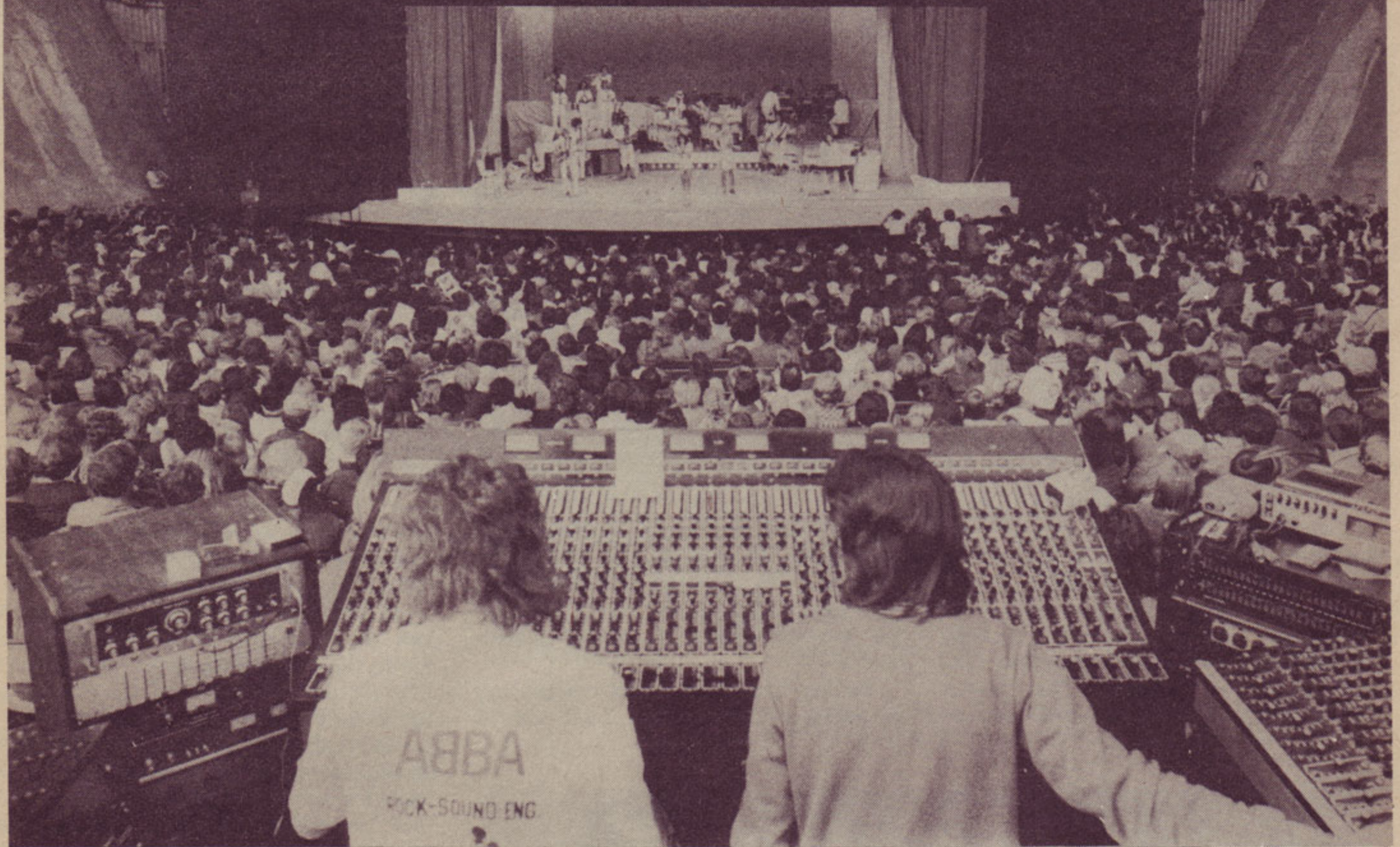


THE ROCK SHOW

Sound System



CONCERT SOUND SYSTEMS come in many sizes, shapes and forms and I don't think I've ever heard two systems that sound identical in the same hall. The sound engineers have different design philosophies although they share a common objective.

Expressions such as 4 way cross-overs, front loaded horns, radials, dispersion angles, etc, are banded about when the crews get together on tour but what **really** makes a good "state of the art" sound system? A system that, given the hundreds of variables such as hall acoustics, mood of audience, time available for set-up and tuning, road damage (that must be taken into account at every concert), will consistently deliver the best possible sound to the audience.

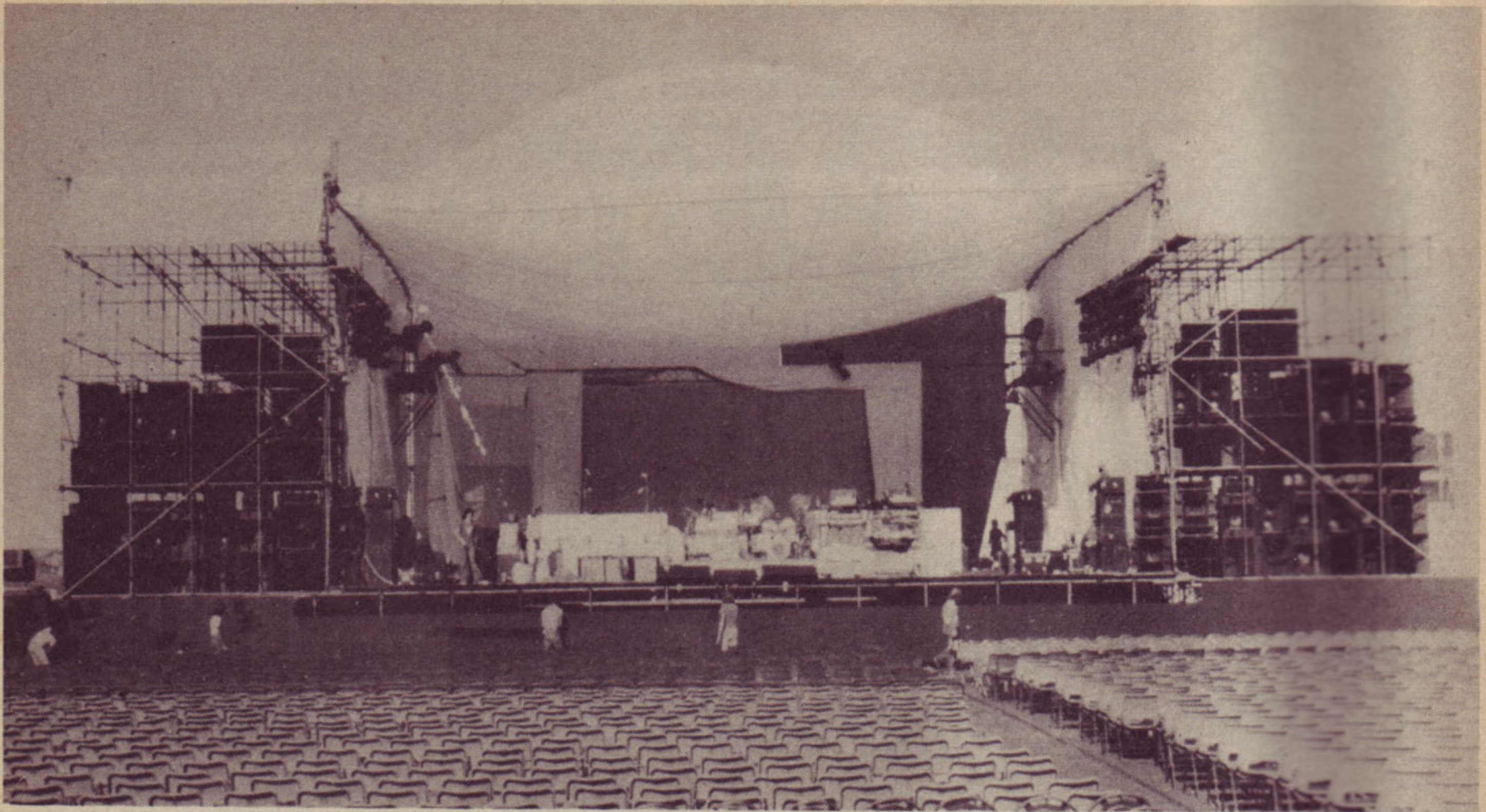
For some of the answers let's look at a system I designed for the Australian tours of Rod Stewart and Abba. The 'Jands No. 1 Touring System' weighs 28 tonnes and delivers a power output of 24,000 watts rms.

The last couple of years have brought bigger and better equipment to the concert stage ... here Howard Page of Jands Pty describes the equipment used in presenting artists like Rod Stewart and Abba to Australian crowds exceeding 30,000.

Let's follow the sound from its source looking first at microphones. The majority of these are made by Shure — type SM 58 for vocals and SM 57 for instruments. On the drums I use some other favorites such as Sennheiser

MD 421 or AKG D12. The actual set-up depends on taste and the way the kit is tuned. The mics plug into 20-way multi-core cables leading to the mixer in the hall. The multi-core input box also has splitting outputs to feed any mic to the stage monitor mixer located on one side of the stage. The house mixing console is custom designed by myself and Jands consultant 'electronic genius' Phillip Storey. This is a 24 track in, 16 track out, studio style board made super-rugged for the 'road'. It has many facilities not normally needed on a PA mixer, such as the ability to do a stereo house mix, a **separate** stereo recording mix, a mono TV mix and an all-up 16 track output **all at one time**.

Why such extravagance? It is because in Australia (due to the limited audio facilities in TV OB vans) we often get asked if we can do all the above — for a live TV show with an album to be released later, so the extra features can be readily justified.



The stereo 'house mix' outputs of the board feed to a set of one-third-octave stereo graphic equalisers. These are set up using pink noise and real time analysis to accurately 'tune' the system for both the hall and, in some cases, the type of sound required. The stereo signals then feed a set of stereo

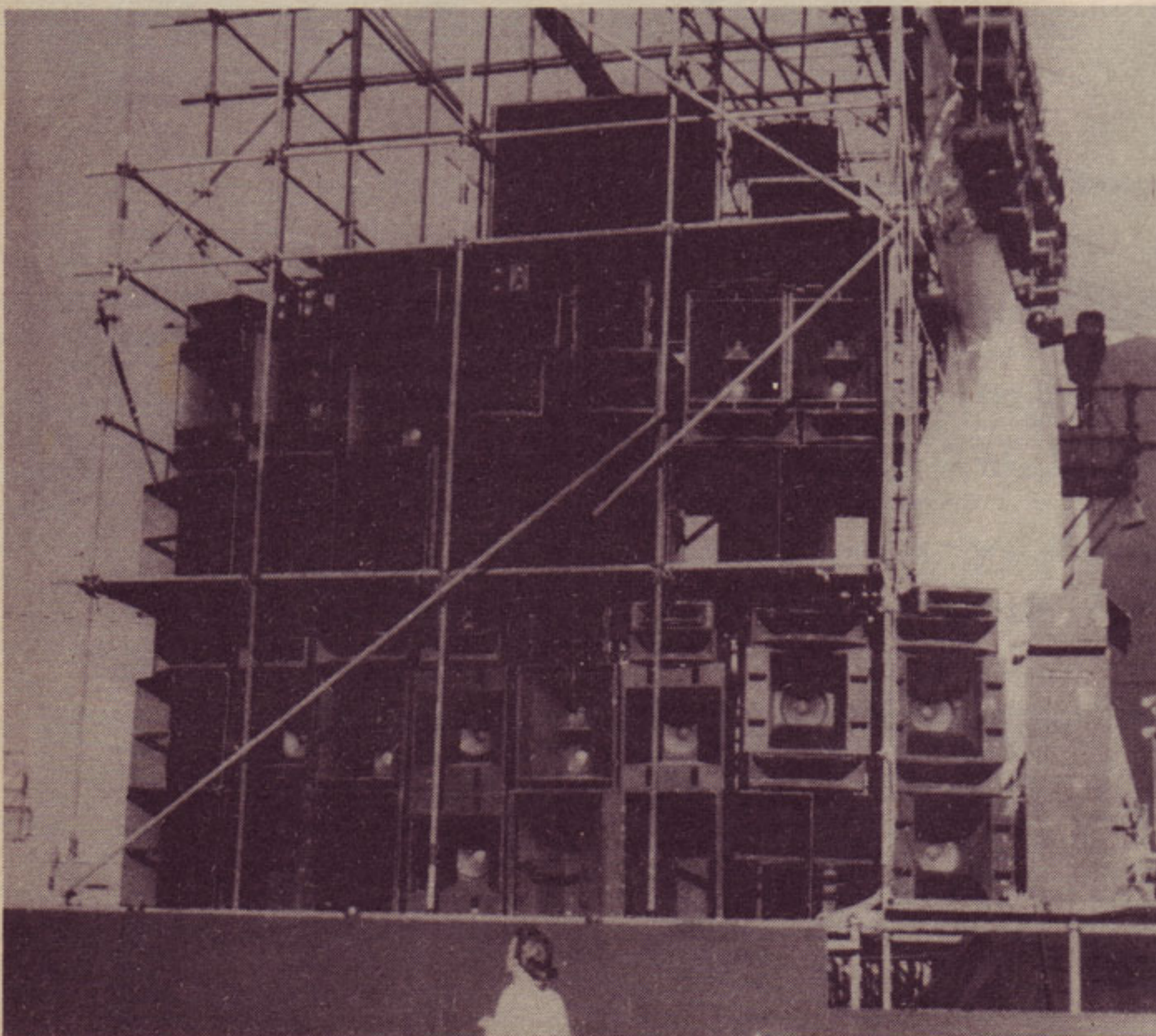
DBX 160s (Compressor/Limiter) which are set as a final safeguard on the system to ensure the amplifiers are not driven into consistent square waves, one of the primary causes of speaker system failure.

Having been tuned and compressed as necessary the signals feed into a

custom-built switchable 3, 4 or 5 way stereo electronic cross-over unit, the design of which is classified information. Also feeding in and out of the mixer are what we call FX devices, ie, echo unit, flanging units, extra compressors for various instruments, digital delay devices, etc, these are used as required.

Once the sound has been divided it is sent down a separate multi-core cable called a system feeder which plugs into the amplifiers on stage behind the speaker stacks. The amplifiers we use are the finest available 'state of the art' units: Phaser Linear 700B, Crown DC 300A, SAE 17K111CM, and a new unit we're especially proud of, our own Jands J600S which is proving equal, if not superior to, anything available from overseas.

Each amplifier rack unit contains switching and matching systems to enable complete flexibility and access should a failure occur. Heavy duty speaker cables connect the amplifier outputs to the final link in the chain, the speaker units themselves. These, in the No 1 System, are for the 'Lo Boxes'



This is the tower of speakers used at one of the smaller gigs on the tour!

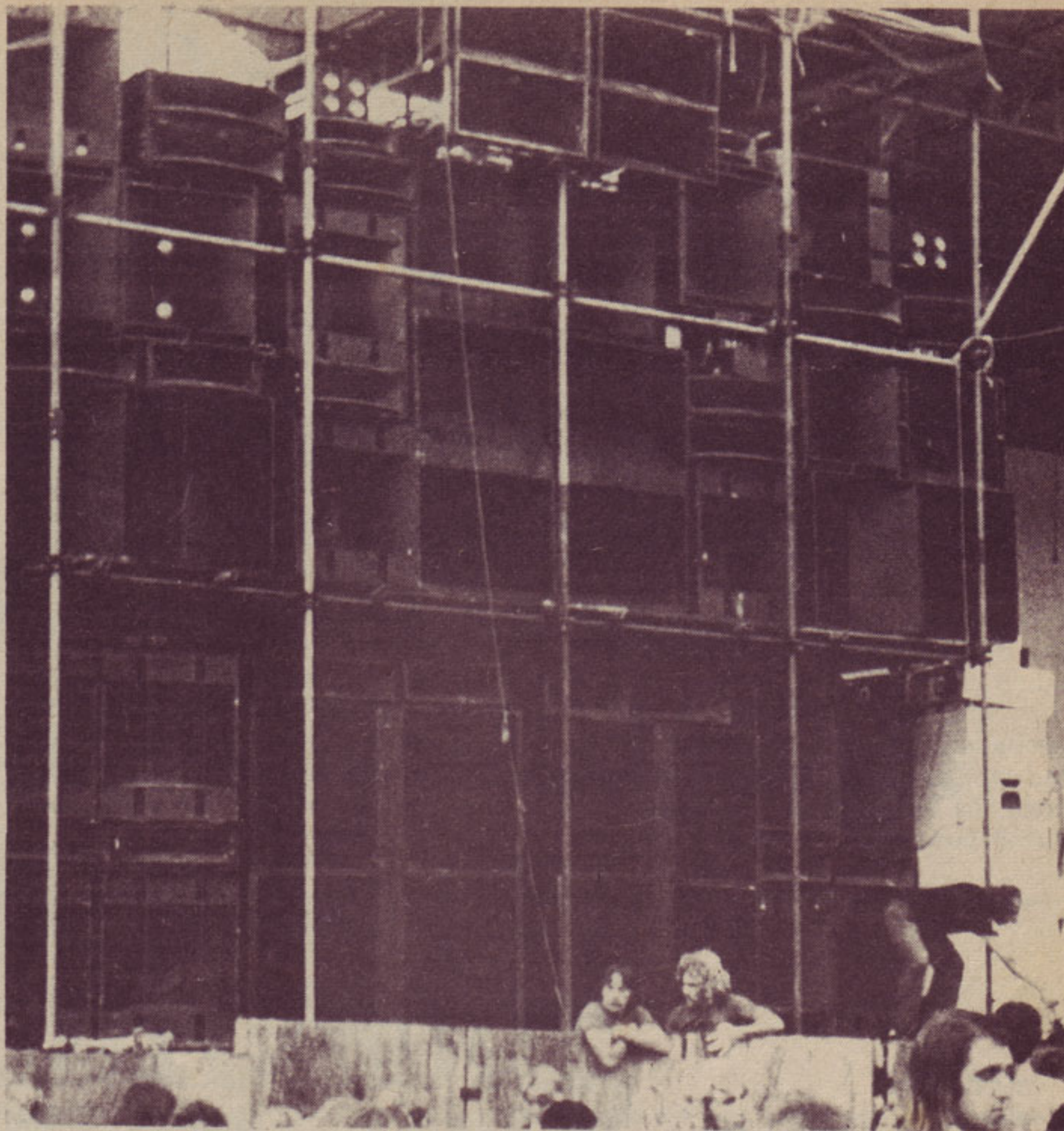
custom-designed Super 'W's containing 4 x 15" JBL (all components in the system are JBL) speakers; for the 'Hi Bass' or 'Mid Bass' another custom-designed front loaded 2 x 12" speaker box tuned reflex porting (for use as the bass unit in a 3-way system); for the 'Mids' JBL 90° and 60° Radial horn units with high powered compression drivers; and for the 'Highs' 2402, JBL 075 radiator units.

Well that's it, total cost approx. \$250,000, but it represents where concert sound reinforcement is at now. Certainly a far cry from a column speaker on each side of stage but its worth it when I hear members of the audience muttering as they file out "They sound just like their record".

LIGHTING AND POWER

One of the biggest problems now facing Jands when operating a PA and lighting rig, such as that used on the Rod Stewart tour is to ensure adequate mains supply (240 V). Simple arithmetic gives power consumption: the PA has six amplifier racks per side, and each rack has 3 stereo amplifiers each drawing four amperes. Total consumption is $2 \times 6 \times 3 \times 4 = 144$ A. Stage equipment, including special effects, can easily draw 100 amperes. The lighting system comprises 100 lamps, each drawing 4 amperes. This adds another 400 amperes to the total requirement!

To help eliminate dimmer noise in the PA system using the three phase supplies, the lights are placed across two phases with sound and stage equipment across the third phase.



This set-up shows the speakers used at the Sydney showground for the Rod Stewart concert.

THE JANDS LIGHTING SYSTEM

Control Desk:

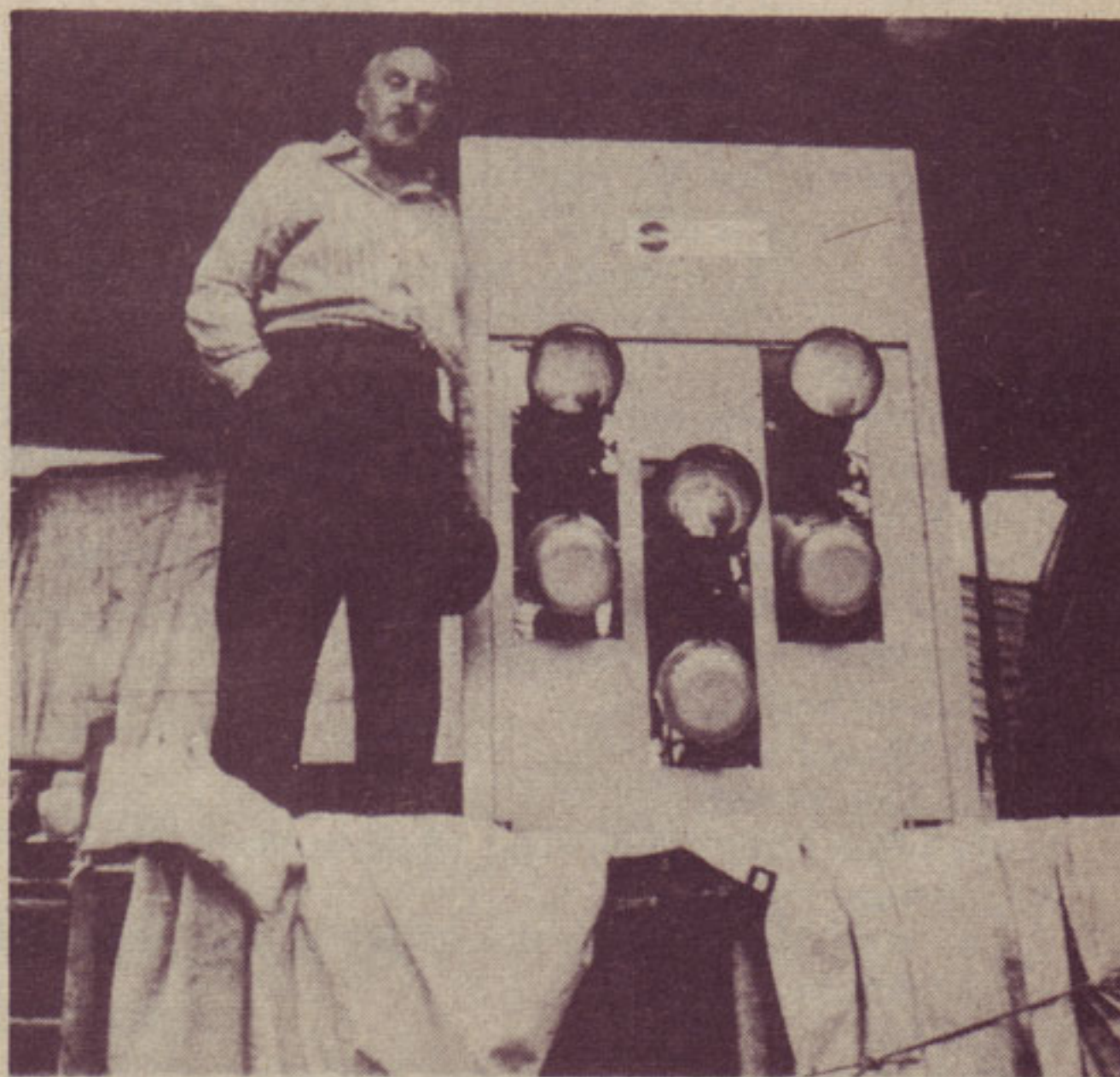
There are forty eight channels each with two preset levels ('A' and 'B'), and a 'full' button. There are sixteen scene masters programable via a matrix patch board such that any of the 48 sliders can be put on any scene. A two-to-six way (selectable) chaser (a 'sequencer') is available; any light can be placed on the chaser. The chaser has speed control, forward/reverse selection, intensity control and a chase/follow mode.

Dimmer Racks:

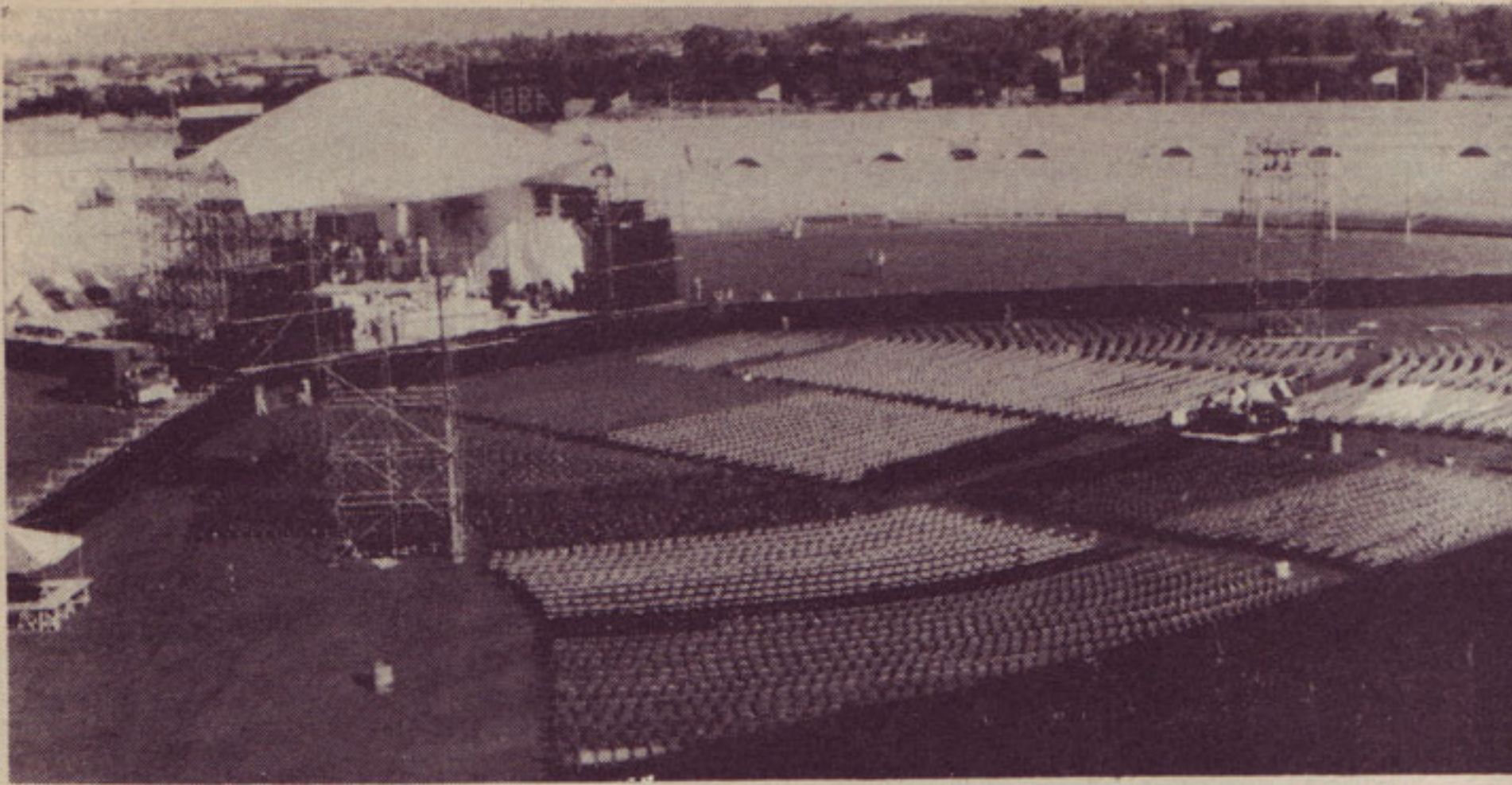
Rod Stewart used two racks, Each rack houses thirty-five 2 kW Strand Miniset cards packaged in plug-in modules. Jands have manufactured Miniset dimmers for Strand Electric since their introduction 6 years ago.

Lights:

The majority of the lights are manufactured by Jands Engineering according to an American design (they're called Altman Cans). They use 110 V 'Par 64' 1,000 watt lamps in pairs wired in series across the 240 supply. Connection to lamps is done with looms of 23/0076 3-core general-purpose flex.



George Mills brought this projection colour TV from London for the Sydney Rod Stewart concerts. Throughout the concert the audience has a close-up view of the action projected onto a massive screen.



The power supply Jands now insist on is 300 amperes per phase with a solid neutral. The electrical code permits a much lighter neutral than active in most installations, the assumption being the load can be expected to be balanced across the three phases and hence little neutral current flows back to the sub

board. With the lights full up and no PA (as occurs at the end of each song) there is a great strain to pull the neutral towards the lighting phases and with a soggy neutral it is possible to get over 300 volts appearing on the PA phase (the neutral drifting 50 volts above earth).

Power is run from the sub-board to the dimmer racks and audio equipment via 416/0178 glass-insulated rubber sheathed mining trailing cable (cable rating 320 amperes and the copper core being 14 mm diameter). Each cable is fitted with a 350 ampere connector imported from Switzerland.

Each lighting phase runs direct into a dimmer rack housing thirtyfive 2 kW dimmer modules. The sound phase runs into a 19" electronics rack containing two 150 A breakers, one to feed PA the other the stage gear. Each breaker is connected to an earth leakage detector set to trip when more than 20 mA flows to earth. The current required to cause a fatal electric shock is 50 mA. Hence if any person comes in contact with a live wire on stage they cannot receive a fatal shock.

To avoid dimmer noise in the PA system it is often necessary to get a separate earth for the audio so Jands always carry a 6 foot solid copper earth stake and 10 kg of salt (for making a brine solution for better earth contact).

JANDS CONCERT SOUND SYSTEM AS USED BY ABBA/ROD STEWART TOURS OF AUSTRALIA

MONITORS

Mixer: Twenty input and six output buses. Each mic can be mixed onto one or all of the six buses, with or without tone control. This gives up to six separate monitor mixes so that each musician can have the extra foldback mix he requires. Each feed then passes through a graphic equalizer and into a Jands J600S to feed a foldback system.

Foldback Speaker System:

Each Side	1 x JBL 4550 with two JBL 2220. 2 x JBL 4560 with one JBL 2220. 2 x JBL 90° horns. 1 x JBL 2390 horn lens.
Back Monitor	4 x JBL 4560 bass bins. 2 x JBL 90° horns.
Front	4 x wedge monitor housing one JBL 15" bass and one JBL horn and driver.

MAIN SYSTEM

2 x 20-way multicore cables feed the signal from forty microphones to the front of house mixer. A Jands 24 channel in and 16 channel out mixer.

The custom-designed 24 track, 16 track out mixer has the following facilities on each module:

1. Selectable Input Attenuation
2. Channel Mute
3. Mic Phase Reverse
4. Mic/Line Switch
5. High Pass Filter (250 cycles 18 dB/octave)
6. Equalizer Bypass
7. Lo; Mid; High; 18 dB Boost/Cut at four selectable frequencies
8. Pan Pot
9. Eight Full Stereo Group Select Buttons
10. Solo Pre/Fade Listen Button

There are eight stereo sub groups with two other sets of eight for making separate mixes of the sub group for

recordings, TV etc.

At the mixer are two 19" electronics racks.

The effects rack and the main system rack housing:
One third octave (27 band) stereo graphic DBX 160
2 x limiters DBX 160
2 x Jands 4-way crossover

The signal passes through each item then goes via a separate multicore to the stage to drive the amplifiers.

At each side of the stage are built the sound towers. These being 24' x 12' with three levels. Better dispersion is achieved by stacking high rather than wide. Each stack has the following:

8 x Amplifier Racks each containing 3 amplifiers these being Crown DC300A, Phase Linear 700B and Jands J600S.

The Speaker System:

12 x 4130 (Jands designed W Bins with four JBL 15" speakers in each).

4 x W cabinets containing two JBL 15" speakers.

24 x JBL 4560 Bass cabinets with one JBL 15" speaker.

16 x Double 12" cabinets (Jands design) containing two JBL 12" speakers.

20 x JBL 90° horns.

16 x JBL 60° horns.

8 x JBL long throw horns.

48 x JBL 075 high frequency.

The total JBL count on the Rod Stewart/Abba main system Sydney Concert was:

80 x 15" speakers.

32 x 12" speakers.

44 x Horns and drivers.

48 x High frequency.

Total value at your local hi-fi shop approx. \$250,000.

The entire system is equalized before each concert using a pink noise generator and a Real Time Analyzer.