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THE SOUND ENGINEERING MAGAZINE

JANUARY 1969 75c

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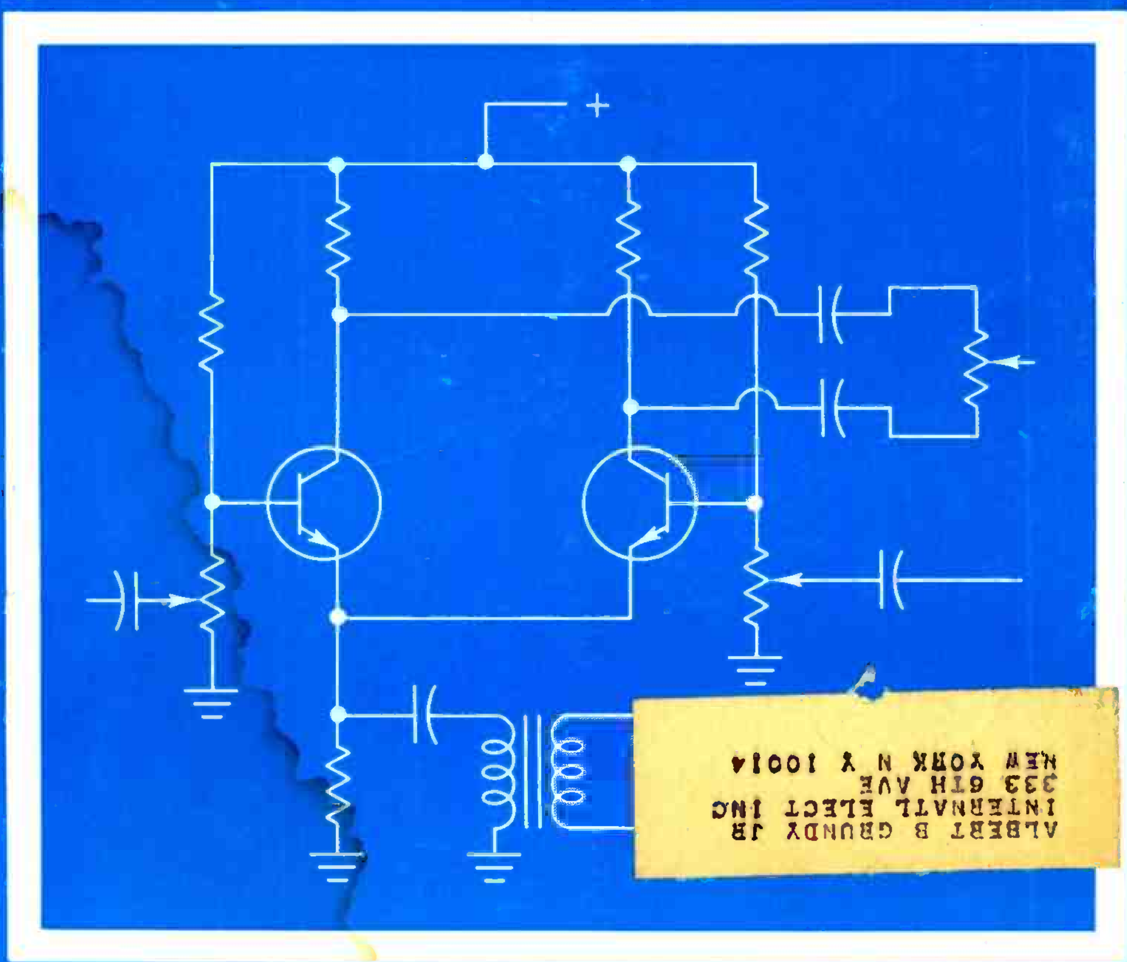

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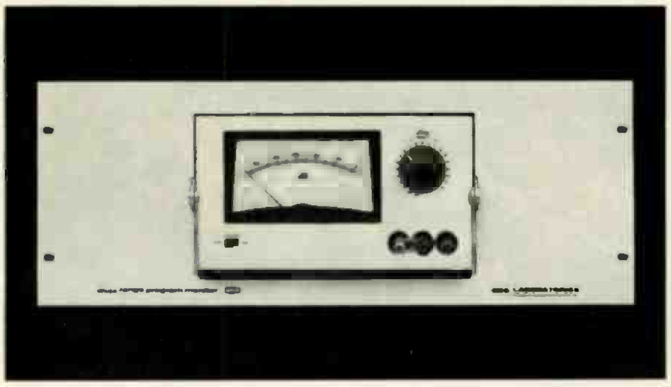

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Coming

The function of earphones as a tool for critical program monitoring is the lead in to an article by Howard Souther. In it he will describe a new electrostatic phone that expands the capabilities of earphone monitoring. In part 1 to appear next month he will cover the limitations of present monitoring systems and the advantages to be offered by earphones.

Sidney L. Silver has written an in-depth treatment of microphones for stereophonic recording. The correct mics for the job, and the correct placement for the size of the talent will be discussed.

Techniques for the Synthesis of Electronic Music is the title of a work by Robert Ehle. This is a pedagogic piece that outlines the sources and methods for the creation of music tones electronically.

And there will be our regular columnists, George Alexandrovich, Norman H. Crowhurst, and Martin Dickstein. Coming in **db**, The Sound Engineering Magazine.

About the Cover

The abstract schematic on our cover is detailed in full on page 22 in the article by Ronald Pesha. Can you figure out what it is?

db

THE SOUND ENGINEERING MAGAZINE

JANUARY 1969 • Volume 3, Number 1

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FEATURE ARTICLES

MONTHLY DEPARTMENTS

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Letters

The Editor:

I would like to comment on your New Products and Services release on page 29 of the October issue, involving the W.H.M. flutter meter.

It is always regrettable that years of effort which go into the establishment of standards both domestic and international are as lightly brushed aside as in the case of the casual sentence: ". . . conforms in all important respects with the generally accepted standards."

It so happens that the instrument described in no way meets either the USASI, EIA, or NAB standards used in this country, or the CCIR and IEC and DIN standards used abroad. At this writing, the United States is about to propose a change in the flutter measurement standard to conform to the international standard — a far reaching step destined to make future flutter specifying throughout the world uniform. Flutter measured using the W.H.M. meter is useless for purposes of comparison to other equipment.

Stephen F. Temmer
President
Gotham Audio Corp.

Mr. Colin Hammond is president of the Revox Corporation, distributors of the W.H.M. flutter meter. His response follows:

The W.H.M. meter is designed around a standard common in Britain and quite similar to the NAB standard. Our purpose in distributing this meter is to provide the service trade with a quality low-cost measurement device that would give accurate relative measurements of a system's flutter and wow. Thus, the technician would be able to directly observe both cause and service effect of flutter-causing difficulties on a machine. The W.H.M. provides this: it will not provide indications that can be directly related to other standards. But the results will be close enough so that the technician will be able to determine if the instrument under test substantially conforms with its specifications. Remember that for the most part, even with professional equipment, you are not told by which standard the published flutter specification was derived.

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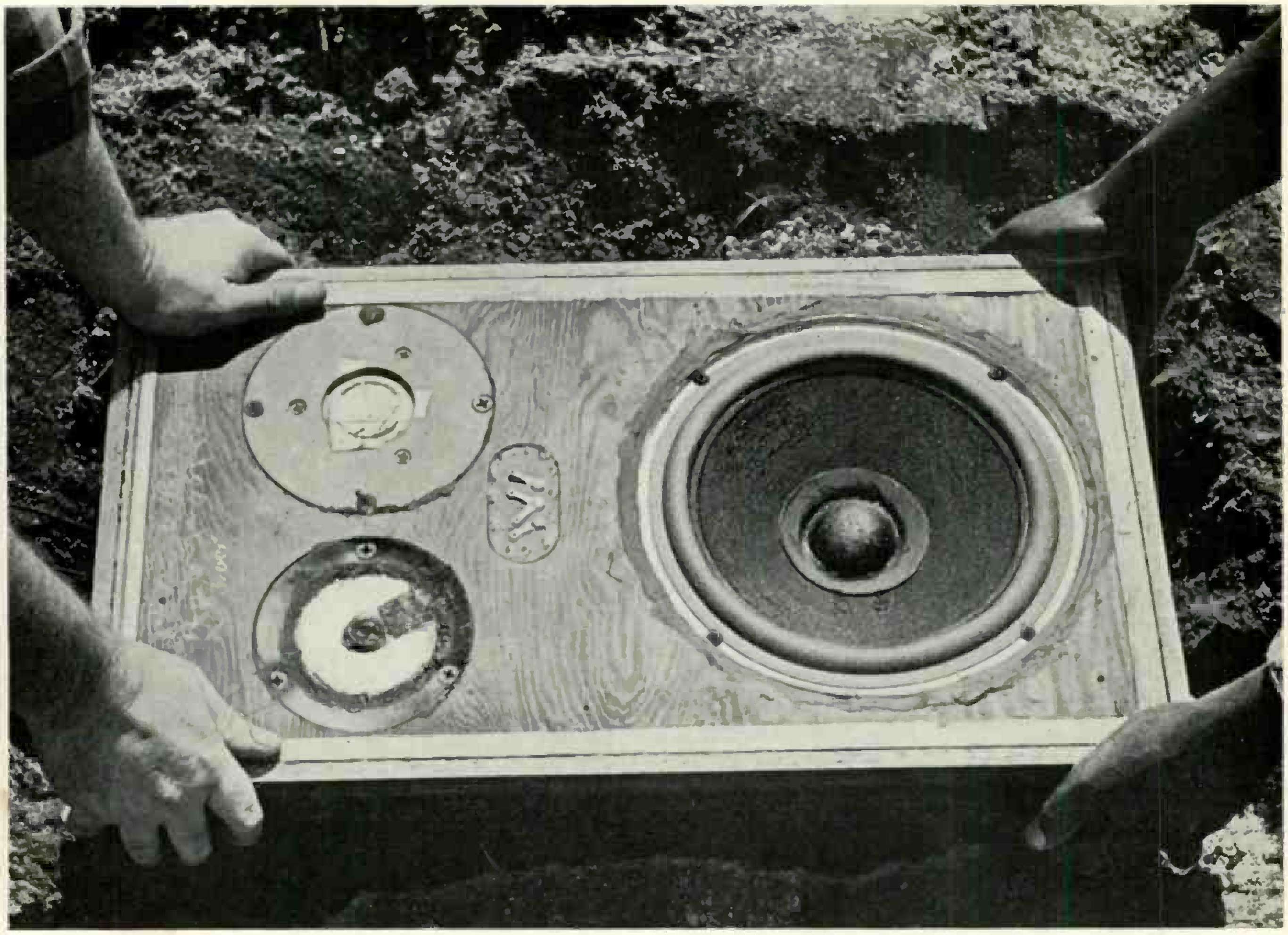
the birth of the AR-5



This is a photograph taken immediately after our final test of the prototype of the AR-5. The speaker system was measured while buried in a flat, open field, facing upward, its front baffle flush with the ground. This technique provides more accurate information than indoor tests, especially at low frequencies, where the precision of such measurements is adversely affected by the limited size of an anechoic chamber.

Our standard of accuracy when measuring the AR-5 prototype was the sound of live music, that is, absolute accuracy of reproduction. At AR, the best response curve for a speaker system, like that for a microphone or amplifier, is the one which most closely matches the input.

The specifications which AR advertises are obtained from production units, not prototypes. All AR-5 systems must match the performance of the prototype within close tolerances. To see that this is true, every AR-5 is tested numerous times in ways which permit it to be compared to the prototype. Only in this way can we be certain of what we have made, and consumers certain of what they are being offered.

AR speaker systems have uniformly received favorable reviews in publications which carry test reports. But even more accurate and comprehensive tests than most of these magazines perform are made on the AR production line, of every AR speaker system which will go into a listener's home.

The AR-5 is priced from $156 to $175, depending on cabinet finish.

ACOUSTIC RESEARCH, INC., 24 Thorndike Street, Cambridge, Mass. 02141
Overseas Inquiries: Write to **AR International** at above address

Circle 32 on Reader Service Card

The Audio Engineer's Handbook

GEORGE ALEXANDROVICH

POWER SUPPLIES

• The power supply is one of the most neglected parts of the audio system affecting performance. The best low-noise amplifiers will not function as specified if the power supply is not delivering well-regulated and well-filtered d.c.

How does the power supply affect the performance of an amplifier? Most of today's amplifiers use class AB circuits. Without signal they draw little current; however, as the signal increases so does the current consumption. It is general practice to provide sufficient decoupling at each amplifier to isolate these fast current fluctuations from feeding to the common power-supply bus. It is impossible to provide 100-per cent brute-force isolation between amplifiers; as a result there sometimes is motorboating.

How many audio engineers have stopped and wondered about what happens to the s/n of the system if the power-supply ripple voltage is higher than the amplifier noise? And who can say how much distortion an amplifier will produce at full output when driven off a *soft* power supply? (This is often referred to as transient distortion. *Soft* is used to mean poor voltage regulation or voltage sensitive to current demands.)

Some may think that substituting a battery supply will solve all the problems. Not so. A battery supply will eliminate ripple to be sure, but the chances are that you have increased the power-supply impedance without the benefits of voltage regulation or remote sensing—not to mention voltage adjustment.

Solid-state technology has required a considerable upgrading of power-supply performance. What was previously accomplished with a few 'lytics will not work with current-hungry transistors. The result has been a special breed of low-voltage, high-current supplies. A variety of circuits have been tried, ranging from the simplest to highly complex transistor-resistor-diode combinations.

The simplest is the brute-force type. It consists of a low-voltage source (transformer or generator), a rectifier section, and smoothing network (r.c. decoupling filters). Brute-force supplies are both economical and reliable. Most of the time they are impervious to shorts and overloads. But they don't work well with class B circuits, offering poor regulation; they're applicable only to class A circuits with small current requirements.

An improvement in performance can be realized by the addition of a zener diode across the output of the brute-force supply. Figure 1 shows a typical brute-force supply. Proper design requires that we first know the voltage and current we need to draw from the circuit. The rectifier section should have the capability of delivering enough voltage to compensate for the drop across filter resistor R when maximum load is applied.

Old reliable Ohm's law calculates this voltage drop:

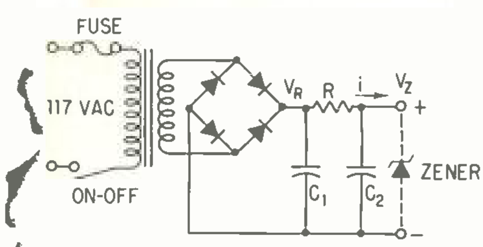


Figure 1. A brute-force power supply.

$$\frac{V_r - V_z}{R} = I;\ V_r - V_z = I \times R = \text{voltage drop}$$

When a zener is used across the output, it maintains constant output voltage by drawing unused current supplied by the circuit. When maximum load is applied the zener should draw only enough current to maintain regulation (normally several mA is sufficient). However, if there is no load, the zener draws all the current from the supply. The power dissipated by the zener is the voltage *times* current.

Let's assume that the voltage across the zener is 24 V d.c. and the current through it is 0.1 amp. Substituting the values into the power formula:

$$\text{Power} = 24 \times 0.1 = 2.4 \text{ watts.}$$

In selecting the proper zener for the job a safety factor should be added. Thus, in our example a 2.5-watt minimum should be used. Quite aside from the current from the power supply that is directed into the load, a zener needs a bias current. The selection of a larger zener will compensate for this addition.

It also should not be forgotten that the power-handling capabilities of a zener are temperature sensitive. In order to control temperature, zeners are normally mounted on a heat-dissipating surface such as a heat sink or heavy chassis. The heat dissipated by the zener is greatest, of course, when there is not load on the power supply.

Brute-force power supplies may be rugged, simple, and cheap. But they cannot be used where low-ripple, high-current and remote-sensing requirements exist. There are no 50- to 100-watt zeners. The alternative is a transistorized regulator circuit which will offer us all of the features we expect from a power supply.

Transistorized regulator circuits require less capacitance less space, and produce much less ripple, better regulation, short-circuit protection, remote sensing, voltage adjustment, and higher reliability. FIGURE 2 shows a typical circuit using three transistors, a zener diode and two other diodes, three capacitors, and a few resistors.

Operation is as follows. The transformer supplies 24 V a.c. to the full-wave bridge rectifier. The output of the bridge is approximately 44 V pulsating d.c. smoothed out somewhat with two (C_1) filter electrolytics. This particular circuit is a series regulator type with Q_1 doing all the heavy current work. As the current demand by the load increases, the power dissipated across Q_1 grows. Usually the circuit is adjusted so that the IR drop produced by the heavy current demand is divided among the bridge rectifier, filter resistor R_1, and transistor Q_1. The silicon diodes in the bridge have a normal forward voltage drop of approximately 0.5 volts.

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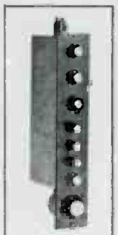

ADM-700R
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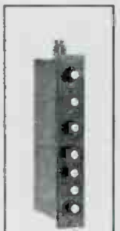

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Circle 34 on Reader Service Card

Q_2 is the driver transistor that has been connected to Q_1 in a Darlington configuration. This increases the sensitivity of the circuit. The base of Q_2 is connected to the collector of Q_3 which in turn works as a sensing and regulation amplifier. Q_3 controls the base of Q_2 and consequently also controls Q_1. The zener diode is in series with Q_3, serving as a voltage reference. Signal derived from the sensing resistors R_5, R_6, and R_7 to the base of Q_3 is compared to the reference voltage. It is then applied to the base of Q_2 as a regulating voltage. The zener draws little current and can be of ½-watt rating. Current flowing through Q_3 is sufficient for the zenering action of Z_1. Resistor R_3 and capacitor C_2 supply constant current to the circuit. At the same time, they are setting the bias for Q_2. Since the base of Q_3 is connected to the slider of R_5 it receives bias according to the voltage appearing between the output terminals of the power supply.

Note that the ends of the R_5 control are actually joined with the load terminals where they can sense voltage as it appears at the load. If power wires are long and current is high, then the voltage drop along the cable to the load will be substantial. But remote sensing compares voltage at the load to the zener voltage and, if lower than the value preset with R_5, changes the bias on Q_3. This, in turn, affects Q_2 and Q_1—biasing them into heavier conduction. This also raises the voltage at the output terminals, thus compensating for cable losses.

If you accidentally disconnect one of the sensing wires while the power supply is on, resistors R_6 and R_7 provide protection against accidental voltage runaway. Both resistors are low enough in value not to affect the operating voltage setting, but high enough be high-value shunts (when sensing wires are connected) across these wires. This does not affect the process of remote sensing.

If the output wires are acidentally shorted, the resistor in series with the emitter of Q_1 (R_2) develops enough voltage across it to turn on the two diodes connected to the base of Q_2. The diodes form current-limiting feedback clamping the output voltage by turning off Q_1. The same circuit works as an overload protection circuit limiting the current supplied to the load, should the load become excessive.

Just as the sensing circuit detects voltage changes at the load (due to line voltage variation or changing current into the load), it senses ripple current produced by the filtering system. Ripple information is again applied and amplifier by Q_3, referred to Z_1, and applied to the base of Q_2 to affect Q_1. So what we have is negative feedback producing regulation of the current being supplied with a speed that is sufficient to cancel all voltage fluctuations up to the megahertz range. The efficiency of this regulation depends on the gain of the sensing circuit and the amount of feedback it can effectively impose upon the regulating power transistor Q_1.

A variety of circuits have been designed using f.e.t.'s, opamps, and even ldr's. However, it is seldom that you can find a power supply which will do all the things audio circuits are hungry for—extremely low ripple with high current supply capacity. Check a power supply catalog. Most of the listed supplies will have ripple voltages specified in the region of a few millivolts. Power supplies for audio have to produce ripple of not more than 0.5 mV *at full load.*

Some amplifiers are beginning to appear on the market with ripple-cancelling features. What we have here in effect are separate sensing circuits with each amplifier. These circuits probably would be economical as integrated circuits, but I see no reason for compromising on the quality of the supply current.

The circuit shown in FIGURE 2 is an example of a simple, efficient, and adequate power supply for audio applications. It is today possible to procure

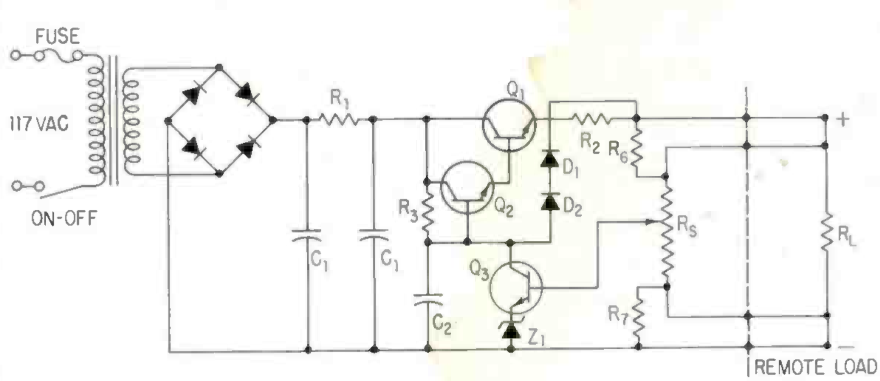

Figure 2. A transistorized regulator circuit.

a complete regulator circuit packaged into a TO 3 transistor can or a TO 5 transistor shell. Only an external transformer, capacitors, and the rectifier circuit are additionally required. The currents these i.c.'s can handle are still fairly low if they are used as they are. But they can be operated with an external power transistor so the circuit can handle up to 100 amps! RCA has just announced a new power transistor capable of 300-watt dissipation at a current of 100 amps—and mounted in a TO 3 case! It's a 2N 5578. Naturally, it is expected that the transistor will be well-mounted on a heat sink capable of dissipating the BTU's generated.

I should mention another breed of power supply circuit that also cares about dissipated heat. This is the shunt circuit that acts pretty much as a large zener, regulating the output voltage by drawing unused current away. This type of circuit is useful where loads are heavy and not expected to be disconnected. The efficiency of this circuit exceeds all other types.

But we must stay with the *practical*. In audio, where hardware is becoming smaller and smaller, with less and less power consumption, we need only concern ourselves with current capacities of a few amps.

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Sound with Images

MARTIN DICKSTEIN

Among the multitude of numbers that boggle the mind every time a space shot goes off, are a few seemingly insignificant ones that account for some startling results. The contrast is quite interesting.

Consider that the largest structure of its kind was specially built to assemble the Apollo spaceship. The command module alone weighs thirty-three tons, has two million working parts, and fifteen miles of wire. Data flowing into the control-center computer from the spacecraft comes in through tracking stations around the world at the rate of 51,200 bits-per-second (equal to an encyclopedia-per-hour). Television pictures from Apollo 8 travelled more than 40,000 times the average distance between the local t.v. transmitter and the home set.

As a result, it's a startling contrast that the camera which picked up the pictures from outer space for live presentation on earth weighs only a measly 4.18 lbs. while the lens weighed only 0.7 lbs.—thirty times lighter and eighty-five times smaller than a standard black-and-white t.v. broadcast camera. This tiny unit requires only 6 watts of power compared to 500 watts for a studio camera. A camera this small was made possible by the use of tiny integrated circuits, and was developed by RCA specially for Apollo.

In order to permit transmission from over 200,000 miles on a transmitter capable of only 20-watts output (compared to a 50,000-watt average for a commercial station transmitting about 5 miles), some compromises had to be arrived at along with changes in scanning standards. Thus, the camera bandwidth is only 500 kHz as compared to 4.5 mHz normally used in broadcast t.v., a reduction of 9 to 1, necessitating a change in frame and line scan rates.

The Apollo t.v. system uses a non-interlaced frame of 10 frames-per-second as compared with the 30 interlaced frames-per-second of t.v. Although the image at the slower rate is useable, there is noticeable jumpiness when moving objects are viewed. The 320 active line resolution of the Apollo t.v. system yields a picture of about 220-line resolution both horizontally and vertically, while broadcast t.v. uses 525 actual lines—resulting in approximately 330-line resolution.

When high-definition still photographs are sent for scientific purposes with the Apollo t.v. system and the 500-kHz bandwidth, it is necessary to transmit at the rate of 1 frame every 1.6 seconds with 1,280 lines-per-frame. RCA's scan converter, used to "translate" Apollo's signal into the proper rate for broadcast t.v., also has provision to convert the scientific requirements to broadcast format.

The table is a list of the operating parameters for the Apollo camera:

Figure 1. This four-and-a-half pound television camera is only 1/85th as large as those used in broadcast television studios. Such a camera-lens-viewfinder system was used on the Apollo 8 mission. Note in this official NASA photograph that the RCA logo has been obliterated.

Bandwidth	500 kHz
Frame rate/lines per frame	10 frames per sec./320 lines per frame
Output s/n	36 db typically
Camera weight	4.18 lbs.
Power consumed	5.3 watts, 6.7 watts max.
Imaging tube	1" Vidicon
Sensitivity	0.1 ft.-candle highlight illumination minimum to 30 ft.-candles maximum.
Lenses	100mm f/4.0 (9:); 5.4mm f/2.0, 160:
Controls	On/off switch near hand hold, Automatic light-control switch.
Resolution	250 t.v. lines limiting
Output voltage	2 volts
Aspect ratio	4:3, horizontal to vertical
Grey scale	7 minimum
Input voltage	28 volts nominal

The camera comes with a 12-foot power-video cable which allows for some hand-held operating freedom.

When transmitting its signal, the camera's output is fed into a premodulation processor where it is frequency multiplexed with voice and telemetry data and fed to the s-band omni-antenna for close-to-earth transmission or to the high-gain antenna. As insurance of proper operation of the Apollo t.v. system with such small output signal from the camera, it was necessary to use more powerful receiving antennae on the ground. Here we have the comparison of a 30-foot antenna for near-earth tracking and an 85-foot antenna for distances over 10,000 miles.

Installations of scan converters exist at Goldstone, Calif., Madrid, Spain, and a third one is going in at Merritt Island, Florida to supplement a previous system designed as a prototype. The scan converter operates in a manner

Figure 2. RCA engineer Richard Dunphy manipulates the t.v. camera inside the Apollo spacecraft in much the same manner the three astronauts did during their historic flight. The camera was developed by RCA's Astro-Electronics Division, Princeton, N. J. for North American Rockwell, prime Apollo contractor.

similar to an instant replay device. Signals from Apollo are applied to a t.v. display, focused on the broadcast vidicon camera and stored on the photoconductor target of the vidicon. During each sixth broadcast field which corresponds to each single Apollo frame, the camera reads out one field of video signal at broadcast rates. During the next five broadcast fields the camera's scanning beam is gated *off*. The result is interrupted video of one *on* and five fields *off*.

This interrupted signal is then fed to a magnetic-disc recorder with a disc 12-in. in diameter and rotating at a servo-controlled speed of 3600 rpm. The record head is one one side of the disc and the read head is 180 degrees away. The first field is recorded on the disc and is read out five additional times to fill the *off* period, thus converting from interrupted to continuous signal. A new field is then recorded. Signal-to-noise from pickup to display on a broadcast monitor is better than 35 dB with response down less than 6 dB at 4 mHz.

Since the first "live" t.v. reception from a manned spacecraft in October of 1968, the astronauts have learned to use the camera to advantage both as cameramen and performers. Panning around the inside of the craft is easy. Panning and tilting to get the moon into the center of the screen was a bit more complex. When the Apollo 8 trip took off, the schedule called for six or seven t.v. transmissions depending on the success of system operations. All went well and earthmen were shown both closeups and long shots by the three spacemen. The only time there was no direct communication between the control center and the spacecraft was during the 45 minute to an hour period when the ship went around to the hidden side of the moon.

The accuracy of all the calculations for the space transmissions was comparable to the earth's t.v. broadcast schedules and will now probably introduce the possibility of a union director going along with a union cameraman on upcoming trips. "O.K., fellas. Turn on the sun and cue the moon. We're on the air."

Technical details and photographs courtesy of RCA News and NASA.

Theory and Practice

NORMAN H. CROWHURST

• The circuit I developed during the last discussion proved that a multivibrator could be frequency controlled by voltage, but I wasn't satisfied that the range of frequency was enough to produce a realistic siren effect, supposing I could get the louder and softer effects I needed to go with it. I needed a wider range of frequency.

My first thought was to compound transistors in the Darlington circuit (FIGURE 1). I tried substituting this little package for each transistor in my original circuit, and changing the base circuit values to be consistent with transistors having a current gain of something like 10,000, instead of 100.

But I wasn't as much better off as I expected to be. In the circuit we discussed last, it wasn't shortage of current gain alone that stopped me from getting all the range I wanted. It was that in conjunction with the thoroughness of saturation. And I was still up against the same problem.

After some cutting and trying, I finished up with the arrangement of FIGURE 2. I used different types of transistor, because the 2N323 give me more current gain, but the 2N395 will sustain the reverse voltage when the base goes positive to make the transistor nonconducting. Using 330-ohm collector resistors and 2.7k resistors in the collector of the 2N323s, which is also the base of the 2N395s, limited the range of current operation imposed on the latter, so I could use a wider range of control in the base of the 2N323s.

Now I found that I could change frequency, using the whole voltage range, except possibly a fraction of a volt right at the bottom. Using 15k base resistors, with .05 mFd capacitors, the frequency could be varied from about 60 Hz up to 1,000 Hz. I didn't know if this was the range I wanted, but it could easily be changed by using different capacitors.

The next step was to find a way of varying the amplitude, and particularly of cutting it off completely. I had the choice of varying the voltage applied to the multivibrator, or of modulating its output. Placing an electrolytic capacitor across the supply terminals, so that when I disconnected the supply it took a while for the voltage to die, I found that the multivibrator kept running until the volts were almost unreadable.

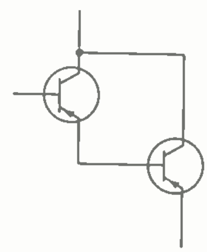

Figure 1. Compound transistors of the Darlington circuit.

So I decided to use a saturated stage (FIGURE 3). Here the problem is to get a square waveform (particularly at the highest frequency, where the rise curves off) and to saturate the square wave completely out for cut-off. Using a 2N323, I found that a 3.3k in the base circuit, with a 1k collector resistor, saturated the stage so the curved top of the multivibrator output disappeared.

Now applying bias through the resistor shown as 33k controlled ampli-

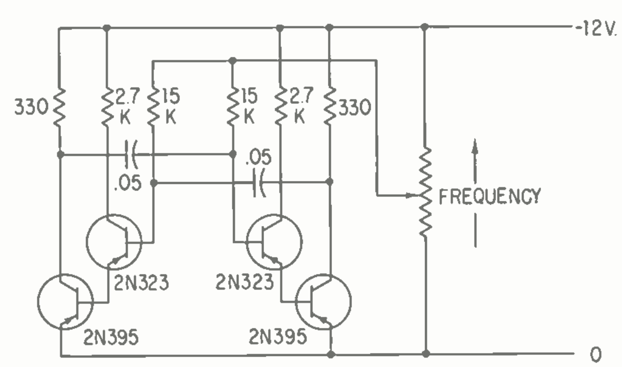

Figure 2. The frequency-control portion of the circuit described.

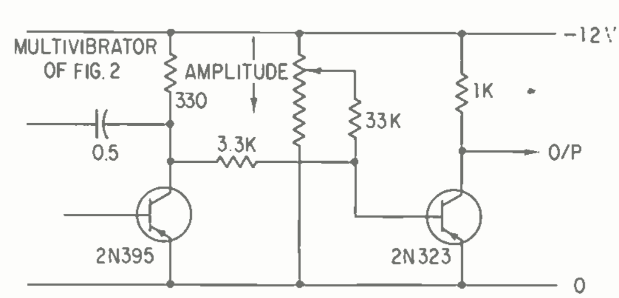

Figure 3. The amplitude control devised for the circuit of Figure 2.

tude, by partially saturating the 2N323 during the part of the period when the 2N395 from which the multivibrator output is taken is conducting, and thus its collector is at zero voltage. The value of 33k was the highest I could use to be sure of saturating the signal right out when its top end goes to supply negative.

After playing with my two potentiometers for a little, varying frequency and amplitude separately and together, and amazing myself at the versatility this little circuit provided, allowing frequency to change over about four octaves, and amplitude to go from inaudible to a full 12-V square wave (the supply voltage), I set about making up an electronic circuit that would convert this to a siren sound when I merely pushed a button.

I tried a few variations before I came up with the circuit shown complete at Figure 4. To cut some corners, I'll tell what each part is there for.

To get the upward and downward sweep of frequency, the 100 mFd capacitor provides the required time constants. The multivibrator provides a load, discharging the capacitor, consisting of 2-15k resistors in parallel, feeding the bases of the 2N323s in the multivibrator. This sets the discharge time constant, which controls the rate at which the siren frequency runs down when the button is released, to about 0.75 second.

This may seem short, but remember that the voltage reduces frequency from full value down to almost zero, so the run-down takes more than 2 time constants, or approaching 2 seconds, possibly more than that—it depends what point you consider as "down".

The run-up must be quicker. The 2.2k controls this. With the 100 mFd capacitor, it is about 1/5th second, which sounds realistic. It runs up fast to begin with and then more slowly reaches its final pitch, quite realistically.

To get the amplitude variation, I needed to make the bias point start from negative supply, with 33k to limit current in the base of the output stage, and then bring this effectively down to ground, and finally release it to go back to supply negative, for cut-off, when the button is released. I also needed to get a time constant in there.

By splitting the bias resistor in two, 15k each part, and applying the time constant capacitor to the mid-point, I can get the slowest turn-off time, directly in that circuit, for a given capacitor value. Using the 500 mFd—the value I eventually settled for—the turn-off time constant is 500 mFd in conjunction with 7.5k, the effective parallel value of the two 15k's. This is 3.75 seconds.

Now we need to change the charge on this 500 mFd capacitor, from 6V when the circuit is saturated to cut off the signal, to a point that almost grounds the junction of the two 15k resistors. And this should come up much faster, like a motor getting under power. Using 390 ohms with 500 mFd makes it about 1/5th second, like the frequency control.

The 2N323 with 10k and 1k in its base serves to switch the time constants for amplitude control. Without the operating button pressed, the 1k resistor returns base to ground, keeping the transistor non-conducting. When the operating button is pressed, the 10k resistor feeds it about 1.2 mA which saturates the transistor (with a 390-ohm load) allowing it to bring the junction of the two 15k's down to about 1/6th volt.

So far, so good. I developed the frequency change and the amplitude change separately, then put them together. Now I found that paralleling the 10k with the 2k on the one button contact changed my frequency run-down time constant, making it much too quick. At the same time, it slowed the amplitude cut-off even more than it speeded frequency drop, because the discharging frequency-control capacitor prevented the cut-off from starting as soon as it should. The whole effect was quite unnatural.

Diode D in FIGURE 4 remedied this. When the button is pressed, the diode conducts, allowing the 100 mFd to be charged through the 2.2k resistor. But when the button is released, the 10k resistor returns its positive side to ground, rendering it non-conducting. Thus the 2N323 is immediately cut off, initiating the amplitude reduction time-constant, and the 100 mFd is discharged only by the two 15k resistors in the multivibrator base circuits.

So the circuit works. It's easy to change anything you want, if you feel the changes happen at the wrong rate, or in the wrong place. I haven't shown any attenuation in the output. Of course, you won't need a 10- to 12-volt maximum signal level, but you can attenuate that to suit the input to which you will apply it. Also, if d.c. blocking is needed to remove the d.c. component, that is easy.

But one little thing that happened while I was working on this triggered more possibilities in my mind. Based on the work with the direct circuit of FIGURE 2, I thought my top frequency would be about 1,000 Hz. That it wasn't didn't matter. Actually the 700 Hz the circuit gave sounded about right, and it started low enough for my liking.

But why didn't it go all the way up? Of course, the reason was obvious: I still had 2.2k in series, with a shunt load of about 7.5k. So the feed to the base resistors, from the 100mFd capacitor, didn't go up to the full 12 volts, only to about 9 volts.

In checking this fact, I shorted the 2.2k resistor with a screwdriver, while the note was held on by the button. The tone changed suddenly, like playing a different key. I didn't hear the tone move from 700 Hz to 1,000 Hz. It was as if a different tone replaced the first.

So could this idea be applied to make other effects? If some other question doesn't divert us meanwhile, I'll take this up next month.

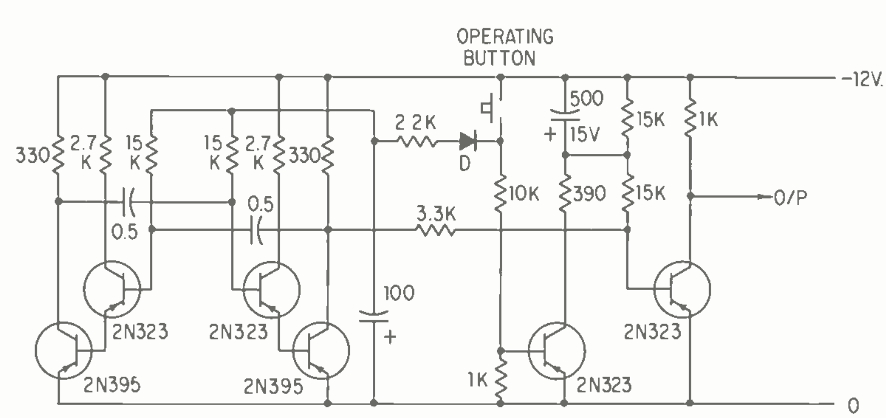

Figure 4. Pressing the operating button of this circuit converts the circuits of Figures 2 and 3 to produce a siren sound.

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Closing date for any issue is the **fifteenth** of the **second** month preceding the date of issue.

Editorial

THE YEAR OF 1969 will be an exciting one for us. Having successfully passed our first full year of publication, we are now entering upon a period of growth and expansion. Our "stable" of writers is increasing. Many articles and projects are underway that will, in future months, make interesting and valued reading.

We are exploring new areas of professional sound. Audio-visuals are the most promising for many audio pros. But there are others as well. Electronic music is becoming deeply important. This art/science will continue to have increasing significance as time goes by. There is an already huge demand for *educated* audio professionals — along with a recognized lack of opportunity to achieve formal training. We will be watching educational opportunities.

There will be continuing increases in sophistication in those areas where the audio signal carries the entire message, just as there have been over the past twelve months. No doubt, however, the most dramatic growth will come from increased marriages of audio and visual effects. We are all too aware of the problems of audio men in television. We must continue to remain on guard lest audio become a mere support industry.

We also intend to continue exploring areas of individual responsibility. The audio man is, after all, first a community citizen. His expertise is needed in improving many aspects of our environment.

But most of all, we will continue to publish articles specifically directed toward making your job better and easier. This "hard" practical audio will remain the backbone of our editorial coverage.

As we said, 1969 will be exciting.

* * *

Last month and this issue have omitted the Feedback Loop column. John A. McCulloch, who authored the column since our second issue, has found himself with increased work responsibilities and a new bride. As a result, he asked us to release him from this responsibility. He has promised to produce occasional feature articles for us.

Beginning next month, the Feedback Loop will appear with a new monthly author. He is Arnold Schwartz, who has appeared in our pages before. His first column will describe some of the design decisions that went into ABC Radio's new network radio facility in New York City.

L.Z.

Better T.V. Audio?

EDWARD TATNALL CANBY

We have published many letters decrying the sound quality of television audio. But how good should the audio signal be? The author explores areas for possible improvement and then makes specific observations on the desirability of change.

Should t.v. audio be improved?

Should we adapt multiplex stereo to t.v?

WHAT A PAIR OF LOADED QUESTIONS! Loaded not merely because both involve t.v. technology, an area which we in audio are valiantly trying to hold off at arm's length as well as we can. Loaded more particularly because in both cases there are factors that reach far beyond the electronic aspect of audio and video broadcasting. We ignore these factors strictly at our own risk.

Anything that affects audio *perception* via the ears is indirectly our business these days. Anything, in particular, which ties our audio technology into some other sort — and that usually means a technology of vision — is now our concern whether we like it or not. *Audio-visual; multi-media*. Take your choice, choose your own terminology, but don't evade the issues! Lack of knowledge of somebody else's professional area is no excuse as far as nature is concerned. Nature's laws are inexorable.

With that preparatory paragraph I will lightly sidestep the technical feasibilities of three aspects of my two questions by assuming that all three are not only technically practicable but might even be considered *commercial*, given enough demand and a proper return on the investment. These are: Improved t.v. audio *broadcast* signals; better t.v. audio *reproduction* at the receiving end; (more controversial but still feasible) a t.v. audio system in stereo multiplex.

BETTER TV AUDIO BROADCAST SIGNALS

On the first of these three I am able to take an unequivocal stand. Yes, we most certainly should have the best possible t.v. audio transmission, from the broadcast station to the home antenna.

There is really no valid argument, except sheer expediency, for the opposing position. (Or maybe the inevitable one that it "costs too much".) On a professional level, the audio signal that goes out to the public should reflect the highest standards of the industry, regardless of the anticipated quality of receiving equipment. Most reputable engineers will agree, even though practicalities may force them to act otherwise.

Edward Tatnall Canby is well known as a professional musician and writer on audio and musical subjects.

The principle has been fought over, of course, for years. There were endless arguments back in the early days of electronic audio on this same basis. We may recall the whole lengthy fight for f.m. along with the argument that the public didn't want better sound, that the receiving radios weren't going to be good enough, and, of course, that the whole idea of quality broadcasting was unrealistic and uncommercial. Well — it often is. But there is no rigid rule, and yesterday's utopian sound may well be today's dollar bonanza, as anybody knows. We recall, similarly, the long argument over disc-record improvements, on the one hand those who argued that the disc should be tailored to the cheap home machine and to public taste, which could not appreciate good sound in any case, and on the other hand those who insisted that however inferior the home equipment, the disc itself should reflect top professional engineering standards; the reproducing equipment would have to come along as best it could. Thankfully, that point of view won out, if not exactly 100 per cent.

Television audio may be the neglected step-child in the video scene but it shouldn't be. *Regardless of existing t.v. audio reproduction,* the audio signal in television should be rigidly perfect, or as near to perfection as the art allows. To my mind there can be no other viewpoint.

IMPROVED TV AUDIO REPRODUCTION

If the audio component of the t.v. broadcast is not always what it should be, the average receiving system is of course far worse. It is simply a matter of plain fact that virtually no television set today has audio that is even barely adequate by purely audio standards. Most of it is simply dreadful — as audio. Who can argue the point? It isn't worth the trouble. Not even the fanciest super-consoles bother with an audio system that might pass a lower-middle-bottom classification in home hi fi. The only t.v. today that can boast "good" audio, by any reasonable audio standard, is that which is tacked onto a home system, component or multi-purpose console, in which the t.v. receiver is merely one element along with a.m.-f.m. radio, phono, tape recorder and so on. Because the other elements demand better sound, the t.v. tube rides along.

Outrageous? I fear I am going to jolt those high minded engineers who have read me this far. *Not outrageous at all, I say. Quite suitable.* Nor do I speak cynically. On the contrary, I am entirely serious.

Could things really be better, from the point of view of perceptive satisfaction, if we had high-quality audio in our t.v. sets? *Definitely not.* In fact, as television is now broadcast and surely will be for many long years, black-and-white or color, a radically improved audio component would merely cause a deterioration in the audio-visual "mix", the combined perception that makes simultaneous use of eyes and ears for a single composite message.

Right now, I would *not* recommend that you unhook your t.v. audio and run it through your home hi-fi system. The greater the improvement in audio, the less will be your television satisfaction! Surely, many an experimenter has already discovered this for himself. As audio quality improves, there is an increasing discontinuity, so to speak, between the audio and video signals that must be joined together if the t.v. message is to get across.

The television experience is like so many others today an ingenious fabrication, making use of the human senses not for a literal reproduction of some hypothetical original but simply to get over a convincing *pseudo-reality*, often more useful than reality itself. Again, we can do extraordinary things by manipulating the abilities of the ears and the eyes to receive information. But we cross nature's barrier lines at our peril. Make a mistake, and nature cracks down in all her fury.

One can argue one's self blue in the face as to how "high" the reproduced fidelity of an audio signal must be for ideally perfect reception into the human brain, and get nowhere. It all depends. What is the essential message? Messages differ! So do listening situations. What are the interferences (from the machinery itself, or external) which distort and/or distract? Hi fi is wonderful, but Beethoven can get through a pocket transistor very adequately, and so can a *basso profundo*. We get the message. Distortion is to be decried, but a lot of people like it — from the avant-garde composer John Cage (who usually has his finger on the fundamentals) right down to the 'teen-ager whose transistor radio blasts hideous distortion at top volume, to *his* satisfaction if not yours.

Electronic reception is one thing, human reception quite another. We are dealing, every last one of us, with human reception in all the modern media.

The essential rule of nature, then, for a dual-sense message (usually one that involves the eyes and the ears) is not realism, not quality, but *compatibility*. Whatever the degree of literalness — or 'way-out fantasy — whatever the level of technical quality, the two simultaneous messages must have *similar attributes*. Otherwise — no blend. Sharpen up on of them and the other must be sharpened too.

Moreover, the dominant medium of the two, if there is one, should have the quality edge over the less important one. The more forward is one element, the more detailed should be its transmission. This, too, however, depends on the message. Is it the t.v. picture that matters most? Or is it the sonic message? Not often the latter. Is it any wonder that the sound of Vladimir Horowitz on t.v. was judged somewhat inadequate? Not merely, you see, because of inadequate t.v, transmission of the audio component but, much more im. portant, because *the sound was the vital message* in this rathe- special case. Normally, television deals in simple speechr easily understood and demanding no great detail or clarity in the transmission. The picture, itself not any too clear, comes first.

The rest of the story is easy. Our American t.v. picture is fuzzy because it is tied to our present transmission standard, which allows a fixed and limited degree of definition in terms of the density of lines. That definition, alas, is only to be described as marginal in purely factual terms. (It makes no difference, of course, how large or small is your screen. The screen-size/viewing-distance factor remains the same.) It is obviously an adequate standard for a vast range of good entertainment and useful message transmission — or we would have no billion-dollar television industry. But compared to a good photograph, a well-projected slide, a no-grain color transparency, t.v. is flatly lo-fi, and not a thing can be done about it short of a major upheaval in our over-all standards.

Our t.v. audio, then, *must not* be significantly better — more detailed, more dense in its information — than its associated picture. Indeed, for most t.v. transmission the message requires that the audio have *less* density than the picture, since the video element is the dominant one, the audio the supporting element.

Television pictures are tiny as well as fuzzy, compared even to home movies, not to mention wide-screen theater pictures. Can we suppose that the huge, ultra-sharp theater movies on their enormous screens (even from theater-seat viewing distance) and the tiny, fuzzy little t.v. picture can use the same variety of sound? Decidedly not.

Photographic moving pictures need good sound. One of the glaring deficiencies of theater sound film for many years was its inadequate audio, far less "hi fi" than the picture. Sharp definition came early to the movie screen; sound of a matching sharpness and definition was long delayed, even in the larger professional film size. Strangely, thus, the "oldie" sound films now prevalent on television in re-run form make a better sound-picture mix than these same films ever did in the theater! The t.v. picture reproduction is nicely deteriorated, for an ideal blend. You are not even aware of the sound deficiency — the surest sign of a good sound/sight mix.

If you are interested in engineering a better t.v. sound, I suggest that your best bet would be to hire yourself out to a European television system. The higher density of picture information on European video broadcasts, as many of us have ruefully observed, makes for a much sharper, more detailed picture than our own. It can take a higher-quality audio, though perhaps not a *bigger* audio — for sound volume and placement must match the perceived dimensions of the picture.

STEREO TV?

Which brings me to my third proposition, now widely discussed and probably in active development somewhere behind the scenes: stereo multiplex sound for t.v.

I've heard plenty of arguments for it. After all, it is an "improvement", isn't it? Just as the stereo disc was an improvement over mono. More cynically, it would provide a new sales gimmick that could conveniently outdate existing t.v. sets in time for the Xmas selling spree, one of these years. But most of all, stereo t.v. sound would round out the incomplete home electronic system, filling in a major "hole" in the stereo set-up just as stereo FM did a few years back. Indeed it is somewhat uncomfortable to know that in most homes all the electronic sound media are now stereo except this one, television sound. Just for symmetry, it might be a good thing to have it. If it works.

It won't. I'm sorry to have to predict that unless we first create a wall-to-wall t.v. picture, yards wide and positively microscopic in its detailed resolution, stereo t.v. sound is going to be a dangerous flop. And this simply because it violates every imaginable compatiiblity between picture and sound. It would compound and exaggerate *by the very nature of its superiority* the problems of blend that are now precariously, if effectively, under control.

Worse, t.v. stereo would make no spatial sense at all. Watching and listening, you would find yourself — given an adequate stereo spread between speakers — fighting to reconcile two utterly unrelated images of the same thing; you would soon end up wall-eyed and cross-eared, a splendid way to a severe headache. Imagine, for instance, an instrumental broadcast of music. On the screen you see a fine two-foot orchestra, complete to the last tiny inch-wide violin. Simultaneously, far behind and beyond the t.v. screen and hugely inflated, you hear the audible version of the same orchestra in full stereo, almost larger than life. The tiny violins on the screen, straight ahead of you, are the same as those huge fiddles you hear 'way over to your left in space — and nowhere near the t.v. set. Now how, I ask you, are you supposed to relate the giant, room-sized stereo image to its tiny visual counterpart? And the same for pictures and speech. The little man on screen left will be speaking from left stage in your room, instead of from his visual image. And what of the vast front-to-rear incompatibility? The television screen is flat, its projection of spatial depth strictly miniature. Not so stereo! And what of the *increased* detail resolution in stereo sound, as compared to mono? More trouble, more incompatibility. No. Properly spaced stereo sound and present t.v. pictures will never mix.

Of course we could launch the kind of weak-kneed stereo that graced the earliest days of stereo phonography, featuring a minimal foot or two of stereo separation between tiny speakers. That would do it. That would allow a workable blend between stereo sound and sight. But only if your nose and eyes were no more than a couple of feet from the boob-tube. Beyond that distance, of course, the sound would be harmlessly blended into mono, and we would then be right back where we started. Worth it? I have my doubts.

Calibrated Monitoring Systems

PART TWO

DON DAVIS

It is not necessary to accept the monitor speaker as the weak link of the recording system. In this concluding part, the author summarizes his method for equalizing the acoustic output of monitors so they become a calibrated part of the audio chain.

LOUDSPEAKER EFFICIENCY BY FREQUENCY

FIGURE 10 illustrates what can happen when trying to equalize a loudspeaker where the driver resonance and the room resonance have emphasized a particular region. In this case, the *Acousta-Voicing* filters have selectively reduced the electrical drive to the system inversely to the combined response of the loudspeaker and room.

The resultant response is, of course, uniform. Looking at the deepest dip centered on 160 Hz we find a frequency that will produce 112 dB-spl at 4′ from 1 watt or 115 dB-spl at 4′ from 2 watts. The electrical power required to achieve the same spl at other frequencies is indicated. After equalization of the system, the equalizers selectively reduce the drive at different frequencies to adjust for the difference in efficiency at that particular frequency.

METHOD OF TUNING PLAYBACK SYSTEMS

FIGURE 11 shows the most conventional approach, and actual components regularly used are indicated to ensure practical dimensions to the technique. The procedure used to tune is to feed pink noise (noise with a −3 dB/octave slope with the increasing frequency to match the ±3 dB/octave slope characteristic of 1/3-octave bandpass filters which are constant percentage bandwidth filters—approximately 23 per cent of center frequencies) to the input of the 1/3-octave bandpass filter set. The output of the filter set is connected to the input of the sound system to be *Acousta-Voiced.* A precision sound level meter is used to measure the output of each 1/3-octave center frequency from 40 Hz to 16,000 Hz as in FIGURE 2.

Don Davis is manager, Acousta-Voicing[TN]*, Altec Lansing.*

Experience and trial and error plus many subsequent plottings results in a uniform response in typically one to two hours per channel ±1 dB). Newer methods now undergoing test allow a channel to be tuned accurately in five to ten minutes.

ACOUSTA-VOICING BY TELEPHONE

A recent experiment of interest was the transmittal of the "house curve" information via telephone from New York to California and the shaping of the necessary inverse response in the equalizer by means of automatic response-measuring equipment in California. Then the correct equalizer settings were phoned back to New York and the equalization was completed.

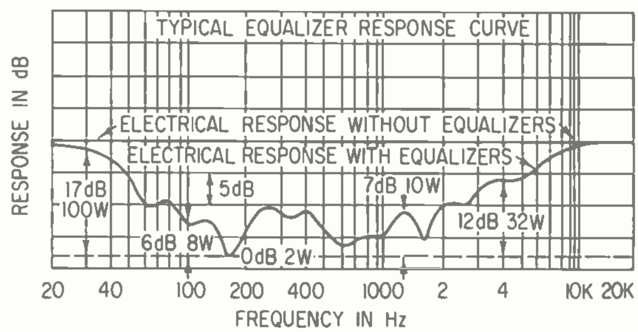


Figure 10. Typical electrical response of a set of Acousta-Voicing filter sections. This illustrates how the power demands at different frequencies can vary. Of course, it is the program material's content that ultimately determines the power demand at any given frequency.

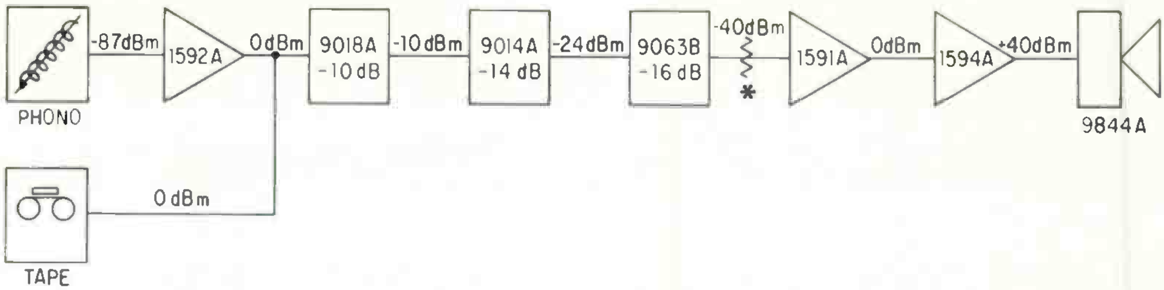


Figure 11. The conventional approach to the interconnection of standard playback-system components with the Acousta-Voicing equalizers plus a standard passive program equalizer. Typical average program levels are indicated. The asterisk indicates the terminating resistor whose actual value is determined by measuring the input impedance of the 1584A power amplifier with an a.c. impedance bridge and selecting the resistor value that when paralleled with the measured impedance will provide 600 ohms.

Such a tour de force indicates that *Acousta-Voicnig* is a science and not an art.

Conclusions

Equalization of sound systems to compensate for detrimental effects of acoustical environments is a significant breakthrough in audio. Reducing the acoustic-response variations from ±8 or 9 dB to ±1 dB is as startling and rewarding as thirty years ago when amplifiers were first widely available with smooth response, low distortion, and adequate power. *Acousta-Voicing* is the natural outgrowth of former technology brought into sharp and useful focus. Standard console equalizers can now be employed from a reliable calibrated base line since their calibration now becomes acoustically meaningful.

The techniques are simple, though designing sound systems with sufficient gain overlap, power-handling capacity (to overcome even the lowest-efficiency frequency), and with sufficient stability to ensure freedom from parasitic oscillation, requires great care and knowledge of sound-system design.

The equalizer circuits must meet certain minimal requirements to give satisfactory service:

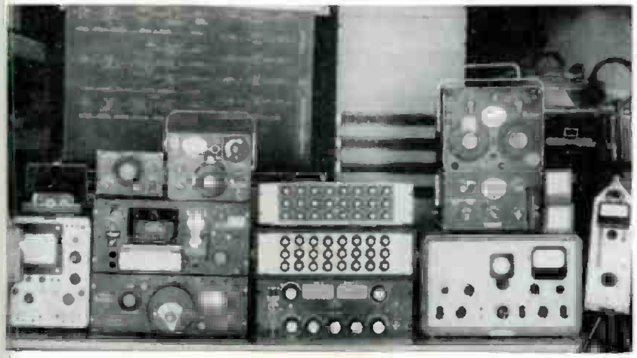


Figure 12. A line-up of the actual equipment used by an Acousta-Voicing contractor. This grouping was photographed at one such contractor, Commercial Electronics, Inc. of Indianapolis, Ind.

- They should be constant "K" circuits of sufficient band width to avoid ringing but sufficiently narrow to be undetectable in normal program material. Our ears detect subjective loudness changes in typical program material (music and speech) in critical bandwidths. Making filters narrower than these critical bandwidths at anygiven frequency results in no audible improvement when compared to the wider filter.
- They should allow individual band correction up to −28 dB as the problem can be of that magnitude in some spaces.
- In order to achieve ±1 dB uniformity of response, it is necessary for the attenuators associated with the equalizers to operate in 1 dB increments.
- A desirable but not absolutely indispensible feature is for each 1/3-octave center frequency to have its own individual equalizer section in a modular form. This allows only those sections required to be installed with the subsequent savings.

Finally, the results will be no better than the sound-system equipment chosen, the quality of the equalizers, the precision test instruments used, and the skill and training of the engineers involved. Certainly, it would a shocking waste of money to tune precision 1 dB equalizers by ear. FIGURE 12 shows the quality and quantity of test equipment used today by conscientious practioners of *Acousta-Voicing*.

The next five years should be the most revolutionary ones ever experienced in the sound industry. *Acousta-Voicing* in its present form is only the first step in this revolution.

Readers interested in a detailed background of these discussions are recommended to author Davis' book Acoustical Tests and Measurements. This is available on the db Bookcase pages at the back of this issue.

Electronic Telephone Patch

RONALD PESHA

Telephone conversation plays an important part in broadcast programming. Here's a method that offers full audio balance and control and at low cost.

BROADCAST STATIONS FEATURING TELEPHONE TALK shows utilize many methods to place the telephone on the air. The simplest connects the beeper audio output to the speech input equipment. The moderator then uses the telephone's handset, with or without the studio microphone open.

More elaborate systems incorporate hybrid coils to balance out the handset's mouthpiece, so the moderator is heard on the air through the studio microphone only. But hybrid coils are expensive and difficult to balance over a wide frequency range.

The illustrated electronic phone patch requires only one initial adjustment yet retains balance over the full audio range. The solid-state circuit is inexpensive and easy to build. The unit needs only conventional transformers, no hybrid coils.

The input bridges the console's output, through an isolating transformer if the console output is balanced. The console audio appears across R_4 and feeds into the telephone line through a 1:1 ratio transformer. The console audio also appears across R_3 and R_7, but mutually out-of-phase. The R_3 and R_7 signals mix and cancel in R_8, which adjusts for best cancellation. Thus, the console audio balances to zero at the output of the device, which is connected to a remote or auxiliary input of the console. Therefore, no feedback from output to input of the console occurs.

Incoming audio from the telephone line appears across R_4, and *in phase* across R_3 and R_7. The R_3 and R_7 signals mix and add in R_8. Thus, the output of the device feeds the remote or auxiliary input of the console.

In use, the moderator listens to the incoming telephone call with earphones, and speaks into the studio microphone. He does not normally use the telephone handset.

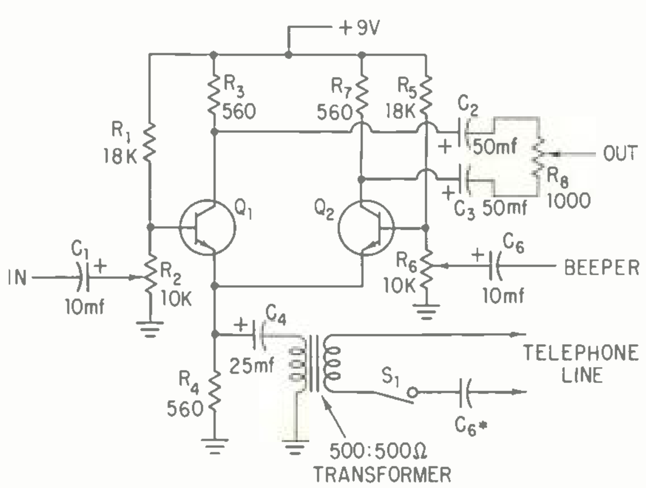
The microphone potentiometer on the console controls the microphone level as usual, while the remote or auxiliary potentiometer controls the level of the incoming telephone call. Once the telephone contact is made, switch S_1 may be closed. This connects the d.c. holding current on the telephone line through the transformer winding, completing the circuit and allowing the telephone handset to be hung up. S_1 must be open to receive calls or dial out.

Note that the unit is connected directly to the telephone line, *not* through a beeper unit. The beeper unit's output connects to the beeper input on the device and supplies only the beep tone. This tone cancels at the output of the patch in the same manner as the console audio signal cancels. Therefore only the telephone party hears the tone, not the air audience. R_6 adjusts the level of the beep.

The circuit is non-critical, and almost any pair of germanium or silicon transistors may be used. R_1 and R_5 might require some trimming to optimize bias for the particular transistors used. Transistors should be of the same type.

Use only a non-electrolytic at C_5. Leakage through an electrolytic can hold the d.c. circuit even when the telephone is hung up, preventing dialing out or receiving of calls. The output of the device should feed a 500- or 600-ohm unbalanced input. If such an input is not available on the console, use a matching transformer.

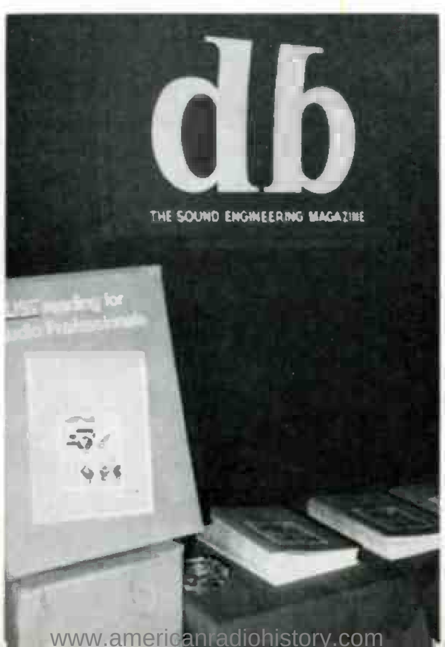
Ronald Pesha is chief engineer of KLWN of Lawrence, Kansas.



The circuit of the telephone patch described in the text. All resistors are in ohms, ½ watt 10 per cent. All electrolytics are rated at 10 volts or better. Q_1, Q_2 are 2N2925 (or see text). *C_6 is at least 2 mF non-electrolytic, 200V.

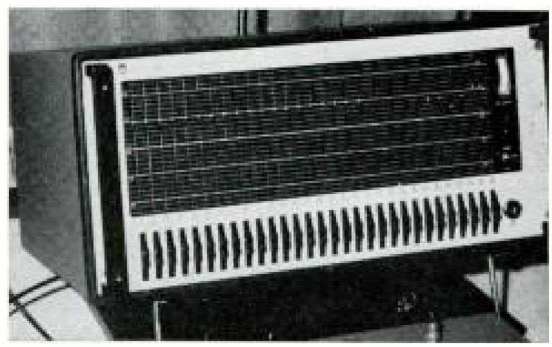
Picture Gallery: East Coast AES Convention

On this and following pages are continuing (from last month) results of our roving camera's visit to the thirty-fifth AES Convention held in New York City on October 21st through the 24th, 1968.



The product illustrations highlight much of the new material shown at the Convention. Each product photo is keyed to the Reader Service Card at the back of this issue. Circle the appropriate number for further information to come directly from the manufacturer.

Gotham Audio Corporation. Gotham distributes Studer professional products. The console contains 12 inputs and a two-channel output. There is full equalization filtering, echo feed, pan pot for all channels, 20-watt stereo monitoring, peak-level metering, and two reverb channels. At right, is one of the Studer tape units. Circle 75 on Reader Service Card.



General Radio. The GR 1925 multifilter contains up to 30 channels of parallel octave-band or one-third-octave-band filters included in the range of 3.15 Hz to 80 KHz. Several options of frequency range, filter bandwidth, and with or without calibration of the channel attenuators, are offered. Price: $1990 to $3680 depending on options. Circle 74 on Reader Service Card.

Capps. Most of the standard disc-cutting systems will find that this company has cutting styli to fit. This photo of their booth shows the giant-size models that illustrate their product line. Circle 71 on Reader Service Card.

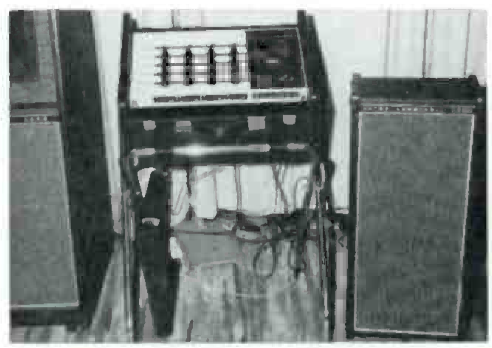
McCurdy. The new DA502 is an audio distribution system offering six channels with eight +18 dBm outputs per channel. It uses the AT242 universal amplifier. Circle 78 on Reader Service Card.

B & K Instruments, Inc. A portable sound and vibration measurement test lab is offered here. The 3501/S kit consists of a sound level meter/octave filter set, cables, various mic heads, and a tripod adapter. Circle 66 on Reader Service Card.

Minnetech Labs, Inc. (Nortronics). They manufacture instruments for the measurement of tension. The illustration shows a model designed to measure exact tape tension. The unit operates on a self-contained nicad battery or a.c. Versions are available with full-scale deflections as low as one ounce. Price: $325.00 without transducer. Circle 86 on Reader Service Card.

Hewlett Packard. Model 8054A is a real time audio spectrum analyser. Its crt face will display the filtering action of multi-channel graphic equalization systems. It has a 140 dB amplitute range and provides display of third-octave filtering steps. The recorder pictured above will provide a printed version of the crt image as a permanent record. Price: $8950. without recorder. Circle 76 on Reader Service Card.

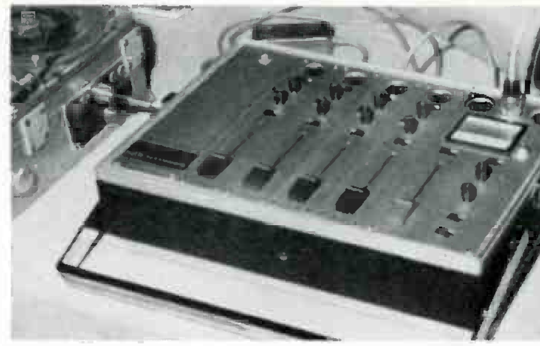
Caddco. The exhibition brought forth several console assembler/manufacturers. One was this handsome walnut-encased board using lighted button selectors and slider attenuators. Circle 69 on Reader Service Card.



Altec-Lansing Div. The amplified music trade is offered a 60-watt continuous amplifier/mixer. Reverb is built-in with individual control for each of the five channels. Several speaker systems are also available including a Voice of the Theater unit with an additional 85 watts of amplification. All units are covered in laminated vinyl offering a measure of protection against rough handling. Circle 67 on Reader Service Card.

Metrotech, Inc. The 500 series tape recorders come in a wide range of configurations. Electronic interlocking prevents incorrect sequencing of tape motion controls. Any adjacent pair of speeds between 15 and 1-7/8 in./sec. are available. Single-speed logging machines are also available down to 5/16 in./sec. The prime feature, however, of these machines continues to be symmetrical, two-direction record/reproduce capabilities. Circle 73 on Reader Service Card.

TapeAthon. They showed their 900 series stereophonic transport and electronics designed for background music systems. Quarter- or half-track heads on quarter-inch tape is standard. Tape speed combinations are $7\frac{1}{2}$-15 or $3\frac{3}{4}$-7 $\frac{1}{2}$ in./sec. Price: $1700; wood console: $250. Circle 82 on Reader Service Card.



Sennheiser. In addition to their line of regular and special-purpose microphones, Sennheiser is distributing several mixers designed for field use. Shown is a four-channel-plus-master unit that may be used with portable recorders such as the Nagra. Circle 68 on Reader Service Card.

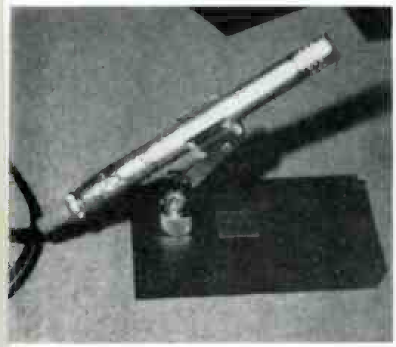
Philips Broadcasting (Norelco). Compact versatility is featured in these MD series desks. Current-dependent mixing is used so that additional input blocks do not require readjustment of bus bar impedances. Each channel may be switched to as many as four outputs in any combination without crosstalk. Circle 72 on Reader Service Card.

Round Hill Associates Inc. The peg-board backdrop displays a wireless cuing system specifically designed for communication with personnel on the studio floor of broadcast and t.v. stations. The CS-10 has also been used in sound reinforcement applications. The system may be powered from a.c. or batteries. Price: $245.00 (transmitter), $39.95 (receiver). Circle 84 on Reader Service Card.

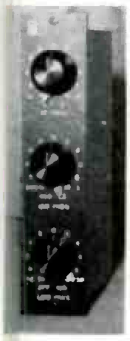
Scully Recording Instruments Company. Sixteen tracks on two-inch tape. $7\frac{1}{2}$, 15, and 30 in./sec., sel-sync, scrape filter, patented disc brakes. Circle 50 on Reader Service Card.

Vega. A variety of quality wireless microphones are available. Shown is a Unisphere 1 by Shure with its pigtailed transmitter attached. The receiver has full control. Circle 85 on Reader Service Card.

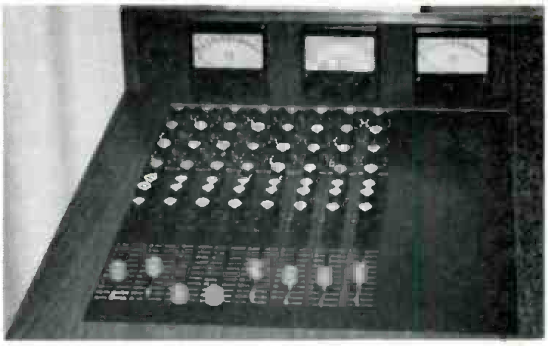
3M Mincom Division. This is a special version of the Isoloop transport system. It is designed for film recordists, providing two-track sync recording in a portable machine. One track is used for audio, the other for the sync signal. Circle 77 on Reader Service Card.



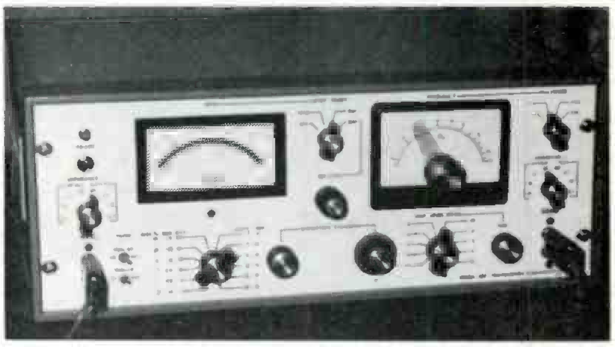
AKG. Unusual versatility is claimed for this new condenser mic using audio frequency circuitry with a f.e.t. The mic may be powered by central feeding techniques, an a.c. power supply, or a battery supply. The mic will accept interchangeable capsules, allowing the selection of different response characteristics. Price: basic system consisting of a C-451E preamp module, CK-1 cardioid capsule, stand adapter, windscreen, and case. Price: $179.00. Circle 69 on Reader Service Card.



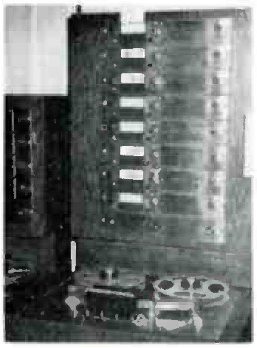
Quad-Eight Electronics. The EQ-312 module provides three-knob control, high-mid-low frequencies. Overlapping selection of frequencies makes this almost a mini graphic equalizer. Price: $325. Circle 87 on Reader Service Card.



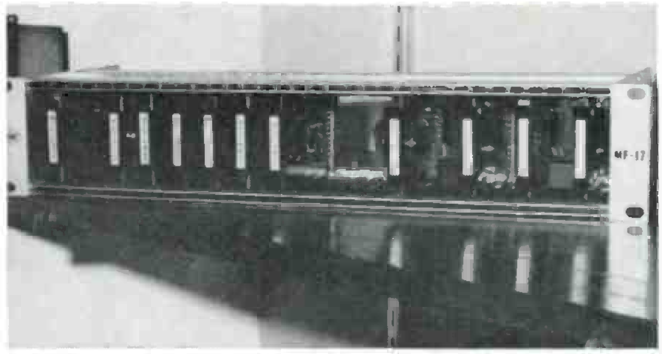
Lang. This expandable console is built-into a walnut-grained laminated plastic desk. As can be seen there is space for four additional modules to fit into the desk. Lang custom manufactures consoles of all sizes. Circle 70 on Reader Service Card.



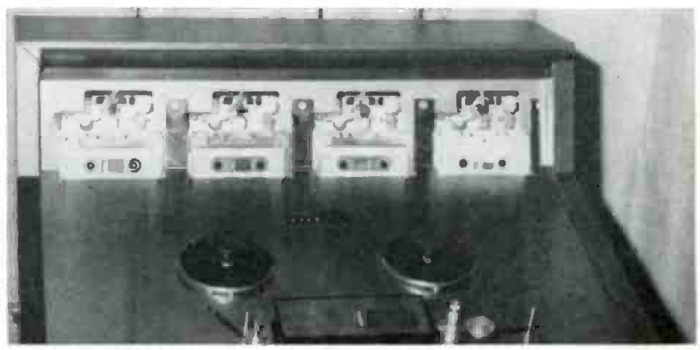
Abphot Corporation. In a single instrument, facility exists for the replacement of several instruments normally used in the measurement of audio. The model 1301 consists of an audio signal generator, an audio voltmeter, a distortion meter, and a phase angle meter. Range of the Wien-bridge type oscillator is 9 Hz to 120 kHz. The voltmeter has a differential input and can be set for bridge or match (four positions) inputs. Harmonic distortion is indicated at a maximum 0.3 per cent full scale. Price: $1200. Circle 80 on Reader Service Card.



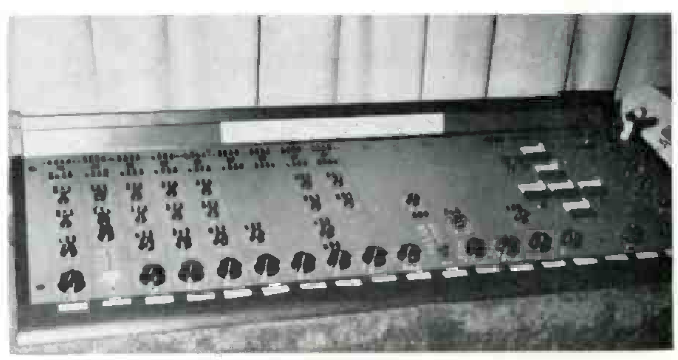
Stemco Electronics Corp., CUSTOM solid-state recorders come in a variety of configurations. Shown is an eight-track one-inch tape unit. Featured is sel-sync operation, 7½-15 or 3¾-7 ½ in./sec. speeds, wiring for remote control. Price in the console is $10,360. Circle 81 on Reader Service Card.



Melcor Electronics Corp. MF-17 is designation for a mounting rack that accepts the wide range of Melcor plug-in modular systems. Various amplifier and preamplifier modules are available. Circle 83 on Reader Service Card.



Infonics, Inc. Four one-hour cassettes are produced every four minutes from a reel-to-reel master on this high-speed, low-cost duplicator. All tracks are duplicated simultaneously. The photo was made at the Harvey Radio Corporation booth, distributors of the unit. Circle 65 on Reader Service Card.



Langevin. The am4a mixer system is a console housing with plug-in modules that provide for virtually any combinations. Two, three, and four output channels are readily available from stock. Depending on the shell, up to 13 or 19 modules can be accommodated. Circle 79 on Reader Service Card.

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Mfgr: Waber Electronics, Inc.
Price: $42.50
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CATALOGS

● Allied Radio Corp has its 1969 catalogs ready. The Electronics for Everyone catalog lists expanded lines of high-fidelity components and consumer electronic gear in general. A separate catalog, the Industrial Catalog, features an immense selection of raw components used by the electronics industry. Single and OEM quantity prices are given.
Mfgr: Allied Radio Corp.
Price: Free

Electronics for Everyone: *Circle 57 on Reader Service Card*

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Mfgr: Universal Audio
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Mfgr: Century General Corp.
Price: $48 (including probes and batteries).
Circle 55 on Reader Service Card

COMPRESSOR/AMPLIFIER

● Model 7106 ProCast is a compresor/linear amplifier with adjustable attack and release times, wideband frequency response, and mic and balanced or unbalanced program input. Plug-in equalizers convert the inputs to RIAA phono or tape head. Noise is —125 dBm weighted over the range of d.c. to 20 kHz.

Mfgr: Harman-Kardon, Inc.
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People, Places, Happenings

• Late word from wall Street has **Jervis Corporation** acquiring **James B. Lansing, Inc.** Jervis presently owns **Harman-Kardon, Inc.** (Jervis president is **Sidney Harman**). It is expected that this merger will strengthen Harman-Kardon on the consumer level, but will also have significant effect on H-K's inroads into the sound-reinforcement field.

• **Robert Bloom,** president of **Audio Designs and Manufacturing, Inc.,** has announced that the company has moved into larger quarters. "The demand for our consoles and components has increased sharply this last year and we needed the extra space to expand our production capability," he said. The new address is 15645 Sturgeon, Roseville, Michigan (a suburb of Detroit). The new phone number is (313) 778-8400.

• **Superscope, Inc.** has set new quarterly sales and net income records for the three months ending September 30th, according to **Joseph S. Tushinsky,** president. After adjustments to reflect the 1968 10-per cent federal-income-tax surcharge, Superscope reported an increase of 17 per cent in net income and 33 per cent in sales for the nine months ending September 30th compared against the similar period last year. This is an increase to 73c a share over the 72c last year. In addition to the exclusive distribution of tape recorders, tape, microphones, and accessories bearing the Sony label, Superscope is the owner of the **Marantz Company.**

• The election of **F. Cervantes** as a vice-president of **Infonics, Inc.** has been announced by **Peter H. Stanton,** president of the magnetic-tape duplicator manufacturing firm. In making the announcement, Mr. Stanton said that Mr. Cervantes was the company's chief engineer under whose direction the breakthrough development of their high-speed, low-priced cassette duplicators was accomplished. In previous associations he has been chief engineer of **Magnasync-Moviola,** a subsidiary of **Monogram Industries.**

• **John Swanson,** president of **Langevin,** recently announced the appointment of **Marvin R. Headrick** as the firm's new national audio sales manager. Mr. Headrick has been active in the audio industry since 1946. Prior to his present association he was affiliated with ABC a.m. radio and t.v. operations from 1949 to 1956. After that, up to his new appointment, he was a manufacturer's rep selling key professional audio lines. Mr. Headrick is expected to play a key role in the company's new diversification program in addition to his regular sales management duties.

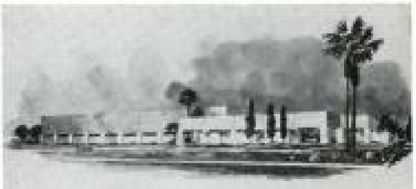
• **Lawrence (Larry) LeKashman** has been named president, **Electro-Voice, Inc.,** a subsidiary of **Gulton Industries.** He succeeds **Wayne Beaverson,** who resigned. Mr. LeKashman has been an executive of E-V since 1957 except for a brief period recently at **Bogen.**

At the same time several other moves were announced at Electro-Voice. **Adolph Wolf** has been named to the new position of executive vice-president. He will continue his responsibilities as v.p.-operations as well as being in charge of all manufacturing facilities at Buchanan and the firms Tennessee operation.

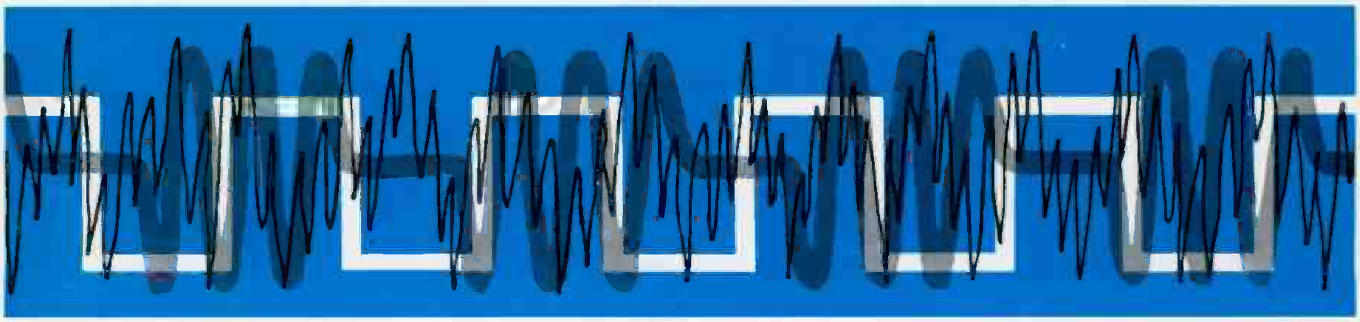
Howard Durbin moves from his position as vice-president sales to senior vice-president and technical director. He will be responsible for product development from initial conception to marketplace.

Robert Ramsey has been promoted from director of engineering to vice-president for engineering. He will have full responsibility for engineering procedures and development.

• **Gotham Audio Corporation** has announced the opening of its Hollywood, California offices designed to service the motion picture, recording, and broadcast complex in the area. At the outset, it is intended that facilities provided will be sales and sales services for the many product lines represented by Gotham Audio, including **Neumann** and **EMT. Hugh S. Allen, Jr.,** vice-president of Gotham Audio, after six years in the New York office, will direct the activities of this new facility. Mr. Allen is a past chairman of the New York chapter of the AES. His early experiences in audio were in recording and broadcasting in San Francisco. **Stephen F. Temmer,** Gotham Audio president, has invited all segments of professional audio to contact Mr. Allen directly for any needs related to Gotham Audio products. The new offices are at 1710 North Le Brea, Hollywood, Calif. 90046; telephone: (213) 874-4444.



• Expansion plans have been announced by **Shure Brothers, Inc.** The new plant is being built by **Shure Electronics of Arizona, Inc.,** a wholly owned subsidiary of the Evanston, Illinois-based firm. Upon completion, the new plant will house a product assembly operation and a warehousing facility, which the company has maintained in Phoenix for approximately two years in separate, leased locations. All of the approximately 125 people presently employed by Shure in Phoenix will move to the new building when it is completed this spring. The size of the building will be 63,400 square feet. Approximately 52,000 square feet will be devoted to production and 8000 square feet to personnel facilities. The balance of space will be administrative offices. The building site allows for ultimate expansion of the plant to 170,000 square feet.



Flutter measurements have one basic problem...

They're usually wrong.

And wrong measurements are of no value to anyone. Most oscilloscope presentations of flutter give you an inaccurate picture for several reasons: they make you *subjectively* evaluate a composite waveform, and even experts have trouble with this; their economical scope construction often can't compete with lab-quality display devices; they lack uniformity in repetitive flutter readings, or several units of the same model give different readings; and they can't track or measure noise-like waveforms accurately.

That's a lot of places to go wrong.

MICOM gives you highly accurate flutter and wow measurements without forcing you to make "eyeball" readings, yet are simple to operate. The MICOM line of meters accurately measure long-term speed errors or drift, and will quickly locate resonant flutter peaks within the flutter bandwidth. Outputs for scope displays are available. MICOM flutter meters can save you both time and money in evaluating your analog recorder—with the confidence that your equipment will meet published specifications.

So if wrong measurements aren't doing you any good . . . correct them by selecting the MICOM flutter meter that best suits your needs.

MODEL 8100/8100-W FLUTTER METER—for professional accuracy and flexibility in measuring to NAB and DIN standards. Used in recording stations, production line testing, and lab work in tape recorder manufacturing.

MODEL 8150 FLUTTER METER—for professional accuracy and best economy in radio/TV broadcast stations, service applications, and production line testing. Available in NAB and DIN configurations.

MODEL 8200/8200-W WIDEBAND FLUTTER METER—for highly critical audio or transport design applications where scrape flutter or automatic peak-to-peak measurement to 1, 2, or 3 sigma limits is important.

MODEL 8300/8300-W IRIG FLUTTER METER—meets all IRIG Standard requirements and eliminates subjective "eyeball" analysis and associated errors in the IRIG measurement. Accepted as the industry standard by the major instrumentation magnetic tape recorder manufacturers.

MODEL 9100/9100A FM MODULATOR—for exceptionally low-phase noise, linear modulation over a wide deviation. Also used for calibration of flutter meters.

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