ISSN 0011-7145

db

THE SOUND ENGINEERING MAGAZINE

FEBRUARY 1975 $1.00

IN THIS ISSUE:

- Recording Studio Acoustics, Part 4
- For Better Broadcast Audio Processing
- A Look At Robins-Fairchild

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COMING NEXT MONTH

- March puts the SPOTLIGHT ON MONTREAL, reporting on a **db** visit to the flourishing, sophisticated audio industry up north.

- A simplified economical solid-state switching system, through the use of enhancement mode p-mos fets, is described in Rick Blade's SOLID STATE SWITCHING FOR AUDIO.

- Step-by-step procedures in creating a biamplified approach to sound reinforcement with emphasis on reality rather than textbook theory, including some explanatory diagrams, is offered by George L. Augspurger in VERSATILE LOW-LEVEL CROSSOVER NETWORKS.

ABOUT THE COVER

- This attractive photo, supplied by Bang and Olufsen, is part of a series of slides used in their audio-visual presentation.

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THE SOUND ENGINEERING MAGAZINE
FEBRUARY 1975 VOLUME 9, NUMBER 2

db is listed in **Current Contents: Engineering and Technology,**

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db letters

THE EDITOR:

I applaud Mr. Tisdale's article on coincidental miking technique (*Recreating Colonial Sound*, November, 1974). I first started using a crossed stereo pair in 1971 after reading an article by Michael Gerzon in a British publication extolling their virtue. I've had great success with it in recording chamber orchestra-sized groups.

The hall was designed by the same architects who designed the Kennedy Center. With a seating capacity of under four hundred, the auditorium's acoustics were satisfactory for dramatic presentations but entirely too dry for live music. After some experimentation, I found that the optimum position for my crossed pair of RE15s (placed 90 degrees off axis) was a point just in front of and below the balcony, some twenty odd feet back and ten plus feet above the skirt of the stage. The resultant recording was extremely accurate in terms of overall sound and stereo image.

Since the hall was so dry to begin with, some form of artificial reverb would have helped, along with a little eq. on the top end. Unfortunately, I didn't have the facilities to add either. At first I considered another pair of RE15s placed further back in the hall on opposite sides to pick up the room ambience, but the sound was too muddy.

I've also had great success recording small instrumental electric jazz groups with the same method. The only problem I encountered was spillover from heavy footed drummers. With coincidental miking, microphone placement is a snap once the optimum location in any given hall has been found.

KEITH BLOOMFIELD
Scarsdale, N.Y.

CALENDAR

MARCH

3-6 **A.E.S. Convention,** Cunard International Hotel, Hammersmith, London W6. Contact: Mr. E. J. Franklin, A.E.S. Convention, Eccleston Rd., Maidstone, Kent, ME15 6AU, England. Charter flight information: Mr. Bob Lewis, Mirque Travel Agency, 350 Fifth Avenue, New York, N.Y. 10001.

APRIL

5 **Midwest Acoustics Conference,** Northwestern University, Evanston, Illinois.

6-9 **National Association of Broadcasters Convention,** Las Vegas Convention Center, Las Vegas, Nevada.

8-11 **Meeting of the Acoustical Society of America,** Conference Center, Austin, Texas.

21-23 **ASTM Committee E-33 on Environmental Acoustics,** St. Charles, Ill. Contact: Mr. Charles W. Rodman, secretary, Battelle Memorial Institute, 505 King Ave., Columbus, Ohio 432101. (614) 299-3151.

23-27 **SONEX Europe '75.** London

MAY

6-8 **NEWCOM Electronic Industry Show Corporation '75.** Las Vegas Convention Center, Las Vegas, Nevada

13-16 **London International Electronic Component Show.** London.

13-16 **Audio Engineering Society, 51st Convention,** Los Angeles Hilton, Los Angeles, Ca.

JUNE

9-27 **Brigham Young University Audio Recording Technology Course.** Contact: Russel Peterson, Brigham Young University, Audio Recording Technology Course, 242 Herald R. Clark Building, Provo, Utah 84602. Phone: (801) 374-1211, ext. 3784.

JULY

8-11 **INTER NAVEX '75** (Audio Visual Aids in Education) London.

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• In an earlier column, we started to discuss room equalization, introducing the notion of using noise as means of taking "real time" measurements of the room's characteristics. Like many other ideas, at first hearing, it seems as if it will overcome all the problems encountered with the old familiar frequency response measurement. But then, either as you theorize a little more accurately, or as you try to put the theory into practice, you find you are merely trading swings for roundabouts.

You can equalize for a transmission link—line or radio—for a recording link, or just for an electronic link, with relative ease, although some of those present their own brand of problems, but when you talk about equalizing an acoustic link—room characteristics—you are in a different ball park. In fact ball park is not not a bad analogy: can you imagine playing galactic football, or baseball, where there is no "ground" to use as a reference plane?

To take a room response, first you put a loudspeaker of unimpeachable frequency response (don't let's argue about that, or we'll never get anywhere) into the room, and let loose some pink noise. Then you pick up the pink noise with a microphone, and analyze what the room has done to the pink noise. Easy, isn't it?

Just a minute. Where do you put the loudspeaker and where do you put the microphone? Well, let's set the thing up, with a real time analyzer, so you can watch what happens, and try a few different spots with both the loudspeaker and the microphone. You find that moving either one has an effect on the dynamic bar graph displaying on the oscilloscope, so you begin to wonder what really is the frequency response of the room, which is what you are looking for.

You realize from this that, although you are not generating the usual kind of standing waves, you do still emphasize some of the same frequencies that a standing wave pattern, with the microphone and loudspeaker in the same position, would emphasize. And this depends, or is affected, more by the microphone positioning in the room than by the loudspeaker positioning, provided you have not done something silly with the latter, such as spacing it at a critical distance from the nearest wall.

So the next step is to use several microphones, to provide an "averaging" effect. Bill Raventos, in laying out the procedure at the Brigham Young University workshop, recommended the use of three microphones. If you realize that your purpose is to average the sound field pickup across the room, you will be guided in placement to achieve that purpose.

Now if an average is to be achieved, each microphone should be set up, its pickup level determined without the others operative, and then the gain should be adjusted so the wide-band output from each is equal in level. When you mix them, the result will give an average of what the three microphones pick up.

So far, so good. But now, you did that with the room or auditorium empty—no audience present—right? What difference will the presence of an audience make? Of course, there is no guarantee that presence or absence of the absorptive bodies of an audience will not make quite a radical difference in the frequency response of the room. A few auditoria have been found in which such a difference is noticeable. But in general, the frequency response of a room or auditorium does not change appreciably when it is filled. What does change is its reverberation time. The sound just "hangs around" longer when the room is empty.

HYPOTHETICAL ROOM SHAPES

This is logical, if you think of the response as being due to the shape of the room. Only if the presence of the audience alters the apparent shape of the room, rather than merely altering its absorption, will the frequency response change appreciably.

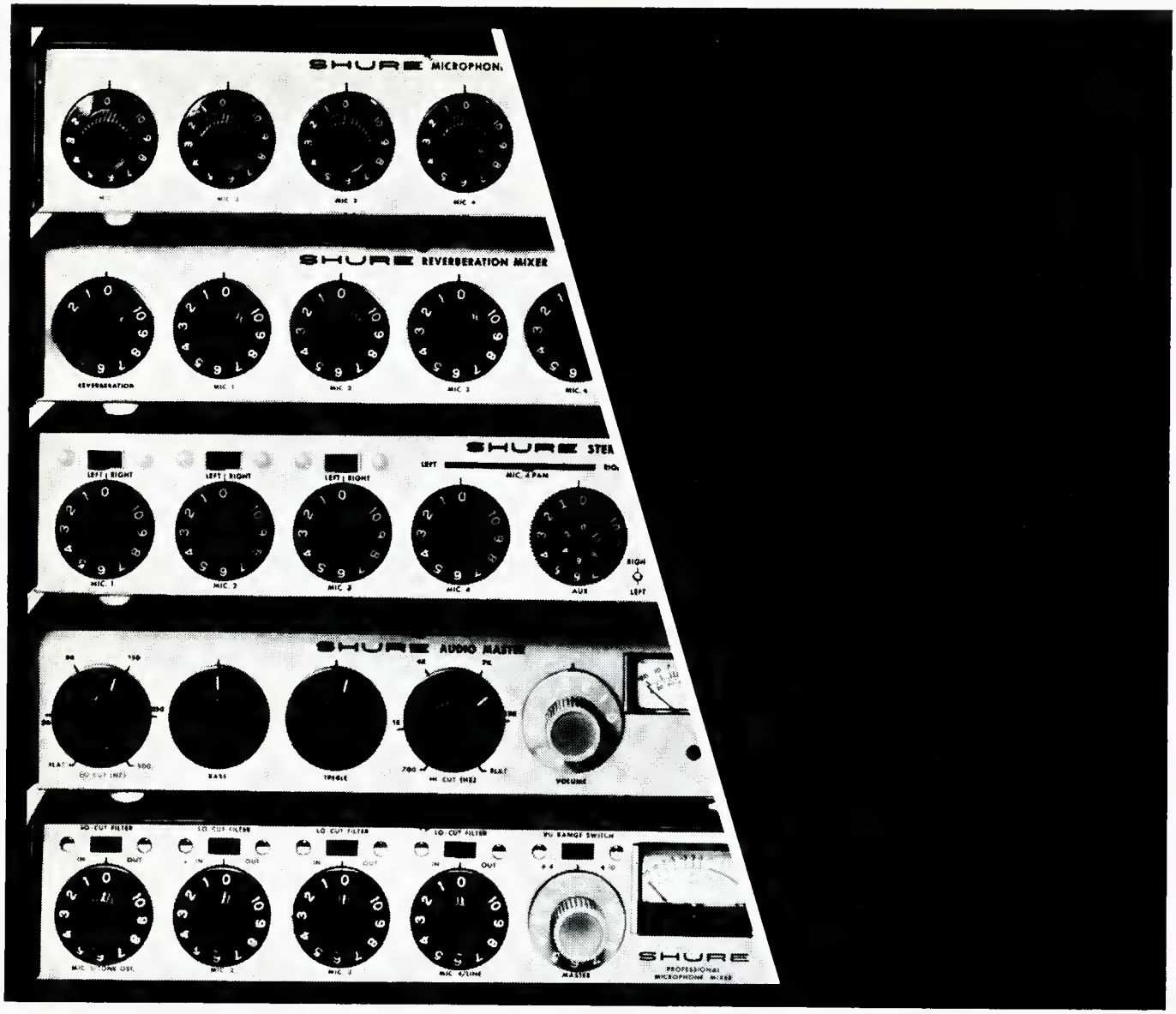
Before the advent of such sophisticated electronics as real time analyzers, making it possible quickly to measure effects empirically, and of high speed digital computers, enabling one to perform a mathematical synthesis of the room's parameters and thus design a room with specified parameters, students relied on ripple tanks to simulate the acoustic properties of hypothetical room shapes.

The problem with that was that a ripple tank can only set up standing waves or determine the response characteristics, due to propagation in a two-dimensional plane. Of course, tanks could be constructed to represent either the horizontal or a vertical plane. But this still did not simulate the behavior of acoustic waves in three-dimensional space.

There are instances in which two-dimensional representation, by parts, so to speak, can give a reasonably good approximation to the three-dimensional counterpart. For example, if you are interested in the characteristics of a fairly large room, whose height does not exceed the 8 to 10 feet of a single building story, its characteristics will be fairly well simulated by a ripple tank representing its horizontal shape.

But such a room does not possess notably good characteristics. A better room frequency requires an irregular shape that avoids the succession of nodes and antinodes, similar to a condition of living inside an organ pipe! Height should vary, over different parts of the room, and as few as possible of opposite walls should be parallel.

When a room has been designed to achieve this, simulating its frequency response with two-dimensional models becomes difficult, if not almost impossible. Response can be derived from mathematical wave equations, but such a procedure, the method used before the advent of high speed computers,



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to run the calculations, is impossibly long.

Simulation with models may be a way to approach the design of new auditoria, to be built from scratch. But the sound reinforcement man more often has to accept a room more or less as is, perhaps modifying it a little with some acoustic treatment, and do the best he can with electronic equipment. That is when the practical approach, using a real time analyzer, is more useful.

Now, what can you expect to find? Rooms have resonances. They can resonate in different modes or directions. This can be affected by choice of loudspeaker placement. To show this, imagine putting a line of speakers along one wall so they generate a plane wave directed at the opposite wall. These will produce a series of peaks and dips, rather like a stopped organ pipe whose length is the distance between the wall where the speakers are, and the one opposite. The other dimensions of the room will have little effect unless you change the wall against which the speakers are put.

So there are these sort of "conditional resonances," that depend on how the room is excited. Then rooms will also have quite definite, but fewer as a rule, frequencies at which a sort of universal resonance occurs: where a peak will show up, no matter how you distribute the sound, or pick it up. These are the resonances that need more important attention in equalizing a room's characteristics.

FALLACIES OF EQUALIZATION

So what have we found? Advocates of room equalization—and we are not opponents of the procedure, we are just a little more conservative about it—adopt the attitude that any room can be made to sound good, by equalizing its frequency response.

We cannot quite agree with that. We will readily admit that such equalization is necessary to make the best of any system installed in such a room. Where we disagree is in whether the "best" in such a context is always worthy of being called even "good!" We readily agree that it will be better than the same room without equalization, but that may not be saying very much! It is not a panacea.

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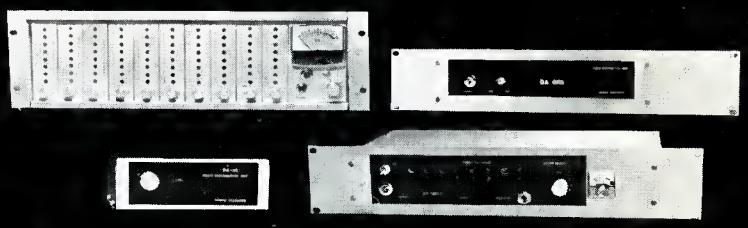

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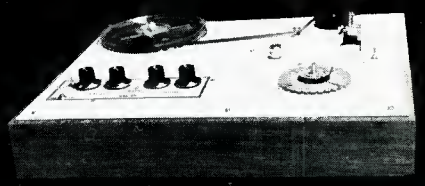

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RAMKO RESEARCH

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can be equalized. But we remember a microphone design, almost 40 years ago now, in which the designer had a brain wave for getting a flat frequency response, in the days when that was a real struggle for microphone designers.

In those days, research on microphones had found that every little cavity had its own resonance or antiresonance. So this designer's brain wave consisted of "cleaning out" the inside, so it had just one big resonance, which occurred at about 1,000 Hertz. The peak was about 30 dB above the level at the ends of the audio spectrum.

So, built right into the microphone's electrical input, was an absorption filter with a 30 dB "hole" at 1,000 Hertz, carefully tailored to have the same width as the microphone's resonance. On the response tracer, using the anechoic room, its frequency response looked beautiful—for those days. It was better than anything else around, at the time.

Then came the acid test: using it. How did it sound? Can you guess?

For a 30 dB peak, in the acoustic part, to be damped by a 30 dB dip in the electrical part, would require a coupling efficiency of at least 99.9 percent. Transducers just don't come that efficient. So, although the electrical filter brought the *average* 1,000 Hertz level down to the same as other frequencies, it did not alter the fact that it rang, with a Q of about 1,000!

Of course, few buildings will have that high a Q to their resonance. And anyway, the fundamental frequency will not be that high. But the phony effect will be of the same general kind as that observed there and just less severe.

When we've said and done all, it was rather gratifying, at the BYU workshop where many of these things were discussed, to find that the operator at their large auditorium still uses the same method we devised almost 40 years ago: that of adjusting multiband filters, under the live, operating condition, until the margin below ringing threshold is as close to uniform as possible, throughout the frequency spectrum.

Incidentally, while mentioning that workshop, we understand that plans are going ahead for another one this summer. If this interests you, we suggest you make sure of being on the mailing list, by writing to the Electronic Media Department, Brigham Young University, Provo, Utah. ■

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db sound with images

MARTIN DICKSTEIN

● Do you recall the heyday of radio (before disc jockies) when one of the most popular features was the dramatic show, in a comic or serious vein? Using only its sense of hearing, the audience was transported anywhere, in any time period, and led through a multitude of plots, now being replayed on television. Much of the realism of the programs was created by a group of people known then as sound effects technicians. These people knew how to create effects that made listeners believe they were eavesdropping on an actual occurence in the location specified in the script. A radio drama could not hold itself together without these special aural effects.

Some of the larger studios of the network stations were specially built with a *live* end and a *dead* end. Acoustically, the live side was made with hard surfaces to reflect sound and was usually used for musical programs, with the instrumentalists arranged there and the studio audience seated in the dead end. Sometimes, the live side had movable or rotating wooden panels which could be set up for the particular liveness desired, with one side of the panel being reflective and the other absorbent. Such a studio might also have been used for dramatic programs when a musical group or instrument, such as the organ or piano, was used for background or as a bridge between one scene and another. Another use for such a studio was as the setting for a comedy show with an orchestra and musical talent, who also appeared as part of the program. Sometimes studios with the best reverberation characteristics were also used for making recordings.

SOUND EFFECTS FOR ILLUSIONS

No matter how much studio characteristics helped create illusions, it was the sound effect which really gave the shows their drama. When the sound had to remain on for any length of time with few variations, the effect was usually pre-recorded on a record which the effects man played on his special turntable. Some record companies specialized in this type of material and had catalogs listing many types of sounds, with variations.

For instance, the background sound of a busy intersection was on a recording of the traffic in Times Square in New York with its intermittent car horns, fire or police sirens, perhaps a police whistle, and a car starting up or stopping as though for a traffic light. You could find a harbor recording, with bell buoys, boat horns, and the lap of water against a dock. A car running at idle, or a speeding car as heard by the occupants, was on a record. So were the sounds of a battle, with sporadic gunfire, shells, machine guns, etc. Trains, boats, large ocean liners, Navy cruisers and destroyers, were all on record. Each record had smaller cuts on the disc for such things as an engine starting up or brake skid or single shots from a cruiser's guns, or for a pistol shot. Single cuts were also ready, with the sound of explosions either above or under the ground, earthquakes, boat whistles of almost every description, train whistles, car horns, and the very brief effects of a train racing by or of a plane taking off or of a dog barking, or . . . .

INGENIOUS LIVE SOUNDS

Although recordings were available for an endless number of situations, some effects had to be made live, by the sound man. One of the simpler ones might have been footsteps on a sidewalk or a wooden floor. These were done, with the called-for speed or rhythm, by the sound man wearing shoes with leather heels. Running up or down stairs was performed by the sound effects engineer on a specially constructed three- or four-step staircase. The speed of ascent or descent was controlled according to the needs or age or sex of the character who was being portrayed in the script.

Sometimes, because of the unique construction of the sound effect turntable, it was possible to play two cuts of one record. The turntable had three tables, with an arm on each in the usual fashion and an additional arm located at the rear of each of the tables. Thus, the sound man could play two effects from one disc, or he could restart at the beginning of a long cut if the effect had to continue beyond the length of the cut itself.

He could even incorporate filtering on the multi-disc console or fades and mixes, but when it came to making a particular sound at a precise moment in the action of the show, this was done live even if the disc had the sound. This would be true of single pistol shots, which were done with a pistol (without real bullets, of course, since realism had to stop somewhere). A body falling was done live by the sound man, not the

actor. "Real" stabs were done with a knife and a head of lettuce, for instance, and an immediate groan from the actor-victim. Horses hooves were achieved, at the proper gait, with either scooped out coconut shell halves or a pair of rubber bathroom plungers. The surface was a sand box filled with a mixture of gravel, a piece of wood, or a piece of slate, depending on the requirements of the program. The "horse" galloped, cantered, trotted, walked or jumped; it made no difference to the sound man, who was possibly on intimate terms with horses and their gaits.

The sound of water lapping against the side of a ship was provided either by a recording of the real thing or done in a square box containing water with a four-bladed paddle suspended in the water from a bracket on top of the box. A handle on the arm of the paddle let the sound man create a lapping with whatever force was needed at the precise moment it was called for. A rainstorm was another matter. Rainstorms on records might not have exactly the type of rain the script demanded, or recorded thunder lacked the desired sharp and brittle effect. Or, perhaps the sound had to be "on mike" or in the immediate presence of the actors (and the audience). Realistic rain was sometimes created with rice or sand on a tin sheet. The effect of lightning was achieved by hitting a tin sheet suspended in a wooden frame. The vibrating tin enhanced the illusion of crackling lightning.

Another effect which was created manually was the sound of fire. Here, the sound man used a piece of cellophane, usually taken from a pack of cigarettes, and crumpled it in his hand, adjacent to the microphone. The harder and faster he crumpled the paper the more fierce the fire.

The sound of a door was the real thing. A wooden frame mounted on wheels, for easy mobility, usually had in it a standard door, complete with door knob and key lock, and a screen door with squeaky spring and handle. A similar frame usually contained a car door, complete with window, handles on both sides, and the locking button. On *Inner Sanctum*, a night-time mystery show, the special sound of a squeaking door at the beginning and end of the program became the signature of the program. This had to be created specially, accomplished with a wooden device in which one piece of wood in the shape of a thick peg was rotated in a hole made in another piece. Tension on the peg was created with a taut strap in order to change the intensity and pitch of the squeak.

JACK BENNY'S MAXWELL

Many more sounds like these were created by the sound effects department for specific needs of scripts, but one that was made aurally was on a comedy show. On the Jack Benny program, the sound of the old car owned by Mr. Benny (a Maxwell with temperament) was made by Mel Blanc, who used his mouth, with heaving and puffing to stall the car, start the engine and have it conk out. The sound came on cue with all the comedy the sound itself could create. It got laughs and applause each time. It became a household word, but not too many listeners, even the regulars, were aware that the name credit for Mel Blanc as an actor on on the show was also for the special sound effect.

One of the other unique effects created for only one special purpose was on the *Fibber McGee and Mollie Show*. A closet was opened by McGee against the better judgment of his wife, who warned him not to do so. The resulting clatter of all sorts of things including what sounded like

pots and pans brought laughter and applause each time. The sound men on the show just dropped items and kicked them around and ended up with a single sound of something falling a beat later and sounding like an afterthought to the whole mess.

Radio had a tremendous effect on the public, who used to spend hours just *listening* and imagining what was going on with the help of sound effects. Only on radio could something like the *Orson Welles Mercury Theater* program of H. G. Welles' "War Of The Worlds" cause such a panic the likes of which we may never see again. Perhaps some of you may remember; maybe you were too young. Today, television, with all its creativity, could never do this, but with the news as bad as it is normally, perhaps it's just as well.

TELEVISION SPECIAL EFFECTS

Television also employs special effects, but the sound effects are actually live, or made to fit the action on the screen. This also requires a good deal of talent, we're not taking that away. The effects used in video that might be of most interest are the visual ones. For example, the backdrops on some newscasts are rear projection of slides or film to fit the story. The *special* effect is the superimposing of the newscaster over the background. You might notice that there is sometimes a slightly visible blue outline to the newscaster like a faint aura all around him (or her). This is a special technique with which the broadcaster is picked up by one camera, aginst a plain background, while the second camera is picking up the screen with the rear projection. The video console operator then performs an operation with a piece of equipment permitting chroma-keying and the person is seen in front of the screen.

SPECIAL EFFECTS GENERATOR

A special effects generator, available on all broadcast video operating consoles, and now even in some of the industrial and educational in-house video systems, allows the technician to cross-wipe from any side, up and down, from any corner, and to insert a second image over another in any spot of the screen desired. Other effects include an opening on another scene from the center to full screen, or the closing to another scene from full screen to a spot in the center. It is also possible to reverse negative and positive images so scenes can be made to look like dreams or the past being brought to mind in the present. Color effects can be used to tint a full image one shade and then switch to any other of the primary video colors (blue, green, red) or any combination. Special typewriters can letter titles on the screen while the video signal from another source is still visible on the screen.

Special effects are being developed every day for particular applications and purposes. Electronics are marvelous, and as engineers in broadcasting and production houses get to learn and know more about the uses and development of circuits and equipment, the effects they will create will be numberless. Television will eat up the special effects as quickly as they can be designed and made, and soon they will cease to boggle the mind of the viewer, and the public will again begin to want more, more, and still more.

Broadcasting has always demanded the most and the best from technically creative people, and they have always been able to come through with something new. Now that we're in the last 25 years of the century, what's next? Pretty soon we'll be in the 21st century, and what's new will be old. Don't just sit there . . . get your thinking caps on!!! ■

NEWS BRIEFS

CD-4 Session in L.A.

Proponents of the CD-4 discrete four-channel sound reproduction process have met in their first plenary session to review recent developments and lay the foundation for further promotions. According to John Eargle, JME Associates and consultant to the CD-4 advocates Matsushita (Panasonic), JVC, Warner Communications (WEA), and RCA, the meeting took full advantage of CD-4 momentum.

A number of multi-media presentations aimed at audio dealers and appropriate for consumer viewing will be launched early this year by a team of CD-4 specialists. The CD-4 team will conduct in-store training sessions for sales personnel, closely tying in the software segment of the industry.

"The idea is to get more knowledgeable salesmen and to broaden software distribution," Eargle said. "This does not mean that the typical audio dealer will stock and sell CD-4 discs, but he will know more about software. The brunt of the software thrust will continue to be through traditional record outlets."

Additional promotion plans call for individual participation of CD-4 sponsors at a number of important trade shows and conceptual presentations at international trade events. A CD-4 handbook is being produced to illustrate the differences of the various CD-4 hardware and includes a software listing.

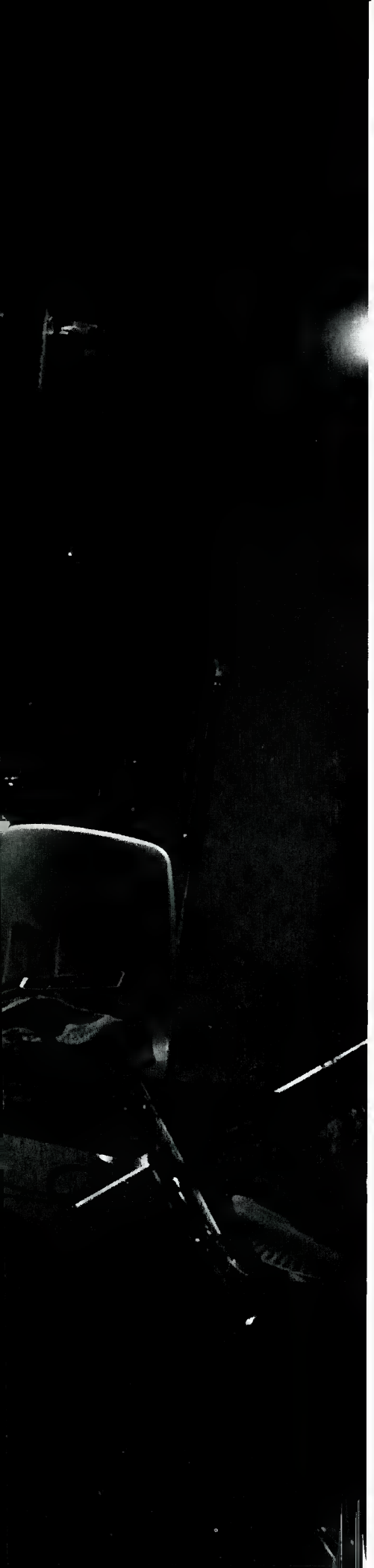
While quad broadcasts are being evaluated by the NQRC and reports are being submitted to the FCC, the CD-4 proponents are pursuing cable FM technology in transmitting four-channel. Tests are being conducted jointly by Gill Cable TV and Panasonic.

Eargle reported that the session included a review of significant technical progress in CD-4 techniques and a preview of the new Mark III cutting system, to be made available next year. The Mark III will provide low-price cutting capability for independent studios and record labels.

Those attending the plenary session included David Heneberry, v.p., RCA Records; Jac Holzman, senior v.p., Warner Communications and Chairman Quadraphonic Planning Group of the Warner/Elektra/Atlantic Labels; Hirobumi Tokumitsu, executive v.p., Victor Co. of Japan, Ltd.; Tex Takeoka, senior managing director, Matsushita Electric Industrial Company, Ltd. of Japan, and Howard Yamato, executive v.p., Matsushita Electric Corp. of America (Panasonic).

At the meeting: David Heneberry, Jac Holzman, Hirohumi Tokumitsu, Howard Yamato, and Tex Takeoka.

Other participants included Irwin Tarr, M. Yasuda and Adam Yokoi (Panasonic), T. Oguri, Vic Goh and M. Furuta (JVC), Keith Holzman (Elektra Records), John Pudwell (RCA) and John Eargle, (JME Associates). ■



A very rugged tape recorder for a very delicate business

Ampex designed the MM-1100 multi-channel tape recorder with your business in mind. We've been building professional recorders longer than anyone else, and we've learned that producers, engineers, and studio operators have a lot to worry about. So we build the one piece of equipment you can plug in and forget.

Coddle your talent, if you must, but shove around your MM-1100
That's right, shove it around. That's why we put wheels on the MM-1100. Dolly it from studio to studio, or truck it across town. The heavy cast frame and solid steel cabinetwork will keep all the little parts and things where they belong, and the only "installation" routine you'll go through is to plug in the power and input lines.

Pinch your pennies, hoard your dollars, but squander your discrete channels
One MM-1100 can give you 24 tracks. Two of them hooked up together with a synchronizer will give you 46 channels. That's enough to mike your setup for left-and-right running water, if you want it that way. And with all that channel capacity, you can save plenty of channels for sweetening, later additions, and a last-minute background by a hundred voice choir.

Three heads are better than one when you can change them yourself
Ampex makes 24-channel, 16-channel, and 8-channel head assemblies for the MM-1100, and changing them is as easy as turning one thumb screw and swapping units. Touch up the equalization and get on with the session. No need to worry about tape tension adjustments because that's all done automatically by the MM-1100 transport mechanism.

Never enough time, never enough tape. But we handle a 16" reel of two-inch easily
The tape transport in the MM-1100 is a real grizzly bear. It has plenty of control power, even when the reel is a sixteen-incher loaded with 2" tape. And even with all that mass to control, the capstan servo zeroes in on synchronizer commands fast enough to use two MM-1100s in parallel for the 46-channel stuff you always wanted to try.

Your maintenance guy can work banker's hours because our "doctor" makes house calls
Ampex field service sells a lot of equipment for us. We build a fantastic machine, and it almost never develops a problem. If it does, however, you'll appreciate our policy of having service engineers who know both our product and your industry. They're available to keep your group together and working.

The business gives you a headache; Ampex gives you a tape you can sell
Full technical specifications are in our MM-1100 brochure, which we'll be glad to send you free. Working models are in studios all around you, and if you don't have a friend who'll let you inspect his MM-1100, we'll arrange a demonstration. In fact, we'll do anything we can to get you rolling in the multi-track business, if you'll just tell us how we can help.

In a delicate business like production recording, there just isn't any substitute for the Ampex MM-1100—a very rugged tape recorder.

AMPEX

Ampex Corporation
Audio-Video Systems Division
401 Broadway
Redwood City, California 94063
(415) 367-2011

Circle 36 on Reader Service Card

overkill in the grounding business

● In the October issue, I printed a letter from "Mr. Doe," who was having his troubles with hum. But there wasn't enough information given to locate conclusively the source of his problem. Was it a ground loop? Maybe it was a (signal) wiring problem. Maybe not. I haven't heard from Mr. Doe again, and he left no clues as to his address, so this may be an unresolved problem.

However, I've received a number of solutions from interested readers, which I'd like to pass along for two reasons: 1. Maybe the thoughts contained in these letters will help Mr. Doe (wherever he is), 2. I can't think of anything else to do this month.

"Let this University Professor try to show you that we can have a practical bone in our body. John Doe has a hum problem because of over-kill in the grounding business. Tell him to take out that '8 gauge copper baling wire hooked to a cold water pipe and sunk 7 feet into the ground' and if the hum doesn't go down a noticeable number of dB's, I'll wear my Paul Klipsch yellow B--- S--- button for a week.

"If it does go away, why? Probably because there is a confusion of safety grounds (those 3 wire power plugs), signal grounds, and power line neutral circuits. This can induce currents in signal line shields that cause millivolts of voltage drop across ends. If, through mysterious interconnection, part of the power line neutral current is carried through the microphone shields, the hum could be horrible.

"The most intelligently engineered equipment from a hum control standpoint is the analog computer. These machines work from d.c. to 2kHz and have to be properly shielded and grounded. They use multiple grounding networks for safety, power distribution, signal grounds, etc. All of these grounds have only one common tie-point and ground loops are avoided like a plague. It works—and Audio can learn a good lesson here.

J. Robert Ashley
Professor, Dept. of
Electrical Engineering
University of Colorado."

Professor Ashley didn't indicate what B--- S---- means. (Some academic term no doubt.) He *did* indicate that grounding is no simple matter. Many studio engineers have given up trying to dope out a confusing grounding system and use the traditional cut/solder technique, which is given here in its entirety. In the presence of an annoying hum:

1. Reach for the nearest ground wire.
2. Cut it.
3. a.) If hum decreases, move on to the next wire.
   b.) If hum increases, solder it back together again and *then* move on to the next wire.
4. Continue through the entire system until:
   a.) the hum is gone, or,
   b.) you run out of solder, or,
   c.) you are accidently electrocuted.

If Professor Ashley taught such nonsense, he'd probably find all his students wearing their Klipsch B--- S--- buttons. But sometimes it's the only way, especially if you've inherited a studio that had its beginnings in the dim dark days of mono and has "just sorta' growed" ever since. Chances are, there's no one around who really remembers what the last guy did with his grounds, and every addition becomes a 60Hz adventure. Or consider the problems of working in a very old building, where the original electrical service may have been a little on the casual side.

HAPHAZARD GROUNDS

"John Doe's problems ring a familiar bell in my memory. I have been the recording engineer for Town Hall in New York City for 8 years, and in that time I designed and built a rather sophisticated recording system. During the process of building it, I have come across hum problems that the average recording engineer would not encounter in a lifetime. Somehow I have managed to cure them all by one means or another, but the one thing that gave me the biggest headache was very similar to the one described by Mr. Doe. He mentioned that the building he occupies was built in 1919, which makes it almost as old as Town Hall. In those days, electrical wiring practices were not as strictly regulated as they are today, and as a result grounds were always made in a haphazard manner. It was not uncommon that two sections of the same building had two separate ground potentials. With the need of greater power handling capacity, many old buildings were rewired or wires were added to the existing system, making it even more helter-skelter. In my original microphone lines, if any ground touched any structural metal, all hell broke loose—including some nasty shocks of the 100-volt type. My cure for the problem was to rewire the whole mic system, making sure that no ground was anywhere near a building ground. In addition, I floated all of my equipment grounds. True, I used a lot of wire that way and spent countless hours tracing down ground loops, but in the end I had a quiet system. It appears to me that the high level hum that is causing Mr. Doe to become an aspirin addict could be solved in a similar manner. I am not sure if this will also cure his low level oscillating hum, but I guess it's worth a try.

John H. Sadler
Sadler Recording Service
New York City

Of course, we've all heard stories of musicians who have been zapped by coming between a microphone stand and a guitar amplifier when the grounding system wasn't quite right. The p.a. boys have a lot of fun with this sort of thing every time they set up on a strange stage. Often there's no time to double check for danger spots, but it pays to be careful. If you're working in a studio, as Mr. Doe is, hopefully you can eventually cut/solder all these problems away.

LOW LEVEL HUM

As for that low level hum that comes and goes, ". . . *this too could be caused by his grounding system. He says that his studio is a 4-track one, which brings to mind Tascam's Model 10. This console, as well as several others, is set up as a high impedance unit. Add-on transformers may be used for low impedance inputs, but since this would lend itself to an easy modification to balanced inputs, which Mr. Doe does not use, I would assume that he is still using High-Z microphones.*

"One problem that I have noticed when setting up an occasional High-Z p.a. system for a church or school is that with any appreciable length of cable between the mic and the system

ground, this will place much of the cable's shield a couple of ohms above ground. This allows a small current consisting of whatever hum or other electrical noise exists nearby to flow in the shield. With a long length of cable, the larger capacitance will easily couple this noise from the shield to the center conductor, where it is fed into the microphone preamps and onto the tape along with the desired audio signal.

"Touching the microphone's case (which is electrically a part of this shield) will increase the amplitude of the hum, since the body presents a larger 'antenna' to pick up the noise. This also happens, to a lesser extent, when one's body is moved close to the microphone. This may sound farfetched, but the next time you encounter such a symptom, notice whether or not the hum seems to keep in tempo with the music. Then look out through that glass window. There's probably someone swaying back and forth in front of a mic.

Ken W. English
A.I.M.D. Work Center
NAS, Patuxent River, Md.)

Do you suppose Mr. Doe *is* running high impedance lines? I'd guess that since he is apparently in business with a few engineers on staff, he has at least a semi-pro operation, which would suggest low impedance microphones. On the other hand, he did mention unbalanced lines, so maybe...

Where the hell are you, Mr. Doe?

I don't know if any of this is helping you, but maybe it will serve to remind others that grounding is not to be taken lightly.

Professor Ashley's reference to computer techniques is particularly relevant. I've just come across a book called *Grounding and Shielding Techniques in Instrumentation,* which I will try to read and include in the next book review column, due in a month or two. In the meantime, watch those grounds!

• • • •

P.S. ON THE LONDON TRIP

Since this is being written so far in advance of publication, it's difficult to say for sure if there is any more room on the package trip to the A.E.S. Convention (March 1-9). However, if you're reading this in late January or early February and want to come along, see the December '74 issue for details, and contact the Mirque Travel, 350 Fifth Avenue, New York, N.Y. 10001 *NOW!* Or call 212 PE 6-6338 for last minute information. ■

Goodbye old paint. Hello Oak.

Goodbye leader. Hello new generation.

Our new generation 604-8G has inherited quite a kingdom from the leader. We changed the 604 after 20 years as the standard monitoring reference source. We added a new dividing network that smooths the response in the crossover region, changed the frame and improved the high frequency diaphragm (it's now up 6dB at 15 kHz).

But the 604 is still the 604. The same duplex speaker delivering sparkling highs, clean midrange and exceptional low frequency transient accuracy from a single point source.

Then we developed the new 620A cabinet for the 604 speaker. The 620A replaced our painted old classic 612. Recording studios were spending thousands of dollars to sound and look beautiful. So we made the 620 enclosure beautiful on the outside. In rift-out oak. Add the 604-8G, and it sounds beautiful. In fact, the new combination delivers another full octave of usable low bass to help meet the requirements of the new generation of music. And it's loud, louder, loudest — even after a full recording day.

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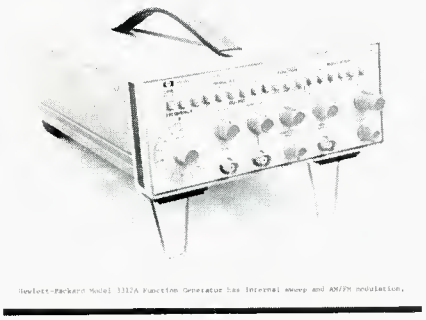
db new products&services

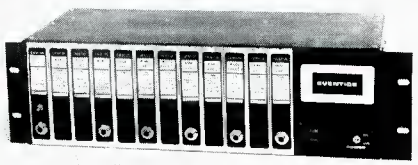
FUNCTION GENERATOR DUO



Hewlett-Packard Model 3312A Function Generator has internal sweep and AM/FM modulation.

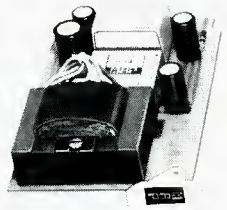
● Two generators in one package provide sine, square, triangle, pulse and ramps, as well as internal sweep, trigger, gate, or burst, the combination designated as model 3312A. The main generator covers 0.1 Hz to 13 mHz in eight ranges, and the modulator generator delivers signals from 0.01 Hz to 10 kHz. The main generator can be triggered or modulated by the modulation generator to provide sweep, a.m., f.m., or tone bursts. Output of the main generator is 10 volts peak-to-peak into 50 ohms for all waveforms with variable control provided by a four-position attenuator. Dial accuracy is ±5 percent of full scale, sine wave flatness within ± (maximum output amplitude) from 10 Hz to 100 kHz and better than ± 10 percent from 100 kHz to 10 mHz. For triangular waveforms, deviation from the best straight line at 100 Hz is less than 1 percent. Using the voltage-controlled oscillator input for external frequency control, a sweep range of 1,000 to 1 can be obtained.
Mfr: Hewlett-Packard
Price: $900.
Circle 40 on Reader Service Card

DIGITAL DELAY LINE



● A plug-in card based system is featured by model C200 digital delay line. The complete unit is determined by selection of these modules, which come in five basic categories: INPUT, TIMING, DELAY, OUTPUT, and SPECIAL. One of each input and timing modules is required and some combination of delay and output, selected as required. The special module is used for interfacing and special analog processing. Delay characteristics are selectable in 7.5 millisecond steps from a minimum of 7.5 ms to a maximum of one output at 907.5 ms. per frame. Greater delay can be achieved by adding additional frames and interface modules. For use in live performances, a microphone mixing module is available, which can preamplify two or four low impedance mics, mix the signals, and apply them to the delay chain.
Mfr: Eventide Clockworks, Inc.
Price: $1,023.00 and up, depending on configuration.
Circle 42 on Reader Service Card

PRINTED CIRCUIT AMPLIFIERS



● Three new printed circuit amplifiers utilize the MAP 1731A audio operational amplifier, from the same manufacturer, as their active elements. The amplifiers are all designed for p.c. card rack or individual mounting. Model AM-27 is a general purpose audio module suitable for low level microphone preamplification. Model ABL-27, with transformer coupled input and output, is designed for amplification of medium to high level (+20 dB) signals or wherever it is necessary to bridge a floating or balanced source. It has an adjustable gain from −7 dB to +33 dB. Model AL-27A is a multi-purpose audio amplification module used in line, booster, differential, or combining amplifier configurations. It has transformer coupled output, adjustable gain/loss up to +47 dB and low noise of −125 dBm.
Mfr: Modular Audio Products
Circle 43 on Reader Service Card

PRODUCTION CONSOLES

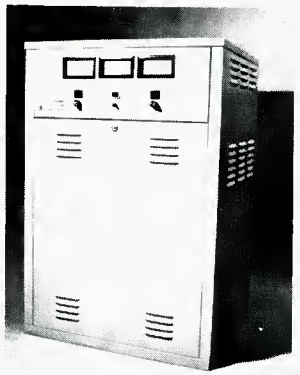
● Modular consoles TV 32 are multiproduct (up to 32) by 4 submaster, t.v. studio and production center units. They contain 20 low-level inputs or 104 high level sources; 4 submaster busses with selection to 2 master busses; echo send on all inputs and submaster; echo return on all submasters and masters; elective group mic muting. 14-band reciprocal equalizers are available on all inputs, as well as cue and selective foldback.
Mfr: Audio Designs
Circle 44 on Reader Service Card

SINGLE-CHANNEL COMPRESSOR/LIMITERS

● Model 160, a pair of single-channel compressor/limiters is continuously variable from 1:1 to infinite compression, with a limiting threshold variable from 10 mV to 3 V rms with a pair of leds to indicate whether the device is operating below or above threshold. The illuminated meter has −40 to +20 dB range with adjustable zero reference and is switchable to read input level, output level or gain change functions. A gain control has a range of −20 to +20 dB. The unit has balanced bridging and 100Ω output with Jones barrier strip terminations and operates at line levels up to +24 dBm in and out. Output is balanced and ground loop compensated. There is a built-in circuit to suppress turn-on and turn-off transients. The manufacturer also offers a simpler model, 161.

Mfr: dbx, Inc.
Price: Model 160: $300.00.
Model 161: $250.00.
Circle 45 on Reader Service Card

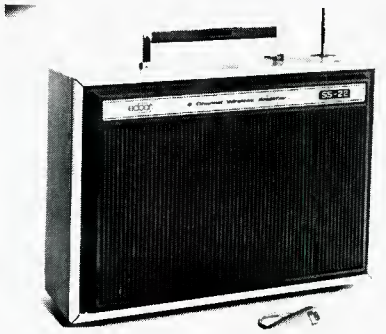
PUBLIC ADDRESS STANDBY



● Emergency a.c. power can be wired into a utility system, powered by solid state generators, known as the SSG system. The system will go into effect 50 milliseconds after utility failure. In large areas, the system can be zoned under separate zone distribution panels connected to the electrical distribution boxes in that area. Available in single, two, and three phase models, in sizes (SS) 200 to 700 watts and (LS) to 10 kW in single phase and up to 30 kW in three phase. SSGs provide 120 volts or 277 volt, 60 Hz power for 1½ hours plus after power failure. Self-checking, the system is controlled by computer logic.

Mfr: Standby Systems, Inc.
Circle 46 on Reader Service Card

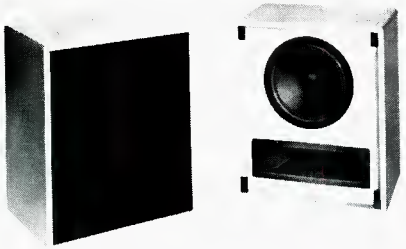
PORTABLE DUAL CHANNEL P.A. SYSTEM



● Convenient in situations where voice amplification is desirable, SS-22 is wireless and portable. Weighing 16 pounds, it runs on standard D-cell batteries or an 110 volt a.c. line and features high fidelity sound quality. Two microphone versions are available, lavalier clip-on or hand held; the microphones have a transmitting range of 100 to 300 feet with a crystal control system. These can be used singly, simultaneously, or in combination with a wired microphone. Applications include function as a complete sound system, a wireless tuner for already existing public address systems, or as an amplifier/speaker for tape or record players.

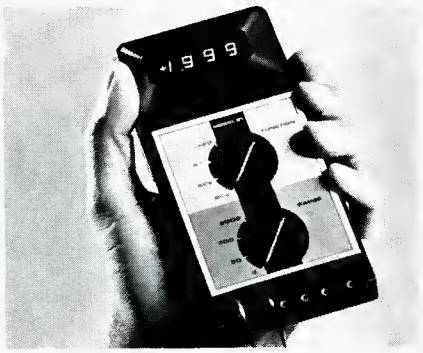
Mfr: Edcor
Circle 47 on Reader Service Card

COMPACT STUDIO MONITOR SPEAKER



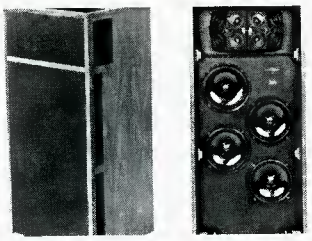
● Designed for applications requiring extended frequency response, low distortion, and wide dynamic range, model 9849A offers this in a small space. The 12-inch bass loudspeaker produces low-frequency response with low distortion, even at high power levels. The dividing network includes an r-c section circuit in parallel with the low-frequency load to stabilize the input impedance of the network at 8 ohms. Frequencies above 1500 Hz are handled by a compression driver mounted on a sectoral high-frequency horn, located close to the low-frequency section. The braced enclosure measures 24 x 20½ x 15¼ inches, made from ¾ inch material.
Mfr: Altec
Circle 48 on Reader Service Card

DIGITAL MULTIMETER



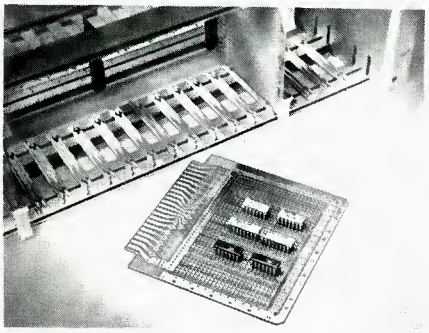
● A palm-sized hand-held digital millimeter, model 21, measures capacitance along with a.c. volts, d.c. volts, and resistance. The instrument has four d.c. voltage ranges with 1 mV resolution; four a.c. voltage ranges with 1 mV resolution; four resistance ranges with 1 ohm resolution; four capacitance ranges with 1 pFd resolution. It has l.e.d. displayed 3½ digit readout (up to 2,000 counts) and simplified five step calibration. Model 21 operates from four rechargeable NiCad batteries.
Mfr: Data Technology Corp.
Price: $269.
Circle 49 on Reader Service Card

MONITOR LOUDSPEAKER



● Intended for monitoring application, high-fidelity loudspeaker Monitor-C employs four eight-inch wide range speakers to provide bass and mid-range tones and eight treble speakers. The bass/mid-range speakers are designed with rigid aluminum cones, intended to prevent "breakup" within the cone and light enough to provide good transient response. The eight tweeters are arranged in a sector-of-sphere configuration; tweeter cones are aluminum. (A characteristic of aluminum is that it is non-hygroscopic, resistant to humidity factors.) Frequency response is 30-to-20,000 hertz. The unit has power handling capacity for 150 watts program power; its nominal impedance is eight ohms. Crossover between bass/mid-range and treble speakers is at 2,000 hertz at a rate of six dB an octave.
Mfr: Bozak, Inc.
Circle 50 on Reader Service Card

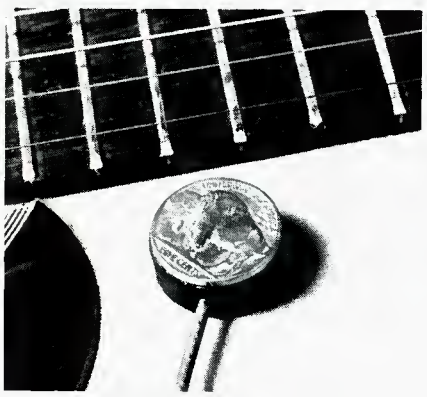
SMALL PLUGBOARD/CAGE



● Economically sized cards, 4.5 inches by 4.5 inches by 1/16 inch, are supported by model CCK13A adjustable cage, 19 inches wide. Six board types provide ground planes, power bus paths, and interconnection pads. Five boards have 0.1 inch spaced 0.042 inch diameter hole patterns to accommodate DIPs; the sixth board has 0.062 inch diameter holes on alternate 0.1 inch centers for discrete components. Contacts are made of epoxy glass. All boards have holes for ejectors. The cage accommodates up to 21 cards, using aluminum card guides.

Mfr: Vector Electronic Co.
Price: Cards: $5.20-$11.65 ea.
Cage: $33.45
Circle 53 on Reader Service Card

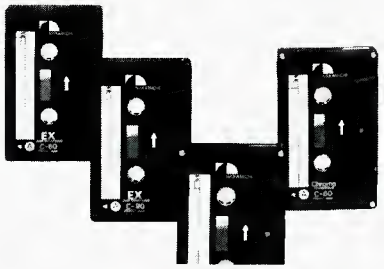
CONTACT INSTRUMENT PICKUP



● The tiny P800 Buffalo pickup, with a Buffalo nickel as a lid, operates on an electret condenser principle and attaches to an instrument with removable adhesive tabs. It has its own power supply, which can be attached to the performer's belt or clipped to a mic stand. Power for the unit's preamp comes from a 9-volt transistor radio type of battery. It's equipped with a standard phone jack. Model P800Z features balanced output and an XLR-3 connector.

Mfr: Group 128
Price: Model P800: $99.50
Model P800Z: $119.50
Circle 54 on Reader Service Card

CASSETTE TAPES



● A choice of two tape formulations, ferrocrystal or chromium-dioxide are offered in this new line of cassette tapes. The ferrocrystal tapes, designated EX, claim improved frequency response, good s/n ratio, enhanced dynamic range and a special binder material to insure even particle distribution. The manufacturer claims that the chromium-dioxide tapes exhibit superiority to iron oxide in frequency response, s/n ratio and extended high frequency output. The tapes are available in C-60 and C-90 lengths.

Mfr: Nakamichi Research
Price: EX: $3.69 & $4.79
Chrome: $4.59 & $5.99
Circle 55 on Reader Service Card

PRODUCT GENERATOR

● Outboard product generator type PG-3 makes it possible to generate the product of two incoming signals, and can achieve tremolo effects, tone modulation, triggered expansion and VCA applications for synthesizers. Integrated circuit technology includes laser trimming and computer aided design. Contained in a standard 3½ x 19 inch rack mounted chassis, the unit has a color-coded front panel.

Mfr: Wattnott Electronics
Circle 56 on Reader Service Card

MILFORD K. SMITH

For Better Broadcast Audio Processing

Station WPGC improved its listening "image" by acquiring some new equipment, experimenting, and modifying. Result: an easily identifiable and more distinct sound.

BROADCAST AUDIO PROCESSING is probably one of the most popular topics of discussion among broadcasters, audiophiles, and hopefully, record producers who care what their final product sounds like when presented to the public en masse via radio. This topic is also easily one of the most misunderstood by many of those mentioned above. Our purpose here is to dispel a few of the myths, point out some of the problems, and hopefully, come up with a few useful solutions.

Many of the techniques discussed herein are currently being employed at WPGC AM and FM in Washington, D.C., where I am chief engineer. WPGC is a 10-kw AM, 50-kw FM stereo operation, which ranks as the number one contemporary station in the nation's capital, and consistently shows up as the overall number one or two station in the market. As such, it typifies the "average" large contemporary station on the air today. Many of the techniques to be described will be of interest to stations of all sizes and formats, but some may be prohibitive to many small facilities, merely from a cost standpoint.

TYPICAL STATION PROBLEMS

Upon my arrival at WPGC, the station was confronted with several problems which will sound familiar to any radio chief who has been part of a competitive top-40 effort. First and foremost, and closest to the heart of any top-40 sales manager or station manager, the station didn't sound loud enough on the air. The complaint was that in car radio pushbutton comparisons, the other contemporary stations in the market sounded louder than we did. One may say, "So what, turn up the volume."

But the top-40 listener is an elusive individual. He tends to jump from station to station in search of the music he likes best. If you can somehow make your station easier to find, it only follows that this dial-spinning person is more likely to find you. Moreover, the psychological impact of tuning in your station and having the music nearly jump out of the radio, is—as strange as it may sound to some not weaned on top-40—not to be dismissed.

In addition to these two somewhat subjective reasons, there are several solid technically defensible ones. First, the level of man-made electrical noise (EMI, QRM, or what have you) throughout your coverage area is constantly increasing. This means that the signal-to-noise ratio is decreasing. In other words, the listener has to try harder to drag you out of the soup. By increasing, and then consistently maintaining, a very high on-air level of modulation and "loudness," you are adding a few critical dB to the diminishing s/n ratio, frequently enough to make the difference between being heard and not being heard.

Considering, for example, a typical signal-to-noise ratio of 9-12 dB present in a city-traffic automobile, this several dB improvement becomes very important. Secondly, some parts of your program material, due to frequency distribution, pre-station processing, etc., may be transmitted at audibly different levels of loudness, although the old vu meter and perhaps even the modulation monitor would hardly give a clue. That leads to a need for continual listener knob-twiddling from program source to program source, and leads eventually to the much fabled, but very real, tune out.

POWER AND LOUDNESS MYTH

Most stations employ at least a minimal audio processing system. Many times this is primarily to avoid overmodulation and resulting citations, but even the simplest system can be optimized to provide the facility with at least some audible benefit.

To start with, let's dispel one popular myth, and this applies to AM and FM stations, although our discussion to this point has centered on AM. Myth: The more powerful your station, the louder it will sound on the air. Not true. For quite some time now, all receivers, both AM and FM, have been equipped with circuits which tend to minimize differences in rf input levels to the sets. In AM receivers they are normally referred to as avc (automatic volume control) circuits, while in FM they are pegged as agc (automatic gain control) circuits.

Provided your station's field intensity over your cov-

Milford K. Smith, Jr. is Chief Engineer at WPGC AM & FM, Washington, D.C.

Disc jockey Jim Collins, who is in charge of the 2-6 p.m. program, is at work in the main control room. In front of him are six stereo cartridge decks used exclusively for all on-air material.

erage area is sufficient (on AM usually 1 mv/m or better; on FM, 50 μv/m for home receivers, 100 μv/m for auto receivers) to fall within the range of these circuits, presto! you are on nearly equal footing with the 50 kw competition, over what we will call your "adequate" service area. Obviously, non linearity in some inexpensive receivers' avc or agc sections may provide some exceptions to the above, but not as much as might first be believed. This, of course, does not mean the "adequate" service area of your kilowatt is ever going to be equal to the 50, but if it covers enough of the market survey area to pull sufficient numbers in the various ratings, the programming department will at least have an adequate tool.

USING AMPLIFIERS AND LIMITERS

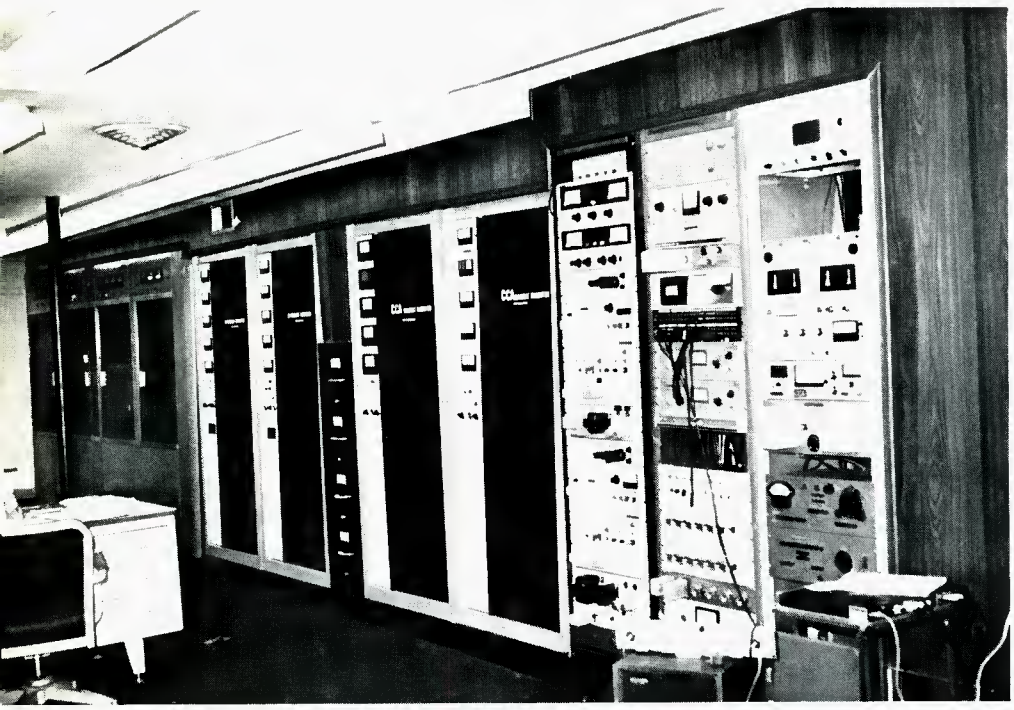
Okay, you suddenly have a better signal than you thought. Now what? Nearly every station has at least some sort of peak limiting amplifier and most have an agc amplifier to stick between the console and the limiter. Already some problems begin to develop. Many stations are using their limiters as agc amplifiers and some their agc amps as limiters.

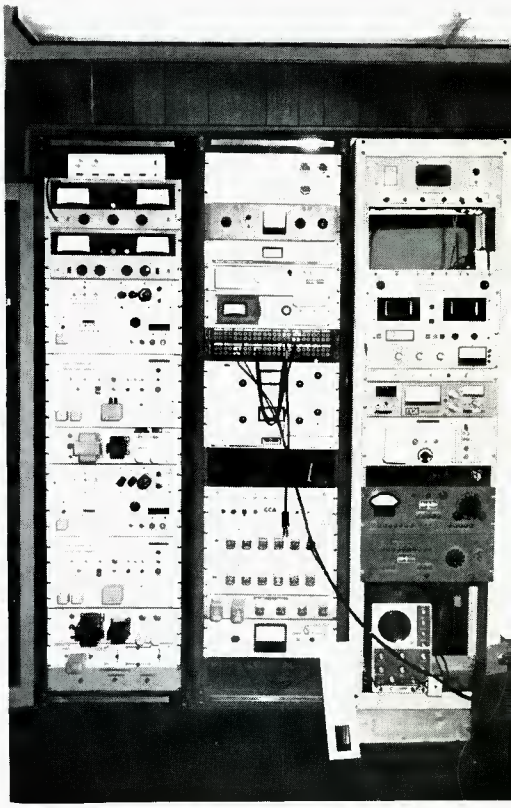
Briefly, an agc amplifier (such as the CBS Audimax, probably one of the most popular units in use today) is a gain-riding device which is designed to follow and control *average* program levels. A limiter is meant to control *peak* program levels. If your agc amplifier is not providing enough control for your particular programming, (i.e., it isn't responding fast enough to level changes or, conversely, is responding too fast) don't use the limiter to compensate. Far too many rock stations let their limiter provide 5-15 dB (or more) of very rapid agc action, which although very desirable in this format, should not be done with the limiter. It causes the limiter to operate off the optimum portion of its curve, and when an actual peak does occur, provided it gets caught at all, it's instant distortion.

Most agc amps, including the latest CBS series, have adjustable controls for rapidity of agc action. These should be carefully set to achieve the desired agc action, consistent with the demands of the program material and the wishes of the programming department. Don't regard the instruction book as god. Your own ears are the best tool you've got. In a top-40 situation, the Audimax alone may very well not provide the degree of compression desired. Don't try to make up for this by pegging the Audimax (or whatever) at the end of the scale. Get another specialized compression amplifier to follow the Audimax, and provide the amount of gain reduction you deem necessary.

WHAT SOME STATIONS DO

At the opposite end of the scale are the stations which seem to feel that the agc amp should be used like a limiter. These are primarily easy-listening or good-music stations who seem to adjust the agc amp so it barely comes off the right hand peg on the highest portions of the program material. Running an agc amp on this end of its control curve is nearly as bad as the converse. These units tend to be optimized both so far as s/n and distortion to work in the mid-portion of their curve; in addition, the gated units (Audimax) will perform their proper func-





Wall panels showing two f.m. transmitters, exciters, stereo generators, and monitoring equipment at WPGC. At right is a front view of the section that has three racks holding monitoring and audio-processing equipment.

tion, as far as nonpumping and return to zero gain is concerned, only when operated within the intended portion of their curve.

Again, the key here is knowing the unit thoroughly. A station of this type may well want slow age action, which can and should be selected with the switches provided, or in earlier units by means of circuit component changes detailed, rather than by backing off input level. In the case of a classical station, of the purist variety, no agc amplifier at all may be a wise choice, especially with the idea of preserving total dynamic range on FM, although many times the dynamic range of the program material may exceed that of the transmission medium.

On AM, though, even with a classical format, it seems that some agc action is a necessity. A complete guide to agc amplifiers and their individual applications, insofar as formats are concerned, is beyond the scope of this article. With the strides being made in audio processing during the past decade or so, it is always wise to keep abreast of what's in the market place, that knowledge may do your facility much good.

USE OF AUDIO LIMITERS

The second major audio-processing item used by nearly every station is the audiolimiter. Let's first consider limiters for AM. Again, the limiter is a peak-control device. It may, depending upon the manufacturer, be able to provide a small amount of rapid agc action, but that is not its primary purpose. There are roughly 50 limiters now available to the broadcaster. The CBS Volumax is very widely used. Most feel that it is a good all-round unit. Unlike the typical recording limiter, there are a number of specialized things going on in the state-of-the-art broadcast limiter. Nearly all of them are vital to producing a good on-air product. The first of these features is switch-selectable assymetrical modulation.

Until recently, the FCC placed no limit on the amplitude of positive modulation of an AM signal. Although this loophole has existed for decades, it was only during the last decade or so, with the increasing interest in broadcast audio in general, that it was widely exploited. I personally, have redesigned transmitter modulators to provide over 200 percent *consistent* positive peak modulation, with an increase in on-air modulation level that must be heard to be appreciated.

Unfortunately, to achieve this degree of super modulation, there are numerous other considerations which must be met to provide a clean signal, free of distortion. Nearly everyone wanted the super modulation, few wanted to do it right. As a result, transmitters with marginal modulators were badly overdriven, additional interference was created, and the Commission acted. Super modulation today sets a limit of 125 percent on positive peak modulation (the limit on negative peaks remains at 100 percent), a two dB asymmetry allowance between the peaks of different polarity.

During the heyday of super modulation, at least two limiters were brought out to aid very much in the transmission of greatly asymmetric program material. Both had peak polarity-sensing circuits to sense automatically the peak with the greatest excursion and, if it was not going positive, flip the limiter's polarity temporarily and make it positive. In addition, both had switch-selectable functions allowing asymmetrical limiting and clipping. These units, while causing smoke to pour out of transmitters when utilized in an "unlimited" positive peak situation, do not, in my experience, provide maximum modulation under the current regulations. In addition, their peak-phasing circuits are nearly useless on well limited recorded material such as found on most contemporary discs today. Thus, they do provide an asymmetric output on voice or other asymmetric material, but a minimum of 70 per cent

of our program material is well limited top-40 music, and thus there is no benefit.

WE EXPERIMENTED, MODIFIED

All is not lost, however. These are all still excellent limiters. And, except in a highly competitive situation, the maintenance of continually asymmetric modulation is not a necessity. At WPGC, we found ourselves in such a situation. After experimenting with a number of limiters, we finally settled on a unit of somewhat older design with a limiting section similar to the newer units (1-2 millisecond attack time) and a clipper section which was originally switch-selectable for negative only or symmetrical clipping. The unit was modified to provide for a continuously adjustable desensitizing of the positive clipping rectifier. In addition, the unit was already equipped with a continuously adjustable clipping level control. In other words, we had a continuously adjustable ratio of rms to peak limiting and a continuously adjustable ratio of positive to negative peak limiting.

The unit, with this modification, consistently outperforms competitive units. The only trade-off has been a slight increase in harmonic distortion, which is still less than the 1.5 per cent or so distortion in the 10-kw modulator. With the poorly designed audio sections in most AM receivers today, the difference is not only inaudible, but unmeasurable. UREI has now introduced this unit as their model BL-40. We have one in use here at WPGC and this unit allows a station to maintain continuous asymmetrical modulation without resorting to clipping circuits.

FM LIMITING DIFFERENT

Limiting on FM must be treated somewhat differently compared with AM. There is no place in FM broadcasting for brutal limiting action. That simply isn't necessary to achieve the desired results.

In FM, though, we have a problem not encountered in AM, that of the 75 μ/sec. pre-emphasis curve. Any strictly linear limiting action will do very little towards controlling the high-frequency peaks which can overmodulate the carrier by 300 percent or more when modulating 100 percent at low and midfrequencies. The CBS Volumax FM limiter, as well as a number of competitive units, compensates for this by passing the flat line-level audio through various stages which compensate for the 75 μ/sec. pre-emphasis by altering the frequency content of the program material at an inverse rate of the slope of pre-emphasis curve.

That, of course, involves some trade-offs in loss of program brilliance, depending on the extent of limiting action, but seems to be the best compromise at the moment. The most recent CBS units (4110 series) utilize frequency selective limiting on the low, mid-high and high frequencies, and achieve as uncolored a limiting action as would seem possible in light of the problem. Perhaps a better solution would be to adopt the Dolby proposal, allowing a relaxation of the pre-emphasis curve to 25 μ/sec. pre-emphasis due to the high-frequency boost of the Dolby.

CHOOSE MODERATION

Again, the word on FM limiting is moderation. Overdriving an older Volumax will severely deaden the high-frequency program content. Your listeners will not tolerate this to the very great degree that it is often done. Our experience at WPGC shows that overdriving the new Volumax will cause the upper highs to increase in amplitude as referenced to the lower frequencies. The message is clear.

At WPGC, we desired to obtain a small amount of additional compression on the FM side, and also a small amount of upper high-frequency peak reduction, over and above that provided by the Volumax. With our type of program material, a slight reduction of the over-10-kHz component has practically no effect on the musical content of the program, and has considerable benefit in allowing us to run a much higher level of modulation without having the average level held down by high-frequency, short-duration peaks.

We chose the Teletronics LA-2 for this chore. The unit provides some of the smoothest compression available by virtue of its optical/electrical limiting system. Additionally, it provides adjustment so that it is more sensitive to high frequencies than low, thus providing the desired high-frequency control and compression. This, too, gets us away from the utilization of any fixed high roll-off filters which are obviously not amplitude selective and do considerably more damage to the program material.

THE PHASE-SHIFT PROBLEM

One additional note on FM limiters. That is the phase-shift problem often encountered in FM stereo installations which precludes meeting the 40-dB (minimum) stereo crosstalk figure (this is L+R into L−R crosstalk and vice versa, not left-right separation). It is nearly always desirable to take the pre-emphasis networks out of each channel of the stereo generator and remove the de-emphasis networks from the output circuits of the Volumax, or other final limiting amplifiers.

That, and a helpful telephone company which is able to give you two equal length, equal gage circuits, will normally enable you to control system phase to within 1 percent, the necessary tolerance to meet the aforementioned minimums. While that is not an FCC required specification, it is vitally important in the transmission of realistic FM stereo programming. Needless to say, proper stereo generator adjustment, transmitter tuning, and antenna VSWR are also important but beyond the scope of this article.

To this point we have dealt primarily with the basics of broadcast audio processing—the factors that will help you deliver a good, clean, full, optimum modulated signal. Many stations seek no more than this from their processing chain; some seek considerably more, and this is where the disputes start.

There are two theories on this matter. One holds that the transmission medium should be an uncolored pipeline from disc to listener. The other feels that the program material can be considerably enhanced through various techniques, and prove a more attractive and better sounding product for the listener.

A DISTINCT ON-AIR AUDIO SIGNAL

At WPGC we were out to create a very distinct sounding on-air audio signal. We wanted to tailor this audio to complement the mean quality of the listening systems in use and to provide the station with an on-air identity so that when tuned to WPGC there would be no doubt in the listener's mind. We also wanted to preserve to the greatest possible extent the transmission quality of which the medium was capable and to provide by programming a general similarity of sound between the AM and FM facilities (simulcast).

Of the many contemporary stations in the D.C. area, not one was using an on-air reverb of any sort. That seemed to be a good starting point. We were determined *not* to end up with the Grand Canyon type of reverb so prevalent in the past and unacceptable today. After careful evaluation we selected what, at the time, appeared to be the best reverb unit available, the EMT 140TS, a unit with which most of our recording industry readers are undoubtedly very familiar. This unit was equipped with a custom-designed control center and was added to both FM and AM program. Since this was a true stereo reverb, we received numerous calls immediately after installation commenting on the "improved stereo" (this, in spite of a 40-dB plus channel separation before the installation). It did not sound canyon-like, listeners said, and it added a nice fullness to the announcers' voices. Somewhat more reverb was added to the AM side than the FM, but this, too, was not of the '60s style and was most welcome. Due to the various phase relationships occurring in the reverb unit, a considerable amount of L−R material was generated even by a totally L+R (mono) system input. That, too, added to the total stereo promotion push.

TURNTABLES AND SOURCE NOISE

In FM, perhaps nothing is so annoying as bad turntable performance. Very likely, most of the stations currently are operating with sub-par turntables. We did not skimp in this department. We purchased EMT-930 stereo tables and from the day of installation, any complaints of rumble or flutter have stopped. We have taken the liberty of running these tables several rpm's fast to provide a faster on-air presentation of the music. Once a listener has heard a record on WPGC, it appears to "drag" on other stations. I would heartily *not* recommend this for any but a competitive top-40 operation!

Another major problem in top-40 FM, is that of source noise. Record scratch, cart machine hiss, hum, even line noise, on our rather lengthy telco circuits can be very intrusive and annoying to the listener. After having initially tested the Burwen Model 1000 noise filter in New York City, I was already sold on this amplitude/frequency sensitive noise suppressor. It performs magnificently, and increases your apparent s/n ratio by 8-10 dB just by inserting it in the line. I heartily recommend that any FM station interested in good sound try this unit.

OTHER IMPROVEMENTS

Most recently, we have added a Garron Phase Enhancer to the FM program and the AM mix to compensate for any phase error in the stereo carts utilized for over half of the program material. The adjustable Marathon carts we use provide excellent phase stability, but occasionally a slightly out-of-phase cart will show up. This unit also maximizes the FM L+R, making for optimum mono listening.

In an effort to compensate somewhat for the poor quality of the average AM radio, we added a CBS dynamic presence equalizer and a Fairchild Dynalizer. The presence equalizer provides an adjustable dynamic mid and upper-mid frequency boost that gives all program material a nice sock in the presence range and corrects for any muddy on-air material. The Dynalizer is used sparingly to extend the high end slightly higher (+5 dB up from 1 kc at 10 kc) and also to reinforce the ever important low end (about +4 dB at 100 Hz.). This action too, is dynamic if the program material already contains what we consider to be adequate compensation. There is no action from either of the two mentioned units. We come off as a very bright, full sounding AM station. Other AM programs come off sounding somewhat muddy and indistinct in comparison.

This then, is audio processing at WPGC. Hopefully, a few of the ideas here may prove useful to you, others may leave you shaking your head, and, that is as it should be. Audio processing at a broadcast facility is an attempted solution to many problems and individual wishes. It should be as unique as the station. These are some of the solutions we have found. Good luck with your own! ■

An overall view of the production area.

db Visits— Robins-Fairchild

From poor relation in the back of a camera company to one of the audio industry's most prestigious names, Fairchild Sound is synonymous with the history of the audio industry.

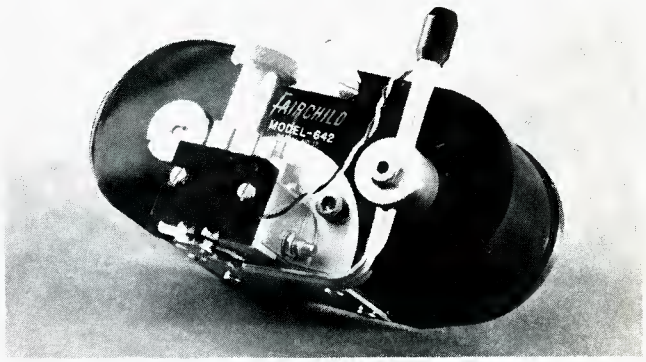
GLENN D. ROGERS

OPERATING FROM an ultra-modern plant in an industrial park in Commack, N.Y. just a bit east of the **db** offices on Long Island, Fairchild Sound Equipment Corp. maintains a position of leadership in technological development that extends back to the earliest days of the audio industry in the 1930's. The firm merged with Robins Industries in 1971 after the death of the founder, Sherman Fairchild. The merger has proven to be a fruitful one for both companies, dovetailing Robins' consumer production know-how and Fairchild's professional output in a harmonious sharing of research facilities and manufacturing plant.

On a recent visit to the plant, we were met by amiable Rick Belmont, the Fairchild sales manager, who guided

The plant in Commack.

Steve Friedman hard at work in the engineering department.



This is one of the earliest stereo cutter heads, Fairchild model 642. It was the first compatible stereo record system of its kind. (Photo courtesy of George Alexandrovich.)

us through both the Robins and Fairchild operations, with a running commentary that interwove descriptions of tomorrow-based research with vignettes of the past. We were joined by George Alexandrovich, Robins-Fairchild's V.P. of engineering and frequent contributor to **db**'s pages. George explained the easy transition that combined Fairchild with Robins. "Hy Post (president of Robins) and I have always kept in touch over the years with technical ties. This made it possible to move right into sharing facilities."

Robins manufactures many fine consumer accessory products and also makes punched tape and related items for the computer field. Although Fairchild's output is quite different, running to consoles, the two companies find common ground in the use of inventory area, shipping facilities, and the use of an impressive IBM computer. The complete and increased manufacturing facilities resulting from the merger now enables Fairchild to manufacture many of its own parts.

FAIRCHILD'S BEGINNINGS

Fairchild Sound was originally part of the Fairchild Camera and Instrument Corporation, of Jamaica, N.Y. Their products at that time included turntables, transcription arms, and related equipment. Gradually, as demand increased, the audio arm of Fairchild began to acquire prestige in its own right, known for sophisticated, innovative equipment. The sound division of Fairchild Camera was one of the first three companies in this country to develop tape machines, all of which were based on the German *Magnetophone*.

Finally, in 1948, the audio operation became autonomous, under the name of Fairchild Recording Equipment, moving to Whitestone, N.Y. The first professional tape machine was sold in 1949, volume reaching 100 in the first two years. By 1954, Fairchild was well established in the tape recorder business. In conjunction with this area, they developed pickup cartridges, designing the first reliable miniature moving coil cartridge, which became famous in both the professional and the high fidelity industry.

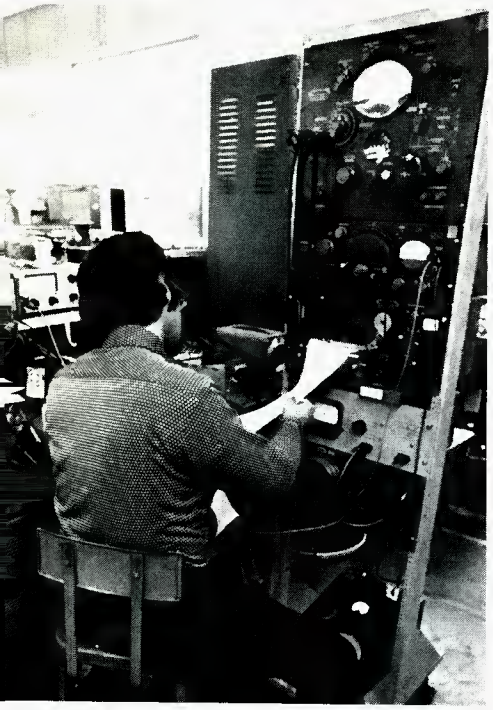
During the mid-fifties, the company dropped many of its professional audio products in order to concentrate on the burgeoning high fidelity demand. Until 1961, the firm was known for quality turntables, arms, amplifiers, etc. in this field. Beginning in 1957, after moving to Long Island City, they branched out once again into professional audio, along with their hi fi products. They developed the first compatible stereo moving coil cartridge for the recording trade, as well as a stereo cutting system and a new professional turntable, plus many other products. As the Fairchild name gained significance in professional audio, concentration became more and more centered on the professional products.

In 1961, Fairchild developed its first transistorized audio line, a development that marked the beginning of the concept of a complete audio channel. Many of these products included the first use of LDR's for controlling audio signals, the forebear of the firm's Lumiten.

Such original products as remote control boards, audio processing cards, Lumiten attenuators, portable mixers, and specialized circuits, including the Ambicon and Reverberton came from the designing boards and production lines of Fairchild Sound.

CONSOLES OF EVERY KIND

Now, in their spacious 50,400 sq. ft. plant, Fairchild continues to turn out quality products, in the forefront of innovative production. Rick pointed out the 30000



The engineering lab uses an automatic frequency spectrum analyzer to check out prototypes.

Series 30000 compact broadcasting consoles ready for shipment.

A bird's eye view of the WKRC card files being mounted in their rack.

series of compact 8- and 5-channel broadcasting consoles, in varying stages of completion. These consoles use Fairchild's new RS-1000 (rotary sliders) sealed faders, inexpensive but very quiet, incorporating Allen-Bradley pots, a Fairchild exclusive.

Fairchild is also proud of their FPC-50 portable mixing console, which features 16 channels in and 8 out. Really compact, it measures only 27 x 28 x 2 inches and weighs 52 pounds. On the other end of the scale are their large custom consoles.

NOTABLE CUSTOMERS

Fairchild's reputation for quality and individualized service has brought them a clientele that reads like a *Who's Who* of the pro audio industry. One project they're deep into now is a custom remote control console, using Lumitens, for the Busch Gardens' Globe Theatre in Williamsburg, Virginia. This system will be the first to use a remote light-activated board in conjunction with a complete special effects and decoder system.

While we were chatting with console project engineer Steve Friedman, a customer, Ken Burros of Creative Theatrical Services in New York and Las Vegas, dropped in with an FPC-50 console for its two-year checkup. Ken's company does sound reinforcement for people like Steve and Eydie Lawrence, Tom Jones, and other top entertainers in Las Vegas and on tour. He had just finished working out the sound on Frank Sinatra's live performance at Madison Square Garden in New York City. His FPC-50, he told us, had once fallen from a plane during unloading (a drop of about 25 feet). He took it right to the job, set it up, and it still worked fine!

Other notable customers who use Fairchild products include NBC-TV, New York City (six wrap-around consoles), KCBS AM-FM, San Francisco (seven consoles), the U.S. Army Band, and scores of other well known broadcasting stations, studios, and users of public address systems. Under asembly now is a remote system for station WKRC, a Taft station.

MOVING AHEAD

Fairchild production at the present time is directed mainly at the custom designing of broadcasting, sound reinforcement, and recording equipment, with the bulk of the work ordered by the broadcasting industry, for whom they also manufacture stock items such as monitor amps, pre-amps, reverbs, circuit cards, attenuators, and other associated products.

On the drawing boards, according to George Alexandrovich, are a number of new products. "We're going to incorporate more advanced circuits with the use of i.c.'s and other technical improvements in the near future." He went on to add that Fairchild will seek new levels of marketing in sound reinforcement and more complete pre-packaged consoles for broadcasting. He sees an increased market for pre-built off-the-shelf products.

We left Robins-Fairchild with a satisfying sense of continuity, a good feeling in the midst of the shifting patterns of today's economy. From a timid "also ran" attached to a mother company to a prestigious position as one of the mainstays of the professional audio industry has been a big climb for Fairchild Sound during the past forty years. A creative attitude correctly foreseeing needs in the industry, plus a solid underpinning of service, has made this climb possible. We cannot help but feel that these values will continue to be the real basis for success. ■

MICHAEL RETTINGER

Recording Studio Acoustics, part 4

Resonance can be enhanced through judicious use of acoustic devices and certain building materials—slat absorbers, splays, suspended ceilings. Recheck your reverberation time after construction.

MARCUS VITRUVIUS POLLIO was a Roman engineer, architect, and acoustician who lived about 25 B.C. He wrote a treatise of ten books entitled *De Architecture,* in which the following text occurs:

> "7. Some will perhaps say that many theatres are built every year in Rome, and that in them no attention at all is paid to these principles of acoustics; but he will be in error, from the fact that our public theatres made of wood contain a great deal of boarding, which must be resonant. This may be observed from the behaviour of those who sing to the lyre, who, when they wish to sing in a higher key, turn towards the folding doors on the stage, and thus by their aid are reinforced with a sound in harmony with their voice. But when theatres are built of solid materials like masonry, stone, or marble, which cannot be resonant, then the principles of the '*echea*' must be applied."

The term echea refers to sounding vessels proportionate to the size of the theatre, constructed in niches between the seats, and facing the stage. Today we call such accoustic devices Helmholtz resonators, of which one commercial version goes by the name of Soundblox. Also, we

Michael Rettinger is a consultant on acoustics based in Encino, California.

have learned to use such devices as low-frequency sound-absorbents, in compensation to the reduced absorptivity which commercial acoustic tiles and plasters exhibit at the low frequencies. But the use of wood as a satisfying building material in concert halls still holds. It is without substitute because of its non-homogeneous composition, in distinction to plastic and metals, for which reason phenolic and aluminum violins have not been able to please any one.

SLAT ABSORBER PRACTICAL

A type of Helmholtz absorber known as slat absorber is frequently seen in American and European recording studios. Details of the unit appear in this writer's book, *Acoustic Design and Noise Control*, available through the offices of **db** magazine and will only be illustrated here.

Of the three Helmholtz resonators shown in FIG. 1, only Type C, the slat absorber, is really practical. The reason is that the low-frequency absorption of such a device is spread over a wide band of frequencies, while Type A and B are tuned to a narrow spectrum. Note how the slots of Type C vary in width and the space between the slats and the back wall varies in depth. Interestingly, the narrower the slots, the lower is the resonance frequency of the device. The reason is that this frequency is proportional to the area of the "mouth" of the unit and inversely proportional to the volume V behind the slats. Hence the deeper this space and the smaller the openings, the lower is the frequency where absorption takes place.

Note also the application of the sound-absorbent blanket or board directly behind the mouth of the unit, and not on the backwall, for most effective absorption. In practice the device can be made highly attractive by employing hardwood slats, stained and varnished, and an acoustic material behind the slats which is dark, like Owens-Corning Duct Liner, 1 in. thick, with its treated side facing the studio, so as to minimize the shedding of glass fibers. The top of the unit should be closed, and the entire assembly may be installed vertically or horizontally, that is, the slats may extend from floor to ceiling or they may run horizontally along the walls. The slats should be at least 1 in. thick; 2- or 3-in. thick slats are even more absorptive. There is no simple explanation why a little slot should absorb so much sound unless we assume that it acts as a sink for nearby air particles whose vibrational energy is changed into heat by their action in the slot against the absorbent.

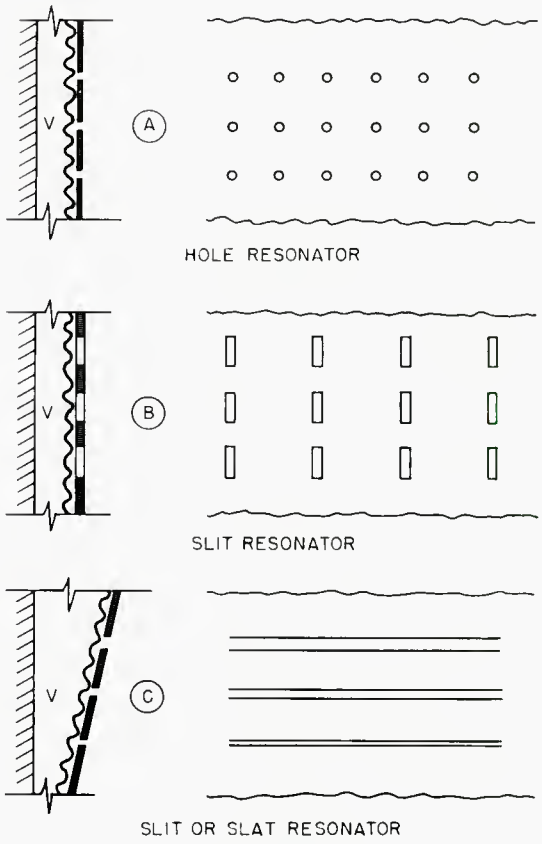


FIG. 1. Various types of Helmholtz resonators used as low-frequency absorbers.

EFFECT OF OTHER MATERIALS

The use of cylindrical wood splays in a recording studio is another preferred installation. It ensures the high-frequency resonance Vitruvius noted, provides a wide reflected wave front, and acts as a low-frequency absorber. They may also be constructed attractively of hardwood plywood. Spaced from the wall, these units may have a convex reflective surface and a flat absorptive back. Mounted on a vertical shaft resting on roller bearings, such splays can be rotated either manually or by an electric motor. In the scoring stage of the Burbank Studios in Hollywood, each side of the stage is furnished with six rotable splays, 6 ft. wide and 20 ft. high.

Petzold splays consist of vertical triangular columns, with every one of the three sides finished with a material of different absorptivity, from near .05 (plywood) to .90 (1-in. thick fiberglass).

The use of drapery for the achievement of variable reverberation is to be discouraged because such materials are extremely absorbent for the treble and little absorbent for the bass. Also, most such fabrics are not fireproof, gather dust, and can rarely be adjusted to the same position twice in a row.

If the floor of the studio is hard, as it should be to allow the preferred first reflections from the area of the instruments (for which reason many people like to sing in a shower), the ceiling should carry some absorbent material. Here one must be careful, if alternate hard and soft surfaces are employed, that the reflective ceiling panels are not parallel with the reflective floor, to avoid multiple or flutter echoes between these surfaces. Almost always, the rear wall of the studio (the wall the band faces)) should carry a highly absorptive material to minimize the "round-the-room" reflections so well liked in concert halls, but which are of little use in recording studios.

USE OF SUSPENDED CEILING

Another way to achieve high absorptivity for the bass in a recording studio is to employ a suspended acoustic ceiling so prevalent in offices for the same reason. The ceiling also hides unsightly air-conditioning ducts, electric conduits, pipes, and it allows recessed lighting.

FIG. 2 shows the absorptivity characteristics of ¾-in. thick Owens-Corning unpainted linear glass-cloth faced ceiling boards (one of this writer's favorite acoustic products) when installed on AIMA (Acoustical and Insulating Materials Association) mountings 2, 4, and 7. Note the dip in the curve at 500 hertz when the fiberglass panels are located 14 in. from the hard backing, and the peak of 250 hertz. The reason for the dip is that the 14-in. deep airspace corresponds to one-half wavelength of 500 hertz

(continued)

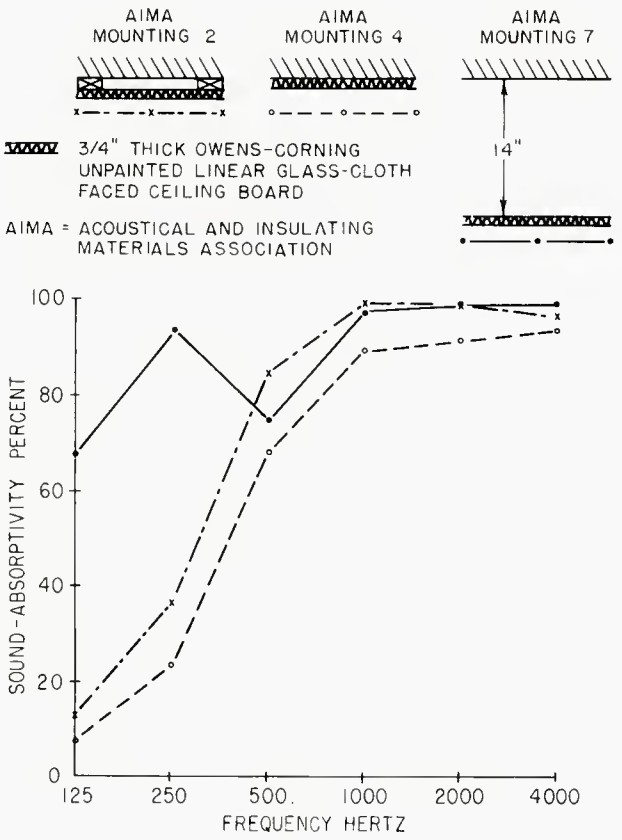


FIG. 2. Absorption characteristics of ¾"-thick acoustic panels on various mountings.

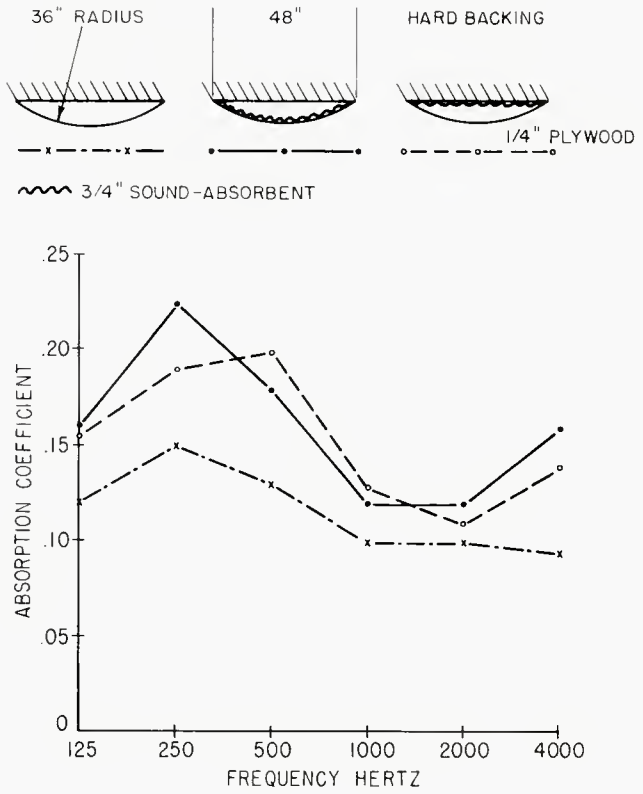


FIG. 3. Absorption characteristics of various plywood splays.

much as the peak corresponds to a quarter-wavelength of 250 hertz.

At a quarter wavelength the reflected sound has maximum air particle velocity, so that much of the vibrational energy of the wave can be converted into heat by the frictional resistance of the intercommunicating channels of the porous material. Similarly, at 500 hertz an interference effect exists between the direct sound entering the ceiling panel and the sound reflected from the concrete structural slab above the panel, and a dip results in the absorptivity characteristic. That is so for all types of porous panels with a deep airspace behind them and is not confined to the product illustrated. The dip in the curve can be minimized by slanting the ceiling so as to vary the air-space behind the panel and by applying a sound-absorbent material to the underside of the structural slab.

FIG. 3 shows the absorptivity characteristics of plywood splays employed so extensively in recording studies.

CHECK REVERBERATION TIME

The condition of a highly absorptive rear wall in a studio as well as the hard-floor, soft-ceiling combination introduces a somewhat non-uniform distribution of the acoustic material. Architects, studio engineers and others instructed in the Sabine and Eyring reverberation time equations and called upon to design a recording studio will find that discrepancies in the reverberation time can occur between the calculated period and the value finally measured in the room after construction.

For this reason their calculated times should be spot-checked with the more complicated Fitzroy* reverberation time equation developed for such cases of non-uniform absorption. If this difference is large, the Fitzroy equation should be employed in the design calculations because it is in better agreement with empiric data for rooms exhibiting walls with concentrated absorption.

The Fitzroy equation may be written in two forms, which tend to deliver very similar results, except in the case of anechoic chambers whose reverberation time is less than .1 sec. The equations are:

$$T' = \frac{0.049V}{S^2}\left[\frac{x^2}{A_x} + \frac{y^2}{A_y} + \frac{z^2}{A_z}\right]$$

$$T'' = \frac{0.049V}{S^2}\left[\frac{x}{-\lg(1-\bar{a}_x)} + \frac{y}{-\lg(1-\bar{a}_y)} + \frac{z}{-\lg(1-\bar{a}_z)}\right]$$

where $\lg = \log_e$
V = volume of room, cu.ft.
S = total interior room surface, sq.ft.
x and y = total area of each pair of parallel sidewalls
z = total area of floor and ceiling, sq.ft.
A_x, A_y, A_z = total absorption of x, y, and z
$\bar{a}_x$, $\bar{a}_y$, $\bar{a}_z$ = average absorptivity of x, y, and z.

■

*J. Fitzroy, "Reverberation Formula Which Seems to Be More Accurate with Nonuniform Distribution of Absorption," *Jl. Acoust. Soc. Am.*, V. XXXI, No. 7, July 1959, p. 893.

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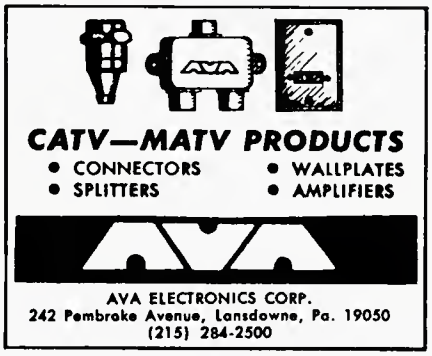

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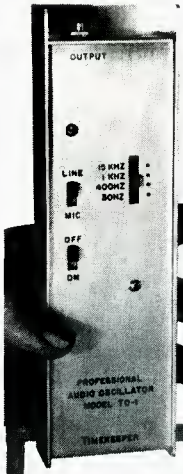

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WANTED: FOR NORTHWEST AUDIO DEVELOPMENT, Phase 8 console: schematics, spare modules, or any information whatsoever. **Cliff Petroll, Charles Lane Studios, 7 Charles Lane, New York, N.Y. 10014. (212) 242-1479.**

WANTED: AMPEX SPEAKER/AMPS. A-692 series; new condition. **Audio Applications, 5½ Dorr Dr., Chepachet, R.I. 02814. (401) 568-5757.**

WANTED: Scully, Ampex, or other two- and four-track; good condition only; must meet specs. Also equalizers, compressors, etc. **David Coulter, (212) 679-7900.**

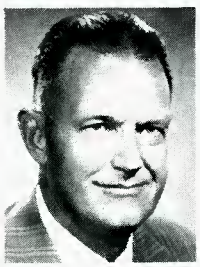
EMPLOYMENT

EXPERIENCED SOUND ENGINEER needed for 16-track studio: must have considerable knowledge in the music field; some maintenance experience needed; must have neat appearance and congenial personality. Submit resume and salary expected to **Box 22, db Magazine, 1120 Old Country Rd., Plainview, N.Y. 11803.**

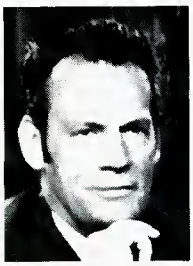
RADIO NETWORK has opening for Broadcast/Recording engineer with five years' experience in radio drama production, music recording, and multi-track work and field remotes. An EOE and affirmative action employer. Eastern area. Send resume and list of production credits to: **Personnel Office, National Public Radio, 2025 M St., N.W., Washington, D.C. 20036.**

POSITION DESIRED: Recording experienced on A.P.I. and Ampex. Career position desired; wiling to relocate if offer secure. References. **Mario J. Salvati, 271 Third Ave., West Babylon, N.Y. 11704. (516) 893-0266.**

db people/places/happenings



MASON



HODGES

CROWELL

SMALL

● **Kenneth M. Mason** has been elected president of the **Society of Motion Picture and Television Engineers.** He will serve a two year term. Mr. Mason is an assistant vice-president of **Eastman Kodak Company** and general manager of the company's motion picture and audiovisual markets division. He has been with the firm since 1935, except for a period of service with the Navy during World War II.

● **Marvin P. Hodges,** coming from **Eastman Kodak,** has been appointed president of **International Audio Visual, Inc.** of Seattle, Washington. Mr. Hodge will be involved with the company's new line of 16 mm. sound projectors and Continu-Sound, a line of miniaturized continuous loop tape equipment.

● An aspect of the television industry, in the private sector, has been tapped in a recent agreement between the **Xerox Corporation** and **Cramer Electronics** of Newton, Massachusetts. The contract is for video equipment to be used by Xerox to establish the Xerox Private Television Network, a communications system within their Information Systems Group. The Cramer firm, under the project direction of **Marty Strauss,** made a study of Xerox' particular needs and will supply the equipment necessary to tailor the private t.v. system to its particular requirements.

● **La Salle Audio** of Chicago, has announced the opening of a branch office in Teaneck, N.J. under the management of **Irv Joel,** who comes from **A & R Recording. Howard Lieberman,** also formerly of A & R, will be sales engineer for the new office. The New Jersey headquarters will service the northeastern states, including the New York metropolitan area. The address is P.O. Box 373, Teaneck, N.J. 07066.

● A newly created position, technical assistant to the president, at **Amperex Electronic Corporation** of Slatersville, N.Y., has been filled by **Dr. Merton H. Crowell.** Dr. Crowell will be in charge of researching product needs in the field of electron tubes, semiconductors, integrated circuits and electro-optical devices. He is well known for his work in solid state electron tube technology and research, especially in the area of camera tubes and image intensification. Dr. Crowell comes to Amperex from **Philips Laboratories.** Previously to that, he was with **Bell Telephone Labs.**

● **Eric Small,** Broadcast Audio consultant, has moved to San Francisco from New York. His new address is 271 Columbus Ave., San Francisco, Ca. 94133. Mr. Small is representing **Nippon Columbia** in the **National Quadriphonic Radio Committee** tests being conducted in the San Francisco Bay area. He is also serving as technical consultant to the **Corporation for Public Broadcasting's** special project on radio for the print-handicapped.

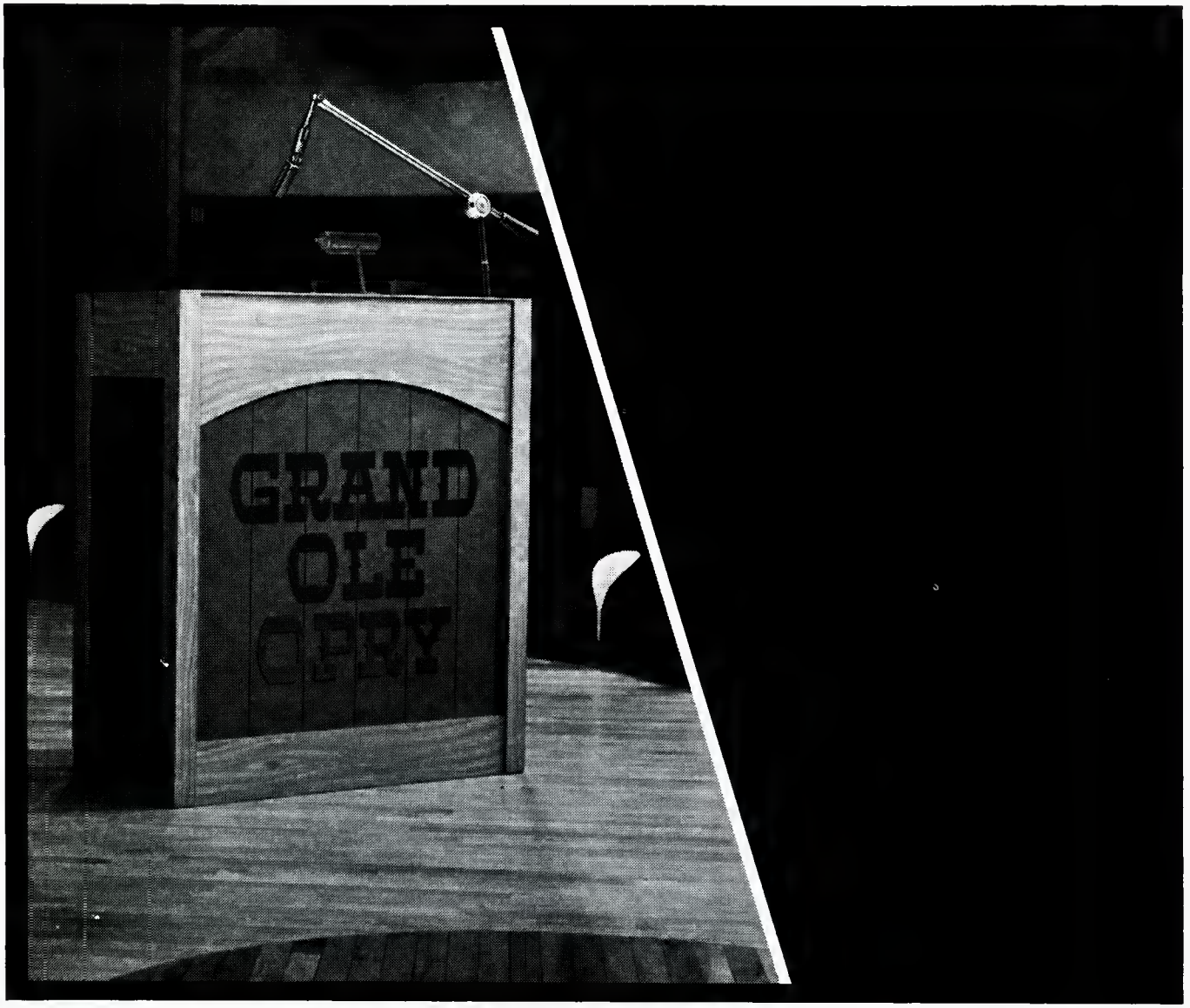
● **Sudden Rush Music** has completely renovated their 4-track studio in Riverdale, Bronx, N.Y. The studio, which has previously concentrated on music recording, will expand its services to include advertising work. The improved facility boasts a Dolby Noise Reduction system, as well as complete program Graphic Equalization. **Michael Berman,** composer and engineer, has recently joined the staff.

● A long term agreement has been reached between **N. V. Philips** and **MCA, Inc.** for the manufacture and marketing of a Philips/MCA video disc player. The agreement includes support video disc programming, combining the techniques which have been used in each company's video disc system so as to permit full interchangeability of video discs.

● **Goldmark Communications Corporation**, a subsidiary of **Warner Communications, Inc.,** has been named communications consultant to the **New York City Convention & Exhibition Center Corporation** for the design and development of telecommunications systems functions and services. They will be working in cooperation with architects **Skidmore, Owings and Merrill** to accommodate all communications services at the $200-million Center. Among the communications services being considered are an integrated communications transmission network for electronic registration of visitors, information retrieval methods, automated parking control, teleclinic facilities, information processing, and television and recording facilities. Looking toward the future, plans are being formulated for the use of satellite transmission of programs originating in the New York City center, to worldwide audiences.

● **Brigham Young University,** in Provo, Utah, will once again offer its intensive three week summer program from June 9-27. This is a five-day-a-week study, carrying with it a full semester's work, which can be audited or taken for three university credits. Specific workshops will be held dealing with micophones, loudspeakers, and consoles, Application of principles covered in lecture sessions on basic electronics, voice and musical instrument tone generation and acoustical engineering will be made in actual situations. The amount of material covered has been increased with the introduction of individualized audio/visual packages, adaptable to the student's needs. **Norman Crowhurst, db** columnist, will return to the seminar again this year. Due to limited space, prospective students are urged to make application early. Contact **Russel Peterson, Brigham Young University, Audio Recording Technology Course, 242 Herald R. Clark Building, Provo, Utah 84602, Phone (801) 374-1211, Ext. 3784.**

● A combination of **Du Pont** manufactured cassettes and **Norelco** VCR player/recorders has been initiated by an agreement between Norelco, a division of **Philips Broadcast Equipment Corp.** and the Magnetic Products Division of the Photo Products Department of Du Pont. The cassette will be sold under the Du Pont brand name, and will include capacities of 20, 30, 50, and 60 minutes running time.



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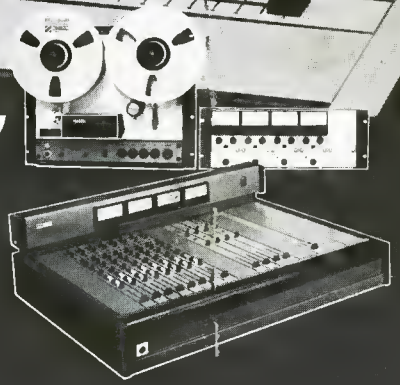

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