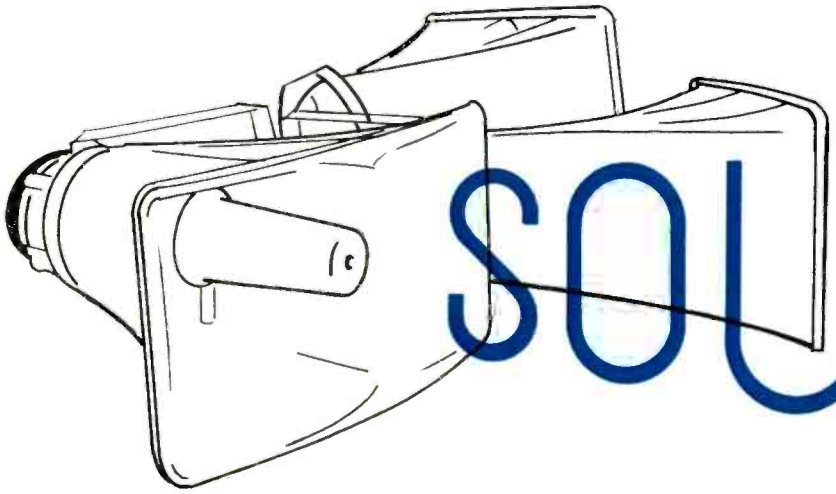
...the original magazine about high fidelity!

AUDIO

SPECIAL ISSUE

APRIL/1965
60¢



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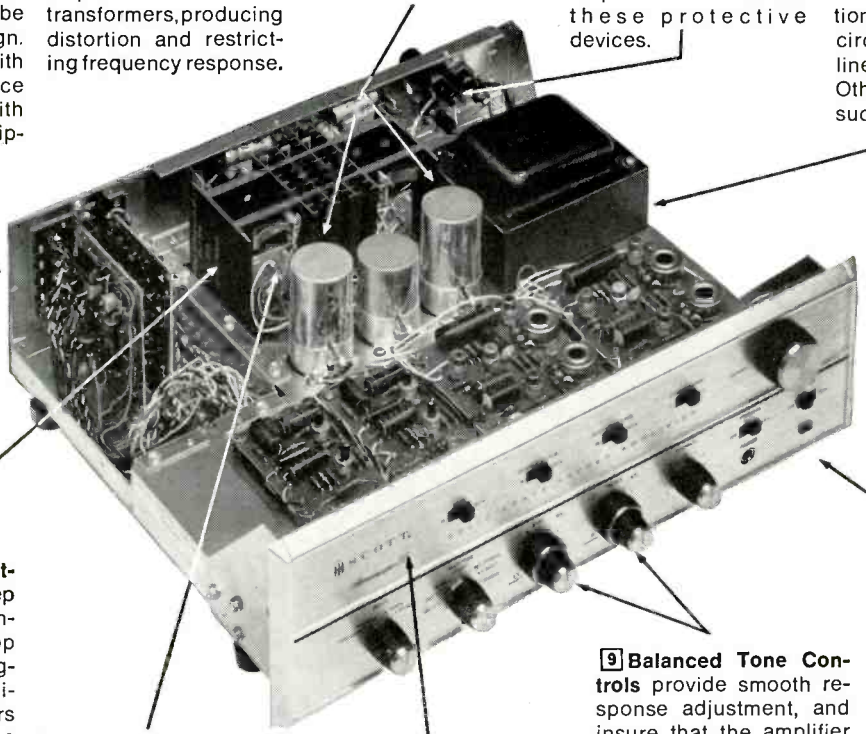

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7 Rugged Silicon output transistors assure long operating life and far superior high frequency performance. Other amplifiers use low-performance germanium transistors that are far less rugged.

8 Full control complement includes BOTH Scratch and Rumble filters; 3-position pickup sensitivity switch; remote speaker provisions AND outlet for private stereo headphone listening; complete facilities for tape recording and monitoring.

9 Balanced Tone Controls provide smooth response adjustment, and insure that the amplifier operates "flat" when controls are center-set. Other amplifiers use controls which change the entire frequency response as well as that portion over which control is desired.

10 FM Stereo Tuner matches the amplifier. Scott's famous solid state 312 stereo tuner perfectly matches the amplifier in looks AND performance. (Audio Magazine said of the 312: ". . . one of the finest tuners anywhere.")

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COMING

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Flat Cables for Audio. Flat adhesive-backed cables can be used to carry signals from amplifier to speakers—unobtrusively. It can also be used to make dipoles which "blend with the terrain."

Profiles

H. H. Scott Solid State Stereo Amplifier, Model 260

Bogen Turntable, Model B62

EICO Solid State Receiver, Model 3566

In the May Issue

On the newsstands, at your favorite audio dealer's, or in your own mailbox

AUDIO CLINIC

Joseph Giovanelli

Send questions to:
Joseph Giovanelli
2819 Newkirk Ave.
Brooklyn, N. Y.
Include stamped, self-addressed envelope.

Erratic FM Tuner Performance

Q. About a year ago I acquired a stereophonic music system with the exception of a tuner. Fortunately, about the same time I ran across an article in an old issue of Audio Engineering *which described a method whereby a person could use the tuner section of a receiver in connection with a high fidelity amplifier.*

The article called for the preparation of a single-conductor shielded cable to connect the amplifier and receiver. The input was obtained by connecting one end of the cable to specified leads at the volume control of the receiver.

I followed these instructions to utilize my old Capehart radio, Model 1004B, and found that it worked very well. Recently, however, it has developed a stuttering when the performance is vocal, or skipping every other note in a musical performance. I also noticed that this occurs only after the receiver warms up. In addition, the wirewound resistor in the power supply of the receiver becomes very hot.

I have checked all tubes in both the amplifier and receiver, as well as the shielded cable. With my limited test equipment I checked resistors and capacitors for shorts and open circuits. I found nothing. I am led to believe that the trouble is in the receiver because the record player works fine through the amplifier. R. L. Alliguie, San Francisco, California.

A. I agree with you that the trouble is in the receiver rather than in the amplifier because of the fact that the receiver works very poorly and the amplifier works very well on phonograph.

There are a number of possible causes. It is possible that after the receiver warms up, the oscillator is squegging, or cutting in and out. Possibly the grid resistor of the oscillator tube has increased in value or the grid capacitor has increased in capacitance. Perhaps this shows up more when the receiver has warmed up.

Another possibility is that the coupling capacitor which isolates the detector circuit of the receiver from the point to which you attached your shielded cable has shorted. If this capacitor has shorted, d.c. can then be applied to your amplifier. If the level of this d.c. is high enough, it can cause cutoff of the input circuitry of your amplifier. The degree to which this stage is cut off varies with modulation. When the capacitor is warm, the condition could be aggravated.

You mentioned that one of the resistors in the power supply gets hot. If this resistor did not get hot before the trouble started and does get hot now, you can be sure that something is wrong with the equipment which is causing excessive current being drawn through this resistor. (The fact that Capehart used a wire-wound resistor in the power supply as you have indicated, you can be sure that this resistor was expected to become heated at least to some degree.) Check the circuit elements on the far side of that resistor. The associated electrolytic capacitors may be leaky, though not absolutely shorted. This leakage will increase when the capacitors are heated. This fact can be determined by reading the voltage on the far side of these resistors when the receiver is first turned on, and then when it has begun erratic operation. The voltage will be lower if this hypothesis is correct.

I stressed electrolytic capacitors in the previous paragraph. Actually, some of the r.f. bypasses might cause a drop in voltage. You should, therefore, check r.f. and i.f. stages to see whether one of these is causing your trouble. You may find a stage in which the decoupling resistor gets very hot. You can be quite sure that the bypass capacitor associated with this resistor is the culprit. Check the circuits having the lowest voltage first. Check for heated or burned components. If nothing is found here, work up toward the higher voltage portions of the receiver until you find the trouble, assuming that the fault lies in the B-supply.

(Continued on page 40)

The same great Garrard plant

that builds the LAB 80...

LAB 80 $99.50

also builds three other fine new Garrards

TYPE A70 Ultimate expression of the Automatic Turntable concept which Garrard launched with the original Type A, the most successful record playing instrument the high fidelity field has ever known. Four speeds. Features low mass, dynamically balanced tone arm with ¼ gram click settings; adjustable anti-skating control; pusher platform; heavy, cast and balanced non-magnetic turntable; Laboratory Series® motor. **$84.50**

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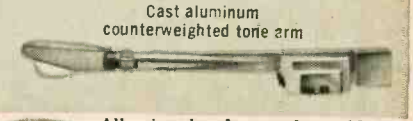

Cast aluminum counterweighted tone arm

All prices less base and cartridge.

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LETTERS

For New FM Rules

SIR:

I have read with enthusiasm your recent article on FM called "A New Look At FM" by the gifted observer Harry Maynard. It is by far the most comprehensive, well-organized and unbiased report on the contemporary FM scene I've read to date. Please extend our congratulations to author Maynard.

As one FM broadcaster in eight in a market of only one million, we are intensely concerned with the future of this superior medium of broadcasting. Too, we are interested in "making a go" of what we are offering on FM. As Mr. Maynard has skillfully observed, this is more often than not a vexing task, artistically and commercially. (The former, we may add, is easy; the latter more difficult).

RAYMOND B. BOTTOM, JR.
Vice President,
Hampson Roads Broadcasting Corp.
711 Boush Street,
Norfolk, Virginia 23510

Against FM Change.

SIR:

I have read the article in your February issue by Harry E. Maynard entitled "A New Look At FM." His first sentence refers to the proposed FM-AM separation plan as "a shot in the arm." It is true that the proposed rule is a shot, but I am afraid it will turn out to be a fatal shot both for the FM-only operator and for many AM stations which duplicate their AM and FM programming. And the most fatal shot of all will wound the general public, which will be deluged with inferior programming.

The announced purpose of the separation policy is to give greater variety of programming to the listener. There is no need for this in New York. There are now 40 stations serving the New York metropolitan area, as indicated by the daily listings in the newspaper radio logs. This includes both AM and FM stations and others which now duplicate. Every practical variety of broadcast fare is presented to New Yorkers, and it would be difficult for any station management to think of an additional format which would be of any value or interest.

Forcing separation of AM and FM programming would simply make the competitive situation worse, particularly for the FM-only stations. Those stations now duplicating on AM and FM would face a very serious cost problem which would deteriorate programming rather than improve it. Even to maintain duplication 50% of the time, as is proposed, would add so much expense for double operations that it would be financially disastrous in many cases.

The common characteristic of the WQXR listener is a love of good music, interest in factual news and cultural programs, and this interest goes back for many years. Ours is not an audience that expects something better on FM than on AM. It is one, and not divisible. Our audience expects the same programming on AM and FM. In their cars and through the use of transistor radios when they are away from home, they expect the same programs on AM. WQXR is the only commercial station in the New York area broadcasting good music on AM, and if the AM listeners were deprived of this, there would be a storm of protest.

It is true, as Mr. Maynard states, that FM is growing, and its growing acceptance by advertisers and advertising agencies has accelerated its growth. The best way to stop that growth is to separate AM and FM programming and to fragment the audience to such an extent that FM's commercial possibilities will be set back many years.

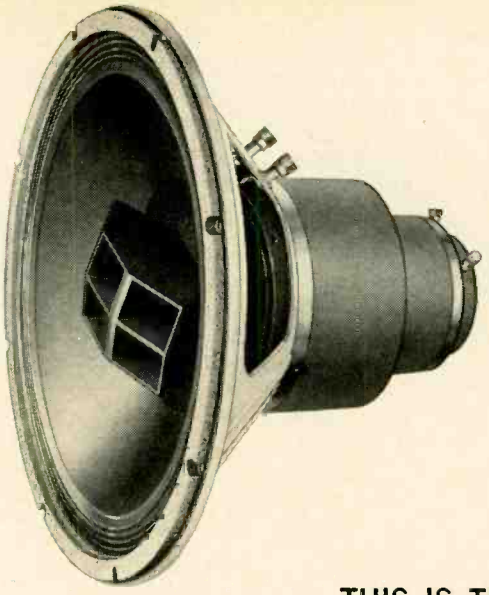
ELLIOTT M. SANGER
Executive Vice President,
WQXR
229 West 43rd Street
New York 36, N. Y.

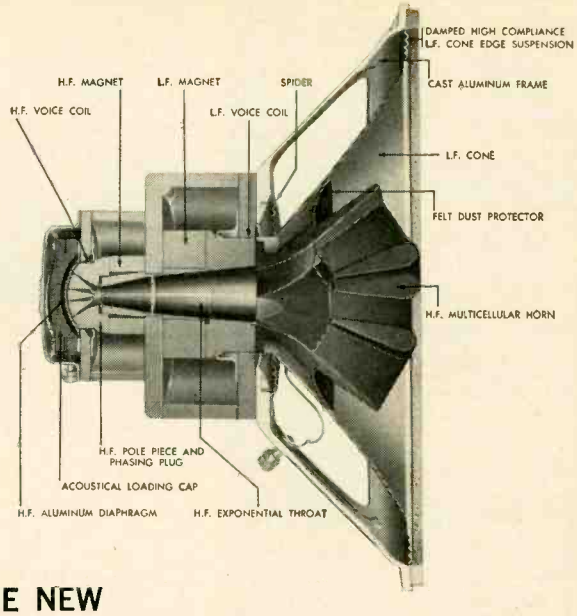
A Crushed Carton Opens Up!

SIR:

Ed Canby's February treatise in AUDIO left our entire company shocked and dismayed. That Electro-Voice has been put on your carton black-list simply is unthinkable in our cardboard-conscious corporation. You have no doubt heard our boast that we have the largest engineering staff of any company our size in the electro-acoustical field. Well . . . for your confidential information, about three-quarters of them spend their time working out those tricky side pieces and little bags full of screws you refer to so disdainfully. They were crushed!

We went into executive conference one hour after receiving the February issue of AUDIO. At first we considered holding up all shipments until we got a favorable carton review from E.T.C. But, then, it seems there are so many insensitive people who just don't care about the fine points of American production genius . . . so we're letting the cartons go out. *(Continued on page 66)*





THIS IS THE NEW *Super* DUPLEX 604E FROM ALTEC. ITS PEDIGREE IS AS LONG AS YOUR ARM. THE HISTORY BEHIND IT IS MUCH LONGER.

Twenty years ago, the first 604 DUPLEX made speaker history ☐ Next came the 604A ☐ Then the 604B ☐ The 604C came next, followed by the 604D ☐ Each was better than its predecessor ☐ All were better than any other single-frame speaker ever made ☐ The new SUPER DUPLEX 604E is better than any other DUPLEX ever made ☐ If you know a recording or broadcast engineer, ask him about DUPLEX speakers. If you don't know one, here are some vital statistics:

The SUPER DUPLEX has a smooth frequency range from 20 to 22,000 cycles. This means not only superb sound quality at the extremes of the frequency spectrum, it also means exceptional smoothness in the mid-range. When you consider that about 90% of all music is contained in the mid-range, you will know why the SUPER DUPLEX sounds so good.

Its dual magnetic structure weighs 26 pounds, 13 ounces. Among other things, this means that the SUPER DUPLEX is the most efficient speaker made. Its coaxially mounted multicellular horn provides a perfectly controlled high frequency distribution angle of 40° by 90°.

This 15″, two-way speaker system in a single frame comes complete with a dual full-section dividing network which incorporates a high frequency shelving control with a 0 to −10 db range.

A slightly lighter, lower efficiency version of the 604E is the Altec 605B Duplex.

Find out for yourself why Altec Duplex speakers are the choice of broadcast and recording engineers for critical monitoring applications. Hear the Super Duplex 604E and 605B at your Altec Distributor's... and compare with any other speaker there! Or, for the new 1965 Altec Brochure, write Department A-4.

The Altec 855A "Malibu" walnut cabinet is recommended as the proper enclosure for the 604E and 605B speakers. Its vertical design saves floor space while providing the necessary air volume for maximum performance. The Altec 858A "Carmel" is an identical cabinet in low-boy design.

ALTEC LANSING

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ANAHEIM, CALIFORNIA

Circle 106 on Reader Service Card

The Tape Guide

HERMAN BURSTEIN

(Note: To facilitate a prompt reply, please enclose a stamped, self-addressed envelope with your question.) Send to:

Herman Burstein
280 Twin Lane E., Wantagh, N.Y.

1.5-mil or 1-mil Tape?

Q. Would you suggest using 1.5-mil or 1-mil tape? I prefer 1.5-mil, but 1-mil yields a longer playing time. How about using 1.5-mil for professional recordings and 1-mil for home use?

A. Good results can be had with 1-mil tape. Professionals generally risk print-through more than amateurs do because the former, faced with the problem of having to go through several generations of tape, try to impress on the tape as high a level as they think they can get away with; thus they require 1.5-mil tape to minimize print-through. The home recordist is less apt to record at levels entailing appreciable print-through. Naturally, though, he takes less of a chance with 1.5-mil than with 1-mil tape. The logical thing is to try both kinds of tape and compare the results.

Q. I own a tape recorder with which I do considerable dubbing from discs and tuner to tape; this necessitates frequent pauses in recording for station breaks, disc changing, and so on. Initiating the record mode on either machine produces a distinct and annoying thump or click in the tape. I suspect, but haven't been able to confirm, that these are caused either by the sudden contact of the tape with the record head before the tape is in motion (i.e. the lifts drop the tape onto the heads before the puck engages the tape at the capstan) or by the sudden application of bias to the record head after the tape is in motion. I have tried without much success to erase these noises from the tapes by careful use of a head demagnetizer, but I would prefer to eliminate the cause rather than erase the results. I have heard similar noises in tapes made on other machines and believe it may be quite common. Am I on the right track regarding the probable cause? If so, have you any suggestions as to means of slowing the bias amplitude rise time?

A. According to the agency for one of the tape machines you own, yours is not an unusual complaint, though it varies from one unit to another of the same model. The agency states that the thumps and clicks depend somewhat on line voltage, tending to increase when the voltage is low. One thing you might do is to fully reduce the recording gain control before stopping and starting. Another is to erase the clicks and thumps by manually backing up the tape a few inches before you start recording anew. You might try introducing an RC network that causes B-plus to be gradually applied to or removed from the oscillator and record-head driver stages. *Figure* 1 is such a network (taken from my book "Elements of Tape Recorder Circuits").

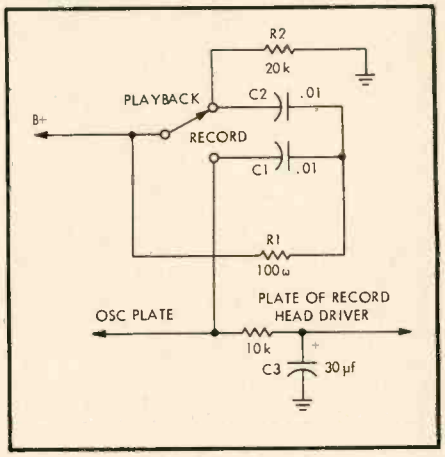

Fig 1. RC network

Frequency Response Specification

Q. The tape recorder I am planning to purchase has a rated frequency response of "40-18,000 cps at 7½ ips." How good is this?

A. This doesn't tell you much. For all we know, response at 40 and 18,000 cps might be as much as 6 db down, or 10 db down, or more. And we don't know how smooth the response is. Perhaps there is an unlovely peak of 6 or 7 db around 5000 cps. Perhaps there is a severe dip around 100 cps. We just don't know. Our suspicions are stimulated by failure of the manufacturer to describe the frequency deviation in terms of db.

"The" Tape for Recording Organs

Q. I plan to record organ music and play back through my mono sound system. Which type of tape is most satisfactory; acetate, polyester, Mylar, or what?

A. Polyester tape (Mylar is a well-known trade name) is the most desirable if you plan to keep your tapes a long time and wish to guard against the effects of age and humidity and temperature extremes. Polyester usually costs somewhat more than acetate-base tapes. Æ

Here's why Anna Maria Alberghetti endorses Roberts Cross Field 770

She is a perfectionist when it comes to creating sound... and a critical judge of sound quality. When she needed a recorder for her in-home rehearsal sessions she picked Roberts Cross Field 770 4-track stereo with the exclusive Cross Field head.

The Cross Field concept which divorces the bias field from the record function opens up a whole new octave in the high frequency range and as far as Anna Maria is concerned, gives broader, cleaner reproduction of the entire sound spectrum.

Overall frequency response: 40-22,000 cps.

Roberts 770 reflects the vivid presence of sound so accurately that even at 1⅞ ips Anna Maria can record full fidelity LP stereo (up to 8 full hours on one 7″ reel).

Automatic All-Off • Hysteresis-synchronous 2-speed motor • Pause/edit Lever • Exclusive Multiple Adjustment heads • 2 extended range stereo speakers • 2 Professional VU Meters • Mute-monitor P.A. Switch • Newly patented Ventilation System • 4 speeds (15 ips optional) • Horizontal or Vertical Operation • FM-Multiplex ready • Roberts Cross Field 770: $499.95. See your Roberts Dealer or write direct to: Department A 4, Roberts Electronics, Div. of Rheem Mfg. Co., 5922 Bowcroft Street, Los Angeles, California 90016

Rheem **ROBERTS** X FIELD

In Canada: J.M. Nelson Electronics, Ltd., 2149 Commercial Dr., Vancouver 12, B.C.
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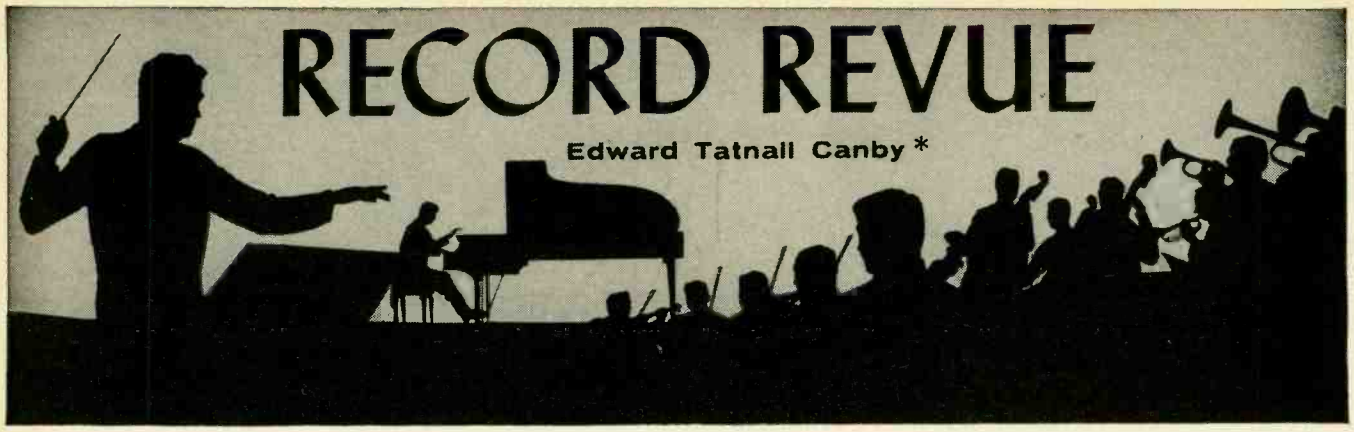

RECORD REVUE

Edward Tatnall Canby *

BIG VARIETY SHOW

Shakespeare: King John. Donald Wolfit, Kenneth Haigh, Rosemary Harris, et al.
Shakespeare Recording Society (Caedmon) SRS 215 (3) stereo

This isn't a review. It's an account. I barged right into this one, all anticipation, without so much as a look-see ahead (I figured that Shakespeare would probably explain things to me en route). Well . . . I soon ran into *this:*

KING JOHN: ". . . Tell me, how if my brother Who as you say, took pains to get this son, Had of your father claim'd this son for his, Insooth, good friend, your father might have kept This calf, bred from his cow from all the world: Insooth he might: then if he were my brother's, My brother might not claim him, nor your father Being none of his, refuse him: this concludes, My mother's son did get your father's heir, Your father's heir must have your father's land. . . ."

Well, *somebody* got the land, anyhow. Bit confusing, first time over, isn't it? So I stopped right there, took off the stylus and got out the printed text—also included in the album—for a bit of study. And there I am. Instead of listening, I've been *reading* Shakespeare like mad. Never fear though. I'll soon be back listening again; and this time it'll go like a breeze. I've got it all straightened out. Fun! A nice combination, this reading and listening.

Fact is that the Shakespeare Recording Society and the Marlowe Society on The London label have between them revolutionized Shakespeare in our time; these big, fat albums in stereo, with complete texts and extended background material, are fantastic bargains for anyone curious to get at the old Bard in a personal, pleasurable way—especially the dozens of his works which seldom get on any stage. The stereo stage is a splendid substitute and a lot easier in many ways, what with all the help you get en route.

Tackle this one with confidence (and plenty of time), then, in spite of the obscure passages which hit you the first time in. They all untangle themselves, quite easily, after you've listened awhile. Tackle *any* old Shakespeare, known or unknown. They all have values of some sort and they all make good records, good entertainment, evenings-long, whenever you're in the mood.

Birds on a May Morning
Droll Yankee DY 14 mono
The Swamp in June
Droll Yankee DY 17 mono
(Box 2355, Providence, R.I. 02906)

Now here are some really terrific nature recording. You are not likely to find better material of the sort, nor more picturesque in every sense. The mike technique worked out by Peter Kilham a parabolic mirror-reflector plus a rather tricky frequency range, produces the most natural bird song sounds I've heard, and swamp sounds too. Excellent combination of partial "close-up" with enough ambient background to put the desired "song" into a natural frame. Same for frogs, beavers and what-have-you.

The Bird record features a supposed walk through the spring country side (it starts in Vermont and ambles via invisible tape editing into Long Island!) with a running commentary in dry New Englandese. Backside has the very same birds, minus spoken comment. Good system.

The swamp record features two people, one of them asking questions, the other, a naturalist of formidable appeal, answering and volunteering all sorts of info en route. Name of Alfred L. Hawkes and he's a show in himself. Backside, again, has the natural sounds minus the comment.

There are others in the series, including some seven-inchers. A new set of these devotes each small disc to one kind of bird. Song Sparrow, for instance.

Soni Ventorum Quintet. Mozart: Music for Mechanical Organ. Villa-Lobos: Quintette en forme de Choros (1928).
Phoenix (lim. ed) stereo
(15 S. 21st St., Phila., Pa. 19103)

I don't know why an outfit named Phoenix, one department of a larger outfit called Instruments for Research, should have produced this disc—I only know that it contains some superb out-of-the-way Mozart beautifully played by a wind quintet. What else can you ask for? Villa-Lobos, maybe.

Mozart didn't like the idea of writing for a mechanical music-maker and said so; but he couldn't keep from composing this unusual music, of his last period, full of profundities, extraordinary harmonies. There are two major works, serious ones, and a third all sunlight: K. 594, K. 608, K. 616, almost the last music he composed. They transcribe very effectively for wind quintet, a much better medium for the music than the usual keyboard transcriptions played by organists (on real organs). And this group is excellent. They are out of the Seventh Army, were invited to Casal's new Conservatorio de Musica in Puerto Rico.

The Villa-Lobos piece is the fruit salad. It's a mild 1920s-modern bit, dry, amblingly humorous, not unlike a lot of art-theatre movie music today. Also reminds me, for all its expert virtuoso wind writing, of a flock of contended hens clucking on a warm day. Fun piece.

Prokofieff: Quintet, Op. 39 (1924). Shostakovitch: Quintet, Op. 57 (1934). Melos Ensemble of London.
L'Oiseau-Lyre SOL 267 stereo

A few seconds of this enchantingly oddball Prokofieff and you'll know that it comes right out of the 1920s—strange, that from our distance it can so easily bring to mind such contemporary music as Gershwin and Dixieland! The piece dates from 1924, an outgrowth of his ballet "Trapeze" (for the same instrumental combo) and it sounds just like 1924. Oboe clarinet, violin, viola and double bass, and the oboe screams like a plucked chicken, the clarinet gurgles, the double bass grunts like a healthy pig and the strings scratch away like a puppy with fleas. Altogether a very pleasing sound, if you like, say Disney shorts; but these sounds make better chicken-sense than Disney's stuff.

Shostakovitch's Quintet, from 1934, is a string piece with piano and, alas, was one of those works which reinstated him with the authorities after he had become a bit too modern for them. Seems like I disagree temperamentally with the Russian musical bosses (and so will you). For the longer-winded the music and the more cliché-ridden, the better they liked it! None of that humorous stuff, please, they said (or we can suppose so); Let's have our music suitably ponderous and interminable.

Like so much Shostakovitch, this piece has lovely ideas, but they get run into the ground, on and on, until you'll go nuts. One quarter the length and it might have been a masterpiece. But nobody ever told Shostakovitch to stop. He didn't, and doesn't. As the old phrase goes, he bends your ear. Until it flaps.

(Continued on page 42)

the totally new sound is why . . .

harman kardon

Stratophonic is the largest-selling all-transistor stereo receiver today

Clean, pure, *spacious* sound . . . a sound never before achieved in stereo . . . is the reason for the great popularity of the three Stratophonic FM stereo receivers introduced last Fall. Freed at last from the heat and distortion of tubes and output transformers, the majestic Stratophonics offer *Sound Unbound* in your choice of IHFM music powers from 36 to 75 watts, at prices from $279* to $469*. And now, with the addition of the two new components shown at right, the Stratophonic line includes five 100% solid-state instruments for every listening wish.

Harman-Kardon, Inc., Philadelphia, Pa. 19132. A subsidiary of The Jerrold Corporation.

LEADER IN SOLID-STATE STEREO COMPONENTS

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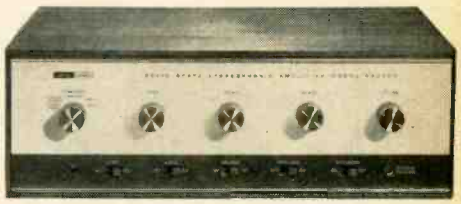
Introducing 2 new additions to the widely acclaimed Stratophonic Series



Model SA-2000 All-Transistor Integrated Stereo Amplifier. 36 watts IHFM music power (18 watts per channel). Response flat (±1 db at 1 watt, normal listening level) from 8 to 25,000 cps. Direct speaker coupling without output transformers results in speaker damping factor of 25:1. Complete controls and stereo headphone jack. **$159***.

Model ST-2000 All-Solid-State AM/FM Stereo Tuner. No tubes (not even nuvistor tubes) to cause heat, drift, or distortion. This fine tuner handles strong input signals without overload or crosstalk. Multiplex separation 25 db. Usable FM sensitivity 2.9 μv IHFM. AM sensitivity 50 μv/meter. **$199***.

*Prices slightly higher in the West. Walnut enclosures optional.

ABOUT MUSIC

Harold Lawrence

Bad Sound In A Good Hall

In recent years Carnegie Hall has become one of the sonic horrors of the New York entertainment scene. I hasten to add that this has nothing to do with the basic acoustics of the place. But the venerable hall that violinist Isaac Stern and others rescued from the wrecker's ball frequently offers the kind of sound one might expect to hear through a hearing aid.

Several years ago Carnegie Hall installed a sound amplification system for non-classical artists and attractions. Loudspeakers placed at the sides of the proscenium, approximately on a level with the second-tier boxes, are aimed directly at the unfortunate occupants nearest the stage. Overloaded amplifiers drive the speakers, and some members of the audience, wild. The least objectionable components of the system are the microphones, although these are usually deployed ineffectually and used incorrectly by performers. Just as medical schools have their students observe the effects of a given disease, audio engineers would do well to send their apprentices to the 57th Street landmark to survey an ineptly designed and poorly operated sound system in action.

Lack of Clarity

Carnegie Hall audiences often complain that the system garbles words. This is particularly frustrating when the text contributes vitally to the understanding and appreciation of a song. At a recent concert by Nina Simone, the cabinet resonance of the proscenium loudspeakers combined with the distortion of the amplification system to produce the kind of cavernous mumbling one associates with political conventions.

Acoustically "live," with a reverberation period of 1.7 seconds, Carnegie Hall makes it possible for a singer to be heard in the upper reaches of the top balcony, provided the accompaniment is not overwhelming. In an acoustically dead hall, sound reinforcement might have posed fewer problems. At the Simone concert, the audience was subjected to a disconcerting mélange of "live" and amplified sound; namely, Nina Simone on- and off-mike. When the singer moved away from the microphone, we heard her true voice; on-mike, it was distorted and raucous. Simone was accompanied by a combo during the first half of the program, by a 40-piece orchestra after intermission. Because of the limited number of microphones available, one of the accompanying guitarists, whose tone would have been audible under ordinary acoustical conditions, was nearly lost because the mike favored other players. During the second part of the program, the condition was aggravated by the size of the orchestra, sections of which were un-miked while others were puffed up.

Microphone technique

Some singers seem to want to devour their microphones, especially when they are singing their loudest. Miss Simone is not a mike-swallower; she handles her instrument intelligently, never uses it as an emotional crutch, and steps back when she lets loose. But short of dispensing with it altogether, she could not escape the sound system. In quiet reflective passages, everything was clear; but distortion took over the moment she sang louder.

Point-source effect

It was impossible to forget the speakers at the sides of the proscenium due to the decibel level set by the hall's technicians. You saw the performers on the stage, but the sounds they were making came from two points high above the heads of most of the audience. This audio-visual disparity might have been made less noticeable by a reduction in volume of the amplified sound to a point where electronics would have helped, rather than usurped, the "live" program.

Body Mike Steals The Scene

When Jose Ferrer played the role of the narrator in Stravinsky's *Histoire du soldat* at a Carnegie Hall concert last fall, it was decided to furnish the actor with a body microphone. Perched on a high stool to the left of the chamber ensemble conducted by Thomas Dunn, Ferrer read his part during pauses in the music. Thanks to the body mike, the audience was treated to more sounds than the part called for: they heard the narrator click his fingernails on the stool, clear his throat, adjust his tie, and move the mike across his starched dress shirt, all of which provided an extra-musical obligato to the work at hand.

Limitations of Pickup Pattern

Carnegie Hall's sound-amplification system is hard put to cope with solo artists. When used to "assist" an operatic cast, the results can be called aural pot luck. The second half of the Kurt Weill evening starring Lotte Lenya was devoted to an abbreviated concert version of the *Threepenny Opera*. The system was in trouble in all numbers involving more than one singer. I won't mention the final ensemble, which resembled reception on an FM receiver suffering from phase shift. In duets, the singers jockeyed for position to get a better shot at the microphone. There was good reason for this: inches away, and the voice usually disappeared, engulfed by the orchestra and the amplified voice of his partner.

Talents Imbalanced

The Benny Goodman Quartet, brought together after a quarter of a century, played at a benefit concert for the Wiltwick School. If ever a jazz concert needed no electronic aids, it was this one. As George Avakian put it, the Goodman combos "were so different from those which preceded them (in 1935) that they inspired the term 'chamber jazz' . . . the Goodman trio and quartet seemed closer to what one might expect in a classical chamber group." Each of the parts – Goodman, clarinet; Teddy Wilson, piano; Lionel Hampton, vibraphone; and Gene Krupa, drums–is designed to dovetail with the others. Carnegie Hall's sound system quickly changed all that. One microphone was placed directly in front of Goodman; another near Hampton; although not near enough; Krupa needed no assistance. But the Hall apparently had no microphone left over for Wilson. What had begun as a quartet ended as a clarinet-and-drums duet with vibes-and-piano embellishment. When in his customary fashion, Goodman signalled to Wilson to take over and the brilliant jazz pianist launched into one of his nimble improvisations, it was as if we were hearing the piano played upstairs in the artist's reception room. Then just as we were beginning to adjust our ears to the natural sound of Wilson's piano in Carnegie Hall, on came Goodman like Gangbusters over the sound system.

New York *Times* critic John S. Wilson, whose reviews of concerts at Carnegie Hall bristle with sharp comments on the room's sound system, is one of the few writers to draw attention to the deplorable use of sound reinforcement in Carnegie Hall. But it seems unlikely that the hall's management will heed his criticisms. Sound reinforcement or not, the crowds will throng to 57th Street to hear their favorites. Æ

INTERIOR DESIGNED BY CARLILE HOLLAND, N.S.I.D.

THE INCOMPARABLE CONCERTONE 800

Every listening moment is more enjoyable, more memorable, with the incomparable Concertone. Only the Concertone provides an exclusive combination of features which makes up a sound system beyond compare. Reverse-o-matic®—an industry first by Concertone—allows you to play or record in both directions automatically, continuously, without having to change reels. Behind the distinctive performance of the Concertone 800 are more than fifteen years of experience in the engineering and production of quality professional and home tape recorders. When you're ready to buy your tape recorder, consider Concertone for greater listening pleasure, greater versatility, and a price that is to your liking. For our free brochure, write today to Concertone, Box 3162, South El Monte, California. **CONCERTONE**

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Circle 111 on Reader Service Card

AUDIO ETC.

Edward Tatnall Canby

THE AUDIOVIDEO TAPE DECK

So now we're going to have *pictures* on our home tapes, maybe. Well—not *quite* yet. But the cards are making indications like crazy.

Slowly, steadily, the various home entertainment media are closing in on our hi-fi preserve, integrating themselves into the erstwhile "music system." Or is it the other way 'round? Slowly but surely, the component field is reaching out to encompass new areas of home entertainment, once unrelated, into the new and larger "home entertainment system."

Thoughts such as these were running through my head recently when the editor and myself greeted each other at one of those fairly infrequent "first line" press events at Ampex which have so often marked a new departure, or a major step in an established direction. I've been to many over the years. This one, like others recently, was not outwardly our business, here at AUDIO. We haven't yet branched out into closed-circuit TV on aircraft carriers, nor institutional training systems, freight-car counting and the like. Yet even so, each of the major Ampex launchings has its own interest for us, simply because of the ever-present implications and overlappings. And especially because of the significances in terms of future hi-fi equipment which emerge, so to speak, on the side. Ampex isn't the only innovator, obviously; but this company is big enough and secure enough—also systematic enough—so that a major new product from its assembly lines is likely to indicate a reliable trend, almost sure to turn into fact.

This latest launching was no exception. A *longitudinal* video tape recorder, using standard-size quarter-inch tape! (Special formulation; but good quality audio tape may be used with acceptable results.) Now, at last, we actually have a machine in production that puts pictures onto the same tape we use for sound. Indeed, the video pictures are even "four-track", recorded in both directions like any home audio recorder. (Almost, anyhow. One track is audio, the other video.) Two tracks each direction. Watching this new tape deck in operation I fairly squirmed with interest—so much was it *like* a home tape recorder. In an exalted sort of way, of course. This deck costs slightly under $4000 and it weighs 95 pounds.

Ampex V-303. That's the name. It is a "third generation" video recorder in the classic progression, heading onwards at $4000 from the preceding models at nearer $10,000 and the first and most highly "pro" recorders at roughly $30,000 each. And in the classic sense, all of these types continue in production and use; the new model is as much a supplement as it is a successor to the older and more complex video tape machines. And so, as always in this reliable industrial developmental system, we can look forward in the direction of the next generations and their intent. That's why this machine is so interesting.

It is a transition model in many ways, though its commercial use is, of course, direct and to the point. Transitional from strictly professional TV broadcast recording towards areas which concern us directly. It is a non-broadcast, closed-circuit TV recorder for professional work of many sorts, in industry, education, training in the services, TV record-keeping and what-not. The machine is not exactly a home tape deck for you and me, to put it mildly. But it aims so succinctly *towards* us, that we can only sit there and gasp with anticipation. As I did.

Signature VI

Ampex introduced the deck itself plus a fancy trainer console, the Ampex Videotrainer ($6000 and up) with built-in monitor, TV tuner, mike and camera, plus two alternative TV cameras ($1000 class). None of this is home hi-fi, to put it *very* mildly. But Ampex usually knows where its own cards lie. And so Ampex also launched another of those Things, an enormous furniture piece, about a mile long (complete with pretty model standing in front), in which there is encased a Home Entertainment Center that includes the very first commercially available (so to speak) home video recorder.

What a monster! It's entitled the Signature VI, and you may actually have one if you want. The price is reputedly around $10,000. But this Signature VI, which nobody in his right mind will buy, is no joke at all. It is the Ampex way of showing us the possible and probable future, right in our own bailiwick.

(Signature V, the preceding extravaganza in this series, incorporated the early professional broadcast portable video recorder and had a ticket of $30,000 attached, in case anybody wanted to buy one. Nobody did.)

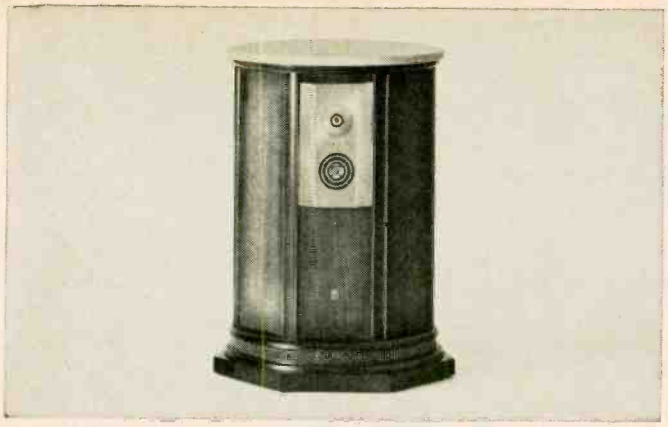
Look inside this Signature VI with me. You'll find, in this luffly supercabinet, just about everything in hi-fi, packaged deluxe and in stereo where applicable. Gorgeous FM stereo from Fisher, Gorgeous color TV on a huge picture tube from Motorola. (A very curious missing link—no disc record player. Maybe Ampex just forgot—I suspect that space limitations were a good reason, what with that huge TV recorder to accommodate!) But what really astounds the eye, here, are the *two* tape recorders, sitting spang in the middle, side by side, like big and little brother.

One is for audio, an Ampex 2050 home tape deck, built-in. Right next to it is the video, the Ampex V-303, larger but otherwise astonishingly similar in basic configuration. It's really startling. There they are, almost semi-twins except for size. Same standard-size tape on both, same reels—though the V-303's are big 12½-inchers, precision-type, while the 2050's are the usual 7-inch size. And the same basic play system on both, bi-directional, two tracks each way, dual fixed head assemblies, one set for each direction of play with automatic reverse at the end of the tape. Even the controls are similar. Imagine it! One recorder for sound, one for pictures. I never thought I'd see the day . . .

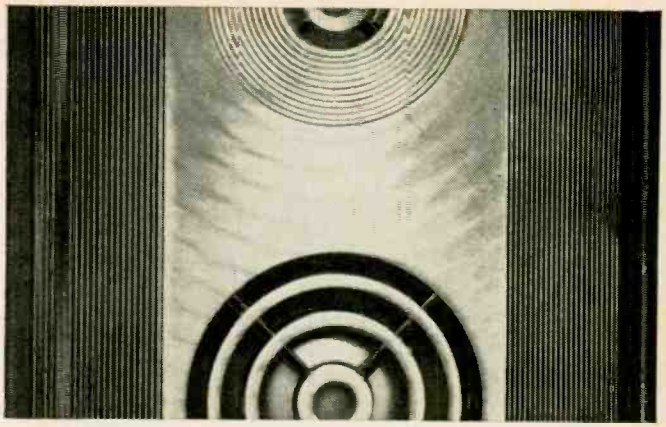
The Integrated Deck

Indeed, if it weren't for a certain necessary discrepancy (at this stage of the game) in respect to tape speeds, which accounts for much, these two decks would already have been "fused" into one. Without a doubt—that is the suggestion here—they eventually will be. And *then* will we have a ball! audio and video, either/or, on one and the same machine.

For, you see, these two tape decks in the Signature VI are glaringly redundant. The video deck records sound too, on one of its tracks. So you have *two* sound recorders, where one is plenty. And you have four reels, six motors, two frames and innumerable other duplications galore that, were it



With the new Royal Grenadier

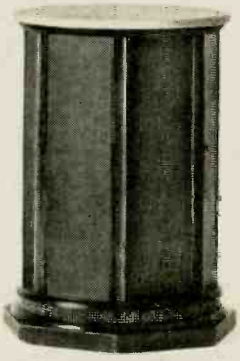


You can turn up the sound

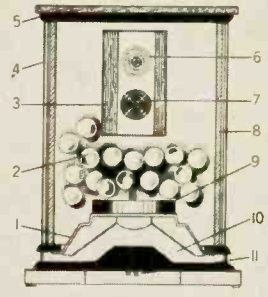
You can turn down the sound

You can sit to the left of it

You can sit to the right of it



You can sit behind it



1. 15" mass loaded woofer with floating suspension and 4" voice coil.
2. Sound absorbent rear loading.
3. Die-cast mid frequency-high frequency full dispersion acoustic lens.
4. Hand rubbed satin walnut finish.
5. Imported marble.
6. Ultra-sonic domed tweeter.
7. Full presence mid range direct radiator.
8. Exclusive non-resonant rigidized heptagonal sonic column.
9. World's largest (18 lbs.) speaker ceramic magnet structure.
10. Front loaded Horn-360° aperture throat.
11. Complete symmetry of design with terminals concealed underneath.
12. Dimensions: height 29" — diameter 22".

Patents Pending

You can examine it

EMPIRE

CREATORS OF THE WORLD'S MOST PERFECT SPEAKER SYSTEMS. FOR A SOUND DEMONSTRATION GO 'ROUND TO YOUR DEALER OR WRITE FOR COMPLETE COLOR BROCHURE.

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And you can say so much about it

Circle 108 on Reader Service Card

not for the speed problem of the moment, could have been neatly eliminated. Not yet. The state of the art won't allow it. So—for now, two separate recorders.

The tape speed is the crux, of course. The Ampex 2050 audio machine moves its tape at a leisurely 7½ ips, or even 3¾ ips. It achieves (after all these years of audio progress) a commendably useful bandwith of around 15,000 cps, top to bottom, if not more. The Ampex V-303, with big foot-wide reels whirling silently, zooms its half-mil tape along at a fabulous 100 ips. Over two miles of tape on each big reel, and for that you get some 50 minutes of picture, both directions, with a 12-second break in the middle for the automatic reverse. Some machine for the home!

(It's a pleasure, though, to watch it handle that ultra-thin half-mil tape at this fantastic speed without spilling or tangling. At least, nothing went wrong during our demo. Hate to think of the mess if it had.)

And listen to this. Those who dicker electronically with their tape recorders will be pleased to hear at the bandwidth the V-303 gets on its tape. It runs from 250 cps to *1.5 megacycles*. How's *that* for highs? (And yet by video standards it is less than the often-mentioned minimum of 2 megacycles, supposed to be required for a proper picture. I thought the Ampex picture was very good, just the same.) So, one way or another, this new kind of "hi-fi" has to boast, instead of our tame old 20 to 20,000, a spread of from practically zero to 1,500,000. Sort of leaves audio out in the cold, doesn't it? And accounts for the presently necessary speed. 100 ips. (Other video recorders have moving heads and use tape up to 2-in. wide—not very practical for home consumption.)

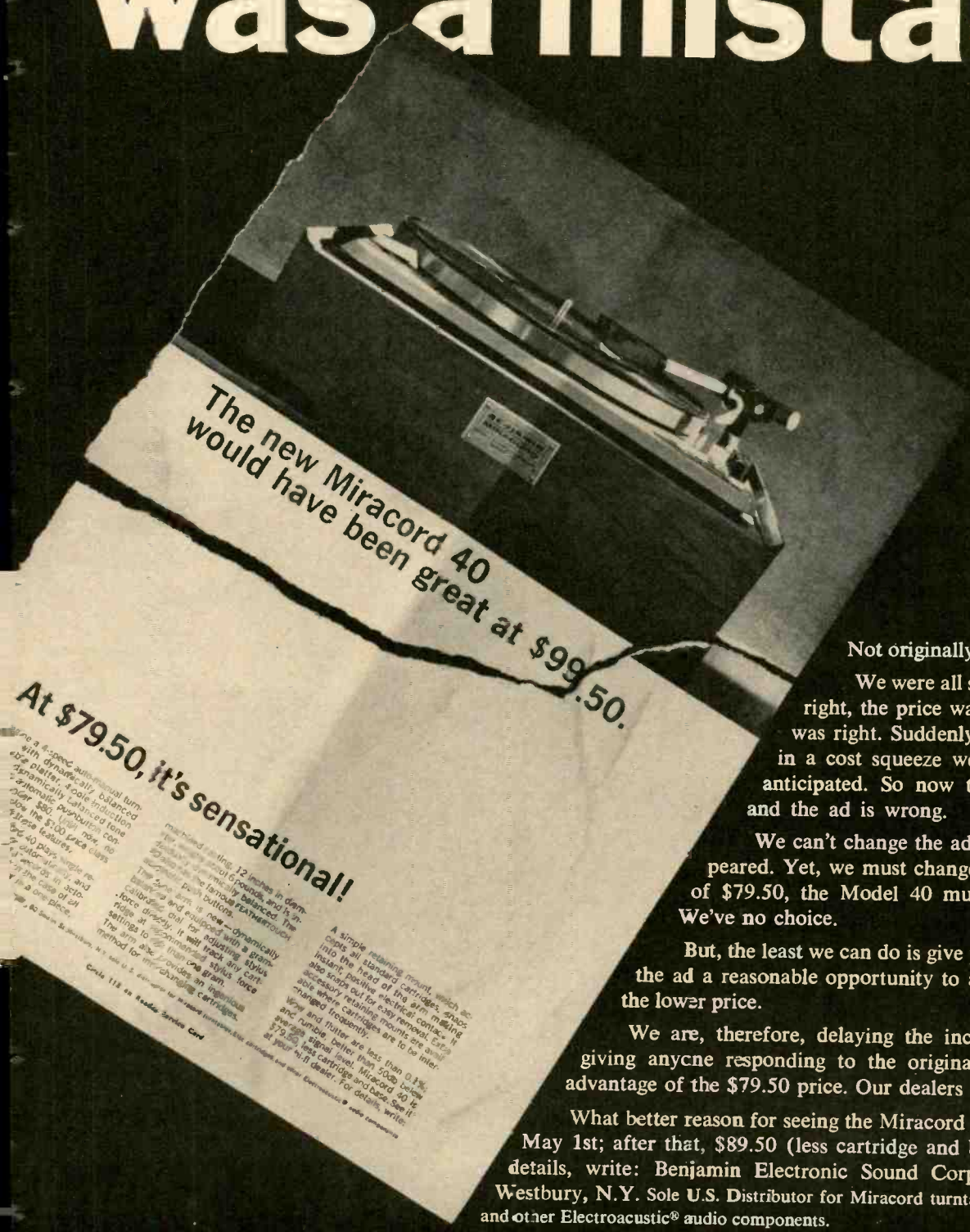
There is, of course, 100 ips audio on that tape too. It just goes along for the ride. You get your audio along with your picture, and (like any four-track audio recorder) you can record both simultaneously, or one at a time to add sound to a picture already on the tape.

Tape Slowdown

Now obviously a lot depends on what can be done in the future, by hook, by crook or by sheer genius, to reduce that video tape speed while maintaining a viewable picture. Obviously, Ampex has hopes—or should I say, plans. A voice out of the AUDIO office whispers in my ear (via phone) that other people are hard at work on this tough problem, too, even though the first intended commercial venture of the sort, imported from Europe, seems quietly to

(Continued on page 42)

This ad was a mistake



Not originally!

We were all set: the product was right, the price was right, and the ad was right. Suddenly, we find ourselves in a cost squeeze we could never have anticipated. So now the price is wrong and the ad is wrong.

We can't change the ad. It has already appeared. Yet, we must change the price: instead of $79.50, the Model 40 must sell for $89.50. We've no choice.

But, the least we can do is give people who've seen the ad a reasonable opportunity to avail themselves of the lower price.

We are, therefore, delaying the increase to May 1st, giving anycne responding to the original ad time to take advantage of the $79.50 price. Our dealers are cooperating.

What better reason for seeing the Miracord 40 now? $79.50 til May 1st; after that, $89.50 (less cartridge and base). For further details, write: Benjamin Electronic Sound Corp., 80 Swalm St., Westbury, N.Y. Sole U.S. Distributor for Miracord turntables, Elac cartridges, and other Electroacustic® audio components.

EDITOR'S REVIEW

STATE OF THE ART

IF YOU ARE INTERESTED IN SOUND you will be fascinated by the sound reinforcement systems used at the World's Fair. Whether you are amateur or professional, you should learn much about the state of the art from the variety of problems faced and solved in order to reinforce sound there.

First of all you'll note that sound pervades the Fair like a smoke screen, and not all of it is intentional. Wherever you go you can hear music, people, and airplanes.

Oh yes, those airplanes.

The airplane is the veritable epitome of advanced technology. Certainly more advanced than most sound systems. And louder.

Hundreds of times during the day and night the increasingly familiar whine and vibration of a jet aircraft undoes the spell of a marching band, a strolling singer, or a pleasant conversation.

But that's the uninvited sound.

The sound that's supposed to be there varies from execrable to excellent. We would expect this range considering the large number of systems at the Fair. The surprise is that some of the most elaborate and expensive pavilions presented poor sound. In some cases it detracts appreciably from a potentially superb presentation. It proves anew that sound reinforcement is a vital and integral part of a performance. And that it's possible to spend a great deal of money without achieving good sound.

Ignoring the mistakes, there are many sound systems at the Fair which demonstrate the best thinking and sound quality available today through commercial systems. The state of the art.

With that thought in mind, we must admit that the "state of the art," insofar as commercial systems are concerned, does not seem to represent that advanced, edge of the unknown thinking we usually associate with that term. Even in the best systems, the improvement is only modest as compared to the best systems of the past.

Why?

It would be rather presumptuous of us to say we knew all the reasons for this state of the state, but certainly an important factor is the dearth of organized research. In the United States, as elsewhere throughout the world, we have come to understand that unpressured (without a specific commercial goal in mind) inquiry by the best minds is a superior method for stimulating advance. Unfortunately, the cost is usually quite high; the best minds are attached to bodies which require sustenance. Only the largest corporations, or the government, can sustain an *apparently* unproductive burden of this nature. And they are not interested in audio that way.

It seems to us, that for real advances in the technology which sustains commercial sound, and high fidelity too, that good minds must be encouraged to do research in this area. An appropriate way to do this would be for the interested groups to provide research grants to individuals or groups who propose an appropriate topic to study, and a reasonable method of inquiry. We don't really have to enlarge on the mechanics of providing this type of grant, after all many foundations have been doing it for a long time. One could discover how they do it.

The important thing is to do it.

Who could do it? Well there are several groups which concern themselves with this area of technology to varying degrees: the Audio Engineering Society, the Acoustical Society, and the Institute of High Fidelity. Surely one of these groups, or all, could sponsor at least one grant a year. Perhaps the groups could join together to sponsor a foundation for the purpose of providing research grants.

Let us hope so.

FM AT THE CROSSROADS

In our February issue we presented an article by Harry Maynard concerning a possible new status of FM broadcasting. It all hinges about a proposed order from the Federal Communications Commission which requires separate and different programming from those FM stations which are "sister" to an AM station. At least 50 per cent different.

The obvious intent of this order is to make FM independent of AM. This, in effect, creates new stations without granting new licenses.

Reaction to date to this proposal has been pretty much what one would expect; broadcasters who are primarily oriented towards AM are against it, those who understand the potential of FM are for it.

The *against* broadcasters argue that it would cost sufficiently more to provide separate programming for little sister FM that they would go bankrupt.

They may be right, but frankly we doubt it. If radio broadcasters have managed to survive the economic hammering of television, they will be ingenious enough to survive the temporary pinpricks of extra programming. We believe, as Mr. Maynard does, that the loss will be for a very brief time.

Besides, it seems to us that when two separate broadcast licenses are issued, there should be two separate stations. In essence, AM stations have been using sister FM stations to increase their coverage. We do not believe that was the intention in issuing FM licenses.

The only other argument we have encountered was from radio station WQXR in New York (see Letters). They feel that there is sufficient variety of programming in the New York City area, thus there is no need to stimulate further programming. There may be sufficient variety for some, but we daresay we have found it rather restricted for our palette.

In any case, whether there is sufficient programming or not is irrelevant (and a matter of opinion). Indeed, whether a station can sustain the new order economically also is irrelevant. The fact that there are two distinct broadcasting licenses involved is the real point. If any broadcaster feels he cannot sustain the economic burden of extra program, he has a simple remedy; sell the FM license. Let somebody else take a crack at it.

Nine out of ten musical people prefer the sound of Pickering.

Nearly all musical people prefer *natural* sound. And natural sound begins with Pickering. Right where the stylus meets the groove.

Any of the new Pickering V-15 stereo cartridges will reproduce the groove, the whole groove and nothing but the groove. That's why a Pickering can't *help* sounding natural if the record and the rest of the reproducing equipment are of equally high quality.

To assure compatability with your stereo equipment, there are four different Pickering V-15 pickups, each designed for a specific application. The V-15AC-1 is for conventional record changers, where high output and heavier tracking forces are required. The V-15AT-1 is for lighter tracking in the newer automatic turntables. The even more compliant V-15AM-1 is ideal for professional-type manual turntables. And the V-15AME-1 with elliptical stylus is the choice of the technical sophisticate who demands the last word in tracking ability.

No other pickup design is quite like the Pickering V-15. The cartridge weighs next to nothing (5 grams) in order to take full advantage of low-mass tone arm systems. Pickering's exclusive Floating Stylus and patented replaceable V-Guard stylus assembly protect both the record and the diamond.

But the real payoff is in the sound. At least for those who can *hear* the difference.

Pickering
Plainview, L. I., N. Y.

For those who can hear the difference.

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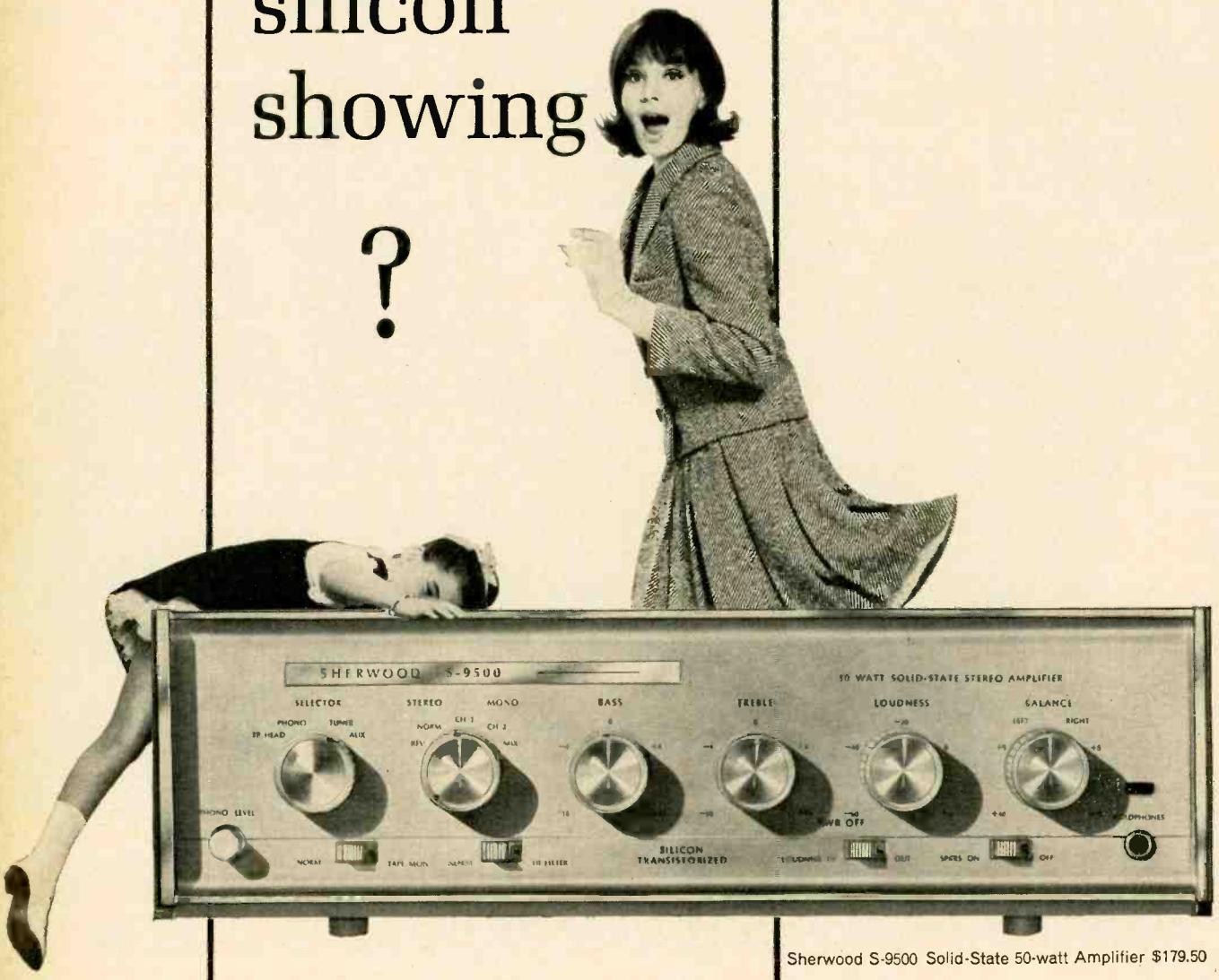
Is our silicon showing ?

Compare these S-9500 Specs! Power output, both channels IHF music power: 50 watts at 1% I.M. distortion. Continuous sine-wave power output (two channels): 36 watts at ½% distortion. Power bandwidth: 12-35,000 cps. at 1% distortion. Hum and noise: Phono—70db, Tuner—80db. Sensitivity: Phono —1.8 mv, Tuner 0.25v. Also available: 150-watt music power Silicon Solid-State amplifier, S-9000, $299.50



Sherwood S-9500 Solid-State 50-watt Amplifier $179.50

Well, it should be . . . if only to show you how very lucky you'd be to own the Silicon transistorized circuitry of the S-9500. We wish you could *SEE* the difference which costs us 50% more than the usual Germanium way of transistorizing your circuit; you will *HEAR* the difference. Furthermore, this 50-watt Sherwood integrated amplifier-preamplifier can be squeezed into the tightest custom installation, with no heat problems either. Perhaps, you are wondering if these transistors will really stand up. Just perfectly, because the new Sherwood all-Silicon circuitry virtually eliminates transistor failure caused by shorted speaker terminals or other improper operation. And all this for only $179.50.

Write now for our latest catalog detailing this remarkable amplifier as well as Sherwood's world-famous FM tuners and speaker systems. Dept. 4A.

Sherwood

Sherwood Electronic Laboratories, Inc., 4300 North California Ave., Chicago 18, Illinois

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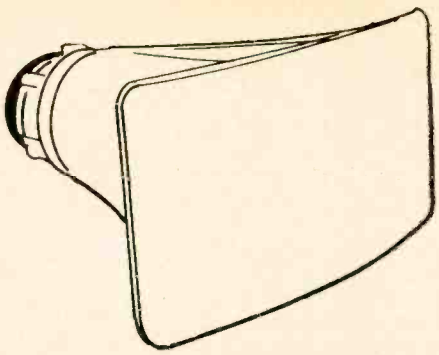


Sound At The Fair

MARTIN DICKSTEIN*

Let us take you on a sound tour of the New York World's Fair and show where and how some of the more distinctive sounds are used, explain in brief detail a few of the more complex sound systems, and to tell how some of the sounds you may or may not have already heard are used to enlighten, confuse, attract, and delight the visitors. For the professional, or would-be professional, it is a vertiable treasure trove—the largest textbook on sound in many years.

Loudest Sound

"Hold on a minute. Im calling from one of those new outdoor pushbutton phones at the Fair and with the music playing and the plane going overhead I can't hear a word you're saying."

Do you recall being at either end of this phone conversation? The person making the call was experiencing three of the most widely heard sounds at the New York World's Fair of 1964. The loudest, of course, was the roar of the jets taking off from La Guardia airport. The din of the 500 to 600 planes a day making part of their flight over the Fair grounds creates quite a disturbance. Shows taking place outside or in tent-like structures suffer the most. Many of the pavilions had taken this noise into consideration when their buildings were designed. Roofs and ceilings are heavily insulated with acoustic material. Some ceilings, such as at Chrysler, are suspended from the overhead steel through rubber or other spongy material to prevent shocks and vibrations from getting into the show areas. In most instances, the treatment proved quite effective. In others, this outside interference was simply masked by the high level of the sound on the inside. In still others, the noise does get through somewhat with the resultant loss of a few words of dialogue or a few bars of music. Imagine for yourselves what the 1965 season is to be like when the average day will probably have as many as 800 to 900 planes flying overhead.

General Music and Fountain Music System

The music mentioned in the phone conversion, as well as the martial music heard when the visitor first enters any of the gates, originates from tapes playing in a central control room. This sound system is the most extensive one at the Fair. The music follows the Fair-goer from pavilion line to pavilion line and from area to area. Only the Amusement Area is not covered, and in just a few isolated places within the general areas is the music heard at low level. The selections played were carefully chosen and grouped together to fill pleasantly the time of the day or evening spent in walking or sitting. For most visitors it seems to accomplish its purpose.

This general music system can also be tied in with the music system used during each evening's fireworks-and-fountains display at the Pool of Industry. Regular Fair visitors soon became familiar with the three loud bursts set off high in the air over the Pool 15 minutes before the show was to begin. The music for this display also originates on tape but from a separate control room near the Fountains. Five different music shows are programmed in cycles, one show each evening. The huge specially-designed speaker for this system, located at the center of the Pool, can also be connected to the general music system for music or special announcements, or to the Fountain music system.

Newest Sound

The third sound involved in the opening conversation, never heard by as many people before, is the telephone company's latest development for public use: "touch-tone."

To accommodate the anticipated 200,000 calls a day, a new central office was built near the Fair, and newly-designed equipment, different from that used in the dial system, was installed. (The pushbutton phone instrument can not be used yet in the present dial-type home or office system.) More than 6500 pushbutton phones are spaced throughout the Fair with 1400 for public use, of which about 500 are located at strategic outdoor points on the grounds. (It was one of these which was being used in the opening conversation.) Many others are inside many of the pavilions.

To provide a different tone for each button, seven oscillators are used, four in the low band (below 1000 cps) and three in the high band (above 1000 cps). The pushbuttons are arranged in four horizontal rows with "0" or "operator" under the center vertical row. These horizontal rows operate the four low-band oscillators (numbered down 1 to 4), and the three vertical lines operate the high-band oscillators (numbered left to right 5 to 7). Thus, when the button for "1" is pressed the tone heard is a combination of oscillators 1 and 5. When "6" is pressed, the resulting tone is that of oscillators 2 and 7, and so on. These tones are also transmitted to the central office equipment where they are translated to numbers again and the call set up. This makes it quick and easy to call anywhere in the United States (not free, of course) even though the number being called is not a "touch-tone" system. (Some people were overheard trying to whistle their most frequently called numbers.)

Fair Tours

When a visitor first enters the grounds, it is possible to take a ride around the Fair in either a bus or a glide-a-ride train. If such a tour is decided upon, the rider is given brief descriptions of the pavilions and other sights either by the driver speaking into a microphone, or from a recorded tape cartridge. The cartridge used is of the loose, rather than the more usual tightly wound type. The sound is fed through an amplifier located at the front of the bus or train and is heard through ceiling speakers in the bus, or horns mounted at the rear of the cars of the open trains.

The tape is preset by the driver to correspond with the starting point, and, once started, the tape will play continu-

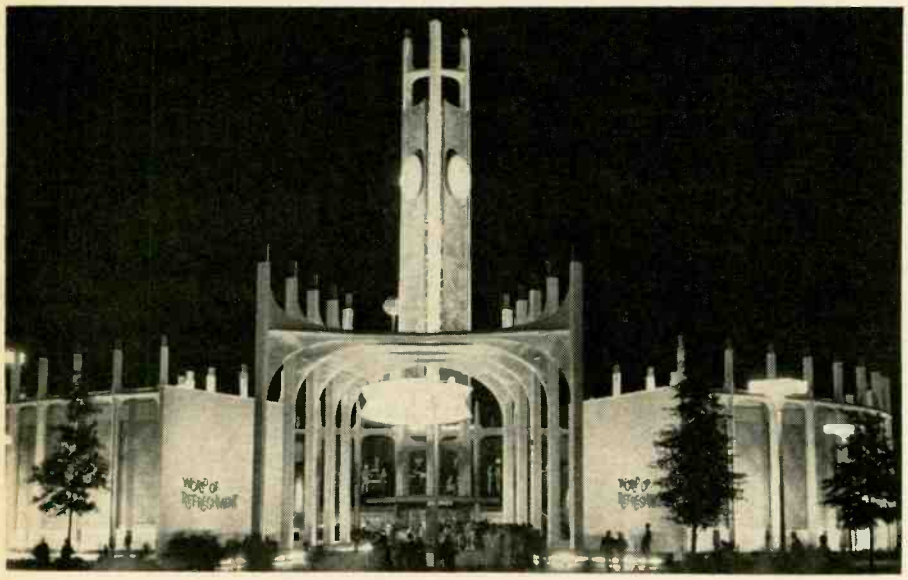
*Sound Systems Inc., L. I. C., N. Y.

ously, in step with the coverage of the grounds at a designated "normal" speed. However, no steady rate can be maintained for any length of time as the bus is slowed, if not stopped completely, by the crowds of people walking in the streets. The driver then has to stop the tape at the proper place in the talk and restart it when he begins to move again. The vehicle also has definite stops to make either to take on or discharge passengers, and the driver then manually restarts the tape. The start switch is located near him.

world's finest carilloneurs perform at the organ-like console (in a completely glass-enclosed studio) at the base of a 120-foot tower which is part of the Coca Cola Pavilion.

A total of 59 specially-designed stentors (giant loudspeakers) are located at the 50-foot, 75-foot, and 100-foot levels, each height individually controlled by a switch on the console. The bells, 610 of them, are tiny cast bronze rods struck by miniature hammers. The sound intensity produced at striking is almost inaudible, but visitors hear the

Fig. 1. Night view of Coca Cola Pavilion. The tower in the center contains the carillon stentors. It is said to be the largest carillon in the world.



Outdoor Sounds

If the visitor decides to walk, he becomes swamped with invitations, loudly proclaimed through horns at the front of, or all around, the many exhibits using outdoor sound systems. Live announcements and/or tape, either cartridge or self-reversing, are used. To attract as many people as possible, the criterion seems to be loudness or distance covered. Although the maximum distance from any pavilion that the outdoor system is *supposed* to be heard is set at 100 feet by the Fair Commission, the actual distance was never really measured, and, of course, no reasonable control can be exercised over the wind velocity or its direction.

In some areas, the walkers are treated to a show being put on for the benefit of the people waiting to enter the featured show of the pavilion, or they can hear the sounds of the main show itself, or the background music played within the pavilion, itself.

Certain distinctive sounds, however, quickly became known to the visitors to the Fair as originating at particular pavilions. Among these is the playing, several times a day, of the largest carillon in the world. Some of the music after amplification of about 1,000,000 times. The instrument consists of 10 basic tone colors each with a chromatic range of 61 notes. If full-size bells had been used, their total weight would be over 2000 tons.

Another carillon, much smaller in size, is located in the International Area. Its operation, however, is automatic. It chimes the hour as well as playing musical selections at preset times during the day.

The hour is also sounded from the Church steeple in the Belgian Village area. Within this town-in-minature, visitors can also hear the sounds of a show taking place in the Rathskeller Restaurant, or the music of bands parading in the city square. A calliope can be heard at the carousel located inside the Belgian Village, or at a merry-go-round in the Amusement Area.

Music with a Continental flavor can be heard, originating live or on tape, from a bandstand platform at the 7-Up Pavilion. Authentic old-time player-pianos, coinolas, and nickelodeons can be seen and heard in the Montana State exhibit after viewing displays of real Western guns, garb, animals, and about $1,000,000 in gold dust and nuggets.

Outdoor Theatres

Several pavilions have outdoor theaters built as part of, or associated with, the main exhibit, although the buildings and the outside arenas may be completely separate in their shows and sound systems.

One such outdoor theater was built at the N.Y. State Pavilion. Another is at the Singer Bowl, and a third at the Tiparillo Bandstand near the General Cigar Pavilion. At the N.Y. exhibit, visitors sit (or stand) under the huge, high, colored-glass ceiling and hear presentations by a variety of singers, bands, school musical groups, and others.

At the Singer Bowl, the audience sits in stands built around the arena, coliseum style, to hear and watch marching groups, jazz combos, an Opera Company, and choirs, and public civic events. The Tiparillo Bandstand, where Guy Lombardo was featured (last year) in the evenings for public dancing and listening, ethnic groups, school performance contests, bands, and choral singing can be heard and seen during the day. Here, the audience sits, or stands under the sun or stars while the performances take place on a stage in front of a shell-shaped enclosure.

In each of these outdoor theaters the sound system is required to cover the listening area with sufficient level yet without acoustic feedback. The N.Y. State and Bowl arenas use sound columns mounted, in the former, on structural pillars located between the stage and the audience, and, in the latter, both on pillars around the arena as well as suspended in a cluster from a cable across the Bowl. At the Bandstand, three large forward-projecting horns are mounted on top of the bandshell.

Music is also heard outdoors all around the Fair performed by the City Service Band. A glide-a-ride train actually two long flat-cars, is used to transport the Paul Lavalle contingent to any and all places on the Fair grounds. A battery-inverter power supply is used to power the amplifiers which feed horns on top of the train. The center speakers can be rotated to face in any direction depending on the location and purpose of the performance. The cars themselves can be driven into a wide V bandstand on which the 75 musicians are picked up by four microphones. Plenty of spare equipment has to be carried along on the train—just in case. Feedback is kept under control by proper level settings on the equipment and attention to the

relative locations of the horns and microphones.

These are only some of the more distinctive sounds heard outside the pavilions, and each visitor can judge for himself whether he likes the sound quality or not. Nevertheless, although each outdoor system may have its problems of balanced coverage, it is inside the pavilions that some of the major sound and acoustic problems are encountered.

Inside—Adjacent Displays

In many open areas where dioramas are located adjacent to each other, the sound of one display can carry over into the listening range of the next. When some of the buildings were first opened, it may have been thought that the visiting people themselves would absorb much of the sound and the overlap would not be unacceptable. This unfortunately, proved true in only a few of the instances. In most others, this did not turn out to be the answer so further measures had to be taken.

One solution was to hold the groups of visitors (where the exhibit lends itself to such control) so that only every other display was playing its sound at any one particular time. By spacing the visitors to alternate exhibits it is possible to eliminate much of the audio overlap. However, this entails decreased numbers of visitors and the rewiring necessary to permit cutting out the in-between displays either manually or automatically.

Most of the pavilions which found overlap objectionable changed the locations of speakers, audio levels were rebalanced when possible, and many installed telephone-type listening devices at the displays, thus eliminating

Fig. 2. Control center for the Belgian Village. The system was designed and built by H. H. Scott and incorporates their 299-D stereo amplifiers as well as a complex switching system.

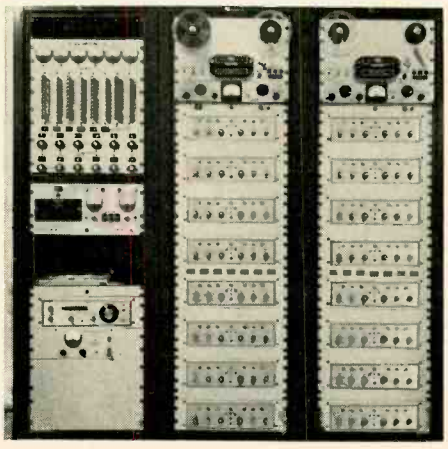


Fig. 3. Aerial view of part of the Belgian Village. The Village is a 17-block complex.

speakers entirely. This decreased the number of people who can see the display at one time, something no pavilion wants, but is preferable to interference between areas.

Almost all pavilions (there were only a very few exceptions) have background music playing through some part of the building. This might be originated from a record player, reversing tape, cartridge, piped-in, or live. This also contributes to the interference problem in a few exhibits. Where this has happened, attempts have been made to adjust levels, cut out certain speakers, change the displays to omit sound, or cut out the background music entirely. There are one or two places where the overlap is not considered objectionable by the exhibitor and no measures were taken, and it is possible that many of the visitors felt the same way.

One exhibit where the visitors walked through five separate hut-like adjacent dioramas and heard no overlapping sound was at the Coca Cola Pavilion. Each setting (Hong Kong, India, Bavarian Alps, Cambodian Jungle, and on board a ship) uses sound but it is background talk and chatter, singing, music, birds and animals, and other sound effects. No overlap or intelligibility problems existed because of this choice of program material, the short walkways between sets, and the padded construction of the displays.

Inside—Rides

Most of the "tricks-of-the-trade" had to be used when it came to designing and constructing the buildings and vehicles where a ride is the featured exhibit, and many unique sound obstacles had to be overcome. In each of these pavilions (Ford, United States, General Motors, N.Y. City, and Bell System) the spoken word plays a vital role in getting display information across. Intelligibility and quality, therefore, became the prime goal. (Pepsi Cola's ride is not mentioned in this group as only music is used, seeming to come from everywhere, but with different instruments and orchestrations being heard, playing the same music, as the boat passed each country's dolls.)

Ford, with the riders travelling in small groups in new model automobiles, uses individual continuous cartridge tape machines, one to a car. The tapes are started by a lever at the beginning of the ride and are heard through small speakers located behind the dashboard. The narration continues through about three displays then the tape is stopped automatically by a cue pulse carried on the tape itself. It is restarted by another lever as the car continues, and this process is repeated several times until the end of the ride. The tape then stops again and is ready to play, from the beginning, for the next riders. This tape also has, on separate tracks, a choice of four different languages which can be selected by the rider using the pushbuttons on the dashboard. The narration is timed to progress at the speed of the car as long as the steady pace is maintained. If something happens to cause the car to come to a stop, the tape will still continue to play until the next stop cue. The building has speakers in the ceiling fed from a separate sound system to tell the riders what the trouble is and how long the delay might be, or to page personnel of the pavilion.

The New York City building features a ride in a helicopter-like car (for a group of about four people) around a large scale model of the city. Here, a tape unit is installed on top of each car and is heard through roof speakers. This tape is also started by a lever at the beginning of the ride and stopped at the end of each trip, ready to be started again for the next group of visitors. After the ride, the passengers are able to walk around the floor level above the ride and look down on the model. Ceiling speakers provide further information on the city. This sound originates on another tape, of the self-reversing type, which also has on it

cues for switching spotlights to coincide with the narration.

At the Bell System Pavilion, each rider travels in his own high-backed chair. A specially designed film optical-track unit is mounted behind the seats, one for every three riders. The transducers are small speakers mounted in movable head-level arms which each individual can adjust for proper height and closeness to the ears.

The rides of General Motors and the United States Pavilions are similar in that people sit side-by-side facing forward as they move through the trip. At the former, three passengers sitting next to each other constitute a car. A specially designed 16-mm sound unit, the same type as the one used at the Bell System ride, is mounted on the moving platform and feeds three cars (9 riders) at the same time. (A total of 463 of the 3-seater cars are used.) The optical sound is recorded with two tracks in each direction, thus giving stereo playback while running in the forward direction on one trip, and automatically reversing itself to play in the opposite direction for the next ride.

At the United States Building, 55 passengers are seated in one vehicle and hear stereo voice, music, and sound effects coming from three separate cartridges in one unit mounted on each car. The back of each seat is curved wing-like around the head of the rider and small speakers, not moveable, are mounted inside these extensions. The top cartridge is used for stereo voice on the first half of the ride, the middle one for the second half, and the third for stereo music and sound effects throughout. The cartridges are set into operation at appropriate times in the journey by levers mounted on the stationary floor on both sides of the moving platform.

Headphones were not employed in order to avoid damage through mishandling, accidental breaking of cables, and for sanitary reasons.

There is no volume control within reach of the riders in these rides. It is up to the operating or service personnel to set the level of sound each morning before the passengers start their trips. Of course each person's hearing differs thus the sound might be too low for some, and too loud for others, but just right for many. Some riders (only a very few) have said they were able to hear the sound of cars in front or behind them. Most of the visitors, however, seem quite pleased with the shows as the rides rate high on most recommended "must see" lists.

Fig. 4. Typical "animated" figures in the General Electric show at the New York World's Fair. Grandpa and Grandma are amongst the 32 "audio-animatronic" figures created by Walt Disney.

Inside Theatres—Stand-Up

Wherever the featured show of the pavilion is a film, a live presentation, or a combination of both, a theater is incorporated into the construction of the building. This raises the problems of seating, acoustic treatment, sound quality, balance of levels, interaction of sound between adjacent theaters (if any), the localization of specific voices and sounds for full effect in the production, and the kind and location of speakers for proper coverage of the audience. Over 30 pavilions have theaters of the stand-up or sit-down type.

At the 360-deg. theater in the Port Authority building, and also in the N.Y. State Pavilion, the film is projected on screens high on the perimeter of the circular stand-up theaters. The audience stands in the center of the area and is surrounded by the movie. The sound, played from the film track, is heard through speakers mounted in the ceiling. By recording different portions of the narration or music on selected films, the program can be made to come from one side of the theater or the other.

In the Museum of Science, the space show uses both a movie and a model of a space ship which moves over the heads of the audience. The voices and music come from speakers high above the standing audience, and when the model is moved across the theater the voices of the astronauts inside it also come from appropriate high-mounted speakers.

One part of the General Electric Pavilion is a stand-up theater with the program projected planetarium-style on the dome ceiling. Here the speakers are placed in the waist-high hand-rail supports. The hand rails run all around the theater. Visitors line up along them to see the show. The speakers, being in the rail supports, are, therefore, lower than the ears of the standing audience, but closer to the audience than if the speakers would have been mounted anywhere on the side walls.

Stand-up theaters are also built into the Alaska Pavilion, the Illinois Pavilion (which also has a sit-down type adjacent to it), the Bell System (the Network Theater) and perhaps a few others.

Sit-down—Theatres

The theaters in which the audience can sit to see a show have a great advantage over the other kind in solving many of the problems associated with sound, acoustics, and intelligibility. Reverberation times are easier to control with a fixed audience by the use of sound absorbing material in ceiling and wall construction. Some theaters of this type, nevertheless either because of the show material being presented or because there might not have been the need for this sort of construction

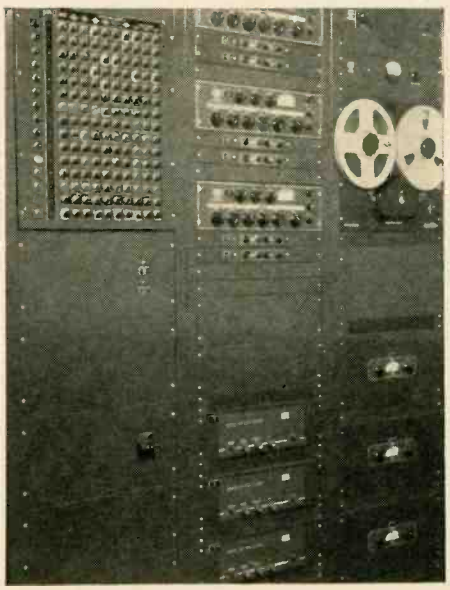


Fig. 5. Amplifier and control rack in the projection room of the DuPont theater.

detail, did not make use of any or all of the acoustic treatment possibilities.

At the Transportation and Travel Pavilion, where visitors see "To The Moon and Beyond," the Cinerama film presentation is projected onto a domed roof. The ceiling, therefore, had to be finished to provide a clear picture, and speakers are placed around the perimeter of the theater, higher than a standing person's head but under the edges of the projection dome.

The Pavilion, as it was named, is a theater in which visitors can watch judo and wrestling matches, listen to bands and singers perform, and attend meetings of various organizations. A mixing console with multiple microphone inputs is installed high on a platform at one side of the theater from where the operator can watch the show while controlling sound levels. The high-domed ceiling of the theater results in very live sound, so the speakers had to be spaced around the sides of the theater to provide a lower level coverage to avoid excessive reverberation and acoustic feedback.

At the Hall of Free Enterprise, the show consists of figures, lights, pictures, and charts located around the walls of the entire theater. The seated audience slowly swings its chairs around to follow the movement of the presentation. Speakers are located within each set a little above ear level, and are, therefore, closer to the audience than if speakers had been mounted up on the walls. Less reverberation results with this arrangement.

At the Protestant and Orthodox Center, where the film "The Parable" is shown, the liveness in the theater did not affect intelligibility. Only sound effects, laughter, and music make up the entire sound track—no spoken words are used during the entire film.

The I.B.M. Pavilion features a multi-film presentation with many synchronized screens of various shapes, and depends for its audio effects on speakers being located at specific places with reference to the screens so that the live narrator and film figures have their voices come from the proper positions. The theater is also unique in its construction. Visitors are seated on benches on the "people wall" at the main floor level and then lifted *en masse* into the theater above.

Fig. 7. Magic skyway ride in the Ford Pavilion. The cars travel through "time tunnels" which recreate various stages in the development of man by means of dioramas.

In the main G.E. theaters the acoustic treatment was included as part of original construction and the public is provided with soft seats from which to see the featured show. The theaters are thus fairly "dead." This building has to contend with the problems of preventing sound from adjacent theaters from interfering with each other, smoothly moving the audience around so that the visitors can see the entire show in all the theaters. Careful location of the speakers provides localized voices and sound effects which seem to come from the animated figures, dog, radio, and so on.

In the theaters built in the Eastman Kodak, Johnson's Wax, Les Poupees de Paris, Morman, DuPont, Chrysler, and other pavilions even more plush treatment is provided in the form of padded seats, carpeting, and drapes. The speakers are either built into the ceiling, mounted behind the screens, or hidden on the walls at the front of the theaters. Acoutically, these theaters were designed with close to optimum reverberation times. However, only at DuPont and Chrysler does the possibility of acoustic feedback come into play as these shows used live microphones in the performances. The main system speakers are placed in the ceiling in front of the stage, positioned and oriented to provide full audience coverage with adequate sound level before feedback. The special acoustic treatment of the theaters also helps reduce the feedback possibility.

The Use of Tape and Film

Many tricks are used, with different methods being devised to achieve the various desired effects in sound and animation at some of the shows presented at the Fair.

The most widely used system generally consists of a tape cartridge with "stop" cues on it to provide automatic recueing of the program material. The tape is usually heard through phone-type units in various shapes and sizes, and is started by a pushbutton on the display or by simply lifting the receiver. There are many systems like this. At some locations the tapes just play continuously and are heard "already in progress" when the receiver is lifted to the ear.

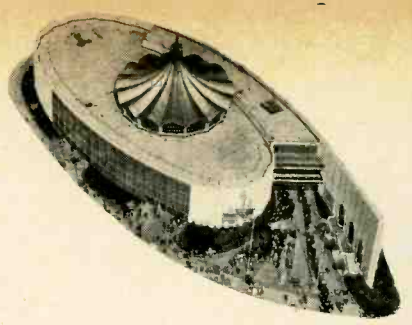
More sophisticated systems use either cartridge or self-reversing tape units with more than one track, either to provide stereo sound, or to use other tracks for switching pulses. Lights, speakers, set movements, slide and movie projectors, and animation controls are triggered by different tones that can be recorded on the multi-track tapes, and the speed control for movements could be maintained by pulse modulation in the more complex systems.

In the Walt Disney presentation at Ford, Illinois, General Electric, and Pep-

(Continued on page 40)

Fig. 6. "Laterna Magika" performers in the DuPont theatre; 3 are projected and 2 are live.

The Vatican Pavilion

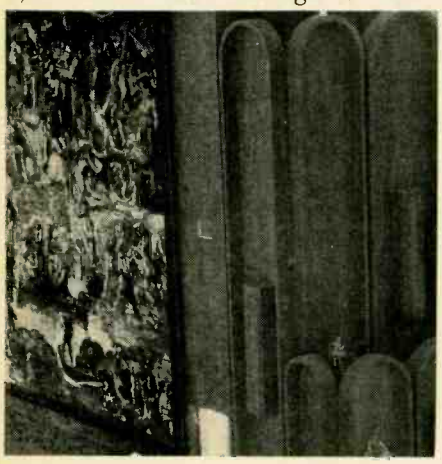


R. T. Bozak

The use of the power of music to stir men's souls is vividly demonstrated at the Vatican Pavilion. There millions of men of every race, creed and color have come to pass in awe before the beauty of Michaelangelo's Pieta while a solemn Gregorian chant fills the air. The planners of the pavilion in their effort to tell a story in sight, sound, and emotion, have skilfully blended ancient art and modern science. The visitor is constantly surrounded by music.

To understand the audio system which was created for the Vatican Pavilion, one must understand the layout of the pavilion and the flow of traffic through it.

The floor plan of the building resembles an egg-shaped spiral (see *Fig. 2*). Visitors enter through a courtyard and proceed down a long gallery. At the end of the gallery they enter the chamber where the Pieta, focal point of the pavilion, is on display. Three rows of moving platforms transport the visitor slowly past the sculpture, which is protected by a transparent plastic barrier.



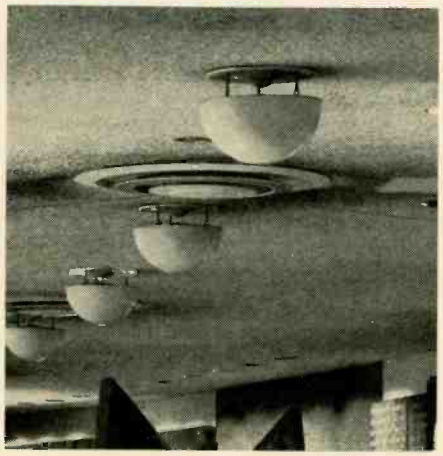


Fig. 1. (*Left*) Column speakers on wall near projection and control booth (notice open door at bottom of picture). (*Right*) Ceiling-mounted speakers are special adaptations of the Bozak "Bard" outdoor speaker system.

After viewing the Pieta, visitors are discharged into the oval main chamber of the pavilion. At the core of the large chamber is a perfectly round structure —almost like a building within a building. On the inner walls of the main chamber and the outer walls of the round core structure are told the story of the church at work today in original works of art, reproductions of paintings, projected slides and motion pictures.

While in the main chamber, ceiling heights are those of a two-story building, only in the core structure is there actually a second story. At ground level inside the central core is the main Vatican exhibit, including a replica of the tomb of St. Peter. Above, on the second story, is a chapel used for frequent Masses daily.

To provide the proper musical setting for each of the separate areas open to visitors, a complex of seven distinct sound systems has been installed. Five provide programmed material to various areas; one functions to provide sound reinforcement in the chapel, and the seventh is an emergency public address system.

Any program source, amplifier, or loudspeaker network can be interconnected with any of the others. Similarly, any of the 20 microphone connections throughout the pavilion can be fed into any one of eight mixer inputs and, thus, fed to any area or taped on any of the tape machines normally used for program sources.

The emergency public address system automatically ties all systems together and adds speakers in areas not normally fed with sound—washrooms, priests' quarters, offices—when a microphone button in the manager's office is depressed. The relays, which tie all the amplifier inputs together, also disconnect all program sources to prevent interference with announcements.

Interconnection of the systems—or any of the components thereof—is accomplished through a simple telephone cord patch system with earphone monitoring. Low-level microphone circuits are all 200-ohm balanced lines. To prevent confusion in making connections, mixer and tape machine outputs and amplifier inputs are 600-ohm unbalanced lines with zero feed level.

The five normally programmed systems use identical sound sources and amplifiers. Ampex Model 351 tape recorders provide the signal and 200-watt McIntosh MI-200-AB amplifiers provide the power to drive loudspeakers.

The chapel sound system employs a pulpit microphone, two altar microphones and an organ pick-up as sources, and a 75-watt McIntosh amplifier.

Loudspeakers have been selected according to the requirements of the various zones in the building.

As the visitor enters the courtyard approaching the pavilion's main entrance, he hears a varied program of choral and instrumental music projected from two weatherproof Bozak CM-209-18 sound columns mounted on either side of the balcony over the entrance. With their wide-angle dispersion in the horizontal plane, the Bozak sound columns provide coverage for 5,000 people in the court, helping make the wait, engendered by the popularity of the pavilion, more pleasant.

Once inside the gallery a visitor finds himself enveloped with sound, much of it specially-recorded at the Pius X School of Liturgical Music at Manhattanville College at the Sacred Heart. Actually, only your eyes can identify the sound source as a row of 12 hemispherical speakers mounted every 14 feet, down the centerline of the ceiling. The speakers are a unique adaption of Bozak Model B-1000 Bards mounted to project toward the ceiling where the sound is reflected from a specially-developed metal plate to provide an omni-directional distribution pattern.

At the end of the gallery, the visitor enters a softly-lighted passage. He walks into a new sound, the beautiful simplicity of a Gregorian chant, which helps build the atmosphere as he steps

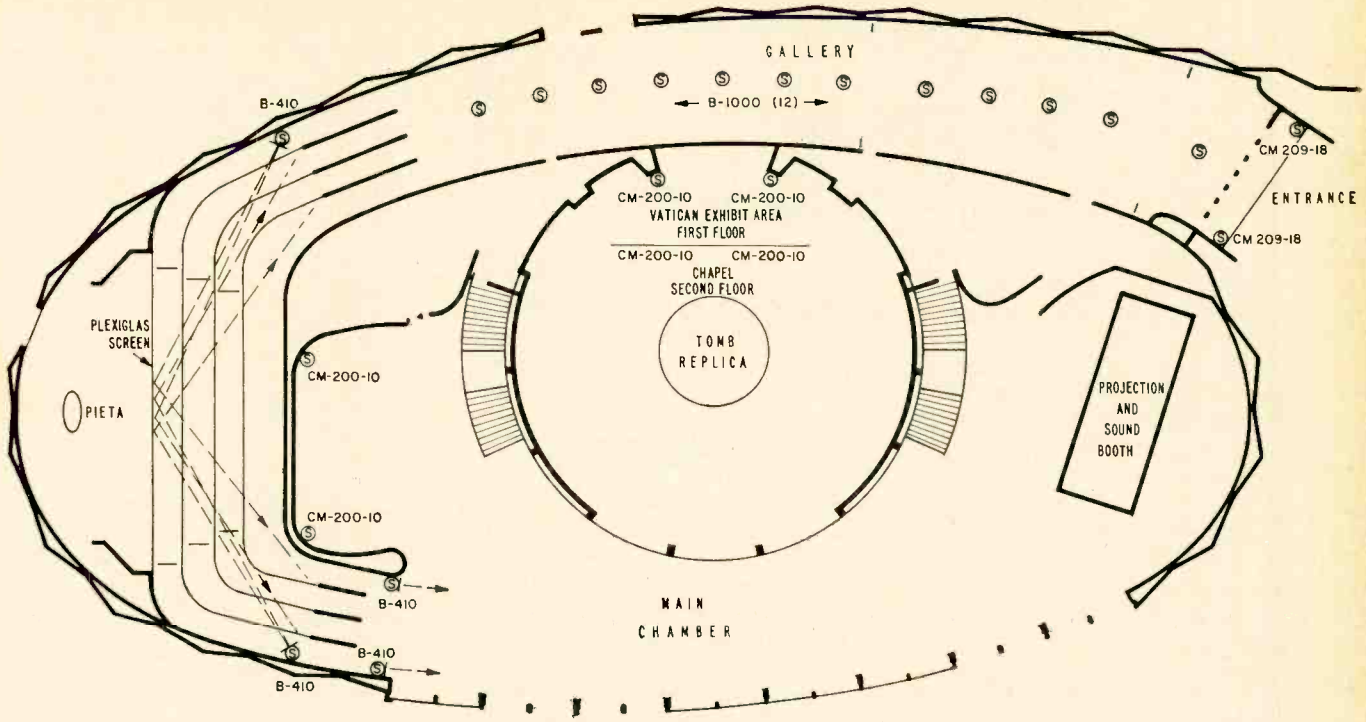


Fig. 2. Plan view of Vatican Pavilion

from the passage into the presence of the Pieta. Then, as the ramp moves him to a position directly in front of the Pieta, the music gradually becomes focused, seeming to emanate from the vicinity of the statue.

To achieve this effect, two Bozak Model B-140 speakers were used because of their extended low-range. One is placed above and behind the visitors at each end of the viewing platform. They are focused so that the sound is reflected off the plastic wall which protects the Pieta precisely at a point in the center. Thus, visitors at either end of the platform hear the reflected sound from the speaker at the other end of the platform, while those directly in front of the statue hear the blended sound of the two speakers, seemingly directly from the Pieta.

On exiting from the Pieta and entering the large main chamber of the pavilion, bright, hopeful music lifts the spirit of the visitor. It comes from two Bozak B-140's mounted above the entrance of the chamber so as to take advantage of the oval shape of the room to reflect sound throughout the chamber. Two sound columns, Bozak CM200-10's, augment the sound in the

(Continued on page 44)

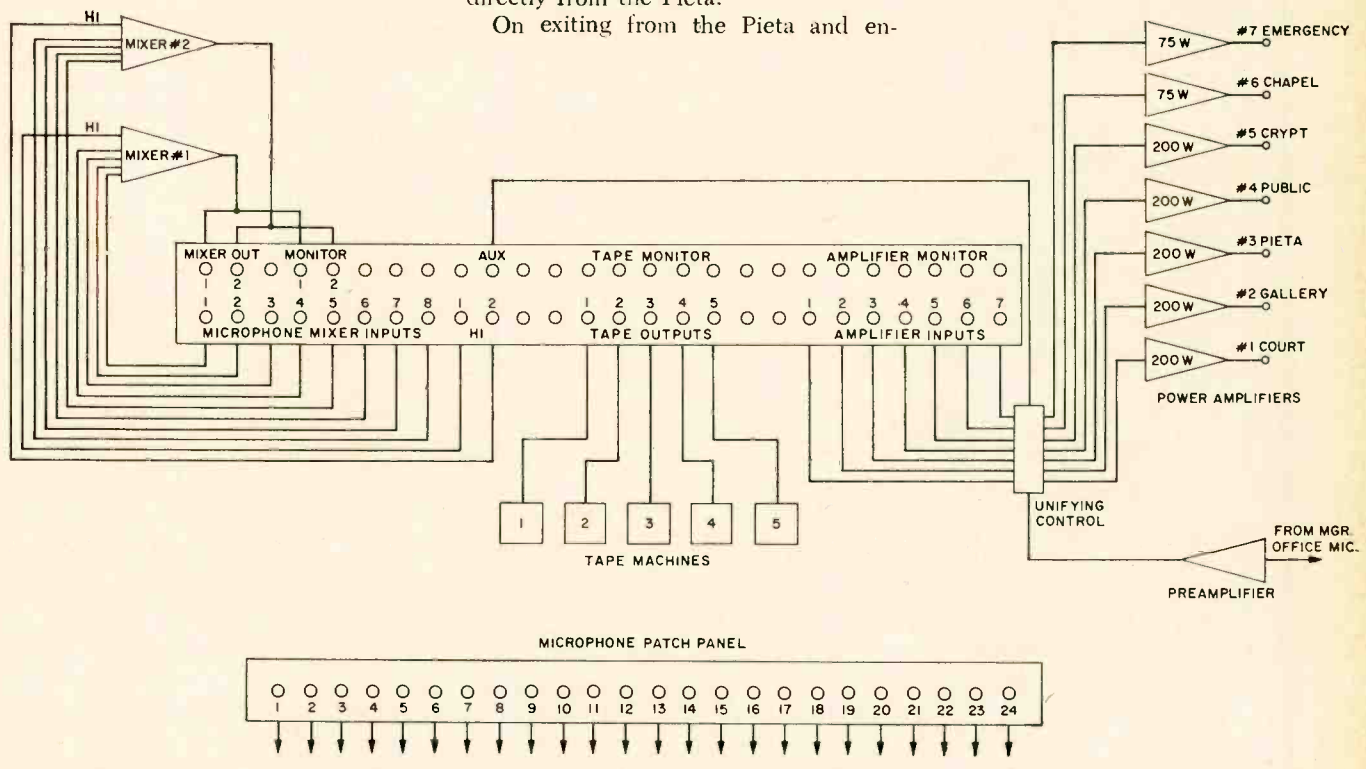


Fig. 3. Functional diagram of sound equipment used in Vatican Pavilion

Fair Outdoor Sound System

ARTHUR W. SCHNEIDER*

IF YOU DON'T think outdoor sound has changed much in the past 25 years, you might try comparing the sound system at the 1939 New York World's Fair with the present installation at Flushing Meadows. I have had the privilege of being associated with both sound systems, and while each is remarkable in its own right, the differences are quite astonishing.

The 1939 World's Fair utilized a high-level sound system, the common practice in those days. It relied on brute force to pipe background music and other program material to the more accessible public areas. The speakers were large exponential horns with direct-radiator tweeters, mounted high at a few strategic places. Amplifiers were equally massive, delivering 1200 watts of power and using transformers as big as my chest.

By contrast, the present World's Fair is served by a low-level sound system, which employs over 500 speakers spaced throughout the streets and grounds and at the entrances to the Fair. The speakers are tastefully concealed in lamppost luminaires which after dark serve to illuminate the Fair's public areas (See *Fig.* 1). The luminaires, in several shapes and colors, provide a gay lighting effect.

In a well-designed low-level sound system, listeners are never subjected to marked changes in sound volume as they move through an area. At the Fair, our problem was to maintain a uniform sound level of 3 to 6 db over ambient noise by proper placement of the luminaire speakers.

The location of the luminaires was determined by the Fair's lighting requirements, and the 1330 lampposts are spaced about 25 to 50 feet apart. To meet the sound requirements, we placed speakers in about 500 of the luminaires, generally from 50 to 100 feet apart and on alternate sides of the roadway.

The exact placement of speakers was determined by conditions in a given area. Thus, a crowded exhibit zone requires a heavier saturation than a quiet area. The sound level in an area can also be changed to meet temporary local conditions by adjusting the amplifiers which control the output to the zone.

This low-level system was only the first step in providing the kind of musical reproduction which we felt that Fair visitors, with a generation of high-fidelity listening behind them, had a right to expect. The second step was the selection of a loudspeaker which would reproduce all frequencies faithfully. A special speaker system was developed for this purpose by RCA. The loudspeaker (see *Fig.* 2) consists of an 11-inch low-frequency cone surrounded by sixteen 2-inch tweeters, with a crossover network at 1100 cps. The speaker assembly is mounted within the luminaire at a height above ground of 15 feet and radiates outward and downward.

The outdoor sound system now at the Fair is far more elaborate than the one we installed in 1939. The present system requires that we cover a listening area spread over 12 miles of roads and walks and eight entrance gates. To meet the requirements, we designed a complex underground sound distribution system, radiating from the control room in the Press Building (see *Fig.* 3).

The system utilizes about 90 amplifiers, strategically located in 16 vaults throughout the Fair grounds and entrances, to feed the luminaire speakers. There is also a weatherproof cabinet in one of the lighting towers associated with the Unisphere, which feeds a special 10-foot high column speaker to cover this important area of the Fair.

The vaults inside the Fair grounds house anywhere from 6 to 19 amplifiers; those at the entrances contain one amplifier each. The amplifiers are RCA model MI-12182-A, 70-watt power amplifiers designed for high-power industrial and institutional use. Each amplifier feeds a maximum of seven speakers, so that at least 10 watts are available for each luminaire speaker. The locations of the amplifiers and the areas covered by their associated speaker circuits are shown in *Fig.* 3.

Audio output is distributed from the control room to the amplifiers over a network of leased telephone lines, at standard 600-ohms balanced. In turn a 100-volt line at 143 ohms carries the output of the amplifiers to the luminaire speakers. A transformer located at the base of each luminaire matches speaker impedance.

(Continued on page 44)

**Executive Vice-President, Commercial Radio-Sound Corp.*

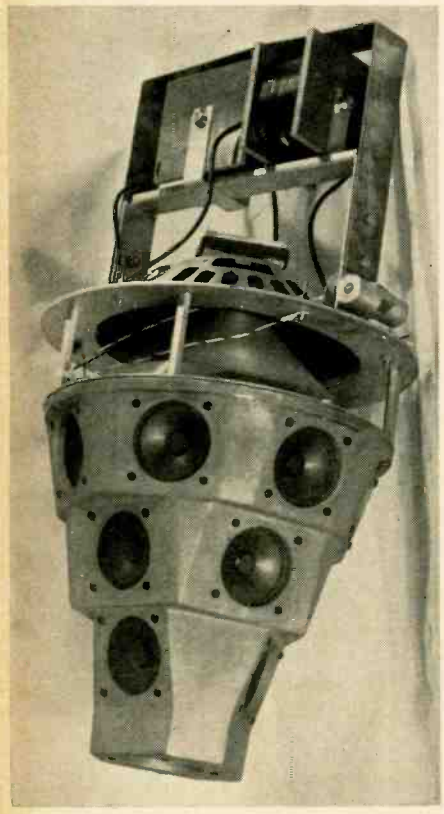


Fig. 2. Luminaire speaker system consists of 11-in. low-frequency cone and 16 tweeters.

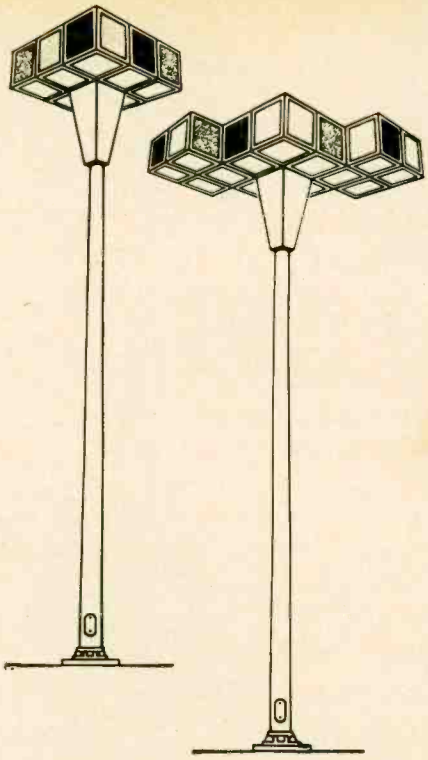


Fig. 1. Outdoor speakers are concealed in luminaires.

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HERE'S THE PROBLEM . . .

We pity the poor audiophile. Besieged with questions from non-audiophiles, as to the kind of music system they should buy. And, cruelest blow of all, after you explain, precisely, the components they need, they decide it's all "too complicated" and wind up with a "hi-fi" piece of furniture that affronts the critical ear.

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The Chrysler Pavilion

William R. Farrell* and David L. Klepper*

Fig. 1. Aerial view of Chrysler complex.

The Chrysler Pavilion, located midway between the Ford and General Motors colossi in the transportation area, has several interesting and amusing structures including a giant automobile, a giant engine, and an automotive zoo, as well as plenty of seating area for the relief of tired feet. The primary structure, however, is a presentation building consisting of four fixed auditoria of approximately 620 seats each, clustered around a rotating platform containing four stages. The show consists of an introductory segment with an announcer supported by Bill Baird and his marionettes and puppets. Subsequently, the stage rotates 90-deg. and a movie is presented. Eight minutes later, after another 90-deg. shift of the stage, a live show is presented and, finally, there is a concluding segment with a live narrator and additional marionettes. Throughout the 32-minute show each audience has remained stationary while the rotating stage brings the successive portions of the show to the audience.

Room Acoustics

The original concept of the program called for a show in which all sound was to be tape recorded. We believe, as do most motion picture house designers, that an acoustically dead theater is most suitable for quality sound reproduction in that it permits the maximum flexibility for various degrees of "liveness" recorded on the tape. The reverberant sounds of interior scenes can always be reproduced in a theater having sound absorbing surfaces, but outdoor scenes played in a reverberant theater will sound as reverberant as the theater itself.

A later decision to include live actors into the show did not change our concept about the room's acoustical design. One portion of the show was a straight motion picture for which the dead room was well suited. In the other three segments live speech was alternated with the recorded voices of marionettes. Each theater is small and it would, by proper location of sound-reflecting panels, have been possible to use unamplified actors' voices. However, better continuity was achieved by amplifying all sounds.

To provide the desired acoustic environment, interior surfaces of each room are of sound-absorbing material, except for the lower eight feet of the main walls and the entire stage walls. The ceiling of the stage and auditoria,

(Continued on page 42)

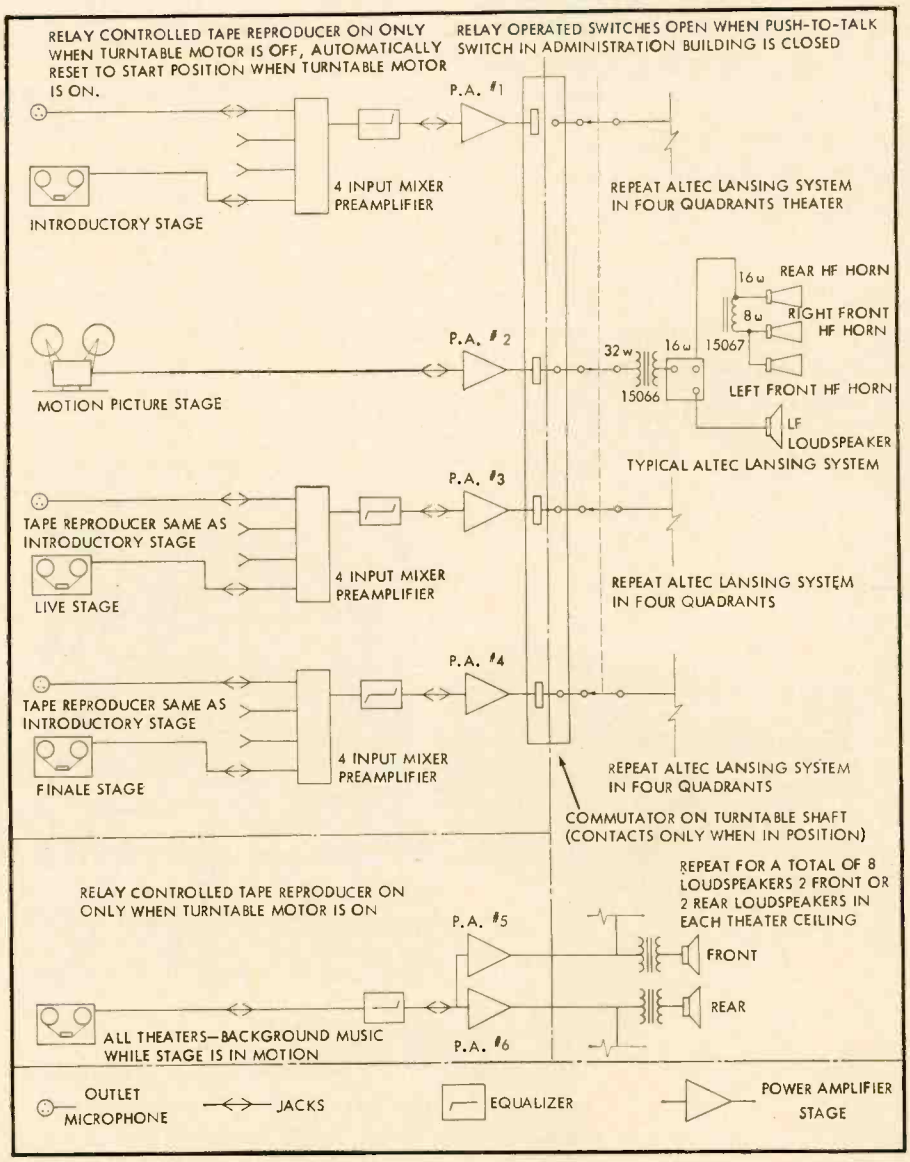

Fig. 2. Functional diagram of theater sound systems.

*Bolt Beranek and Newman Inc., Cambridge, Massachusetts.

Calibrated Stereo Control Unit

RAPHAEL F. EHAT

Exact separation ratio plus built-in Bauer circuit make this control unit ideal for the stereo listener. You can have the exact stereo separation you desire.

PART ONE

SEVERAL YEARS AGO the author embarked on a project meant to help fill what he feels is the largest void in the field of home entertainment, the refinement of "theatre organ"[1] sound produced electronically, taking as a standard of comparison the pipe organ design we have inherited mostly from the genius of Robert Hope-Jones.[2] With a goal as ambitious as this, one first uncovers more problems than solutions. We uncovered the first problem quickly by asking the question, "What design area needs the most attention in order to better assure attainment of a truly lush "theatre organ" sound?" The sound must have a harmonious chorus of highly individualistic voices capable of being combined and rendered in a highly versatile manner. Versatility of tonal combination was brought to a state of virtual perfection at the first decade of this century by Mr. Hope-Jones. His invention of the "unit organ" principle gave us a nearly infinite variety of useful sounds even from instruments of limited size. Tone generators giving highly contrasting voices (sometimes described as orchestral in nature) are no real challenge to the circuit designer, except in the area of keeping costs down. Now we see the stickler; how do we "harmonize" this chorus or orchestra of voices? A symphony has its conductor and the pipe organ its tonal designer or architect, an artisan whose talents are almost too rare and exotic to be believed. He must take the many orchestral voices, the clash of which are minimized by unification and refine the ensemble into a cohesive whole. This makes him a master of acoustics. He must take a relative simplicity of voices and achieve either a real or apparent complexity of tone that belies that simplicity. In an electronic instrument this task would be performed in the circuits following the tone generators and in the speaker system, or both.

Sound quality is intimately associated with the manner of coupling between source and environment, so it seems logical to start improving the speaker system first. The most notable advance to date is Donald Leslie's vibrato generating speaker system.[3] He utilizes the Doppler principle by rotating a sound source around a vertical axis. Even after 20 years his method is the most universally used and licensed means for harmoniously increasing the complexity of organ tone. Any simple extension of this principle is likely to have only minor advantages, yet have major cost disadvantages. A more subtle rotating sound source is the Allen "Gyrophonic" projector which also uses the Doppler effect, but rotates the source around a horizontal axis. The effect is completely different, the improvement being greatest on celeste voicing and classic ensemble.

It seems evident that speaker design would have to be concerned with three dimensional space, i.e., with stereophonic equipment. At this late date it may seem incredulous of the author to consider this a real stumbling block. But he does, and this will be discussed later.

Controlled Complexity and the Stereo Stumbling Block

Turning now to the "electronic" improvements needed, we find ourselves wanting to add a controlled complexity to the signal paths following the tone generators. Again Mr. Leslie leads the field[4] by dividing a complete instrument into two electrical and acoustic channels so that adjacent tones (semi-tone intervals) are never amplified or "spoken" from a common channel. The significance of this is in the fact that fifth and fourth intervals, which occur in many chords, are kept separate electronically and acoustically until they reach the listener. There is a seeming paradox here since we are striving for greater complexity of tone. Yet Mr. Leslie takes those very intervals which statistically bring in the greatest amount of strong, noticeable beats and distributes them in the environment before they can be heard clearly. This paradox is dispelled when it is realized that we are after a controlled or "harmonious" complexity. A major chord when sounded by three pipes (or any three acoustically independent sources) pleases us via our ears which receive the beats in a subdued manner, therefore this degree of control must be considered correct. It follows then that these same three tones coming from a single loudspeaker, and having a strong beat must sound different. It turns out that not only is the sound different but the beats in it are unpleasant, so this degree of complexity must be incorrect, tantamount to being uncontrolled. Here comes that stumbling block again. The root and fifth of a major or other chord containing these two tones become a two-channel stereophonic signal with a separation ratio of one when handled as separate signals (as in the Leslie two channel method). So to study this design area properly one must again use stereophonic channels. The stumbling block is not the availability of stereo equipment but the lack of means where the acoustic output of such equipment can be used in a quantitative manner for a definitive study. This truth is evident to those who have experienced the real acoustic and decor problems to be solved before a satisfactory stereophonic installation can be realized. Witness the number of letters editors get from people who "debunk" stereo itself as unnecessary hogwash. I venture to say that not all of these skeptics were conditioned by the type of equipment pervading the mass market which glosses over correct stereo design and acoustic environment. Some of them know of this modern tragedy but have not heard good stereo even though listening to good equipment, and have become disillusioned.[5] They haven't stopped to realize that any person with two functioning ears experiences natural three dimensional sound during every waking moment. If the thrill is thin from a lifetime of jaded familiarity, let them listen to music,

(Continued on page 42)

[1] "Posthorn," Vol. II, No. 1, Feb. 1961, pages 2 and 3. (Available through membership in Theatre Organ Club of Los Angeles 18445 Ventura Blvd., Tarzana, Calif.)

[2] Journal of A.T.O.E., Vol. V, No. 2 and 3, Vol. VI, No. 1, 1964. (Inquire to "Theatre Organ," Box 248, Alameda, Calif.)

[3] U. S. Patent No. 2, 622, 692, Filed July 9, 1945. Also Re 23, 323.

[4] D. J. Leslie Patent No. 2, 596, 258, filed Sept. 24, 1948.

[5] E. T. Canby "Stereo Hoopla," AUDIO, Jan. 1959, page 10.

Some plain talk from Kodak about tape:

Sensitivity and frequency response

Kodak TRADEMARK

Controlling every electrical factor involved in the making and using of sound tape is a bit like trying to watch a three-ring circus . . . it can be done, but you need fast eyeballs. Let's discuss two critically important parameters: sensitivity and frequency response.

Sensitivity means the degree of output for a given input.

We put in a 400-cycle signal and measure the output. The result: low-frequency sensitivity. We choose 400 cycles for a number of good reasons. A 400-cycle note recorded at 15 inches-per-second gives us a wave length that the tape "sees" of roughly .0375 inches, and by a happy coincidence this wave length penetrates the entire depth of the oxide coating, but not the support material. Everything else being equal, low-frequency response is a function of the thickness of the coating. The thicker the coating, the better the bass response. We test at a frequency that penetrates the entire coating. We choose 400 cycles instead of, let's say, 20 cycles because the 400-cycle note tells us just as much—and has an added advantage. An engineer can *hear* 400 cycles, so we have audio monitoring as well as instrumented observation on a scope face.

Just as the low-frequency sensitivity test gives us an idea about oxide thickness, the high-frequency test gives us a fairly accurate picture as to just how smooth the surface of the tape is. Good high-frequency response is impossible on a tape having a rough surface. Here's why: The low points will represent gaps in the oxide and cause a loss of H.F. response. We test our high-frequency sensitivity at 15,000 cycles. (Inches-per-second divided by cycles-per-second gives us recorded wave length.) So at 15 ips the arithmetic looks like this:

$$\frac{\text{inches}}{\frac{\text{second}}{\text{cycles}}} = \frac{\text{inches}}{\text{second}} \times \frac{\text{second}}{\text{cycles}} = \frac{\text{inches}}{\text{cycles}} \quad \text{which is wave length } (\lambda)$$

THUS:

$$\frac{15 \text{ inches}}{\frac{\text{second}}{15{,}000 \text{ cycles}}} = \frac{15 \text{ inches}}{\text{second}} \times \frac{\text{second}}{15{,}000 \text{ cycles}} = \frac{1 \text{ inch}}{1000 \text{ cycles}} = 1 \text{ mil wave length}$$

At this high frequency (short wave length) we are recording only on the surface of the tape. If any roughness is present, big troubles result. If you have a surface condition where the amplitude of the roughness is just .0001 inches and your recorded signal has a 1-mil wave length, you will lose 5.5 db in high-frequency response! Let's rephrase the catastrophe. It takes a surface variation of just one tenth the wave length to knock down response by about 6 db. And this can happen at any frequency!

We are working toward making a point: KODAK Sound Recording Tape has a surface that is unsurpassed in smoothness, a surface that varies no more than 25-50 millionths of an inch from a theoretically perfect plane.

Frequency response is merely the arithmetic subtraction of high-frequency sensitivity from low-frequency sensitivity. Ideally the response is zero. It's quite an easy matter to juggle the characteristics of an oxide around so that frequency response is nice and flat. For instance, if your oxide has poor high-frequency sensitivity, you can reduce the thickness of the oxide layer. This will degrade L.F. sensitivity, and thus effect a flat response. But is the resulting L.F. loss worth it? We don't think so. That's why we designed our coating to give us superior low- and high-frequency sensitivities, as well as a nice flat response.

Next time we'll chat about a few other basic considerations.

KODAK Sound Recording Tapes are available at all normal tape outlets: electronic supply stores, specialty shops, department stores, camera stores . . . everywhere.

FREE! New comprehensive booklet covers the entire field of tape technology. Entitled "Some Plain Talk from Kodak about Sound Recording Tape," it's yours free on request when you write Department 8, Eastman Kodak Company, Rochester, N. Y. 14650.

EASTMAN KODAK COMPANY, Rochester, N. Y.

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EQUIPMENT PROFILE

MARANTZ MODEL 10B FM-STEREO TUNER

Every serious audiofan was excited some three years ago with the announcement that there was about to be a Marantz FM-Stereo tuner. The reputation of the company was so good that had Marantz decided to bring out a new automobile, hundreds of fans would have been standing in line with checkbook in hand to be one of the first to own one. Then a long time passed, during which the dedicated Marantz fans were occasionally treated to a glimpse of some prototype models at the various hi fi shows, and what they saw intrigued them still further.

Finally the coveted Model 10B arrived at our "lab." And this is what we saw:

A handsome brushed pale-gold-finish panel 5¾-in. high by 15⅜-in. wide with a large window (2¾ by 11¼ in.) solid black in appearance when off, but showing a full 10-inch dial scale which is perfectly linear from 88 to 108 mc—one inch for 2 megacycles—the even numbers in white lettering and the divisions in soft green, all traversed by a fluorescent red cursor. At the left, centered over 91.7 mc, is an inverted T scale in red, serving as the indicator in front of a 2-in. cathode ray tube with a deep green filter over it. At the right, centered above 104.8 on the scale is the word STEREO illuminated in red in the presence of a stereo signal, solid black when listening to a mono station. MARANTZ and FM TUNER appear in white on the rear glass plate, and "Stereo" in green script on the back of the front glass plate give a three-dimensional effect. MODEL 10B in red completes the identification—a strikingly handsome appearance.

There are seven knobs on the front panel—a large one in the center for tuning, two smaller ones at the left control the type of indication on the scope and the manual control of stereo switching, and two more at the right to control power and dial illumination intensity on one, muting on the other. Tiny ¼-in. knobs at each end of the dial window are vertical and horizontal positioning controls for the CR-tube spot in the tuning display, of which more later. The chassis extends 15⅝-in. behind the front panel, and is almost all black—the exceptions are the balun transformer box, the chassis plate for the front end, which is brushed chrome, the discriminator transformer can, and three electrolytic capacitor cans. All external connections are made on the top of the chassis—there are none on the rear apron, not even the power cord. Four adjustable controls for the CR tube functions, stereo-threshold and muting-threshold controls, and the output level-set controls are also on the chassis top. Phono jacks are provided for detector output, right and left main outputs, and external scope input. A test jack is also furnished for service use. The antenna input terminals are on top of the balun housing.

If we are unduly detailed in describing the physical aspects of the 10B, it is only because we can not give a detailed circuit rundown as is our custom—there are too many unique circuit arrangements in the 10B, and the manufacturer understandably wants to keep quiet about them for a bit longer. Maybe next year . . .

Fig. 1. The Marantz Model 10B FM-Stereo Tuner.

Design Features

While we cannot give details, we can provide the reader with considerable "semi-technical" data about the Marantz 10B. The antenna is connected to a balun, making it possible to maintain complete balance of the antenna line and eliminate any longitudinal noise appearing in the lead-in. This indicates that the search for minimum noise begins even before the signal enters the tuner. The tuned circuits in the front end are interesting from the design standpoint because of the difference in the L/C ratios in the various circuits. One usually expects a gang capacitor to be of the same value in each section, which indicates that the coils are all approximately the same. However, in the 10B the sections are not identical. Each coil is chosen to work at the correct impedance in the circuit in which it is employed—for example, the coil feeding a grounded-grid stage is comparatively small, indicating a large capacitor section, and so on. The main tuning capacitor is a four-gang unit, with each section having a split stator. The coils are found of heavy wire (about #14) and supported on polystyrene rods for stability. For exact trimming, all of the front-end circuits are provided with trimmers, the inductances are adjustable, and temperature compensating fixed capacitors are employed where necessary. The entire front end consists of two low-noise triodes (EC88/6DL4's) and a 6DZ4 oscillator, a type designed for uhf TV oscillator service. The output is fed to a balanced-bridge modulator using instrument-type silicon diodes, and thence to the first i.f. stage, employing a 6JK6 pentode. The i.f. amplifier is unusual in several respects. Basically, the entire i.f. section consists of tubes providing "packages" of amplification, with passive filter networks between them. Each of these networks consists of three precision cup-cored coils, with the required fixed and variable capacitors for tuning them. These filters are modified Butterworth types, with flatter tops and steeper skirts than are usually obtainable with two-winding i.f. transformers. One further difference between conventional i.f. amplifier design is that every one of the amplifier tubes also serves as a limiter, due to back-to-back diodes in its input circuit. In addition, the 10.7-mc amplifier is followed by three more 6JK6's as limiters immediately preceding the discriminator coil—an air-core winding of extreme stability. We are now up to 12 tubes, with only ten more to go for the total of 22. A 12AX7, two 12AU7's, and a 6U8 serve as the multiplex decoder circuit, and another 12AX7 is the output stage, with separate gain controls on each channel. A 12AU7 serves as the muting control.

The cathode-ray tube is an interesting addition to an FM tuner, and since this is the only one we know of so far in which a CR tube is built into the tuner itself

KLH Model Seventeen

The price tag went on last

The quality went in first. The kind of quality you can hear. Quality in the Seventeen's smooth, flawless response. Quality that gives the Seventeen the lowest harmonic distortion in the bass of any speaker in its price range. KLH quality in a handsome new oiled walnut enclosure. In the ingenious grillecloth that can be changed in a snap.

And while the quality was going in, the waste was coming out. All the waste that inflates the cost of speakers. The waste of rejects and varying quality in stock components from outside suppliers. (KLH builds, tests, and rigidly controls the quality of every component that affects the musical performance of a speaker.) The waste of obsolete design and engineering. Of inefficient and outdated manufacturing techniques. Of gingerbread 'features' that add nothing to musical performance.

When we finally had a speaker that was all quality and no waste, we put the price tag on. And you won't find a trace of puff in the price.

This is the Model Seventeen. A speaker that brings a whole new level of sound quality — a new distinction to speakers costing under $100.

But no description can tell you how the Seventeen sounds. You've got to hear it. Only then will you be able to understand what an unusual achievement the Seventeen is in high performance at low cost. See the Seventeen at your KLH dealer now. Listen to it. *Then* look at the price tag. We think you'll agree that nothing touches the Seventeen for honest sound at an honest price.

**Suggested retail for eastern U.S. Slightly higher in the West.*

KLH RESEARCH AND DEVELOPMENT CORPORATION
30 CROSS STREET, CAMBRIDGE 39, MASSACHUSETTS

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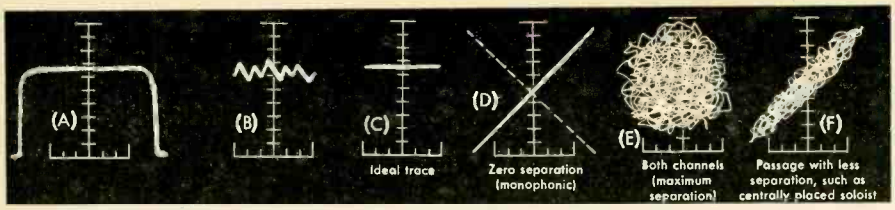


Fig. 2. Patterns on the tuning indicator.

to serve as a tuning indicator as well as multipath distortion indicator, and additionally to monitor the output signal visually. In the TUNING position of the "display" control, the spot traverses the face of the tube as shown at "A" in *Fig.* 2, showing approximately the curve of the i.f. amplifier as the tuning control is turned. When properly tuned in, the spot is centered on the vertical red line of the reticule, deviating to right and left in accordance with the modulation. With no signal, the spot rests on the bottom of the reticule in a fuzzy haze caused by the noise. The height of the spot on the scale gives an indication of the signal strength, and when the spot is near the top of the scale the signal is approximately 100,000 microvolts. The range is logarithmetic, so that small differences at lower signal strengths can be observed. When there is any multipath distortion, the spot's travel with modulation is likely to be a wavy line, rather than a straight one which it follows when there are no reflections to cause multipath distortion in the reception. These different patterns are shown at "B" and "C" in *Fig.* 2. When the wavy line is encountered, it is the sign that the antenna should be rotated to a position where the line is least wavy, and a minimum of multipath distortion is then present.

In the OUTPUT position of the "display" control, a totally different pattern is shown on the screen—one in which the vertical movement of the spot represents the left signal, and the horizontal represents the right signal. "D" in *Fig.* 2 shows the appearance of an in-phase monophonic signal, which is one in which right and left signals are equal to each other. Referring to this slope as positive, we get a negative slope (shown as a dotted line) on out-of-phase monophonic signals, which are occasionally encountered during the first few weeks of broadcasting by a new stereo station, possibly—at least we have seen some in that category. This same signal will indicate when an announcer is being broadcast monophonically even though the station is on stereo—that is, his microphone is fed to both channels equally. If he is on only the left channel, the pattern will be a vertical line; if he is on only the right channel, it will be a horizontal line. On stereo programs, the pattern is a mish-mash such as that in "E" *Fig.* 2. If this pattern appears to be a narrow ellipse, as at "F," it is an indication that there is not the full amount of separation between the channels—full separation will give a pattern which essentially fills a full circle, at least part of the time. The third position of the "display" switch is EXTERNAL, which accepts a signal from the external jacks on the chassis, so the user can connect the output of his preamp to these jacks, so as to observe the stereo content of records or tapes, if he wishes, with, we might add, occasional surprises as to phasing.

To provide the functions of the CR tube, three more tubes are required, a 12AX7 for the stereo signals, and two more 12AX7's for horizontal and vertical deflection. These, with the CR tube itself, make the total of 22.

The "mode" switch also has three positions—two for automatic stereo switching and one for mono. One of the automatic positions is marked NORMAL, and provides normal separation with good reception conditions; the other is marked HI-BLEND, and reduces separation on the high frequencies so as to overcome the effects of multipath distortion or weak signal strength Switching to stereo is automatic, unless prevented by placing the mode switch in the MONO position. The switching is controlled by the one transistor in the tuner, and a threshold control is provided. Stereo switching and muting are both accomplished by light actuated cadmium-sulphide cells.

One other unusual feature that particularly intrigued this observer is the dial indicator adjustment. This takes the form of a screw at the right side of the chassis just back of the front panel, and permits the user to set the pointer accurately to a station of known frequency. Once this is done, every station within the range of the set will come in *exactly* at its indicated frequency. As a matter of fact, Marantz engineers claim that this tuner is more accurate than most laboratory signal generators, which are usually guaranteed to be within 1 per cent. The 10B is within 25 kc, which is about ¼ of 1 per cent. This is greater accuracy than we have ever encountered in any FM tuner heretofore, and the linear scale is most unusual. If nothing else, it betokens a very careful design of the tuning capacitor, which looks as though it might have been a component of a top-quality "Mil. Spec." space receiver—solid construction, silver plated, with ceramic insulation, and such indications of accuracy and stability.

Performance

In our listening location some 20 miles east of New York City, we were able to log 53 stations—more than ever before on any tuner. Not all were of entertainment quality, we must admit, and some three pairs of them were on the same frequency at different times. Four of the stations received, however, were in Philadelphia, and two of those *were* of entertainment quality. Philadelphia is approximately 103 miles by air line from our location. For a "practical" test we used an antenna which was a simple dipole, such as is furnished with most FM tuners. We mounted it on a 5-ft. strip of wood on top of a photographic lamp stand so we could rotate it. We were able to receive Philadelphia with this setup *inside* our building.

We are, naturally, accustomed to excellent equipment in our normal listening, and when someone makes a product which is *very* good, we may not be able to "rave" about it. But we can say that it is in that rare category of amongst the best. (We maintain that when we are continually comparing different equipment and claiming that high-quality components are 95 per cent perfect, it becomes most difficult to assign some unit as being 96 per cent—or even possibly 100 per cent.) There is no question that the 10B does show up as having better separation than the average FM tuner, and this is easily observable on the 'scope. Also, there is no question that the 10B would satisfy the most particular FM listener. It is beautiful in appearance, obviously well designed, and extremely stable. We are thoroughly impressed by the quiet performance—the unit is said to reach 50 db of quieting at a signal of only 6 microvolts, which is an extremely sharp quieting curve. We are equally impressed by its selectivity, which permits receiving stations in adjacent channels in many instances where many another tuner won't, and almost invariably in alternate channels. We also must admit that the indicator with its two modes of display is a useful tool—every FM station should have a 10B as a monitor. This is undoubtedly the Rolls Royce of the tuners. With a price tag of $650 in the East, it isn't cheap, nor even inexpensive, but one look at its underside will show why the cost is what it is. It is a tuner the most critical would be proud to own and more than happy to listen to.

Circle 220 on Reader Service Card

CLARIFICATION OF DUAL 1010 REPORT

Once upon a time, when life was much simpler in audio (and at AUDIO), one could speak of "manual play" and "automatic play" and be clearly understood to really mean "single play" and "changer" respectively. But today one must be more specific. Unfortunately, this didn't dawn on us until after we had reviewed Dual's new 1010 automatic turntable in February.

In that otherwise favorable review, we *had* somehow described the 1010's "manual" and "automatic" operation in terms of "problems" and "nuisance," whereas it really is quite simple and flexible. So, let us now proceed to describe how the 1010 actually *does* operate with its interchangeable spindles. (All Duals operate the same way.)

For single play (*not* necessarily manual), the short spindle is dropped in. For *automatic* start, the operating slide switch is moved to the right, past "stop" to "start." For *manual* start, the tonearm can be placed anywhere on the motionless record, and the same switch moved to the left to "manual." If a manual start on a rotating record is desired, the switch

(Continued on page 66)

Why are these DYNAKITS the most popular of all high fidelity components?

PAS-3
$69.95 kit
$109.95 assembled

Stereo 70
$99.95 kit
$129.95 assembled

FM-3
$109.95 kit
$169.95 assembled

The superior quality of separate components (tuner, preamplifier, power amplifier) is universally accepted. Only with separate components can you achieve the "state of the art" in music reproduction.* Integrated components, receivers, or packages are compromises which deny the perfectionist his goal of the highest possible fidelity.

Why are components so much better?

UNCOMPROMISING ENGINEERING

lower hum ■ lower noise ■ lower distortion

GREATER CONVENIENCE

more flexibility ■ logical control groups
easier installation ■ freedom of choice

SUPERIOR RELIABILITY

higher quality parts ■ better ventilation
conservative operation
isolation of sensitive parts from heat sources

Quality is never cheap. Most components are very expensive. **But not Dynakits.** The universal recognition that Dynakits offer "the very best for the money" does not satisfy us. Never has a Dynakit been introduced which could not meet or exceed the listening quality of the most expensive alternatives. We urge you to evaluate every Dynakit on performance standards without regard to cost.

The overwhelming acceptance and subsequent word-of-mouth advertising by Dynakit owners has made the 3 Dynakits shown above the most popular of all such components. No other stereo tuner has ever matched the phenomenal popularity of the FM-3. More Dynakit stereo preamps and Stereo 70's are being sold than all other such components **combined.**

Modest initial cost (even lower if you build-it-yourself!) is a powerful incentive, but this acceptance would not have been maintained year after year in ever increasing numbers were it not for Dynakit's proven reliability and the recognition that every new Dynakit design is so far ahead of its time that it stays on top for years. This partly explains why critical audiophiles have been known to "trade up to Dynakit" from far more expensive models.

In the face of the extraordinary publicity given transistorized equipment in recent months, it is significant that these pace-setting Dynakits are well established tube designs. When transistors have matured so that they can provide comparable quality and value with tubes, Dynakit too will offer solid state circuitry. Dynakit does not believe in riding the promotional bandwagon at the consumer's expense through inauspicious introduction of premature products. We will continue our established practice of introducing new products only when they represent improved quality or value.

Rarely is quality as inexpensive as Dynakits.

*Live vs recorded concerts, performed on several occasions using Dynakits and AR speakers, best demonstrate the "state of the art" in music reproduction.

DYNACO INC. 3912 POWELTON AVENUE, PHILADELPHIA 4, PA.

Circle 120 on Reader Service Card

INZIDE AUDIO

by LARRY ZIDE

One of the advantages about living within shooting distance of New York City in 1964 was the ease of popping in a car and scooting over for a day at the Fair. Robert Moses' Fair is a *big* place. We still haven't seen everything we want to see in half a dozen visits. *We*, I should explain, consists of one patient wife, one moderately patient 7-year old girl, and one utterly impatient 5-year old girl. True, their patience was strained at times, by my slow, careful camera studies, but the big problem was waiting on line. As enjoyable as the attraction might ultimately be, it's hard to justify a one-hour wait to children.

So, there we were at the Fair. I was determined not to make *this* day a busmans holiday. I would be immune to the myriad sound systems assailing the ears. "Judge everything as a whole, not just by the sound," I told myself. It didn't work. I reacted. My wife reacted. Even the children reacted.

Entrance to the Fair was easy. We managed to survive the martial music played at the entrance. The sound was adequate; the program material unfortunate.

Walking along the streets and avenues of the Fair, we were struck by an awareness of an even, and unobstrusive, continuity of background music that followed us along, staying always in the background. The low-level distribution system via the poles on the pathways was exceptionally effective.

Since it was still early morning, we decided to buck the line at the General Motors Pavilion. The culmination of that wait was a well produced ride, via moving chairs through a series of panoramas (animated) depicting the future as seen through the impartial eyes of this giant of industry. Narrative is supplied to each chair via head-high wing-mounted speakers. Sound was quite satisfactory for the purpose; the only annoyance was that our 5-year old had to remain on her knees through the ride in order to get her head high enough to hear what was going on.

General Motors adjoins Chrysler. Since the crowds were minimal we scooted in. This pavilion actually consists of a number of separate exhibits. Included is a giant 100-ft. animated mock-up of an auto engine. We walk through this while an automatic tape recorder supplied sound and cued the production. The effect was quite good.

The main pavilion attraction is the Bil Baird puppet show. Actually, an integrated live and puppet show, this production is given continuously. A rotating stage provides a number of elaborate settings. There is a complex of synchronization of live and recorded sounds here. Our experience was most enjoyable. The production was excellent and was never marred by any failure or gross deficiency of the sound system.

We wandered on to Sinclair's Dinoland. Full-size replicas of Tyrannosaurus Rex, Brontosaurus, and friends. You should have seen the wide-eyed kids here. These rubber beasts have motor drives inside that slowly move heads or body. There are also little speaker horns tucked away between the beasts legs that vainly attempt to provide beastly roars. Sounds more like sick beasts.

We wandered on, just enjoying the sights. And sounds. We winced (all of us) as we went by a national pavilion that was loudly hawking its features over a paging system which provided enormous amounts of distortion. We oohed at the sound of the Coca-Cola electronic carillon. We could find no quarrel with the live sound of a calypso band at Seven Up, that is until we moved away from the band and found that more distant reinforcement was being provided by very conventional, and unmusical, speakers.

DuPont's pavilion has a production that was, for us, one of the high points of the fair. It is a most involved combination, fully synchronized, of live actors and "celluloid" likenesses. The effect is impressive; the sound impeccable. This marvel of electronic ingenuity (and theater production) should be on everyone's must list.

Bell Telephone offers an armchair ride, mechanically quite similar to General Motors. The displays, of course, are entertainingly directed toward communication. Again, our 5-year old found herself on her knees. I must say that I was favorably impressed with the quality of sound from the small chair-wing speakers. Though restricted in range, it was quite clean.

Bell is around the corner from GE. There we went. Here we were sure the kids would be entertained. And they were. A ring of theaters is turntable mounted and rotated around fixed stages. Life size dioramas show the progress of electric appliances from the "good old days" to the present. The stage figures are Walt Disney's amazing audio animatronics. Taken on an *absolute* basis, they may seem a bit crude in motion. But, considering that they move arms, bodies, legs (they don't walk, however), and lip sync, all on tape cue, they are quite interesting. The kids loved the show, mommy loved the new-fangled appliances, and daddy squirmed in his seat at the big, boxy sound that came from the stages.

IBM was way over the children's heads in their theater exhibit. Not that the production was bad, a combination of live narrator and multi-screened film images that flitted from place to place, quite the contrary. Sound was excellent, the production very interesting. But, how many 5- or 7-year olds do you know that are interested in discussions of logic, no matter *how* well presented?

One of the real highlights of the Fair should have been the restaurants. What an opportunity for a concentrated world gastronomic tour. We did find some excellent restaurants at the Fair, but at what prices!

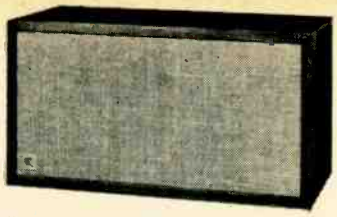
But, we did get through supper. Afterwards, we simply sat around for a while enjoying the overall sights and sounds. It must be said that this "thing" in Flushing Meadow is a most extraordinarily well-prepared exposition. It is easy enough to go round picking faults here and there, but viewed as a whole, I cannot join those critics who decry the Fair. Our family cast four votes for Moses.

Night fell. Lights lit. What a kilowatt output that Fair has. It is a wonderland of afterdark color and effect. Since it was still the supper hour, we decided to chance the possibility that Ford's line would not be too big, so we cut across the grounds from where we were (at the other end, visiting the extremely good sounding and looking Vatican Pavilion—our vote for the best music sound at the Fair), and joined the end of the line, long as always.

Well we finally got to the ride. We were seated in a lovely Ford convertible (on a moving track) and proceeded into the exhibit. Beautiful dioramas carry you from the dawn of life to the future. Artistically, this is a very well done show. Sonically, everything came from a speaker mounted in the usual dash location in the car. And, like car speakers in general, they were *awful*. Our unanimous vote for the most unsatisfactory sound of any major exhibitor at the Fair. (It was not the individual car we were in, I checked with others who had taken the ride and found the same effect.)

The final big event of the night, every night, at the Fair is at the Fountain of the Planets. A massive fireworks display is presented against a musical background and a physical backdrop of one of the more impressive fountains around anywhere. Music, on tape (which also has cues for synchronizing the motion of the fountain waters and the firing of the rockets), is dispersed by a large speaker system that projects from the center of the fountain. Musical realism is not one of the strong points of this system. And, it is loud enough, since it is an active part of the panorama, not to be ignored. Still, I suppose that it served its purpose, even if it was too much for sensitive musical ears.

I must say that we all had fun, exhausting fun, at the Fair. It truly is a Grand Exposition in the tradition of such things. It is not perfect, nothing that vast is likely to be, but it is entertaining, particularly to anyone interested in communication. Because, every means is used. And, if some are not completely successful, their creators will learn from them. There is a lot of revision between what we saw in 1964 and what we will see this year. We expect to be there, wide-eyed and sharp-eared. Æ



The AR-4—$51 to $57, depending on finish

Excerpt from a column by Robert Marsh, music editor of the ***Chicago Sun-Times.*** *A reprint of the complete AR-4 review is available on request.*

The AR-4 is a best buy in any comparative shopping survey. It is going to attract a lot of interest in the low-price bracket, but, more than this, it is going to raise a big fuss in the next bracket up, competing with its own big brothers the AR-2 and the AR-2a.

Development work on the AR-4 has made possible an improvement in the AR-2 and AR-2a speakers as well. The AR-2a has a new mid-range unit of improved smoothness and dispersion, and has had its name changed to AR-2a^{x}. The AR-2, with the same new unit installed as tweeter, has become the AR-2^{x}.

These new models are entirely compatible in stereo with the original speakers. The grille cloths are new, but the older grilles are still available. The AR-2 and AR-2a speakers are also still available for those who want exact matching, or the owner of either of these speakers can convert to the corresponding new model for $15 and about half an hour of his time. Conversion kits are available at your AR dealer or direct from Acoustic Research.

The AR-2a^{x} is $109 to $128, depending on finish, and the AR-2^{x} is $89 to $102. These prices are the same as for the original models. AR's five-year speaker guarantee (covering all costs including freight) applies, of course.

ACOUSTIC RESEARCH, INC., ***24 Thorndike St., Cambridge, Mass. 02141***

☐ Please send me_____conversion kits ☐ AR-2a to AR-2a^{x} ☐ AR-2 to AR-2^{x} with complete instructions. I enclose_____in cash or check ($15 postpaid per kit), and/or

☐ Please send me literature on AR products.

NAME _____

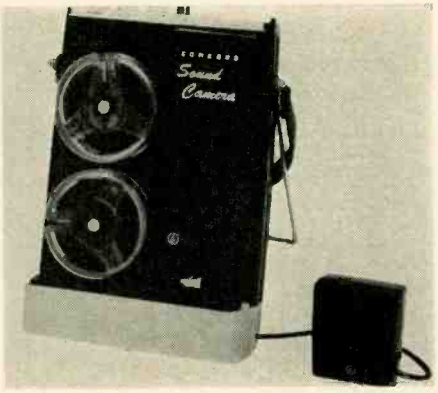
ADDRESS _____

_____

Circle 121 on Reader Service Card

NEW PRODUCTS

• **Ultra-compact Tape Recorder.** The new Concord F-85 is being promoted as a "Sound Camera." Complete push-button operation, camera size, and a weight of only 2 pounds promote convenient "sound snapshot" use of the recorder. Operation at the one tape speed of 1⅞ ips is accurately maintained by a constant-speed motor. Included in the basic package is a microphone and carrying pouch, as well as a reel of



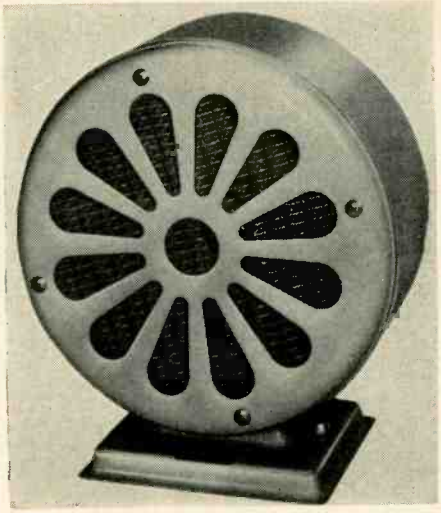
tape and a takeup reel. The recorder has an earphone outlet and can feed an auxiliary speaker. In addition to microphone, the unit can be fed from standard high level sources. Power is from four flashlight batteries; sufficient for up to 12 hours of use. An a.c. adapter is available. List price is under $50. **Circle 200**

• **Solid-State Amplifier.** A new low-cost, all-transistor amplifier has just been announced by Lafayette Radio. Designated the LA-340 it will deliver 20 watts IHF music power per channel. Compact size plus cool operation allows bookshelf or table-top use. Five pairs of stereo inputs accommodate a tuner, phono with magnetic or ceramic cartridge, tape recorder, and auxiliary sources. Other features include: front panel stereo headphone jack, speaker silence switch, concentric volume/balance controls,

and separate on/off power switch with pilot lamp. Specifications include: Response ± 1 db 30-20,000 cps, 1 per cent harmonic distortion, hum and noise of -70 db at the tuner input and -56 db at the phono and tape head inputs. The amplifier will feed 4 through 16 ohm speakers. Dimensions are 11¾-in. wide by 3¾-in. high and 10½-in. deep. Stock number is 99-0111WX. Price is $79.95. **Circle 201**

• **Transistor Tester.** This new design from the IIT Research Institute, available through Transition, Inc., is specifically designed for in-circuit testing of leakage current. The basic unit is portable and accurately measures collector-to-base leakage currents as low as one microampere with a collector load resistance down to 100 ohms. Simplicity of operation and rapid setup time allow the unit to be used even by non-skilled personnel for both manufacturing and maintenance testing. A 0-25 microampere meter with a taut-band movement is used to read leakage currents and to indicate transistor shorts and opens with complete safety for all components. Maximum ranges on the three-range scale are 25, 250 and 2500 microamperes. Power is external, 120VAC, 60 cycles. Special power supplies are available on request. Dimensions are 5⅛ inch wide, 10 inches high and 12½ in. long. Weight is approximately 7 lb. **Circle 202**

• **Bi-directional Speaker.** Bi-directional sound distribution in corridors and outdoors in sheltered locations is made available, at reduced cost, with the new Atlas TW-11 speaker and battle combination. Using one extended-range 8-in. cone speaker to do the work of two, the TW-11 radiates sound in two directions from grille openings at both ends of the compact enclosure.



The unit is equipped with a 5-in. by 6-in. mounting bracket and concealed universal mounting plate for flat surfaces and electrical outlet boxes. The speaker's steel enclosure parts are chemically corrosion-proofed and weather protected by means of a baked-enamel finish in a neutral beige color. The speaker will handle 8 watts at 8 ohms. Dimensions: 9 inches in diameter and 5 inches thick. List price is $19.00. **Circle 203**

• New Miracord. Benjamin Electronics announces the Miracord Model 40. This new automatic features a fully-balanced tone arm that will track any cartridge at its recommended stylus-force settings to less than one gram. Stylus force is obtained by spring-torque tension applied at the vertical pivot point of the arm after first balancing the weight of the cartridge. The unit has a gram-calibrated scale. The cartridge-mount assembly snaps into position making instant electrical contact. The

mount is designed to handle any standard cartridge. Extra mounts are available, for quick cartridge interchangeability, as accessory items. The Miracord 40, plays single records manually or automatically and stacks up to ten records in automatic sequence. The turntable platter is a one-piece machine casting, 12-in. in diameter, weighing about 6 pounds. The platter is dynamically balanced. Wow and flutter are stated as less than 0.1 per cent and rumble is better than 50 db below average signal level. Retail price for the Model 40 is $79.50. **Circle 204**

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- ☐ MR 71 fm stereo tuner
- ☐ MR 67 fm stereo tuner
- ☐ MC 225 stereo power amp
- ☐ MC 240 stereo power amp
- ☐ MC 275 stereo power amp
- ☐ MA 230 stereo amp/preamp
- ☐ MX 110 stereo tuner/preamp

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Circle 123 on Reader Service Card

SOUND AT THE FAIR

(from page 23)

si Cola, 7- and 14-track tape machines are used (with ½- and 1-in. tapes). By using tone pulses, high-frequency modulated signals, and standard audio material at the proper places in each of the tracks on the tape it is possible to achieve the intricately controlled movements of the animated mechanical figures in the show and also the proper sound localization. By using a single tape for all the control signals and the audio, the synchronization remains constant for all the successive shows. With the use of the audio signal itself to activate the mouth movements of the figures it is possible to achieve good lip-synchronizaion.

Two sets of tape machines are used to ensure continuous performances. As the first tape comes to an end, it automatically starts the second tape playing forward while it starts itself rewinding. When it arrives at the beginning, it stops, cues itself up to the beginning of the show, and is ready to start when the second tape comes to its end. As long as tape and components hold out, this process can continue endlessly.

At Ford, a multi-track tape is used to play music throughout the pavilion. Different tracks are used to provide various orchestrations of the same music, each arrangement typical of the locale of the miniature models displayed in the area the visitors walk through on their way to the car ride. Localization speakers are hidden in or near each of the different countries represented in the display.

At the Tower of Light, Hall of Free Enterprise, Post Office, Gas Pavilion, American Express, and many others, cartridge tapes are used with sound on one or more tracks and light/speaker/projector switching cues on others. At the Tower and G.E., sound is used to activate lights of different colors in time with the music, the various colors responding to different frequency ranges.

The I.B.M. feature show uses a 6-track tape to provide proper sound orientation relative to the position of the speaking narrator or screen figure, and another 6-track tape for selecting one of six languages.

Sermons From Science features film programs with a synchronized 6-track tape for simultaneous foreign language translations, and also live demonstrations in which sound is used as part of the show. In one live program, sound is changed to light and then converted back. In another, a volunteer is asked to talk into a microphone while wearing headphones. His voice is then recorded. By moving the playback head on the tape machine, the words are delayed varying times before being heard in the phones. This proves quite confusing to most volunteers who can be made unsure of their own names.

At the General Cigar exhibit, cartridge tapes are used to provide narration and music for the featured magic show, and also the smaller one in the lobby area. How the tricks are performed must remain a mystery.

Sound even has to play under water. At the Transportation and Travel Pavilion, the "Sea Hunt" show features live scuba divers in a glass tank in front of the seated audience. Narration is provided for the visitors from a tape deck playing through sound columns at the sides of the tank (on the outside), and through under-water horns for the benefit of the performers.

At the Bell System Pavilion, yet another trick is played with sound. In the display of the "vocoder" the normal voice is heard first, then as it came from the device. The unit breaks up the sound and reverses the pitch so that as the voice goes up, the frequency of the voice heard by the audience goes down, and vice versa. The unit is being used by the Bell System for study and research.

Conclusion

Sound in every form plays a very important part in the entire presentation of the 1964-65 World's Fair. Some unwanted noise can not be helped but has to be accounted for and lived with, or overcome. When used judiciously, sound can enhance exhibits. Where it is not used carefully, sound can be a hindrance and a most disturbing influence. In most instances, sound made or broke shows. This in 1964 became more fully realized by the exhibitors as the season wore on.

Right now, the Fair grounds have just come to life again. All through the winter months, since the closing last year, the area was fairly quiet except for the inevitable planes, a few birds, the wind, and small groups of people crunching their ways through snow to the pavilions in which they were working.

Quite a few of the buildings had work done in them during the last few months in preparation for this final season. You may not recognize some of the shows you remember so well from the 1964 Fair, and you may not hear the same things you did last season. Some exhibitors may have left and new ones have taken their places. New exhibits have been put up in previously open spaces. Some of the shows have been changed or redone beyond recognition, and some of last year's shows have been replaced by completely new presentations. When the Fair opens again on April 21, most of the pavilions will have made changes in their dioramas, some more extensively than others, and those that did not finish last year may be completed and even re-renovated. However, remember one thing—each change was made with the idea of improving the display, and to re-invite you to visit again those exhibits you may have seen last season. Or simply to entice you to come to those you missed.

One fact is certain—more sound is used in the 1965 World's Fair than there was in 1964. Improvements in quality and intelligibility will undoubtedly have been accomplished, perhaps not in all cases, but especially where the importance of sound has been fully realized. The only suggestion that can be made is that you come and listen for yourselves. Æ

AUDIO CLINIC

(from page 2)

The reason I want you to start looking in the lower-voltage portions of the tuner is:

1. The oscillator is in that portion of the receiver.

2. Many resistors will get hot if the trouble is in the lower-voltage portions of the receiver, whereas fewer of them will heat up as the voltage or the power increases in other portions of the circuit.

3. If you started to look for trouble in a higher-voltage point, you might find a heated resistor. You might then change the capacitor associated with it and find that the circuit behaved as before.

4. This would mean that your trouble is further down the line, and that the current passing through the first check point is originating elsewhere in the circuit.

There are many ways to check for such troubles. You could check individual voltages against those listed in the service manual for your equipment. If you have no manual, you will have to guess at what the voltages should be and work from there. Screen voltages can run as low as 70 volts but usually they are higher in FM receivers. The voltages in limiter stages are often quite low. One cannot be sure, however, unless the circuit is examined. Æ

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Stanton

Circle 124 on Reader Service Card

RECORDS

(from page 8)

Almeda Riddle. Songs and Ballads of the Ozarks.
Vanguard VRS 9158 Mono

Wow! A real, genuine old-lady folk singer, who knows hundreds of songs and thousands of verses and sings 'em all without—mind you *without* guitar. Not even a a dulcimer or an autoharp. Just her own slightly creaky voice.

She's Ozark. I guess the Southern Mountains have been stripped of folk singers nowadays. (The Southern old ladies now live in split-levels near New York and appear on TV, or are signing movie contracts and doing the night spots.)

This one is good, very good. Her singing is a bit plainer and more matter of fact than some of the more subtle Southern music, as befits a semi-Westerner of her background. Halfway to cowboy songs, sort of. But she has a real style, perfect pitch for verse after verse, considerable drama (within the strict conventions that allow no change in emphasis or speed from verse to verse) and a splendid repertory of country-style ornaments, upward hiccups at the ends of lines, quavers, artful shrillnesses. In other words, a real folk artist, and an "original"—she didn't get hers from the nearest LP record, straight out of Vanguard.

Better listen. There aren't many left. And better marvel and/or deplore, how far our so-called folk music of the young has moved away from its origins! For better or worse? Who knows. *Æ*

AUDIO ETC.

(from page 14)

have faded away. Evidently if you have the right kind of mind you *can* figure a way to get those millions of cycles onto usable home tape at speeds that might be compatible, more or less, with audio tape speeds. (The big "pro" machines now use the slow speeds but via those wide tapes and tricky moving heads. I suspect they'll have to figure a different way to do it, for the home.)

My own private hunch is that the Ampex development, and in fact the whole spate of new thinking on more economical video taping, stems right out of the improved tapes that were launched a year back, sparked by 3M's unusual 200 series, on which I commented at length a while ago. (But I didn't think of video; I should have.)

All sorts of opportunities and benefits open up when the basic parameters of tape recording are changed in a fundamental way, and especially by a change in tape itself. It seems likely that with improved tape characteristics it has only this year been possible to think—and act—upon the proposition that quarter-inch tape might sustain life (as you might say) for a TV picture. And so—we're off.

(Funny coincidence. Ampex's "special formulation" half-mil tape, which you can have at around $58 for a 12½-inch reel, is strikingly like the now-familiar 3M 201 tape, with the same shiny silver-gray look and oily feel to it. Maybe a special formulation to help with head wear and such at the fast speeds; but other new-type premium audio tapes will also work for the Ampex machine.)

Let us put all this aside to digest for a month. In the next issue, I'll continue with some speculations as to how this hypothetical home video recording might fit into our present setup.

CONTROL UNIT

(from page 30)

conversation, or any complex sound with one ear deliberately plugged. Let them tell me if this is not a jarring, unnerving experience. I will ask them in return to tell me which ear sounds deaf, as deaf it does feel. Imagine their surprise when they find the uncovered ear feels deaf and the plugged one super-sensitive, straining in its background noise (not normally heard) to complete the stereo effect the other ear cannot do alone. This diversion is to emphasize the fact that stereophony is real, and if handled correctly, is a necessary meduim in the subjective evaluation of experimental variations of a complex sound.

One more diversion. This same problem exists for apartment dwellers who are unlucky enough to reside in relatively unsuitable environments. Then there are the people who travel for a living; if the other problems didn't discourage them, the need to carry the stuff would. Thus the problem the author faces in producing reliable subjective impressions from utterly objective electronic experiments is shared in part by many readers, even though they are most probably concerned with the entertainment aspect alone.

Earphones are Binaural

This brings us to the subpect of earphones, the ideal solution for these problems, when the loudspeaker output is not satisfactory for one reason or another. But wait, we immediately come upon even worse frustration. The loudspeaker difficulty is only common to some of us, but the earphone problem is common to all who wish to use them properly. There is no equipment on the market, kit or otherwise, that treats earphone operation with importance on a par with the alternate loudspeaker mode of operation. Excellent treatises by E. T. Canby in his "Audio Etc" column explain this matter in full detail. Mr. Canby, in his Sept. 1960 column discussion brings up the unfortunate situation that now, earphones are being glossed over as the "perfect stereo reproducers" for private stereophony "not available with loudspeakers." (The quotations are advertising phrases). In reality they are binaural devices, an entirely different thing. To just "plug them in" produces, not stereophony, but, according to Mr. Canby "In a word, if you don't look out you'll get seasick." There are innumerable other discouraging details, but read these articles yourself (through 1961–62), they are highly interesting and informative.

These are the problems that are delaying my original project, organ tone. However things are looking up. The Jensen Co. has made available, through license from CBS, the Bauer selective crossfeed circuit for earphone operation.[6] This is a step in the right direction, but there are the inevitable disadvantages attendent upon the "plug it in and all's rosy philosophy" in regard to passive circuit adaptors which makes us less patient as we wait for the more desirable integrated circuits to appear. The author decided not to wait, and for those readers who are of similar mind, a control unit design is offered which treats phones and speakers as equals. A brave attempt will be made to handle all design areas so as to simplify deletion or change of circuits that conflict with your personal requirements.

[6] Larsen and Eargle, "Headphone Control Center," AUDIO, Nov. 1962, page 55.

(TO BE CONTINUED)

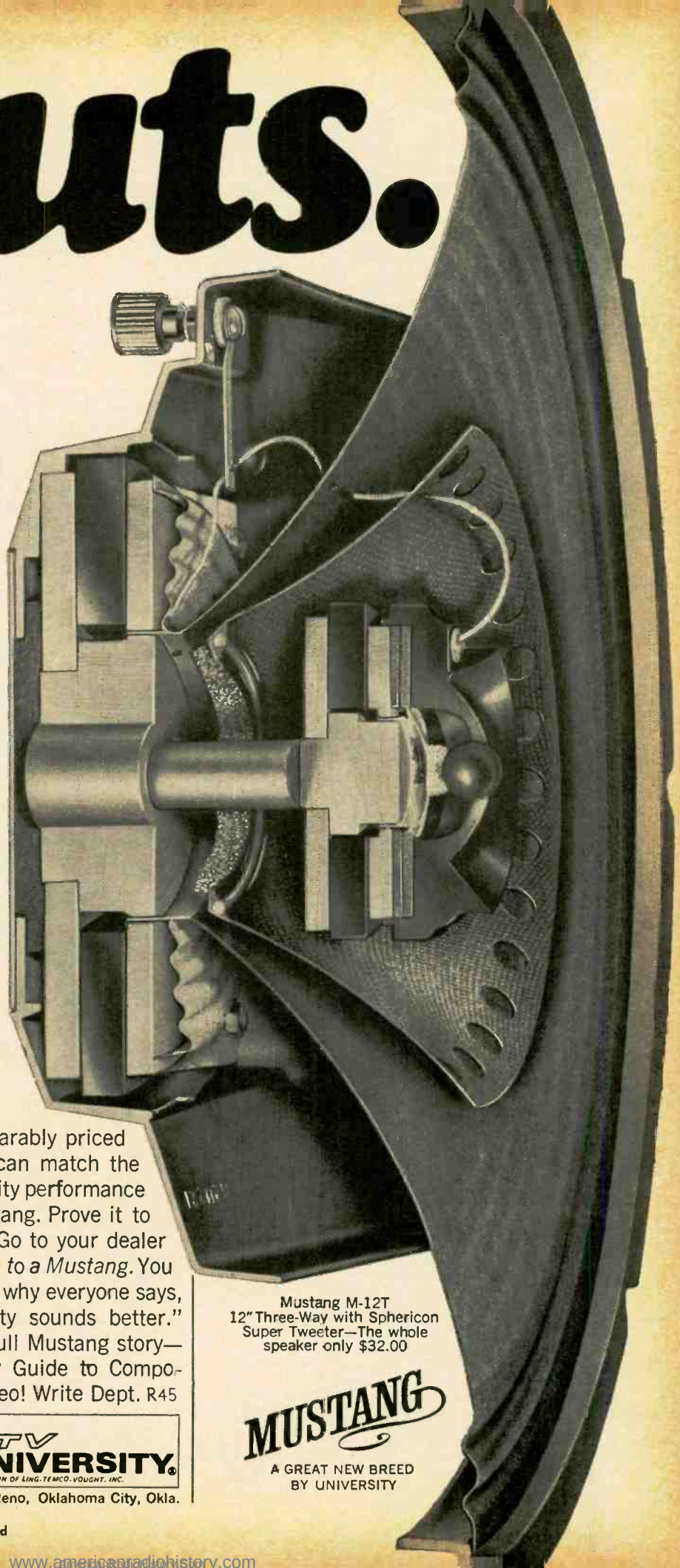
CHRYSLER

(from page 28)

as well as the side walls of the theaters above eight feet, are covered with fissured acoustic tile. The back wall has a 2-in. thick glass wool sound-absorbing blanket protected by a layer of perforated hardboard.

The closeness of the four theaters to one another and the common stage structure provided the most challenging aspect of the acoustical design. A small wedge-shaped room is located between each pair of auditoria. Analysis indicated that the 12-in. masonry block walls spaced by about 4 to 7 ft. (the width of the wedge-shaped room) would be sufficient to isolate even loud amplified sound between adjacent auditoria. The problem of sound traveling upwards through one ceiling, through the large attic space, and down into the next room was resolved by suspend-

Guts.



It took *guts* to even think of making a *low-cost* speaker line to University's *high quality standards.* But—the challenge paid off!

Rugged one-piece die-cast basket

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Electroplated metal parts to prevent distortion and assure long life

Shallow depth styling

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You've just got to see it and hear it to believe it. Hold a Mustang in your hand . . . immediately you will recognize the high quality construction that has made University a leader in its field for more than 35 years . . . the same quality design that won first prize in a recent national competition.

No comparably priced speaker can match the high quality performance of a Mustang. Prove it to yourself. Go to your dealer and *listen to a Mustang.* You will know why everyone says, "University sounds better." Get the full Mustang story—plus new Guide to Component Stereo! Write Dept. R45

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12" Three-Way with Sphericon Super Tweeter—The whole speaker only $32.00

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ing heavy plaster ceilings from the structure above each room, and these ceiling were suspended on rubber isolation mounts to prevent structure-borne transmission from room to room. The acoustic tile mentioned previously was glued to the underside of these plaster ceilings.

Actual openings between adjacent spaces transmit far more sound than large areas of wall. The cracks which extended all around the perimeter of each proscenium opening and which were required for tolerance in motion of the turntable, required very special and careful detailing. Heavy rubber sweep gaskets, running from the bottom of the turntable structure to the top of the stage ceiling construction join the auditoria to the stage components. Mufflers made up of 8 to 12-in. of glass wool faced with a protective screening, are used to supplement the effect of the gaskets. The results of this composite isolation mechanism seem to equal the isolation provided by the heavy masonry construction.

The heavy resiliently-suspended ceiling provided primarily for room-to-room isolation also served as a barrier to aircraft noise penetrating through the room. In addition, the roof is of heavy concrete plank construction, topped by a wood frame and a wooden roof which forms the familiar five-pointed star emblem. Noise transmission through the four exterior doors in each theater was reduced to appropriate levels by using heavy steel doors gasketed with leaded-vinyl sweep-strips. Mechanical noise of equipment operating in the building was quieted by mufflers and absorbent material, as necessary.

Sound Reproduction Equipment

The sound system was originally designed for flexible use, since no producer had been selected. Gradually, the show was written and developed and the functional diagram shown here represents the system essentially as built. Inputs consist of Shure and Electro-Voice microphones and Gates message repeater cartridge tape reproducers. The amplification and control equipment selected by the contractor are by Altec Lansing. Notice that for systems 1 through 4 all input and amplification equipment is located on the stage, but the loudspeakers are fixed in each auditorium. The amplified signal is fed through a mechanical commutator located below the stage floor.

The introductory system is straightforward encompassing a microphone and tape reproducer, a mixer-preamplifier, a spectrum shaping filter and a power amplifier. The amplifier output, as can be seen here, is fed to the loudspeaker through the commutator. The other systems are basically the same, except the movie system which is fed from the projector preamplifier directly to the power amplifier.

The four systems above operate only when the turntable is at rest. A fifth system shown at the bottom of the functional diagram plays music tapes simultaneously to all four auditoria while the turntable rotates, via the four ceiling-mounted cone loudspeakers in each theater. All tape reproducers are rewound automatically during the periods in which they are not in use.

An interesting modification to the electronic equipment (incorporated by the contractor, Sound Systems inc., and developed by their chief engineer, Mr. Irving Wood) was the use of the audio tape reproducers to program the various activities of the building. Signals on the magnetic tapes are used to activate the turntable, to switch on and off the various tape recorders, and to activate the rewind of the recorders. The signal also controls the motion picture projector.

The Chrysler Pavilion was enjoyed by roughly a million visitors in 1964, a larger number is expected in 1965. Æ

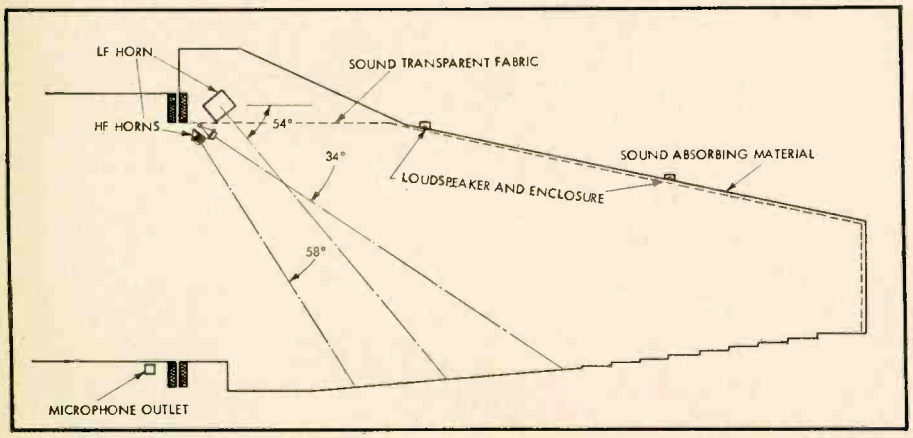


Fig. 3. Speaker locations in theatres.

VATICAN

(from page 25)

Missions area, which is in the aural shadow of the core structure.

Sound in the inner core exhibit area, which houses the replica of St. Peter's tomb, is provided by another two CM-200-10 sound columns.

In the chapel above the core exhibit area, the sound system is largely used for reinforcement of priests' voices. Sound outlets are two CM200-10 columns recessed into structural columns on either side of the altar.

The public address system makes use of all the sound facilities described plus another McIntosh 75-watt amplifier to drive speakers not used in the regular programmed sound systems.

All the tape machines, mixers, amplifiers, patch panels and other audio system components are located on the lower level of a specially-constructed control and projection booth. The upper level of the booth is used for motion picture projection.

If you're planning an Audio trip to the Fair, make the Vatican Pavilion a "must see" (or rather, "must hear"). Æ

OUTDOOR SOUND

(from page 26)

The outdoor sound system at the World's Fair is required to furnish background music continuously every day from 8 a.m. to past midnight. In addition, it also broadcasts public announcements and provides coded instructions to Fair security personnel in emergencies.

The use of magnetic tape, which was not available in 1939, has made programming background music for this Fair much easier and more flexible. Two dual-track continuous-play tape reproducers play recorded music from specially prepared 14-in. tapes. Two different programs are transmitted simultaneously. One goes to the luminaire speakers within the Fair grounds, and the second, featuring somewhat more spirited music, is fed to the speakers at the entrance gates.

Public announcements are recorded on tape cartridges. Up to 55 cartridges may be stored in an automatic tape message recorder unit for use as required. This unit is operated remotely from a position in the control room, permitting the operator to select and

play a particular stock announcement and then resume the program of background music.

Because the World's Fair system is so vast and elaborate, it must be monitored regularly and troubles if they should occur, located quickly. For this reason, every amplifier in the system is checked hourly by means of a 400-cycle tone. If gain should fall more than 3 db below the normal output, the amplifier will be automatically cut out of the circuit and its location signalled to the control room. Other indications of improper operation, such as excessive heat in a rack, are also reported with the locations pinpointed automatically.

No description of the outdoor sound system at the World's Fair would be complete without mentioning the huge outdoor speaker at the Fountain of the Planets. This three-ton loudspeaker, measuring 16-feet in diameter by 11-feet high, provides the musical accompaniment for a spectacular 20-minute fireworks and water display which attracts between 25,000 and 35,000 to the Fountain area each evening.

Probably the largest speaker ever built, this system was designed by RCA and manufactured and installed by Commercial Radio-Sound Corp. The big speaker is connected to the Fair's outdoor sound system and provides the regular program of background music during the day, in addition to the special program each evening. Æ

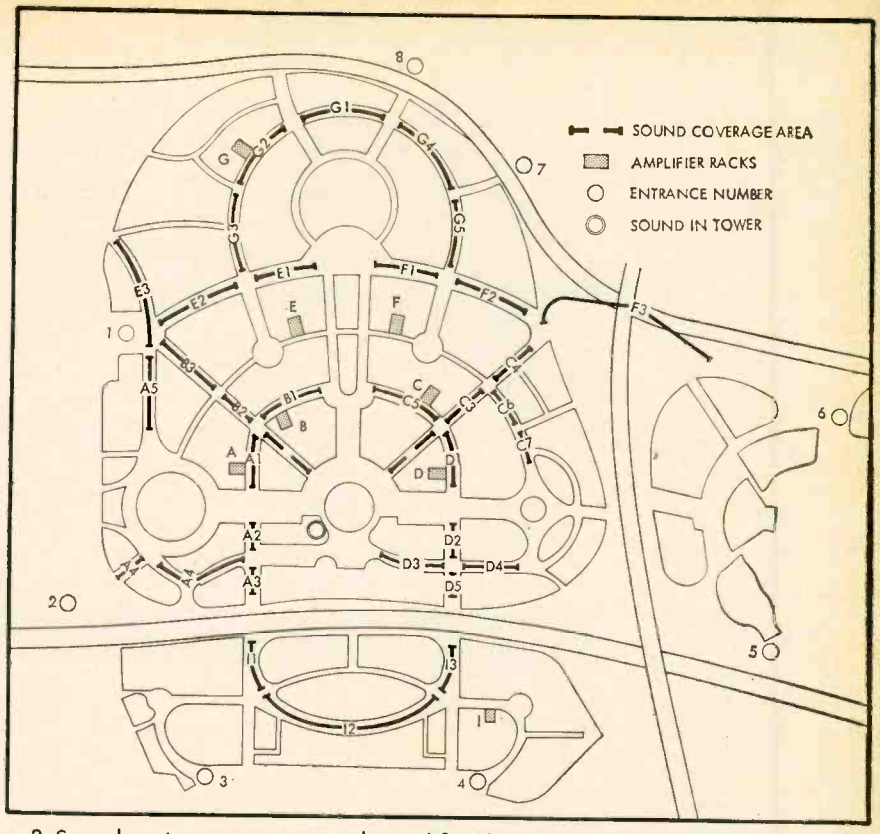
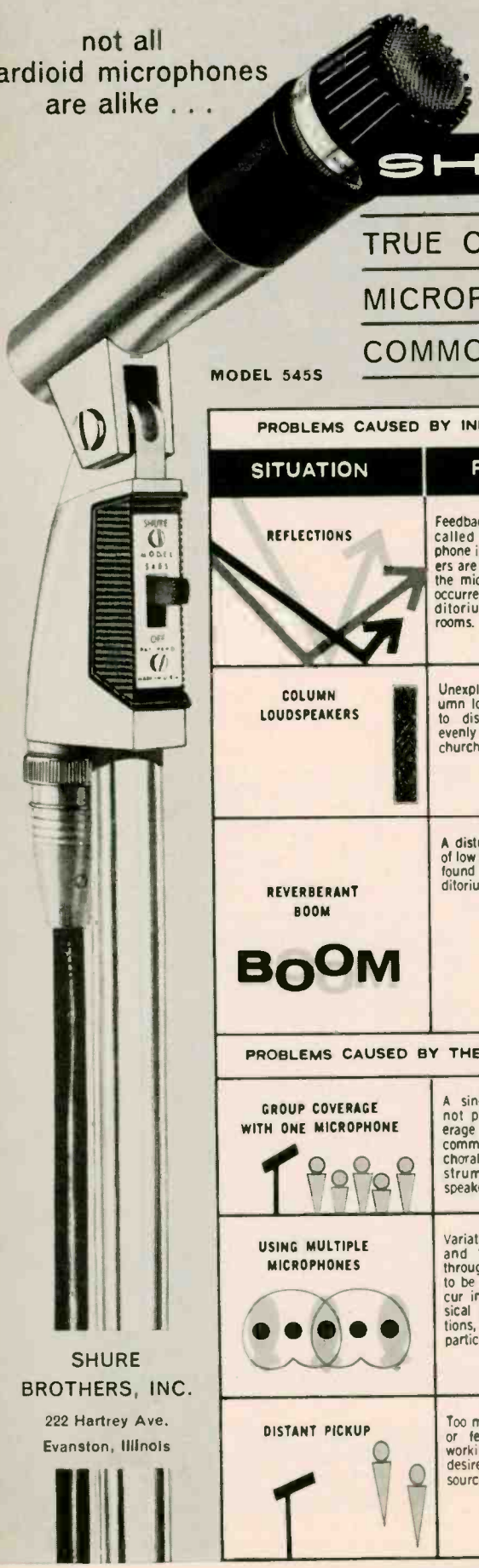


Fig. 3 Sound system coverage and amplifier location at New York World's Fair.

not all cardioid microphones are alike . . .



only the

SHURE UNIDYNE III

TRUE CARDIOID UNIDIRECTIONAL DYNAMIC MICROPHONE SOLVES ALL THESE COMMON MICROPHONE PROBLEMS!

MODEL 545S

PROBLEMS CAUSED BY INEFFICIENT REJECTION OF UNWANTED SOUNDS BY THE MICROPHONE

SITUATION	PROBLEM	CAUSES	SOLUTION
REFLECTIONS	Feedback occurs where a so-called "cardioid" microphone is used and the speakers are placed to the rear of the microphone. A common occurrence in churches, auditoriums, and meeting rooms.	Sound bounces off hard surfaces on the walls, floor and ceiling, in and around the audience area and the microphone used is not effective in rejecting these sounds at all frequencies, and in all planes about its axis.	The Unidyne III eliminates this problem because of effective rejection of sound at the rear of the microphone with uniformity at all frequencies. Sounds bouncing off the floor or other reflective surfaces that reach the rear of the Unidyne III are rejected.
COLUMN LOUDSPEAKERS	Unexplained feedback. Column loudspeakers are used to distribute sound more evenly to the audience in churches and auditoriums.	While column speakers direct the sound toward the audience, they also have side and rear sound lobes which may reach the microphone. Feedback occurs when the rear and side sound lobes of the speakers coincide with the rear and side lobes of a so-called "cardioid" microphone.	The Unidyne III solves this problem because it has no rear or side lobes. Thus it rejects the side and rear lobes of the sound column speakers.
REVERBERANT BOOM	A disturbing, echoing effect of low frequency sound often found in churches, large auditoriums, and arenas.	The particular "cardioid" microphone used fails to retain its unidirectional characteristics with low frequencies. In addition, its front response tends to accent low frequencies of the desired sounds. These factors result in pickup and reinforcement of the low frequency reverberation and boominess characteristic of many halls.	Using the Unidyne III Microphone will solve the problem because it maintains a uniform pattern of sound rejection in all frequencies, even as low as 70 cps. The frequency response also has a controlled roll-off of the low end. This prevents reinforcement of the low frequency reverberation and diminishes the effect of a boomy hall.

PROBLEMS CAUSED BY THE MICROPHONE'S INEFFECTIVENESS IN PICKING UP THE DESIRED SOUND

GROUP COVERAGE WITH ONE MICROPHONE	A single microphone does not provide uniform coverage of a group. This is commonly experienced with choral groups, quartettes, instrumental combos, and speaker panels.	The particular "cardioid" microphone used lacks a uniform pickup pattern, so that persons in different positions within the general pickup area of the microphone are heard with varying tonal quality and volume.	The Unidyne III affords uniform pickup of the group with a resulting consistency in volume and sound quality among the members of the group.
USING MULTIPLE MICROPHONES	Variation in the pickup level and tonal quality exists throughout the broad area to be covered. This may occur in stage pickup of musical and dramatic productions, panels and audience participation events.	The pickup pattern of the microphones used is too narrow, causing "holes" and "hot spots". The off-axis frequency response of the microphones also varies.	The Unidyne III permits a smoothness in pickup as the true cardioid pattern gives broad coverage with uniformity throughout the coverage area. This eliminates "holes", "hot spots", and the variations in sound quality and permits blending many microphones with ease.
DISTANT PICKUP	Too much background noise or feedback results when working with microphone at desired distance from sound source.	So-called "cardioid" and particularly long range microphones being used are less directional with lower frequencies. In addition, they have lobes or hot spots that pick up sound at the rear, resulting in the background noise or feedback problem.	Use the Unidyne III to gain relatively long range with effective rejection of sound at all frequencies at the rear of the microphone.

SHURE BROTHERS, INC.
222 Hartrey Ave.
Evanston, Illinois

U.S. Patent D190,864; other patents pending.

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COMMERCIAL SOUND PRODUCT DIRECTORY

The manufacturers listed below produce a variety of products intended for commercial sound applications. The products they make, or at least a reasonable sampling of them, are presented in 6 convenient charts. The charts are designed to help you pick out the product you want—quickly. The charts cover: 1. Power amplifiers, 2. Mixer amplifiers, 3. Mixer preamps, 4. Microphones, 5. Speaker mechanisms, and 6. Enclosed speakers.

Altec Lansing Corp.
1515 S. Manchester Ave.
Anaheim, Calif.

Atlas Sound Corp.
1419-51 39th Street
Brooklyn 18, N. Y.

Bogen Comm. Div.
Lear Siegler, Inc.
Paramus, N. J.

Bozak Mfg. Co.
P. O. Box 1166
Darien, Conn.

Capps & Co., Inc.
20 Addison Place
Valley Stream, N. Y.

C/M Laboratories, Inc.
248 Canal Street
Stamford, Conn.

Dynaco, Inc.
3912 Powelton Ave.
Philadelphia 4, Pa.

Electro-Voice, Inc.
400 Carroll St.
Buchanan, Mich.

Ercona Corp.
432 Park Ave. So.
New York 3, N. Y.

Fairchild Recording
10-40 45th Ave.
Long Island City 1, N. Y.

Fanon-Masco
439 Frelinghuysen Ave.
Newark 14, N. J.

Geloso
American Geloso, Inc.
251 Park Avenue So.
New York 10, N. Y.

Grommes Div.
Precision Electronics, Inc.
9101 King St.
Franklin Park, Ill.

Harman-Kardon, Inc.
55 Ames Court
Plainview, N. Y.

Jensen Manufacturing Co.
6601 S. Laramie Ave.
Chicago 38, Ill.

Karlson
KRC Corp.
24 Church St.
Malverne, N. Y.

Klipsch and Associates
P. O. Box 96
Hope, Arkansas 71801

KSC Systems, Inc.
P. O. Box 303
Knickerbocker Station
New York 2, N. Y.

Federated Industries, Inc.
Electronics Park
Antioch, Ill. 60002

Gates Radio Co.
Quincy, Ill.

Langevin
503 S. Grand Avenue
Santa Ana, Calif.

Lansing, James B., Inc.
3249 Casitas Ave.
Los Angeles 39, Calif.

McIntosh Laboratory, Inc.
4 Chamber Street
Binghamton, N. Y.

McMartin Industries, Inc.
605 N. 13 St.
Omaha 2, Nebraska

Melcor Electronics Corp.
1750 New Highway
Farmingdale, N. Y.

MISCO
Minneapolis Speaker Co.
3806 Grand Ave.
Minneapolis, Minn. 55409

Neumann
Gotham Audio Corp.
2 West 46th Street
New York 36, N. Y.

Newcomb Audio Products
6824 Lexington Ave.
Hollywood 38, Calif.

Norelco
North American Philips Co.
High Fidelity Products Div.
100 E. 42nd St.
New York 17, N. Y.

Quam-Nichols Co.
Marquette Rd. & Prairie Ave.
Chicago 37, Ill.

Rauland-Borg Corp.
3535 West Addison St.
Chicago 18, Ill.

Reslo
Fentone Corp.
106 Fifth Ave.
New York 11, N. Y.

Royce Electronics Inc.
50 Hancock Place
Valley Stream, N. Y.

Schoeps
International Electroacoustics, Inc.
333 Sixth Avenue
New York 14, N. Y.

Scott, H. H., Inc.
111 Powdermill Road
Maynard, Mass.

Sennheiser Electronics Corp.
25 West 43rd Street
New York 36, N. Y.

Shure Brothers, Inc.
222 Hartrey Ave.
Evanston, Ill.

Sony Corp. of America
580 Fifth Avenue
New York 36, N. Y.

Superex Elec. Corp.
4-6 Radford Place
Yonkers, N. Y.

Turner Microphone Co.
Cedar Rapids, Iowa

University Loudspeakers
LTV University
Div. of Ling-Temco-Vought, Inc.
9500 West Reno
Oklahoma City, Okla.

Viking of Minneapolis, Inc.
9600 Aldrich Ave. S.
Minneapolis 20, Minn.

CS-1 BASIC POWER AND BOOSTER AMPLIFIERS

MANUFACTURER	MODEL	POWER RMS WATTS	POWER BAND WIDTH	FULL POWER THD	HALF-POWER FREQUENCY RESPONSE	NOISE BELOW FULL OUTPUT-db	SENSITIVITY FOR FULL OUTPUT	TOTAL GAIN-db	INPUT IMPEDANCES	SPEAKER OUTPUTS-Ohms	FIXED GAIN OUTPUTS	CONTROLS AND SWITCHES	POWER CONSUMPTION-Watts	DIMENSION-Inches-HxWxD	WEIGHT-Pounds	PRICE	COMMENTS
Bogen	MO200A	200	21-50K ±1db	5%	18-65K ±1db	−80	Hi Z 2v Lo Z 0.5v	60	Hi Z or 600Ω	8 bal.	25V, 70V bal.	AC on/off Low-cut	500	6x16x11½	48	247.50	Several may be paralleled. Plug-in input sockets.
	MO100A	100	As above	As above	As above	As above	As above	As above	As above	16 bal.	As above	As above	250	6¾x8x13	29	136.45	As above.
	MO 60A	60	21-30K ±1db	As above	18-45K ±1db	As above	As above	As above	As above	4, 8, 16	As above	As above	160	As above	28	105.75	As above.
	MO 30A	30	21-40K ±1½db	As above	18-50K ±1db	As above	As above	As above	As above	As above	As above	As above	105	As above	23	86.95	As above.
	MT 30	30	22-40K ±1db	As above	20-55K ±1db	−85	Hi Z 1v Lo Z 0.25v	As above	As above	As above	As above	As above	60	As above	19	103.90	All transistor. Can be operated from 12-15V DC.
CM Labs	35MRM	35	5-20K	0.5%	5-40K ±1db	−80	1.3 to .65V	25	100K	4, 8, 16	–	AC on/off impedance	100 max.	19 rack 5x12	30	210.00	All transistor. Short circuit proof. Damping factor above 100.
	70DRM	70	As above	As above	As above	As above	As above	As above	As above	As above	–	As above	200 max.	As above	35	360.00	As above.
	70MRM	70	As above	As above	As above	As above	As above	31	As above	As above	–	As above	As above	As above	As above	380.00	As above.

CS-1 BASIC POWER AND BOOSTER AMPLIFIERS

MANUFACTURER	MODEL	POWER RMS WATTS	POWER BAND WIDTH	FULL POWER THD	HALF-POWER FREQUENCY RESPONSE	NOISE BELOW FULL OUTPUT-db	SENSITIVITY FOR FULL OUTPUT	TOTAL GAIN-db	INPUT IMPEDANCES	SPEAKER OUTPUTS-Ohms	FIXED GAIN OUTPUTS	CONTROLS AND SWITCHES	POWER CONSUMPTION-Watts	DIMENSION-Inches-HxWxD	WEIGHT-Pounds	PRICE	COMMENTS
Fairchild	688	50	10- 5k@ 5-20k@	0.5% 1%	10-20K ±1db	–80	1.5V	83	100K	8, 10, 16	–	AC on/off gain TransGard	32	3½x19x9½	22	249.00	Overload protection provided in TransGard system. 70V plug-in output transformer available.
Grommes	G-51	50	13-15K	2%	20-20K ±1db	–80	400MV	50	500K	–	25V, 70V Bal. or unbal.	Input lev. bias adjust	187.5	4⁹/₁₆x19x7	21	105.00	Input transformer for 600Ω line Note: Heat shield adds 1¹³/₁₆ height.
	G-101	100	As above	As above	As above	–83	As above	53	As above	–	As above	As above	325	10½x19x7	35	179.95	Input transformer for 600Ω line
Harman-Kardon	BA40	40	30-20K	2%	15-50K ±1db@ 1 watt	–90	500MV	79	600Ωbal. or Hi Z unbal.	4, 8, 16	25V, 70V bal. and unbal.	gain AC on/off monitor gain 10 cut	90	7x8½x13½	24	155.63 list	Provision for monitor speaker VU meter. 2V monitor output and bridge output.
	BA75	75	35-20K	As above	18-65K ±1db@ 1 watt	As above	600MV	82	As above	As above	As above	As above	150	As above	27	198.75 list	As above
	BA150	150	50-20K	As above	20-50K ±1db@ 1 watt	As above	700MV	85	As above	1,4,8,32	12V, 25V 35V, 70V	As above	300	7x13x13½	40	289.38 list	As above
Langevin	AM-128X-C with INP-R input panel	20	50-15K	2%	Not given	–78	1-6V	76	Hi Z	1-1K	–	Chassis gain, Panel gain	Not given	7¾ x 18¾ x 7¾	26		Note: Langevin manufacturers a large variety of plug-in front ends for this basic amplifier. Included are low Z, phono, mike, tape hand.
	AM-101-D	50	100-8K	3%	30-5K ±2db	–80	Not given	60 at 600Ω	600Ω 1-25KΩ	Not given	Not given	AC on/off gain	Not given	8³⁵/₆₄x18¹³/₁₆ x10¼	45		As above
	4000 series modules	These are plug-in module boards providing a wide variety of functions. Langevin has a complete catalog of this equipment.															
McIntosh	MC275	75 per channel	20-20K	0.5%	10-100K ±0-1db	–90	500MV	Not given	250K	4, 8, 16	25V, 70.7V, 115V, 250V	gain, gain selector, bal.	240-400	8x12¼ x17¼	68	444.00	Stereo amplifier. Dual parallel inputs.
	MC240	40 per channel	As above	As above	As above	As above	As above	Not given	As above	As above	25V, 70.7V, 140V	As above	145-270	8 x 10¾ x 17¼	56	288.00	As above.
	MC225	25 per channel	As above	As above	14-100K ±0-1db	As above	As above	Not given	As above	As above	25V, 70.7V	gain, gain selector	85-200	7 x 9⁵/₁₆ x14⅛	34	198.00	Stereo amplifier.
McMartin	LT-30 LT-30T	3	20-15K ±1db	1%	20-20K +2db at 250 mw	–65	LT-30 500MV LT-30T 0dbm	Not given	LT-30 5K LT-30T 600, bal.	4	–	gain	–	5½x2¾x5	3		All transistor. Requires 24V at 0.5A max. Input and output on a single octal socket.
	LT332	32	Not given	5%	15-15K ±2db	–60	250MV	Not given	15K	8, unbal.	25V, 70.7V, bal.	gain, AC on off	75	Not given	Not given		All transistor. Plug-in transformers for 10KΩ bridging (or bal. 600Ω)
	LT750	75	Not given	As above	As above	As above	As above	Not given	10K	As above	As above	As above	Not given	Not given	Not given		As above
Melcor	A-40	+40dbm	20-20K	0.75%	20-20K ±0.5 db	Not given	Not given	60 adjustable	150 or 600 bal. or unbal.	less than 10% of nominal load	–	Not given		Not given	7		Requires external DC power supply, P-2.
Newcomb	KB-400	40	20-20K ±1db	5%	20-20K ±0	–80	1.2 or 3V	74	1 meg	4, 8, 16	25V, 70V	gain, low cut, output bal., AC on off	110	17 x 13⁵/₁₆ x7⅞	26½	179.50	Plug-in transformer converts input to 600Ω. Also available is a plug-in for bridging-in.
	KB-600	60	As above	As above	As above	As above	As above	76	As above	As above	As above	As above	145	As above	31¼	204.50	As above.
	KB-1250	125	As above	As above	As above	As above	As above	79	As above	As above	As above	As above	185	As above	40½	249.50	As above.
Rauland-Borg	RA-32	32	40-20K	3%	30-20K ±1.5db	–80	250MV	83	5 meg	–	25V, 70V	gain	106-140	5¼ x 19 x6¾	16	110.00	Terminations plug-in.
	RA-70	70	As above	5%	20-20K ±1db	As above	As above	87	As above	–	As above	gain, bias cut-off	106-230	5¼ x 19 x7	19	146.10	As above.
	TA-50	50	As above	As above	50-15K ±1.5db	As above	As above	78	As above	–	As above	gain	25-110	5¼ x 19 x6	21	265.55	All transistor. Has overload indicator. Terminations plug-in.
	TA-100	100	As above	As above	As above	As above	As above	81	As above	–	As above	gain, low cut, AC on off	40-230	7x19x9	28	283.35	As above.
H.H. Scott	250B	50	15-15K	1% at half power	20-30K ±1db	95	500MV	Not given	100K	4, 8, 16	Variable to 140V	gain, AC on off	180	7x12x10¼	27	185.00	Rack mount available. Output impedence switch available.
	255	300	25-12K	1% at 200 W	As above	75	5V	Not given	5K	25, 50, 100, 200	250V max.	meter range overload reset, AC on off	650	10½ x 19 x 17	108	2,800.00	Silicon transistors. Output voltage meter, short circuit protection, load mis-match protection.
Viking	PA82	2	Not given	Not given	30-25K ±1db	70	1V	Not given	500K	4, 8, 16	–	–	25	3¼ x 5¼ x 4½	4	49.25	

CS-2 MIXER-AMPLIFIERS

MANUFACTURER	MODEL	POWER—WATTS (RMS)	POWER BANDWIDTH	THD—RATED POWER	RESPONSE—HALF POWER	NOISE BELOW FULL OUTPUT—db	MIKE INPUTS			SENSITIVITY—MAG. PHONO—MV	AUX. GAIN—db	SPEAKER OUTPUTS—OHMS	FIX GAIN OUTPUTS—VOLTS	CONTROLS & SWITCHES	SPECIAL CONNECTIONS	POWER CONSUMPTION—WATTS	DIMENSION—INCHES	WEIGHT—POUNDS	PRICE	NOTES
							QUANTITY	IMPEDANCE	SENSITIVITY & GAIN											
Altec	342B	35	45-12K	5	20-20K ± 1 db	75.5	4	Hi	2.3 MV	—	115	4,8,16,150	11.8,16,17, 23.6,70.7	4 low level mixers, master gain, bass, treble.	—	110	7 x 19⅝ x 8⅛	22	239.00	Portable or rack mount. Inputs can be converted to low Z.
	352A	40	30-12K	3	20-20K ± 1 db	81	5	Hi or Lo	0.27 MV at Lo-Z	1	115	4,8,16,125	12.7/18, 25.3,70.7	5 mixers, master, 5 equalizers, normal/ bright, bass, treble, mon. vol.	2 Recorder outputs	90	7 x 19 x 7½	23½	339.00	All transistor. Operable from 12 V DC. Compressor or amplifier and VU meter optional. Plug-in transformers for low Z mike or mag. phono.
	361A	25	30-15K	2	10-30K ± 1 db	73	2	Hi or Lo	As above	1	—	4,8,16	10,14.1	2 mixer, tone, input selector for mike or cer. phono.	—	42	4¾ x 13⅛ x 8 11/16	10	123.00	Compressor amp, 70 V output transformer and plug-in facilities. All transistor.
Bogen	MTX30A	30	22-35K ± 1.5 db	5	20-40K ± 1 db	Mike, −70; Aux, −85	6	Hi or Low	2 MV — 125 db	3	95	4,8,16 Bal.	25,70 Bal.	6 mike/aux, bass, treble, master gain, variable notch filter.	2 Recorder outputs bridge in/ out.	60	4¾ x 16½ x 12	24	239.25	All silicon transistor. May be operated from 12-15 V DC. Full output to +65° C. Wide range of accessories.
	MX30A	30	21-40K ± 1.5 db	5	18-50K ± 1 db	Mike, −70; Aux, −80	5	Hi or Low	3.5 MV — 125 db	2	85	As above	As above	5 mike/aux, otherwise as above	As above	125	As above	34	157.45	2 or more may be paralleled.
	MX60A	60	21-30K ± 1 db	5	18-45K ± 1 db	As above	5	Hi or Lo	As above	2	85	As above	As above	As above	As above	180	As above	40	194.65	2 or more may be paralleled.
	M330A	30	50-25K	5	35-30K ± 1 db	Mike, −65; Aux, −80	3	Hi or Lo	6 MV — 120 db	50	95	As above	As above	3 mike/tape/mag. phono, 2 aux.	600 μ output	120	5¾ x 14⅞ x 9⅞	20	113.25	
	M60A	60	50-25K	5	As above	As above	3	Hi or Lo	9 MV — 122 db	24	96	As above	25 Bal. 70	As above	As above	160	As above	28	138.75	
	MU15A	15	50-25K	5	As above	Mike, −60; Aux, −80	3	Hi or Lo	125 db	—	100	As above	As above	2 mike, 2 aux.	As above	90	6¾ x 15¾ x 10	19	83.95	
	MU10A	10	50-25K	5	As above	As above	1	Lo	125 db	—	100	As above	As above	Mike, aux, master gain, bass, treble.	As above	70	As above	15	58.45	
	BT35	35	250-15K	10	—	Mike, −90	1	Lo	1 MV — 110 db	—	90	4,8,16	—	Mike, aux, selector switch.	Radio input Siren input	3.6A at 12 V DC	3 x 8 x 6¼	8	79.45	All transistor. Full output to +65°C.
	BT20	20	250-15K	10	—	As above	1	Lo	As above	—	90	4,8,16	—	Mike, aux.	—	2.95A at 12 V DC	6½ x 4½ x 4	4	59.95	All transistor. Full output to +65°C.
	CHB100	100	Not given	5	Not given	Mike, −70; Aux, −80	2	Hi	5 MV — 125 db	15	100	4,8,16 Bal.	25 Bal. 70	2 mike, aux, master gain, bass, treble	600 μ output	300	6¾ x 15¾ x 10	25	116.95	
	CHB35A	35	Not given	5	Not given	Mike, −65; Aux, −80	2	Hi	4 MV — 125 db	25	100	As above	As above	As above	As above	125	As above	21	73.40	
	CHB14A	14	Not given	5	Not given	Mike, −55; Aux, −80	1	Hi	4 MV — 120 db	—	95	As above	As above	Mike, aux, master gain, bass, treble.	As above	70	As above	16	47.90	
Fanon-Masco	FMA20	20	Not given	5	50-15K ± 3 db	Mike, −65; Aux, −75	2	Hi	5 MV — 123 db	0.5	83	4,8,16	25,70	2 mike, phono/radio, master gain, tone.	Tape recorder output	115	14 x 5¾ x 10	Not given	—	Wide range of accessories. Mike inputs convertible to low Z or mag. phono with plug-in transformers, rack mount units available.
	FMA35	35	Not given	5	As above	Mike, −65; Aux, −80	2	Hi	As above	0.5	83	4,8,16	25,70	As above except seperate tone controls.	As above	As above	18 x 6⅝ x 10¾	Not given	—	As above.

CS-2 MIXER-AMPLIFIERS

MANUFACTURER	MODEL	POWER–WATTS (RMS)	POWER BANDWIDTH	THD–RATED POWER	RESPONSE–HALF POWER	NOISE BELOW FULL OUTPUT–db	MIKE INPUTS			SENSITIVITY–MAG. PHONO–MV	AUX. GAIN–db	SPEAKER OUTPUTS–OHMS	FIX GAIN OUTPUTS–VOLTS	CONTROLS & SWITCHES	SPECIAL CONNECTIONS	POWER CONSUMPTION–WATTS	DIMENSION–INCHES	WEIGHT–POUNDS	PRICE	NOTES
							QUANTITY	IMPEDANCE	SENSITIVITY & GAIN											
Fanon-Masco (Cont'd.)	FMA65	65	Not given	5	As above	As above	2	Hi	5 MV – 126 db	0.5	86	4,8,16	25,70	As above, also has phono mag. switch.	As above	210	As above	Not given	–	As above. This unit and one below are also available as booster without mike and tone control.
	FMA100	100	Not given	5	As above	As above	3	Hi	4 MV – 130 db	0.4	90	4,8,16	25,70	3 mike, phono/radio, master gain, bass, treble, phono mag.	As above	286	As above	Not given	–	As above.
	3311	11	Not given	10	70-20K ± 3 db	Mike, –56; Aux, –75	1	Hi	4 MV	–	85	4,8,16	70	Mike, phono/radio, tone	As above	60	9½ x 5¼ x 6½	13½	–	Mike input convertible to low Z with plug-in transformer.
	3527	27	Not given	10	150-10K ± 3 db	Aux, –70	1	Hi	3 MV	–	70	3,2-16	–	Mike, radio/phono, tone, radio-aux.	–	3.5 A at 12.6 V	6½ x 3¹⁄₁₆ x 4⁵⁄₁₆	4	–	All transistor-mobile.
	3512	12	Not given	10	As above	As above	1	Hi	3 MV	–	65	4,8,16	–	As above	–	2 A at 12.6 V	As above	4	–	As above
	3535AD	35	Not given	5	250-7K ± 3 db	Mike, –55; Aux, –65	1	Lo or Hi	Low Z 0.5 MV	–	85	4,8,16	70	Mike, phono, tone.	–	95	13½ x 10¾ x 5¼	16	–	Can be operated from 12 V DC source.
Geloso	G230-PA	25	100-10K	2	100-12K ± 3 db	–60	Not given	Hi	7 MV – 110 db	–	Not given	4,8,16 32, 500	Not given	Mike, phono, tone.	–	30	4 x 9 x 8	9	–	All transistor. Can be operated from 6-12 V DC.
	G249PA	8	Not given	Not given	100-10K ± 3 db	–60	–	–	0.2 MV – 116 db	–	Not given	8,16	–	As above	–	10.8	3½ x 8 x 6	3	–	As above.
Grommes	G-40A	30	Not given	Not given	30-15K ± 0.5 db	Mike, –55; Aux, –70	3	Hi	4 MV	10	Not given	8,16	70	3 mike, phono, bass, treble.	–	128.7	9¼ x 16½ x 8	20	119.95	Low Z mike transformer available.
	G-75A	60	Not given	Not given	As above	As above	4	Hi	1 MV	5	Not given	8,16	70	4 mike, 2 phono, bass, treble.	–	228	9¼ x 20½ x 8	28	169.50	As above.
Harman-Kardon	CA12	10	–	–	–	–60	1	Hi	5 MV	–	76	4,8,16	25,70	Mike, mix-music-page, aux, bass, treble.	Bridge out	65	6½ x 12½ x 7¾	12	79.90	
	CA23	20	–	–	–	–80	1	Hi	As above	–	79	4,8,16	25,70	As above.	As above	90	As above	15	104.38	
	CA35	30	–	–	–	–90	2	Hi	As above	–	81	4,8,16	25,70	2 mike, otherwise as above.	As above	100	7 x 15 x 10	22	129.88	Two extra mike channels available.
	CA65	65	–	–	–	–80	2	Hi	As above	–	87	4,8,16	25,70	As above.	As above	167	As above	27	171.25	As above.
	CA100	100	–	–	–	–83	2	Hi	4 MV	–	90	4,8,16	25,70	As above.	As above	205	As above	28	199.88	
	40GA-12	40	–	–	–	–90	2	Hi	5 MV – 135 db	3	94	4,8,16	25,70	4 mike, 2 aux, bass, treble, low-cut monitor volume, master gain.	–	150	7 x 17¼ x 13½	34	246.88	Wide range of access. Speaker outputs via plugs.
	75GA-12	75	–	–	–	As above	2	Hi	5 MV – 138 db	3	87	4,8,16	25,70	As above.	–	200	As above	36	324.88	As above.
	150GA-12	150	–	–	–	As above	2	Hi	5 MV – 141 db	3	90	4,8,16	25,70	As above.	–	300	As above	47	408.75	As above.
Langevin	See Section CS-1. Langevin Amplifiers are available with a variety of plug-ins.																			
McMartin	MA-10	10	Not given	3	30-20K ± 2 db	Mike, –55; Aux, –65	1	Hi	7 MV – 120 db	–	65	8	25, Bal. 70.7	Mike, aux, master gain, bass, treble.	600 Ω, Bridge out.	60	10³⁄₄ x 5¾ x 5¼	8	82.00	Low Z mike input transformer available.
	MA-12	10	Not given	3	As above	As above	2	Hi	As above	–	65	8 unbal.	25,70.7 Bal.	2 mike, otherwise as above.	As above	60	13½ x 5¾ x 5¼	8½	101.25	As above.

CS-2 MIXER-AMPLIFIERS

MANUFACTURER	MODEL	POWER—WATTS (RMS)	POWER BANDWIDTH	THD-RATED POWER	RESPONSE-HALF POWER	NOISE BELOW FULL OUTPUT—db	MIKE INPUTS			FIX GAIN OUTPUTS—VOLTS	CONTROLS & SWITCHES	SPECIAL CONNECTIONS	POWER CONSUMPTION—WATTS	DIMENSION—INCHES	WEIGHT—POUNDS	PRICE	NOTES
							QUANTITY	IMPEDANCE	SENSITIVITY & GAIN								
McMartin (Cont'd.)	MA-20	20	Not given	3	As above	As above	2	Hi	8 MV — 120 db	As above	As above.	As above	110	As above	9½	118.00	All transistor. Full power to 130°F. Low Z mike, mag. phono, tape head, program, transformers available.
	LT-80A	8	Not given	1	20-20K ± 3 db	Mike, −60; Aux, −70	1	Hi	8 MV	70.7	Mike, program, tone.	—	18	9x7x4½	8	—	
	LT300A LT304	32	50-10K ± 2 db	3	As above	Mike, −60; Aux, −65	2	Hi	Not given	25, 70.7 Bal.	2 mike, program, bass, treble.	—	75	11x9x5¼	14		As above also rack mount available. LT304 model same except has 4 mike inputs.
	LT753	75	Not given	3	50-15K ± 2 db	Mike, −60; Aux, −70	3	Hi	Not given	As above	3 mike, otherwise as above.	—	Not given	Not given	Not given		As above (LT-80A)
Newcomb	K3-400 K4R-400 K5-400	40	25-20K ± 1 db at 35W	1 at 35W	20-20K ± 1 db at 1 watt	−80	K3-3 K4R-4 K5-5	Hi	3.36 MV — 128 db	25, 70 Bal. or unbal.	Up to 5 mike, input sel, chan. 1, 2 mike filters, master gain, bass, treble, anti-feedback	—	110	17 x 13⅜ x 7⅜	29½	354.00 379.50 394.00	Three models identical except for mike input quantity. Input transformers for low Z, mag. phono available.
	K3-600 K4R-600 K5-600	60	As above at 50W	1 at 50W	As above	As above	As above	Hi	3.36 MV — 130 db	As above	As above.	—	145	As above	33¾	384.00 409.50 424.00	As above.
	K3-1250 K4R-1250 K5-1250	125	As above at 110W	1 at 110W	As above	As above	As above	Hi	3.36 MV — 133 db	As above	As above.	—	185	As above	42½	424.00 449.50 464.00	As above.

CS-2 MIXER-AMPLIFIERS

MANUFACTURER	MODEL	POWER - Watts (RMS)	POWER BANDWIDTH	THD - RATED POWER	RESPONSE - HALF POWER	NOISE BELOW FULL OUTPUT - db	MIKE INPUTS			SENSITY - MAG. PHONO - MV	AUX. GAIN - db	SPEAKER OUTPUTS - OHMS	FIX GAIN OUTPUTS - Volts	CONTROLS & SWITCHES	SPECIAL CONNECTIONS	POWER CONSUMPTION - Watts	DIMENSION - Inches	WEIGHT - Pounds	PRICE	NOTES
							QUANTITY	IMPEDANCE	SENSITIVITY & GAIN											
Rauland-Borg	2010A	10	Not given	Not given	40-20K ± 2 db	–66	1	Hi	15 MV – 116 db	–	75.6	4,8,16	25,70	Mike, phono, tone.	–	50 at 1/3 pwr.	6¾ x 11 x 6"	8½	74.50	Rack mount available.
	2020	20	Not given	Not given	30-20K ± 2 db	–75	1	Hi	6.5 MV – 126 db	–	83	4,8,16	25,70	As above.	–	60 at 1/3 pwr.	6⅜ x 14 x 8½	14	106.25	As above.
	2120	20	100-5K	5	40-20K ± 2 db	–70	2	Hi	3 MV – 130 db	–	82	4,8,16	25,70	2 mike, phono, treble, bass.	–	80 at 1/3 pwr.	7 x 13½ x 8	17	172.50	Low Z plug-in mike transformer and rack mount kit available.
	2035	35	Not given	Not given	30-20K ± 2 db	As above	2	Hi	4.5 MV – 132 db	–	89	4,8,16	25,70	2 mike, phono, tone, low filter	Tape output	110 at 1/3 pwr.	7 9/16 x 17 x 8¾	21	143.75	Output selector, rack mount available.
	2135	35	100-5K	5	35-20K ± 1 db	–75	4	Hi	5 MV – 125 db	–	91	4,8,16	25,70	4 mike, phono, bass, treble, gain.	–	135 at 1/3 pwr.	8¾ x 17½ x 10 1/8	28	236.25	Low Z plug-in mike transformer, rack-mount, meter, remote mixer available.
	2075	70	Not given	Not given	30-20K ± 2 db	–70	2	Hi	2.8 MV – 139 db	–	97	8,16	25,70	2 mike, bass, treble, low filter.	–	180 at 1/3 pwr.	7 3/8 x 17 x 8¾	26	199.50	Output selector, rack mount available.
	2175	70	100-5K	5	35-20K ± 1 db	–75	4	Hi	5 MV – 128 db	9	94	8,16	25,70	4 mike otherwise as above.	–	175 at 1/3 pwr.	8 x 17½ x 10 1/8	32	298.75	As model 2135.
	2030B	30	Not given	5	20-15K ± 2 db	–70	4	Lo	3 MV – 110 db	–	80	–	25	4 mike, phono, bass, treble.	–	105 at 1/3 pwr.	20 x 15 x 4	29½	355.00	All transistor in-wall unit.
	2025A	30	Not given	Not given	150-12K ± 3 db	As above	1	Lo	6 MV	–	Not given	4,8,16	–	Mike, phono, tone, low filter, output-Z.	–	4.5A at full pwr.	3¾ x 11 x 9 3/8	6	148.75	All transistor portable powered from 12 V DC.
Royce	DV2 ADV25	25	100-15K	10	100-15K ± 3 db	Mike, –60; Aux, –80	1	Hi or Lo	115 db	–	85	4,8,16	–	Mike, aux, treble, low filter.	–	ADV-25–64, DV-25 –3.2A at 12 V DC	3¼ 11¼ x 8	ADV-9 DV-4½	ADV–119.11 DV–81.90	All transistor, identical models. ADV-25 A.C. operated; DV-25 is 12 V DC operated.
Viking	PA94B	10	Not given	Not given	50-16K ± 2 db	Mike, –60	1	Hi	35 MV	Tape Head 2 MV at Hi Z	Not given	4,8	70	Mike, tape, tone.	24 V DC out	30	2¼ x 8½ x 6¼	7	85.95	

CS-3 MIXER-PREAMPLIFIERS

MANUFACTURER	MODEL	FREQUENCY RESPONSE (0 dbm)	RATED OUTPUT		NOISE		THD AT FREQUENCY BAND WIDTH	MICROPHONE INPUTS				OTHER LOW LEVEL INPUTS		AUXILIARY INPUTS		CONTROLS AND SWITCHES	SPECIAL CONNECTIONS	POWER CONSUMPTION	DIMENSION - Inches - H x W x D	WEIGHT - Pounds	PRICE	COMMENTS
			VOLTS	DBM	BELOW DBM	DB		QUANTITY	IMPEDANCE	GAIN - db	SENSITIVITY - MV	TYPE	SENSITIVITY - MV	SENSITIVITY - Volts	GAIN - db							
Altec	470A	20-20K ± 0.5 db	Not given	+27	Equivalent input: –127 dbm		1% 20-20K	1	50, 150, or 600 – bal. or unbal.	Not given	Not given	–	–	–	–	None	150 or 600μ output bal. or unbal.	130MA at 24VDC	3 x 1¾ x 11	3	132.00	All transistor recording broadcast preamp. Also available as plug-in module replacement for Langevin AM-116-B.

CS-3 MIXER-PREAMPLIFIERS

MANUFACTURER	MODEL	FREQUENCY RESPONSE (0 dbm)	RATED OUTPUT		NOISE		THD AT FREQUENCY BAND WIDTH	MICROPHONE INPUTS				OTHER LOW LEVEL INPUTS		AUXILIARY INPUTS		CONTROLS AND SWITCHES	SPECIAL CONNECTIONS	POWER CONSUMPTION	DIMENSION - Inches - H x W x D	WEIGHT - Pounds	PRICE	COMMENTS
			VOLTS	DBM	BELOW DBM	DB		QUANTITY	IMPEDANCE	GAIN - db	SENSITIVITY - MV	TYPE	SENSITIVITY - MV	SENSITIVITY - Volts	GAIN - db							
Altec (Cont'd.)	1567A	30-15K ±1 db	50 open circuit	+18	+18	–86	Not given	4	30 50 and 120 200	97	Not given	2 mag. phono	Not given	5 inputs at 17 MV for 0 dbm	55	5 mixers, 1 master bass, treble, VU range, illum. control	Recorder output	20	$5\frac{1}{2}$ x 19 x $6\frac{3}{4}$	$10\frac{3}{4}$	189.00	Portable or rack mount. VU meter optional.
	250SU	As above	Not given	+30	+30	–100	0.5% 30-15K at +20 dbm	10	Any	98	Not given	8 utility inputs, low Z	Not given	–	–	30 color-coded controls for single, two, three channels	Center tap for simplexing input-monitor outputs - aux.	Not given	$9\frac{1}{2}$x$39\frac{1}{4}$ x 16	Not given	1,393.00	Plug-in amps, preamps, utility studio console.
Bogen	MX6A	50-15K ±2 db	10 Hi Z	Not given	Not given	–70	3%	4	Hi Z	45	Not given	–	–	Not given	15	4 mike aux.	–	10	$5\frac{1}{2}$x8x$4\frac{3}{4}$	$4\frac{1}{2}$	40.50	Cathode follower output. Mixes 4 mikes or 2 mikes and 2 aux.
	RP-2	50-18K ±2 db	Not given	Not given	Not given	–60	3%	2	Hi or Low Z	76	3.5	–	–	0.4V	35	1 mike, 1 aux., 1 bass cut	Hi Z and 600Ω outputs	25	$5\frac{1}{8}$x11x$7\frac{3}{8}$	7	57.00	Plug-in low Z mike transformer. Available accessory cage has VU meter.
	MXM	20-25K ±2 db	20 Hi Z	+18	Not given	–60	1% 20-25K	5	Hi or Low Z	Not given	4	mag. phono	4	0.5V	Not given	5 mike/aux., bass, treble, master gain, 4 special filters. 1 selector switch.	Remote control, monitor jack bridge or Hi Z output.	27	$5\frac{3}{4}$ x $16\frac{3}{4}$ x 13	21	160.40	VU meter, remote control socket for 4 channels. Plug-in low Z mike transformers.
Fairchild	662	Not given	Not given	Not given	–120 dbm below full output		0.75%	1	Not given	50	Not given	–	–	Not given	Not given	gain 32-50 db	–	Not given	$5\frac{1}{8}$x$1\frac{1}{2}$x$7\frac{1}{2}$	2	124.00	Microphone or line amplifier.
	803	15-20K ±0.75 db	Not given	+24	Not given	Not given	0.4% 30-20K	6	Not given	Not given	Not given	–	–	Not given	105	6 attenuators, 6 reverb posts, 3 buss switching, 1 reverb remix, 6 high/low level switches.	Can be interconnected with 2 other 803 units.	75	72 x 18 x 11	Not given	2,375.00	Console.
Fanon-Masco	EMM-6	50-15K ±3 db	1	Not given	Not given	–70	0.75%	4	Hi Z	75	3	–	–	0.1	40	2 mike or aux.	–	10	$8\frac{3}{4}$ x $5\frac{3}{8}$ x $4\frac{1}{4}$	4		Cathode follower output. 4 channel mike mixer available.
Gates	M-6407	20-20K ±0.5 db	Not given	+8	+8	–70	0.5% 30-15K	6	Low Z	100	Not given	–	–	–	–	4 input selector, 4 channel mixer, 1 master gain, 1 mon. select, 1 mon. gain, 1 cue select.	Lineout, 600Ω bal. spke. output	30	24x$10\frac{1}{2}$x15	$33\frac{1}{2}$	575.00	All transistor console. Two-channel output.
	M-6434	20-20K ±1 db	Not given	+18	+18	–62	As above	4	150	97	Not given	2 mag. phono	5	600Ω at 15 dbm	33	4-channel faders, 1 master gain, 1 PA feed gain, 2 mike/phono tape selectors, 1 oscillator.	600Ω line, PA bridge.	Battery operated, AC optional.	$12\frac{3}{4}$ x $4\frac{3}{8}$ x $12\frac{1}{8}$	12	575.00	All transistor, 4-channel remote amp. Illuminated VU meter.
Grommes	G5-MA	20-20K ±0.25 db	Not given	+4	Not given	–60	0.05%	6	Hi Z	Not given	1	mag. phono	2.5	0.3	Not given	6 mixers, master, gain, bass, treble, VU meter off.	–	42	7 x 19 rack panel	14	179.95	Inputs can be converters from Hi Z mike to Low Z or to mag phono or aux. inputs.
Harman-Kardon	UPR-1	10-50K ±0.5 db	25	+18	+18	–72	0.5% 30-20K	5	Hi Z	97	5	mag.phono tape head	4 2.5	0.3	56	5 mike, 1 aux., master gain, bass, treble.	–	60	$6\frac{1}{2}$x$12\frac{1}{2}$ x $7\frac{3}{4}$	$10\frac{1}{2}$	97.38	
	PR-1	10-50K ±1 db	25	+18	+18	–85	0.5% 20-50K	As above	Hi Z	96	5	variable	2.5	0.3	55	4 mike, 2 aux., master gain, low cut filter, bass, treble.	–	25	7 x $17\frac{1}{2}$ x $13\frac{1}{3}$	17	211.90	Wide-range of plug-in accessories.
McMartin	LX-40	18-75K ±2 db	Not given	Not given	Not given	–55	0.5%	Not given	Hi Z	95	Not given	–	–	0.5	Not given	Not given	600Ω bal. or unbal.	Not given	Not given	Not given		

CS-3 MIXER-PREAMPLIFIERS

MANUFACTURER	MODEL	FREQUENCY RESPONSE (0 dbm)	RATED OUTPUT			NOISE		THD AT FREQUENCY BANDWIDTH		MICROPHONE INPUTS					OTHER LOW LEVEL INPUTS		AUXILIARY INPUTS		CONTROLS AND SWITCHES	SPECIAL CONNECTIONS	POWER CONSUMPTION	DIMENSION - Inches - H x W x D	WEIGHT - Pounds	PRICE	COMMENTS
			VOLTS	DBM	BELOW DBM	DB				QUANTITY	IMPEDANCE	GAIN - db	SENSITIVITY - MV	TYPE	SENSITIVITY - MV		SENSITIVITY - Volts	GAIN - db							
Melcor	A-24	20-20K ±0.5 db	Not given	+24	Equip to −122 db from a 600Ω source		0.5%		Not given	Not given	Not given	Not given	Not given	RIAA NAB	Not given		Not given	Not given	Not given	–	75 MA at 24 VDC	Not given	Not given	27.50 26.50	Temperature range 0°-65°C.
Newcomb	K3-P	20-20K ±1 db	10	Not given	10V	−100	0.5%		3 4 5	Hi Z	54	2.8	mag.phono	2.2		0.34	Not given		3 mike, 3 pos. input selector for chan. 1. 2 voice filters. Master gain, bass, treble, anti-feed back.	Dual outputs before and after master gain. Screw terminals for optional low Z output.	25	17 x 13⅜ x 7⅞	16½	262.00 287.50 302.00	VU meter optional. Output convertible to 600Ω. Monitor head phone jack available. RB-4 remote control for use only with K4R-P.
	K4R-P																								
	K5-P																								
Rauland-Borg	PA1400	30-20K ±2 db	1.5	Not given	Not given	Mike −52, Aux. −62	1%	40-15K	4	Low Z	Not given	0.5	2.8	Not given	0.5	0.2	Not given	Not given	4 mike, 1 aux. Selector, 1 aux. gain, treble, bass.	Tape in-out	10 MA at 28 VDC	13⅜x19x5	3	161.10	All transistor. Available accessories: mike expander, selector, remote volume, low Z bal. input transfomer.
	2104	20-20K	Not given	150 MV	Not given	Mike −47, Aux. −75	2%	100-5K	4	Hi or Low Z	103	2	65	–	–	0.2	65		3 mike, 1 mike/phono, master gain, bass, treble, 4 low-high Z mike switches.	–	50 at 1/3 rated power	8 x 17⅜ x 10	20	325.00	Rack mount model available.
Shure	M61-1 M61-3	25-15K +2.5 db	4.5	Not given	76 db below 10 MV input		1%		2	Hi Z	63	45	Not given	RIAA NAB	Not given	–	–	–	Selector switch for mike, RIAA, NAB.	–	AC 30 VDC	2⅝ x 4⅞ x 5¼	1¼	27.50 26.50	AC operated. DC.
	M65	25-15K ±1.5 db	Not given	Not given	Not given	−50	Not given		2	Hi Z	45	–	RIAA NAB			–	–	–	Rotary switch, mike, RIAA, NAB.	–	6	3⅛ x 3 15/16 x 6⅞	3	24.00	To convert ceramic phono input of PA amplifier for mag. phono or tape head.

MANUFACTURER	MODEL	TYPE	BASIC PATTERN	ADJUSTABILITY OR OTHER PATTERNS	DIAPHRAGM MATERIAL	CASE MATERIAL AND FINISH	OUTPUT IMPEDANCE-OHMS	FREQUENCY RESPONSE	SENSITIVITY OR OUTPUT LEVEL	LENGTH CABLE FURNISHED-FEET	DIMENSIONS-INCHES	WEIGHT-OUNCES	MOUNTING METHOD	PRICE	COMMENTS
Altec	686A	Dynamic	Omni.	–	Not given	Baked enamel, dark green	30/50 or 150/200	70-20K	Not given	20	1-1/16 tapered to 3/8 x 3½ L.	3	Neck cord	$ 45.00	Lavalier.
	M30	Condenser System	Cardioid	–	Mylar	Stainless steel. Grey anodize	30 to 10K or higher	20-20K	–54 dbm into 600 µ	30 total	11/16 x 2-27/32	Mike only 2	Stand	280.00	Separate power supply.
Capps	CM2250A	Condenser	Omni.	–	Titanium	Grey	250	30-15K ± 3 db	Not given	20	1-1/8 x 10	4	Standard pipe	225.00	
Dynaco	53	Ribbon	Figure 8	–	Aluminum	Brushed chrome	50/250/Hi Z.	30-13K ± 2.5 db	Not given	20	7¾ x 1-3/16	15	Bayonet to std. pipe	69.95	Also available as model 50, Lo Z only at $9.95.
	100	As above	As above	–	As above	As above	200	30-13K ± 2 db	Not given	As above	7 x 1-3/16	11	Quick-clip to std. pipe	89.95	Convertible to model 200 below.
	200	As above	As above	–	As above	As above	As above	As above	Not given	As above	10½ x 1-3/16	16	As above	149.95	Stereo mike with controlled separation.
Electro-Voice	611	Dynamic	Omni.	–	Acoustalloy	Die-cast zinc. Satin chrome	150/Hi Z	50-9K	–55 db	16	2-3/8 x 3-1/8 x 6¼ inc. stud	20	Stand coupler to stan. pipe	45.00	
	623	As above	As above	–	As above	Pressure cast. Satin chrome	Lo Z/Hi Z	60-12K	–56 db	16	7½ x 1-5/16	15	As above	57.00	
	624	As above	As above	–	As above	Pressure cast Non-reflective grey	150 unbal or Hi Z	100-7K	–56 db	18	3-5/32 x 1-7/32	14	–	42.50	Lavalier supplied with neck cord and clips.
	630	As above	As above	–	As above	Pressure cast zinc	150	60-11K	–55 db	16	2 x 6¼	16	As 623	52.50	
	636	As above	As above	–	As above	Steel. Satin chrome	Lo Z/Hi Z	60-13K	–58 db	16	1-1/8 x 10¼	15	As above	72.50	

CS-4 MICROPHONES

MANUFACTURER	MODEL	TYPE	BASIC PATTERN	ADJUSTABILITY OR OTHER PATTERNS	DIAPHRAGM MATERIAL	CASE MATERIAL AND FINISH	OUTPUT IMPEDANCE-OHMS	FREQUENCY RESPONSE	SENSITIVITY OR OUTPUT LEVEL	LENGTH CABLE FURNISHED-FEET	DIMENSIONS-INCHES	WEIGHT-OUNCES	MOUNTING METHOD	PRICE	COMMENTS
Electro-Voice (Cont'd.)	635	As above	As above	–	As above	Pressure cast zinc. Satin chrome	50/250	40-13K	–55 db	18	2 x 6¼	16	As above	82.00	
	652/652A	As above	As above	–	As above	Aluminum. Non-reflecting grey	150	80-8K	–60 db	20	652 - 25 long 652A - 15 long	11	Model 300 stand coupler	120.00	
	642	As above	Cardiline	–	As above	As above	50/150/250	30-10K	–48 db	20	17-7/8 x 3-3/16	3 lbs, 4 oz.	Boom or floor stand	390.00	Model 356 shock-mount or 357 wind-screen and shockmount required.
	668	As above	Cardioid	–	As above	As above	As above	40-12K	–51 db	20	9-5/8 x 3¼	27	As above	495.00	Internal shockmount and windscreen. 36 variations in response available.
	644	As above	Cardiline	–	As above	Die cast zinc. Satin chrome	150/HI Z	40-10K	–53 db	16	16 x 2-5/16	2 lbs, 9 oz.	Std. pipe	110.00	Ultra-directional for long reach.
	649B	As above	Omni.	–	As above	Aluminum. Non-reflecting grey	150	60-12K	–61 db	30	2¼ x 3/4	31 grams	–	105.00	Smallest lavalier available. Also, may be used on stand.
	647A	As above	As above	–	As above	Aluminum. Grey	150/Hi Z	60-12K	–60 db	18	3¼ x 3/4	2	Stand damp	82.50	Lavalier.
	654A	As above	As above	–	As above	Aluminum. Non-reflecting grey	150	50-16K	–58 db	18	6-15/16 x 1-1/8	16	Stand mount or hand-held	–	Lavalier. Supplied with clamp and neck cord.
	655C	As above	As above	–	As above	As above	50/150/250	40-20K	–58 db	20	10½ x 1	7	Stand, hand-held or boom	200.00	Std. pipe adapter and ½ inch adapter, model 300, included.
	665	As above	Cardioid	–	As above	Pressure cast zinc. Non-reflecting grey	As above	50-14K	–58 db	18	7-3/16 x 1-7/8	26	Table or floor stand	150.00	Low-cost version of model 666 below.
	666	As above	As above	–	As above	Cast aluminum. Non-reflecting grey.	As above	30-16K	–58 db	20	7⅜ x 1¾	11	As above	255.00	
	664	As above	As above	–	As above	Die-cast. Chrome, gold, grey.	150/Hi Z	40-15K	–58 db	16	7-3/16 x 1-7/8	26	Std. pipe	85.00	Gold – $90.00
	676	As above	As above	–	As above	As above	150/Hi Z	40-15K	–58 db	16	7-3/8 x 1¼	12	Model 300 clamp	100.00	Gold – $110.00. Three-position bass tilt switch.
Fairchild	F-22	Condenser	Cardioid	No	Mylar	Beige metal	50/200	30-18K ± 2.5 db	–49 dbm ref. 10 dyne/cm²	20	9¾ x 1⅞ dia.	1.5	Std. pipe	219.00	Transistorized, self-cont., 2500 hour batt. suppl.
Geloso	M18	Dynamic	Omni.	–	Not given	Chrome metal. Dull finish	250	60-20K ± 3 db	Not given	10	1 x 3¼	4	–	–	Lavalier
	M22	As above	As above	–	Not given	As above	As above	As above	Not given	10	As above	As above	Not given	–	Cartridge type.
	M48	As above	Cardioid	–	Not given	As above	As above	80-20K ± 3 db	Not given	10	As above	As above	Std. pipe	–	
	M60	As above	Omni.	–	Not given	Gold finish	As above	50-20K	–54 db. 1V/μ bar	5	1½ x 4½	13	As above	–	On-off switch.
Ercona	D44HL	Dynamic	Cardioid	–	Polystyrene foil	Anodized black	200 Hi Z	60-17K ± 5 db	–51 db	12	5 x 2	4.7	Std. pipe	34.95	
	RD36	As above	As above	–	As above	Chrome and black	As above	30-20K ± 3 db	–54 db	20	4-1/8 x 1¼	5.1	As above	89.50	
	EK61	Condenser	Omni.	–	Gold-plate polystyrene	Satin chrome	30/50/200/600/ Hi Z	30-18K ± 3 db	–52 db	10	2¾ x 3/4	1.25	As above	99.50	Requires separate power supply. Also available as EC61 cardioid at $109.50.
Neumann	U-64	Condenser	Cardioid	–	Gold-steamed mylar	Matt satin chrome or non-reflecting dark grey	200	40-18K	–43 dbm re 10 dyne/cm²	Up to 100	7/8 x 4	3	Std. pipe	360.00	Price includes separate power supply and cable. Multiple microphone/power supply packages available.
Norelco	D-19	Dynamic	Cardioid	–	Mylar	Dull metal	50/200/Hi Z	40-16K	–53 db	15	1½ x 6	7	Slip-in	58.00	Bass attenuation.
	D-12	As above	As above	–	As above	As above	50-250	40-15K	–54 db	15	5½ x 2 x 2½	17½	Swivel	99.00	
	D-24	As above	As above	–	As above	As above.	50/200.	30-16K	–53 db	15	1½ x 6	6	Slip-in	150.00	Bass attenuation.
	C-60	Condenser	As above	To Omni.	As above	As above	200	30-18K	–42 db	33	3/4 x 4	2-1/8	Fixed	280.00	Bass attenuation.

CS-4 MICROPHONES

MANUFACTURER	MODEL	TYPE	BASIC PATTERN	ADJUSTABILITY OR OTHER PATTERNS	DIAPHRAGM MATERIAL	CASE MATERIAL AND FINISH	OUTPUT IMPEDANCE-OHMS	FREQUENCY RESPONSE	SENSITIVITY OR OUTPUT LEVEL	LENGTH CABLE FURNISHED-FEET	DIMENSIONS-INCHES	WEIGHT-OUNCES	MOUNTING METHOD	PRICE	COMMENTS
Reslo	PRH	Ribbon	Mono-directional by damping	To bi-directional	Not given	Satin-finish metal	30/50 and Hi Z	Not given	Not given	Not given	3¼ x 1-3/8	9	Std. pipe	–	Also available in other low impedance models.
	Celeste	As above	Figure 8	To cardioid or direction-al	Duraluminum	As above	30/50 and Hi Z	30-15K ± 2 db	–58 db	Not given	Not given	Not given	Std. pipe	–	Also available as symphony model-250Ω and 600Ω.
Schoeps	CMT240V	Condenser	Cardioid	–	Nickel	Chrome metal. Dull finish.	150/250 or 30/50	Not given	0.4 MV/μ bar	Non furnished	6 x 25/32	6	Std. pipe	330.00	Shock suspended.
	M221/240	As above	As above	–	As above	As above	As above	Not given	0.3 MV/μ bar	33	As above	As above	Std. pipe	460.00	Shock suspended.
Sennheiser	MD4	Dynamic	Figure 8	–	Not given	Black finish	200	50-10K	Not given	Not given	7-1/8 x 2-3/8	13½	Hand held	–	Available also in a high Z model or with built-in switch.
	MD42	As above	Cardioid	–	Not given	As above	As above	200-10K	Not given	Not given	5 x 2	6½	As above	–	Model with on-off switch available.
	MD403	As above	Unidirec-tional	–	Not given	As above	As above	Up to 12K	–56 db	Not given	3½ x 2-1/5 x 1½	10½	Table stand	–	Hi Z model available.
	MD21	As above	As above	–	Not given	Grey finish	As above	50-15K ± 3 db	–53 db	Not given	4¾ x 1-4/5 x 1-4/5	9-1/5	Hand-held	–	Table/floor stand adapters. Lo Z/Hi Z model available.
	MD421	As above	Cardioid	–	Not given	Metal finish	As above	40-16K ± 2 db	–53 db	Not given	7 x 2 x 1-4/5	13-1/5	Hand-held	–	As above.
	MD3T	As above	Omni.	–	Not given	Black finish	As above	50-10K ± 3 db	–61 db	Not given	Housing: 2-3/5 dia. Base: 2-3/5 dia x 17-7/10	24.6	Table stand	–	Miniature mouthpiece connects to transducer in base.
	MD31	As above	As above	–	Not given	Metal finish	As above	50-12K ± 3 db	–59 db	Not given	Housing: 9/10 dia. Base: 6-7/10 x 2-1/5	3¼ lbs.	Floor stand	–	As above except floor stand. Adjustable weight 35-60 inches.
	MD406	As above	Super-cardioid	–	Not given	Metal finish	As above	70-15K ± 3 db	–55 db	Not given	1-7/10 dia. x 5½ L	6.5	Hand-held	–	
	MD211	As above	Almost spherical	–	Not given	As above	As above	40-17K ± 2.5 db	–57 dbm	Not given	7/7 x 4¾	Not given	Hand-held	–	Stand adapters available.
	MD408	As above	Super-cardioid	–	Not given	As above	As above	100-14K ± 3 db	–55 db	Not given	1½ dia.	Not given	Std. pipe	–	Mounted on gooseneck.
Shure	545	Dynamic	Cardioid	–	Shure Dura-coustic	Die-cast zinc. Black and satin chrome	50-250 and Hi Z	50-15K	Hi Z 1.76 MV/μ bar	18	5-7/16 x 1-15/16	3/5 lb.	Swivel adapter for std. pipe	51.00	Available as 545S with on/off switch. Also available in gold finish.
	546	As above	As above	–	As above	As above	50 or 150	As above	150Ω 0.176 MV/μ bar	20	8 x 1-3/8 x 2-1/16	16	Std. pipe	81.00	Mounted on vibration isolation.
	555W	As above	Ultra-cardioid	–	Aluminum alloy	Die-cast zinc. Satin chrome	35/50-150/250 Hi Z	As above	Hi Z 1.41 MV/μ bar	18	7-3/8 x 2-3/16 x 3-3/16	26	Std. pipe	51.00	On-off switch. Impedance switch. Available in gold finish.
	556S	As above	As above	–	As above	As above	30/50-150/250 Hi Z	40-15K	As above	20	7¾ x 2-3/16 x 3-1/16	32	Std. pipe	81.00	Vibration isolation.
	571	As above	Omni.	–	Shure Dura-coustic	Steel non-reflecting grey	50/250	50-10K	0.085 MV/μ bar	30	2½ x 3/4	2	Hand-held or Std. pipe	57.00	
	576	As above	As above	–	As above	As above	50 or 150	40-20K	150 0.095 MV/μ bar	25	8-3/8 x 3/4	7	As above	105.00	Slips easily in and out of stand adapter.
	578	As above	As above	–	As above	As above	50/250, Hi Z	50-15K	Hi Z 1.11 MV/μ bar	18	7-3/8 x 3/4	7	As above	49.50	On-off switch. Gold finish available. Std. pipe version only is 578S.
	550S	As above	As above	–	As above	Zinc and brass. Satin chrome	As above	As above	Hi Z 1.76 MV/μ bar	18	6½ x 1½	15	Std. pipe	41.40	On-off switch. Gold finish available.
	570	As above	Omni.	–	As above	Steel. Non-reflecting grey	50/250	50-12K. Shaped for lavalier use	0.094 MV/μ bar	30	2½ x 3/4	2	–	57.00	Lavalier 570S model ($69.00) has on/off switch.

CS-4 MICROPHONES

MANUFACTURER	MODEL	TYPE	BASIC PATTERN	ADJUSTABILITY OR OTHER PATTERNS	DIAPHRAGM MATERIAL	CASE MATERIAL AND FINISH	OUTPUT IMPEDANCE-OHMS	FREQUENCY RESPONSE	SENSITIVITY OR OUTPUT LEVEL	LENGTH CABLE FURNISHED-FEET	DIMENSIONS-INCHES	WEIGHT-OUNCES	MOUNTING METHOD	PRICE	COMMENTS
Shure (Cont'd.)	560	As above	As above	–	As above	Metal. Black satin	150/250, Hi Z	40-10K. Shaped for lavalier use	Hi Z 1.33 MV/μ bar	18	3-29/32 x 1-1/3	5	–	25.50	PA lavalier.
	540S	As above	As above	–	As above	Die-cast zinc. Satin chrome and black	50/250, Hi Z	60-13K	Hi Z 1.76 MV/μ bar	15	1-21/32 x 3-5/8	16	Std. pipe	29.97	On/off switch. Adjustable frequency response.
	315S	Ribbon	Bi-directional	–	Metallic	Die-cast zinc. Satin chrome	30/50, 150/250, Hi Z	50-12K	Hi Z 1.41 MV/μ bar	18	6 x 1-7/16 x 1-3/32	16	Std. pipe	54.90	On-off and multi-impedance switches.
	330	As above	Unidirectional	–	As above	As above	50,150,200	30-15K	200 0.111 MV/μ bar	20	7-9/32 x 1-7/32 x 1-7/8	24	Std. pipe	72.00	Impedance switch. Vibration isolation.
Sony	F-91	Dynamic	Omni.	–	Mylar	Aluminum. Satin finish	150/250,10K	40-20K	–58 db	20	Not given	Not given	Std. pipe	149.50	With desk stand and carrying case.
	F-113	As above	Cardioid	–	As above	As above	As above	30-16K	–57 db	20	Not given	Not given	Std. pipe	249.50	With windscreen, desk stand and carrying case.
	F-75	As above	As above	–	As above	As above	As above	30-14K	–48 db	20	Not given	Not given	Hand-held	395.00	Highly directional wave type. With carrying case.
	C-37	Condenser	Omni.	To cardioid	As above	As above	50 or 250	20-18K ± 2 db	–52 db	Not supplied	Not given	Not given	Std. pipe	295.00	With power supply and carrying case.
	C-57	As above	As above	As above	As above	Aluminum. Satin and flat grey finish	As above	20-20K ± 2 db	–53 db	Not supplied	Not given	Not given	Std. pipe	375.00	As above.
	C-220	Stereo condenser	As above	To cardioid or bidirectional	As above	Aluminum. Satin finish	As above	30-15K ± 2 db	–53 db	Not supplied	Not given	Not given	Std. pipe	650.00	Stereo pick-up.
Superex	MB-2	Dynamic	Directional	–	Mylar	ABS plastic	20	50-12K ± 3 db	–57 db	7	1½ x 1½	3	Thumb nut	17.95	Earphone/boom type. This, and model below mount on Superex earphones.
	MB-3	Ceramic	As above	–	Aluminum	As above	50K	80-8K ± 3 db	–55 db	7	As above	2	As above	12.95	As above.
Turner	58	Dynamic	Omni.	–	Mylar	Aluminum. Brown painted finish	150, Hi Z	60-13K	–60 db	25	1 x 4	3½	–	57.00	Lavalier. Model available with on-off switch at $67.00.
	500	As above	Cardioid	–	As above	Chrome metal. Satin finish	As above	40-15K	–55 db	20	1-17/32 x 6-13/16	12	Hand-held	84.00	Clamp for std. pipe. Available at $87.50 with on/off switch.
University	1000	Dynamic	Cardioid	–	Unilar	Die cast zamak 3. Silver grey and matte black	50,200, Hi Z	30-16K	–147 db (EIA)	18	8-13/16 x 1¾	32	Std. pipe with clamp	81.00	Model 1040 identical except has on-off switch. $87.00.
	1050	As above	As above	–	As above	As above	As above	As above	As above	18	10-3/8 x 1¾	32	Std. pipe	91.20	On-off switch.
	1100	As above	As above	–	As above	As above	As above	As above	As above	18	7-13/16 x 1½	32	Std. pipe	74.40	Shock mounted.
	1140	As above	As above	–	As above	As above	As above	As above	As above	18	9-1/16 x 1½	32	Hand-held	81.72	Identical mike with pipe mount base - model 1150, $85.50. Both have on/off switch.
	2050	As above	Omni.	–	As above	As above	50 or Hi Z	50-14K	–143 db (EIA)	18	8-15/16 x 1-5/32	2½ lbs.	Std. pipe	33.18	On/off switch.
	2100	As above	As above	–	As above	As above	50,200 or Hi Z	30-20K	–148 db (EIA)	18	7¾ x 1-1/8	24	–	39.30	Lavalier.
	2000	As above	As above	–	Not given	As above	50 or Hi Z	50-14K	–143 db (EIA)	15	6 x 1-5/32	32	Hand-held	23.10	Std. pipe clamp. Also available as model 2040 at $30.60. Has on/off switch.
	2140	As above	As above	–	Unilar	As above	50,200, Hi Z	30-20K	–148 db (EIA)	18	9 x 1-1/8	28	Hand-held	45.36	As model 1140. Model 2150 is $46.74.
	2200	As above	As above	–	As above	As above	As above	As above	As above	18	10¾ x 1-1/8	32	Hand-held	43.74	Shock mounted. Model 2240 is identical except has on/off switch.

CS-4 MICROPHONES

MANUFACTURER	MODEL	TYPE	BASIC PATTERN	ADJUSTABILITY OR OTHER PATTERNS	DIAPHRAGM MATERIAL	CASE MATERIAL AND FINISH	OUTPUT IMPEDANCE-OHMS	FREQUENCY RESPONSE	SENSITIVITY OR OUTPUT LEVEL	LENGTH CABLE FURNISHED-FEET	DIMENSIONS-INCHES	WEIGHT-OUNCES	MOUNTING METHOD	PRICE	COMMENTS
University (Cont'd.)	2250	As above	As above	–	As above	As above	As above	As above	As above	18	11-13/16 x 1-1/8	32	Std. pipe	51.18	On/off switch.
	4000	As above	As above	–	As above	As above	As above	50-20K	As above	18	5-1/8 x 1-1/8	24	–	54.96	Lavalier.
	4040	As above	As above	–	As above	As above	As above	As above	As above	18	6-7/8 x 1-1/8	28	Hand-held	63.64	As model 1140 and 2140. Model 4050 is $65.48.
	4080	As above	As above	–	As above	As above	50 or Hi Z	60-20K	As above	25	3-3/8 x 1-3/32	28	–	52.96	Lavalier.
	8000	As above	Cardioid	–	Not given	As above	250 or Hi Z	70-15K	–154 db (EIA)	15	6-3/8 x 1-23/32	20	Hand-held	29.95	Std. pipe clamp.
	8100	As above	As above	–	Not given	As above	As above	As above	As above	15	As above	20	Std. pipe	31.50	Shock mounted. On/off switch.
	9000	As above	Unidirec-tional	–	Not given	Grey cycolac high impact ABS.	Hi Z	95-95K	–55 db	Coil extends to 6	4 x 2¼ x 1¾	10	Hand-held	24.75	Panel mounting bracket supplied.

CS-5 LOUDSPEAKER MECHANISMS

MANUFACTURER	MODEL	TYPE	POWER CAPACITY - Watts	IMPEDANCE - Ohms	FREQUENCY RESPONSE	SENSITIVITY - Watts Input for +85 db level 10 feet on axis	VOICE COIL DIAMETER	DIMENSIONS - Inches - Dia. x Depth	WEIGHT - Pounds	PRICE	COMMENTS
Altec	604E	Coaxial	35	8-16	20-22K	100 db SPL at 4 feet from 1 watt	LF 3 HF 1¾	13¾ x 11⅝	34	199.00	6 cubic foot enclosure recommended.
Atlas	HLE-1-32	Explosion proof trumpet	60	16	190-12K	128 db SPL at 4 feet from 60 watt	2	16½ x 21½	25	137.00	Also available: HLE-2-32. Sensitivity is 126.5 db, price $157.00.
	HLE-1-30	As above	60	16	250-12K	125 db as above	2	14 x 6 x 17	22	122.50	HLE-2-30 at $142.50 is rated as 123.5 db.
	WT-6	Cone	15	8	100-15K	Not given	Not given	15 x 12	16	60.00	High-fidelity weatherproof.
	W-6	Cone	15	8	100-8K	Not given	Not given	15 x 12	14	45.00	Weatherproof.
	MO-1	Mobile trumpet	25	8	300-13K	122db (as HLE-1-32)	1½	7¼ x 6½	4½	44.00	
	DC-5	Baffle	6	8	120-7K	Not given	¾	7 x 14	3	23.75	
	PD-20	Driver	20	16	120-7K	125 db (as HLE-1-32)	2	Not given	2¾	23.00	
	PD4V	Driver	30	16	85-7K	128 db as above	2	Not given	4	29.50	
	PD5VH	Driver	40	16	80-12K	131 db as above	2	Not given	5	37.50	PD5VT - same driver except has built-in matchup transformer. Price $51.00.
	PD60	Driver	60	16	70-12K	136 db as above	2	Not given	6	51.00	PD60T - as above. Price $62.00.
	DR32	Horn only	–	–	–	–	–	16½ x 12½	10	30.00	

CS-5 LOUDSPEAKER MECHANISMS

MANUFACTURER	MODEL	TYPE	POWER CAPACITY - Watts	IMPEDANCE - Ohms	FREQUENCY RESPONSE	SENSITIVITY - Watts Input for +85 db level 10 feet on axis	VOICE COIL DIAMETER	DIMENSIONS - Inches - Dia. x Depth	WEIGHT - Pounds	PRICE	COMMENTS
Atlas (Cont'd.)	DR42	Horn only	–	–	–	–	–	21 x 16	14	36.00	
	DR54	Horn only	–	–	–	–	–	26 x 19	23	49.00	
	CJ-44	Trumpet	40	16	115-12K	129 db (as HLE-1-32)	2	23 x 13 x 19	19	79.50	
	RC-6	Redial horn only	–	–	140 cycle cutoff	–	–	25 x 13¾	22	50.00	
	EC-10	Trumpet	6	8	400-13K	112 db (as HLE-1-32)	¼	6¼ x 6⅛	2½	23.75	
	HU-12N	Trumpet	7.5	8	350-13K	115 db as above	¼	7½ x 7¼	3½	28.00	
	HU-15N	Trumpet	25	8	250-13K	123 db as above	1	9¾ x 9	7	45.25	
	HU-24N	Trumpet	25	8	200-13K	124 db as above	1	11¼ x 12	6	38.50	
	CJ-14N	Trumpet	7½	8	350-13K	115 db as above	¼	5½ x 9½ x 8	3½	31.00	
	CJ-30N	Trumpet	25	8	250-13K	121 db as above	1	6 x 14 x 11¼	7	43.50	
	TP-15N	Twin trumpet	25	8	250-13K	120 db as above each horn	1	9¾ x 16½	7½	53.50	
	TP-24N	Twin trumpet	25	8	250-13K	121 db as above each horn	1	11¼ x 23	8	59.50	
	DU-12N	Trumpet	7½	8	350-13K	115 db as above	¼	7 x 14	4	36.00	
Electro-Voice	PA7	Reentrant projector	7½	8	400-13K	60 db (EIA)	Not given	6¾ x 6	2	27.00	Weatherproof paging.
	PA30	Reentrant projector	30	8	250-14K	54 db (EIA)	Not given	11 x 6½ x 8½	5 lbs. 9 oz.	34.50	As above - high power.
	847	Compound diffraction projector	25	16	250-10K	114 db (EIA)	Not given	11⅜ x 7⅞ x 10 7/32	8	51.00	Fiberglas high-fidelity horn - weatherproof.
	848	Compound diffraction projector	30	16	150-10K	52 db (EIA)	Not given	10½ x 20½ x 20	13½	82.50	Fiberglas, weatherproof.
	SP15	Cone	40	16	25-15K	53 db (EIA)	2½	15⅝ x 8 x 8⅛	25	93.75	15 inch high-fidelity speaker SP-12 similar except 12 inch. 8 cu. ft. enclosure recommended.
	SP15B	Coaxial	30	16	30-15K	51 db (EIA)	2	15⅛ x 7⅝	12	52.50	15 inch high-fidelity speaker. SP-12B and SP-8B similar except for size. 6 cu. ft. recommended.
	15TRX	Three-way cone	40	16	25-20K	55 db (EIA)	2½ woofer tweeter not given	15⅛ x 8¼	27	143.75	15 high-fidelity speaker. Sub cone for mid-range, tweeter is coaxial horn. 8 cu. ft. recommended. 12 TRX similar except for size.
	15TRXB	Three-way cone	30	16	30-20K	52 db (EIA)	2 woofer tweeter not given	15⅛ x 9	14	89.38	As above. 12TRXB also available.
	30W	Cone woofer	100	16	15-300	54 db (EIA)	2½	29¾ x 13 15/32	34	281.25	30 inch high-fidelity woofer. 20 cu. ft. recommended.
	LS-15	Cone	40	8	35-14K	47 db (EIA)	2	15⅛ x 6 11/32	9	31.25	15 inch high-fidelity speaker. 6 cu. ft. recommended. LS-12 and LS-8 similar except for size.
	LT-12	Three-way cone	20	8	40-18K	45 db (EIA)	2 - Woofer 1 - Tweeter	12⅛ x 5¼	8	40.00	12 inch high-fidelity speaker. Sub cone for mid-range, tweeter is coaxial horn. 4 cu. ft. recommended. LT-8 is similar except for size.
	MC-8	Three-way cone	12	8	50-13K	46 db (EIA)	Not given	8¼ x 3 5/16	4	15.63	8 inch high-fidelity speaker.
Fanon	HDA-5	Horn	15	8	400-12K	118 db SPL 4 feet on axis at full power	Not given	5¼ x 6	3¼	17.50	45 ohm version available.
	HDA-6	Horn	15	8	350-13K	119 db SPL as above	Not given	6½ x 8	3½	24.95	As above.
	HDA-10	Horn	30	8	250-13K	124 db SPL as above	Not given	10¼ x 9	5	32.95	As above.
	HDB-8	Horn	25	8	350-13K	122 db SPL as above	Not given	8¼ x 5½ x 8½	3¾	33.95	As above - wide dispersion.
	HDB-12	Horn	30	8	250-13K	124 db SPL as above	Not given	6½ x 11 x 11½	6½	42.50	As above.
	HFA-12	Coaxial horn	10	8	100-15K	Not given	Not given	12 x 9	7½	44.95	Weatherproof music reproducer.

CS-5 LOUDSPEAKER MECHANISMS

MANUFACTURER	MODEL	TYPE	POWER CAPACITY - Watts	IMPEDANCE - Ohms	FREQUENCY RESPONSE	SENSITIVITY - Watts Input for +85 db level 10 feet on axis	VOICE COIL DIAMETER	DIMENSIONS - Inches - Dia. x Depth	WEIGHT - Pounds	PRICE	COMMENTS
Fanon (Cont'd.)	HFA-8	Horn with built-in cone tweeter	5	4	150-10K	Not given	Not given	8 x 5½	4	24.95	As above.
	HS-9	Wall mount speaker	10	8	250-6K	Not given	Not given	7 x 9 x 2¾	4	28.50	Fits standard wall recesses.
	HA-15 HB-15	Wall mount speaker	–	–	200 cycle cut-off	–	–	15 x 11½	5	28.50	HB-15 is wide dispersion. Price $37.95.
	HA-20 HB-20	Horn only	–	–	150 cycle cut-off	–	–	20 x 16	6¾	33.95	As above. HB-20 price $42.95.
	DU-25	Driver only	25	16	120-6.5K	Not given	Not given	3 x 3	2	23.50	
	DU-35	Driver only	35	16	85-7.5K	Not given	Not given	4¼ x 4	3	29.95	DU35T, at $41.95, is identical except has built-in matching transformer.
	DU-45	Driver only	45	16	80-12K	Not given	Not given	4¾ x 4	3¼	36.95	
	DU-60	Driver only	60	16	70-12K	Not given	Not given	5½ x 5	4¼	47.95	DU-60T, at $59.95, is identical except has built-in matching transformer.
Federated	RKVC	Cone	8	8	55-11K ±2db	94 db (EIA)	¾	5¼ x 1½	1¼	9.95	For wall installations 1 cu. ft. recommended enclosure.
Jensen	TX-525	Plastic cone	10	8	70-10K	Not given	1	5¼ x 2 1/32	2¼		Industrial, outdoor or tropical use. 1.5 cu. ft. enclosure recommended.
	TX-800	Plastic cone	15	8	60-10K	Not given	1¼	8¼ x 3	3¼		As above.
	H-1380	Coaxial	25	16	50-15K	88 db SPL at 10 feet from 1 watt	Woofer 1½. Tweeter not given	12⅜ x 6¾	9		12 inch high-fidelity speaker with multi-cell horn tweeter mounted coaxially. 1½ to 3 cu. ft. enclosure recommended.
	K-1350	Coaxial	14	8	45-14K	85 db SPL as above	Woofer 1. Tweeter not given	12⅛ x 4¾	3¾		As above except tweeter is 3 inch cone.
Lansing	375-537-512	High-frequency driver/horn/lens	50	16	Not given	Not given	4	36Wx12Hx25L	67	375.00	High-fidelity tweeter assembly.
	LE8T	Cone	20	16	Not given	Not given	2	7 x 3¾	11	66.00	High-fidelity, full-range speaker. 1 cu. ft. or more enclosure recommended.
Misco	K-120	Coaxial	15	8	40-20K	Not given	Woofer 1½. Tweeter not given	12¼ x 6½	Not given	31.50	Tweeter is at apex of woofer cone. Infine baffle enclosure recommended.
	K-12-HFD	Dual-cone	15	8	40-13K	Not given	1½	12¼ x 6½	Not given	21.00	Infinite baffle recommended.
	K-12-HFW	Cone woofer	15	8	40-14K	Not given	1½	12¼ x 6½	Not given	19.50	As above.
	F-8-HF	Cone	10	8	40-13K	Not given	⅜	8¼ x 3¾	Not given	10.80	
	F-8-HFD	Dual cone	10	8	40-17K	Not given	¾	8¼ x 3¾	Not given	12.00	
	D-4-HFT	Cone	10	8	2K-20K	Not given	¾	4 x 2½	Not given	6.75	High-frequency tweeter.
Quam	15C12CO	Coaxial	25	8	25-18K ±5db	Not given	Not given	15 x 7¾	6½	52.50	12 and 8 inch versions are available. High-fidelity with coaxially mounted cone tweeter.
	12C12X	Cone	18	8	30-16K ±5db	Not given	Not given	12 x 4½	4¼	26.00	Full range dual-cone. 10, 8, 6 x 9 and 6½ inch versions are available.
	15C12L	Cone	15	8	20-4K ± 5 db	Not given	Not given	15 x 7½	5¼	35.00	Woofer. 12 inch version available.
	5A15T	Cone	10	14	2K-15K ± 5 db	Not given	Not given	5 x 2 5/16	1	6.50	Cone tweeter. 3½ inch version available.
University	MIL-A	Trumpet	7½	4, 8, 45	350-13K	Not given	Not given	7 13/16 x 6⅞	3¼		Paging/talkback.
	CMIL-A	Trumpet	7½	4, 8, 45	350-13K	Not given	Not given	6¼ x 9½ x 8½	4		As above.
	IB-A	Trumpet	25	4, 8, 45	250-13K	Not given	Not given	10¼ x 9	4		As above.
	CIB-A	Trumpet	25	4, 8, 16	250-13K	Not given	Not given	7⅝ x 14 x 12	5½		As above.
	IBR-A	Trumpet	25	4, 8, 16	300-10K	Not given	Not given	13 x 10¼	5¼		As above.

CS-5 LOUDSPEAKER MECHANISMS

MANUFACTURER	MODEL	TYPE	POWER CAPACITY - Watts	IMPEDANCE-Ohms	FREQUENCY RESPONSE	SENSITIVITY - Watts Input for +85 db level 10 feet on axis	VOICE COIL DIAMETER	DIMENSIONS - Inches - Dia. x Depth	WEIGHT - Pounds	PRICE	COMMENTS
University (Cont'd.)	MIS	Trumpet	5	4, 8, 16	500-13K	Not given	Not given	5½OD x 4⅞	2½		As above. For flush mounting.
	CR	Trumpet	20	16	250-8K	Not given	Not given	11½ x 11½	8¾		Paging/talkback.
	LIL-8	Trumpet	15	8	300-10K	Not given	Not given	15½ x 6⅞	4½		As above. Decorator styled.
	ES-50	Trumpet	50	16	250-10K	Not given	Not given	6 13/16 x 6⅞	5½		Multi-duty. Recommended for electronic siren applications.
	MM-2	Trumpet	25	16	350-10K	Not given	Not given	6 x 5	5¼		Completely weatherproof.
	MM-2F	Trumpet	25	16	350-10K	Not given	Not given	7¼OD x 3¾	5¼		As above. Flush mounting.
	MM-2TC	Trumpet	25	16	350-10K	Not given	Not given	10 x 6 7/16 x 4 7/16	8½		As above. Bulk head mount. Completely waterproof.
	MM-2TC-T	Trumpet	25	16	350-10K	Not given	Not given	10 x 6 7/16 x 4 7/16	9¾		As above with built-in multi-impedance transformer and pad attenuator.
	MSR	Trumpet	25	16	250-10K	Not given	Not given	10¾ x 7⅛ x 8⅛	10⅛		Bulkhead or wall mount completely waterproof. MSR-T version is identical; has built-in transformer and pad.
	4A4L	Trumpet only	–	–	–	–	–	30¾ x 28⅞	46		Super-power. Up to 240 watts depending on drivers used.
	B-6P	Trumpet only	–	–	–	–	–	12½ x 21⅜	55		As above. Maximum power is 360 watts.
	B-12P	Trumpet only	–	–	–	–	–	31½ x 47	60		As above. Maximum power is 720 watts.
	2-WP	Trumpet only	–	–	–	–	–	8½ x 20½	4		Bi-directional paging/talkback.

CS-6 ENCLOSED SPEAKERS

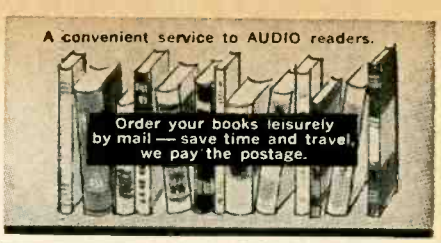
MANUFACTURER	MODEL	ENCLOSURE TYPE	DRIVERS			POWER CAPACITY - Watts	CROSSOVER TYPE	FREQUENCY RESPONSE	SENSITIVITY - Watts Input for +85db level 10 feet on axis (Unless specified otherwise)	DIMENSION - Inches - H x W x D	WEIGHT - Pounds	FINISHES AVAILABLE	PRICE	COMMENTS
			QUANTITY	SIZE - Inches	TYPE									
Altec	A7-500	Reflex and exponential horn.	1 HF 1 LF	• 15	Horn Horn	30	RC	35-22K	109-2 db with 1 watt input at 4 feet	54 x 30 x 24	142	Theater grey; walnut	315.00 grey 411.00 wal.	
	844A	Bass reflex	1 HF 2	– 12	Horn Horn	30	RC	30-22K	Not given	29⅜ x 35 x 17⅜	Not given	Walnut	346.50	
Atlas	WR-7	Steel cabinet	1 HF 1 LF	4 6	Direct Radiators	15	None	70-15K	Not given	18 x 8 x 5½	8	Beige paint	37.50	
	TW-11	Steel baffle	1	8	As above	8	None	80-10K	Not given	9 diameter	5½	Beige paint	19.00	

CS-6 ENCLOSED SPEAKERS

MANUFACTURER	MODEL	ENCLOSURE TYPE	DRIVERS			POWER CAPACITY - Watts	CROSSOVER TYPE	FREQUENCY RESPONSE	SENSITIVITY - Watts Input for +85db level 10 feet on axis (Unless specified otherwise)	DIMENSION - Inches - H x W x D	WEIGHT - Pounds	FINISHES AVAILABLE	PRICE	COMMENTS
			QUANTITY	SIZE - Inches	TYPE									
Atlas (Cont'd.)	C-46	Column	6	4	As above	20	None	200-10K	Not given	28 x 5¼ x 5	8¼	Beige paint	62.50	
	C-66	Column	6	6	As above	40	None	125-10K	Not given	42 x 7¾ x 6	18½	Beige paint	95.00	
Bozak	CM-200-10	Column	2 LF 8 HF	6 2	Direct radiators, slot loaded	50	Not given	200-15K	0.42 watts at 4 feet	42 x 9 x 6¾	55	Unfinished, beige or medium grey	199.50	For severe reverberation conditions.
	CM-209-6	Column	6	6	As above	75	None	75-13K	0.12 watts at 4 feet	42 x 11 x 8¼	85	As above	225.00	General purpose.
	CM-209-18	Column	6 LF 12 HF	6 2	As above	50	Not given	150-13K	0.19 watts at 4 feet	44 x 12½ x 8	105	Beige enamel	395.00	Concert service weatherproof finish.
	CM-109-6	Column	6	8	As above	100	None	50-10K	.024 watts at 4 feet	57 x 11 x 11¼	110	Unfinished or beige enamel	325.00	General purpose, heavy duty.
	CM-109-18	Column	6 LF 12 HF	8 2	As above	100	Not given	100-13K	.04 watts at 4 feet	57 x 15½ x 10	155	Beige enamel	495.00	Concert series, heavy duty.
Electro-Voice	Sentry I	Wood	1 HF 1 LF	– 12	Horn Direct radiator	20	Not given	30-20K	49 db (EIA)	17 x 37 x 21¾	82	Sanded wood	248.33	Broadcast monitor.
	Sentry II	Wood	1 HF 1 LF	– 12	Horn Direct radiator	20	Not given	30-20K	49 db (EIA)	32 x 20 x 13	68	As above	265.00	As above.
	Sonocaster	Plastic	1	8	Direct radiator	30	None	70-13K	46 db (EIA)	16¾ x 17 x 5⅞	8	Beige	36.00	Molded in carrying handle.
	Musicaster I	Cast aluminum	1	8	Horn	30	LC	60-13K	48 db (EIA)	21½ x 21½ x 8½	31	–	100.00	
	Musicaster II	Cast aluminum	1 HF 1 LF	– 8	Horn Cone driver	30	LC	60-18K	As above	As above	33	–	135.00	
	LR4A	Wood column	3 HF 9 LF	3½ 3 x 5	Cone drivers	25	LC	200-15K	49 db (EIA)	49 x 7½ x 13	26	Tan	125.00	
	LR4S	Metal column	12	4	As above	25	LC	200-15K	As above	52 x 7½ x 4⅝	28	Tan	140.00	
	LR7	Wood column	2 HF 9	– 5 x 7	Horns Cone drivers	50	LC	50-17K	51 db (EIA)	60½ x 11 x 14	59	Tan	275.00	
Geloso	N-3111	Steel column	5	6 x 9	Cone drivers	15	None	100-10K ±3db	Not given	48 x 6 x 4	14	Grey paint		
	N-3112	As above	7	6 x 9	As above	20	None	100-10K	Not given	68 x 6 x 4	20	As above		
	N-3113	As above	1 HF 3 LF	Not given 6 x 9	– Cone drivers	12	Not given	60-15K ±3db	Not given	40 x 12 x 6	Not given	As above		
	N-3110	As above	4	6 x 9	As above	12	None	100-10K ±3db	Not given	40 x 6 x 4	11	As above		
Jensen	55	Wood column	5 LF 5 HF	5¼ 3	Direct radiators	30	LC	100-10K	91 db – S.P. on axis at 1 watt, 10 feet	30 x 11½ x 3¾	20	Grey paint		Has shaping networks for constant angle dispersion.
	1010	Wood column	10 LF 10 HF	5¼ 3	As above	60	LC	100-10K	95.5 db to above specs.	56⅞ x 11½ x 3¾	36½	As above		As above.
	E-516	Vented enclosure	6 HF 1 MF 1 LF	– – 15	Horns Horn Direct radiator	40	LC	40-15K	Not given	46 x 27 x 18	90	Black		High efficiency small theater reproducer.
	G-516	As above	As above	As above	As above	As above	As above	As above	Not given	47 x 27 x 19	101	Walnut		As above except totally enclosed.
	TXR-525	Die-cast aluminum	1	5¼	Direct radiator	10	None	70-10K	Not given	11 x 8¼ x 4	6¼	Beige		For all in or outdoor or tropical installations.

CS-6 ENCLOSED SPEAKERS

MANUFACTURER	MODEL	ENCLOSURE TYPE	DRIVERS			POWER CAPACITY - Watts	CROSSOVER TYPE	FREQUENCY RESPONSE	SENSITIVITY - Watts Input for +85db level 10 feet on axis (Unless specified otherwise)	DIMENSION - Inches - H x W x D	WEIGHT - Pounds	FINISHES AVAILABLE	PRICE	COMMENTS
			QUANTITY	SIZE - Inches	TYPE									
Jensen (Cont'd.)	TXR-800	Molded glass fibre	1	8	As above	15	None	60-10K	Not given	13⅜ x 13¾ x 7⅞	10¾	As above		As above.
	RK-62	Metal case	1	6	As above	8	None	100-8K	Not given	9¼ x 8 1/16 x 3⅞	3½	As above		Bidirectional heavy duty speech reproducer
Karlson	AP-9C	Karlson projector	1	6 x 9	Direct radiator	12	None	50-15K	0.405	6¼ x 12 x 12	7	White lacquer	29.50	Ceiling or wall mounting. 120° horiz. dispersion.
	AP-W	As above	1	6 x 9	As above	12	None	80-15K	0.6	8 x 10½ x 16	9	White sand finish	49.50	Wall mount. 140° horiz. dispersion.
Klipsch	K-447	Horn enclosure	1 HF 1 MF 1 LF	1 2 15		60	Three-way. Type not given.	60-17K ±5db	107 db SPL at 4 feet 1 watt	33 x 24 x 24	105	Black	455.00	In wood finishes this is the La Scala system.
KSC	P85-3	Wood enclosure with wall/ceiling brackets	1 HF 1 MF 1 LF	10 3½ 3½	Direct radiators	25	Three-way LC	60-20K ±5db	90 db SPL at 3 feet – 2V	11⅞ x 11⅞ x 20	28	Unfinished pine		Adjustable mid and high range. Adjustments on front of enclosure.
Lansing	D50SMS7	Wood enclosure, infinite baffle.	1HF 1LF	6 15	Direct radiators	60	LC	Not given	Not given	30 x 24 x 20	90	Satin grey	516.00	Broadcast monitor. 6 cu. ft. enclosure.
	D43085	Wood rear loading horn	1 HF 1 MF 1 LF	4 7 15	As above	50	LC	Not given	Not given	48 x 24 x 24	181	Black	741.00	High efficiency theater system.
	D55080	As above	1 HF 2 LF	7 15	As above	100	LC	Not given	Not given	50 x 36 x 30	324	Black	909.00	High power system.
Misco	MMS-8-F	Steel	1	8	Direct radiator	8	None	70-13K	Not given	9 x 9 x 4½	1¼	Gold electrostatic with clear epoxy	19.95	Outdoor use.
	MS-3-B MS-3-BB	Steel	1	3½	As above	3-4	None	120-8K	Not given	4 x 4 x 2	1¼	As above	MS-3-B 7.95 MS-3-BB 9.95	BB model has mounting bracket. Both models for high speech intelligibility.
University	CSO-4	Wood column	4	Not given	–	75	None	70-17K	Not given	41⅜ x 11⅞ x 7¾	40	Grey paint		Completely weatherproof. Hor. 120° Vert. 18°
	CSO-6	As above	6	Not given	–	120	None	65-14K	Not given	60¼ x 11⅞ x 7¾	51	As above		As above. Hor. 120° Vert. 16°
	CS-3	As above	8	Not given	–	25	None	150-10K	Not given	48 x 7½ x 8¾	33	Grey fleck paint		Tapered response. Hor. 120° Vert. 22°
	WLC	Metal	1	Not given	–	30	None	50-15K	Not given	33½ x 20	68	Grey paint		Weatherproof hi-fi speaker.
	MLC	Metal	1	Not given	–	15	None	150-15K	Not given	12¾ x 9⅛ x 10⅝	10	Green		As above.
	CLC	Metal	1	Not given	–	30	None	55-14K	Not given	22¾ x 12 11/16	23	Green		As above.



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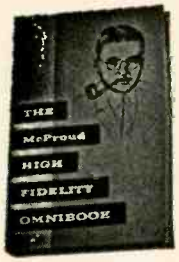

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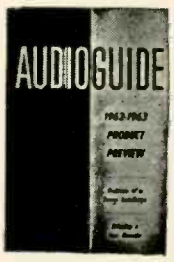

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LETTERS

(from page 4)

Finally, one of our brilliant engineers hit on the perfect way to take care of Mr. Canby. Since his requirements for wastebasket-type cartons are variable, although rigid, we voted to ship him one of each type we use . . . at last count (and it's hard to keep track) about 473 different varieties. In that number we feel he will find one, or perhaps even two, that will meet his specs. Oh . . . hold it! We can't ship those empty cartons. It seems that the reason we put products inside the cartons is to give them strength and rigidity. The cartons would be completely ruined if shipped without products. Oh, well, we'll come up with something.

Incidentally, we certainly want to apologize for your receiving an Electro-Voice product in perfect condition, while the carton was badly damaged. We will immediately check our quality control procedures to be sure nothing like this happens in the future.

We are sending Mr. Canby a sample of one of our better boxes in hopes that it will meet his needs temporarily. If he will send us detailed blue-prints and a specification manual on the exact package he needs, we may be able to customize something.

Many thanks for your patience and understanding. We trust that we may improve our packaging products sufficient to earn an A-recommended rating in a future review.

WILLIAM S. SUTHERLAND
Manager,
Advertising and Sales Promotion
Electro-Voice,
Buchanan, Mich.

EQUIP. PROFILE

(from page 34)

is moved to "manual" before placing the tonearm on the record.

Now for changer operation, Dual's changer spindle replaces the short one. This isn't dropped in, however, but must be inserted so that the small key at the bottom fits into a slot in the turntable shaft, and the spindle then given a short clockwise turn. (The reason for this will come in a moment.)

Up to ten records can now be placed on the three-prong platform of this spindle. Automatic start is now the same as with the single-play spindle. If you look carefully at the stack during cycling, you will note all the records but the bot-

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More classified on page 67

tom one rise up. This movement is accomplished by three soft grippers (located just above the platform) which expand against the center holes of the records and then move them up a fraction of an inch. The platform then retracts into the spindle to release the bottom record, the platform extends once more, and the stack is lowered to await the next cycle.

According to Dual, this "Elevator Action" was designed to lift all weight from the bottom record at the moment of its release. Because there is no force exerted on this record, Dual suggests that new records should be examined to make sure the label has been cut clean at the center hole. Any excess paper there may keep it from dropping. Our own records presented no problems, however.

Now, although the prime purpose of any changer spindle is to allow a sequence of records to *drop*, Dual's changer spindle also allows records on the platter to be lifted back *up* and off, either for removal or replay without need to remove the spindle itself. (The locked-in position of the spindle, as noted above, and the freely retracting platform prongs make this possible.)

Any record already on the platter, even with none on the spindle, can be started exactly the same as with the single play spindle. If there are records on top of the one you wish to replay, they can be removed entirely or just lifted back onto the platform.

To sum up, except for the drop of the first record when using the changer spindle, you can start, stop, or interrupt play exactly the same way with either spindle. And if you happen to start automatically without unlocking the tonearm, don't let it worry you. The tonearm is engaged by a slip clutch during cycling, and such restraint won't lead to malfunction. During play, the tonearm is free-floating.

So much for the operation of the Dual spindles. There's one other point which we'd also like to amend. On rechecking the accuracy of the 1010's stylus force adjust, we find each click stop adds or removes 0.5 gram (± 0.1 gram) stylus force *after the tonearm with cartridge installed is "zero balanced."* (We tried this with cartridges weighing from 7 to 14 grams.) Thus four click stops from the "zero" position will bring the force to Dual's recommended minimum of two grams (± 0.2 grams) stylus force for the 1010's tonearm.

An occasional reminder like this that we're not infallable is good for the soul. Hopefully our soul doesn't need much more improving. Æ

MORE CLASSIFIED

WANTED: Used Ampex PR10-2, 354, 351-2, 601-2, 602-2 or similar tape recorder; lathe; condenser microphones and other studio quality equipment. Send description and prices. M. Draper, P. O. Box 412, Huntsville, Alabama.

FOR SALE: McIntosh MC-240, MX-110; pair walnut KLH-4's. Late models, excellent. Best offers over 2/3 original price. Concertone CS-505-4R, ½ price. Glenn McComas, Saxonburg, Pennsylvania.

SALE: Klipsch horn, lacquered walnut, EV 848 mid-range and T35 tweeter, $375. Citation 1 preamplifier like new, $135. Crown SSX 800 recorder used 5 hours, solid state electronics, $1,000. William W. Wilson, 1911 Marconi Rd., Belmar, N. J.

MUSIMATIC: FM music without commercials. Easily connected to your tuner. $59.50 complete. Don Henderson Enterprises, Box 343, Reseda, Calif.

UHER Model 8000 tape recorder, new condition, $275. Robert B. Reed, 1209 Atlas Life Bldg., Tulsa, Oklahoma 74103.

¼" Tape Duplication
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U.S. Tape Duplicators, Box 3121
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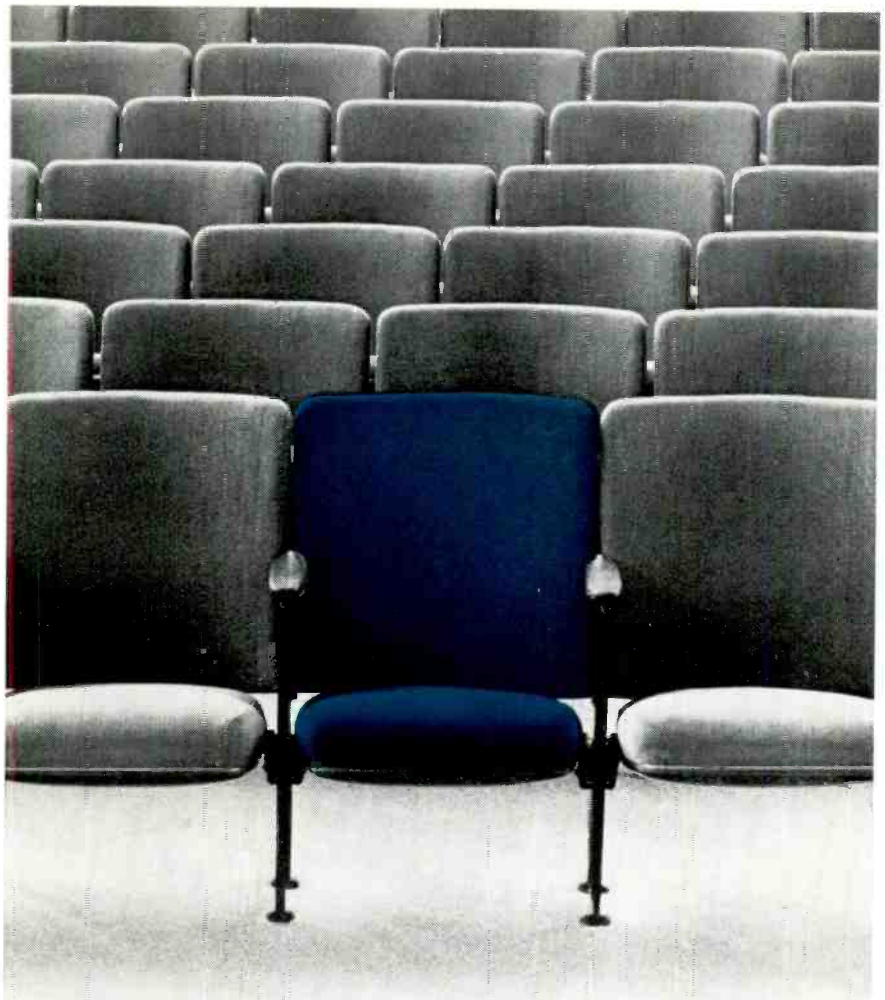
FISHER FM80 tuner, $65; 2 Knight mono preampifiers, $19 each; 50 watt Dynakit amplifier, $39; all attractively mounted on 19" rack panels. R. H. Wagner, 880 Ridgedale, Birmingham, Michigan.

WANTED: Marantz Model 3 crossover and Model 7 preamplifier. George Thomas, 2808 15th West, Seattle, Washington.

ADVERTISING INDEX



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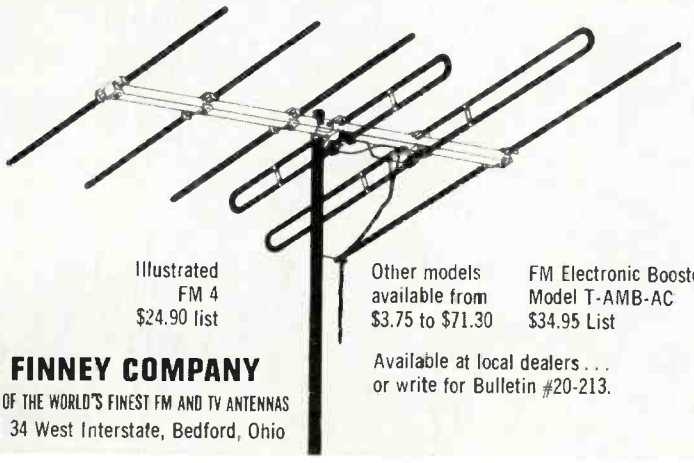

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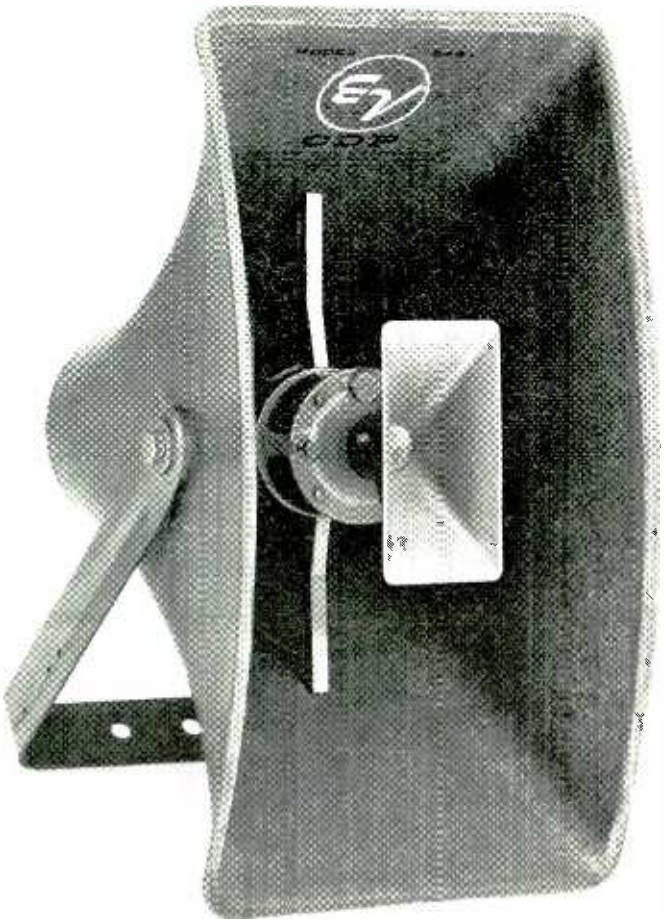

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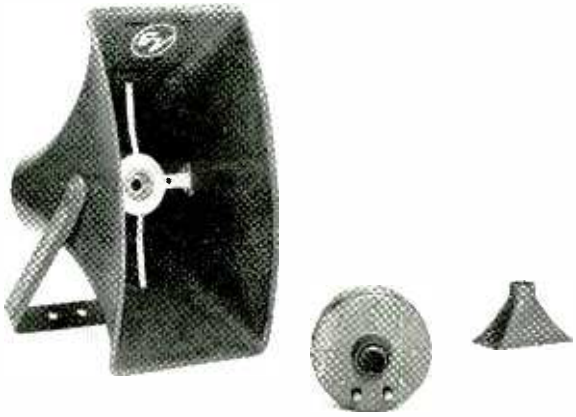
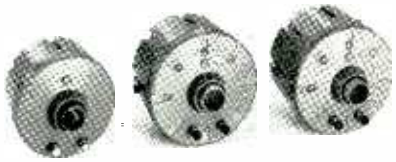


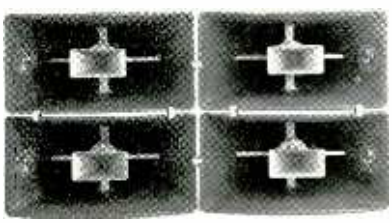
2. But sometimes more power—or more efficiency (or both) is needed. Simply choose the CDP horn (Model FC100) and our Model DC40 driver. Ten more watts, just like that!

3. And for bigger problems, a bigger driver. The DC50 provides 50 watts power handling plus the highest full-range efficiency of *any* driver, all with traditional CDP clarity and peak-free response.



4. Furthermore, you can have a low-loss 70.7-volt transformer built in. These DC30T, DC40T, and DC50T drivers fit the same horn perfectly. They also save you precious time and money during installation.

5. Here's something that may surprise you: the CDP with our RA-1 Radial Adapter is better than any so-called "radial horn" you may have tried. No hot spot at all, for really uniform coverage from corner to corner.



6. And when problems gang up, gang up the CDP's! It's the easy way to increase coverage or power to fit even the biggest installations. Any number can play.

7. OK. That's pretty versatile for a wide-angle horn. But what about concentrated coverage? Simple. The same drivers fit our AC100 horn as well. It offers the wide-range, low distortion advantages of the CDP, but with more sound level on axis than even the largest horns can give you. It's like getting extra watts free!

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