ISSN0011-7145

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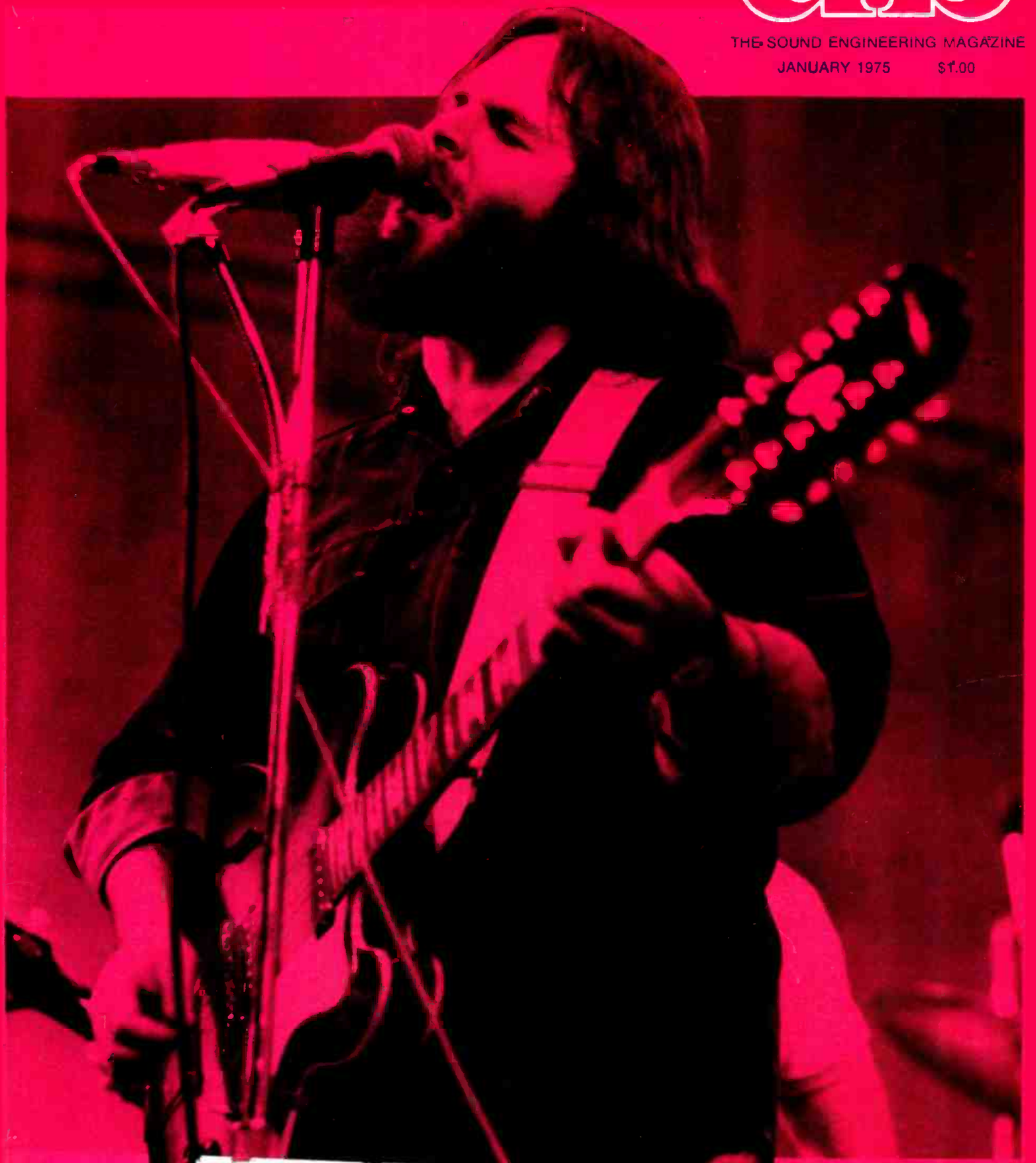
THE SOUND ENGINEERING MAGAZINE

JANUARY 1975 $1.00



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COMING NEXT MONTH

- Milford K. Smith, Jr. chief engineer of WPGC, Washington, D.C. gives an on-the-job report on experimenting with and modifying equipment to create a more distinctive sound, in FOR BETTER BROADCAST AUDIO PROCESSING.

- Glenn D. Rogers has made a **db** VISIT TO ROBINS-FAIRCHILD for an inside view of one firm during most of the history of the audio industry.

- Michael Rettinger continues his highly specific series on RECORDING STUDIO ACOUSTICS, going into the judicious use of acoustic devices and certain building materials, with resonance the subject of Part 4.

- Norman Crowhurst's column, on room equalization, gives additional depth to Michael Rettinger's architectural discussion. The other columnists will be in their usual places, dispensing information and/or wisdom. Coming next month, in **db, The Sound Engineering Magazine.**

ABOUT THE COVER

- One of the Beach Boys appearing in a live broadcast on Radio Luxemburg, which was beamed all over the world in the summer of '72. Sound system on the European tour was provided by C. S. I. Audio of Highland Park, N.J. Photograph by Marvin Welkowitz.

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THE SOUND ENGINEERING MAGAZINE
JANUARY 1975, VOLUME 9, NUMBER 1

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

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GRAPHICS **Crescent Art Service**

db, the Sound Engineering Magazine is published monthly by Sagamore Publishing Company, Inc. Entire contents copyright © 1975 by Sagamore Publishing Co., Inc., 1120 Old Country Road, Plainview, L.I., N.Y. 11803. Telephone (516) 433 6530. db is published for those individuals and firms in professional audio recording, broadcast, audio-visual, sound reinforcement, consultants, video recording, film sound, etc. Application should be made on the subscription form in the rear of each issue. Subscriptions are $6.00 per year ($12.00 per year outside U. S. Possessions, Canada, and Mexico) in U. S. funds. Single copies are $1.00 each. Controlled Circulation postage paid at Harrisburg, Pa. 17105. Editorial, Publishing, and Sales Offices: 1120 Old Country Road, Plainview, New York 11803. Postmaster: Form 3579 should be sent to above address

db letters

THE EDITOR:

In my article, "Noise Considerations in Audio Amplifiers," which appeared in the October issue of **db**, there is an omission in a mathematical expression which may cause confusion to the reader trying to follow the mathematical progression. The error appears between Equation (7) and Equation (8). The item omitted is 10^4. Equation (7) should read:

$$E_T = \sqrt{[3 \times 10^{-9})^2 + (7.2 \times 10^{-13} \times 80)^2] \times 10^4 + 1.29 \times 10^{-14}}$$

$$E_T = \sqrt{9 \times 10^{-18} + 3.31 \times 10^{-21}) \times 10^4 + 1.29 \times 10^{-14}}$$

$$E_T = \sqrt{9 \times 10^{-18} \times 10^4 + 3.31 \times 10^{-21} \times 10^4 + 1.29 \times 10^{-14}}$$

R. S. MINTZ

CALENDAR

March

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

April

21-23 **ASTM Committee E-33 on Environmental Acoustics,** St. Charles, Illinois. Contact: Mr. Charles W. Rodman, secretary, Battelle Memorial Institute, 505 King Ave., Columbus, Ohio 43201. (614) 299-3151.

May

Two-day **Workshop on Children's Television,** conducted by the National Association of Broadcasters, Washington, D.C., early May. Contact: Mr. Robert D. Gordon, N.A.B., 1771 N St., N.W., Washington, D.C. 20036.

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db the sync track

JOHN M. WORAM

● It turns out that this issue features some articles on the general subject of education. I've gotten some mileage out of this over the past few months, what with all that business about microphones, books and communicating. So perhaps I should get off the pot and move on to other things, like how to quit worrying and make hit records, or something.

Anyway, what more needs to be said about education? A lot I guess, since there seems to be no slackening of inquiries about "How do I get started in Audio?"

Since I've been involved in answering this question for a long time now, I've developed some thoughts on the subject of educating the audio man. Much of this is just a variation on things I've said before, but I guess it beats reporting.

At the Institute of Audio Research, where I hide out between consulting and recording sessions, I've been teaching a resumé preparation class for a while now. I wonder whether the medical schools teach classes in "how to get a job as a doctor" to the pre-med students? Well, getting a job is no cinch, especially these days, and the resumé class is just an informal guide to getting your thoughts together so as to make a reasonably good impression. One of its purposes is to get the students to realize that they will surely not be hired as recording engineers if their only qualification is a diploma. There are many lower rungs on the recording studio ladder, and the line forms at the bottom, not the top. And since there aren't too many jobs even at the bottom, if you want one you've got to do something to lessen the odds against you. When a job turns up, you've got to be better prepared than the others.

HOW PREPARE?

But since the qualifications are so vague, how *do* you prepare? Do you study music, electronics, noise control, or perhaps the fine art of the "hype"? If you're looking for studio work, you can use your Ph.D. thesis in comparative noise reduction for wall paper if you don't possess a native talent for ego soothing. Musicians who will cheerfully fly around the world with a pilot they've never met, or place themselves under the knife of a misanthropic surgeon, will go berserk if their recording engineer doesn't have "good vibes." What matter if he thinks multi-track is something that's made with lots of tires; so long as he grooves—that's what's important!!

So, where do you go to school to become groovey? If you're asking the question, studio work isn't for you. (As usual, this column is oriented towards recording studio education). But, assuming you already possess some native instinct for survival in the studio, what else is needed?

Well, if you wanted to be a doctor, there wouldn't be much problem spelling out the formal requirements. They've been spelled out for years. But studio work is quite another thing. There is still no consensus of the formal requirements, or even if there are any. Some studios encourage education, some don't. Some colleges offer courses in recording-related subjects, and so do some studios. Some are good, some aren't. A few colleges know lots about education, but nothing about the facts of life in a recording studio. Some studios know lots about recording, but not a damn thing about education.

And there you are in the middle, wondering which way is up. Sometimes, I think the worst thing to do is ask for advice, since every "authority" has his own treasured opinion, and rarely do they match.

ENTHUSIASM VARIES

Here at the Institute, I stumble across many students who—for whatever reasons—have decided our program is right for them. Or, maybe they haven't made that decision, but have just landed in our classrooms by chance. Well anyway, they're here; and right or wrong, their reactions to the curriculum are interesting, and at times frustrating. If the subject of the day is bias, or some other cliff hanger, their enthusiasm isn't exactly inspiring. In fact, a reasonably paranoid instructor may detect some ill-concealed hostility. But let the subject turn to something with a little built-in entertainment value, and the interest picks up dramatically.

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already been used for some seminars, and by the time this sees print, for lab sessions. During the construction stages, we've had to beat the students off with sticks. The same students that have to be tied to their seats when the subject is the hysteresis loop. The enthusiasm is great, I suppose. I don't recall getting so worked up about lab courses back in my student days; but, of course, that was before electricity.

Sometimes the students want to skip all the education stuff completely, and just spend their time in the control room. In fact, if we weren't careful, it could easily turn into a great big 20 to 20,000-Hz sand box.

I wonder if the sight of adding machines and ledger pads quickens the pulse of accounting students the way consoles and such affects our classes? Probably not. But then, adding machines are predictable gadgets. In fact, they're so damn predictable, they even come with an instruction book. And, if you give the whole Principles-of-Accounting-II class a problem, they should all come up with the same answer. Those that don't are wrong, and their mistakes can be corrected, for there is a step-by-step right way to solve any problem.

NO 'RIGHT' WAY

But accounting techniques can't be applied to recording. There's no right way to convert music into magnetism. At best, you should know something about music, and something about magnetism, and then work out your own technique. You can waste a lot of time trying to work out that technique in school. Every minute spent at the school's console could probably have been better spent at the blackboard. In other words, there's a time to play recording engineer, and a time to learn.

Of course, blackboards aren't fun and games. But if it's kicks you're after, why not spend your tuition on booze or some other immediate turn-on? It'll wear off in a while and leave you with nothing, but so will show-and-tell at the console. Unless you're actually under fire on an actual session —say, recording the school's band, or broadcasting on the school's radio station, those let's-pretend sessions that let you be the Walter Mitty of the recording industry are more for your entertainment than instruction.

So here we are with a multi-track Neve console, lots of Dolbys, Ampexes all over the place, four different speaker systems, Kepexes, plenty of patch cords, and a man from the Institute who wants everyone to sit quietly in the classroom and marvel at the fine points of the polar pattern. What frustration!

But, if you can't get through the theory stuff, you're not going to get maximum mileage out of all the knobs and switches, either in our lab sessions later on, or in your recording sessions much later on. Speaking of much later on, if you're still just getting started, don't lose sight of the fact that the advance of technology is not going to come to a halt in your honor on the day you engineer your first record. There are a lot of engineers around who really believe they have nothing further to learn. Don't become one of them. ■

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db theory&practice

NORMAN H. CROWHURST

● Since learning that this issue is to be about education, I have collected some reactions on the subject. While many people agree with my general criticisms of the educational establishment, a few, particularly within the establishment, disagree with me. It seems as if we must be talking about a different world!

The real differences are in time and place. Some have interpreted me as comparing education in today's America with that in my native country. But my knowledge of the situation in England dates back to when it was not so bad there, either, so that is not true. Others see their own efforts as being constructive, and assume that to be representative of the picture as a whole.

The experience at Brigham Young University last summer was enlightening. Everyone there impressed me as having the same kind of insight into the problems as my own. And I receive letters from readers indicating that other institutions possess a quality that, at least as seen from the inside, is at variance with much that I have been criticizing. But the participants of that workshop, who came from everywhere *else*, certainly had needs that would never have developed, had the whole system been doing what it should.

So what is the truth? Is it a matter of picking a good institution? I wish it were that simple. Then we could list the colleges that offer the requisite curriculum, with various "star rating" annotations. But it is not that easy.

We must of course give credit where it is due. But we cannot imply that things are generally improving when the facts are clearly otherwise. Twenty years ago, when I came to this country, I was very disappointed with the lack of preparation evidenced by young engineers, not just in one place, but as an industry standard (or lack of standard).

This condition has changed, only for the worse. My own observations, as well as complaints I repeatedly receive, from many quarters, confirm this. As basis for discussion of the reason, let me refer to something that is currently happening in Oregon's school system.

Last year the legislature, in collaboration with the State Department of Education, introduced a directive that every school district establish new graduation requirements. When you cut through the volumes of words, its issuance is based on recognition of the need for graduation to be indicative of more than the fact that kids have sat through so many prescribed courses and acquired a certain minimum grade level.

The directive even included mention of the need to introduce a "lifelong learner" requirement. In a changing world, people need to be able to keep up with change, so that made sense. But as I have visited various groups working on these requirements, it has become obvious that teachers have no idea what that means.

In discussion with such committees around the state, I constantly encounter the argument that what the law specifies is "survival requirements." My viewpoint is that survival depends on some of us, at least, being able to keep abreast with change. But these teachers repeatedly assure me that, if a person can ask the way to the welfare office, and can write his name on the forms and fill in the spaces, he will survive.

Their attitude is that the government will look after everyone. Whether you believe it or not, that notion prevails among our curriculum designers today. I could not believe it. But I meet it repeatedly.

Our nation has embarked on a "problem solving" fad. Now, problem solving is an engineer's specialty, so it sounds, first off, as if our nation is on the right track. But we need to take a closer look at what they mean by problem solving.

In an engineering context, problems are solved, period. A problem solved does not need solving again. Progress results. Not so in our national problems. Everyone has his own problems today, to a far greater extent than a decade or two ago. And what I learned at these school committee meetings reflects the pattern of national thinking: let the government solve our problems for us.

Whatever your problems may be, you are the only person who is fully cognizant with them. So if you set about solving your own problems, you will evolve the best and most direct way to solve the problems of the community (if the government allows you to). But if, as most Americans are now conditioned to do, you take every little piece of a problem to some different government agency, what can you expect?

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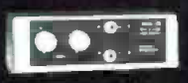

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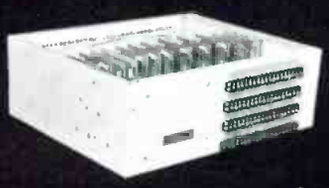

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RAMKO RESEARCH

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theory & practice (cont.)

is quite unconcerned with the other pieces of your problem, telling you to take them somewhere else. So we have a number of departments, each concerned with a mass of tiny pieces of problems from a great many people. Apart from the fact that such a disjointed approach is very inefficient, it also completely misses the relationships between the problems.

Currently, two big pieces of the national problem concern energy and pollution. Anyone with an engineering economics background immediately knows that pollution results from misuse, or waste of resources, a direct cause and effect connection. But we find separate agencies trying to do quite opposite things approaching pollution and waste, as if they were entirely separate matters! The same situation is repeatedly found, relative to people's individual problems.

In the school situation, actual application of the "lifelong learner" principle would streamline existing curricula, cut out duplication and reinforce ways of learning new things. The system would end up doing a far better all around job at lower cost. Instead, what do educators do?

They will not cut out anything. Everything already in the curriculum must stay there. Something mysteriously called lifelong learning must be added as an *extra*. Nobody really knows what it means, but it is an excuse to employ more teachers and that is just fine.

Perhaps this hints at a way to select the better places to learn. What we have been saying applies, quite universally, to institutions that look to government funds for everything they do. Suggest something to them, and their response is, "That sounds good, now how can we use the idea to justify getting more funds?" Maybe you were really talking about getting better and more education for less money, so that makes you wonder if they were even listening to you!

The only hope of breaking away from that will be found at institutions that do not chase government funding. This explained what I found at BYU. They are concerned with doing the right thing, not with doing what they can get funded.

MEDIATED INSTRUCTION

Perhaps we are hopelessly committed to the notion that, before students can learn something, the teacher should already know it. But adherence to that notion is suicide. We are never going to change the great mass of teachers, to enable that to happen. So we must concentrate on reaching

Waters Attenuators

smoooooooth

The answer to the mixologist's prayers! Smooth, quiet, and forever - Waters MystR® conductive plastic faders.

The Waters line of professional audio controls covers every need of the professional recording or broadcast studio. Linear or rotary motion, mono, stereo, or quad, all using Waters' glass-hard MystR conductive plastic elements and slip rings and precious metal contacts. Only Waters audio controls are made using our automatic curve shaping to provide linear, modified audio, or logarithmic tapers which really track. Standard impedance values of 600 or 10,000 ohms available right now.

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Circle 18 on Reader Service Card

the students, which is where mediated instruction, including audio-visual materials comes into the picture.

That is an important reason why this publication and its readers need to involve themselves in education. How else will mediated instruction created by the audio industry ever succeed? Leave it up to some teachers, and they will merely use it to continue what they are already doing. That is the only way they can think. Often, the programmed instruction, following lifeless directives, turns into something arid itself, negating its very purpose.

For example, before I left Teaching Research, the last assignment I was offered was to update a mediated and programmed course in Dental Anatomy. This six or seven part course started by telling the dental students, in very easy bites, (sorry about the pun) what a tooth is.

For example, it would tell them, "The enamel is the hardest part of a tooth." Then it would ask, "What is the hardest part of a tooth?" Then perhaps, "The enamel is what part of a tooth?" If the student could correctly answer those questions, he would proceed to the next piece. In the whole course, there was nothing to promote intelligent thought, such as why teeth, or the jaw they are in, are made that way, to serve the function of eating.

Presumably, a year or two later, as he pushed a drill into someone's tooth, the student would discover how hard enamel is. I asked about the rote fact orientation of the course, because if I revised it, I wanted to change that. There was a reason: students who enter dental college are incapable of creative or intelligent thought, so we must not expect it of them!

AVOIDING THE FUNDING TRAP

My apologies to dentists, but government funded projects are committed to that kind of philosophy. Teaching material can be updated, but not made creative. The only hope is outside of government funding. Let me illustrate what can be done, by briefly telling a little about what we are doing at Educational Research Associates, without a penny of government funding.

The course on *Basic Electronics* prepares the student for continued growth as technology advances by showing him how advances are made, new ideas developing from established concepts, not just feeding him so-called facts, all predigested.

The course in *English* includes all the grammar and syntax anyone would ever need, quite enough to pass the currently administered English tests. But it is organized around the concept of communication: that speaking and writing constitute sending, while listening or reading is receiving. The important thing is a good *connection*, which needs attending to from both ends. The course comes alive with examples of communication gaps, and how they may be overcome.

The *Physics* course tells how we find out about the world around us, starting from everyday observations, too many of which we pass up without thought as commonplace, and proceeding to the last lesson, on "Looking Forward to the Twenty First Century."

The *Problem Solving Arts* course, discarding the wornout old and new math approaches, sets about finding easier and shorter ways to solve increasingly difficult problems, starting with the very simplest. It concentrates on many practical techniques that conventional courses omit, such as tracking down mistakes, being sure of right answers, linking together concepts that enable the student confidently to attack new problems that he has never seen before.

But these courses are only examples, small pieces of the solution to the tremendous need for clarity in education. If we are to revitalize education, once again, matching approach to what is really required, we need to simplify that instead of becoming overwhelmed with top-heavy programs designed to remedy educational deficiencies that should never have existed. In any learning situation, first we must grasp the basics involved and then decide how we can present them in the most efficient, meaningful way. If necessary we can achieve this through, and in spite of, the system. And once we have done it, we need to go to work and to do more of it. ■

Audio Visuals in Education

• Most professional educators are aware of the great variety of audio-visual devices and materials available for their use in teaching. But they, as well as their students, may not be fully cognizant of all the latest equipment and applications or aware of those who use the equipment and devise the techniques and related software.

One of the best ways to keep up with what is new in any field is to attend exhibits and conventions devoted to the specific fields of interest. An example, devoted to the educational and training hardware and software, was the 1974 convention of the Association for Educational Communications and Technology. This organization, headquartered in Washington, D.C., provided members and anyone else who was interested, with a very large exhibit of equipment, devices, and materials available for use in education, as well as many discussion sessions related to education, its media, and the latest in concepts and techniques.

The convention took place early in the year, ran a full week, and had about 250 exhibitors of items ranging from stick-on labels to complex video-editing systems. Presentations covered such subjects as education of minorities, teaching the handicapped, uses of various types of equipment, and other education-oriented subjects. Before taking a more specific look at this convention, the equipment, the applications and the possibilities for students in the related fields, here's a brief look at the AECT.

The organization is made up of those directly or indirectly involved with education, training, and related audio-visual materials. That would include teachers, principals, superintendents, curriculum specialists, training directors, librarians, audio-video specialists, graduate students, behavioral specialists, and educators in religious, industrial, military, medical and governmental organizations. There are also business memberships whereby companies and their employees can participate and contribute to the programs of the AECT.

SUBJECTS COVERED

For the educators, the titles of some of the subjects covered in the presentations were: "All About It," an introduction to Instructional Technology by A. C. Wagner of Wagner College, covering ways and means of modern communication techniques for classroom use, the growth of technology, current practices, and theoretical applications; "Academic Tradition and Instructional Technology" by L. E. Fraley and E. A. Cargus of West Virginia Univ.; "Population Education" by Ralph Wileman of the U. of North Carolina; "Understanding the Black Learner" by Lionel Duncan of Morgan State College; "Today's Community College" by David Jenkins of Bergen Community College; "Producing Multi-Image Presentations" by Douglas Crane of Arizona State Univ.; and "Slide/Sound Techniques" by Steve Cartwright of the American Hospital Association. This very brief listing offers some idea of how wide a range of interest the sessions took into consideration.

Among the exhibitors, about half were involved or directly associated with software. That would include companies which publish text books, instruction manuals, magazines, encyclopedias, catalogues, and charts, as well as makers of globes, models, and maps. Also in this group might be producers of slides, films, transparencies, taped programs, and the makers of the materials on which these audio-visual aids are produced. In this group alone, many of the items shown and demonstrated are usually taken for granted by those that use them. But if consideration is given to the design and making of these educational aids, a great number of present and future careers become apparent. (In fact, it might also be well to give a good deal of thought to the improvement of the present and creation of new future instructional aids to keep up with the potential of the technical advances. But that's a whole 'nother subject.)

SOFTWARE CREATIVITY

In the software fields, there is great potential for those with creative, artistic and production talents. Among the most widely used materials in any classroom is the educational film. Many of the film exhibitors produce and distribute these to interested schools or institutions and offer possible futures for talented young people.

Let it be said here that no exhibitor made any specific mention of opportunities. But it is quite easily seen that with the number of this type of exhibitor, and the number of applications for their product, here is a field worthy of exploration for the future. Creativity in handling the camera, directing others to do so, editing the film, developing negatives and introducing special color and movement effects can help greatly in the production of an interesting and important educational aid.

There is also a very vital position in the film production area for the audio specialist who is involved with recording sound on the filming site, in the studio, mixing the components, editing and introducing special effects and then re-recording the final sound track onto the final film. It may be true that a picture can be worth a thousand words, but in education the oral portion of the lesson can be as important, if not more so, than the pictures and they (the audio tracks) should be as good as they can possibly be.

There are also creative possibilities for writing talent in the creation of the oral and written material to be used for communicating educational

An example of the sophisticated equipment being used for educational audio/visual programs is this Automated Cassette Duplicator system, produced by Recortec, Inc. of Sunnyvale, California. The system shown has been installed for Educational Sensory Programming (ESP), an Arkansas based corporation producing prerecorded educational cassette programs. The ACD high speed duplicator copies tape at 32 times normal speed and simultaneously loads the recorded tape into cassette shells to produce the finished product in a one-step operation. Near the equipment are Bill Lawless of Recortec (left) and Bob Nelson, executive director of E.S.P.

information to others. Artistic talent is invaluable in the production of much of the material used in film and slides. Those who specialize in the production of graphics, illustrations, animatics (drawings used in place of live talent for some film material) can also find possible opportunities in software production companies. Incidentally, although film production was mentioned here, there are similar possibilities for those who are interested in slides, another very widely used training material, and also in transparencies which are used on overhead projectors, and filmstrips which are also widely used either with or without an accompanying sound disc or tape.

HARDWARE POSSIBILITIES

Among the hardware exhibitors, there were the usual manufacturers of film projectors (both 8 mm and 16 mm), slide projectors, various software production devices, makers of tape and technical equipment such as tape recorders and remote access devices, manufacturers of programmed learning and response systems, and companies that offered associated equipment or furniture such as language labs and study carrels.

But the largest and most impressive exhibits (judged in part by the number and interest of passers-by who stopped to look and learn) were those devoted to demonstrating video equipment. Since video has become available to the training and educational fields, it will (if it hasn't already) surpass all other methods of transmitting information, not only in total mass and quantity, but in effectiveness as well. The number of video exhibitors may have been small, but their products have become accepted by so many in their homes before this, that now it has become a most natural carry-over to educate in the classroom.

Among the exhibitors there were manufacturers of TV sets, cameras, video recorders, and complex studio production equipment and systems. Much of this equipment is now being used in schools from the lower grades to the universities, and many educators and students may be aware of the general systems being used. There are, however, some newer units worthy of mentioning, not only for their capabilities and possible applications, but also for their potential to the student intertested in getting involved in video as a future career.

ADVANCES IN TAPE

The equipment shown at the convention included the now standardized ½-in. tape width (which means that recordings made on any ½-in. machine of any manufacturer conforming to the standard can be played on any machine of any other maker also following the prescribed requirements), units using the same ½-in. tape width but in cartridges or cassettes, and machines using the newer ¾-in. tape width in cassettes. In this latter category, it was not possible to edit the tape to produce a clean cut from one scene to another (the cut part of the tape caused a roll-over of the image on the screen) until recently. Now there is equipment and a system for making a professional cut that is totally undetectable if performed properly.

In fact, there are several systems for accomplishing this. One uses a small master console to set up the tapes and then record only those portions that are desired in the final presentation. Another uses a very intricate computer to perform professional editing electronically whereby a complete sequence or showing can be assembled automatically by presetting the proper information in the memory banks. There is also a system for making editing notes with an electronic pen which allows the equipment to make the cuts according to the instructions.

For those interested in the techni-

cal fields, there does not seem to be any end to the possibilities of the future. For those interested in present applications, this newest development allows a complete production facility to be built in a central location from which video cassettes in the ¾-in. format can be distributed to other locations. Since the ¾-in. format has become an unofficial standard, tapes can either be sent, or transmitted via a cable system and recorded on matching equipment at the other locations on the system. Cable and microwave transmission have had a very great effect in the distribution potential of television. Within a school, for example, it is possible to show an experiment to any number of classes even when it might be almost impossible for the students in the lecture room to see the experiment clearly without TV.

LINK WITH VIDEO

Now, with color equipment, and the small hand-held camera becoming available for technically acceptable pickups at a fairly moderate price, the video system can go almost anywhere. Whole portable recording systems, in both ½-in. and ¾-in. formats, provide the producers and the schools with a most valuable and effective tool in the education process. Recording on battery-operated units and then playing back (with or without editing) immediately or in some other location provides the educator with a system and technology that can have greater influence in the learning process than almost any other medium. The ability to store programs for future showings or to erase them as soon as desired and to use the tape again can make the video system more widely used than other type of teaching device.

Here, too, the opportunities for career-minded students are unlimited. Production, writing, technical (camera-person, editor, sound man—or woman) are only a few of the possibilities. Here, also, great importance should be placed on the software being stock-piled for teaching and the need to match the potential video offers.

With the speed of technical advances and improvements, it is vital that software keeps up. Perhaps the future audio-visual educators, the present students, will make sure of this.

Incidentally, the AECT convention in 1975 will take place in Dallas April 13-18; in Anaheim, Calif. from March 28 to April 2 in 1976; in Miami Beach in April of 1977; and in Kansas City in April 1978. Just thought we'd let you know so you can make your plans. ■

db new products&services

ONSTAGE MICROPHONE

● Designed specifically for applications in entertainment, where appearance counts, model 589S Unidyne cardioid mic has a ¾-inch case, small grille with integrated windscreen and a glare-free metallic finish. The cardioid pickup pattern is symmetrical about the axis and uniform at all frequencies. Other features include dual impedance, frequency response tailored to compensate for proximity effect, and a built-in on-off switch with lockplate. Hand held or stand-mounted; the stand adapter has a locking ring and a 15-foot hum-shielded cable with a female three-pin audio connector at the microphone end.

Mfr: Shure Bros., Inc.
Price: $51.00
Circle 46 on Reader Service Card

PROGRAM LIMITER

● Available on a variety of printed circuit board sizes, this limiter was designed to complement the manufacturer's consoles, but is also available individually. It features a "ducking" characteristic, whereby an external voltage applied during announce microphone closure permits "ducking" of the channel level by a preset amount. The unit also produces an adjustable "knee" on limiting curve: 20:1 limiting ratio, 40 dB limiting dynamic range, and 10 dB nonlimited gain. It is suitable for individual channel limiting.

Mfr: Dyma Engineering
Circle 42 on Reader Service Card

HARMONIC ANALYZER SYSTEM

● Speedy calibration, signal-to-noise ratio measurements, as well as frequency response testing, are possible with the compact (5¼ inches high, twenty five pound) model 101B harmonic analyzer system. 101B, useful for monitoring tape recorders, tape cartridge, or cassette recordings, contains a continuously variable 100 Hz-5 mHz oscillator, an automatically tracking wave analyzer tuned to both second and third harmonics of the oscillator frequency, and a wide-band voltmeter which ranges automatically to give direct voltage or harmonic distortion readings. According to the manufacturer, the calibration process is reduced to minutes and the device does the work of a rack of calibration equipment, signal patching, and cabling. It's engineered to IRIG standards and measures second or third harmonic distortion of fundamentals up to 1 mHz and voltage up to 5 mHz.

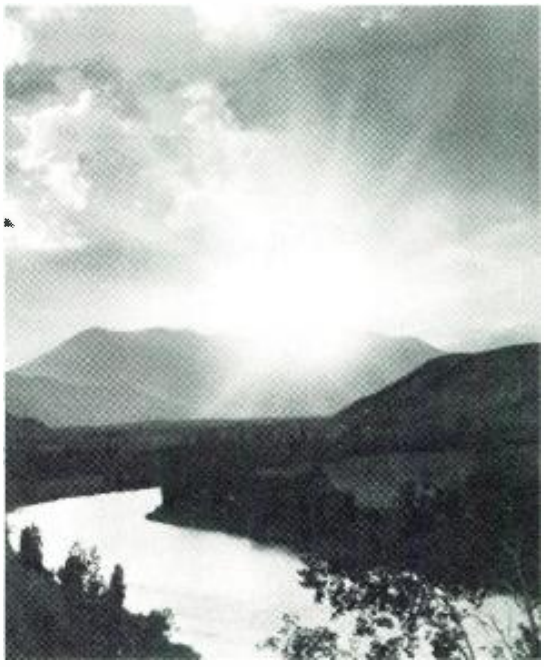
Mfr: Vu-data Corporation
Price: $3,495.
Circle 43 on Reader Service Card

PRECISION TEST CLIPS

● Designed to work in extremely small printed circuit boards, integrated circuits, fully insulated 101 series miniature gripper clips feature an "eagle nose" closure which facilitates disconnection. The clips are available in five basic types and six colors, for coding. They accept both cable and banana plug leads. Dimensions are 0.5mm or 1.0mm.

Mfr: SPI/Electronics
Price: $65.00 for sample set.
5 models in 6 colors.
Circle 44 on Reader Service Card

For sheer reliability, few things can beat our RE15 microphone:



And we're conceding only the slightest of edges to the sun.

Because the RE15 is one mike you can always count on to give you the same reliable response at any distance, any angle. It's a Continously Variable-D® cardioid microphone—an exclusive E-V design.* Once you've set your equalization, all that varies is the level.

Unwanted noise is no problem, either. Not with a super cardioid pattern that provides maximum rejection at 150° off axis. So when the mike is tilted in its most natural position—30° from horizontal—you'll be sure of getting maximum rejection in the horizontal plane. And there's a 100-Hz cutoff "bass tilt" switch for boom use and other long reach situations.

Other features abound. Like a "hum buck" coil to supply an extra 25 dB of hum rejection. And a rugged design that stands up to shock and mechanical abuse.

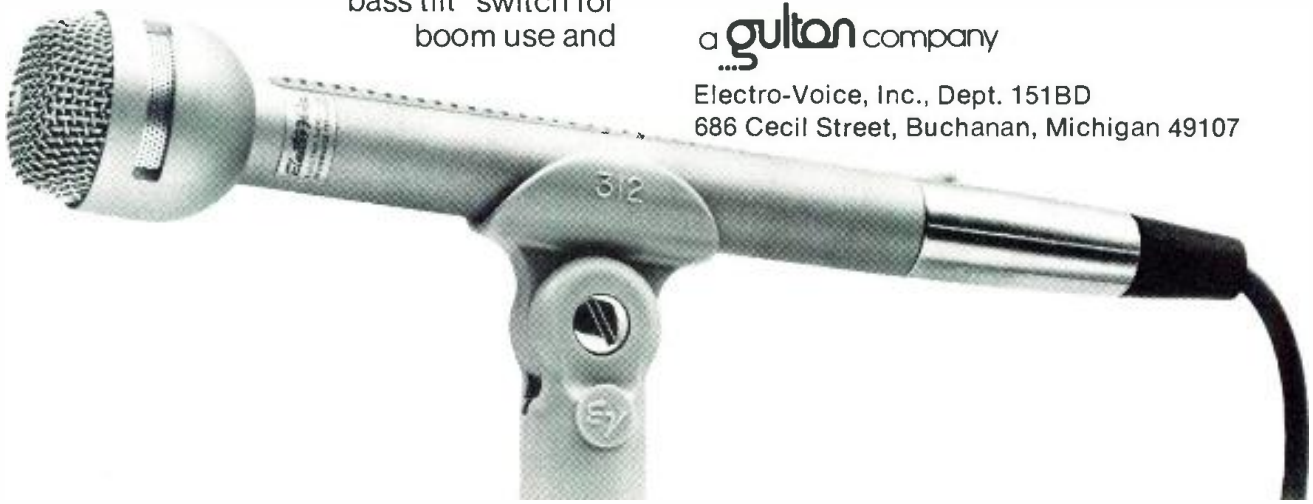
The Electro-Voice RE15. So you can work with confidence in the most demanding professional applications.

RE15...$180.00. RE16...(with blast filter) $190.20. And for slightly less demanding situations, RE10... $110.10. RE11 (with blast filter)...$120.00. Suggested Resale Net Prices. Slightly higher in Western States.

*U S Patent Number 3,115,207 Trade mark registered

Electro-Voice INC
a gulton company

Electro-Voice, Inc., Dept. 151BD
686 Cecil Street, Buchanan, Michigan 49107



Circle 37 on Reader Service Card

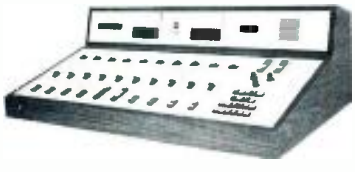
new products & services (cont.)

COMPENSATOR FOR DOLBYIZED BROADCASTS

● An increase in the number of listeners getting benefit from Dolby™-ized f.m. broadcasts, which cannot be decoded without special equipment or recorders incorporating such capacity, is made possible by a simple compensator device, model 621. The unit changes conventional 75 microsecond f.m. de-emphasis characteristic to the 25 microsecond characteristic used in Dolbyized f.m. broadcasts; it can be used in either form. In addition to facilitating the pickup of encoded material, the device also makes it possible to record Dolby broadcasts in B-type encoded form. The unit is installed by disconnecting "record out" leads from "line in" jacks or recorder. "Record out" leads are then connected to the compensator input jacks and the compensator is connected to output leads of the recorder or noise reduction unit. The compensator switch is then set to "75" for regular f.m. broadcasts or "25" for Dolby broadcasts.

Mfr: Switchcraft, Inc.
Price: $12.95
Circle 49 on Reader Service Card

DUAL MONOPHONIC CONSOLE



● Ten channel dual monophonic console MA 31 features an automatic cartridge channel. Four momentary illuminated pushbuttons allow automatic start and audio switching on each of the two cartridge input channels, making it possible to accommodate a total of eight cartridge machines, or, if cross-fading between cartridge machines is desired, duplication of the cartridge machine output on the individual channels. There are two microphone channels, two turntable channels, automatic cartridge switching on two channels, with inputs for reel-to-reel and remote use. The console also features automatic monitor switching, automatic cue switching—turntables are automatically switched to the cue buss when turned off—and automatic headphone switching. Full six-function remote controls for two tape machines are provided. An elapsed timer with automatic reset and start are incorporated in the console; a realtime digital clock is supplied. Both program and audition channels are identical. The cue channel contains an internal cue speaker and amplifier.

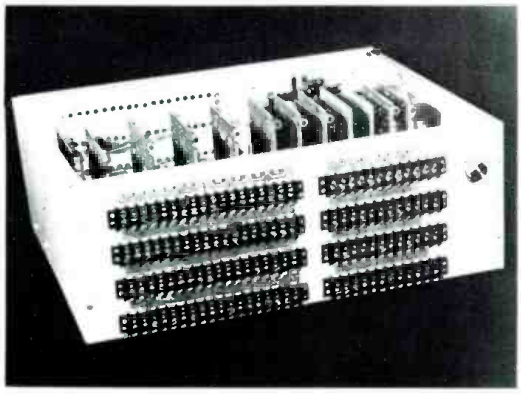
Mfr: Dyna Engineering
Price: $6,995.
Circle 50 on Reader Service Card

FLEXIBLE PLASTIC CONDUIT SYSTEM

● Simplification of wiring and harness fabrication is aided by the use of Z-Flex, a new flexible plastic conduit system, which consists of a crush-resistant plastic conduit formed in continuous convolutions for maximum strength and flexibility. Used with special Z-Flex fittings, the entire system snaps together instantly with finger pressure; it can be reopened and reused over and over if desired. It comes either as a solid tube or split longitudinally. When slit, it allows easy slipover installation around the conductor wires without use of fishing-line methods. The accompanying fittings, including "T"s, outlets, etc., come open. When snapped shut at any desired point on the conduit, special ribs on the inside of the fitting lock onto the grooves of the conduit. A simple unlocking movement allows reopening when necessary. Available in a choice of three rustproof materials, including a flame retardant type, Z-Flex comes in six different I.D. sizes, in 100 foot lengths. It can be easily cut to a desired length.

Mfr: Zippertubing Company
Circle 51 on Reader Service Card

AUDIO CONSOLE



● A completely d.c. controlled design permits series 35 console to be used in a standard tabletop configuration, rack mounted, or in custom applications. With d.c. used to control mixing and switching in the main frame, any combination of rotary, slide or pushbutton faders may be used, as well as any physical grouping or arrangement of the controls without hum pickup or ground loops. The unit has eight channels: mono, dual channel mono, stereo, dual channel stereo. It has a fail safe power supply and plug-in interchangeable cards. The manufacturer claims 0.3 percent or less distortion and 124 dBm equivalent noise on low level channels.
Mfr: Ramko Research
Price: $1.200 up.
Circle 52 on Reader Service Card

MULTI-TWEETER LOUDSPEAKER

● A multi-tweeter array with a full 160 degree dispersion in both the vertical and horizontal planes is distinctive in the FRM-2 loudspeaker. This is achieved by mounting three moving coil tweeters in a trihedron array. The FRM-2 uses a ten inch acoustic suspension woofer with a narrow voice coil gap, which the manufacturer claims provides the efficiency of a vented design without sacrificing low bass.
Mfr: Micro/Acoustics Corp.
Price: $129.
Circle 53 on Reader Service Card

Instructor John Barsotti prepares for class session in the main control room, while students set up for the evening recording session. John is seated at dual Cetec console, to his left is rack mounted Ampex 4-track.

RON ZISKIN

Sound Education By the Bay

With well-equipped facilities, this West Coast university is offering valuable experience in sound recording for film, broadcasting, commercial recording, and live performances.

In addition to his association with San Francisco State University, Ron Ziskin is connected with Creative Media for Children, a firm specializing in educational a/v materals.

During the summer session, a temporary mixdown room is set up, with a Langevin board and two tape machines. Instructor and soundman Vance Frost is at right.

Shot of individual sound laboratory. Through the glass is the instructor's booth for monitoring and observation. Patch bay and 2-track are rack-mounted at left.

San Francisco State University has acquired a reputation for producing individuals who are prepared to enter the television and film industries. That is due, in part, to the well-equipped facilities available to the student in three television studies, a large master-control video center, radio station, film editing and projection rooms.

Until now, the philosophy of the Broadcast Communication Arts Department (BCA) at S.F. State has reflected that of professional industry, namely, a greater stress on visual conent than on sound. A change in this philosophy is evident with the unveiling in January, 1974 of a completely new audio complex and program designed specifically for the audio student.

The new complex is located underground, in the University's School of Creative Arts. The facilities include a large recording studio, four sound laboratories with a booth for monitoring and observation by an instructor, a combination classroom and film-projection room, and several offices. The program designed for these facilities will enable the student to obtain valuable experience in sound recording for film, broadcasting, commercial recording, and in sound reinforcement for live performances.

CONTAINS VARIETY OF EQUIPMENT

The studio is equipped for 4-track recording, and was designed as such for a specific reason. Several of the above mentioned areas of sound often require a certain amount of pre-mixing during professional applications. Most complex recordings at S.F. State will also require live mixing, so students will be prepared for such situations once in the field.

The control room of the main studio contains dual Cetec mixing consoles. The left hand console (10 in, 4 out) is for recording, the right hand (8 in, 4 out) for mixdown. There are two AKG echo chambers, four U.R.E.I. limiters, eleven assorted power amps (Altec and RCA), four Altec graphic equalizers and eight Altec monitors. The 4-track tape machines are the new AG440C's and an Ampex 445. There is also a 440A 2-track. The four practice sound labs each contain a Sparta ASC-305B stereo studio control, Sparta stereo cart reproduce unit, and an Ampex AG600 with a remote.

Because the facilities are housed in a state educational institution, some interesting problems arise now and then. The State of California requires classroom lighting in all educational facilities, even in the studio (it is a classroom of sorts). That means an annoying buzz, especially annoying during those quiet, yet critical, recorded passages that occur so often. To overcome this problem, staff engineer Brian Weiner (who to a large degree is responsible for the overall design of the studio) installed the ballasts in a soundproofed microphone locker. For mood lighting, incandescents were also installed in the control room and studio.

(continued)

Audio Coordinator Paul Smith (left) and John Barsotti (seated) discuss setup problems with a student. The rack behind and to the right contains 4-track, patch bay, the limiting amplifiers and graphic equalizers. Everything is color-coded for easy identification by new students.

Recording group for the evening warms up while levels are taken in the studio.

FUNDING WAS A PROBLEM

Another irritation has been, predictably, money. Although Stuart Hyde, chairman of the BCA Department fought long and hard for the facility, it took nearly eight years to procure the funds. According to the State, a sound facility existed. It did. But it was a *TV* sound facility.

Waiting patiently for the funding to go through was Paul Courtland Smith, Audio Coordinator at San Francisco State. Paul came to the school after a 23-year career in audio. During that time he worked at CBS as a sound engineer for the Bing Crosby, Gunsmoke, Lux Radio Theater, and Suspense radio shows. He also worked at Liberty Records as a sound recordist and editor, and is credited with engineering the King Family, Hollywood Palace, Lawrence Welk and Shindig television shows. One additional note on Paul Smith's background: He learned sound recording on the first two Ampex tape machines, under the guidance of the man who developed them, Jack Mullen.

This is the combination classroom and film projection room. Large screen pulls down over the blackboard, speakers and television monitors are built in for sound and video tape playback in the classroom.

COURSES—PRESENT AND FUTURE

One very successful feature of the old audio program is being carried over into the new facilities. It is the Stereo Recording Workshop, held every summer. This course provides the student with an intensive experience in recording, studio setup, mixing and music intercutting. Participants also learn to work with musicians and to appreciate the problems encountered by these artists during recording sessions. Instructors for the summer sessions are working Bay Area soundmen Vance Frost and John Barsotti.

Future plans include an interdisciplinary Bachelor of Arts program in Audio Production. Students will be required to cover the necessities, such as acoustics, microphones, solid-state theory, operation and function of all equipment, and lots of production. Courses in music and business management will be required as part of the interdisciplinary concept.

Very likely, postgraduate programs will also be designed for those interested in pursuing specialization in any one area. And for those who might feel that all of this is not enough, consideration of the following is strongly advised: location. San Francisco has to be a beautiful place to learn just about anything. ■

Studio 1, where students are instructed in the basics of audio production, and student recordings are made.

Audio Gets Big Boost At Syracuse

In addition to offering audio aud audio-related courses, Syracuse University boasts a modern communications center that houses nine studios with finest equipment, as well as a student-run FM station.

MARK R. GANDER

STUDENTS OF AUDIO need both diversity of knowledge and experience with facilities to prepare them for work in the industry. The many schools and departments at Syracuse University offer a variety of disciplines which are involved in audio as well as the facilities to obtain actual experience in the aesthetic, production, and scientific aspects of audio art.

The heart of audio activity on campus is the recently completed Building II of the Newhouse Communications Center. This is the home of the Television-Radio department of the School of Public Communications. In addition to video, film, and office facilities, there are on the fourth floor nine audio studios, geared for a variety of applications.

Studio 1 is a medium-sized studio/control-room/an-

Mark R. Gander is associated with Syracuse University Audio Services. He is a member of the Audio Engineering Society, and is currently completing work on a degree in Audio Technology.

Studio 3 is a fully equipped multi-track recording studio, with the versatility for a wide variety of needs.

Various tape configurations, as well as mag film, can be accommodated, depending on the particular production.

nounce-booth complex where students taking Production for Electronic Media are taught basic audio production technique. Audio projects are produced here, and also in the four individual audio production carrels. All the studios are equipped with a control board, two turntables, two tape machines, a cart machine, microphones and monitoring equipment.

CHANCE FOR ADVANCED LEARNING

Students also have the opportunity to learn more advanced audio at various levels. This activity is centered around Studio 3, an acoustically isolated studio/control room designed for multi-track recording work. The control room is equipped with top-quality professional audio gear; Neve console, Dolby noise reduction, 8-, 4-, 2-, and full-track tape machines, Altec and JBL monitors, and a variety of ancilliary equipment. In addition, there are 16mm magnetic film dubbers, recorders, projector, and sync equipment for film sound track work, and audio lines for recording of productions originating from the video studios downstairs. Principles of sophisticated audio engineering as well as emphasis on the aesthetics of sound are taught here, and students have the opportunity to do actual recordings and mix-down as part of their course work.

Audio Services, part of the university's support services, operates an office and studio on the floor, where faculty- and university-related projects are produced. Responsible for the design, construction, and maintenance of the facility, Audio Services also furnishes technical support to student projects.

A STUDENT-RUN FM STATION

A combo studio with news-announce booth, and master control with its associated production studio are the center of operation for WAER, the student-run FM radio station. Because the station trains its own engineering staff, this affords excellent opportunity to learn basic audio and broadcast engineering. Remote work is an integral part of station programming, and many live activities are brought to the air from campus, including live concerts by professional musicians, originating both from the halls on campus and direct from the Newhouse studios.

Elsewhere on campus, the University Union also offers a chance to get practical experience with audio work. U. U. Audio runs a portable sound reinforcement system, as well as providing sound in the Jabberwocky Club and Watson Theatre. All professional music concerts on campus, as well as many other activities, are provided with top-quality audio support, run entirely by students.

The Moog room in the School of Music provides both facilities and stimulation to creativity.

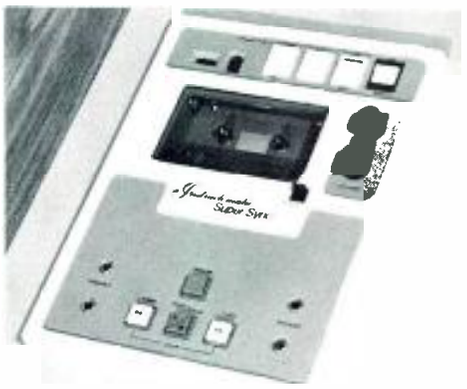
Combo control is the heart of the 24-hour broadcast operation of WAER-FM.

In the more formal areas of study, the School of Music offers Electronic Music Composition, instruction in the use of the Moog synthesizer at the beginning, intermediate, and advanced levels. A Survey of the Recorded Music Industry is being given, in which executives, producers, engineers, and artists from the industry are procured to speak on various aspects of the recording business. This is a first-course offering in a proposed degree program in the recording industry.

OTHER COURSES OF STUDY

The Physics Department, in addition to its traditional disciplines, now offers a course in Physics and Music, in which the physical principles of sound production and reproduction are explained. And, the Engineering School offers lecture and laboratory in electrical science, as well as course work in acoustics.

Currently, there is no formal degree program offered in the audio field. Students interested in these areas register in a school with a related major, such as Engineering or Television-Radio, and take courses as electives; or, they define their direction and career goals and create a major through the Selected Studies program in the College of Arts and Sciences. Hopefully, with great enough student interest and faculty support, a formal degree program in the audio field can be developed in the future to fully exploit the facilities and resources available at Syracuse University. ■



A CASSETTE/SLIDE SYNCHRONIZER FOR THE STUDENT

The learner sets the pace, with the aid of Instructomatic's Super/Sync cassette/slide synchronizer. A section of the program can be repeated, or the student can skip ahead, all without losing synchronization of sound and picture. The device also has facilities for listen-only of standard mono or stereo programs without synchronization pulses. SuperSync is available for carrel mounting or classroom use, operating with a continuous duty bi-peripheral beltless drive mechanism and featuring three button solenoid remote control. It uses the standard separate audio and cue track format to insure compatibility with existing materials and equipment. Instructomatic is in Sunnyvale, California.

MARSHALL KING

How to Handle a Square

When you square a certain amount of something, what have you got, and why? You can avoid errors in thinking and make squaring meaningful.

AUDIO MIXERS are not necessarily mathematicians; they handle many of their calculations from rote memory, from applying rules, from remembering short-cuts, from trial-and-error, or from cookbook application of formulae. There is nothing wrong with this, for a mixer's first job is to deliver an end-product that is *sound quality* of the highest order. Nowhere does it say that a meticulous knowledge of engineering math is a prerequisite for this feat.

Nevertheless, cropping up in a mixer's life, usually at the most inconvenient times, are instances where certain concepts he has taken for granted suddenly seem false. It is even more frustrating when he has occasion to prove arithmetically some of the simplest ideas with which he has lived for years. All of a sudden the proof is as evasive as smoke, and he wonders if all along he has been stealing money from his employers.

A typical example is the business of *squaring* a certain amount of something and then honestly realizing what we've got, or why we got what we got. Even if we do come up with the correct answer arithmetically, it is sometimes questionable whether or not we truly understand what we have done in the practical world of physics or electronics.

To wit: Our very first exposure to the mathematical process of squaring whole numbers showed us that if we have a certain amount of something, and if we square that amount, we get a rather good deal more of that something. Without giving it a tremendous amount of thought, we think we remember that 3 calves squared gives us 9 calves. Yet, there is a warning here. We also remember from our early days that if we square something less than 1 we get a smaller number. That is, $(\frac{1}{2})^2 = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$. But the seldom-asked question is: less than one *what?* One number or one thing? Or does it make any difference?

For example, we feel sure that squaring three pieces of candy gives us nine pieces, which is a lot more than three. But what if those three pieces were all that remained of a box of candy that originally contained 30 pieces? Now, instead of saying that we are squaring three pieces of candy, we can say that we are squaring 1/10 of a box of candy. This gives us 1/100 of a box of candy, which is 1/100 of 30 pieces, which is a lot less than three. What happened? In one case we squared a certain amount of something and got more, and in the second case we squared what is surely the same amount but got less. Obviously, something has gone wrong. Perhaps we have victimized ourselves by careless thinking.

Marshall King is a television audio mixer with many big specials to his credit.

MATH IS SHORT-HAND

Herein lies our first reminder that mathematics is not a process in itself so much as it is a short-hand form of language. When someone says something in ordinary language we may have cause to wonder, "What did he mean by that?" Before language can have any value as a means of communication we must understand intended meanings. Being an extension as well as a short-hand form of language, mathematical statements must be understood before we can take a proper action upon them. To make a false assumption, as we did in the example above, is to lead ourselves directly to an incorrect answer.

Such a false assumption can easily be made, probably unconsciously, when we try to give ourselves an answer to the practical question: Does the size or the name of the object being squared have any effect on the truth of the process? Putting it another way, does squaring large objects involve the same process, and get the same kind of results, as squaring small objects?

Intuition, if not observation, tells us that it makes no difference whatever. We almost know without proof that the process of squaring must be independent of the thing(s) being squared. We can visualize 3 cows as

= 3 cows, and

3 cows squared as

= 9 cows.

And, it takes very little effort to imagine that we get the same kind of result when we change the object to one of a different size—cows to calves, for example.

Our thinking so far may not be called rigorous and our

semantics unimpeachable, but this has been deliberate, for it represents many of the assumptions with which we proceed during much of our working life. I shall continue in this manner until we determine further along whether or not our work has been correct.

When we say "three calves squared is nine calves" we almost never stop to remind ourselves that we have done nothing to the calves to make them square, they are still very roundish and we have squared only their number, 3, to get 9. The word *calves* is merely carried along in order that we will know the name of the object(s) which the number 3 refers to.

SQUARING IN OUR THINKING

And our thinking usually goes along these further lines. Since what we are squaring is three calves, we often visualize the expression as "squaring three calves gives us nine calves" so that (3 calves)^2 = 9 calves. This notation is the beginning of our trouble, but since it represents the path our thinking often takes, we shall continue with it for a moment.

By taking an object smaller than a calf, squaring three of them should, by the same process, give us a larger amount of this commodity, namely, nine of them. That is, we feel no reason why squaring, let us say, three *baners*, should not give us nine baners—and that's without even knowing what a baner is, for I just made it up. In fact, it appears that we can use *any* word if we believe that the process of squaring is independent of the thing being squared. For now I'll use the undefined word *baner*, although in a moment we'll give it a definition.

First, however, it is important that we go one step further and take a still smaller object, which I shall call a *ryon*, so that we can be consistent in saying that "squaring three ryons gives us nine ryons" or (3 ryons)^2 = 9 ryons. Now we have set the stage for an investigation.

In our mind's eye we can now see something like this:

3 calves as

 = 3 calves, and

(3 calves)^2 as

 = 9 calves, and

3 baners as

○ ○ ○ = 3 baners, and

(3 baners,)^2 as

○ ○ ○
○ ○ ○
○ ○ ○ = 9 baners, and

3 ryons as

= 3 ryons, and

$(3 \text{ ryons})^2$

= 9 ryons.

Now let's identify these things. I decree that a baner is 1/1,000 of a calf. Call it a veal cutlet if you like, but for our purposes here we should drop all other names and call it a millicalf since the prefix *milli* means 1/1,000 or 10^{-3}. I also decree that a ryon is 1/1,000 of a baner, or 1/1,000 of that veal cutlet. Call it a bite if you wish, but we should properly call it a *microcalf* since the prefix *micro* means 1/1,000,000 or 10^{-6}. Now let's see if anything has happened to our process of squaring simply because we seemed to have replaced one object-name with another.

If $(3 \text{ baners})^2 = 9$ baners, and if a baner is a millicalf, then we expect it to follow that $(3 \text{ millicalves})^2 = 9$ millicalves. But mathematics shows, as we shall see in a moment, that three millicalves squared is nine microcalves, which is only .009 millicalf. This is a far cry from the nine millicalves we expected; in fact, it is exactly 1,000 times smaller.

What happened? Before, when we replaced one object-name with another, we got nine of them by squaring three of them. But after the change, squaring three of them gave us a smaller amount. Again we must wonder; does the name of the object being squared have an effect on the mathematical process or not? If squaring three millicalves gives us .009 millicalf, how can we possibly believe our earlier conclusions that, before we know what a baner was, squaring three of them gave us nine? And if that does *not* give us nine baners, how can we further believe the thing which we knew absolutely was true: $(3 \text{ calves})^2 = 9$ calves?

At the beginning when we said that "three calves squared is nine calves" we were attempting to convey the idea of taking three calves three times. (Squaring would require us to take four calves four times, five calves five times, etc.). Lazy thinking led us to form the expression $(3 \text{ calves})^2$. Maybe we think we know what we mean by this, but it is an improper notation, for we have included "calves" as an entity to be squared, and "square calves" is a meaningless expression.

WHAT IS SQUARED AND WHAT IS NOT

The idea to remember is that in any expression involving the squaring process we have to understand which part is to be squared (the *root*) and which is not (the *basic unit*). As mentioned, we are not striving for square calves, but for $(3)^2$ somewhat roundish calves. So the expression should have been thought of and written as:

$$(3)^2 \text{ calves} = 9 \text{ calves},$$

where *3* is the root and *calves* is the basic unit. It should *not* have been written as

$$(3 \text{ calves})^2 = 9 \text{ calves}$$

which is mathematically wrong, nor

$$(3 \text{ calves})^2 = 9 \text{ square calves}$$

which is semantically wrong.

To repeat, we square the root and do not square the basic unit, *and our responsibility is to identify each in any expression involving squaring.* In forming mathematical expressions we must be careful to put the sign of squaring $(\ )^2$ around only those factors of the expression which are to be squared, and this becomes the *root*. We exclude from this notation the *basic unit*, which is carried along into the final answer as an identifying term.

Now let's look at the options we have in the expression, "three millicalves squared."

Option I

$(3)^2$ millicalves = 9 millicalves, where the root is *3* and the basic unit is *millicalves*.

Option II

$(3 \text{ millicalves})^2 = 9$ microcalves where the root is *3 milli* and the basic unit is *calves*. This answer is developed from:

$$\begin{aligned}(3 \text{ millicalves})^2 &= (3)^2 \text{ (milli)}^2 \text{ calves} \\ &= (3)^2 (10^{-3})^2 \text{ calves} \\ &= 9 \times 10^{-6} \text{ calves} \\ &= 9 \text{ microcalves} \\ &= (.009 \text{ millicalves})\end{aligned}$$

Which of the above two options do we use? It depends on what it is we intend to say. If we grab up three things called "millicalves" (our basic unit in this case), and if we want to do this three times, we'll have nine of the little rascals and we'll notate our intentions mathematically as

$$(3)^2 \text{ millicalves} = 9 \text{ millicalves},$$

giving us 9 basic units.

On the other hand, if we divide a calf (our new basic unit) into a thousand pieces and take three of these pieces, and if we want to repeat the process on each of the three, we'll have nine pieces, each of which is one one-millionth of a calf, and we'll notate our intentions as

$$(3 \text{ millicalves})^2 = 9 \text{ microcalves},$$

giving us 9×10^{-6} basic units.

Thus, two different semantic statements give rise to two different mathematical problems, which in turn give us two different answers.

SQUARING WITHOUT ERROR

Here are three steps we can remember to keep us out of trouble in expressions where squaring is involved:

1. Think or write the problem as a spoken statement.
2. Identify the *basic unit* and the *root*.
3. Bracket the root with the sign of squaring and proceed arithmetically.

It will pay to note that almost any term can be used as either a root or a basic unit, depending on what the expression is intended to say, but one entity which must always be treated as a basic unit is an *object-name*. The following table may illustrate this idea:

Terms which can be Roots or Basic Units:

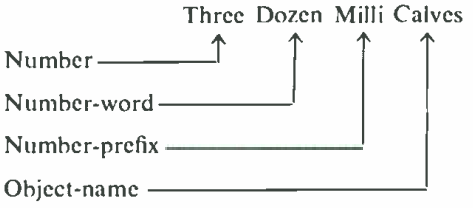
1. Numbers, such as 3.
2. Number-prefixes, such as milli.
3. Number-words, such as dozen.
4. Dimensions, such as inches.

Terms which must be Basic Units:

1. Object-names, such as pieces, ideas, calves, amps, and boxes.

The more terms or factors our expression contains, the more options we have in squaring. While such additional arithmetic may not be an obstacle, the additional available semantic meanings *may* be. Therefore, it may pay us to expand on what we have done so far to see if we can pave the way for our handling unlimited possibilities.

Let's change the expression to "three dozen millicalves" and note that we have considerable more lattitude in deciding which factors can be the root and which can be the basic unit. Bearing in mind the examples of roots and basic units just given, we may see the new expression as:



Before squaring, this expression may be visualized graphically as shown in FIGURE 1.

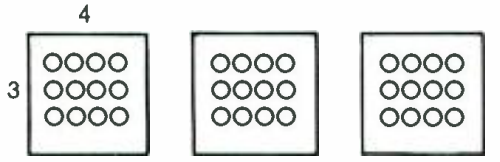


Figure 1.

OUR OPTIONS IN SQUARING

Now, what are our options in applying the squaring process to the expression "three dozen millicalves"? Again, it depends on what it is we want to say.

OPTION I. If we consider that *calves* is our basic unit, the expression, when squared, becomes

$$(3 \text{ dozen})^2 \text{ (milli)}^2 \text{ calves.}$$

This is a mathematical instruction that tells us

a) from *(milli)*^{2} to divide one or more calves into a million parts each, and

b) from *(3 dozen)*^{2} to take three dozen of these parts three dozen times,

giving us 1,296 microcalves, or $1{,}296 \times 10^{-6}$ basic units.

In FIGURE 2 is shown the mathematical derivation as well as the graphical representation of what we are instructed to do.

Derivation:

$$\begin{aligned}&(3 \text{ doz. milli})^2 \text{ calves}\\ &= (3 \text{ doz})^2 \text{ (milli)}^2 \text{ calves}\\ &= (36)^2 (10^{-3})^2 \text{ calves}\\ &= 1{,}296 \times 10^{-6} \text{ calves.}\end{aligned}$$

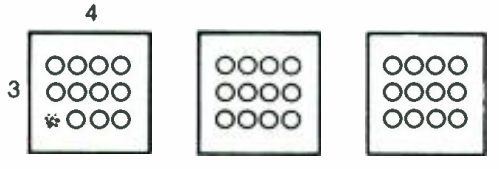


Figure 2.

OPTION II. If we consider that *millicalves* is our basic unit, the expression, when squared, becomes

$$(3 \text{ dozen})^2 \text{ millicalves.}$$

This is a mathematical instruction that tells us

a) from *milli* to divide one or more calves into a thousand parts each, and

b) from *(3 dozen)*^{2} to take three dozen of these parts three dozen times,

giving us 1,296 millicalves, or 1,296 basic units.

In FIGURE 3 is shown the mathematical derivation as

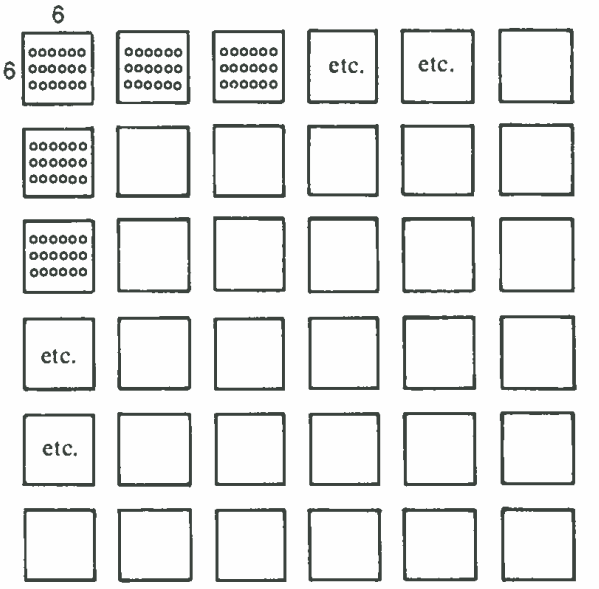


Figure 3.

well as the graphical representation of what we are instructed to do.

Derivation:

$(3 \text{ dozen})^2$ millicalves
$= (36)^2$ millicalves
$= 1{,}296$ millicalves.

OPTION III. If we consider that a *dozen millicalves* is our basic unit, the expression, when squared, becomes

$(3)^2$ dozen millicalves.

This is a mathematical instruction that tells us

a) from *milli* to divide one or more calves into a thousand parts each, and
b) from $(3)^2$ dozen to take one dozen of these parts nine times,

giving us 9 dozen millicalves, or 9 basic units.

In FIGURE 4 is shown the mathematical derivation as well as the graphic representation of what we are instructed to do.

Derivation:

$(3)^2$ dozen millicalves
$= 9$ doz millicalves.

Graphic Representation:

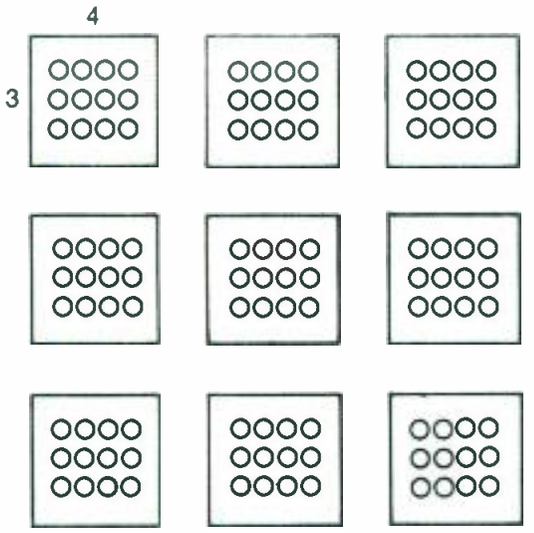


Figure 4 Each square = 1 doz millicalves.

THREE CRITICAL FACTORS IN SQUARING

From all of the above, our conclusions should be that we have at least three critical concerns in squaring:

1. *Our mathematical language must be precise.* "Three milliamps squared" is not the same as "three squared milliamps."
2. *We must distinguish roots from basic units.* In $3^2 = 9$, the root is *3* and the basic unit is *1*. In $(3 \text{ ma})^2 = 9$ microamps, the root is *3 milli* and the basic unit is *amps*. In $(3)^2$ ma $= 9$ ma, the root is *3* and the basic unit is *milliamp*.
3. *For a forecast of the magnitude of our answer, we must compare the product of the factors to be squared with the number 1.* If their product before squaring is less than 1, as in $(999 \text{ ma})^2$, the answer will be smaller than before squaring. If it is larger than 1, as in $(1{,}001 \text{ ma})^2$, it will be larger.

Now, what about those three pieces of candy coming from a box which contains thirty pieces, mentioned earlier in this article? We said that if we squared three pieces of candy we'd get nine pieces, but that if we called those three pieces a tenth of a box and squared that, we'd get $(1/10)^2 = 1/100$ boxes of candy which is only three-tenths of a piece. Why didn't we get the same answers when squaring the same thing?

The answer to that is, we were *not* squaring the same thing. In one case the basic unit was *pieces*, in the other it was *boxes*. In one case we had no number-prefix such as "milli" or "deci" to square, in the other we did.

ANSWER DEPENDS ON BASIC UNIT

It all boils down to the principles we now understand so well from our problems with calves and millicalves. In short, our answer depends on what our basic unit is. It's either millicalves or calves; it's either pieces or boxes. These two parallel problems and their solutions are shown side by side:

I. Where the basic units are *pieces* and *millicalves:*

Pieces	*Millcalves*
$(3)^2$ pieces $= 9$ pieces	$(3)^2$ millicalves $= 9$ millicalves

II. Where the basic units are *boxes* and *calves:*
(NOTE: 3 pieces of candy = 1 decibox)

Boxes

$$(1 \text{ decibox})^2 = (1)^2 \text{ (deci)}^2 \text{ boxes}$$
$$= (1)^2 (10^{-1})^2 \text{ boxes}$$
$$= 1 \times 10^{-2} \text{ boxes}$$
$$= .01 \text{ boxes}$$
$$= \frac{.01 \text{ boxes}}{1} \times \frac{30 \text{ pieces}}{\text{box}}$$
$$= .3 \text{ pieces}$$

Calves

$$(3 \text{ millicalves})^2 = (3)^2 \text{ (milli)}^2 \text{ calves}$$
$$= (3)^2 (10^{-1})^2 \text{ calves}$$
$$= 9 \times 10^{-6} \text{ calves}$$
$$= .000009 \text{ calves}$$
$$= \frac{.000009 \text{ calves}}{1} \times \frac{1{,}000 \text{ millicalves}}{\text{calf}}$$
$$= .009 \text{ millicalf}$$

If you still want that 1/10 box of candy, when squared, to give us the same 9 pieces, what you are asking, effectively, is that we change our basic unit from *boxes* back to *pieces*. It can be done (as follows) providing we remember we're back to dealing with pieces, not boxes:

$$\left(\frac{1}{10}\text{box of candy}\right)^2 = \left(\frac{1}{10}\right)^2 \text{(boxes)}^2$$
$$= \left(\frac{1}{10}\right)^2 (30 \text{ pieces})^2$$
$$= \frac{1}{100} \times \frac{900}{1} \text{ pieces}$$
$$= 9 \text{ pieces}$$

Is everybody happy? Now that we have this perfectly clear, no longer will we wonder why six milliamps, when squared, does not give us thirty-six milliamps. And we know what to do with three pieces of candy—even if they're round! ■

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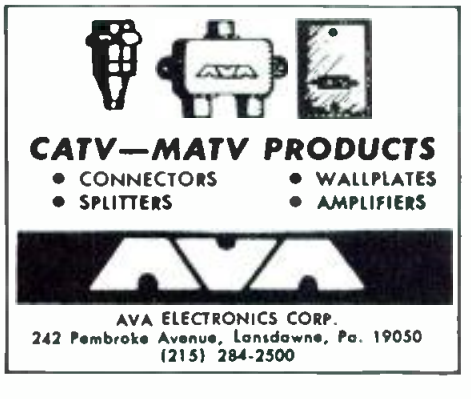

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W.A.L. 804-4 audio console, $6,400; Spotmaster 500AR-114C mono record/play cart. machines, $269.00 each; new Crown recorders and amplifiers in stock; Ampex 350 F.T., $895; Ampex 350-2-C, new heads, in console, $1,250; Ampex 351-2, console available, $1,395; Ampex 354-2, $1,195; Ampex 300-4 w/sel. sync, new heads, $2,595; Ampex 300-4 w/sel. sync., metal console, $2,050; Ampex PR-10-2-P, 7½ & 15 ips, case, $495; Ampex 351-8 or FR-1100-8C w/new heads and new Inovonics model 355 electronics in Scully type console, $7,450; Ampex 300-8C Accurate Sound 351 electronics w/remote sel. sync. and Formica console, $4,995; Ampex AM-10 transistorized mixer w/case and meters, $335; Magnacord 1022P transistorized two-track, 7½ & 15 ips w/fourth quarter track play head, cases, $595; Telectro F.T. mono, 7½ & 15 ips, new heads and case (like Ampex 351), $850; Ampex FR-100 & 3M Isoloop Mincom instrumentation decks, $395; Univac ½" digital decks, $75; Presto 8N lath and Gotham Grampian head & amplifier, $1,150 (other lathes and heads available); new and used Atlas stands and booms at discounts. All used equipment checked and guaranteed, some rebuilt. **Wiegand Audio, R. D. 3, Middleburg, Pa. 17842. Phone for details (717) 837-1444.**

NEW YORK'S LEADING PRO AUDIO/VIDEO DISTRIBUTOR for audio, video, broadcast, public address, and hi-fi systems; representing over 130 audio/video manufacturers, featuring such names as Ampex, Scully, Tascam, Sony, J. B. Lansing, Neumann, Altec, McIntosh, AKG, Dynair, T.V. Microtime, UREI, 3M, and other major brands; the largest "in stock" inventory of equipment, accessories, and parts; competitive discount prices; factory authorized sales, service, parts, systems design, installation. Write for free catalog! **Martin Audia/Video Corporation, 320 W. 46th St., New York, N.Y. 10036. (212) 541-5900.**

LINE DISTRIBUTION TRANSFORMERS: ± .25 dB, 30 Hz-15kHz @ 27 dBm; p.c. or panel mount; 30 ohm pri. 150/600 CT. Sec. $4.00. 300 available. **L. A. Krause, 107 W. Walnut, Chanute, Kansas 66720. (316) 431-6232.**

TARZAC PROFESSIONAL CASSETTES —Custom Cassette Labels. Complimentary samples. **TARZAC, 638 Muskogee Avenue, Norfolk, Virginia 23509.**

PROTOTYPE/FABRICATION SERVICES: Any project or installation, from breadboard to complete studio. **Box 210, Locust Valley, L.I., N.Y. 11560. (516) 759-0174.**

AMPEX 300, 352, 400, 450 USERS—for greater S/N ratio, replace first playback stage 12SJ7 with our plug-in transistor preamp. For specifications write **VIF International, Box 1555, Mauntain View, Ca., 94042. (408) 739-9740.**

WE HAVE A FEW competitively priced used Revox A77 decks available. These have been completely reconditioned by Revox, are virtually indistinguishable from new, and have the standard Revox 90-day warranty for rebuilt machines. One example is an A77/Dolby for $675, plus shipping. Satisfaction guaranteed. Please write, stating your requirements to **ESSI, Box 854, Hicksville, N.Y. 11802. (212) 895-9257.**

SCULLY 280 ELECTRONICS, $350; Scully 4-channel playback electronics, $575; Altec Graphic EQ, $295; Spectra Sonics 22-in/8-out remix console, $3,950; 1 Dolby M-16, $7,800. **Sound 80, Inc. Minneapolis, Minn. (612) 721-6341.**

AMPEX SERVICE COMPANY: Complete factory service for Ampex equipment; professional audio; one-inch helical scan video; video closed circuit cameras; video systems; instrumentation and consumer audio. Service available at **2609 Greenleaf Avenue, Elk Grove Village, Ill. 60007; 500 Rodier Dr., Glendale, Ca., 91201; 75 Commerce Way, Hackensack, N.J. 07601.**

Continued next page

TAPCO Professional Audio Mixers

Model 6000RCF

This is the best sounding, most rugged and all around finest mixer we have yet found for use by musical performers, sound systems operators and all others who require a superb mixer at a reasonable cost.

A unique combination of special input circuitry and studio type mixing results in unusually fine performance under actual concert conditions. No channel interaction, no overloading. Each channel has its own volume, bass and treble controls.

Provisions for stacking two or more mixers make this exceptionally versatile where more than six channels are required. Accepts either high or low impedance mic inputs without switches or transformers plus a unique microphone equalization circuit that compensates for high frequency microphone loss.

Best of all its price is reasonable. Model 6000CF is only $219.00 complete with Cannon and phone jack inputs. The Model 6000 with phone jack inputs only is just $188.00.

Model 6000RCF (with reverb and and effects control) is priced at $326.00. All prices include shipping costs. A two year parts and labor warranty applies to all TAPCO units. A bulletin describing all models is available upon request.

SPECIFICATIONS

6000 STANDARD MIXER

Response: 10 hz to 40khz ±1 dB
Distortion: Below .3%, typically .08%
Overall Gain: Over 120 dB
Bass & Treble: ±15 dB
Input Impedance: Mic 150-200 ohms (low) to 50k ohms or higher (hi); Aux-Tape input 82k ohms
Outputs: Hi level, up to 10 volts r.m.s. or +16 dBm into 600 ohms; Adjustable level, 0-10 volts r.m.s.
Size: Chassis, 15.5" w, 3.25" h, 7.25" d; Overall, 15.5" w, 3.25" h, 7.75" d
Power: 117 volts A.C. 60 hz
Weight: 7 lbs.

WHO IS TAPCO?

TAPCO (Technical Audio Products Corp.) is a young group of musically oriented and technically skilled people in Edmonds, Wash. who started building guitar amps in 1968. Their close association with other musicians and their knowledge of their needs and requirements led into more advanced systems. It is this background that enabled them to develop and produce a series of mixers that are especially meaningful. They really care about the equipment they make.

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FOR SALE

ONE OTARI PROFESSIONAL tape machine, excellent condition, $1,400; one Gately PM1 mixer, $500; 2 Shure M67 mixers, $90 each; 2 Beyer M360 ribbon mics, excellent condition, $175 each; 3,000 feet of two-conductor cable, $200; joblot Atlas stands and spare parts, $100. **R. Waterstradt, 50 S. Penn St., Hatboro, Pa. 19040. (215) 674-3214.**

ONE WAY NOISE REDUCTION for cutting rooms/tape copies; retains highs, rids hiss/surface noise & clicks/pops by a full 10-14 dB and costs $150 up per channel! **Music & Sound, Ltd., 11½ Old York Rd., Willow Grove, Pa. 19090. (215) 659-9251.**

FOR SALE: 8 A301 DOLBYS with automatic changeover, built into rack and power supplies, $8,500; 4 A301 Dolbys, each $850; 1 3M model 64 4-track recorder/reproducer with sync line amp cards, 15/30 ips, $4,800; 1 3M model 64 2-track recorder/reproducer, 7½-15 ips, $2,500; 1 3M model 64 full-track recorder/reproducer, 7½-15 ips, $2,000. **Crystal Industries, Inc., 1014 N. Vine St., Hollywood, Ca. 90038. (213) 466-6452.**

SPLICE FASTER, BETTER, BY SHEARING; replaces razor; attached splicing tape dispenser; quality workmanship; reasonably priced; endorsed by professionals. $24.95 prepaid. Guaranteed. Distributors wanted. **NRP, Box 289, McLean, Virginia 22101.**

SCULLY, ELECTRO-VOICE, Neumann, Shure, Spectrasonics, Quad Eight, Masterroom, ARP, Crown, Microtrak, Russco, dbx, Interface, EMT, and others. **The Audio Marketplace, Div. United Audio Recording, 5310 Jockwood, San Antonio, Texas 78238. (512) 684-4000.**

FOR SALE: AMPEX 16-track master recorder; excellent condition; non-servo, 2½ years old; low cost financing available; assume our low interest loan (if you qualify): $3,500 down and $368 per month for approximately 31 months. Will accept $12,000 cash. Reason for sale: going 24-track. **Studio West, California. (714) 277-4714.**

FOUR TRACK SERIES Tascam ½" tape recorder; good condition. **Moon-Hill. (512) 472-1618.**

FOR SALE: PROFESSIONAL TAPE RECORDER, OTARI model MX7000, 2-track stereo, in table top console; 3 speeds, electrically switched; brand new, with one year parts warranty. $1,600. **Box 11, db Magazine, 1120 Old Country Rd., Plainview, N.Y. 11803.**

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FREE ROOM EQUALIZATION with purchase of ⅓ octave filters. This is **not** a misprint. **Music & Sound, Ltd., 11½ Old York Rd., Willow Grove, Pa. 19090. (215) 659-9251.**
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WANT TO GO BI-AMP?
DeCoursey Electronic Dividing Networks are available from $89.10 (monaural bi-amp) to $205.00 (stereo tri-amp). Price includes plug-in Butterworth filters; 6, 12, or 18 dB per octave at any desired cutoff frequency. **DeCoursey Engineering Laboratory, 11828 W. Jefferson Blvd., Culver City, Ca. 90230.**

SOLID-STATE AUDIO MODULES. Console kits, power amplifier kits, power supplies. Octal plug-ins—mic. eq., line, disc, tape play, tape record, amplifiers, Audio and tape bias oscillators. Over 50 audio products; send for free catalog and applications. **Opamp Labs, Inc., 1033 N. Sycamore Ave., Los Angeles, Ca. 90038.**

BROADCAST AND RECORDING EQUIPMENT: Scully; Metrotech; Langevine; Electrodyne; Q.R.K.; Micro-Trak; M.R.L.; Nortronics; McMartin; U.R.E.I.; Revox; Crown; Byer; Lamb; Master Room; Stellavox; E.V.; A.K.G.; Sennheiser; Atlas; Ferrograph; HAECO; Stevenson; Gately; dbx; Advent; Altec; Fairchild; Audio Designs; 3M; Magnacord; Telex; Inovonics. Disc recording systems; package deals; installations; service. **Wiegand Audio, Middleburg, Pennsylvania 17842. (717) 837-1444.**

MULTI-TRACK

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AUDIO DUPLICATING EQUIPMENT; high speed, quality systems for cartridge or cassette duplicating. Duplicators, loaders, QC checkers, master recorders, electronics. **Audio/Tek, Inc. 503-F Vandell Ave., Campbell, Ca. 95008. (408) 378-5586.**

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Inventors/Engineers

FOUR-TRACK RECORDER: Ampex AG-500 with sel/sync; brand new with warranty, $1,995.00. **Gately Electronics, 57 W. Hillcrest Ave., Havertown, Pa. (215) 449-6400.**

ONE WAY NOISE REDUCTION for cutting rooms/tape copies; **retains** highs, rids hiss/surface noise & pops by a full **10-14 dB** and costs **$125 up** per channel! **Music & Sound, Ltd., 11½ Old York Rd., Willow Grove, Pa. 19090. (215) 659-9251.**

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DYMA builds roll-around consoles for any reel-to-reel tape recorder. **Dyma Engineering, Route 1, Box 51, Taos, New Mexico 87571.**

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ONE AMPEX 440-4; includes two-track stereo head block IN CONSOLE; 7½-15 ips, $2,950.00. One Ampex 300—top plate MCI electronics; two-track; IN CONSOLE; 7½-15 ips, $1,950. Ampex 351—top plate MCI electronics; two-track; IN CONSOLE; 7½-15 ips, $1,850.00. Ampex 351—top plate MCI electronics in Scully portable cases; two-track stereo; 7½-15 ips, $1,750.00. MCI 16-track tape machine with matching 8-track heads and guides; autolocator; IN CONSOLE; 15-30 ips, $12,500.00. **Criteria Recording Studios, 1755 N.E. 149th St., Miami, Florida 33161. (305) 947-5611.**

DYMA builds custom studio consoles, desks, enclosures, studio furniture. **Dyma Engineering, Route 1, Box 51, Taos, New Mexico 87571.**

THE LIBRARY . . . Sound effects recorded in STEREO using Dolby™ throughout. Over 350 effects on ten discs, $150.00. Write, **The Library, P.O. Box 18145, Denver, Colorado 80218.**

CASSETTE DUPLICATION; 25 or more pieces—C-60 or shorter; monaural. **TARZAC, 638 Muskogee Avenue, Norfolk, Virginia 23509.**

WANTED

WANTED: TIRED BUT REPAIRABLE 8-track duplicating equipment. **P.O. Box 764, Holly Hill, Florida 32017.**

EMPLOYMENT

AUDIO ENGINEER/MIXER seeks employment, preferably in music recording, especially rock/blues & electronic. Will consider commercials. Will relocate. For further information & resume, write or call: **Joe Tierce, 2129 Central, Memphis, Tenn. 38104, 1-901-754-8058.**

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.**

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db people/places/happenings

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● Filling a newly created position, **Rod Bell** has been appointed vice president, consumer products, at **James B. Lansing Sound.** Mr. Bell, national sales manager for the company, will focalize long range planning and promotion of all JBL consumer products. He will continue to function as sales manager, directing all marketing programs and supervising dealer training programs. Prior to joining JBL in 1971, Mr. Bell was associated with **Roland Olander & Company.** Another appointment of interest at JBL is that of **Richard A. Bloom**, who will serve as manager of the Michigan audio office, at Southfield. Mr. Bloom comes to JBL from **Superscope.**

● Appointment of Paul Galburt as senior project engineer has been announced by Automated Processes, Inc., Melville, N.Y. Mr. Galburt will work on the development of the company's line of consoles and audio components. He was formerly with the **Digiac Corporation.**

● Three new appointments have been announced at **Electro Sound, Inc.**, of Sunnyvale, California. **Charles Link** has been promoted to the post of vice president and general manager. **Mort Fuji** has undertaken responsibility for the firm's research and development activities as vice president of technical operations. Coming to Electro Sound from **CBS, Robert W. Cochran** has joined the firm as vice president of marketing and sales.

● A program for the establishment of marketing avenues and distribution channels for dictation and telephone answering systems in Mexico, Central, and South America has been embarked upon by the **Dictaphone Corporation,** Rye, N.Y. **Jerry A. Klein** has been named to the new position of vice president, international development. Mr. Klein joined the company in 1970 when Dictaphone acquired **Ansonics International Corporation,** which he founded in 1967.

● In a recent ceremony in Switzerland, **Toshiya Inoue**, managing director of the **Audio Engineering Research Center of the Victor Company of Japan, Ltd. (JVC America)** was awarded the Diploma d'Honneur, the Seventh Annual Montreux International Award, for his work with the CD-4 discrete quadriphonic disc. Most of Mr. Inoue's work on advanced disc transfer technology has been done during the five years he has been associated with the research center. He was responsible for the first LP cutting systems in Japan and also introduced 45/45 stereo disc technology to that country. He has made a number of contributions to technical journals, describing his work.

● With executive responsibility for marketing RCA broadcast systems in Europe, the Middle East, and Africa, **John M. Boatman** has been appointed as manager, field sales by **RCA International Marketing S.A.** in Geneva, Switzerland. Mr. Boatman comes from a previous position as sales engineer. He has been with the company since 1959.

● A new state-of-the-art, 16-channel recording studio has been added to the facilities of **Accurate Sound Company,** Redwood City, California. The firm hopes that the new studio will increase their capability in recording music for their area. They also plan to design and build turnkey multichannel recording facilities.

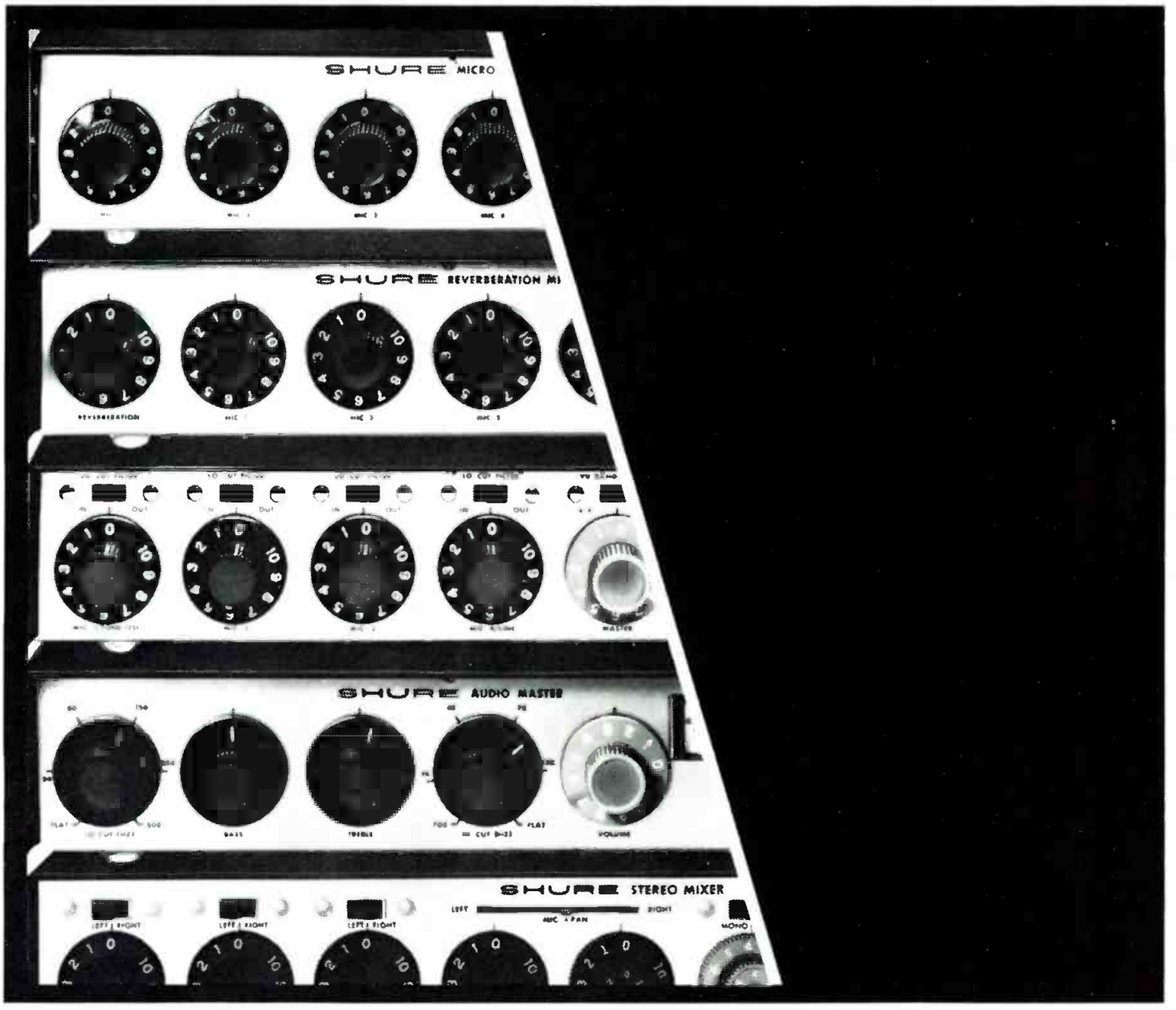
● The first stereo signal to reach Malaysia will be sent through twin transmitters installed on top of a mountain near Kuala Lumpur, using equipment purchased by the **Malaysian Ministry of Information** from the **Sparta Electronic Corporation.** The transmitter will be fed by a Sparta-supplied composite STL situated in the Ministry's modern studio in the nation's capital. On-site instruction in operation and maintenance will be provided by Sparta Trasmitter Division engineers.

● **Laurence Malkin**, specialist in electronic equipment financing, has joined **Advanced Leasing Services, Inc.**, New York as vice-president. He will work primarily with electronics firms and radio-t.v. recording studios in arranging equipment financing. Mr. Malkin comes to Advanced Leasing from **National Equipment Rental.**

NOTRE DAME CONTROL CENTER

● Modernization and increased flexibility of the public address system at Notre Dame stadium, **Notre Dame University**, in Indiana was recently completed. Equipment used was Crown DC-300A amplifiers, Spotmaster 5 BEM-2005 audio console, a Crown VFX-2 filter and Electro-Voice speakers and microphones. A simple wiring change converted the four stereo amplifiers into eight monaural amplifiers, six used to drive the speakers and the others kept as spares. Ten access channels allow the system to pick up sound in all areas of the stadium simultaneously. **Phil Casey**, of WSBT-TV at Notre Dame, designed the layout which was installed by the **Koontz-Wagner Electric Company** of South Bend, Indiana, under the direction of **Ken Kempf.**

● Appointment of **Randy S. McCallister** as a product analyst for **RCA Broadcast Systems,** of Moorestown, N.J. has been announced. Mr. McCallister will be responsible for product management of RCA's line of a.m. radio transmitters and audio equipment for radio and t.v. broadcasters. Prior to joining RCA, he was chief engineer for **WCIR-AM/FM** in Beckley, W. Virginia.



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