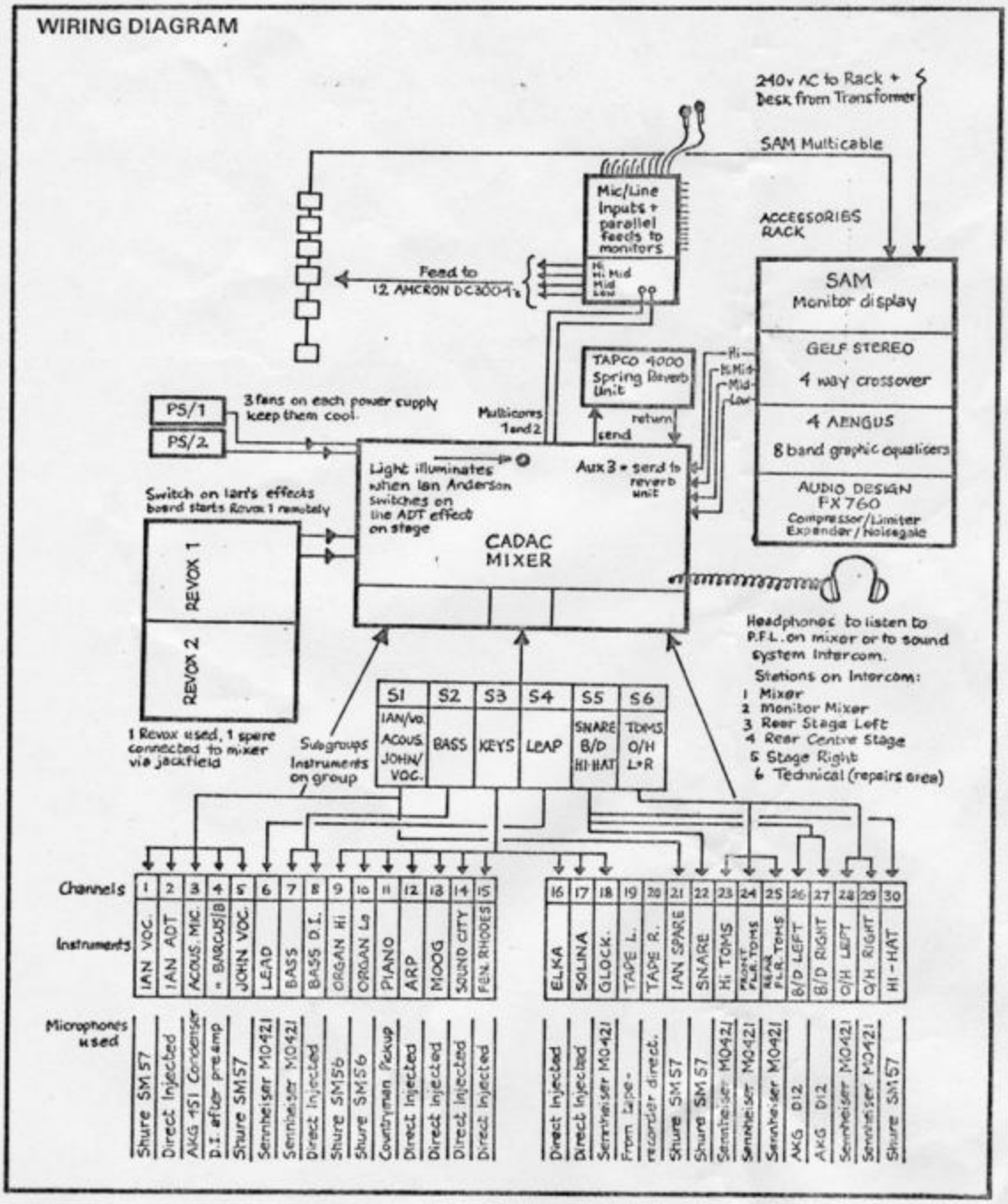


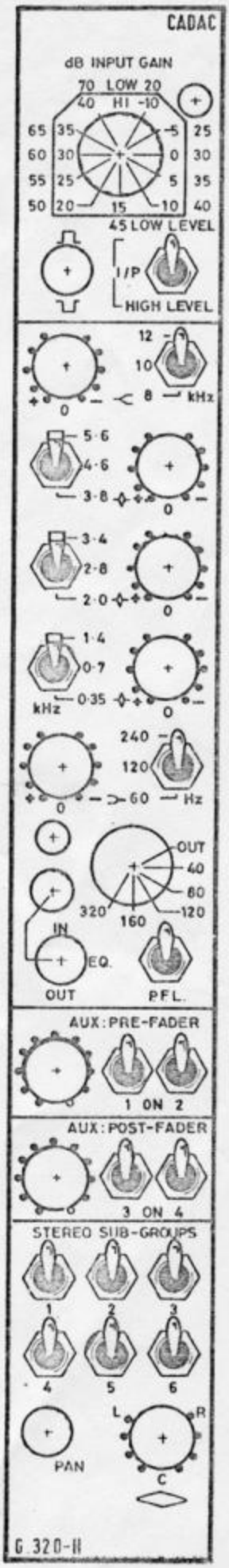
were designed by Cadac to specifications laid down by Chris Amson, who works as 'Tull's balance engineer. The first thing that strikes one about the console, apart from the obvious sophistication in design and quality of construction, is its sheer size and weight: it looks more like it was designed for permanent installation somewhere rather than for use on the road. Part of the reason for this is the high profile of the channel modules, which slope upwards at an angle of about 40 degrees; Chris specified this feature deliberately, so that he could inspect and adjust all 30 channels and 6 stereo sub-groups, without growing eyes on stalks or gorilla's arms (he still carries a swivel chair with him on tour, so he can wheel at speed up and down the over 6 feet long console!). The working surfaces of the desk are in three sections: faders on the lower, horizontal, panel; patching sockets, main output and P.F.L. meters and a small speaker on the upper, vertical, panel; channel plus group modules on the angled portion in between. The complete console is lifted by means of sturdy metal bars which hook into square-section steel tubes at either end of the chassis, and it takes four hefty blokes to lift it into the alloy flight case which protects the mixer whilst in transit.

Each microphone channel on the board has five equalisation controls which can be switched to operate over different frequencies (see line drawing of microphone input module.) A switch at the top of the module reverses the phase of the incoming signal — quick method of sussing out balanced line cables with 'back to front' wiring — and an Eq Cut switch is provided for rapid comparison of a sound 'straight' and with tone correction.

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WIRING DIAGRAM





JETHRO TULL'S P.A.

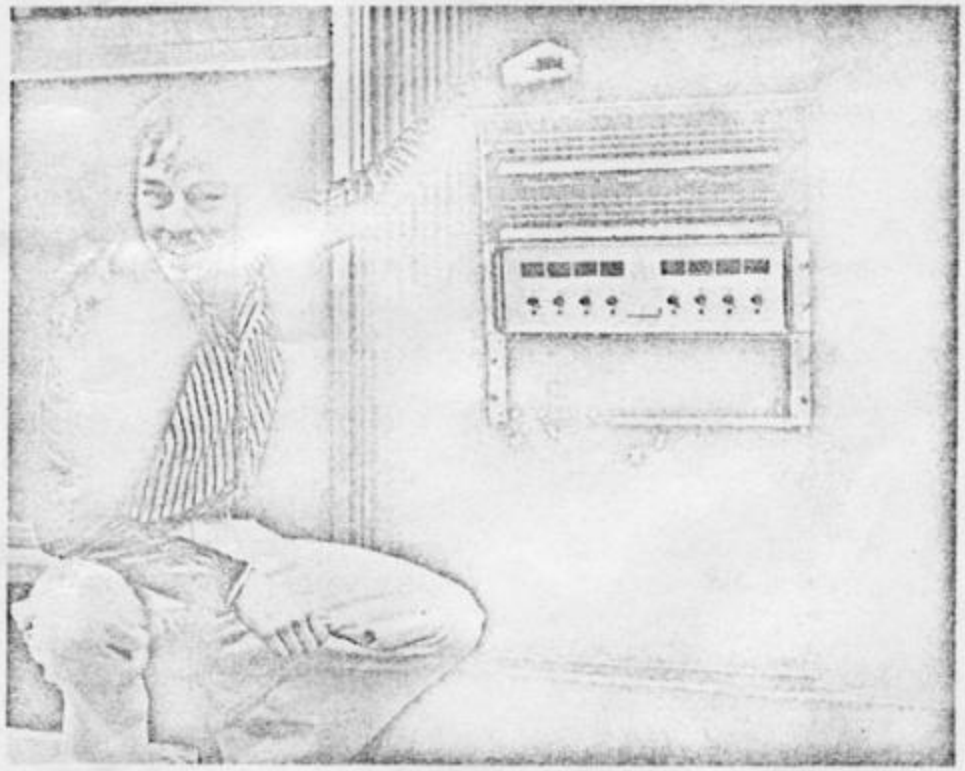
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Two effects and two foldback sends are available on each channel, the four master modules for each of these being located along with the double stereo outputs, at the far right hand side of the console. Chris chose this position for them because of the limited amount of adjustment that one needs to make upon these functions during a gig. FX (effects, get it!) return masters have level and panning controls, and the foldback masters have gain and basic treble and bass Eq controls. In fact only one of the foldback groups is normally used, sending out a drum mix for the keyboard players via a separate onstage mixer, of which more later.

At the lower end of each mic input module a bank of six switches and a pan control direct the sound to the six stereo subgroups, where the overall levels of whatever is grouped up on each are mixed to either or both of the twin left and right main outputs. The subgroups are each provided with independent left and right output feeds for recording and suchlike, plus pre-fade listen (to headphones) and on/off switches, whilst the master stereo outputs merely have pfl and on/off switches. Chris chose a central location for the subgroup masters, and says that at gigs he mainly works on these and the left hand side of the board, which contains the vocal channels and instruments that need to be altered most. Along with the wiring diagram of Jethro Tull's complete PA, there's a list of channels and subgroups, set in order exactly as Chris uses them.

As you can see from the photographs, there are quite a few sockets along the top panel on the mixer. On inspection, we found that most of the sockets on the left hand side were taken up by the 30 outputs from the multicore cable and the 30 inputs to the microphone channels, which are normalled through in the relevant pairs. 'Normalled' means that the output from multicore channel 1 is normally connected to mixer channel 1, unless a jack plug is inserted, in which case the microphone line from the multicore may be routed elsewhere, or a different multicore line may be used for the channel. Eight spare multicore lines appear at the right hand bank of sockets, and all the other input and output connections from the board, plus 'insert sockets' for individual groups, are available for re-routing or patching-in of signal modifiers. An 11 frequency oscillator also has its output amongst these sockets, and may be used for testing and aligning purposes.

The rather unusual provision of such flexibility in connection was explained to us by Chris: "We went through a phase of making everything as foolproof as possible — the safety factor is so important when working live." Apart from pure quality of electronics, the 'Tull board does indeed offer significant advantages in this respect over every other live mixer that we've seen; the extra facilities can, in most cases, be used for other purposes besides the "failsafe" function — the spare stereo output, for instance, could be used to supply a video camera truck with sound, or to feed a twin track tape machine for simple stereo recordings. Chris also pointed out that, as Jethro Tull's requirements for taped music, string sections, additional keyboards and so on change from album to album, flexibility really is the key



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words as regards the grouping and routing of channels. As a final example of Chris' attention to detail with regards to the mixer's specification (no doubt born of hard experience!), we noted with interest that there are two supplies "In case one got water in it or something", changeover from one to the other being accomplished by a single on/off/on switch on the console itself.

The mixer is connected to mics and main PA via two 250ft lengths of Belden cable, each containing no less than 81 pairs of signal wire. For every mic input on the stageboxes there are two transformer-isolated outputs, one spare (useful for live recording), and one to feed the monitor mixer, which is a Gelf 16 input 6 output job. Inputs to the monitor mixer are as follows: Ian Anderson's voice; Ian's A.D.T.'d voice; Ian's acoustic guitar; John Glascock's voice; the monitor mix of drums from the console (for the keyboard players); David Palmer's two string machines. Four of the outputs from the Gelf are utilised, and a Zoot-Horn 10 in 4 out desk provides a mix of John Evans' and Dave Palmer's keyboards, which is then amplified via a pair of Tycobrahe cabinets, angled to give coverage to any musician moving towards the back-line gear. Ian Anderson uses two WEM 2 × 12" plus horn wedge monitors, the rest of the monitors consisting of four cabs housing 1 × 12" Celestion Powercell each, manufactured by MEH. Chris Amson had a few things to say on the general subject of monitoring: "If musicians play too loud onstage, you get a constant 'point source' from the back-line, and then spend all your time trying to drown that out with the monitors. Because Jethro Tull achieve a good natural balance onstage, our monitors play a relatively low key role — they'e always been quite quiet."

Another unusual feature of the PA that Jethro Tull use is the arrangement of power amps driving the main PA. 24 Amcron DC300A amps are used, housed in racks of two amps each, with a panel containing all the signal input and power output sockets on XLR connectors, and monitored by a unique fault-finding display system. The Speaker and Amplifier Monitor — SAM for short — was devised especially for Jethro Tull by Mike Sells after Ian Anderson, during excursions upstage at a couple of gigs, had noticed that one or two bass bins weren't working, and had determined that some form of visual monitor should be devised to allow this situation to be remedied. Quite a difficult problem to solve, when you've got 48 different amplification stages to deal with, but Mr Sells managed to come up with the answer. Each stereo half of each Amcron amp has four red indicator lights mounted next to its input sockets. When the lights are illuminated, they give warning of the following amp conditions: 1/ No imput present. 2/ Amp malfunction. 3/ Open circuit. 4/ Short circuit. In the case of either an amp malfunction or a short circuit, a relay operates to isolate the amp, hence giving the loudspeakers protection from DC voltage. Chris has a remote display panel that repeats all the light readouts, so that he can check on the whole lot from the console. Yet more ingenuity here: instead of running hundreds of separate wires back to the console, a cable with six screened pairs (of which only two are used), feeds the remote display, and each amp rack is linked by a four-way XLR lead. A device known as a Multiplexer scans or "looks at" each display every 5,000th of a second, and alters the remote display to follow the original readings. Nice one, SAM!



The PA system that Jethro Tull use is larger than most British hire companies' rigs, and the bulkiest part of the system as a whole is the loudspeaker component. Chris explained to us how he came to choose it: "I went to three major PA rental companies in the States, and I saw Clair Brothers, Bob Heil and Showco. I went around their factories, and went to some concerts where they were doing the sound. I decided that Clair Brothers' systems were best suited to our purposes, and whilst I was over there they'd just introduced the S4 system, which is basically composed of direct radiating enclosures. It was a good sound, but I was still interested in a previous type of set-up comprising RCA and JBL 4560 bins, plus Roy Clair mid-range units and horns. What you need in really large halls is massive projection, so what we were after was a completely horn-loaded system to accomplish that. The system that we ended up getting was basically a Clair-designed rig, but from MEH."

Per stereo side, that system consists of:

Bass — 4 × RCA folded horn enclosures, each loaded with two 15" Gauss loudspeakers.

6 × JBL 4560 front-loaded horn/bass-reflex enclosures, each loaded with one 15" Gauss loudspeaker.

Mid — 6 × Roy Clair type front-loaded horn enclosures, each loaded with two 12" Gauss loudspeakers.

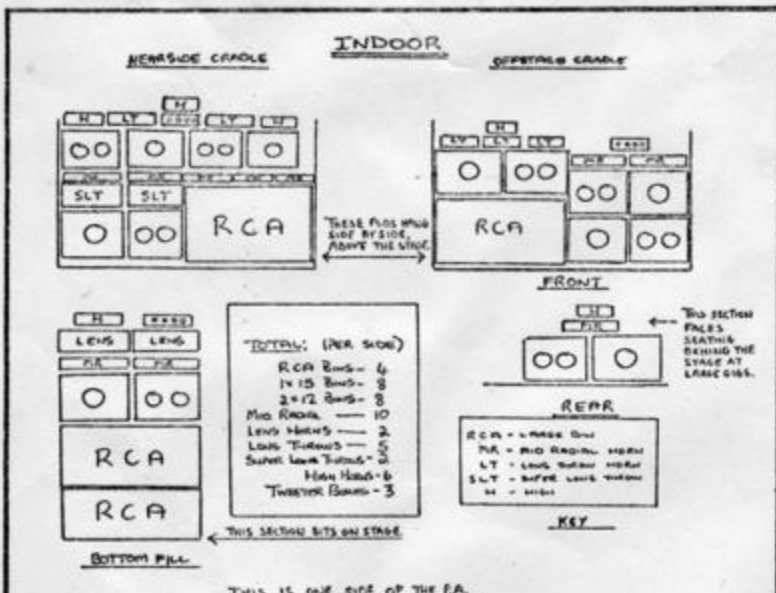
Upper Mid — 9 × JBL 2350 (90 × 40 degrees dispersive pattern) radial horns, with 2482 drivers.

4 × JBL 2355 (60 × 40 degrees dispersive pattern) radial horns, with 2482 drivers.

2 × JBL 2395 (140 × 45 Degrees dispersive pattern) slant plate lens assemblies, with 2482 drivers.

High — 6 × JBL 2345 (90 × 40 degrees dispersive pattern) radial horns, with 2440 drivers.

12 × JBL 2402 "Bullet" ultra-high frequency units. Crossover frequencies, determined at present by a Gelf GX24 electronic crossover, are at approximately 450 Hz, 1.6 KHz and 8 KHz.



Above is a reproduction of the diagram that Jethro Tull's road crew used to guide them when assembling the loudspeaker system for indoor gigs on their last American tour. A few extra items of equipment, including the 'Super Long Throw' horns, were hired especially for the tour. The "Mid Radial Horns" are JBL type 2350, the "Long Throw Horns" are JBL type 2355, the "Super Long Throw Horns" are JBL type 2356, and the "Highs" are JBL type 2345. The square bins with one circle represent 1 × 15" 4560 enclosures, the ones with two circles represent 2 × 12" Clair mid-range enclosures, and the oblongs with four very small circles are boxes each housing four JBL 2402 tweeters.

Each Amcron DC300A power amplifier drives into a 4 ohm load, Amcrons are rated at 340 watts RMS into 4 ohms per side, so the theoretical output power of the PA is 16,320 watts RMS. Normal current consumption of the PA alone is 80 amps at 240 volts. The Cadac mixing console cost £16,000 and the complete PA system, which is actually owned by the company Salamander & Son, cost about £100,000 "once you've added up all the little bits and pieces"!

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Despite this massive array of equipment under his control, Chris is more concerned about the creative aspects of sound engineering rather than the technical paraphanelia that goes with it. As the mixing equipment that he uses is as sophisticated electrically as studio gear, we asked him to describe some of the main differences in the way that it is used 'live'. "The biggest difference is that in a live situation you're spending all your time making the instruments sound as natural as possible,' whereas in the studio you're often working with interpretations. In a hall, you're often working against the acoustics of the place — large theatres are designed to give a natural amplification of voices only, and from the centre of the stage — the majority of the arenas that we play in the States were actually designed for sports, and not music at all! Working live, you've also got a completely different time schedule — you have to work very, very quickly, and adjust the whole thing in a fairly short period of time." One of the latest (and usually pretty expensive) gadgets for use with large PAs is the spectrum analyser, a device with readouts to display sound energy in ⅓ octave bands, derived from a test signal fed through the PA and picked up by microphone(s) in the auditorium — a system which should theoretically allow the engineer to compensate for hall acoustics by cutting or boosting troublesome frequencies via ⅓ octave graphic equalisers, inserted across left and right master outputs. Had Chris used one? "We tried using one, a Urei Sonipulse, but I personally found the whole thing a waste of time. "The system fails because the approach is too purist. A hall is like a huge ripple tank, with the PA making waves that expand and refract all over the auditorium in different places — even when equalised, you can walk around and hear the differences: you see, its impossible to walk into a hall on the day of the gig and carry out a task that would normally require a month's work of acoustic research!"

As Chris has obviously had so much experience in playing really large venues, we asked him if he could explain some of the problems involved, and how he copes with them. "Halls don't really change that much, certain things, like single resonances, keep cropping up in similar places." He went on to say that awkward venues could, very roughly, be divided into three categories: really horrible places, like the Frankfurt dome where Hitler us to give his speeches, where the whole sound is just plagued by a cloud reverberation and multiple echoes—these one just has to 'live with'! Halls wi hard parallel walls facing each other at either end, giving short repeats sounds such as snare drum beats — these often cure themselves once a lar crowd of absorbent bodies fill the hall, and the most troublesome frequenci can be 'notched out' of the relevant instrument sounds with comprehensi channel Eq (like on the Cadac.) Very large arenas which have resonances one or two frequencies because of their specific volume — these are usual resonances in the lower register, and can be filtered out of the main output "It's worse when a place is really dead, as its very hard to achieve a satisfac tory *blend* instruments. The first place we played on the most recent tour c the States was open air, at Hartford in Connecticut. The separation wa over emphasised to such an extent that little sounds like fret noise wer coming over really clearly — I had to go out the next day and buy a sprin reverb to give the sound a bit more natural life."

Performance

With the thought of Jethro Tull trucking around the States, playing 50,00(seater open air stadiums, having 'A' and 'B' crews leap-frogging from alternate gigs to assemble the stage and lighting set in advance (there being an 'A' and 'B' rig for each), we leave you to inspect the wiring diagram of the PA that brings the sound to all those people, and which has to be set up in an afternoon at every gig. The complete system is very unusual in that it has been exactly tailored to meet the requirements of the band and their balance engineer — it is to our knowledge the only PA in the world to incorporate a Cadac mixing console — and it is interesting and refreshing to examine a sound system put together in such a way as to combine top performance 'hard working' components with that extra touch of quality (so often lacking in large PAs) that comes from a really professional approach in attention to detail.