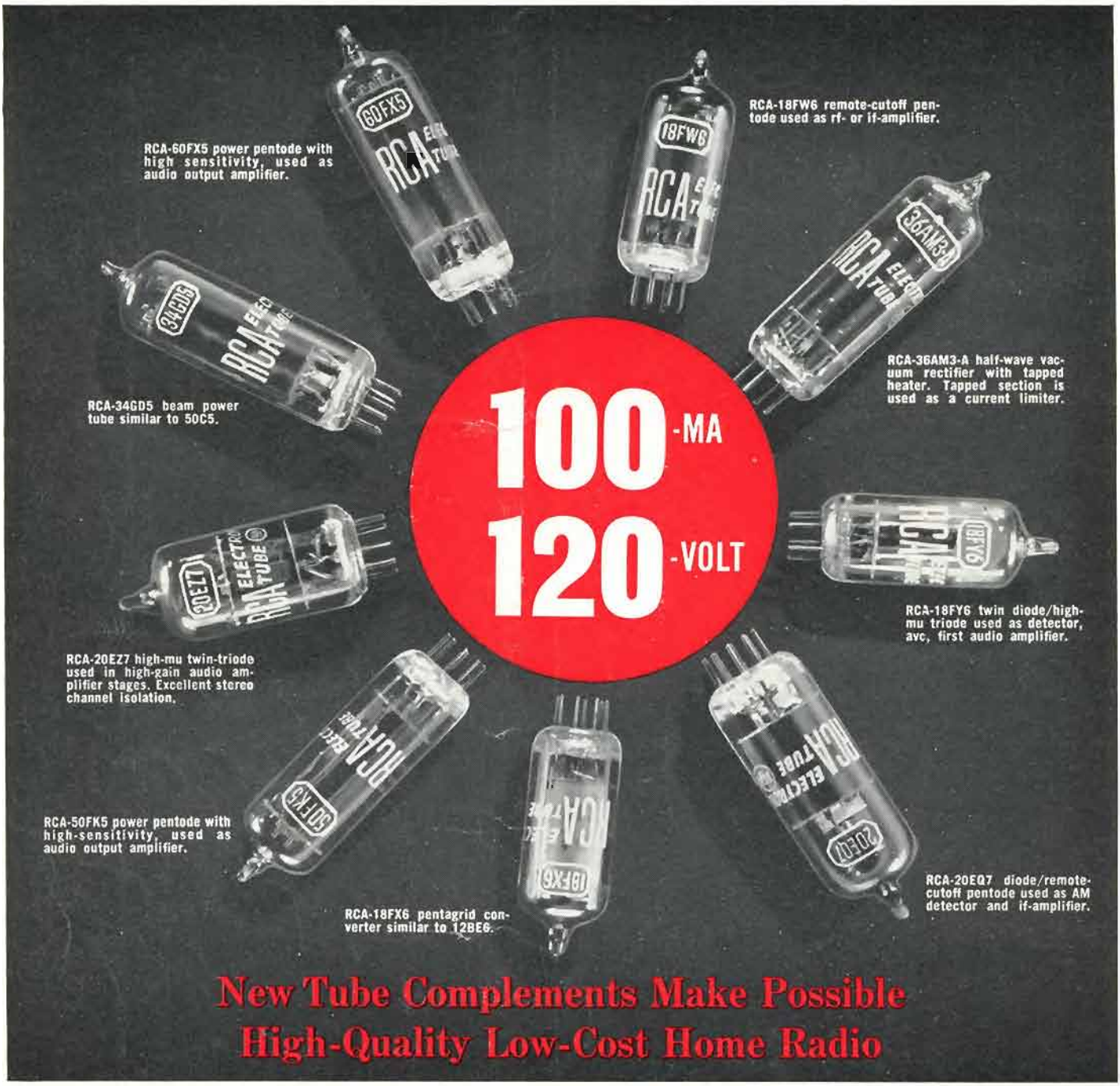
AUDIO

DECEMBER, 1960
50¢

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New RCA complements of 100-milliampere heater tubes for 120-volt series-heater complement, bring important sales advantages to your ac-dc radio and phonograph designs.

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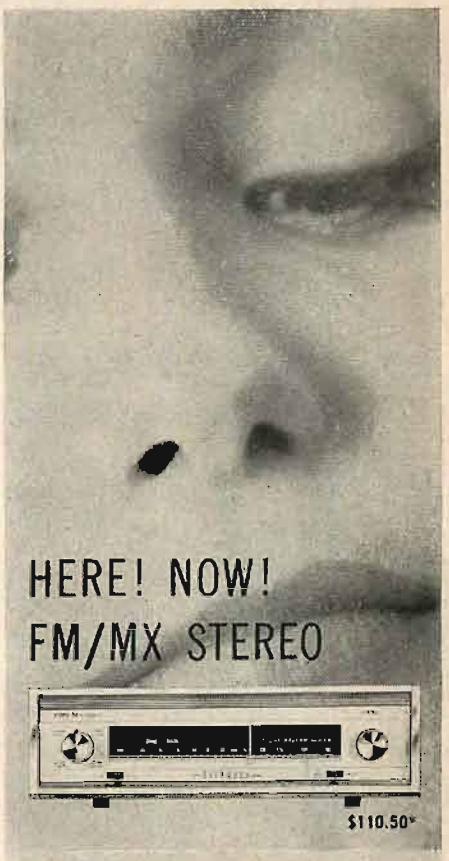
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COVER PHOTO—This installation, photographed in the Boston, Massachusetts, home of interior designer Alan Francis, is housed in two matching end tables. Composed essentially of H. H. Scott equipment, the one shown houses the Model 122 Dynaural Preamplifier and the Model 33D stereo AM-FM tuner, while the Model 290 100-watt power amplifier is placed behind the sofa. The matching end table at the other end of the sofa contains a Model 710 turntable and a London-Scott Model 1000 stereo arm and cartridge. Two KLH speakers are placed on the opposite wall for maximum stereo effect. Photograph by Edward Bishop, Boston.

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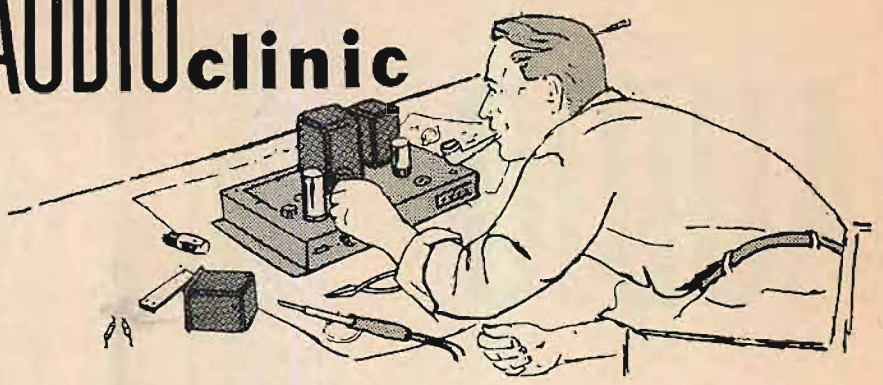
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Output Level:	– 75 dB (0 dB = 1 V/μ bar 1,000 c/s)
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AUDIO clinic



JOSEPH GIOVANELLI*

Tape Speed—50 or 60 cps

Q. I hope to exchange tapes with friends in England where I believe the power supply is 220 volts, 50 cps.

I have been told that the difference in line voltage will not affect the recordings, but that the difference in line frequency will cause my recordings to have a much lower pitch and vice versa.

Please suggest a solution to this problem. Name withheld.

A. Before discussing the effects of supply line frequency on tape speed, I should mention that the higher voltage, although it does not have a great deal of control over the tape speed, will ruin a machine designed for 117 volts. The power transformer will be overloaded, probably all the tubes will burn out, and the motor will undoubtedly overheat and open up. When a European machine is plugged into an American a.c. main, the machine will probably not run at all. The tube filaments will not get hot enough to emit electrons, and the motor will not receive sufficient power to cause it to turn over. Probably no damage will result, except to certain types of motors which draw too much current because of their inability to generate self-inductance, which, in turn, is caused by their not rotating. This type of motor is seldom, if ever, used in tape machines.

To make the answer to your problem clear, let us assume that you have a tape recorder which is designed for 60 cps operation. Your friend has one designed for 50 cps operation. When your machine is operating at its proper line frequency, we shall assume that it will record and playback at 7.5 inches per second. When your friend's machine is operating at its proper line frequency, his transport mechanism also makes the tape move at a speed of 7.5 inches per second. Notice that you are both playing the tapes back at the same speed, regardless of the line frequency.

Let's go one step further. Suppose that you and your friend have exchanged tape machines. You now have one which operates at 50 cps as intended by its manufacturer, but you will have to operate it at 60 cps because that is the power line frequency commonly used in this country. The motor will run faster—pulling the tape along at a speed of roughly 9.0 inches per second. The machine which your friend now has will operate slower than it would at 60 cps. In other words, his motor is running slower than it should—pulling the tape at approximately 6.25 inches per second.

All that need be done is to operate the tape machines on their proper line frequency and voltages. All will be well.

What is important is the speed of the tape. Before exchanging tapes, check to see that your machine and his are equipped to play at the same *speed*. If your machine operates *only* at 3.75 inches per second and his *only* at 7.5 inches per second, you will be unable to utilize these machines for tape correspondence. This possibility has nothing to do with the line frequencies used to furnish power to the two tape machines. On the other hand, however, if your machine operates at 7.5 and 15 inches per second and your friend's machine operates at 3.75 and 7.5 inches per second, you may correspond by using that speed which you both have in common—7.5 ips.

Don't worry about the problem which would arise if both you and your friend each have a Ferrograph which, as you probably know, is a British-made machine. The Ferrographs which come into this country are so modified that they can operate at our line frequency and voltage—60 cps at 110 volts. Those used in England are that company's standard models which operate at 50 cps at 220 volts. The machines will, in either case, pull the tape past the heads at the same two tape speeds, 7.5 and 15 inches per second.

Bandpass in FM Tuners

Q. What are the merits and faults of either a 150 or a 220 kc bandpass i.f. for FM tuners? Name withheld.

A. The merits of a 150 or a 220 kc i.f. bandpass of an FM tuner can be argued both ways as I see it. By law, the maximum permissible deviation from the assigned frequency of an FM station licensed for commercial broadcast, is limited to 75 kc either side of that frequency. The total bandwidth of the signal is, therefore, 150 kc. It would seem, wouldn't it, that an i.f. having this required bandwidth would be all that is necessary. However, it is generally understood that the signal is attenuated at 3 to 6 db at the extreme edges of any bandwidth. The audio voltage at the output of the detector will be proportional to the deviation of the signal in accordance with the program transmitted. But, if the signal drops 6 db at the extremes of the deviation, plus or minus 75 kc, the signal at the output of the i.f. strip will not be dependent solely on the deviation. It will be

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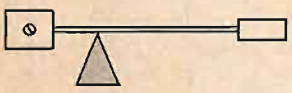


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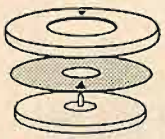
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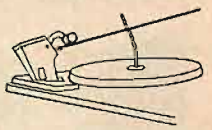
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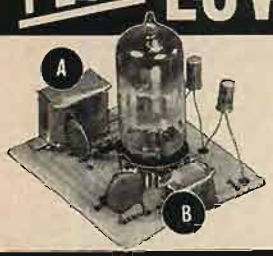


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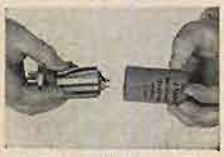
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influenced by the voltage loss created by the beginning of the band rejection slope. If, now, we widen the i.f. bandpass so that it is now 220 kc in width, the signal will be relatively flat at the 150 kc point.

We have arrived now at a point where we would think that this would settle the argument in favor of the 220 kc wide i.f. strip. Suppose, however, that you live in an area where you have the choice of two signals on adjacent channels. The one in which you are not interested was somewhat stronger than the one in which you really were interested. If your tuner was one which had the wider i.f. bandpass, it is likely that the undesired station would break into the bandpass of the station in which you were interested. If the i.f. bandpass were just a bit narrower, this interference would be avoided. If *you* were in that situation, perhaps you would feel that you could tolerate a bit more distortion created by the nonlinearity of the voltage supplied to the detector, in favor of the ability to receive a signal free of interference from another program.

Well, now, let's build another tuner and provide it with a 150 kc deviation total i.f. bandpass, but let's set up our detector circuit to have a bandpass of at least 220 kc. We tune the receiver to a strong signal, many db stronger than is required for good quieting. What really happens to the voltage at the detector when the deviation reaches its maximum? True, the signal drops in strength by perhaps 6 db, but the detector will not see this as a drop. At that instant of the modulation cycle, the limiter becomes less effective because it, in turn, has a reduced signal level impressed across it. The effect will be similar to AVC action, and the signal at the detector will be relatively flat. The bandwidth of the detector will be good enough to pass the signal in a linear manner. Yet, when we want to listen to a weak station, the i.f.'s will be sharp enough to reject a strong, adjacent signal to some extent.

Obviously, this arrangement is a compromise. When the signal to be received is weak, the limiter will not be effective as a leveling agent, and the system will take on the characteristics of a 150-kc strip.

There is even more to complicate the picture. When we state the bandwidth of an i.f. strip, what signal strength is necessary in order to obtain this width? It is well to know that, as the signal strength decreases, the bandwidth of the i.f. strip decreases. If the tuner has a bandwidth of 150 kc when a reasonably strong signal is applied, the bandwidth will be reduced considerably below this value when the tuner is set to receive a weak signal. In order for us to understand the bandwidth picture we must know what signal strength is required to give us the stated width. It is possible, though I have never heard of just such a situation, that the bandwidth of a given tuner is 150 kc with the limiter acting as a leveling agent. If, according to what has been stated above, this means that the signal is down 6 db at the extremes of the modulation swing, even with the limiter acting as a restoring force, what will this same tuner do when the signal is well below the limiter threshold? At least I would have a good reason for giving it a "worst buy" rating. Æ

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LETTERS

Earphone Stereo

SIR:

I cannot agree with Mr. Canby's comments on stereo earphones. His approach to the earphone type of stereo is entirely unfair and leads me to believe that either he has an earphone psychosis or he just doesn't know what he is talking about technically.

While it is true that "binaural" and "stereophonic" effects are two different animals, he has missed the point entirely when he states that stereo recordings are intended for loudspeaker reproduction only and that earphone reproduction presents a distorted and out-of-focus program which causes a strain on the ears and may even cause *mal de mer*.

Suffice to say that almost everyone realizes that the effect of listening to stereo recordings through two-channel earphones results in merely a rearrangement of the instruments or sound sources. There is only a change in placement of the listener in relation to the sound sources.

In the case of a normal stereo recording involving two microphones, earphones would only create the illusion of being surrounded by the orchestra instead of being seated in the front row of a theatre or auditorium.

The effect of multi-pick-up stereo recording and mixing in its true sense serves only to reinforce weak orchestral sections or instruments to bring the output into a more balanced arrangement. Also, multi-mike pick-ups are used to create the illusion of different positioning of the elements of the orchestra in the final recording by proper mixing between the two channels. This practice is used extensively in *super* stereo recording.

Now, let's briefly discuss Mr. Canby's comparison of stereo sound recording with stereo photography. Is he aware that many stereo photographs are taken with the two taking lenses much farther apart than the average distance between the human eyes? This is quite often done to create a greater illusion of depth. (*Actually, it makes the scene look as though it were a miniature movie set.* ED.) This does not give the viewer a headache. It is doubtful that the viewer is conscious of this illusion. In this case, are the viewers eyes on stalks?

I have owned a set of stereo earphones since the first opportunity to buy them presented itself. I accept them for what they are and I have enjoyed them immensely. No earstrain, no seasickness. (To prove I can experience seasickness, I can tell you that I get extremely nauseated when viewing poorly taken movies.) (*Is this necessarily related?* ED.)

Finally, as an enthusiastic audiofan (as well as a musician and engineer), it grieves me deeply to think that many of my fellow audiofans may be discouraged from giving stereo earphones a fair trial and thereby be deprived of the enjoyment, convenience, and privacy of earphone listening because of Canby's comments.

F. J. PACKARD,
2904 S. Moreland Blvd.,
Cleveland 12, Ohio

SIR:

Mr. Canby makes several statements that are unquestionably correct (about earphones), but he also wrote before he thought in stating that, essentially, stereo with earphones puts one's ears where they could not exist in actuality and must, *res ipse loquitor*, be inferior to listening with loudspeakers. A short session with pencil, paper, and a bit of moderately sophisticated math will demonstrate to anyone that loudspeaker stereo permits an even less perfect recreation of the original situation than does earphone stereo, just on a theoretical basis; had Mr. Canby been able to listen longer it seems certain he would be of a similar persuasion.

Together with several interested and experienced acquaintances, I have spent much of the last year listening to a large and varied assortment of recordings with good earphones and comparing them to the few live concerts our positions allowed us to attend, as well as to various systems employing loudspeakers. We have come to the following conclusions:

1). It is quite true, as Mr. Canby points out, that one does not get the particular sensation he might have had when sitting in some particular seat in the original concert hall (but then, as stated above, speakers are even worse in this regard); this does not invalidate the method, however. The illusion of reality (although not necessarily the re-creation of any actual existing environment) is markedly enhanced by this method of reproduction, and one can get a more accurate conception of the composer's intentions than under all but the most ideal live conditions.

2). There are only two or three records in my collection for which I ever feel the need of increasing the center fill by use of the blend control when using earphones, and no one else who has used the system has indicated such a need. In other words, it is possible for the mind to integrate the two channels in all cases except those of the most flagrant engineering excesses.

In summary, stereo recordings reproduced over the best earphones offer markedly improved realism (or fidelity) in addition to the advantages usually touted.

LEWIS A. LINDNER,
Columbus Psychiatric Institute and Hospital,
473 W. 12th Ave.,
Columbus 10, Ohio

Tape Demonstrations

SIR:

I have just read Mr. Cade's letter in the October issue in regard to wanting to buy tapes, but unable to listen to them before he buys them.

I am a United Stereo Tape dealer, and would like to make this offer to Mr. Cade, or to anyone else who may be interested in purchasing tapes. I will ship a tape to anyone—at list price, of course—and they in turn can keep the tape for three days and play it as much as they like in this period. If at the end of this period the tape is unsatisfactory, they may return it for exchange, or if nothing else will do, for a full refund minus a small charge for shipping and postage, which should be about 35¢ per tape. This is, of course, with the provision that the tape is not damaged by breaks or partial erasure. I think this is a fair offer to anyone interested in purchasing tapes.

BOB MYERS,
P. O. Box I 3325,
Fort Worth 18, Texas

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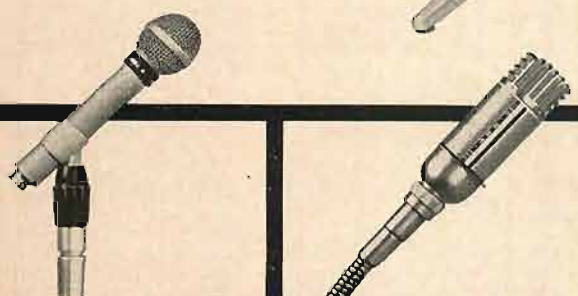
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CHESTER SANTON*

The symbol ✪ indicates the United Stereo Tapes 4-track 7½ ips tape number. When Mr. Santon has listened to the tape only, the tape number is listed first. Otherwise, the corresponding tape number is furnished by United Stereo Tapes.

Andre Kostelanetz: Joy To The World
Columbia CS 8328

I detect another significant leap forward in stereo disc quality in this Christmas release. There have not been many breakthroughs in basic quality since two signals began to make their way into a single groove. Earlier improvements came in the penetration of the region above 10,000 cps, healthier signal level on the record, and the general tidying up that brought about the gradual disappearance of groove imperfections.

In trying to figure out why this particular record stands out above the rest in this month's releases, I'm tempted to conclude that it does so because a non-classical Columbia performance was allowed to go through the entire production process without artificial enhancement of any kind. If you think some enhancement techniques these days do not constitute a serious problem on a proficient sound system, sample the brand new Percy Faith album called "Jealousy" (CS 8292) which traveled through the same Columbia plant only last month. On my setup the Faith release displays little charity and holds forth scant hope because the orchestral sound is about thirty per cent echo chamber.

Yet the same playback equipment reveals this month that Columbia has produced the most realistic chorus-with-orchestra recording I've heard so far on stereo disc. Earl Wrightson is the fortunate baritone soloist. He was miked at a distance almost equivalent to that of the chorus. All the production values, therefore, place the emphasis on the carols themselves. The arrangements are simple and in the best of taste. Mingled with the familiar carols are seasonal tidbits by Tschaikovsky, Victor Herbert, Leroy Anderson, and Waldteufel's *Skater's Waltz* in the famous transscription for orchestra by Arturo Toscanini. These performances, unlike some popular treatment of Christmas music these days, will give pleasure for many seasons and the sound is the best present you could give a deserving stereo system.

Percussive Vaudeville
Audio Fidelity DFS 7001

As 1960 draws to a close, it is safe to say that the year has not produced a wilder record than this one. Here is a pit band torn out of vaudeville's most raucous era and then its bag of tricks emptied in the center of a recording studio. Three percussionists and two drummers were assigned to take care of the noisemakers that once were handled by one man in the depths of the pit. No matter how vivid their memory of the Twenties, few vaudeville fans will be prepared for the close-range wallop uncorked here. Audio Fidelity's new DFS series stresses directionality while maintaining the ultracrisp presence of their higher-priced AFSD series. The stuff really piles in from all sides. It starts with the bill's opening bit of ragtime and carries through to the last sound effect in the *Whistler and His Dog*. A dulcimer combined with honky-tonk piano creates the effect of an old street piano in *Sidewalks of New York*. Banjo, wood blocks and tambourines of differing pitches revive a cakewalk in *Georgia Camp Meeting*. A snappy minstrel instrumental routine is followed by a George M. Cohan two-step. The most intriguing novelty in the lineup is a bell instrument called the Una-fon. This electrical marvel has a small keyboard which controls rows of bells (rack mounted for ease in servicing) and is rated by its manufacturer (in American watts, that is) as being capable of brass band volume.

Percussive Latino Cha Cha Cha
Audio Fidelity DFS 7003

Here is stereo directionality for dancers. Rene Hernandez leads an orchestra small enough to place the Latin percussion on an equal footing with the trumpets, saxes, flute, bass, and piano. More pains have been lavished on maximum frequency response of the percussion than on the dexterity of its transfer from channel to channel. In the area around 50 cps and again in the region above 10,000 cps, this disc delivers unforced response where the output of other labels begins to fall off. Some of the secret undoubtedly lies in the proximity of the miking. The three trumpets are at extreme right, the four saxes at far left with the rest of the group linking the two ends. Presiding over the center is a plump bass that can take on any speaker in the business and make it shudder like a woofer should.

Sy Shaffer: Seems Like Old Times
Westminster ✪ 4T 106

Eric Johnson: Rodgers and Hart
Westminster ✪ 4T 108

Before the appearance of stereo discs, Westminster's two-track tapes were right up there with the best of them, in audio quality. In the opinion of listeners conversant with the major tape labels, only two other companies shared the top spot with Westminster. Each label, at that time, processed its own two-track tapes and the variables in sound quality fluctuated with the conscience of the individual firm. When four track came along, UST supplied a uniform duplicating process and Westminster confined its efforts to the master tapes.

These two reels featuring the orchestras of Sy Shaffer and Eric Johnson illustrate an interesting point. In each case, the masters from which these tapes were taken are at least two years old. Yet the steady improvements in mass duplicating put these tapes on a par with tape releases recorded only a short time ago. If we assume that tapes of average popularity are produced in small quantities at the duplicating plant, by the time the stockpile of these tapes needs replenishing, improvements in the duplicating process are bound to show up in the subsequent batches of tapes. It's a more flexible arrangement than one found in the disc business.

The two reels under consideration here provide a better than average grade of music making for relaxed listening. Sy Shaffer is no stranger to Arthur Godfrey fans. His band has been featured since 1945 on the Godfrey TV and radio programs with his trombone a vital part of the theme song. In addition to the theme, *Seems Like Old Times*, played in its entirety, Shaffer presents a batch of standards in the smoothly professional style of a network crew untroubled by constant changes in personnel. Fourteen strings, four woodwinds, French horn, and harp add up to a flexible medium.

The Eric Johnson crew featured in the other reel is not too well known outside of the Westminster catalog but, like the Shaffer organization, they go about their work with minimum fuss and no suggestion of cuteness in the arrangements. Rodgers and Hart fans can't go wrong on this one.

Richard Hayman: Caramba
Mercury ✪ STB 60103

Anyone for small clouds of hope on the horizon? This reel offers several clues portending a slight shift in the attitude of record companies where tape is concerned. The first inkling that something a bit different was underway arrived with the morning mail the other day. A bunch of Mercury tapes that had been shipped for review on the initiative of the parent disc firm instead of the industry's clearing house, United Stereo Tapes.

Ever since Ampex reached its decision on the technical and commercial feasibility of open-reel, four-track tape at 7.5 ips, most record companies have been quite content to let others shoulder the burdens of providing music on tape. So widespread was this feeling among record firms when the stereo disc elbowed out two-track stereo tape, there is good reason to believe that tape recordings would have disappeared from the market if Ampex had not set up UST to process, distribute, promote and worry about them in general. In the last few months, three major labels—Victor, Columbia, and Capitol—have been handling all responsibilities for their own recently announced entries on 7.5 ips open reel. Now Mercury is showing signs of a more active role in the fortunes of its releases finding their way to tape. In addition to making more rounded and purposeful the gradually improving career of the tape reviewer, Mercury Records—in this reel at least—appears to be taking closer interest in the volume of the signal on the tape. The choice of level may have been dictated to some extent by the nature of the music—Spanish and Mexican blockbusters vaguely connected with the spectacle of the bullfight. Volume is several notches above the regular level used by UST in processing tape recordings for other labels. Such individualism will not be easily derided by the listener who has insisted on working out his own highly personal choice of playback components. It may even prove useful in some circumstances but I find the level to be higher than I need.

Arthur Lyman: Taboo Vol. 2
Hi Fi Tape ✪ R 822

In its day, the Taboo series by Arthur Lyman made quite a hit with novelty seekers who were more interested in exotic demonstration material for their rigs than they were in reasonably accurate depiction of music from the South Seas. The novelty field in both disc and tape has broadened so tremendously in recent years, I'm afraid that anyone who has kept up with trends will find even Volume Two of Taboo somewhat old hat. Some tape fans have discovered that items such as this one are too transitory in their appeal to form any sizable portion of their tape library.

Dick Schory: Wild Percussion and Horns A'Plenty
RCA Victor LSP 2289

A brass section has been added to the Schory Percussion Ensemble. This is the third record by the outfit that had a beautifully engineered "straight" percussion disc on the market at least a year before the current ping-pong vogue in percussion caught the

(*Continued on page 86*)

* *12 Forest Ave., Hastings-on-Hudson, N. Y.*

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AUDIO ETC.

Edward Tatnall Canby

1. UHER'S TRULY

For some months now I've been playing around with a gorgeous, gray-white, pebble-grained, portable tape recorder, four-track stereo and full of tricks, with a name that is prone to all sorts of unintended linguistic confusion—its German makers didn't think along such lines, obviously, when they attached the monicker. In fact, I've worked with two of them, and listened in on a third, part of the editor's home system. On that occasion I found myself, after a couple of martini's, saying, "is that Uher recorder, or mine?" Double talk, but I meant it quite singly.

There are many things I find wholly admirable about this Uher "Stereorecord III" and a few minor items that have given me a bit of trouble—enough to postpone this discussion until I had them cleared away and straightened out. That being done, I'm off in a cloud of dust (as we used to say when we were kids), and my only hope is that in the meanwhile Uher hasn't gone and brought out a new model. No need for one that I can see.

The Uher recorder has the simplest, most compact, most reasonable and easy-to-learn control system of any four-track stereo recorder I've so far looked at. This means a lot, because four-track stereo, both playback and recording, requires a lot of controlling. At a drop of a designer's hat, the control "board" of a home recorder for this sort of all-out stereo can evolve into a flashing maze of colored lights, pushbuttons, levers and what-not, guaranteed to bewilder anybody, even including the designer himself. (The same thing applies to the modern stereo preamplifier, you'll note. The tendency is towards enthusiastic complexity.)

There's so much to be controlled, in four-track. You must provide not only for two-way stereo recording and two-way playback, but also for complete mono recording, on all four tracks one after the other, plus complete mono playback of the same. (And if you really want to be comprehensive, you provide for old-type two-track stereo playback as well). All of which modes must be integrated with other functions—erase, for instance. Gotta be able to erase two tracks at once, but not the one between them; or erase just one track (mono), leaving three. Got to be able to push the recording "safety" button for one-track or two-track recording and hook up the playback for one track, or for two, through the built-in monitor speakers as well as *not* through them, i.e. bypassing whatever built-in power amps may be on hand.

Then there are level problems. Two incoming channels, from mikes and/or from radio or phono or another recorder, or what-have-you; two outgoing channels, to be balanced somehow or other for the built-in speakers, but *not* to be balanced when bypassing the speakers. (You want a fixed output level from the playback preamps.) There are the level-indicating devices, two of them, which basically measure what is going *in*, on each channel, but may also measure what comes back out—if you hook things up that way. (Uher doesn't.)

And there are the extra conveniences. Stereo reversed, for instance, switching channels to opposite sides. Useful in case you got your mikes mixed up in the recording, on the wrong sides. Tone controls—one for each channel on playback (but *not* on recording)—plus, of course, a pair of volume controls for recording your two channels and another pair (the same, or different, depending. . . .) for playback levels via built-in speakers. Should they be semi-detached, i.e., adjustable as a unit via friction, but also adjustable separately? Should they be entirely separate, one control for each channel, in and out? Or should they be ganged, joined, one control for both channels, unadjustable? Should there be an adjustment, but maybe off somewhere inside, to be set and then left alone? Moot questions, that must be answered somehow in every four-track tape recorder.

And, as if this weren't enough, there are the extra-extra conveniences. Play back one track and simultaneously record on another. Brilliantly useful, but a switching headache, I would think. "Pause"—stop the tape, but don't disconnect the recording circuit. Again, useful but adding more innards.

All this in addition to the standard mechanical controls on any recorder, problems enough in themselves even after ten years or so of progress. Fast forward and reverse. Slow-speed, careful movement, either way, for accurate spotting. Tape lifting for rewind, to save heads. Tape *non*-lifting, for manual jockeying of the reels during sound-spotting. (Not all recorders have this negative refinement, these days, but Uher does, via the "pause" control.)

And finally, there are the stunt controls. Remote service of one sort or another—Uher has it. Start or stop, record or play, via controls at a distance. (Have to be able to disable the remote stuff, too.) A final fillip—synchronized operation with assorted film or slide projectors. Uher has that, too.

And all of this to be incorporated in a low-priced, snazzy-looking, home-type machine that Aunt Minnie is supposed to be able to say ooh-how-lovely and then operate correctly the first time with her eyes tight closed in ecstasy. Phew! Big order.

Impossible, indeed. But Uher has done as well as anybody will for awhile.

Let's see whether I can make it sound the way it works—reasonable and simple-like. The basic controls, to begin with, are grouped in three easily identified clumps. Middle for the stop-and-go part. That's mechanical. Left side for all playback functions, plus the on-off and speed knob. Right side for all recording functions. This tripartite arrangement, I'd suggest, is likely to become the standard format for home stereo recorders and has already appeared on a good many recorders, with variations in detail.

Uher's knobs, pushbuttons and tabs (keys) are tastefully and symmetrically distributed, all in white except the glaringly red record safety button. I was particularly pleased with the variety of sizes and shapes, within this symmetry. A standard design weakness, it has always seemed to me, is the desire for symmetry at the expense of practical variety in the controls. Rows and rows of identical buttons, or plugs or levers, neat looking but extremely hard to use! Uher knows that the sense of touch is vital in control functioning, and thus the actual controls are of easily "feelable" shapes and sizes, clustered for the easiest muscular action.

Where functions are similar, in record and playback, the Uher controls are alike. Take the channel-choosing pushbuttons, a pair of them on each side. There's no confusion, because of the clear functional separation, right and left. And yet the identical "feel" does in fact indicate comparable action, for playback and for recording. They do an astonishing amount of switching between them, these four buttons, two on a side. On the left, playback, you push both down for stereo sound, snap both to the up position for stereo reversed, switching the two playing amplifiers to opposite speakers. Push down only one button and you get mono, playing only one track; push the other and you get only the other track. ("Mono I and II")

On the recording side, on the right, the same pair of pushbuttons works in the same fashion, except for the stereo reverse, which is omitted in recording. (Why have it twice; two wrongs to make a right?) Both buttons down for stereo recording; to record either track separately, mono, push down only the corresponding button.

Not a chance of a mistake. You always know what you are doing, at a glance, and more important, you know *what you have done*, what you are hearing in playback. The controls tell you instantly.

This seems to me essential, even though it does require what looks like duplication of numerous controls where, theoretically, there could be an economical doubling-up to save on costs. Uher keeps things apart (with separate controls) *where the mind must keep them apart*. I won't soon forget my initial bewilderment with the ingenious Tandberg 5, which used the same volume and channel-selecting controls for both recording and playback. (The machine, of course, was an adaptation of a "chassis" originally designed for mono recording. Tandberg 6, designed for stereo, is another story.)

In line with Uher's control clarity there are some nicely foolproof associated switchings. On recording, Uher has a tricky mike hook-up for mono work that allows the lower of the two mike receptacles to be used for either of the two available tracks—just push down the button for the track you want and leave the mike where it is. But when both buttons are pushed down, for stereo recording, the lower receptacle feeds only its own proper track; the second mike takes on the other track. Neat.

The same kind of circuitry is used in the playback area. With both channel buttons pushed down, for stereo playback, each track feeds its own amplifier-speaker system, via the separate (dual concentric) volume controls, and you hear stereo from the two tiny built-in speakers. Snap both buttons to the up position and you have stereo reverse, the tracks switched to the opposite speakers. *But* push down only one button, for mono playback, and automatically the one signal is fed into *both* amplifier-speak-

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No. 4-1 chome, Kanda Hatago-cho, Chiyoda-ku, Tokyo, Japan

ers. Two-speaker mono. You can do it with either track, via either button. (If you want only one speaker, turn down one volume control.)

In either situation, recording or playback, it is virtually impossible to make a mistake. And all via four simple push-buttons, two for each function.

Details like this excite my admiration, for they represent the best sort of ingenuity and simplicity, good thinking in a situation where a false move means disaster. Personally, I would like to see a stereo preamplifier as simple and as foolproof, in its own area, as this Uher is in its tape field. I haven't yet.

The Uher runs at three speeds in a tricky way. One knob does it, and to change speed you must turn the machine off entirely. The knob moves up and down for speed change, turns clockwise in each position to switch on the power. (The drive motor in the Uher is of the constant-running type.) This sort of electromechanical interlock is, of course, a feature of most home tape recorders and it is further used in the expected ways throughout the Uher. You can't push the recording safety button without stopping first, then pushing the start tab. You can't move the rewind-fast-forward until unlocked by the stop tab, and so on.

An indication of Uher's wide-awake thinking on the matter of home usage in actual practice is in the simple and effective tab marked STOP. There are three tabs, like piano keys, lined up in front of you; the middle one, STOP, is *three times as big* as the other two, START and PAUSE. Excellent! For it is the STOP control that you'll want to find quickly in every emergency. The others are always used with deliberation and care. Now who else has thought of *that?*

Moreover, the fast-motion key, thin, sidewise and placed immediately in front of these, slides either way in the direction of the resulting tape motion. You can move tape very slowly, via light friction, slide this tab further for full speed and at the extreme positions lock it in place. It unlocks via the big STOP tab, instantly. (I found the locking too quick for my taste. I often locked it in fast motion when I didn't mean to.)

The handy convenience of these odd-shaped tabs and keys, right under the fingers, must be felt to be appreciated. Again, a minimum chance for confusion, where a row of identical buttons or keys merely invites mistakes, however pretty they may look.

Levels? A horizontal double "eye" right next to the center operating controls and angled forward, two thin green stripes that close from the sides to meet at the middle. Neat, accurate, and they read only on recording. With the "pause" key down (it's called "stop"), you can read levels *before* you record, or use Uher for a public address system—or two, via two mikes. (But look out for feedback.)

Mikes? Two dynamics are furnished as regular equipment; I took on a pair of fancier ones, the AKG D 19 Bk/Hi, to avoid bottlenecking, just in case. But you can get these as an alternative; you needn't buy them in addition to the standard pair. (I would certainly recommend the more expensive mikes, if you can manage them in your budget, and you can always argue with the Uher salespeople.)

The Uher inputs and outputs, with German-type connectors, are clumped in a recess to one side of the recorder, with a sliding shutter to cover it up. The twin speakers face towards you at the front end, behind the carrying handle, a strap that goes all the way across. The Uher lid goes on with the two reels in place—which isn't possible with many other recorders, even including the old Ampex 600. (Indeed, I "lost" a valuable reel of tape for a week or so, then found it sitting on the Uher, just where I'd left it.)

This is the first portable recorder I've tried that features built-in stereo playback. (The Tandberg 5 had only one speaker.) It works—with reservations. What more would you expect?

The two little built-in speakers, first, are able to make an astonishing amount of noise for their size. I used the machine one night to play a mono dance tape for some thirty or forty noisy folk dancers and the sound was actually louder and more solid than that of the local phonograph, which had much larger speakers in it. The quality, via these miniatures and their built-in dual amplifiers, is surprisingly good. I was impressed.

As for the built-in stereo—it is there, right in front of your nose. That is, to hear stereo you must put your nose down about six inches in front of the recorder, or tip the machine bodily up into your face at close range. The speakers aren't much more than six inches apart. At this nosey range, the stereo *is* excellent—just switch to two-speaker mono (via those excellent push-buttons) and you'll hear how excellent it is.

At a few feet of distance, of course, the stereo increment decreases quickly to infinity; it is plain mono, for all but the man with his nose in the machine. But for quick monitoring and on-the-spot playback the stereo speakers are extremely useful and, indeed, essential for portable stereo. I'm all for them, even if the stereo is strictly for one listener at a time.

* * * *

I could go on and on, but it's time for a few minor reservations—what good is a plus report without a bit of minus to give it salt?

I'll have to prod Uher gently in one very minor direction. As in some other recorders, both American and European, this one has no outputs. What? No outputs at all?

A single receptacle, for a special plug feeds only to Uher's own pair of extension speakers, via the internal amplifiers; but nary a socket will you find that feeds straight from the preamps, for your own outside hi fi system. No visible way to hook the machine into your hi fi.

Instead, you can use one or another of the sockets intended for other functions. The directions don't help you much, but I was told verbally how to do it. You use either a socket labeled cryptically "balance," or else use the radio *input*. Absolutely nutty, on the face of it; but this is not an idiosyncrasy of Uher's; it appears on most European tape recorders, until modified for American usage, and evidently reflects a European way of thinking. Over there, you use a recorder as a recorder, not as a hi fi component.

What is needed, obviously, is a standard pair of American-type TAPE-OUT sockets, RCA-type, straight from the two preamps. Eventually, that's what there will be, when the news gets back to Germany. It's happened already in other imported machines. Meanwhile, you can play your stereo tapes quite nicely via your own stereo amplifier; it's just that your sense of fitness may be violated by using an input for an output, even if it does work! All these outputs, by the way, are three-wire hook-ups, which may cause you some mild stereo complications. Four-wire is better.

Time flies and so does space. I'd like playback tone controls marked for "flat" or "normal," which these aren't. Not important. I'd like an easier playback cut-out

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*Quoted from

high fidelity

EQUIPMENT REPORTS

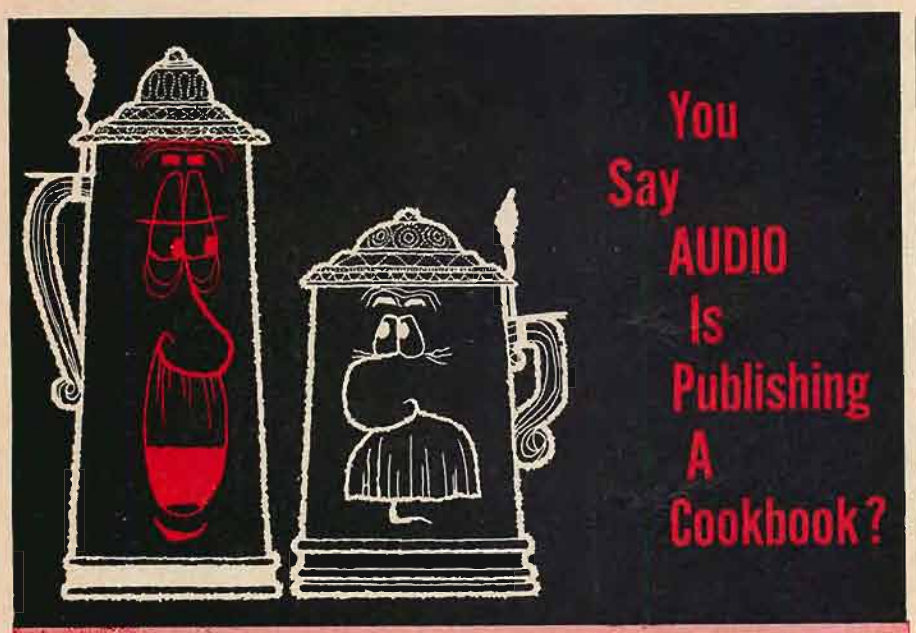
terial will soon reveal the almost total absence of coloration introduced by the AR-3. The sounds produced by this speaker are probably more true to the original program than those of any other commercially manufactured speaker system we have heard. On the other hand, the absence of

*A reprint of the complete Hirsch-Houck Laboratories' report on the AR-3 speaker system, as it appeared in *High Fidelity* magazine, will be sent on request.

AR-3's (and other models of AR speakers) are on demonstration at AR Music Rooms, at Grand Central Terminal in New York City, and at 52 Brattle Street in Cambridge, Massachusetts.

ACOUSTIC RESEARCH, INC., *24 Thorndike Street, Cambridge 41, Massachusetts*

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Yes. AUDIO is publishing a cookbook—not that we intend to extend the subject of gastronomy to include recipes in future pages of AUDIO.

You may ask...why?

And we would answer—Simply because we feel that people who read AUDIO, and enjoy the finest quality music reproduction also enjoy really good food on their tables.

Your next question may be...Is it a different kind of cookbook?

Of course our reply would be—Yes! Oh, it doesn't have a revolutionary format and it appears to look like any ordinary cookbook. But, the secret of its goodness is the recipes that fill its 148 pages... recipes responsible for the heart warming, flavorsome, homespun aromas experienced only in the kitchen of an Adirondack country home.

The name of the book is PLACID EATING, and it is chock full of palate-tempting recipes compiled by Climena M. Wikoff, owner of the Mirror Lake Inn ...at (you guessed it) Lake Placid, New York.

Actually, the first edition (now out of print) was discovered by Mr. AUDIO (C. G. McProud) during his stay at Mrs. Wikoff's Mirror Lake Inn, where, in Mr. McProud's own words—"*...every meal is so tasty that eating becomes a real joy, where each night's dessert excels the one from the night before, where one has to push himself away from the table before upsetting the daily calorie count.*"

Here is a cookbook that will enable you to recreate in your own homes superb dishes experienced only at the Mirror Lake Inn—dishes like *Lake Trout Baked In Wine* and *Adirondack Apple Pie*, recipes for which are reproduced below—

LAKE TROUT BAKED IN WHITE WINE

Remove heads and tails from a 2-pound fish. Split open down back and rinse well. Remove backbone and rub inside with lemon, salt, pepper and thyme to taste. Knead 1 tablespoon of butter and anchovy paste the size of a large pea; placing mixture inside fish. Place fish in a greased baking pan and cover with ½ cup of white wine. Bake 25 to 30 minutes in moderate oven, 350 degrees. Baste frequently. Garnish with parsley and lemon and serve with plain boiled potatoes.

ADIRONDACK APPLE PIE

1 c. sugar
2 tbsps. sifted flour
½ tsp. grated nutmeg
½ c. orange juice
⅓ c. melted butter
3 tbsps. white corn syrup
6 to 8 tart apples, thinly sliced
pastry

Mix together the sugar, flour, nutmeg, orange juice, corn syrup and melted butter. Add the sliced apples and mix thoroughly. Butter a pie pan heavily before putting in your pastry. Fill the pie shell with the apple mixture and make pastry strips for the top which should be dipped in melted butter before putting on the pie. Bake in 400 degree oven for 15 minutes; reduce heat to 250 degrees and bake 35 to 40 minutes longer.

This colorful book, plastic bound for easy handling, will contribute many wonderful adventures in food for everyone in the family. Order a copy today, the Lady-of-the-house will adore you for it. Incidentally...it makes a wonderful gift for anyone. PLACID EATING, 152 pages, Plastic Bound: $3.95.



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(No C.O.D., all books sent postpaid in U.S.A. and possessions, Canada, and Mexico. Add 50c for Foreign orders.)

NAME ..... ADDRESS .....

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switch; on Uher you must lift the volume control clumsily upwards to kill the two speakers for recording—and I invariably forget, producing an ungodly squall of feedback the instant the record button is pressed, scaring my talent out of its wits. Again, minor; nor is it easy to know just what to do in this case. And one last, incongruous item that I'll bet Uher has never noticed. When you carry the machine, the speakers point upward, directly beneath the carrying strap. *What do you do when it rains?* It rains right into the speakers, I can tell you, and it snows into them too. I experienced both—but managed to prevent serious damage by scuttling quick, like a crab, to where I was going.

Oh yes—something about the phono-radio input switch, and I forgot to observe that the recording volume control is permanently ganged, one control for both channels. (But with two level "eyes," one for each.) This, I believe, is a good idea. Nothing is more disastrous, for amateur stereo recording, than a shifting volume balance that changes in mid-recording. It is impossible to compensate for it in the playback and your recorded sounds will always jump madly from side to side, uncontrollably.

Uher is absolutely right, then, in hooking the two channels permanently together for all stereo recording, leaving the adjustment and balance for playback. I suggest only that either an internal level-set or a careful factory balancing should be provided. The two recording preamps are likely to be different, and probably will grow different with time. Mine weren't the same, though the difference was not serious.

No recorder should ever have separate channel gain controls for recording *unless* there is a master control in addition. In professional models there always is. In home machines, the Uher arrangement seems to me the only one that is practical for foolproof two-channel recording.

The Uher's controls are marked ingeniously via the European system of graphic little "pictures," that explain functions at a glance. These, with the few necessary English words, are laid onto a sheet of clear plastic that fits under the control panel—just replace the plastic for any other language you may need. Uher's somewhat complicated instruction booklet isn't quite so simple but also comes in various tongues. Mine was in German (I got an English replacement with the second machine), and I really floundered, from *Lautstaerkeregelung und Klangfarbenwahl* right through to *Bandgeschwindigkeit waehlen*. But I figured out most for myself, by the try-it-and-see-what-happens method, even before I got the English booklet.

There's more—automatic stop, sound on sound, the extra "Akustomat" remote control, and that excellent synchronized slide projector feature, where your recorder gives your lecture for you and runs an automatic slide projector too, changing the pictures at the right moment as your voice talks from the tape. Works like a charm. Enough said. Given the right playing speed and proper output connections to your hi fi, this little Uher recorder can be a solace to anybody's stereo hours.

2. MACRO AND MICRO

It's getting dreadfully hard to say anything useful about loudspeakers, these days. Now, if only a new speaker had the complex array of controls and general gadgetry you find on a new tape recorder! Instead, all there is normally is a level control or two and a pair of standard con-

(*Continued on page 52*)

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there are mixers . . . then, there are the fabulous

new CustoMixers

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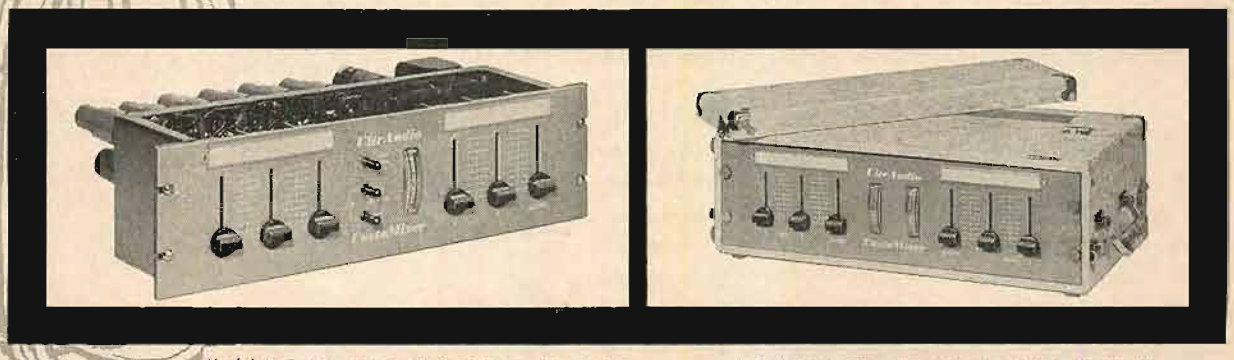
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*handsome carrying case optional at extra cost.
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Model M-5: Five independent mixing positions plus master gain control. Phono equalizing and cueing switches on front panel for mixers 2 & 3. A 60db pad switch enables mixer-1 to accept a high level, low impedance source. Single channel output.

A 2-channel fully stereophonic mixer (shown in optional carrying case) with two mix positions and a master gain control per channel. Special "MIX" switch permits all mix positions to feed **both** channels simultaneously with sub-master on each channel.

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EDITOR'S REVIEW

YEAR IN REVIEW

THE YEAR WHICH ENDS in just a few more days is likely to be remembered as the beginning of the end of the sellers' market in hi-fi and the beginning of a new era wherein quality is the important consideration. Five years ago, or even two years ago, it was possible to sell almost anything that was labeled "hi-fi"—now the potential buyers are beginning to listen with their ears instead of with their eyes, which many seemed to do with their entire experience of sound consciousness deriving from what the newspapers advertisements said.

True there is plenty of junky equipment on the market, though very little of it is in the component field. It is still possible to buy a complete stereo phono system including a changer, a stereo amplifier, and two speakers (however close they may be spaced) for somewhere around $30. With, possibly, a few LP records thrown in. But in the high fidelity component field, the really successful companies are those which are building the best possible merchandise, even if the price tags must reflect the extra cost of manufacture.

All of this is a good sign, in our opinion. The entire audio industry was founded on the desire of the sincere music lover to have sound reproduction in his home as close as possible to what he would hear in the concert hall. While that elusive quality has never been properly defined because with 2000 seats in a given hall the "concert hall" quality is sure to differ slightly with each one. The concertgoer who habitually sits in the top gallery hears an entirely different sound than does any occupant of the first five rows. Aside from that, however, it is certain that the serious listener is at least able to obtain his—as Mr. Canby has occasionally said—"imagined original" by choice of equipment and by careful manipulation of the controls and by judicious placement of the loudspeakers.

In spite of comments often made in the industry, we feel that the swing back to top-quality equipment is a good sign. No one in the high fidelity industry seriously expects that component hi-fi will ever become a "mass" business in the same sense that TV or pocket transistor radios have. But there is plenty of reason to believe that this industry can always find plenty of quality-conscious buyers to ensure a thriving—though possibly small when compared to some of the mammoth radio and TV companies—business. There are over three million new homes started every year, and *every single one of these homes is a prospect for a hi-fi system*. Not, possibly, for the most expensive units in the line for every one of these new homes, but surely for *some* sound reproducing equipment. And do not forget for a moment that the younger generation—those who are starting these new homes—are more conscious of sound and music than the older generation, largely because they have been exposed to more music in schools and elsewhere. We see no *necessary* diminution of the over-all high fidelity market for years to come.

But it is possible that we will have to *sell* hi-fi in the next few years—the days are likely to be over when all that was necessary was to open up a store and then sit down and watch the customers walk in. The successful hi-fi merchant must know his business, both technically and commercially; he must provide impeccable service; he should, in fact, conduct his business to the same standards that the successful automobile dealer does.

Actually, automobiles and hi-fi have some points of similarity—neither is an absolute necessity, but both are desirable. Both require service. Both require a high degree of selling. True, the typical automobile buyer knows he wants to buy a car, while we have to convince the potential hi-fi buyer that he wants music in his home. But we still must sell and keep on selling, and perhaps most of all, we must keep the customer sold by the quality of our service.

As we say in the publishing business—all that was necessary in the early days of hi-fi was to put out a book or magazine with the word "Audio" on it and people would flock to buy it, even though nothing was printed on the inside pages. Now the people look inside first, and we have to give them something besides the cover.

Perhaps when people learn that there is something more to high fidelity than the words "hi-fi" on the label, they will begin to enjoy music more than ever before.

SINCEREST FLATTERY

We find it difficult to suppress a smile—possibly even a smirk—when we look over the panel of experts assembled by another magazine in this field to judge a number of groups of hi-fi components. On the panel were two regular AUDIO contributors, and we were reliably advised that another was asked but declined.

When an authority is needed, even the other magazines know where to go to get one.

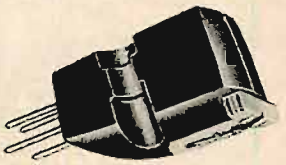
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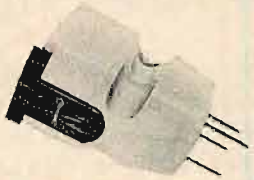
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A HISTORIC TELEPHONE EXPERIMENT BEGINS IN AN ILLINOIS TOWN

New technology brings the dream of an electronic central office to reality . . . foreshadows new kinds of telephone service.

Today, the science of communications reaches dramatically into space, bouncing messages off satellites. But an equally exciting frontier lies closer to home. Bell Telephone Laboratories engineers have created a revolutionary new central office. At Morris, Illinois, an experimental model of it has been linked to the Bell System communications network and is being tried out in actual service with a small group of customers.

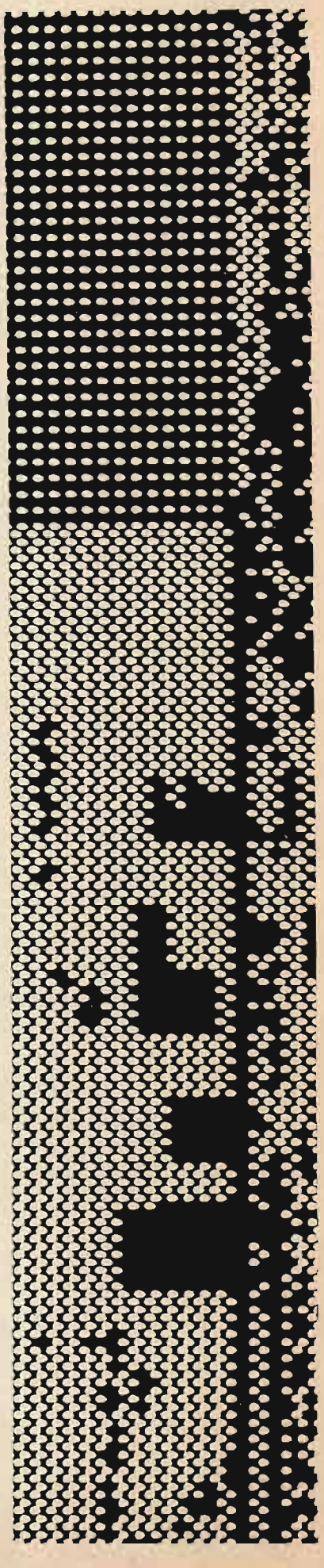
This is a special electronic central office which does not depend on mechanical relays or electromagnets. A photographic plate is its permanent memory. Its "scratch pad," or temporary memory, is a barrier grid storage tube. Gas-filled tubes make all connections. Transistor circuits provide the logic.

The new central office is versatile, fast and compact. Because it can store and use enormous amounts of information, it makes possible new kinds of services that will be explored in Morris. For example, some day it may be feasible for you to ring other extensions in your home . . . to dial people you frequently call merely by dialing two digits . . . to have your calls transferred to a friend's house where you are spending the evening . . . to have other numbers called in sequence when a particular phone is busy.

The idea behind the new central office was understood 20 years ago, but first Bell Laboratories engineers had to create new technology and devices to bring it into being. A Bell Laboratories invention, the transistor, is indispensable to its economy and reliability.

This new experiment in switching technology is another example of how Bell Telephone Laboratories works to improve your Bell communications services.

BELL TELEPHONE LABORATORIES
World center of communications research and development



Part of a memory plate of the new electronic central office is shown at right (enlarged 8 times). Spots are coded instructions which guide the system in handling calls and keeping itself in top operating form. Over two million spots are required. Logic and memory are physically separated in the machine, so new functions can be easily added. The experiment is being conducted in co-operation with the Illinois Bell Telephone Company and the Western Electric Company.

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The Anode Follower

CHARLES P. BOEGLI*

Possessing virtues far in excess of its namesake the cathode follower, the anode follower provides the audio engineer with a simple tool for achieving a wide range of high-quality audio circuits.

THE "ANODE FOLLOWER" is so called because, in its simplest version, the anode of the amplifier tends to reproduce the input signal in much the same manner as does the cathode in a cathode follower. It is a tool of unusual versatility to the electronic designer. Although the cathode follower is more or less limited to a gain approaching 1.0, the anode follower suffers no such limitation; gains of more or less than 1.0 are easily attained. In common with the cathode follower, the anode follower may have high input and low output impedances. Again, it is not greatly restricted in this sense.

The term "anode follower" is generally applied to single stages of amplification supplied, in addition to the active element, with a series input impedance and a feedback impedance. In its strict sense, the term is applicable only when the input and feedback impedances are identical, so that under the usual conditions, the gain approaches 1.0. For want of a better term, the plate of a tube, the collector of an *npn* transistor, and the colector of a *pnp* transistor, are all called anodes, even though the last is a negative element. The versatility of this type of amplifier arises from possibilities of using nonidentical impedances; in such cases, although the similarity to the cathode follower ends, the term "anode follower" persists.

Circuits of this type find manifold uses in the entire field of electronics. They may be used as simple mixers, to add several inputs with very little interaction or loss of gain; by their use, signal filtering may often be accomplished with minimum loss of gain; as impedance-matching devices, they are far more versatile than cathode followers; and in the audio field, such stages provide good amplification with wide frequency response and notable lack of distortion.

Design of such a stage involves more, however, than simple addition of two impedances to an ordinary vacuum-tube or transistor stage. If satisfactory results are to be obtained, attention must be paid to the choice of impedance values, and unless the impedances are properly chosen, the circuit is apt to perform somewhat differently than expected. Unfortunately, treatments accorded the circuit in various texts make assumptions that tend to obscure the factors affecting the proper choice of impedances. For this reason, it has appeared worthwhile to consider the circuit at some length; this article summarizes the results of that work.

* *Product Planning Manager, Bendix Corporation, Cincinnati, Ohio.*

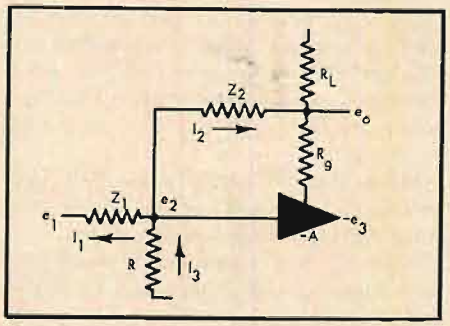


Fig. 1. Basic scheme of the anode follower.

ANALYSIS

Consider an amplifier (*Fig.* 1) in which a feedback element, Z_2, is connected between output and input. Z_1 is a series input impedance and R is an input shunt. In practical circuits, R may be very large (as in the case of tubes with a single input) or quite small. The latter situation arises when the amplifier has a low input impedance (e.g., a transistor) or when the amplifier is used for mixing a number of inputs, in which case R represents the paralleled resistances of all inputs other than the one whose behavior is being investigated.

The usual analysis of anode-follower circuits ignores the existence of R but, as will be seen, its effect upon the performance of the circuit may be quite profound.

With the currents as shown in *Fig.* 1,

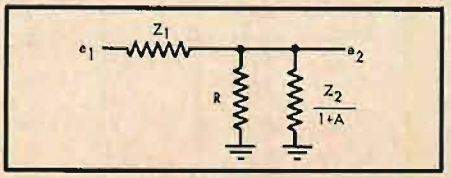


Fig. 2. Equivalent input circuit for the anode follower.

the following equation is obtained:

$$\frac{e_2}{R}=\frac{e_1-e_2}{Z_1}+\frac{e_0-e_2}{Z_2} \qquad (1)$$

which, rearranged, yields

$$e_2\left(\frac{1}{R}+\frac{1}{Z_2}+\frac{1}{Z_1}\right)=\frac{e_1}{Z_1}+\frac{e_0}{Z_2}. \qquad (2)$$

Equation (2) is the basic equation for the anode-follower circuit.

Gain

Let $e_2=-e_0/A$, indicating that the amplifier has a phase shift of $n\cdot 180°$ where n is an odd number. Then, equation (2) becomes

$$-\frac{e_1}{Z_1}=e_0\left[\frac{1}{Z_2}+\frac{1}{A}\left(\frac{1}{R}+\frac{1}{Z_1}+\frac{1}{Z_2}\right)\right]$$

from which

$$\frac{e_0}{e_1}=-\frac{1}{\frac{Z_1}{Z_2}+\frac{1}{A}\left(\frac{Z_1}{R}+\frac{Z_1}{Z_2}+1\right)} \qquad (3)$$

The exact implications of this equation depend upon the use to which the circuit is to be put. Examples of such uses will be treated subsequently.

Impedances

In equation (2), let $e_0=-Ae_2$; then

$$\frac{e_2}{e_1}=\frac{RZ_2}{(A+1)RZ_1+Z_1Z_2+RZ_2}. \qquad (4)$$

An analysis of the voltage divider shown in *Fig.* 2 shows the voltage e_2 is related to the input e_1 by precisely the same equation (4) as was derived for the feedback amplifier. In *Fig.* 1, the current entering the circuit through Z_1 sees, at e_2, an impedance of R in parallel with $Z_2/(A+1)$. When viewed from the grid of the tube or the base of the transistor, therefore, the impedance Z_2 looks like $Z_2/(A+1)$.

In the expressions for gain and input impedance appears the term A for the amplification of the amplifier. This A is the gain that would be measured if the Z_2 were connected between the outpnt and ground rather than between output and input. Calculations of A must therefore include the loading effect of the feedback impedance.

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The output impedance may be found by letting $e_i = 0$ and considering a signal to be applied at e_o. A certain fraction, β, of this signal will be fed into the amplifier input, resulting in an output $e_g = -\beta A' e_o$ which will cause more current to flow in R_g than would be the case in the absence of the feedback. The current is, as a matter of fact, multiplied by the factor $(1 + A'\beta)$ so that the generator resistance, R_g, appears from the output terminals as

$$\frac{R_g}{1 + A'\beta}.$$

In the general case, β is complex so the net generator impedance, R_g, will also be complex. A complete expression for Z'_g, applicable to *Fig.* 1, is derived simply by replacing β by its equivalent in terms of impedances:

$$\frac{Z'_g}{R_g} = \frac{1}{1 + A'\left[\dfrac{Z_1 R}{Z_1 R + Z_2 R + Z_1 Z_2}\right]} = \frac{Z_1 R + Z_2 R + Z_1 Z_2}{(1 + A')Z_1 R + Z_2 R + Z_1 Z_2}. \quad (5)$$

It must be remembered that the actual output impedance of the circuit is Z'_g in parallel with R_L.

The gain A' that appears in equation 5 is the gain that would be realized from the amplifier with an infinite load resistance; it may be considerably larger than the quantity A that appeared in previous expressions.

Spurious inputs

The effects of spurious inputs such as noise, drift, and microphonics are generally expressed in terms of an equivalent signal to the grid of the tube or the base of the transistor. If the spurious input is of magnitude δ, then the output of the amplifier in *Fig.* 1 is not given by $e_o = -Ae_2$, but rather $e_o = -A(e_2 + \delta)$. The effects of δ are therefore added to e_2.

If the above expression for e_o is solved for e_2 and this e_2 is substituted into equation (2), the result is

$$-e_o = \frac{e_i}{\dfrac{Z_1}{Z_2} + \dfrac{1}{A}\left(\dfrac{Z_1}{R} + \dfrac{Z_1}{Z_2} + 1\right)} + \frac{A\delta}{1 + \dfrac{ARZ_1}{RZ_1 + RZ_2 + Z_1 Z_2}}. \quad (6)$$

When this is contrasted to the open-loop equivalent, consisting of the passive filter of *Fig.* 2 followed by an amplifier A, for which the output is

$$-e_o = \frac{e_i}{\dfrac{Z_1}{Z_2} + \dfrac{1}{A}\left(\dfrac{Z_1}{R} + \dfrac{Z_1}{Z_2} + 1\right)} + A\delta \quad (7)$$

it is seen that the effects of the spurious signal are reduced in the anode follower by the factor

$$F = \frac{RZ_1 + RZ_2 + Z_1 Z_2}{(1 + A)RZ_1 + RZ_2 + Z_1 Z_2} \quad (8a)$$

over that which would be observed with the open-loop circuit. This factor, of course, holds whether the spurious signal effects at the plate or the grid are under consideration.

In case where R is much larger than Z_1 or Z_2

$$F' = \frac{Z_1 + Z_2}{(1 + A)Z_1 + Z_2}. \quad (8b)$$

APPLICATIONS

Amplifiers

The equations so far derived may be used to design a stage of amplification with predetermined characteristics, or to find the effects of certain uncontrollable factors on the performance of an existing stage.

When straight amplification is being considered, the object of the anode-follower circuit is usually one of the following: (a) to devise a highly-stabilized stage whose amplification is substantially unaffected by a reasonably small change in tube or transistor characteristics, (b) to provide an amplifier of low output impedance, (c) to accomplish control over the input impedance, or (d) to control the frequency response.

In the usual case, it is desirable that the gain be controlled by impedances Z_1 and Z_2, remaining substantially independent of A. With the substitution $A \to \infty$ in equation (3), the gain expression becomes

$$\frac{e_o}{e_i} = -\frac{Z_2}{Z_1}$$

and the problem is to determine the magnitudes of Z_1, Z_2, and A such that this condition can be closely realized. Now, the presence of the shunt input resistanee R may greatly affect the performance of the stage. In the case of a vacuum tube, R is usually the grid-return resistor, around one megohm; but if a transistor is used R may be of the order of 2000 ohms. Because of its small input resistance, a transistor anode follower may not operate as expected unless attention is paid to the magnitudes of Z_1 and Z_2.

From equation (3) it may be seen that if the gain is to be determined principally by Z_1 and Z_2, then we must have

$$\frac{Z_1}{Z_2} \gg \frac{1}{A}\left(\frac{Z_1}{R} + \frac{Z_1}{Z_2} + 1\right).$$

(1) If $Z_1 \leqslant Z_2$ and $Z_1 \gg R$, the condition is $AR \gg Z_2$.

(2) If $Z_1 \geqslant Z_2$ and $R \gg Z_1$, the condition is $AZ_1 \gg Z_2$ or $Z_1/Z_2 \gg \frac{1}{A}$.

(3) If $Z_1 \gg Z_2$ and $Z_1 \leqslant R$, the condition is $1 \gg 1/A$.

In the discussion that followed equation (4) it was shown that, viewed from the input terminal of the amplifier, Z_2 looks like $Z_2/(A+1)$. Condition (1) above is tantamount to saying that $Z_2/(A+1)$ must be small compared to the shunt resistance, R. Since the other two conditions apply when Z_1 R, it≤ may be concluded that a condition for the proper functioning of an anode follower is that the shunt resistor, R, multiplied by the gain of the amplifier, must be large compared to the feedback impedance.

Anode-follower feedback may be used to overcome the detrimental effects of certain inalterable amplifier characteristics. Consider a grounded-emitter transistor amplifier with an input resistance of 3600 ohms, a gain of 100, and a collector-base capacity of 36 mmfd. Suppose further that this amplifier must be driven from a source with an internal impedance of 30,000 ohms. Viewed from the input, the collector-base capacity looks like (101)(36) = 3636 mmfd and this, together with the source resistance, leads to a 3 db drop at about 1500 eps. If, for audio work, a response out to 40,000 eps were desired, a resistance equal to the reactance of 36 mmfd at 40,000 eps could be introduced between collector and base. The resistor would be about 100,000 ohms and the voltage gain of the stage (= output voltage/generator open-circuit voltage) would be 3. This gain is, of course, quite low and it points up the unsuitability of this type of transistor in a grounded-emitter transistor stage for use with high-impedance sources, in cases where good voltage gain and wide response are desired.

The amplifier, A, may consist of a single stage of amplification, or any odd number of phase-inverting stages. Because of instability problems, the number of stages is usually limited to three, but even a three-stage amplifier may have properties unattainable with a single stage. For example, by loading a low-impedance tape-playback head with about 10 ohms, a constant-current output is obtained which requires very little equalization. Given a grounded-emitter transistor stage with a gain of 100, the feedback resistor would have to be 1000 ohms to attain this low input impedance, but such a heavy load on the transistor output is apt to lead to low gain and excessive distortion. If, however, three stages are used ($gain = 10^6$) then the feedback resistor may be 10 megohms for the same 10-ohm input impedance.

Mixing

An anode follower may be used to mix several inputs, with good isolation between the signal sources. The various inputs are all connected, through their own series input resistances, to the anode-return resistor. The series resistor of each input looks into a shunt resistance equal to the paralleled input resistor of

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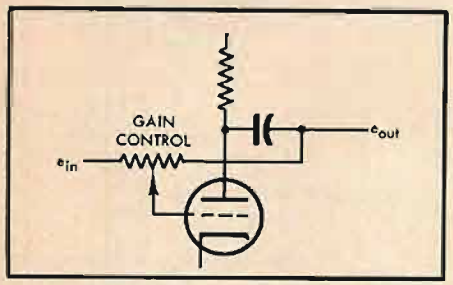


Fig. 3 Anode-follower gain control.

all other inputs. There is thus a limitation on the gain that may be obtained with a mixer.

Let it be desired, for example, to mix $(n+1)$ inputs, each having an internal resistance of R ohms, by means of an anode follower with a gain of about 1.0. For each individual input, Z_1 will be a resistance equal to R, while the shunt resistor will be R/n. Presumably, the feedback impedance Z_2 will also be R. In this case, obviously, $Z_1 \gg R$ (that is, $R \gg R/n$) so that the first condition of the previous section applies. Thus, we must have $AR/n \gg R$ which imposes a rough lower limit on A. If, for example, ten inputs are to be mixed, $n=9$, so we have $R \gg R/9$. If we let $AR/n = 9R$ (which introduces a sort of pseudo consistency) then $A = 81$.

The symbol "$\gg$" is, of course, much less definite than the symbol "$=$". If we wish to find how far the actual circuit departs from ideal performance, recourse must be made to the original equations. In the case of the 10-channel mixer we should find

$$\frac{e_0}{e_1} = -\frac{1}{1+\frac{1}{81}(9+1+1)} = -0.9$$

instead of the 1.0 that was expected. Were a gain of exactly 1.0 desired, an adjustment could be made to the value of Z_2 to obtain it.

Gain control

It is possible, by using the anode follower, to duplicate the gain characteristics of any combination of passive filter and simple amplifier. Although gain control is customarily carried out by means of resistive attenuators, it may also be performed by an anode follower (*Fig.* 3).

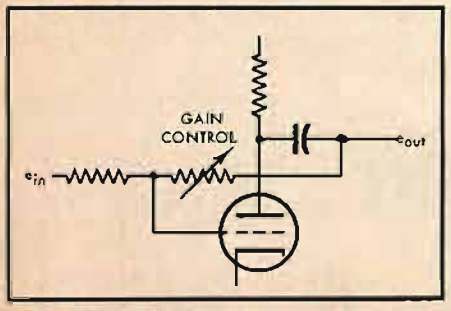


Fig. 4. Anode-follower gain control with fixed input resistance.

The anode-follower gain control has the advantage that the distortion of the stage is greatly reduced at low levels. For this reason, this type of gain control is particularly felicitous with transistors, which are generally operated with much larger ratios of signal-to-power-supply voltages than are tubes, and which are therefore more susceptible to distortion.

The input resistance of the gain-control stage varies, depending upon the setting of the gain control. A minimum input resistance may be set by introducing a small series resistor into the input; its effect is also to set the maximum gain of the stage. Where an approximately fixed input resistance is desired, an alternative arrangement can be used (*Fig.* 4) in which a fixed input resistor and a varying feedback resistor are employed. The maximum size of the feedback control is determined by conditions previously outlined.

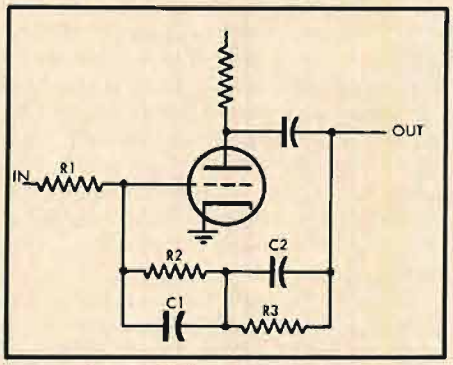


Fig. 5. RIAA equalizer stage.

Equalization

The anode-follower circuit permits a great deal of control over the frequency response of an amplifier. When equalization is the object, the impedances Z_1 and Z_2 may be complex, and their limiting values are determined by already-stated considerations.

For instance, let us consider the design of an amplifier to provide correct RIAA recording characteristic for playback. As is well known, the desired playback equalizer shows a flat response up to 50 cps; between 50 and 500 cps it drops with increasing frequency at 6 db per octave. Between 500 cps and about 2100 cps the response is again flat, while above the latter frequency the response again drops, as the frequency increases, at the rate of 6 db per octave.

In the design of an equalizer stage, the gain at one particular frequency may be specified. For a phonograph equalizer, it is usually wise to set the low-frequency (below 50 cps) gain, which is the maximum gain over the audio spectrum, at from one-fourth to one-tenth that of the open-loop stage. *Figure* 5 shows the design of an anode follower for accomplishing the necessary equalization. At low frequencies, the gain of this stage is determined by the feedback resistances R_2+R_3 and the input resistance R_1. At 50 cps, C_1 begins to shunt R_2 and the response begins to drop; this drop continues until the reactance of C_1 is equal to R_3, which should occur at 500 cps. At 2100 cps, capacitor C_2 begins to shunt R_3 and the response again drops off above this frequency.

Most phonograph pickups operate well with a load resistance of 27,000 ohms or more. Thus, R_1 may be 27,000 ohms. If the tube has a gain of 150, the gain at 50 cps may be set at about 15. Within the ranges of commercial capacitors and resistors, the values $R_2 = 330k$, $R_3 = 33k$, $C_1 = 0.01$ *mfd*, and $C_2 = 0.0022$ *mfd* meet the requirements quite accurately, and permit a gain at 1000 cps of about 1.22. R_1 may be reduced for pickups that can operate into lower resistances, with a resultant improvement in gain.

Tone control

A tone-control stage is a variable equalizer of rather simple characteristics. A tone control using the anode-follower circuit has been designed by Baxandall; a simplified and highly satisfactory version is shown in *Fig.* 6. The difficulty in its design is carrying out two control functions (i.e., bass and treble) independently. If it is remembered, however, that the bass-control capacitors present effective short circuits at high frequencies, then it can be seen that the components effective in the bass control are capacitors C_2 and C_3 along with resistors R_3 and R_4 and the bass control itself; the components effective in treble control are the capacitor C_1 and the resistors R_3 and R_4, along with the treble control.

This circuit is also very effective with transistors, provided suitable impedances are used. *Figure* 7 shows a transistor stage which permits as much as

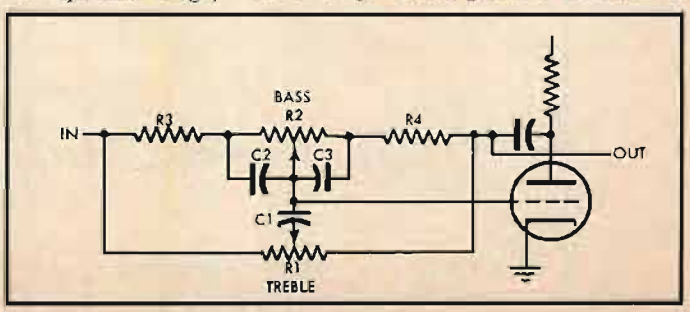


Fig. 6. Simplified Baxandall tone control.

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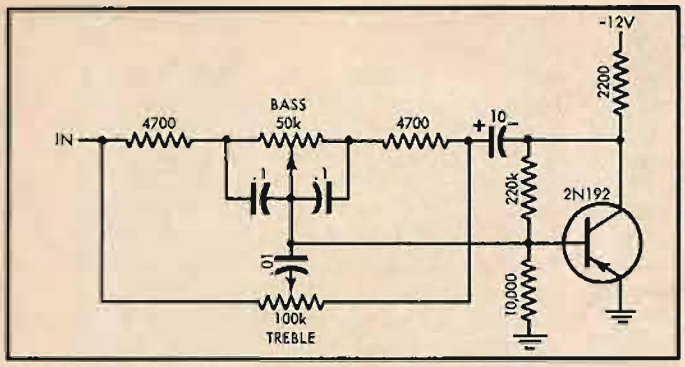


Fig. 7. Transistor anode-follower tone control.

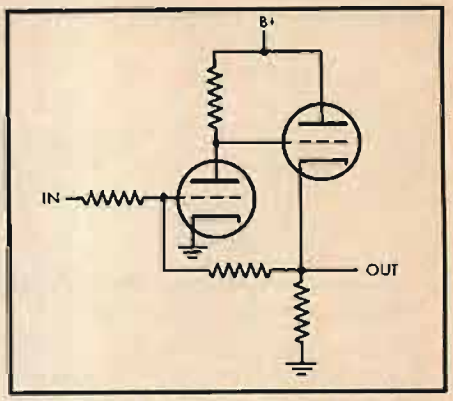


Fig. 9. Amplifier with extremely low output impedance.

15 db boost at 20 cps. Linear controls are used, and in the flat position the response is down only 1 db at 10 cps and 100,000 cps. The *IM* distortion (60/7000 cps, 4:1) with a 12-volt supply is less than 0.3 per cent at an output of 1 volt rms.

Capacity pickups

Capacity pickups are useful devices for the measurement of small displacements, particularly where it is important to avoid loading the unit being measured. An excellent phonograph pickup may be designed by causing the stylus to move a small metallic plate closer to, and farther from, a fixed plate. Often, the maximum permissible dimensions of the capacitor plates are very small, so that the capacity between them is minute, particularly in comparison to stray capacities that exist elsewhere in the circuit. For example, in a capacity pickup, the capacity between plates may be 2 mmfd. while the stray capacities between each side of the connecting line and ground may be over 200 mmfd. If an attempt is made to obtain an output from the pickup by polarizing one plate, grounding the other, and obtaining the signal from the polarized plate, the effect of the stray capacities is to attenuate the signal severely.

An anode follower may be used to overcome these effects. Here, the capacity pickup is, in effect, connected between the anode and input terminals of an amplifier. It has already been demonstrated that by this means the capacity is effectively multiplied by $(A+1)$. At the same time, the strays are split, half of them being shunted between the anode and ground, and the other half between the input terminal and ground. By this means, the stray-capacity attentuation of the signal is reduced to a considerable extent.

D.c. amplification

A d.c. anode follower can be constructed by inserting a v-r tube in the feedback path of the conventional circuit to attain a favorable distribution of d.c. voltages (*Fig.* 8). An amplifier of this type has a large useful gain, reasonably low drift, low output impedance, and input and output terminals at approximately ground potentials in the quiescent state. If it is necessary that the input and output terminals be exactly at ground potential, a small resistor may be inserted in the cathode of the amplifier tube to adjust to this equality.

Because the plate-load resistor of the tube must carry not only the plate current of the amplifier, but also the v-r tube current, it is generally of somewhat lower resistance than it would have been in a similar a.c. amplifier. For this reason, high-perveance triodes are very useful in d.c. anode-follower amplifiers.

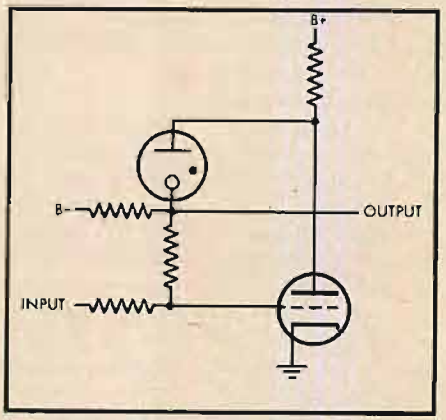


Fig. 8. D.c. anode-follower amplifier.

Amplifiers of extremely low output resistance

It will be remembered from equation (5) that the effect of anode-follower feedback is to reduce the effective generator resistance of the amplifier; that is, the plate resistance of the tube or the collector resistance of the transistor. The benefits of this reduction are much more noticeable with triodes, for which the plate resistance is usually lower than the load resistance, than with pentodes or transistors, for which the generator impedances are quite high.

The addition of a cathode follower to the amplifier, as shown in *Fig.* 9, permits amplifiers of extremely low output resistances to be obtained with great economy of parts. In this circuit, the open-loop generator resistance is the output resistance of the cathode follower —already a low value—and it is reduced appreciably by the anode-follower connection. For example, a 12AX7 cathode follower has an output resistance of some 500 ohms, while the same tube operated as a voltage amplifier may easily show a gain of 60. By using the two halves of a 12AX7 in the circuit of *Fig.* 9, and proportioning the resistors to yield a voltage gain of 1.0, an output resistance of some 17 ohms is obtained.

The connection of *Fig.* 9 is also very useful with transistors. Output resistances lower than one ohm can be obtained in this manner. Thus, high-impedance techniques may often be brought to bear on circuits which are presently considered low impedance, such as 250- or 500-ohm audio circuits. Æ

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Junk-box FM Alignment Unit

CHARLES H. CHANDLER and ALLEN R. GREENLEAF*

Here's a good way to put your electronic "junk-box" to work—build an oscillator capable of aligning the i.f. in your FM tuner.

TO FULFILL ITS FUNCTION as a high fidelity instrument, an FM tuner must produce a signal that is as free as possible from distortion. A fully modulated FM signal deviates 75 kc on each side of the 10.7 megacycle center frequency, so that its i.f. bandwith must be at least 150 kc; if the bandwidth is less than 150 kc, distortion occurs that is particularly objectionable on weak signals. Alignment on the center frequency, as is usual with AM tuners, is therefore not acceptable with FM. Most FM tuners are designed with a bandwidth greater than 150 kc; the test oscillator described here permits alignment of i.f. amplifiers with bandwidths as great as 1000 kc.

Ideally, an FM tuner is aligned by use of a sweep generator and oscilloscope, for direct visual observation of the response curve. Such equipment is highly desirable for a serviceman, but the unit described in this article is designed for the impecunious experimenter or owner of a hi-fi outfit; it may be used with a VTVM for readings. The unit had its inception when coauthor Greenleaf got stuck with an "RF Generator" kit that was represented as suitable for i.f.-r.f. alignment of TV, FM, and AM sets; it was in fact useless for FM because the dial was not, and could not be, graduated closely enough to give the required readings; actually the dial space between 10 and 11 megacycles was only about 13½ degrees. Indeed, most "service test oscillators" suffer from a similar design deficiency.

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Coauthor Chandler came to the rescue with a schematic of a suitable oscillator (*Fig.* 1), and the necessary design information, of which a distillation follows.

The chosen oscillator circuit was the popular Colpitts, which is readily realized with a 2-gang tuning capacitor of conventional type. This circuit imposes few requirements on the tuning coil used, since no taps are necessary, and the designer need not worry about inductive asymmetry resulting from the position of a ferrite or polyiron slug. With suitable tubes and conventional wiring, it will oscillate to reasonably high frequencies; here a 6AF4A, designed primarily for UHF service, performed without strain.

A cathode follower of conventional design was added for two reasons: to provide an output impedance low enough to be uncritical of load, even to the point of working into loads of the order of 300 ohms if required; and to isolate the oscillator circuit from undue loading, which might affect the frequency calibration or stop oscillation altogether. In this case a 6C4 was used, primarily because it was on hand. The 6C4 is rated up to 150 megacycles as an RF amplifier, and difficulty was neither expected nor encountered with its use in the heavily fed-back cathode follower circuit.

With this general design approach determined, coauthor Greenleaf searched his junkbox and the "surplus" market for parts, and put the unit together. Two variable capacitors, each of stated 25 μμf value, were found on a bargain table in a radio store; the shafts extended all the wal through, so that they could be coupled together. Each variable capacitor was shunted with a 20 μμf fixed capacitor (5% tolerance) to reduce the tuning range. Assuming that each variable capacitor had typical extremes of 5μμf minimum and 25 μμf maximum capacitance, the minimum and maximum capacitances of each combination of variable and fixed capacitor were about 25 and 45 μμf, respectively, so that the complete dual capacitor had a range of about 12½ to 22½ μμf.

Cut-and-try methods were used for preparing the inductor for the oscillating circuit. A "surplus" slug-tuned coil of about ⅜-inch diameter was unwound and the form was rewound with a number of turns of No. 26 enameled wire that was certain to be too great. Then the coil was tried out with the dual capacitor described above, and turns were removed, a few at a time, until a range of 500 kc below and 500 kc above the 10.7 megacycle center point occupied a conveninent space (about 85 degrees) on the dial. The final count was 33 turns.

Separate filament transformer and plate-voltage transformer were used because they happened to be on hand, and were of reasonably small size. There is nothing critical about this oscillator; if no 25 μμf variable capacitors are available, capacitors of lower or higher value can be used, with appropriate values of shunting fixed capacitors and inductor. The No. 26 wire was used because it was on hand and was of convenient size.

The unit was enclosed in a 5×6×9 inch aluminum utility cabinet, and it is important that it be calibrated while it is in the cabinet, with both back and front panels fastened securely.

Because no laboratory oscillator was available, the unit was calibrated against signals from FM stations. For example, the 96.3 megacycle frequency of WQXR-FM is the ninth harmonic of 10.7 megacycles, so that if the FM tuner is tuned carefully to WQXR, and the test oscillator is then applied to the antenna terminals, the tuning indicator shows when the oscillator is tuned to 10.7 megacycles. The point on the uniform scale of the dial is recorded at which each FM station is found, and a calibration curve is drawn on cross-section paper; from this

(*Continued on page 91*)

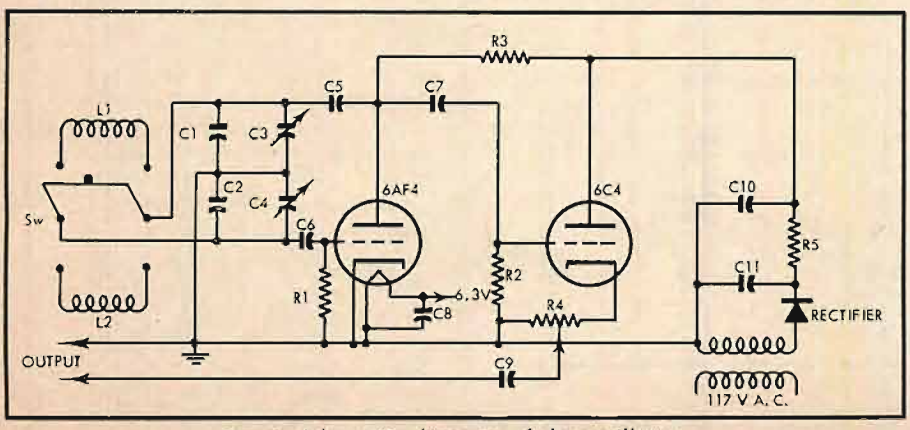


Fig. 1. Schematic diagram of the oscillator.

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A Variable Pitch Disc–Recording System

TOM H. JONES*

The goal of this system is to increase the amount of recording time per disc with no loss in quality. Here's how it works—

IN THE PROCESS of transferring taped material to an acetate record for mastering purposes, various problems arise in the cutting of the master disc. Primarily, however, every effort must be made to see that none of the quality of the master tape be lost in the duplicating procedure.

The cutter head used for mastering contributes greatly to the over-all quality. Linked-in with the head is the circuitry used to drive the cutter and its equalization characteristics. Even with present day mastering techniques, disc recording still suffers from diameter loss; that is loss of high frequencies as the center of the recording blank is approached.

The use of a slight amount of stylus burnishing plus the use of the heated stylus technique reduces the losses to a much lower level than previously experienced.

Still, at the present state of the art, maximum utilization of the outer diameter of the blank is considered important from a maximum time per side view.

The use of variable pitch cutting, or should we say variable groove spacing, is not new in the recording industry. The advent of the LP record helped to bring about variable pitch.

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It is possible, with present-day recording lathes, to cut very fine pitches (a large number of grooves per inch) using small groove-dimensions and obtain 25 minutes per side of a twelve-inch long-play record. However, only the very highest quality reproducing system could track this material. The largest part of the record-buying public would have no use for such records.

If one were to time a recent popular music release of a major record label (six selections per side) you would find only about 15 minutes recorded per side, plus or minus about three minutes. Bring this into "pitch" figures it means that the master acetate was cut at a pitch about 180 to 220 lines per inch. Groove depth at these pitches is ideal for the majority of reproducing systems, whether it be a small table phonograph or a deluxe system.

Fifteen minutes per side is not, however, ideal for lengthy classical recordings or combinations of narrative and music. If a system could be devised to utilize the valuable space on the record surface at times when modulation was low and stylus excursion was nil, considerably more time could be realized per side.

Adaptation

The system to be described was adapted to a standard recording lathe to provide maximum utilization of the available space on the recording blank. It is manually controlled.

A certain amount of mechanical work is involved in the actual installation and if the builder does not have machining facilities, or access to them, some amount of parts fabrication may have to be purchased. Aside from this, the rest of the installation and circuitry can be installed by the builder.

We have adapted this system to two popular recording lathes, the Fairchild series 539 and the Presto model 8D-G. Since the operation of all cutting machines is along the same basic principles, applying this system to other units should present few problems. One might encounter some difficulty applying variable pitch to lathes which obtain their feed-screw motion from the top center of the turntable. The movement of the overhead mechanism before and after each cutting presents problems as far as belt tension and alignment.

Inasmuch as the system is electronic, wear of parts such as rubber pucks is not a factor of importance. Also there is little chance of introducing rumble or patterns into the lathe because of the coupling of the mechanical drive to the lathe.

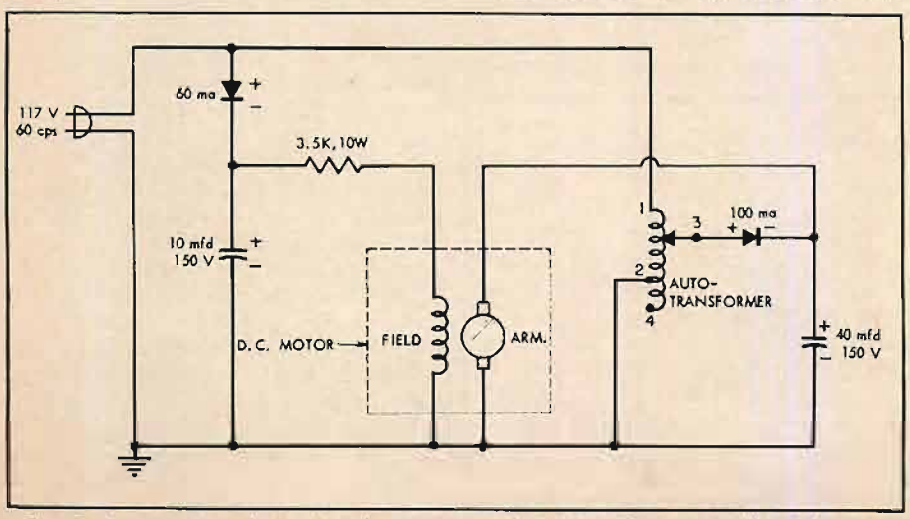


Fig. 1. D.c. motor and asscciated motor control circuitry. (Beware of "hot" chassis.)

Variable Speed Motor and Circuitry

The heart of the system is the variable speed d.c. motor which now drives the feed-screw in place of the former method. A variable speed motor was chosen because of its simplicity in comparison with mechanical methods of speed variation such as rubber pucks and planetary drives. The use of an electronic system also eliminates a large amount of mechanical work in the installation process.

The motor used in this application was obtained from the Gerald K. Heller Company, Las Vegas, Nevada, model number 2T60-100 (NSH-12-R). It is a direct current, shunt-wound motor. A built-in gear reduction unit reduces the maximum armature speed of 4000 rpm to a gear-output maximum speed of 40

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rpm. Change in direction of rotation is also easily effected by reversing the two leads of the armature winding.

A small power supply unit, *Fig.* 1, supplies the necessary constant-field voltage. A variable auto-transformer, connected in another rectifier circuit, supplies a variable d.c. voltage to the armature which in turn varies the speed of the motor. Selenium rectifiers are used in both circuits and current requirements are low.

The black and red leads are the field winding. Recommended field voltage is 80 to 120 volts. Increasing the field voltage within these limits will decrease the motor rpm while decreasing the field voltage will have the reverse effect.

The armature leads are respectively yellow and blue. These are fed a varying d.c. voltage from a second rectifier circuit. As the voltage to the armature is increased, the speed of the motor will be increased and which in turn will increase the speed of the lathe's feed-screw thus cutting a coarser pitch. The variable auto-transformer is connected so that an increase in rotation clockwise will cause a voltage decrease with the result that the feed-screw rpm will be slower, which in turn means a greater (more lines per inch) pitch. The auto-transformer is so wired that with clockwise rotation of the control knob, the pitch will vary from approximately 90 lines per inch to a maximum practical pitch of 500 lines per inch. The pitch control knob can be located on the lathe bench or at another convenient location for the operator. *Figure* 2 shows the knob located on the Presto lathe. It is located on the right side of a master control panel which was installed for other automatic features incorporated on the machine.

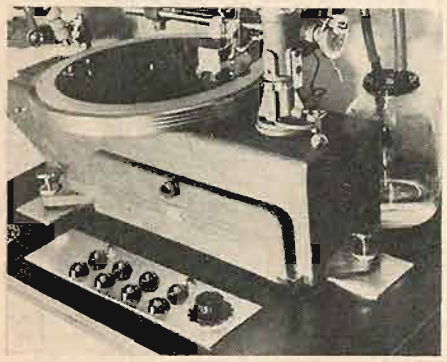


Fig. 2. Location of pitch-control knob.

The case of the d.c. motor should be grounded by braided grounding cable to the studio grounding system or to a good ground. Because of the construction of the motor, a certain amount of static-type interference or noise will probably be heard in the audio system. If grounding the shell of the motor does not eliminate the noise, insert the filter, shown in *Fig.* 3 in the a.c. power line before the power supply unit. Again, a good ground is necessary for the filter, preferably to the main studio grounding buss.

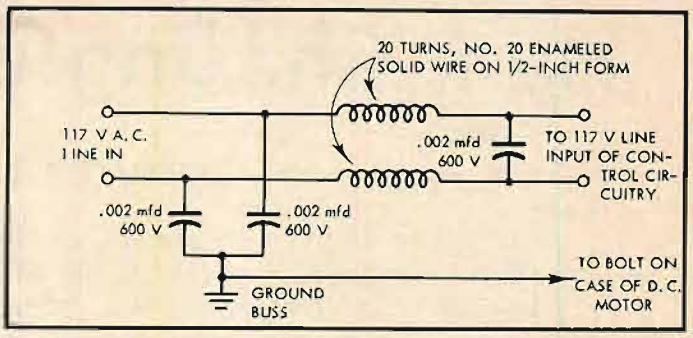


Fig. 3. Filter for removing noise caused by motor.

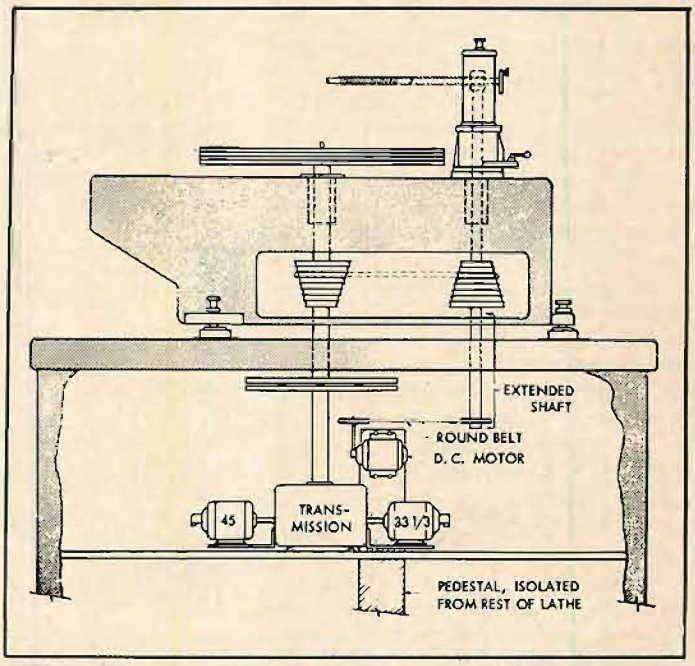


Fig. 4. Basic setup of Presto model 8D-G lathe with extended shaft and added d.c. motor.

The system was not designed to cut variable pitch at speeds other than 33⅓ rpm for LP work. There is little practical value at the 45 and 78 rpm speeds. If, however, one required the variable pitch control at these speeds, a three-stepped pulley could be incorporated on the pitch motor to compensate for the speed changes. We retained the former belt arrangement of the 8D-G for driving the feed-screw at the 45 and 78 rpm speeds.

Mounting

It can be seen from *Fig.* 4 that the pitch motor was mounted on a pedestal isolated from the lathe proper. It was necessary to install a longer feed-screw drive shaft than the one normally used on the 8D-G lathe. The stepped pulley which drives the feed-screw is mounted on this shaft. This was done so that another pulley could be mounted below the surface of the bench to be driven by the new pitch motor.

A small round rubber belt is used to connect and transfer motion from the pitch motor to the feed-screw driving shaft. (See *Fig.* 5.) Other types of belts such as the cotton variety used to drive a dental drill will operate satisfactorily although it is difficult to obtain such a belt in the short length required for this application. Custom-made belts of the exact length and material required may be ordered for a reasonable price from the Arthur S. Brown Mfg. Co., Tilton, New Hampshire. A round, woven-cotton belt, impregnated with a rubber compound would be ideal as it would not have any tendency to stretch but would still have gripping properties. All other devices formerly used to drive the feed-screw must be disengaged so as not to present resistance to the motor now driving the feed.

Because of the physical isolation of the motor and its mount from the lathe,

(*Continued on page 89*)

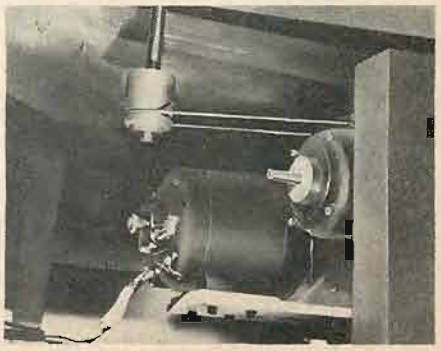


Fig. 5. Closeup of d.c. motor and belt driving extended shaft.

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Hum Chasing is Engineering?

NORMAN H. CROWHURST*

The job of chasing hum can be one of the most exasperating chores the engineer is required to perform. Here's some fresh ammunition for the hum hunter—calculated to help him "buck out" some of the difficult problems.

YES, THE WORD IS "Chasing"—not "Tracing." When hum develops in a piece of production equipment, it is a technician's job to *trace* it. That is not what we're talking about. In that case, the hum may be due to a dried-out electrolytic, a defective tube, or a leaky power transformer, which has to be traced. But when you have a new piece of equipment—a prototype—and it hums, the job often proves to be one of chasing.

It's a chore. The senior engineer does not regard it as engineering—at least *he* doesn't want to bother with it. Let a junior engineer or technician fuss with that. He's already engineered the thing and it works. It's just a little hum that has to be got rid of. And anyone can get rid of hum. . . . .

All too often the junior engineer runs into "difficulties." The books don't help him much, but he's tried everything he's learned about hum. Some of the things he does may vary the hum somewhat, but none of them stops it—except removing all the tubes or switching off the power. He's checked for ground loops, magnetic and electric (or electrostatic) induction, hummy tubes—the works. Wherever he goes in the thing, the hum's still there.

Sometimes he gets in a real muddle. Changing the value of one component inexplicably reduces the hum. There is no valid engineering reason why it should, but he accidentally found out it does. So he makes the change. The hum is still not good enough, so he continues to work on it. Presently he finds the hum is worse than ever, and he cannot even repeat results as good as when he started working on it.

Is that a familiar story? The real lesson is that hum chasing is an engineering job, not to be pursued in such an aimless or frantic manner. Approaching it from a true engineering basis does not eliminate the "chasing" aspect of the job, but it can eliminate the hum.

The first thing to keep in mind is that, when you are working on new equipment that has never been "de-hummed," you may not be tracing just one source of hum, but several. At one point in your endeavor, you may try additional filtering in the B+ supply, for example, and find it makes no difference or even increases the hum slightly. But don't conclude that this lets out the B+ filtering as a possible contributing factor to your problem.

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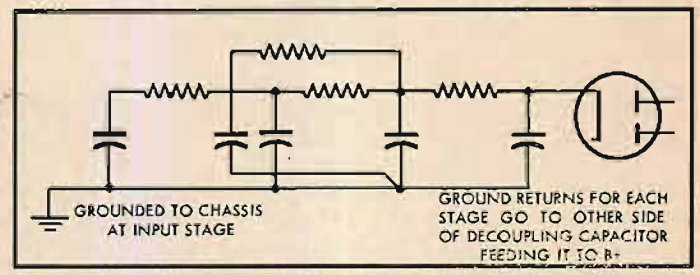


Fig. 2. Basic principle of good grounding system is to have ground "bus" a mirror image of the B+ distribution system.

All hum comes from the same ultimate source—the supply. It has the same frequency, or harmonics of it. So all kinds of addition and cancellation can occur on the way. When you clip on additional filtering capacitance, the ground point you choose for the extra connection may inject some ripple current into a signal circuit. So, while you may be reducing the ripple on the B+ supply, you are inducing as much or more hum into a signal circuit, and the net effect is no change, or an increase.

Or it may be you are eliminating one source of hum. But at present it is not your major source. Because it was cancelling some of your major source, the elimination of this piece makes little difference, or even makes it louder. Later on, after you have eliminated what proved to be a bigger source of hum, you can make the same test, and discover that now it produces a dramatic reduction in hum. Until you have gotten rid of the hum, *never accept any conclusion as final.*

In particular, anytime a change that should reduce hum just changes its harmonic content, or increases its magnitude, you can be sure you have more than one kind of hum to trace down. No simple change is going to get rid of all of it.

It is a big help to look at the hum on a high-gain scope, as well as listening to it. Not only can this help identify the source, it can often help identify interacting effects of the type we have just mentioned. Sometimes a circuit change may not reduce the magnitude of the

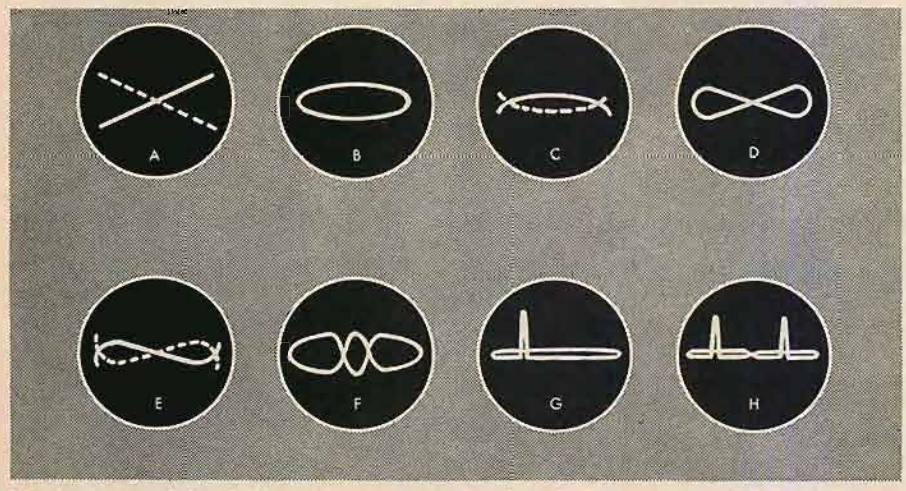


Fig. 1. Some of the basic patterns encountered in hum chasing: a. 60 cycles; b. 60 cycles with 90° phase shift; c. 120 cycles; d. 120 cycles with 90° phase shift; e. higher odd order harmonics; f. same with 90° phase shift (relative to 60-cycle timing); g. spike due to half-wave rectification; h. spikes due to full-wave rectification; all using 60-cycle line time base.

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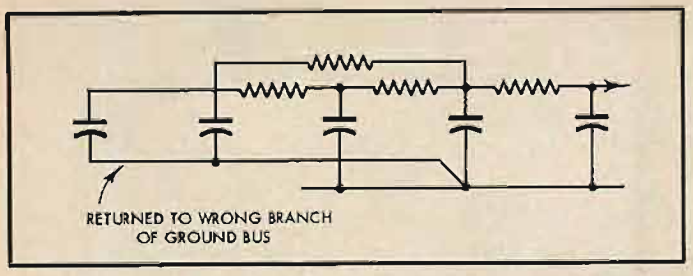


Fig. 3. Incorrectly returned capacitor can inject hum due to wrong return of ripple currents.

hum, but it will change either the harmonic composition or its phase relation to line frequency. Harmonic composition can be identified much more readily by looking than by listening, and the phase can only be recognized by looking.

If the equipment uses full wave B+ rectification and 60-cycle heater supply, the predominant frequency in the hum also provides a good lead. For most informative display, use the scope's line frequency time base. Then 60-cycle components will produce a slanting line or ellipse (*Fig.* 1-a or -b), while 120-cycle components, originating in some way due to the B+ supply, will produce a curve or figure 8 (*Fig.* 1-c or -d).

A third or higher order odd harmonic (*Fig.* 1-e or -f) is usually due to induction from a power transformer or motor. Higher order "ticky" hums, that produce one or more spikes on the trace (*Fig.* 1-g or -h) are usually due to rectifier circuit pulses finding their way to where they shouldn't.

That much information tells you where the hum comes from, but not by what route. Most of these forms can get into signal circuits by a variety of routes. By now everyone knows about ground loops. But a ground loop does not always produce a hum, and sometimes a ground system that has no loop can be responsible for producing hum.

Sound engineering makes the ground return system a mirror image of the B+ supply circuit (*Fig.* 2). Where the supply branches, the ground line should similarly branch, so return currents follow courses corresponding to outgoing currents. A decoupling capacitor returned to the wrong place on a ground line, or to a wrong branch on it (*Fig.* 3) may be a cause of hum, due to ripple current it injects at the wrong place.

Watch electrolytic capacitor returns. If necessary, use the insulating wafers for mounting so they can be isolated. It may sometimes be necessary to change the group in "cans" because the common grounding in a single can causes trouble.

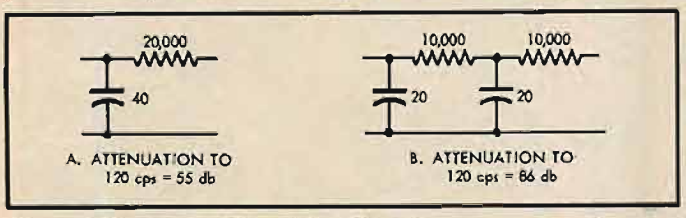


Fig. 4. Two stage filter, using same voltage drop and total capacitance, is more effective in hum reduction.

Only when you have the wiring correct in this way, can you be sure that checks on the adequacy of smoothing at various points give valid answers. Now you can try increasing the size of different smoothing or decoupling capacitors to check this. If you're up against smoothing versus d.c. voltage drop, don't forget that two 20's with a couple of 10k resistors will do much more ripple smoothing than one 20k with a 40 mfd. capacitor, for the same d.c. drop (*Fig.* 4).

This brings up another aspect of supply induced hums—phase. Each smoothing element (R and C together) produces approximately a 90 degree phase shift in the ripple voltage. Check your phases around the circuit to see whether residual hum injected at different points adds, subtracts, or is in quadrature (*Fig.* 5). This simple deductive process can be a big help in interpreting what you see on the scope. It may also help you arrive at another supply arrangement that will let the hum components buck rather than aid one another.

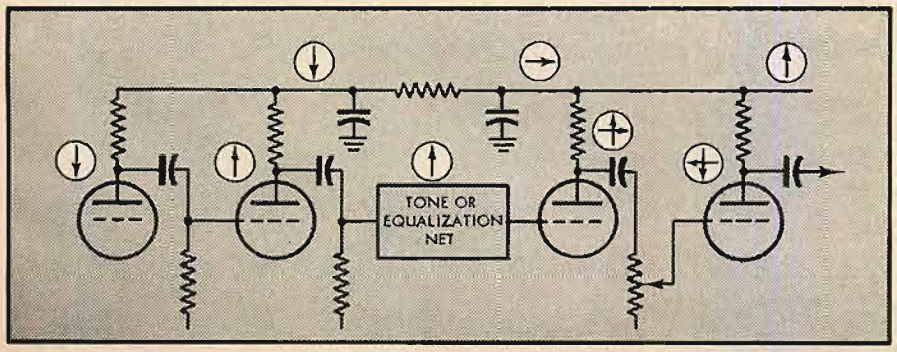


Fig. 5. Using phase arrows, as shown here, can help trace whether sources of hum are additive or otherwise.

Heater supply hum can be induced into the signal circuits in a variety of ways, internal or external to the tubes. Internal, it may be due to capacitive transfer either to grid or cathode. To grid, the effect will depend on the grid circuit impedance, as with other capacitive (electric) transfers; to cathode, it depends on the impedance between cathode and ground.

Electronic conduction between cathode and heater, due to the heater acting as a plate with low applied a.c. potential, can cause hum, either 60 or 120 cycles. A remedy for this is by now well known.

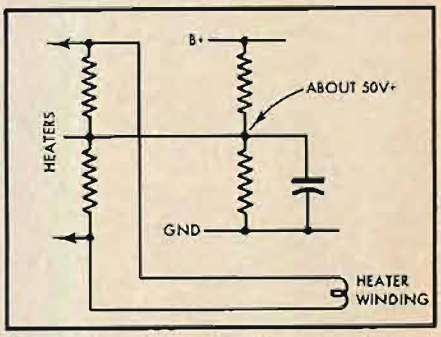


Fig. 6. Use of positive bias to eliminate internally caused heater hum.

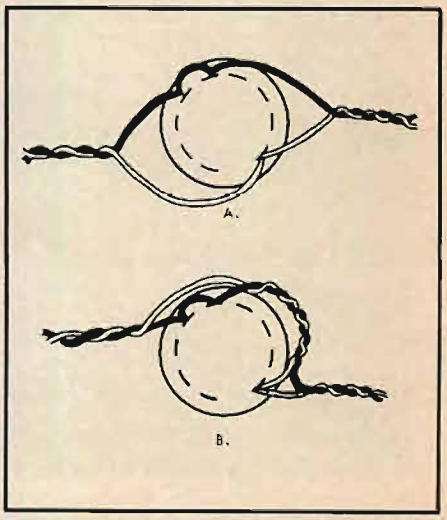


Fig. 7. Heater wiring lead dress is important: although twisted throughout rest of travel, (a) leaves a loop under the socket, which (b) eliminates.

The heater is biased positive so this conduction path is maintained at saturation (*Fig.* 6).

In series-connected (tranformerless) heater chains, cathode injected heater hum can be a real problem. A really low ground return impedance is necessary in the cathode circuit. Often the best solution is to connect the cathode solidly to the ground bus or chassis, and use grid-current biasing instead of the usual self-bias resistor in the cathode circuit.

(*Continued on page 87*)

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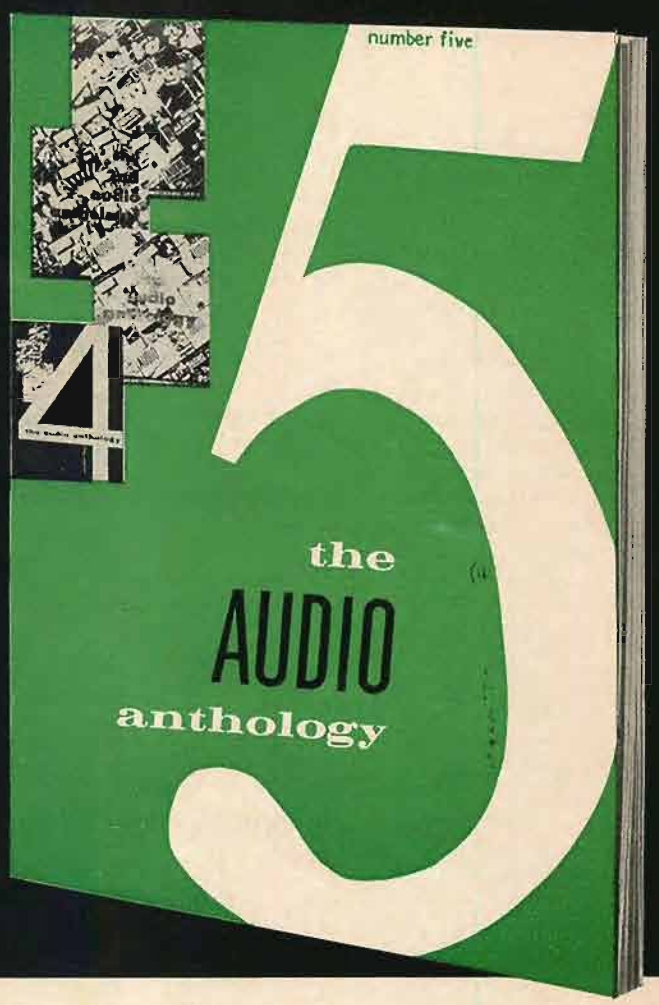
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The Pro- and Con-vention

L. GOELLER*

Electron flow vs. conventional current—the battle has been going on for a long time. Here is the case for conventional current by a reluctant convert.

IN AN ELECTION YEAR, the demand for equal time is larger than the total time available by about a factor of ten. Even so, when one side of a question is aired, the public *is* entitled to a crack at the other side of the story.

The case in question is electron flow vs. conventional current. I don't see myself as the champion of conventional current, but after at least fifteen years of statements similar to those of Almus Pruitt (Those crazy mixed-up currents, AUDIO, April, 1960), it struck me that many readers might like to know why conventional current is the winner hands down over electron flow and is quite likely to stay that way.

Before we start, let me emphasize one major point of agreement between champions of both points of view: it would have been much neater if Dr. Franklin had chosen his signs the other way. But since he goofed, let's see what confronts the would-be changer of convention at this late date:

1. To the best of my knowledge, there is not one single engineering textbook or professional journal which uses electron flow as a substitute for current.

2. There are many areas in ordinary circuit theory where electron flow (or *any* charge flow) fails miserably.

3. In other than the most elementary explanations of biasing low-frequency vacuum tubes, electron flow offers negligible advantages over current.

4. In dealing with more general problems in electronics and physics, electron flow as a replacement for current would confuse the issue badly.

* *2 Marsha Terrace, Parsippany, N. J.*

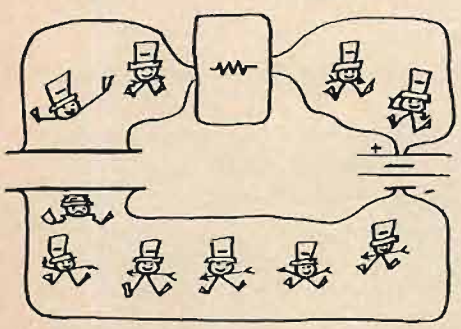


Fig. 1. Current is the same at all points in a series circuit. This includes capacitors. Unfortunate electrons, viewed anthropomorphically above, are stopped cold by capacitors.

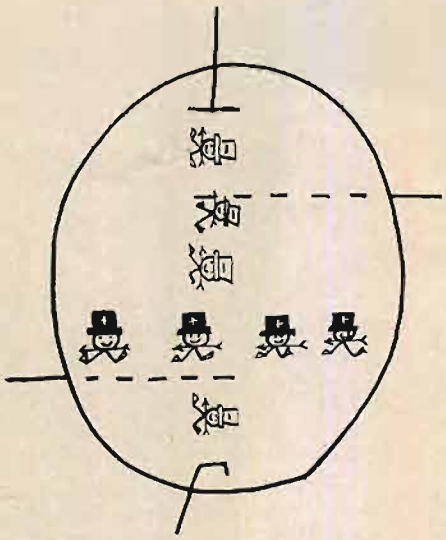


Fig. 2. In a vacuum tube, electrons flow from cathode to anode and positive ions flow to the grid. It is supposed to be possible to describe the situation realistically in terms of electron flow.

5. The present standards are maintained by the pros . . . the people who arrange and use their own tools in their own way. They are remarkably unamenable to outside pressures for change. One might as well ask the musicians to define *piano* as loud and *forte* as soft.

Before the tar and feathers come out, let me remark that I am merely acting as a reporter. I am hardly unbiased, but there *was* a time when I supported the electron flow convention with vigor. I only wish that someone had pointed out a few of the pitfalls to me then. It would have saved me a lot of frustration and grief later.

What is wrong with electron flow? In the first place, it is only *part* of current. Current can be carried by positive charges, negative charges, and no charges at all. Consider a battery, switch, resistor, and capacitor in series. Close the switch and current flows out of the positive terminal of the battery, through the resistor, through the capacitor, and back to the negative terminal of the battery. That's right. Through the capacitor.

What price electron flow now? Who wants to step forward and use it to prove that current is the same at *all* points in a series circuit, including the dielectric of the capacitor? The displacement current, as it is called, is a perfectly valid current. It is not electron flow, but it is current, it does flow in the dielectric, and it is equal to the current everywhere else in the circuit.

The idea of current, independent of carriers, is worth thinking about. When charges are present and capable of motion, positive charges in the positive (conventional current) direction and negative charges in the negative direction direction both produce positive current. But as we have seen, current can exist in the absence of charges, too. For examples we can turn to electroplating systems where both positive and negative charges carry current. In gas tubes, both polarities of charge are again present and moving. In transistors it is handy to think of current in terms of negative electrons and positive holes because, for one thing, holes move slower than electrons (as well as in the opposite direction) in the same electric field. We could wander into magnetohydrodynamics and radiation theory for further examples but let's not overdo it. It should be clear by now that current is perfectly general while electron-flow is limited to electrons flowing.

This conceptual difference is, however, only part of the story. Obviously a general current could have been defined in the electron-flow direction as easily as not. But since it wasn't, we come to the heart of the matter.

In most problems in electrical engineering, the *mechanism* of conduction is utterly irrelevant. Current might just as

(*Continued on page 84*)

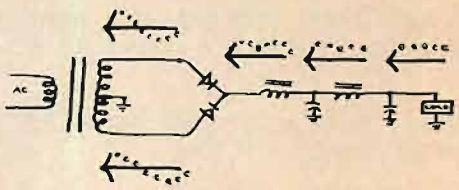


Fig. 3. In this circuit, electrons flow up from ground, through the load and into the output of the filter. The filter adds an a.c. component until, at the rectifier output, pulsating electron flow is obtained. After electrons flow against the arrows representing silicon diodes, they are converted to pure a.c. Note that some books which use the electron-flow convention locate the filter in positions seldom encountered in practice to avoid facing up to the above situation.

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The Esquire 200—Now the value-packed Esquire is available in three different forms . . . the handsome Esquire 200, the economical unfinished Esquire 200 Utility and the new Esquire 200 Kit. Each is a full three-way system with a 12" woofer, 8" cone-type mid-range speaker and E-V Super Sonax very-high-frequency driver. Esquire 200—14" high x 25" wide x 13½" deep. Hand-rubbed Walnut, Mahogany or Limed Oak . . . . $133.00. Esquire 200 Unfinished Fir Utility—14" high x 23½" wide x 12" deep . . . . . $107.50. Esquire 200 in easy-to-assemble Kit form—14" high x 23½" wide x 12" deep . . . . . $93.00.

The Regal 300—A premium-quality, three-way system utilizing the finest quality components to assure the best sound possible in a small-sized system. Deluxe 12" woofer, a Deluxe 8" cone-type midrange speaker, and a compression-type, diffraction horn-loaded very-high-frequency driver. 14" high x 25" wide x 13½" deep. Walnut, mahogany, or limed oak . . . . . $179.00. Unfinished fir . . . . . $149.00. In Easy-to-assemble Kit Form . . . . . $125.00.

Consumer Products Division Electro-Voice

Dept. 12 A, Electro-Voice, Inc., Buchanan, Michigan

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Tape's Future

HERMAN BURSTEIN*

Rapid change has been characteristic of the tape industry for the past few years—a blessing to those who bought late, a curse to early buyers. What does the future hold? Well—

CHANCES ARE THAT a really good speaker, power amplifier, FM tuner, turntable, or possibly other audio component which you may have purchased ten years ago is still capable of high fidelity service. Unfortunately, the same cannot be said about home tape recorders that are ten years old, or for that matter five years and perhaps one year old. Throughout its history as a consumer item, the tape recorder has undergone a series of changes that have spelled rapid obsolescence. Tape speeds have been reduced. Gaps of playback heads have become narrower for better treble response. Tape heads have gone from single-track to half-track mono; from staggered heads to in-line heads; from 2-track to 4-track stereo. Record and playback equalization characteristics have been in transition. Recommended values of bias current have varied as tape formulations have changed. The tape cartridge has appeared, necessitating a new type of playing mechanism.

Considering this history of continual change, the perplexed audiofan may well wonder if the next ten years will hold a similar tale. Even though changes are in the nature of improvements, it is a questionable type of progress that produces such rapid obsolescence that few can afford the cost of a tape recorder per year of useful service.

For a glimpse of what the next decade may hold, the author has addressed a questionnaire to a number of manufacturers of tape recorders, tape, and related components. While their responses show that no one expects progress to stop, nevertheless they are virtually of one mind that tape is past its period of initial growth, when changes could be expected to be most numerous and far-reaching; that such changes as do occur will be evolutionary rather than revolutionary, so that older machines will not be technically outmoded; that tape technology has settled down to the point where today's purchaser has substantial assurance against early obsolescence.

Following are the specific questions that were asked and a number of the replies.

1. *What Tape Speeds Do You Expect To Be Standard?*

The concensus is that 7.5 ips will be with us for a substantial period of time as the standard speed for truly high fidelity, despite the fact that very good results are achievable at 3.75 ips and even less. A representative reply was: "7.5 ips is the standard of the Magnetic Recording Industry Association. With the strong impetus that 4-track 7.5 ips has been given by United Stereo Tapes . . . we see no other speed becoming standard for high quality home purposes." Another stated, "I believe 7.5 ips will remain standard for some time for hi-fi."

Of the contest between 7.5 and 3.75 ips, one respondent had this to say: ". . . it is our feeling that the 7.5 ips tape speed will remain more or less the standard insofar as true high fidelity is concerned. . . . Thus at this time it looks as though the recording camp will be divided between 7.5 ips for the die-hards and 3.75 ips for the sports car group who put the accent on economy and derive their satisfaction from saying, 'Look what I did at 3.75 ips.' " With respect to the 1⅞ ips speed, this respondent stated, ". . . ferrite heads and extremely short gaps and probably new tapes may bring in 1⅞ ips as a home standard. We have heard no hint, however, that these heads, the tape, or the recording process were intended for the do-it-yourself recording market." (In other words, 1⅞ ips may be confined to playback so far as high fidelity is concerned.)

Following are replies of those who see 7.5 ips being displaced some day as the home standard for high fidelity.

"The tape speed that appears standard, at least for the time being, is 7.5 ips. Of course, there has been a great deal of discussion about adequate fidelity at lower speeds, but as of the moment this is still in the developmental stage. I have no doubt that at some time in the future . . . 3.75 ips will be developed to the point where it is more than adequate for home use."

"I cannot tell you, nor can anyone, what tape speeds will be three, five or ten years from now. All we can say is that it appears that they will be slower than present day standards."

"Tape speeds will decrease. The current trend toward tape economy and reduction of tape storage space dictate a future 'high quality' tape speed of 3.75 ips. 'Good fidelity' will be available at 1⅞ ips. In addition, many machines will be equipped to record and play back at speeds below 1 ips."

2. *What Playback Equalization Curves Are Likely To Become Standard?*

It appears that the NAB curve—borrowed from the official standard for 15 ips—is well entrenched as the "de facto" standard for 7.5 ips. This involves playback boost commencing at 3180 cycles (3 db rise) and eventually tapering off

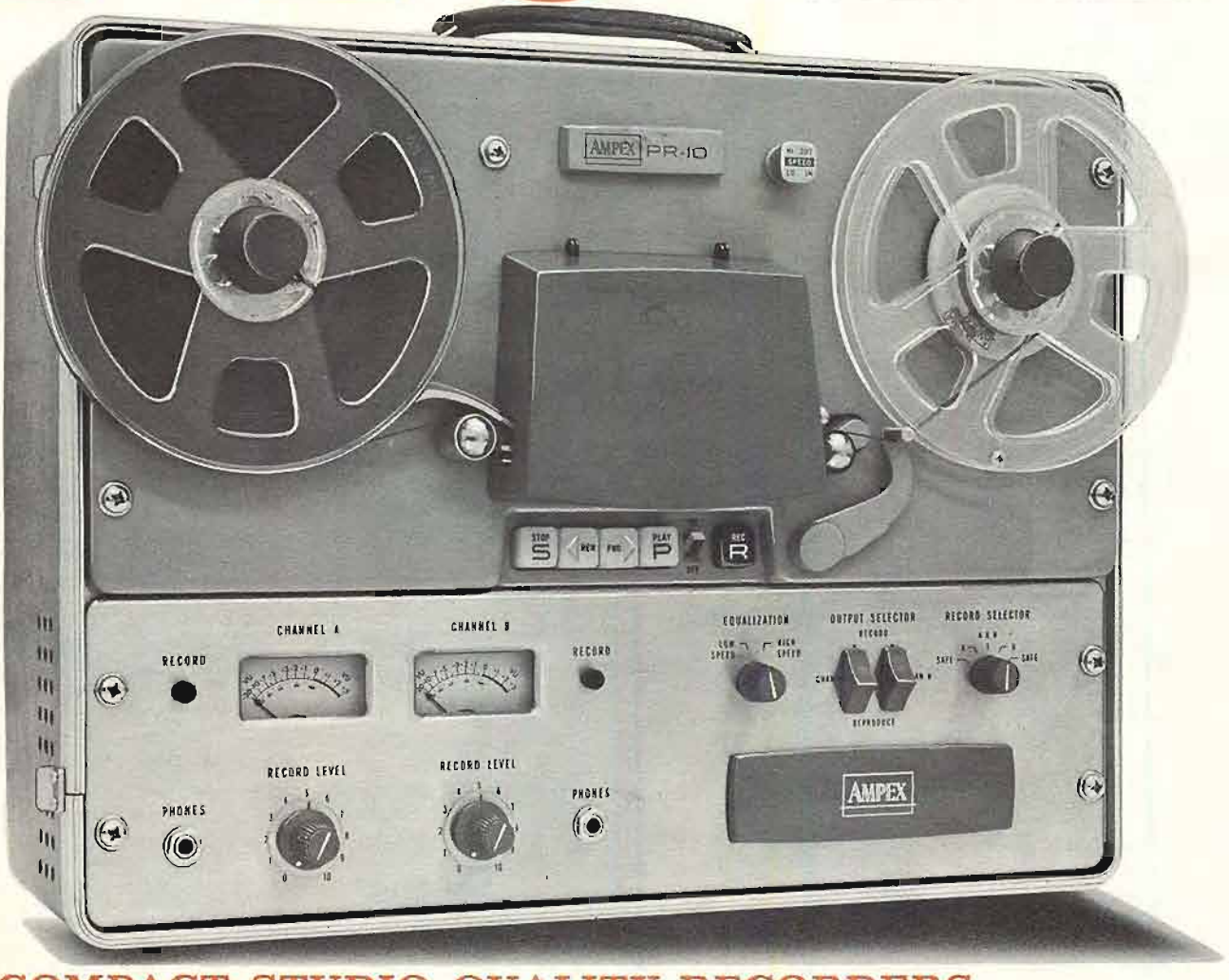
(*Continued on page 35*)

* *280 Twin Lane E., Wantagh, N. Y.*

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EXCLUSIVE ELECTRODYNAMIC CLUTCHES for fast, gentle, error-proof tape handling

EXCLUSIVE AUTOMATIC TAPE THREADING ACCESSORY introduces "No Hands" tape handling for speed and convenience (optional)

PROFESSIONAL PUSHBUTTON RELAY/SOLENOID CONTROLS for rugged, positive, convenient operation

COMPLETE REMOTE CONTROL of ALL functions permits expanded use of recorder

ALL NEW COMPACT ELECTRONICS with many advanced design features

ADVANCED DESIGN 4-POSITION HEAD ASSEMBLY (erase, record, playback, + space for extra head) permits changing heads in the field for special requirements

PLAYBACK WHILE RECORDING for on-the-spot quality assurance

4-TRACK STEREO PLAYBACK (optional) for fourth head position

MINIATURIZED "PLUG-INS" for flexibility of equalization and input characteristics

HYSTERESIS SYNCHRONOUS MOTOR for timing accuracy

TWO SPEEDS: 15 and 7½ ips or 7½ and 3¾ ips

RUGGEDNESS AND DURABILITY of overall design to outlast a succession of lower cost units





STEREO/MONOPHONIC MODEL PR-10-2

Important technical advances permit combination of complete, professional stereophonic and monophonic record and reproduce at little more cost than monophonic alone. The versatile PR-10-2 provides 1) complete stereophonic record and reproduce, 2) monophonic record and reproduce with many of the new two-channel techniques now being used, 3) conventional monophonic use (½ track).

In addition, separate-track erase head in combination with new "record/safe" selector permits half-track recording of either track, sound on sound, cue tracks, and other special effects. Full-track playback applications can also be met with full-track playback head in 4th position.

MONOPHONIC MODEL PR-10-1

Available in full- or half-track versions. Includes all advanced features listed above plus — the single channel electronics with a built-in mixer that can mix line and microphone or two microphones (by using a plug-in preamplifier). Later conversion to two or more tracks is accomplished by changing full-track head stacks and adding an electronics. (The half-track version is originally equipped with stereo heads.)

PORTABLE OR RACK MOUNT AVAILABLE ON BOTH MODELS

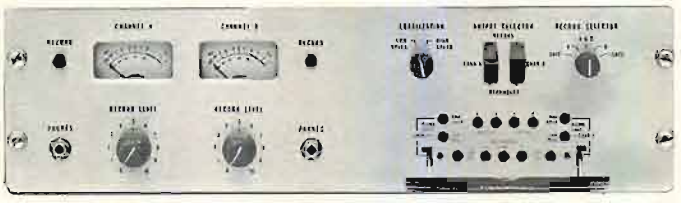
As a portable, the PR-10 offers performance found only in units twice its size and weight. For rack installation, either the monophonic or stereo units require only 19" wide by 14" high mountings — a space occupied by many older recorders, permitting easy replacement without disruption of equipment racks.

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CONVENIENCE, DEPENDABILITY AND LONG LIFE ARE BUILT INTO THE PR-10'S ADVANCED DESIGN

- Rigid, noise-insulated top plate of special aircraft style construction insures permanent alignment of all components for precision tape handling
- Shielded, hinged head cover fully exposes heads for easy tape editing
- Head alignment "locked" to eliminate periodic need of head adjustment
- Error-proof pushbutton operation
- Simple, guided, straight-line tape threading
- Tape lifters permit touch cuing on fast wind and rewind
- Positive, dependable speed change
- Provision for fourth head (four-track stereo, sync head, etc.)
- Motor cuts off to permit "stand-by" position when safety switch arm is released
- Lifetime, solenoid operated self-regulating brakes never need adjustment





- Hysteresis, synchronous motor for timing accuracy. Reserve power insures against stalling or overloading
- Exclusive electrodynamic drive assures permanent, adjustment-free tape handling
- Each transport component (clutches, motor, solenoids) is unitized, plugs into color coded socket on control box
- All new compact electronics with new, low noise circuits and many operating features and conveniences
- Safe-Record selector protects against accidental erasure
- Two 3" side-by-side VU meters permit simultaneous reading and balancing of channels
- All electronic alignment controls accessible through exclusive front panel door, eliminating need to remove unit from case or rack
- Individual A-B switches on each channel for quick comparison between original and recorded program

ACCESSORIES AND ASSOCIATED EQUIPMENT

optional at extra cost













FOUR POSITION TWO-CHANNEL, MONOPHONIC/STEREO MIXER
The MX-10 mixer was designed to extend the flexibility and operation of the PR-10 recorders, permitting up to four microphones, or two mikes and two lines, to be controlled and fed to either or both output channels. Request Bulletin No. 211 for full details.

PROFESSIONAL SPEAKER AMPLIFIER MONITOR SYSTEM
The finest, most flexible unit ever designed for professional monitoring. Provides quality, power, and overload characteristics essential to critical listening and evaluation. Powerful 40 watt amplifier with new stabilizing power demands circuitry and efficient, long excursion speaker in special completely separate tuned duct enclosure assure lowest distortion at critical low frequencies. Available for portable, rack or wall mounting. Request Bulletin No. 214.

REMOTE CONTROL
Greatly expands use of recorder. Plugs into receptacle provided and permits recorder to be controlled from any desired location. Duplicates all functions of record, play, fast forward and fast rewind buttons on tape transport. Record button prevented from functioning when record selector is in "safe" position. Available as a boxed or flush plate unit.

TWO-SECOND AUTOMATIC TAPE THREADING
Exclusive Ampex Professional accessory allows two-second threading without being touched by hand. Kit is either factory-installed or can be added later by user.

PLUG-IN EQUALIZERS
Interchangeable units provide NAB, AME or CCIR curves appropriate to tape speed used. Equalizers for other curves to meet special requirements available on special order.

PLUG-IN INPUT UNITS
Interchangeable units match various inputs such as zero loss transformer for balanced bridging; 40 db miniaturized microphone preamplifier for close pickup conditions and/or high output microphones — 60 db miniaturized preamplifier for distant pickup conditions or low output microphones.

GENERAL PERFORMANCE CHARACTERISTICS AND SPECIFICATIONS

IMPORTANT: AS PROFESSIONAL EQUIPMENT, THE AMPEX PR-10 SERIES OF RECORDERS IS DESCRIBED BY SPECIFICATIONS LISTED BELOW WHICH ARE ACCURATE MEASUREMENTS REQUIRED BY PROFESSIONAL STANDARDS AND DO NOT INCORPORATE EXAGGERATED SALES CLAIMS. THESE ARE THE GUARANTEED MINIMUM PERFORMANCE SPECIFICATIONS THE CUSTOMER CAN EXPECT IN LONG-TERM OPERATION.

FREQUENCY RESPONSE:	30 - 18,000 cps ± 2 db at 15 ips 40 - 12,000 cps ± 2 db at 7½ ips 40 - 8,000 cps ± 2 db at 3¾ ips
SIGNAL TO NOISE RATIO:	Better than 55 db at 7½ and 15 ips 50 db at 3¾ ips
FLUTTER AND WOW:	Less than 0.15% rms at 7½ and 15 ips 0.25% rms at 3¾ ips
TIMING ACCURACY:	Within ± 0.25%
OUTPUT:	+ 4 dbm into 600 ohm balanced or unbalanced load. Cannon XL connectors. Single and two-channel headphone jacks provided.
INPUTS:	**PR-10-1 single-channel model** with two inputs: No. 1 — Low impedance microphone input stage. No. 2 — Unbalanced bridging with provisions for plug-in balanced bridging transformers or low impedance plug-in microphone preamp. Individual gain controls on each. **PR-10-2 two-channel model** with one input per channel: Unbalanced bridging with provisions for plug-in balanced bridging transformers or low impedance plug-in microphone preamps. The MX-10 accessory mixer is designed to feed unbalanced bridge inputs.
SPEEDS:	7½ and 15 ips, or 3¾ and 7½ ips
POWER REQUIRED:	117 volts AC - 60 cycles, 1.84 amps (215 watts)
RACK SPACE:	Transport 8¾" x 19" x 6" D. Electronics 5¼" x 19" x 5⅞" D.
WEIGHT:	Unmounted 44 lbs; Portable 53 lbs.

STUDIO CONSOLE PERFORMANCE AND FEATURES AT HALF THE WEIGHT, HALF THE SIZE AND HALF THE PRICE:

PR-10-1	Monophonic recorder	$845
PR-10-2	Stereo/Monophonic recorder	$945
MX-10	Stereo/Monophonic mixer	$395
SA-10	Speaker/Amplifier	$295

Prices are for unmounted models

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847 Divisadero St.
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Arco Electronics
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Fidelity Sound Inc.
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East Coast Radio of Miami
1900 N. W. Miami Ct., N. W.
Flagler Radio Co.
1068 W. Flagler St.
ORLANDO
East Coast Radio of Orlando
1012 Sligh Blvd., S. W.
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Grice Electronics Inc.
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TAMPA
Burdett Sound
3619 Henderson Blvd.

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AMPEX

TAPE GUIDE

(*from page 32*)

so that at 50 cycles it is 3 db below the maximum boost of 36 db attained at the lowest frequencies. At 3.75 ips, it is indicated that the RCA standard playback curve is being accepted. This is similar to the NAB curve, except that bass boost is 3 db up at 1326 cycles. At the time of writing, there were no indications of agreement on 1⅞ ips equalization.

3. *How Likely Is It That Home Tape Machines Will Provide Three or More Channels?*

None of the replies gave encouragement to the view that home tape machines will eventually provide three or more channels. Representative replies were as follows:

"There is no sign at present of multiple channel development."

"I seriously doubt that more than 2-channel stereo will ever be adopted for home use."

"We have no present plans for 3-channel equipment and have no feeling that it is likely to become a factor; for four or five channels, even less so."

"It is my personal feeling that such industry moves will be made with a great deal of caution and deliberation."

"It seems probable that 2-channel will continue as standard."

4. *What Changes May Be Expected in Tape Recorders?*

As suggested at the outset, the outlook is for slow, steady improvements in quality instead of the radical changes that overnight cause a tape machine to be outmoded. The only radical change contemplated by the respondents is the growing role of the cartridge player. At the same time, however, it is not expected that the cartridge player will displace the open reel machine (or reel-to-reel machine, as it is often called). Instead, it is generally believed that the two will exist side by side, each serving a particular function. Following are a number of the comments concerning the role of the cartridge machine vis-a-vis the present-day open reel machine.

"Complete coexistence."

"Both will remain standard. Cartridge and 3.75 ips for general 'mass market' use, but open reel will remain the favorite for hi-fi applications."

"The cartridge and reel-to-reel approaches will probably become 'hand holding friends' instead of the 'bare knuckle combatants' they are supposed to be. Each has its advantages, and together they will broaden the base market for tape."

"I think without question reel-to-reel

(*Continued on page 83*)

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An Engineer's High Fidelity System

R. A. GREINER*

IN TWO PARTS—PART 2

Versatility and attention to detail characterize this engineer's high fidelity system. The concept and the execution are both uncompromising.

IN THE PREVIOUS section I described the speaker system. Now I'll detail the over-all system electronic setup, with specific parts of the electronic system described in greater detail. A block diagram of the system is shown in *Fig.* 1. On the left are seen the signal sources. These consist of two stereophonic tape recorders—one a Berlant the other a Concertone; two Rondine Deluxe turntables with Shure stereo and monaural pickups and arms; and an FM tuner. Preamplifiers are mounted in the playback consoles to bring the output level up to 0 VU. The signal sources are brought to the jack panel and can then be plugged to the various control amplifiers. All of the control amplifiers have essentially unity gain, or less, and are therefore only used for modifying the signal in some prescribed way. The control at the top is the main remote unit which normally controls the main power amplifiers and the main loudspeaker system. The dubbing control is described in more detail later. It performs the function of switching for the process of tape or disc copying. The "third channel" is also developed in this chassis. The filter is not described in this article but is simply a low and high pass unit to cut out the frequency extremes for certain kinds of copying.

The outputs of all of the control amplifiers then go to the jack panel and can be plugged to the appropriate power amplifiers. The power amplifiers consist of four 50-watt amplifiers for the main system and a pair of commercial 35-watt amplifiers on a single chassis. The amplifiers are connected to the loudspeakers via a jack panel so that the speakers may be disconnected or connected to other amplifiers, or the amplifiers may be used for other purposes independently.

* *University of Wisconsin, Department of Electrical Engineering.*

The Remote Control Amplifiers

In this system, the signal sources and the power amplifiers are not at the most convenient location for the control amplifiers. Thus the remote control unit was devised. In order to simplify the interconnection of many long cables, the re-

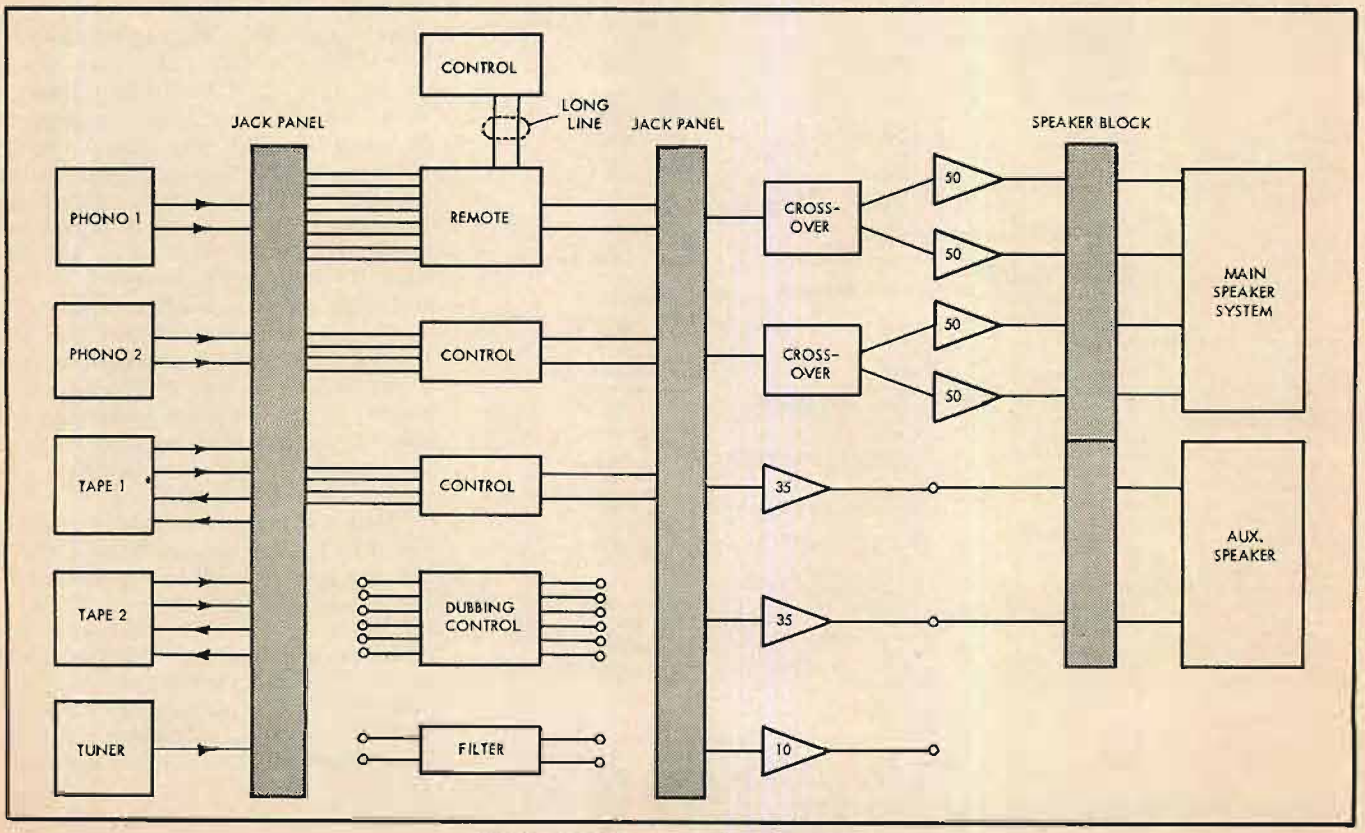


Fig. 1. Block diagram of entire system.

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It Took Eleven Years and One Night to Design The World's Best Speaker System The New CITATION X by Harman-Kardon



Stewart Hegeman, Director of Engineering, Citation Kit Division, Harman-Kardon, Inc.

STEW HEGEMAN owns a big, old Charles Adams-type wood frame house in New Jersey. It has its disadvantages—but it's a rather special kind of house. The original high-ceilinged living room has been converted into a sound laboratory replete with morris chairs, the best testing equipment and Universal Coffeematic machines. According to legend, Stew has coffee now flowing through his veins instead of blood —a concomitant of spending night after night searching for perfection in audio design. It was at this house, one night last summer, that the Citation X speaker system was born.

The antecedents of this story date back to 1949 when Hegeman first heard a Lowther driver. That was it; the beginning of a remarkable collaboration between this great American audio engineer—now Director of Engineering of the Citation Kit Division of Harman-Kardon – and the highly regarded Lowther company of England. Together, they created speaker systems which became classics: the original Hegeman-Lowther horn—the great "Grey Monster" with its top section of plaster of Paris and the Brociner Model 4 Horn.

Over the years, Hegeman and Donald Chave—head of Lowther—continued to work together. Ideas were exchanged; concepts discussed and explored. Independent lines of research into the perfection of speaker design were followed by both. Then came their meeting one night last summer—and the creation of Citation X —the culmination of 11 years of joint and independent research into speaker design.

Reflected Sound

DESIGNED IN THE CITATION TRADITION—the best regardless of cost—the new speaker system places no limits upon performance. It can perfectly reproduce the whole complex structure of a musical composition without adding or taking anything away from the original performance.

The Citation X diffuses sound in a hemispheric radiation pattern—by a blend of direct and reflected sound. In creating this design, the precise process of what occurs in a concert hall has now been duplicated.

Audio engineers know that approximately 80% of the sound in a good concert hall is reflected from the ceilings, walls, etc. It is this mixture of direct and reflected sound that gives music its depth and dimension, its exciting spatial quality.

The Citation X achieves precisely this effect by distributing music on vertical and horizontal planes. Conventional speakers beam the sound at you on a horizontal plane—similar to automobile headlights. In stereo, this is akin to listening to the full orchestra through two holes in the wall. Replace the conventional speakers with Citation X and the wall disappears. *You are in the same room with the music.* There is no ping-pong effect; no "hole-in-the-middle." All of the music is there in all of its depth and dimension and reality. For the first time, the word "presence" has been made meaningful.

The Lowther Driver

THE BASIC ELEMENTS of the Citation X are the Lowther driver and the Hegeman enclosure design—a split, slot-loaded conical horn, with two 7½ feet sections folded within the enclosure.

The driver is a massive Lowther unit specifically engineered for the Citation system. It consists of four working elements:

- *Direct radiation from front of cone.*
- *Radiation from the midrange "whizzer" cone which operates between 2000 and 7000 cycles.*
- *A stabilizer which places a damping load on the cone and acts as a diffuser and distributor of the very highs.*
- *Radiation from the back of the main cone which is directly coupled to the folded horn.*

Features of the specially designed driver include: magnetic structure of anistropic magnetic alloy (Ticonal G) which is the most efficient magnet material known today; usable frequency range of 20 to 50,000 cps; gap flux—17,500 gauss; total flux 196,000 maxwells; aluminum voice coil for increased high frequency efficiency; twin cone construction with foam plastic front and rear suspension; no distortion at crossover frequencies due to elimination of distortion producing LC networks.

The Horn

CONVENTIONAL HORN DESIGNS use an acoustic chamber to couple the diaphragm to the throat of the horn. In the Citation X, the chamber is removed and the driver placed directly into the throat of the horn. This eliminates the last resonating element in the horn configuration and results in absolutely smooth transfer of radiation between horn and driver.

Instead of the conventional "open mouth," the Citation X horn terminates in a slot at the base of the enclosure. This presents the horn and driver with the impedance of an infinite horn. Thus, phase shift is reduced within the horn and room reflections are prevented from entering the horn's mouth and reaching the driver. Pressure loading by the horn damps completely the mechanical resonance of the cone and its suspension.

The interior of the handsome, hand-rubbed walnut enclosure is constructed of Timblend which has no directive resonance and is stronger than wood. The entire internal horn structure is honeycombed for strength and prevention of panel resonance.

For those who own Citation units—for all those who want perfection in speaker performance—we can recommend the Citation X without qualification. *The dimensions of the Citation X are 20" wide x 14¾" deep x 36½" high—because that is the size necessary for the design of the world's best speaker system.*

The Citation X—$250.00

Price slightly higher in the West.
For complete Citation catalog write to: Dept. A-12, Citation Kit Division, Harman-Kardon, Inc., Plainview, New York.



The Citation X
A Hegeman-Lowther Design

CITATION *by* harman kardon

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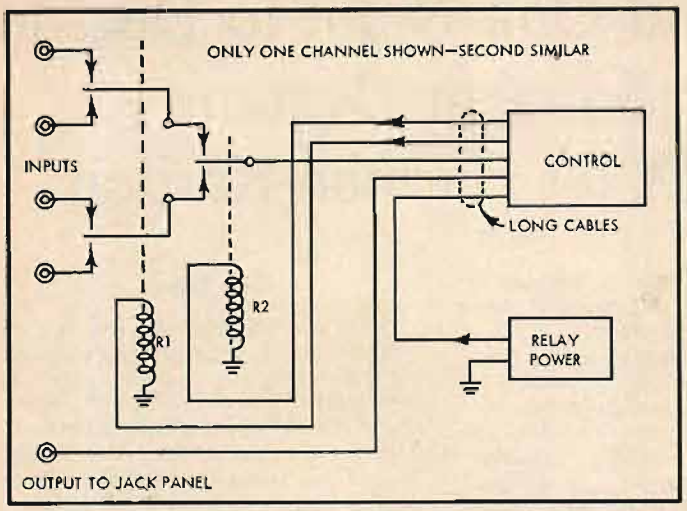


Fig. 2. Relay tree.

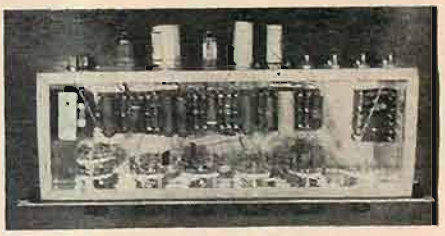


Fig. 5. Bottom view of one of the control amplifiers illustrating the uncluttered, orderly layout possible with terminal board construction.

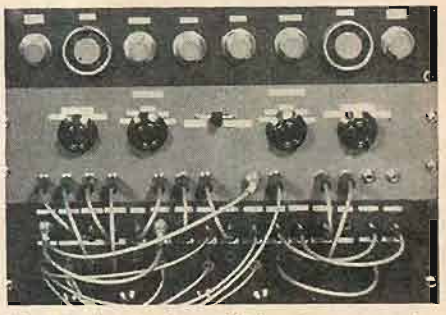


Fig. 6. Front view of the tape recorder control panel.

lay switching part of the control is mounted in the control rack and the signal which is selected is the only one sent to the control amplifier. Four cables are used to carry the signals to the control units and return them to the relay rack. A total of eight inputs can be selected from the control chassis through the relay tree in the relay chassis. This number may be easily extended by using additional relays. Each input has a separate level control on the control chassis. These level controls are switched with the relay



Fig. 4. Remote control amplifiers shown in listening room. Although designed for rack mounting, they are shown mounted in a wooden box.

signal in the control chassis. Since the original source signals are developed at very low impedance levels, there is no trouble with high-frequency response falling off. *Figure* 2 shows a schematic

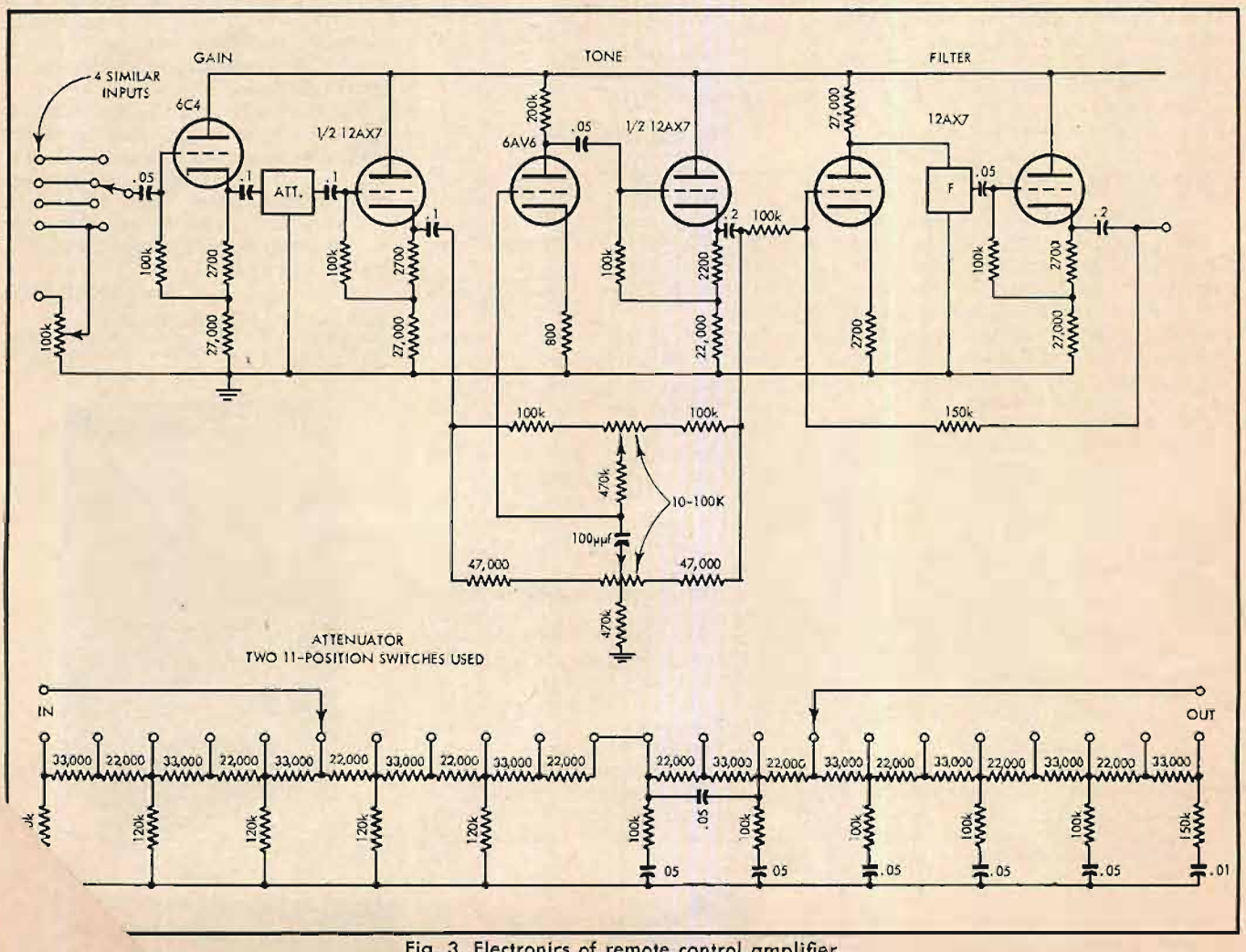


Fig. 3. Electronics of remote control amplifier.

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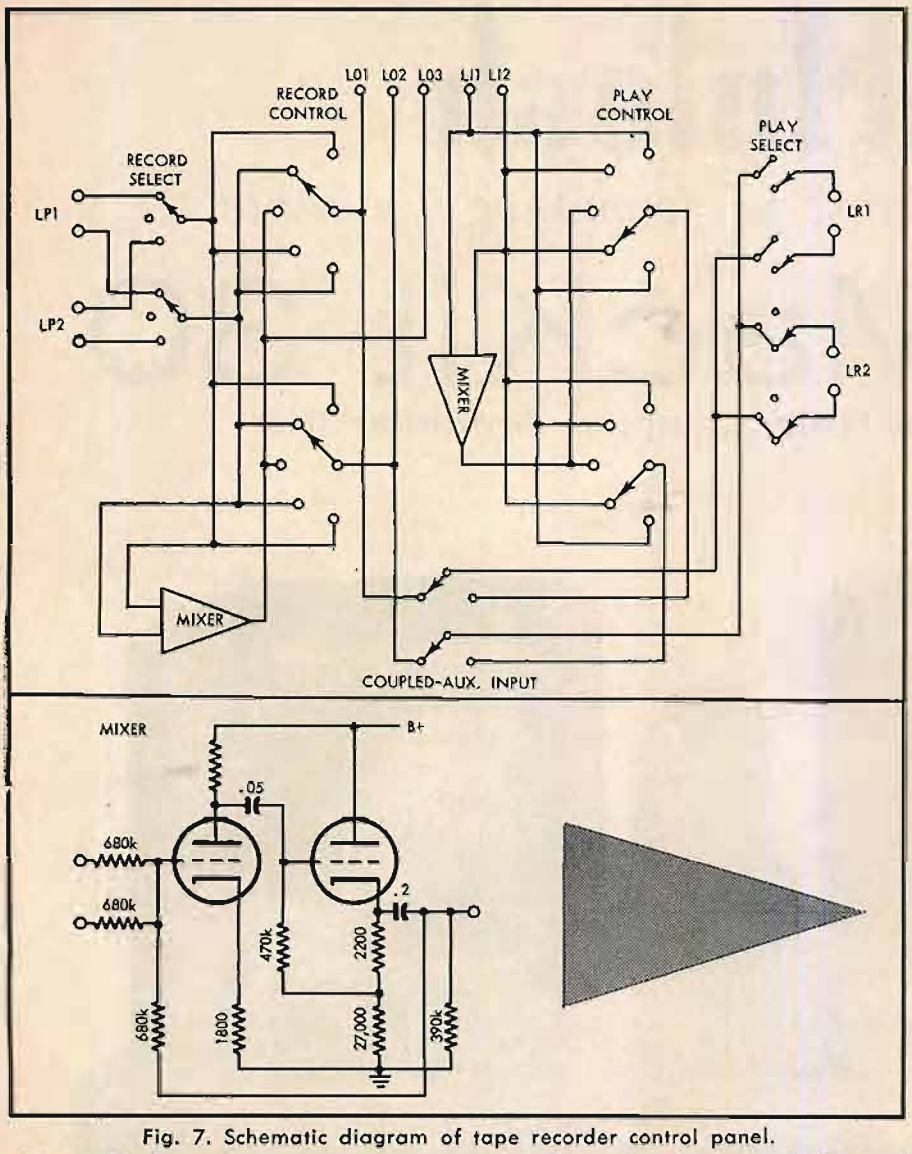


Fig. 7. Schematic diagram of tape recorder control panel.

of one-half of the relay selector chassis. The schematic is largely self explanatory. The relays are driven from a d.c. source to avoid any possible hum pickup which might result with a.c. relay operation. The electronic part of the control is shown in *Fig.* 3. Feedback tone controls are used and a high-cutoff filter is provided. The attenuator is a bit unusual. It consists entirely of switches. A combination frequency compensated and uncompensated ladder network is used to provide control of either gain or loudness. With both controls set at the inside position there is no attenuation. As the left control is operated one obtains straight gain attenuation. If the right control is operated, loudness compensated attenuation is obtained. *Figure* 4 shows the pair of control amplifiers in the listening room. Use of terminal board construction gives the underside of the chassis the neat appearance shown in *Fig.* 5.

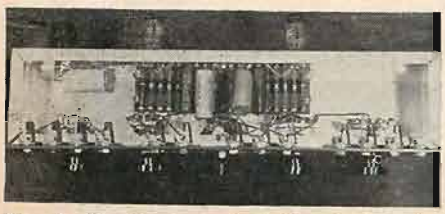


Fig. 8. The tape control chassis is relatively empty since it only contains a pair of mixer amplifiers.

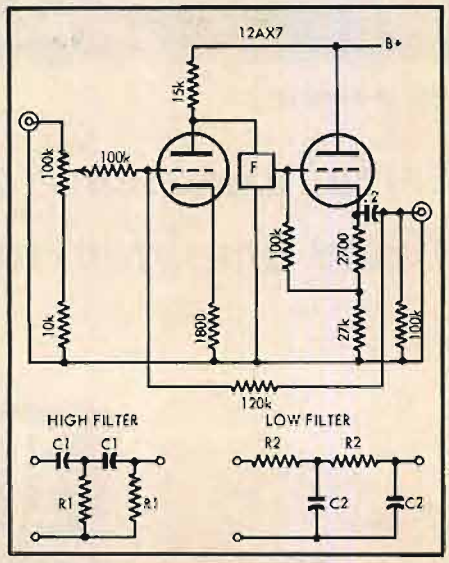


Fig. 9. Schematic diagram of the electronic crossover.

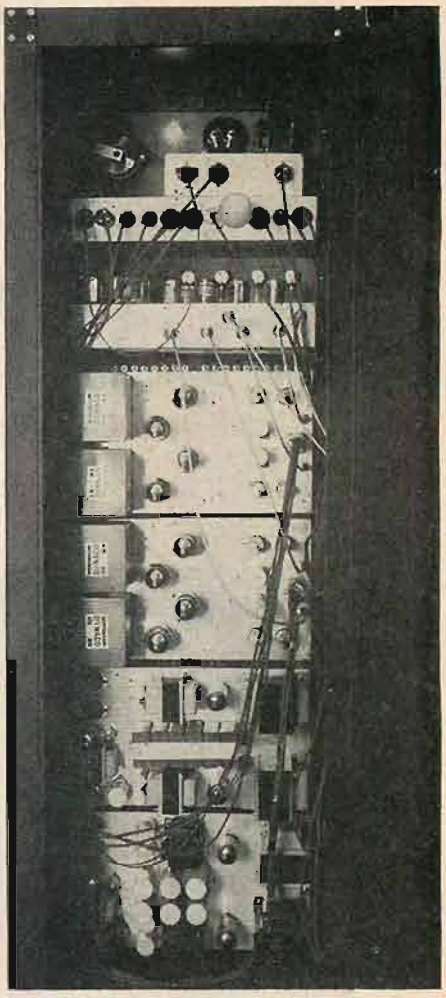


Fig. 10. Back of the power amplifier rack showing the four 50-watt amplifiers and the power supplies. Note that the four amplifiers are mounted on two chassis. The rack is forced-air cooled.

Dubbing Control

It is frequently desirable to mix the separate channels of stereo discs or tapes or to record or listen with the channels inverted or mixed. The dubbing control allows the tape and disc sources to be controlled in a very versatile manner in this sound system. The control is shown in place directly above the jack panel in *Fig.* 6. The schematic is shown in *Fig.* 7. There is no power supply shown since the power of this chassis is derived from the main power supply built into the relay rack and designed to handle all of the control amplifiers and special effects amplifiers in the sound system. A separate supply which delivers 250 volts at 10 milliamperes, and 6.3 volts at 0.6 amperes may be used. As can be seen, the control consists mainly of passive switching arrangements. Two mixer amplifiers are provided and allow unity-gain mixing of the two channels.

There are several useful input-output setups possible, but the one most usually used is as follows:

1. LP1 and LP2 going to the play select switch are connected to the two tape play channels. Thus either tape ma-

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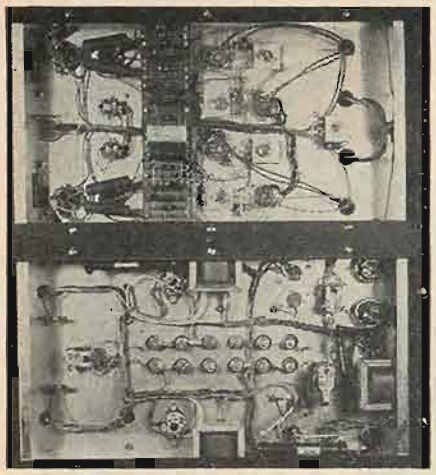


Fig. 11. Bottom view of a power supply and a power amplifier chassis illustrating the terminal board construction and the cabling of the plate and filament leads.

chine signal may be modified by the play control switch and sent to the outputs LO1, LO2, and LO3.

2. LO1, LO2, and LO3 go to the left, right and "center" audio channels of the loudspeaker system respectively. Note that LO3 always contains the mixed channels.

3. LI1 and LI2 are connected to the disc play preamplifiers. These two inputs go the record control. The lever switch may be used to select the output of the record control or the output of the play control. In this way either the tape or the disc material is available at the record select switch (after passing through the appropriate control switch).

4. LR1 and LR2 go to the two tape recorders or to the control amplifiers in the system.

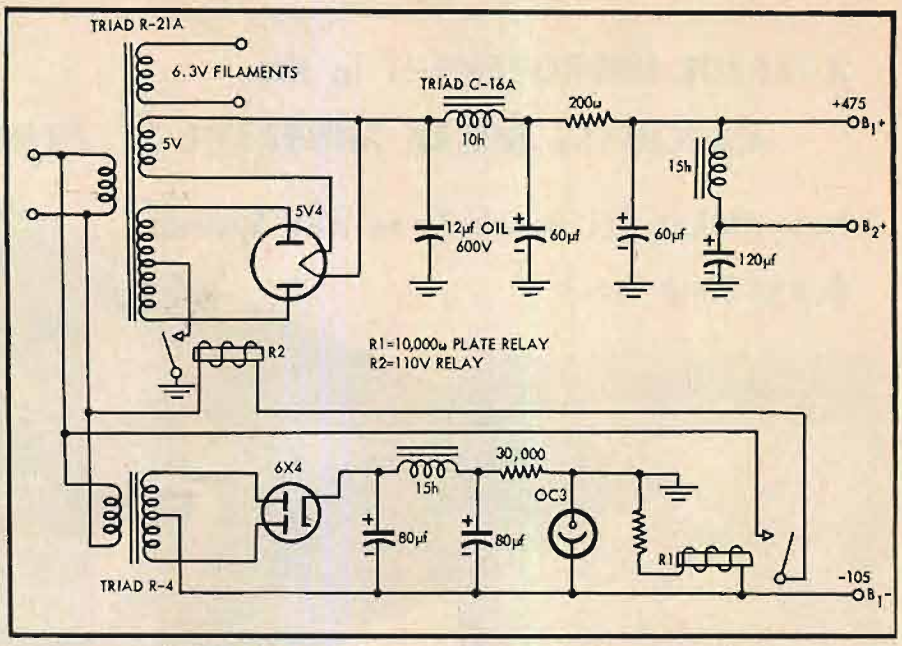


Fig. 13. Schematic diagram of one of the power supplies.

It is apparent that great versatility is provided for copying stereo discs or tapes while listening to either or to something else. While such a control system may seem a luxury, the continual plugging and unplugging of patch cords is a great bother. The control center eliminates about a half bushel or so of plugs and wires.

The underside of the dubbing control is shown in *Fig.* 8. Here again, use of terminal board construction gives the amplifiers a neat look.

Electronic Crossovers

The main loudspeaker system is driven by two pairs of amplifiers. Separate amplifiers are provided for the low and high ends of the audio spectrum in each channel. The crossover point is 500 cps. The electronic crossover used with this system is shown in *Fig.* 9. Four of the filter amplifiers shown are used in the dual channel setup. Again unity gain is provided. The gain in the feedback loop is controlled so that there is a rise of about 1 db near crossover and the ultimate slope is then reached very quickly. A slight adjustment of resistors R_1 and R_2 is provided from the front panel to allow precise setting of the response while it is measured at the loudspeakers with a microphone.

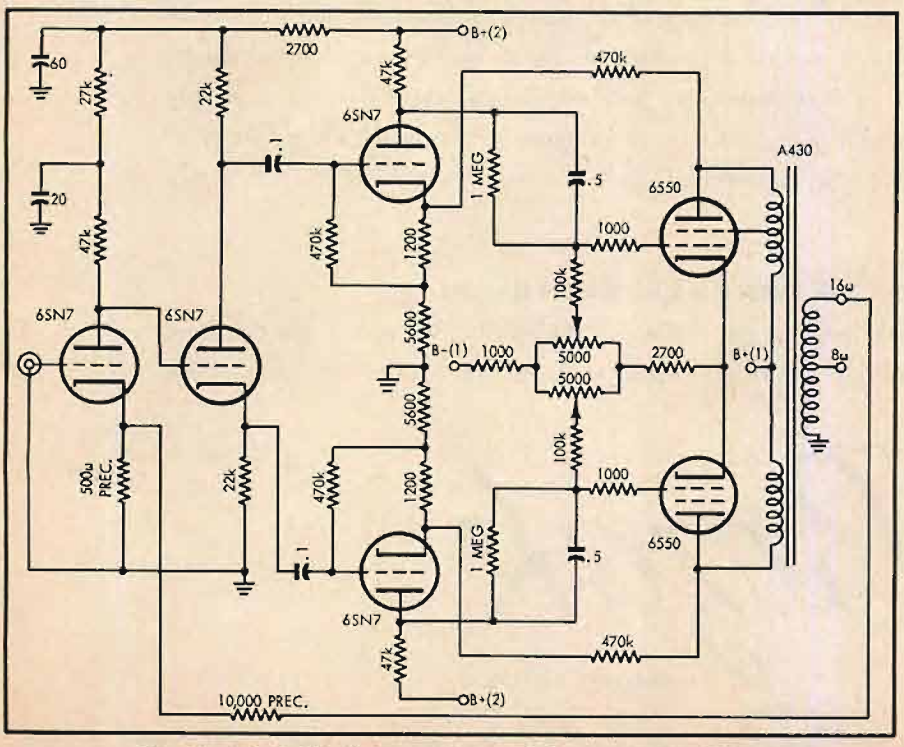


Fig. 12. Schematic diagram of one of the power amplifiers.

Power Amplifiers

The main power amplifiers are shown from the back of the relay rack in *Fig.* 10. The power supplies are at the bottom and the amplifiers on the chassis directly above them. The rack is cooled by forced air to insure reasonably cool operation of the power amplifier array. The front of the rack is constructed to give access to the undersides of all of the power amplifier chassis for purposes of setting the balance pots and checking out the performance of the amplifiers from time to time. The access panels are shown removed in *Fig.* 11. A schematic of the amplifier is shown in *Fig.* 12. The amplifier is rather standard in design except for the internal feedback loop. It is quite undesirable and unnecessary to include the entire amplifier under a single feedback loop since the stability of this arrangement is so poor. Two loops do not give quite the same distortion reduction as will one loop but the stability is very much improved and the overload characteristics are far superior. The d.c. coupling from the driver to the output

(*Continued on page 75*)

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THESE UNRETOUCHED PHOTOGRAPHS TELL THE FULL STORY

Photo A shows tracking of a 1 kc sine wave at a stylus velocity of 30 cm/sec with a conventional tone arm. The upper portion shows output of the left channel, the lower portion shows output of the right channel. Note how the right channel distorts due to skating effect which tends to hold stylus tightly against inner wall of stereo groove (left channel) but does not maintain sufficient contact against outside wall (right channel).

Photo B shows the identical traces under the same conditions except that the Fairchild Arm-Transport with Anti-Skating is used in place of the conventional Tone Arm. The results are obvious...*right channel distortion clears up completely!*

Photo A

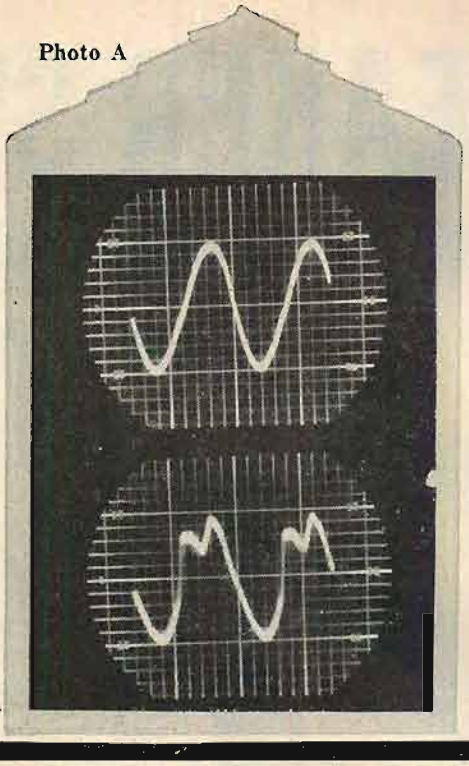
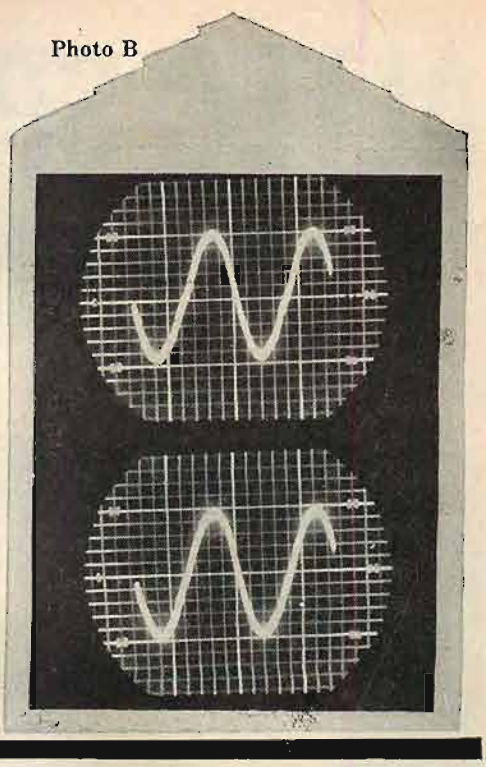


Photo B



A NEW, RADICAL IMPROVEMENT IN RECORD REPRODUCTION, THE FAIRCHILD 500 WITH ANTI-SKATING!

(PATENT PENDING)



New FAIRCHILD Arm-Transport and Cartridge combine to realize full potential of complex stereo groove...makes all existing arms and cartridges virtually obsolete through Anti-Skating feature and new Linear Separation, High Compliance Cartridge.

HOW? First...the FAIRCHILD 500 has Anti-Skating which allows treatment of cartridge and its transport as a single entity. At present all arms possess the tendency to ride towards the center of the record regardless of stylus pressure, balance, etc. Known as "skating", this action is easily noted if any arm and cartridge are placed on the label or any other smooth rotating surface.

But, with stereo's two information tracks, this unevenness in wall pressure upsets the delicate balance, increases tracking error, stylus wear and distortion. The only possible solution is the introduction of another force equal in magnitude and opposite in direction to the unwanted skating force. This is the exclusive Anti-Skating feature of the FAIRCHILD 500.

In addition the Arm-Transport is dynamically balanced by a method which *eliminates* undesirable springs generally associated with this type of balancing in the past.

Second...the new FAIRCHILD SM-2 Cartridge has linear separation over the entire spectrum! Many cartridges that claim 20 db separation possess this characteristic only at 1 kc. The difficulty becomes apparent at higher frequencies and in many cases stereo cartridges lose their separation and actually act as monaural transducers above 10 kc!

The FAIRCHILD SM-2 has Linear Separation of 20 db up to 15 kc. Its compliance has been substantially increased to take full advantage of its anti-skating transport which makes for even greater *actual operating compliance.* Its sound is best characterized by an opulence herefore thought unobtainable.

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1. Improved overall quality of reproduction. **2.** Reduced groove degradation and stylus wear. **3.** Improved separation by virtue of symmetrical tracing. **4.** Improved stereo balance with maintenance of original artistic and engineering concepts. **5.** A remarkable reduction of tracing distortion . . . as much as 50%!

The FAIRCHILD 500 is the MOST IMPORTANT DEVELOPMENT IN DISK REPRODUCTION since the development of the long playing record for it allows the full and effective reproduction of the stereo disk. LIFT THE CURTAIN NOW . . . HEAR YOUR RECORDS PLAYED WITH THE FAIRCHILD 500.

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Model above in mahogany or walnut shown with accessory floor stand. Standard model includes round legs.

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AVALON – 837A...a two-way system with a guaranteed frequency range of 35-22,000 cps. Enclosure houses one 12" 414A low resonance, high compliance bass speaker and an 804A high frequency driver on an 811B sectoral horn **$246.00**

CARMEL – 838A...a two-way system with a guaranteed frequency range of 30-22,000 cps. This system offers the additional dimension of two 12" 414A low resonance, high compliance bass speakers, as well as the 804A high frequency driver on an 811B sectoral horn **$297.00**

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This model is constructed to house any Altec biflex and duplex 12" or 15" speaker.

Compact model or cabinet style—whatever you want in a furniture speaker system, you'll find Altec cabinets house the precision-engineered system to put you at the pinnacle of listening pleasure. Whether you want to start with mono or stereo, you'll find that Altec-engineered speakers will never be out-dated. Where space is at a premium, Altec's compact bookcase speakers provide a quality of sound reproduction generally found only in much bigger systems. Where you have the room, you'll want the important sound and impressive styling of the Altec cabinet enclosures, which have won designer's awards for their elegance and modern simplicity.

Whatever style you choose—for stereo or mono—for large rooms or small, Altec engineering makes the big, big difference in the sound you hear. Each enclosure shown here features Altec's famous controlled linear excursion bass loudspeaker for the cleanest, richest reproduction of the low frequencies. This fine bass is matched with a professional quality sectoral horn or direct radiator to deliver the highs as you like to hear them. So whatever kind of system you're planning, the place to start is with an Altec furniture speaker system. One Altec bookcase speaker starts you out on the right road toward the true sound of music—the Altec sound of music!

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THE CAPISTRANO – 831A

The elegant simplicity of the Capistrano, selected for its excellence of design in the California Design exhibit, is the perfect compliment to the precision-engineered sound components it encloses: one 15" 803B controlled linear excursion bass speaker, an 802D high frequency driver mounted on an 811B sectoral horn. Guaranteed frequency range of 35-22,000 cps. Walnut or mahogany finish. 30" H, 47" W, 23½" D **$399.00**



LIDO – 836A

The most recent addition to the Altec line of bookcase speaker systems, the Lido boasts acoustical elements that give truer balance between high and low musical spectrum than found in any other system of comparable price. A unique Altec technique employed in matching speakers to the tuned enclosure produces this important improvement. Speakers have a radiating area of over 76 sq. inches, give extended frequency response, exceptional efficiency. 12⅞" H, 26" W, 12⅞" D. Walnut or mahogany finish, **$125.00.**



MONTEREY – 834A

Big speaker sound in a compact enclosure. The Monterey houses two of Altec's exclusive controlled linear excursion bass speakers for lowest possible resonance and distortion, plus the 3000B sectoral horn. Frequency range: 40-22,000 cps. 20 watts power, 8 ohm impedance. Walnut, blond, mahogany or fruitwood finish, or unfinished. 14" H, 26" W, 14½" D.

Finished **$174.00**
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Audio Power Requirements and Statistics

C. NICHOLAS PRYOR*

A discussion of the power requirements in audio amplifiers based on the statistical distribution of peaks in complex signals

ONE OF THE MAJOR points of contention in the audio field concerns the peak output power which an amplifier must be capable of delivering for faithful reproduction of complex audio signals. There are two major reasons for the large spread of estimates, which range from milliwatts to hundreds of watts. The first of these reasons is the range of average power required in the particular application. Loudspeaker efficiency may range from about 2 to 50 per cent, room size and acoustical properties influence the power required for a given sound level, and some people just like their music louder than others. These differences are generally understood, and it is a fairly simple matter to measure at least the average voltage input to a loudspeaker under listening conditions.

The other reason for variation in the estimates is the different allowance made by different individuals for peaks in the audio material. Everyone knows that there are sharp peaks in ordinary signals that are considerably higher than the highest readings shown on an ordinary VU meter monitoring the signal, but there is little agreement as to the size and number of these peaks. The broadcast industry has at times allowed as little as 6 db (a factor of 4 in power) for these peaks, while some have argued for as much as 23 db (a factor of 200 in power) reserve allowed for these unseen peaks. This is quite a large spread of allowances made for a single factor, and it is the purpose of this article to show the way the peaks are distributed in audio signals and to develop a reserve power estimate based on the knowledge of this distribution.

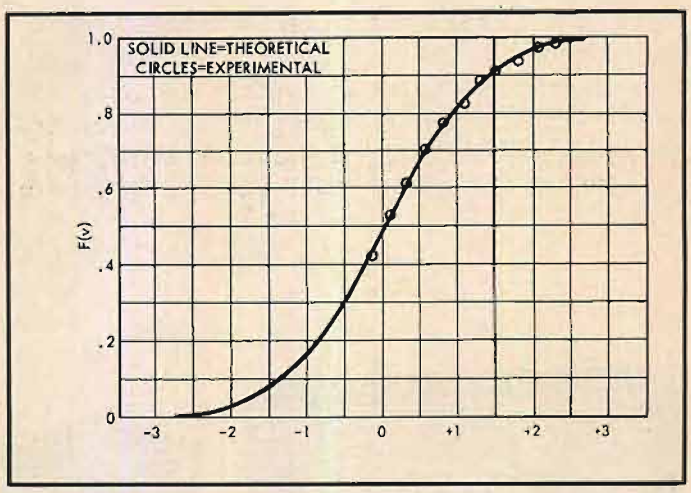


Fig. 2. Normal distribution function, $F(v) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{v} e^{-\frac{x^2}{2}} dx$

To aid us in talking about the distribution of peaks we will borrow from statistics the *cumulative distribution function*. This function simply tells us the probability (or the fraction of the time) that the variable is less than or equal to a given value. Thus the value of the distribution function at one volt, for example, tells us the fraction of the time the actual signal voltage will be less than (or negative compared to) one volt; and of course this value will be between zero, if the signal is always greater than one volt, and one, if the signal is always less than one volt.[1]

As an example of the distribution function, let us consider a single sine wave of amplitude one volt. Its distribution function can be derived to be $\frac{1}{2} + \frac{1}{\pi}$ arcsin V in the range between minus and plus one volt, zero in the range be-

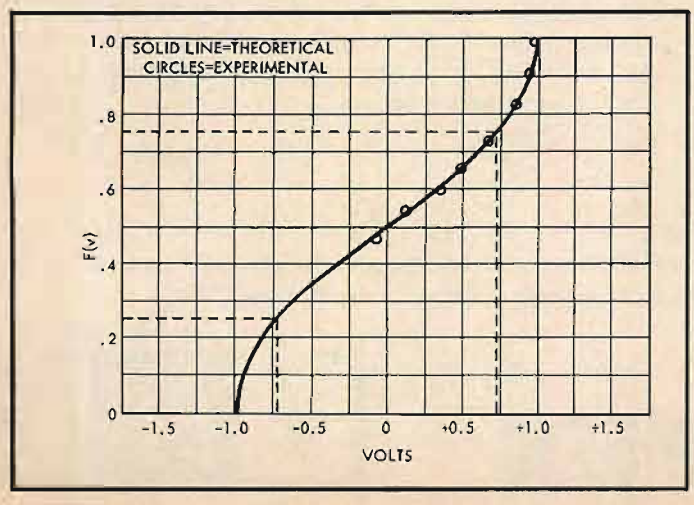


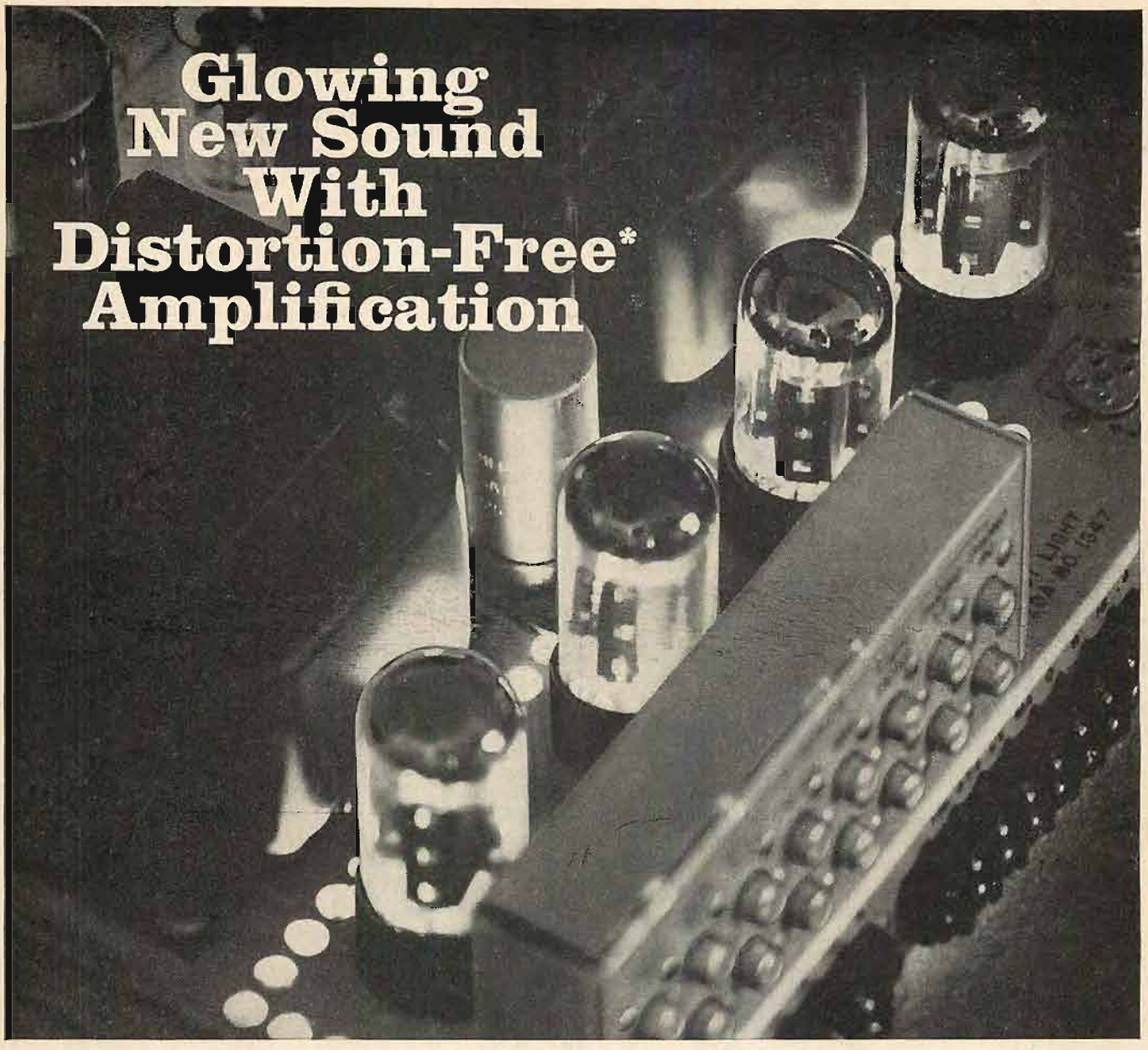
Fig. 1. Distribution function for sine wave, $F(v) = \frac{1}{2} + \frac{1}{\pi}$ arcsin V

* *145 Pinckney St., Boston, Mass.*

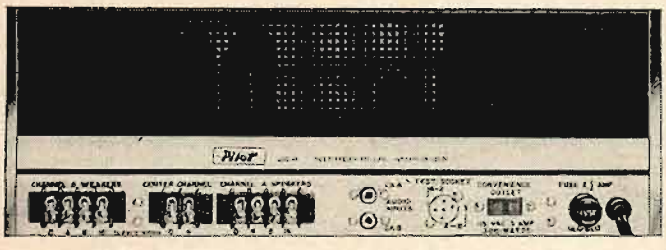
[1] Notice that the distribution function, as defined, considers all negative voltages to be "less than" any positive voltage and is defined for all voltages from minus infinity to plus infinity. A perhaps simpler function for our purposes would be the distribution function of the *magnitude* of the signal, which would indicate the fraction of the time the signal was smaller (whether positive or negative) than the given value. This function is easily obtained from the ordinary distribution function by substracting one-half from its values for positive voltages and multiplying the result by two, but it is less general in nature and does not allow for asymmetrical distribution functions or for asymmetrical amplifiers (single-ended or complementary-symmetric). The ordinary distribution function is also the one measured directly by the method to be described here and is the one most often tabulated in literature on statistics, thus it will be used throughout this paper.

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low minus one volt, and one in the range above plus one volt. This function is plotted in *Fig.* 1; and from it we can verify some of the things we already know about the sine wave. First we can see that the voltage is never less than minus one volt (the distribution function is zero at −1), and that the voltage is always less than, or equal to, plus one volt (the distribution function is one at +1). Also from the value .5 for the distribution function at zero voltage, we can verify that the sine wave has negative values exactly half of the time and positive values the other half.

However, from closer inspection of the curve, we can see something further that perhaps is not quite as obvious from the sine wave itself. The value of the distribution function at −0.707 volts is 0.25, which indicates that the voltage is less than −0.707 25 per cent of the time. Also the value at +0.707 volts is 0.75, which indicates that the voltage is greater than 0.707 volts 1.00–0.75 or 25 per cent of the time. Thus if we tried to obtain the one-volt amplitude sine wave from an amplifier whose maximum output voltage was plus or minus 0.707 volts (this is the rms value which an a.c. meter would read for the sine wave of one volt amplitude), the signal would be too negative for the amplifier 25 per cent of the time and too positive 25 per cent of the time. As a result this amplifier, which is capable of putting out a voltage equal to the rms value of the sine wave, would be completely overloaded exactly 50 per cent of the time. To provide an undistorted sine wave output the amplifier must have a maximum output voltage of at least plus or minus one volt (so the signal will be outside this range 0 per cent of the time) which is a 3 db reserve or 1.414 times the voltage indicated on an a.c. voltmeter.

While the distribution function has been of some use in dealing with sine wave amplification, its real power lies in the analysis of complex audio signals. With these signals, unlike periodic sine waves, it is impossible to predict what the voltage will be at any time. However, it is still possible to derive a distribution function for the voltage, so the percentage of the time that the voltage lies outside certain limits may still be determined. There are several ways to arrive at the distribution function of a complex signal, but one of the clearest is to consider the signal to be made up of a large number of individual sine waves. Then by a series of mathematical operations on the individual distribution functions, we may arrive at the distribution function of the sum of all the sine waves. Or more directly we may use the Central Limit Theorem which states that the sum of a large number of independent variables has a distribution which approaches the so-called Normal or Gaussian distribution function. Unfortunately, no algebraic function has been found to describe the Normal distribution function, but it is defined in calculus by a definite integral and numerical values of it have been tabulated. From these tables we may determine the distribution function for the instantaneous voltage in a complex signal once we are given the true rms voltage of the signal, which is equal to the *standard deviation*, or width parameter, of the Normal function. This distribution function is plotted in *Fig.* 2 for a standard deviation of one volt. Note that the function never quite reaches the values zero or one, but that it comes quite close for voltages of magnitude greater than two or three volts. This means that extremely high peaks are theoretically possible, but occur only rarely. Thus for perfect reproduction of an audio signal, an amplifier of infinite power capability would theoretically be required. However, the very high peaks in the signal have such a low probability of occurring that we may never experience them, and the power requirements are thus very much relaxed.

At this point it is well to demonstrate the validity of the above discussion by means of an experiment. The distribution function of any signal may be measured by means of a circuit such as that shown in *Fig.* 3. The resistor network at the input provides, at this point, half the difference of the input signal and the voltage read on voltmeter V. This will be positive if the input is greater than V and negative if the input is less than plus V volts. The amplifier gain, A, is sufficiently large that the output is clamped to 0 for positive input voltages and is clamped to 10 volts for negative input voltages, there being only a very narrow range near zero volts where the amplifier is operating linearly. Thus the percentage of time the output is 10 volts equals the percentage of time the input is less than V volts, and we have only to average the outpnt voltage over a short period by means of the RC network to obtain the value of the distribution function at V volts. This was done with a sine wave input to demonstrate the method, and the experimental results are shown along with the theoretical curve in *Fig.* 1. With the validity of the method thus established, a sample of orchestral music was recorded on a tape loop and fed into the measurement circuit at a level of 1 volt "rms" as indicated by a standard audio VTVM. Because of the characteristics of audio voltmeters, this corresponds to a standard deviation of 1.128 volts.[2] With this correction factor accounted for, the results of the experiment are shown in *Fig.* 2. Notice that the theoretical curve is quite closely followed for the range of V investigated. Although no measurements were taken beyond 2.5 volts, the results are conclusive enough to show that the audio signal does have the Normal distribution.

Having shown that a typical audio signal does follow the Normal distribution, we may proceed to consider what this means in terms of reserve power required. If the rms voltage output of an amplifier at normal listening level is measured and the maximum possible voltage output of the amplifier is also known, the ratio of these quantities is the *number of standard deviations* of the signal which the amplifier will pass. Anything between plus and minus this number of standard deviations from zero will pass undistorted, while any instantaneous peaks outside this range will be clipped by the amplifier. The fraction of time that the signal is not distorted is simply the difference between the values of the distribution function at the extremes of the linear range. The rest of the time the signal is clipped.

Table 1 is designed to show the fraction of time the amplifier will be overloaded as a function of the ratio of maximum output voltage of the amplifier and the audio signal voltage as indicated by an ordinary audio or VU meter. (This encompasses most types of a.c. meters except the peak or P-P reading meters found in most modern VTVM's which cannot be used here, and the iron-vane movement found in certain inexpensive a.c. meters which are true rms reading and may be used with *Table* 1 if their

(*Continued on page 88*)

[2] Most audio voltmeters, while calibrated in rms, actually measure the average absolute value of the voltage and are corrected for true rms only for sine waves. Thus a correction factor must be applied for true reading with any other type of input signal.

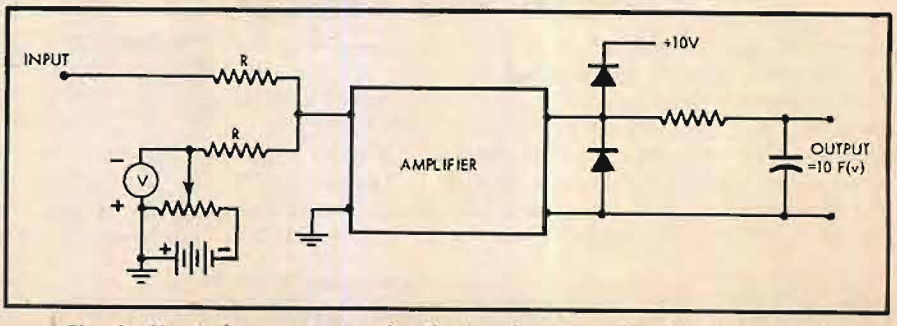
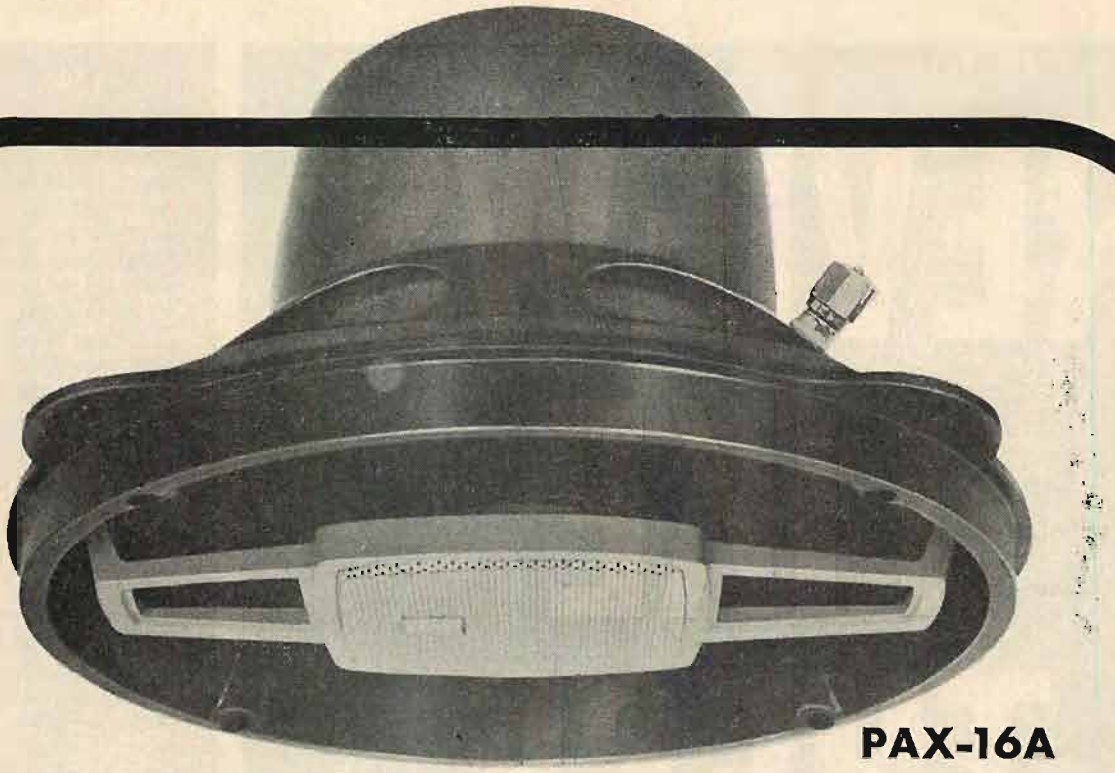


Fig. 3. Circuit for measuring distribution function of a complex signal.

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PAX-16A

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Resonance Frequency	50-70 cps
Frequency Range	40-20,000 cps
Power Input	8 watts
Sensitivity	103 db/watt

Model No.	PAX-20E
Voice Coil Impedance	16 ohms
Resonance Frequency	50-70 cps
Frequency Range	40-20,000 cps
Power Input	8 watts
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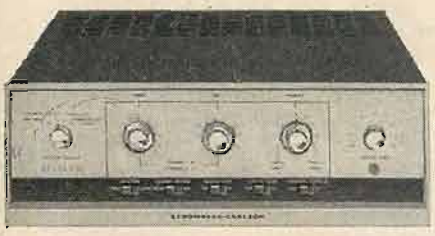
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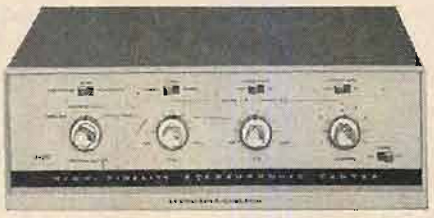
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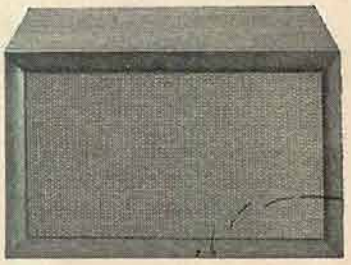
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"The sensitivity measurement of the FM-443, according to IHFM standards, is amazing. Its usable sensitivity is 3 microvolts, a figure not usually found in tuners in this price range. This high sensitivity has not been obtained at the expense of IF bandwidth."

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"Each channel delivered 50 watts at 2% harmonic distortion, or 48 watts at 1% distortion. This is unusual in an amplifier rated at 32 watts . . ."

"The distortion of the ASR-880 is very low at usual listening levels when correctly operated . . . it has a rare combination of very high gain and very low hum. The amplifier has a number of special features, such as center channel output and a very effective channel-balancing system, as well as the usual stereo control functions found in all good amplifiers."

"Only 0.6 or 0.7 millivolts at the phono inputs will drive the amplifier to 10 watts output per channel. At normal gain settings . . . the hum level is better than 70 db below 10 watts even on phono input. This is completely inaudible."

"With a listening quality matching its laboratory response, the Stromberg-Carlson ASR-880 must be considered a very good value at its **$199.95** price."

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AUDIO ETC

(*from page 14*)

nections. Everything else is in the sound—that is, all but the matter of size, which is rapidly becoming routine, and furniture finish, which has never been a subject on which I could rhapsodize for pages. And what, my friends, is sound? Something to listen to, not talk about. Something unmeasurable—or if it is to be measured, then measurable only in such crazy places as the anechoic chamber.

Yep—it all depends, and anything we say, today, is held strictly for us or against us, as the case may be. It is usually both. You can't please everybody, nor make sense to everybody. One man's meat . . . well, not quite *that*. But there still is disagreement on sound, quite aside from that produced by differing ears, as measurable by the ear doctor.

Of course I'm not at all confused as to where *I* stand on loudspeaker sound. I know that I depend for my reaction, as do a million other listeners, upon a complex of factors in which the nature of the playback room, the nature of the recording (not only the sound quality but the microphoning), the nature of the music (or what-have-you) and of the performance itself, all rank as factors *even more important* than the actual loudspeaker.

I mean exactly that, of course. A splendid recording of a splendid performance of a stirring piece of music can bowl me over on my table-model AM radio, without a shadow of a doubt.

But this doesn't mean that I (and other listeners) ignore the speaker. Far from it! It doesn't even mean that people want a speaker that can, so to speak, be seen but not heard—a transparent device that merely passes on the sound-signal without coloration. People still do like colorations, especially in the show room. And they like coloration at home, too. They buy it.

I'm perfectly clear in my own mind on this point, too. I *don't* like coloration. The less of it, the better. I am, moreover, dead certain that people in general are moving in the same direction, as they become more accustomed to good, i.e. uncolored, sound.

People's tastes do change. People used to distrust all highs over 4000 cps or so, as the big manufacturers used to tell us again and again back just before and just after the war. People don't feel that way any more—because they have "discovered" that highs with even reasonably low distortion are both pleasant and informative.

Nowadays, you can hear the "S" sounds in every juke box, and June doesn't rhyme with moon merely because both are low-fi dependables. Only a few years back, no juke box *ever* moaned out an S-for-Sugar. People do change, given half a chance.

It seems to me obvious that, whereas the old-time lack of highs (and lows) was a negative distortion, the still-existing phenomenon of speaker "coloration" is a plain positive distortion. Coloration *is* distortion, whether people love it or not. If you believe, as I do, in a better world and in the common-sense adaptability of the human being to things that he sees (or hears) are better for *him*, then you'll agree that coloration must go, steadily and surely, on into the low-fi limbo of the past, whether people now like it or not. It's on the way, already.

And so I have a fairly solid private way of categorizing the differences in sound between speakers of today called "hi fi" and, therefore, theoretically, *without* audible differences of a major sort. Differences are distortion. What else? There is an ideally perfect speaker in theory, and it has no distortion at all. In practice, as elsewhere, speakers are bound to exhibit a certain amount of, shall we say, residual distortion.

By their nature, speakers must be allowed a lot more distortion, of various sorts, than all-electronic amplifiers and even cartridges, which, like speakers, are go-between transducers involving physical motion. "Residual" in all honesty must be quite a lot, even for the most highly perfected speaker. But, then, the ear can tolerate quite a lot, too. The factors tend to cancel out, as we know. We still claim we can judge not only hi fi but specific hi-fi components *through* the residual distortion of the loudspeaker—if so, we must be able to handle that distortion pretty well in our listening. We mentally "reduce" it, indeed, to a factor not too unlike the distortion factors that we meet in our other components, though the actual distortion figures for even the best speakers are still pretty large.

I introduce, therefore, two terms I've used before on recent occasions, which in my mind help to set these similarities in a subjectively useful framework. The *micro-factor* and the *macro-factor*. I'm not sure yet just how best to use them, but I'm getting an idea of their practicality as I go along.

A *micro-factor* is a relatively tiny difference that, however, may mean life and death to those who are vitally interested. It still is tiny. The differences between the sound of two top-rank stereo cartridges are usually in the micro-factor category as far as I'm concerned—unless something is radically askew in one of them. Like a stylus that "bottoms" on a warped record in one cartridge, where the other's stylus rides out the warp. A lot of difference in sound, there. Macro.

A *macro-factor*, then, is a relatively huge—though often tolerable—difference between two items. A different scale in the mental measurement. I can't draw a line, anywhere, nor will I ever. This is a loosely subjective business, at best. But the macro-vs.-micro difference is not a thing you can just dismiss, even so.

Take speakers, again. My own private and unmeasurable standard for an acceptable speaker is in terms that go just like that. I do not like macro-colorations, whether in low-priced or in expensive speaker systems. They do exist. They are clearly macro to any listener, whether he likes them or not.

I tried out two bookshelfish speakers of a famous maker a few years ago with just such a result. My point was not, in my own mind, whether a lot of people might, or might not, like the sounds of these two systems. The immediate fact that mattered was that *the two differed between themselves by obviously macro amounts*, on the same signal. They did not even sound remotely alike, side by side. Macro-differences.

On the other hand, I have been able to interchange a number of more recent speaker models in my stereo set-up because, though different, these speakers exhibited unlikenesses that clearly—and practically—are in a relatively micro category. They may loom large in terms of figures on paper, as measured in a sound chamber. But in practical operation, as speaker sound works upon our ears, the differences are micro-differences. Important—but relatively small.

I see no reason, what with modern speaker technology, why any manufacturer should produce speakers or speaker systems with macro-colorations, macro-distortion. Even in the lower price brackets, it is no longer necessary. Some of the cheapest little 3-inch cone speakers produce sound that, in its range, is for me well out of the macro area; the distortion is, again relatively, of a reasonably minor sort, not macro.

I see no reason, either why the general speaker-buying public should not come to demand and expect speakers in *all* areas that produce variations no greater than the presently micro range. Variations, yes. But not *gross* variations. That day is moving upon us fast in the component area and it may even come along in the mass-produced home radio-phono. You can forget that side, but don't forget the component speaker. It *must*, sooner or later, give up all gross coloration.

My micro-macro scale has no watertight areas, no dividing lines. Only extremes. It exists because, alas, there *are* extremes, there are speaker differences, between models and in theoretical comparison with an ideal, that are still grossly large.

In most other hi fi areas, the macro-factor is unimportant. Records, for instance. How many *grossly distorted* new recordings have you heard lately? I mean really bad, fuzzy, harsh, grating, buzzing, overloaded, etcetc.? We used to have lots on the market. Now, though stereo LP's still are not by any means perfect, the main differences in physical quality are reduced to a legitimate micro range. You can fight to the death about these micro-differences and many of us do. But they are *not* macro. Not in my scale, any how.

So, before long it must be the same way in the increasingly competitive speaker market. There are many ways to sell a speaker and there are plenty of people who are still glad to go along with presently acceptable macro-variations. Their privilege. But in the end, sheer hi fi, sheer reproductive quality, will win every long-range battle, until all good speakers are merely micro-different.

There was never any clearer handwriting on any wall than that.

Jensen TF-3

As to specific speakers, I must say again that as a sheer listener (who does not test via instruments) I find it hard to say very much about *any* speaker today in terms that will be useful to anybody but myself. However, there are still factors of external interest and there is always the quality-vs.-price element, as in the significant Pilot half-size bookshelf model I described recently.

Jensen's TF-3 is new to Jensen but is not in any way intended as a revolutionary development. It is a bookshelf-type speaker, the size of the smaller and lower-cost models that originally established this category. (The old R-J, the very first, was thinner and shallower than what has become the conventional shape.)

This is a competitive speaker from a major and ancient company in the field and its significance, I think, is in the honesty of its competitive approach. This is Jensen's major move for the present in the direction that speaker design itself seems to be moving, and I must say I like the speaker. It is not perfect, I do have a couple of fairly specific questionings, but even so, here is a medium-priced unit (around $80) that clearly fits into my reasonably micro category. There is nothing macro about its performance at all in the way of coloration (distortion). What idiosyncrasies it has are clearly micro-fac-

(*Continued on page 92*)

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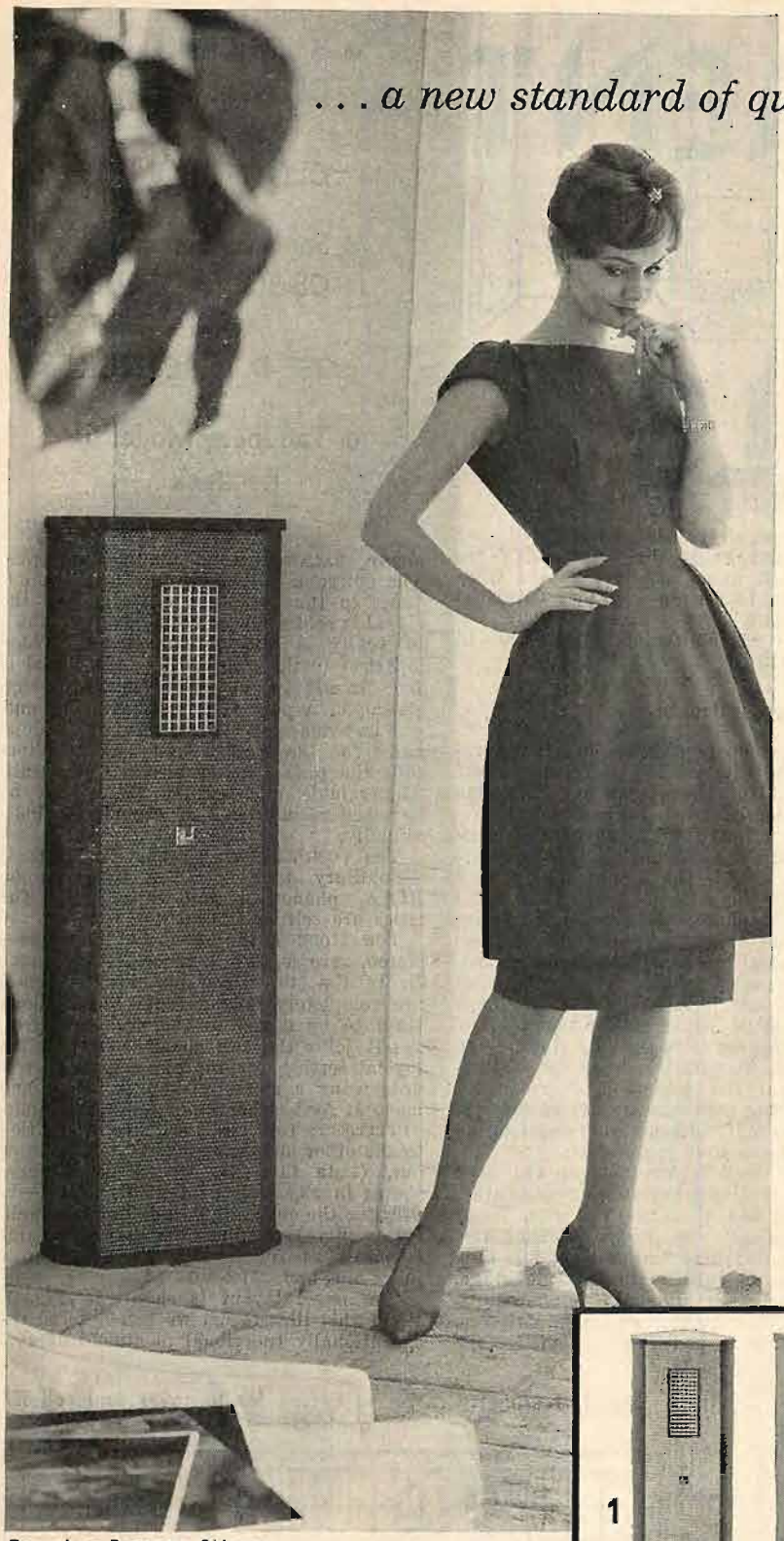
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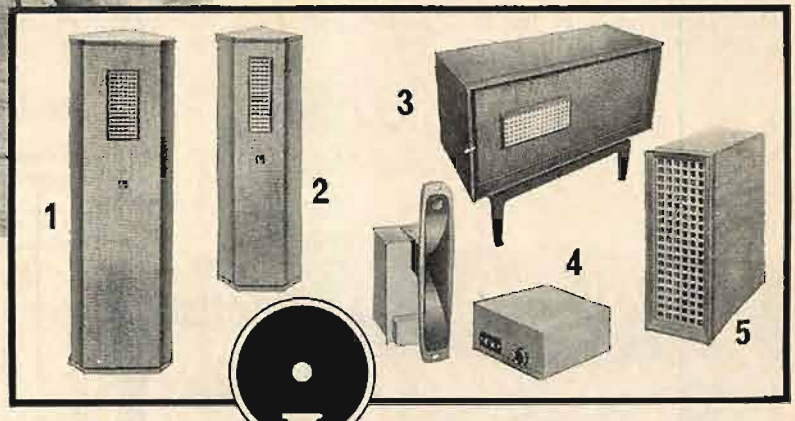
The IONOVAC offers an entirely new concept of sound reproduction. New and different because an ionic cloud replaces the diaphragm used in ordinary speakers. Sound is generated and transmitted inside a tiny quartz cell* no larger than a dime. Nothing moves but the sound waves, yet the quality of reproduction far exceeds anything you have ever heard. You can actually see the ionic cloud as the strains of your favorite music emanate from the speaker horn . . . *sight* is now added as a third dimension in the enjoyment of sound reproduction.

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4 . . . IONOVAC 14A430: Basic IONOVAC High Frequency Speaker.* Includes horn (9" high) modulator and power supply.

5 . . . DuK-10: "Add-On" Unit: Includes complete IONOVAC Speaker* mounted in smartly styled baffle with acoustic lens. Baffle measures 13½" x 5¼" x 11".

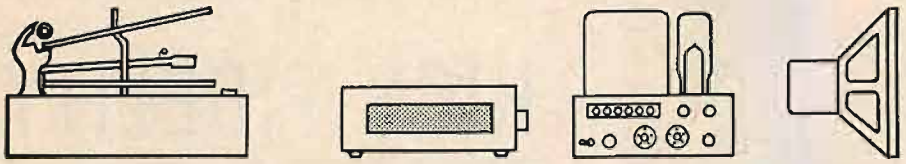
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EQUIPMENT PROFILE



- Harman-Kardon CITATION IV and CITATION V
- Sony-Superscope CS-300 RECORDER and 262-D TAPE DECK
- Tandberg Model 6 Recheck

HARMAN-KARDON CITATION IV STEREO PREAMPLIFIER KIT

Early this year Harman-Kardon introduced a line of kits which broke precedent in many ways. First, and foremost, was the design philosophy which insisted on the highest standard of performance consistent with the available components—and let the price fall where it may. As we all know, the price didn't fall very far; again demonstrating the maxim that quality exacts its price. This brings us to the Citation IV which sells for $40 less than its big sister Citation I—in kit form. Obviously, to sell for a lower price, some changes have to be made. The question is, "Did they compromise quality to achieve lower price?" Thank goodness, the answer is a firm, unequivocal, no! Perhaps we are so conditioned to the constant erosion of quality standards evidenced in many consumer products that it comes as a pleasurable surprise when quality is maintained. The answer is, of course, that the Citation IV is not quite as versatile and refined as is the Citation I; but the performance standards are every bit as good. One might say that the Citation IV is a Cadillac without *all* the optional extras.

On one score, however, there is absolutely no difference between the two preamps: they both take in the neighborhood of 30 hours to construct. Not at all an unpleasant neighborhood if you feel as we do that kits are much more than money-saving devices; they permit, in fact require, participation in the final product. In addition, they invite inquiry into the electronic mystery being constructed.

After completing the Citation IV we connected it to an amplifier—not a Citation at this time since we didn't finish the V until two days later—and were impressed by the noticeable improvement in sound quality.

Circuit Description

There are no remarkable circuit innovations in the Citation IV, which is in itself remarkable in view of the unusually fine performance achieved. In reality this preamp is a prime example of quality engineering using well-known techniques. Included in this is the use of high-quality components in critical locations, careful attention to phase shift reduction, passive equalization networks, and feedback loops around each "package" of amplification. The "packages" consist of one or two stages of amplification with a feedback loop around the entire unit so that the frequency response is essentially flat over a wide range. In addition, when the controls are set for flat response, *all* frequency compensating networks are out of the system, which makes for accurate equalization with a minimum of phase shift.

The low-level inputs (phono and tape head) are fed to a two-stage amplification "package" and then to a passive, losser type, equalization network. Following this is another flat amplification unit, this time consisting of only a single-triode stage. Then comes the high-level inputs which feed into the FUNCTION and MODE switches, in that order, and from them to the BLEND, BALANCE, and LOUDNESS controls. The CONTOUR switch is, of course, an adjunct to the LOUDNESS control. Now the signal is routed to the TONE CONTROL, which is really a tone-defeat switch. When switched to the out position, the signal is fed directly to the outut "package" consisting of a pair of triodes with low output impedance. When switched in, the circuits for the rumble and scratch filters plus the tone controls are in the circuit. The rumble and scratch filters can be switched in and out of the circuit individually.

The FUNCTION switch has six positions—auxiliary, tape amplifier, tuner phono-RIAA, phono-LP, and tape head. The titles are self explanatory.

The MODE switch has five positions—stereo, reverse, A+B, mono A, and mono B. In the stereo position, both channels are completely independent; blend allows them to be mixed to the desired degree. A+B joins the two channels, and is the logical setting for reproducing mono records using a stereo pickup. Mono A and mono B feed either input to both outputs.

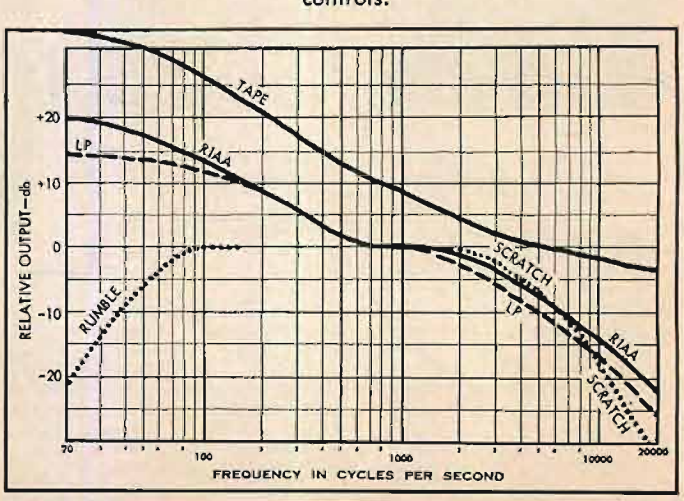
There are four slide switches in addition to the other switches—SCRATCH filter in or out, (note that the scratch filter curve shown in *Fig.* 2 is of the filter alone—in practice the curve would add to the equalization curve), RUMBLE filter in or out (same comment as for scratch filter), CONTOUR in or out, and TAPE MONITOR.

The panel layout is shown in *Fig.* 1. From this illustration we can observe the exceptionally functional placement of con-

Fig. 1. Citation IV stereo preamp.



Fig. 2. Frequency response curves for turnover and rolloff controls.



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A new kind of speaker system from Scott lets everyone in the room hear stereo—no matter where they stand or sit. This is the first thing you should know about the new Scott Custom Stereo Speaker System: there is nothing else like it available today. The Scott is a totally reflective system—reflecting the sound off the floor and wall. There is no direct radiation.

Other stereo speaker systems produce a true stereo "mix" only when you sit midway between the two systems. With the Scott, you hear true 3-dimensional stereo anywhere you stand or sit in a room. By reflecting the sound off the wall, the sound is dispersed throughout the room. There is no single point source. The box-like sound of other speaker systems is eliminated. The wall becomes alive with music—with a realism, a depth and dimensionality never before achieved. Stereo is everywhere. And everyone hears it.

Because of its totally reflective design, the Scott system does not look like a conventional speaker system. It eliminates the need for grill cloth—a woman's pet hatred. It is available within handsome, authentically-styled benches and cabinets. Or it can be slipped out of sight—under a couch, for example. Listeners have termed it the "invisible speaker system."

No combination of pretty and vainglorious words can adequately describe the incomparable musical beauty of the Scott Speaker System. You should, of course, hear it yourself. For our illustrated brochure and the address of the music or audio store nearest you, write to: Dept A4, Scott Laboratories, Inc., 241 West Street, Annapolis, Md.

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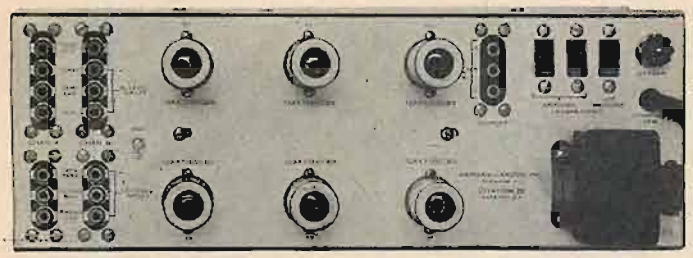


Fig. 3. Back panel of the Citation IV showing the input and output jacks.

trols. Notice that the most used controls are grouped together on the right side. Although shown with plastic knobs in *Fig.* 1, the Citation IV is normally supplied with machined aluminum knobs finished in a gold color to match the panels. The appearance and feel of these knobs is substantial.

All inputs and outputs are located on the back panel as shown in *Fig.* 3. There are three pairs of low-level inputs, three pairs of high-level inputs, and a pair of outputs to feed a tape recorder. There are three more outputs, one each for channels A, B, and C. There are three a.c. receptacles, two of them switched. All tube heaters are fed with d.c.

Performance

The frequency response measurements of the Citation IV are shown in *Fig.* 2. Distortion measurements are not shown for an excellent reason; they are so low that the "curve" would be a straight line almost on the zero distortion line. For instance, intermodulation measurements were below 0.1 per cent with outputs up to 10 volts. But the rated output is 2 volts. With 2.5 millivolts in at the tape head output, and the volume control set to deliver 2 volts to the amplifier, total hum and noise measured −66 db. Component and circuit tolerances are held so close that at no point was there more than 4 db difference between the channels with the two sections of the volume control tracking within ±0.7 db from minimum to 45 db down.

Construction

There is no need to dwell on the construction details of this preamp—the description given in the Citation I profile certainly highlights the excellent, and careful, thinking that went into these kits. We would, however, like to stress the important role played by the heavy-duty terminal boards in assuring a high-quality unit. Even the novice can produce a properly wired terminal board; thus permitting him to realize the potential engineered into the preamp.

Of course the most significant test for the preamp is the listening test, which we will describe at greater length in the report on the Citation V. M-23

CITATION V STEREO BASIC AMPLIFIER KIT

Immediately after completing this kit —in a total of 8 hours—we installed it in our system for a listening test. First of all we were anxious to hear how the Citations IV and V sounded together. As we mentioned in our review of the Citation IV, this amplifier was not completed until a few days after the preamp. Our first reaction, was that we could *hear* no difference between a Citation IV and V team and a Citation I and II team. Of course our test only involved a small amount of listening —we were really racing the clock to get these reports ready in time for this issue. In addition, we did not compare the two "teams" under identical conditions. So we'll have to hedge somewhat in our statement, pending further testing. But at the very least we can say that the sound quality of these two combinations is extremely close.

We also listened to the Citation V using a non-Citation preamp, comparing it with the Citation IV by switching back and forth. Although the non-Citation preamp is an excellent piece of equipment, there was a noticeable difference when the Citation IV was switched back in. Conversely, we A-B'd the Citation V against a non-Citation amplifier, also a fine piece of equipment. We were unable to detect any large differences but the Citation V had a slight edge by virtue of a somewhat firmer bass. Here again, the listening time was rather short so we will take refuge behind a hedge; we would really like to listen for a much longer period of time before forming firm opinions. And again we part the hedge slightly—we are certain that any serious audiofan would be completely satisfied with this amplifier.

Circuit Description

There is not a great deal to be said about the circuitry of the Citation V; it is not at all unusual. Undoubtedly the high level of performance achieved is primarily due to the quality of the components. For example, the output transformers are specially designed and have a resonant frequency above 200,000 cps. The output stage consists of a pair of 7581's per channel, operating very conservatively with fixed bias. A bias meter is provided to balance each pair statically and dynamically. The phase-splitter consists of a twin triode, a 6CG7, in a long-tailed-pair configuration. The input stage is a 12BY7A video pentode. Feedback is applied in one loop—from the secondary of the output transformer to the cathode of the input stage. Over-all feedback is 22 db.

Performance

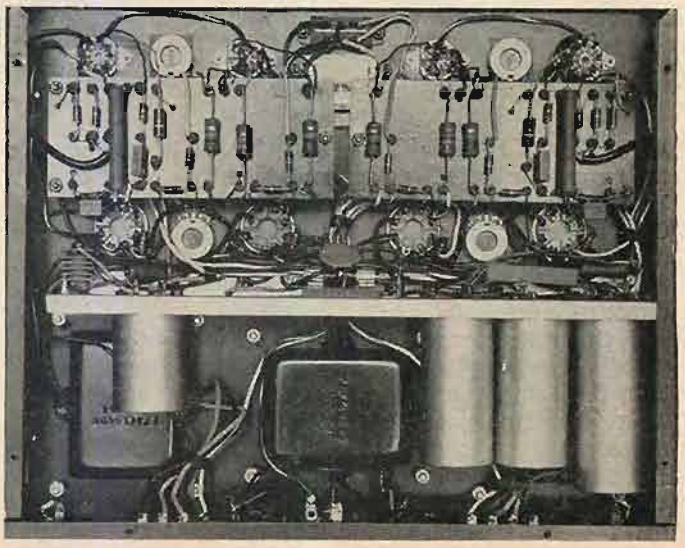
We need not say very much about the performance of the Citation V—primarily because it meets all of its performance specifications—and then some. For example, specifications call for an intermodulation distortion of less than 0.5 per cent at 40 watts output. Our measurement was 0.4 per cent. In addition, we measured only 1.1 per cent distortion at 50 watts and 3.9 per cent at 60 watts. Also at 60 watts we measured harmonics of 0.3 per cent (1000 cps), 0.28 (30 cps), 0.23 (5000 cps), 0.42 (7500 cps), 1.9 (10,000 cps), and 2.9 (15,000 cps). Clearly the performance is "way up there."

Construction

We indicated earlier that it took us only 8 hours to construct this kit. Considering the $60 extra charged for a factory-wired unit—here's a good way to earn $7.50 per hour. Not bad at all—and you get a bonus too. Several thoroughly enjoyable evenings—for in reality the Citation V, like the Citation II, is a joy to build. It's always a pleasure to construct units so obviously well-engineered. M-24

Fig. 4 (left). Citation V stereo basic amplifier. Fig. 5 (right). Bottom view of Citation V chassis showing the uncluttered layout possible with terminal boards.





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MODELS B60, B61

the most 'able' turntable in high fidelity!

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MODEL B50—$40.40



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MODELS TT4, TT5 $99.50, $129.50



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Fig. 6. Portable model CS-300 Sony-Superscope stereo tape recorder.

SONY-SUPERSCOPE CS-300 STEREO TAPE RECORDER

A complete stereo tape recording system in one package, including the loudspeakers, is how the Sony Sterecorder model CS-300 might be described. Imported and sold in the United States by Superscope, Inc., this unit is the current top-of-the-line, following the 555A4 which was described in these pages in December, 1959. The new unit offers some new and attractive features which were not present in the earlier model, but the high quality of performance of the 555 is retained, with some simplification of controls and some additional features.

The CS-300 provides for stereo or mono recording and playback on both two and four tracks. It is equipped with a handsome two-tone carrying case which mounts two 4" x 6" monitor speakers with integral reflectors which may be opened out to provide suitable stereo distribution. The cover holds an empty reel, two microphones in ingenious nylon clips, and the power cord, making it a complete package. Access to the internal circuits is through a panel on the rear of the case, with a hinged cover to protect the sockets and receptables. The side reflectors—shown in a typical listening position in *Fig.* 6—are locked in the closed position when the case cover is in place.

The tape transport employs a single hysteresis-synchronous motor with idler drive to a massive flywheel, and belt drive to the take-up reel; in the fast forward and rewind positions, the drive to the reel hubs is by means of idlers. Either of two speeds—7½ or 3¾ ips—may be selected by a panel control. All transport controls are located on the top panel, and all electronic controls are located on the front "shelf" panel. The two heads—erase and record-playback—are of the four-track type, and both are shifted up and down to provide the proper positioning for two- or four-track recording. While the two-track position does not record a full half-track band, it does at least position the heads correctly so that two-track tapes will be centered over the heads.

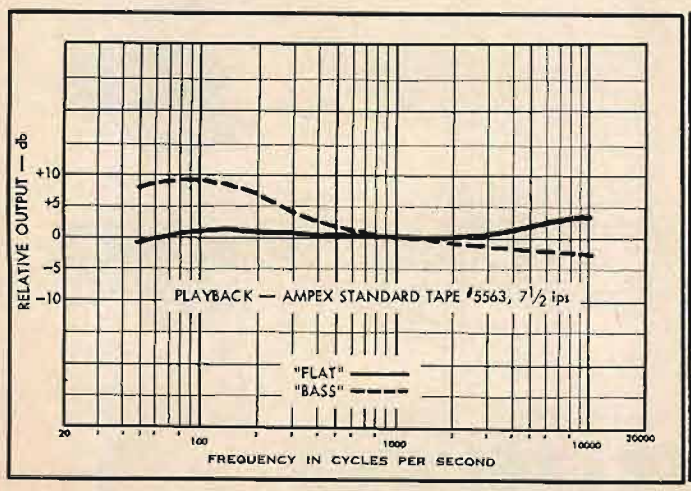
The electronic control panel is equipped with two level-indicating meters, one being illuminated in the mono mode and both for stereo; two red recording indicator lights work similarly when the recording pushbutton is depressed. Concentric controls are provided for each channel, with the upper knobs controlling microphone recording and tape playback and the lower knobs controlling the high-level inputs. Thus it is possible to mix microphone and a high-level source while recording, or—with the use of an attenuator—two high-level sources. One slide switch at the right end of the control panel turns on or off the monitor loudspeakers, either internal or external when additional speakers are plugged in; a second slide switch selects either flat response or 8 db of bass boost for low-level playback listening. In the monophonic mode, both amplifiers and speakers are fed from a single track. Two output impedances are provided—8 ohms for monitor speakers or headphones, and a 600-ohm line for feeding external amplifiers or a broadcast-type line. The two microphones plug into miniature jacks between the volume controls.

Among other features are the momentary stop lever, which permits editing and cueing; an automatic shut-off which also acts as a tape tension guide; a digital footage counter; and automatic tape lifters which protect heads during fast forward or rewind operation. The tape motion is controlled by a single large lever-type knob for forward and rewind, with an additional thumb-operated lever for the fast-forward mode. The head cover is instantly removable for editing or for cleaning the tape heads.

Mechanically, the construction is in accordance with precision practices. The motor bearings are of the oil-retaining type and never need oiling. The capstan bearing should be lubricated with three drops of light machine oil once a month onto a felt retaining ring, and the pinch roller, reel shafts, and idler shafts require only one drop of oil each month. With this treatment, however, the unit is sturdy enough throughout to give years of satisfactory service. When one disengages the drive from the flywheel at 7½ ips, the capstan continues to revolve for over two minutes—a fair indication of precise workmanship.

Performance

Measured playback output, using a standard tape which covers the range only from 50 to 10,000 cps, is shown in *Fig.* 7 to be flat up to about 3000 cps, with a gradual rise to 10,000 when the bass-boost switch is in the flat position; in the boost position, there is a boost of approximately 9 db at



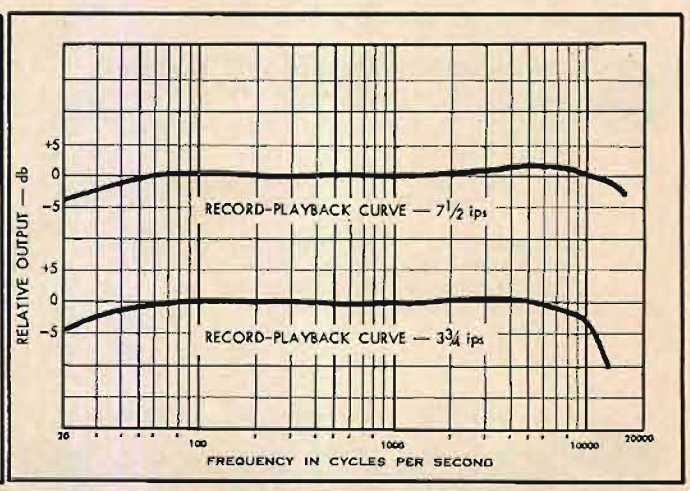
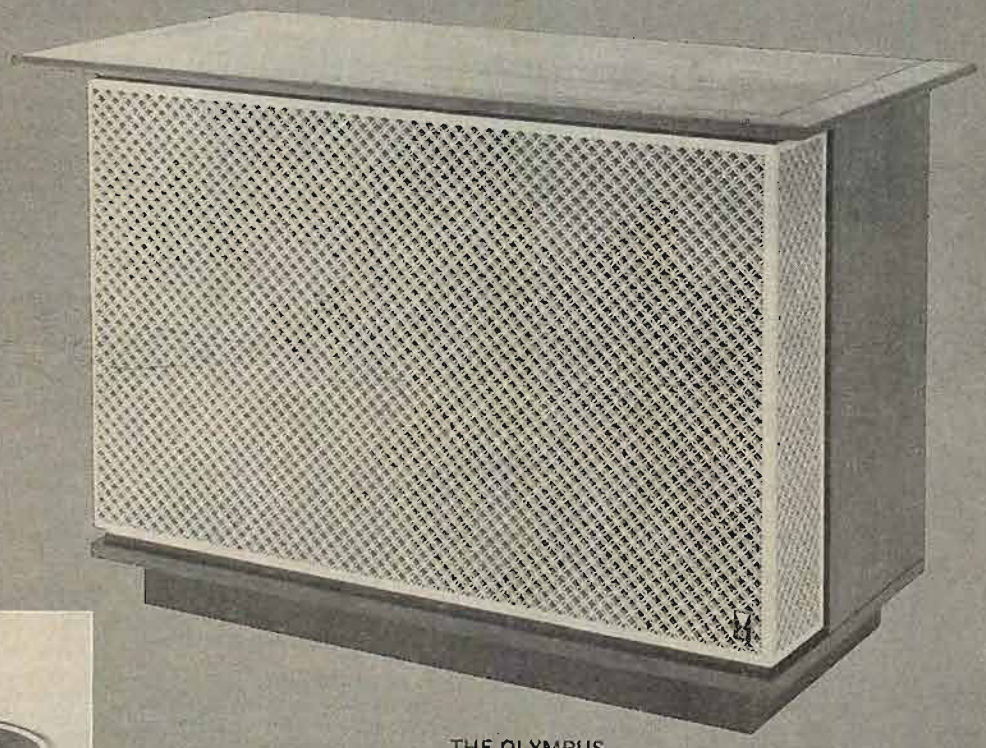


Fig. 7 (left). Playback response from standard frequency tape at 7½ ips. Fig. 8 (right). Frequency response of "flat" signal recorded and played back at the two speeds.

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This is the new JBL S6 Linear Efficiency System with a new 15" low frequency unit, new dividing network, new high frequency driver, and new horn and acoustical lens. The new LE15 is made with a 4" edge-wound copper ribbon voice coil, long-throw Lans-a-Loy suspension, rigid, cast frame designed for mounting from either the front or the rear of the baffle. This is the only 15" unit on the market capable of linear cone excursion of ¾ inch. Free air cone resonance is approximately 20 c.p.s. The new LX5 Dividing Network matches the LE15 perfectly to either the new LE75 (in S6 Kit) or the new LE85 (in S7 Kit). Crossover is 500 cycles. The LE75 and LE85 are laboratory standard high frequency drivers with silver impedance compensating rings; voice coil and pole piece assemblies are held to previously unattainable tolerances. The new HL91 Horn-Lens Assembly, specifically designed for the new drivers achieves completely uniform dispersion over a 120° horizontal × 45° vertical pattern through its full range from 500 c.p.s. to beyond the limits of human hearing.

A sensational sight with sensational sound, the new JBL Olympus has been enthusiastically acclaimed at every preview for its unprecedented flat, accurate reproduction of the entire audio spectrum. The Olympus has remarkable bass response... goes all the way down smoothly clean. It reproduces the lowest fundamental in all its rich, original power. And does it in the JBL manner—with precision articulation, accurate delineation. The new slant-plate acoustical lens refracts equally all frequencies which pass through it. Not only does this heighten realism from any listening point, but permits a new latitude in speaker placement in stereophonic installations.

The C50 enclosure is styled with timeless elegance. Top edges are tapered to slim the cabinet's proportions. The wrap-around grille disguises the sturdy, heavily braced sides. Though the C50 is a six cubic foot enclosure, its bulk is comparatively small when the magnitude of the system's performance is taken into consideration, and the D50S6 might be accurately described as "a compact system." The new wood grille is shown above. Also, you have your choice of a fabric grille.

Production of the new systems is underway. To reserve a proximate place on the backlog, it might be advisable to get your name on the list without delay.

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Fig. 9. Model 262-D Sony-Superscope stereo tape deck.

100 cps, with a slight rolloff from 1000 cps up to 10,000. *Figure* 8 shows the over-all result of feeding in a flat signal from 20 to 15,000 cps and playing back through the entire unit—all outputs being taken from the 600-ohm line terminals. At 7½ ips, the response is seen to be ±2 db from 30 to 15,000 cps, and at 3¾ ips the response is within ±2 db from 30 to 10,000 cps, in both cases completely in accordance with the specifications. A level 13 db above "0" on the VU meter corresponded with 3 per cent harmonic distortion at 1000 cps with a steady tone, which ensures that any signal recorded within the range of the VU meter would be well under 1 per cent harmonic distortion, which was borne out by measurements at a zero level on the meter. Hum and noise measured 55 db below a signal recorded at zero on the meter on one channel, and 53 db down on the other. Flutter and wow measurements indicated a value of 0.12 per cent at 7½ ips and 0.20 per cent at 3¾ ips—both well under specifications.

Circuit Description

Each channel of the CS-300 consists of a 12AD7 twin-triode cascaded to form the preamplifier section which is used for both microphone and for playback. A passive network is switched in between the two triode sections to provide low-frequency boost for playback equalization. The microphone recording level and the playback level are controlled at the output of the preamplifier section. The high-level input is fed through a mixing network with the output of the preamplifier section to the grid of a 6AU6 which feeds a 6AQ5 output stage. The recording signal is taken from the plate of the output tube for head feed through an equalizing network. A transformer in the plate circuit of the 6AQ5 feeds the loudspeaker and the line output through separate secondaries. The VU meter is fed from the line circuit with separate adjustments for recording and playback. The bass-boost circuit is incorporated in the feedback network around the 6AQ5 and the 6AU6. The bias oscillator is a 12BH7 with the two triode sections operating in push-pull for low bias distortion and consequent low tape noise. Separate controls are provided for adjusting bias level to the two channels. Hum adjusting controls are provided in the heater circuits of both channels to allow for independent adjustment. A 6CA4 furnishes plate power for the entire electronic section.

In addition to the CS-300 which includes two dynamic microphones and the carrying case, the unit is also available as a deck under the designation DK-300. No microphones or monitor speakers are supplied with this model, making it ideal for custom installation.

The DK-300 is 16½ in. wide by 12¾ in. deep by 7⅞ in. high and weighs 35 pounds. The portable CS-300 measures 20 by 14 by 9, and weighs 42 pounds including case, microphones, monitor speakers, and connecting cables. **M-25**

SONY-SUPERSCOPE MODEL 262-D TAPE TRANSPORT

Incorporating the same transport mechanism as the CS-300, the smaller 262-D is the ideal unit for anyone who wishes to construct his own electronic section for recording and playback, or who wishes to use the unit for playback only, feeding the tape-head outputs to an equivalent input on a typical modern preamplifier or integrated preamp-amplifier. This unit, shown in *Fig.* 9, is 13 in. wide by 10 in. deep and 5⅜ in. high, and weighs only 10 pounds. It is fitted with two stereo heads—four-track erase and four-track record-playback—without provision for moving to the two-track position. Six input jacks are provided—two for playback output, two for recording input and two for erase current input. A slide switch is mounted on the terminal panel with positions for record and playback. In the record position, the heads are connected to the input jacks and erase current is fed from the erase jacks to the heads. In the playback position, the r/p heads are connected to the corresponding output jacks and a dummy load is substituted for the erase heads. For playback only, a single pair of connecting cables may be run between the transport and the amplifier and the switch left in the playback position. The ingenious home constructor could readily devise an amplifier/oscillator unit which incorporated all switching within itself and thus avoid the need for operating the switch on the transport. For the really adventurous, let it be said that there is plenty of room under the transport to accommodate the entire electronic section if it were transistorized. For the more conventional user, however the accompanying instruction book gives a simple circuit diagram for a recording amplifier bias-erase oscillator.

Since the 262-D is essentially identical mechanically with the CS-300, the same performance figures were obtained for flutter and wow, and closely similar outputs were measured from the standard tape.

The serious tape enthusiast occasionally finds a need for a second machine to permit dubbing from one machine to another. Assuming that he has an amplifier or preamp with a tape-head input, this deck gives a complete solution to his requirement, since he can feed the output from the deck through the amplifier and thence to his other tape recorder and dub from one tape to another very simply. As the 262-D is priced under $100, the additional investment should not cause too much of a strain on the pocketbook. In any case, such a user may be sure that the quality of the deck is not likely to be lower than that of any other machine he may have. In addition, the simplicity of the 262-D makes it easy for anyone to use. **M-26**

TANDBERG MODEL 6 RECHECK

As indicated in the footnote at the end of the Tandberg Model 6 PROFILE in the November issue, there was some reason to believe that the later shipments of this model had been corrected as to the low-frequency response, since in the unit tested there was a noticeable dip in response between 50 and 70 cps at 7½ ips. Another unit from a later production run was tested and in this case the bass performance turned out to be virtually irreproachable. The following table shows the measured record-playback response on each channel at 7½ ips between 40 and 200 cps, referred to 1000 cps as 0 db.

Frequency cps	Left channel db	Right channel db
40	0.0	−2.0
50	0.0	−1.5
60	−1.5	−2.5
70	−1.5	−2.5
80	−1.0	−1.5
90	−1.0	−1.0
100	−1.5	−1.5
125	−1.0	−0.5
150	0.0	0.5
200	1.0	0.0

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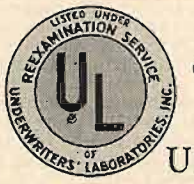
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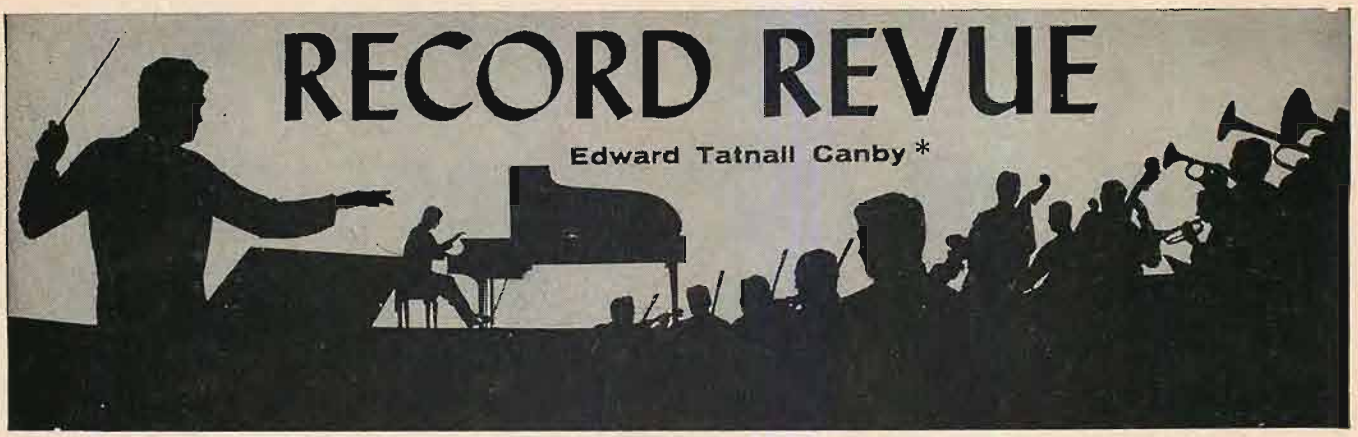
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RECORD REVUE

Edward Tatnall Canby *

PROS AND CONS FOR CHRISTMAS

Mahler: Das Lied von der Erde. Dietrich Fischer-Dieskau, Murray Dickie; Philharmonia, Kletzki. **Angel 3607B (2) stereo**

The great "Song of the Earth" has been waiting around many a year for me to catch up with its beauties. This superb recording has brought the music finally to me, an experience that I knew I could have, but postponed in sheer anticipation, as one delays the first taste of a fine dessert. I've heard the music before—as far back as an ancient 78 rpm recording, enormously heavy and endless in the playing, but the piece seemed too big for me, too big for recording. I waited, for another day. Now, it has come.

I won't argue with those who know the other famous versions, with tenor and contralto—Kathleen Ferrier made one of them. I'm not bothered at all by the fact that this is the first recording to substitute a baritone for the contralto, as per Mahler's original alternative, even though tradition has become fixed upon the contralto version. I'll only say that this incredibly profound work, so strangely semi-oriental (based upon Chinese poems in German translation), is served supremely well by this whole team, led by Fischer-Dieskau in the finest, most perfectly suited singing I've ever heard from that splendid musician. It is exactly right for his earnest, eloquent, dignified vocal mien, his powerful emotional projection, the perfectly controlled melody of his voice, the wonderfully clear diction that speaks as well as sings.

Murray Dickie, Scotch tenor from Vienna, is good, but has a subordinate role. The great Mahler orchestra, the Philharmonic under Kletski, is unbelievably alive and expressive, recorded in sound that is so alarmingly real and present that it borders on the surrealistic. A great experience, listening to this with the fine booklet of texts in hand, each song illustrated by a reproduction from ancient China.

Mahler: Symphony No. 4. N.Y. Philharmonic, Bernstein; Rari Grist, sopr. **Columbia MS 6152 stereo** (mono: ML 5485)

Mahler's 100th birthday was last summer and this recording is part of the Mahler commemoration, as staged in a festival by the orchestra which Mahler himself conducted back in 1910 and 1911. (He had guest-conducted it before that.)

As Bernstein himself says, most true musicians are Mahler fans. In that case, I rate as a musician, for I've long figured Mahler as one of the real geniuses of music, faults and virtues taken alike. Today, we find his more modestly proportioned works easiest to take, and this symphony is decidedly one of them —it's merely twice as long as a Haydn Symphony and about average for Beethoven's size. No huge choruses, a moderately big orchestra and only one vocal solo, the child-like soprano folk tune singer of the last movement.

Bernstein's concept of this music is quite strikingly unlike that which we've come to accept as a present-day standard, the Bruno Walter approach. Oddly, it is Walter who achieves the greatest intensity, the highest tension and seriousness; but this we can understand, Mahler being the great influence in Walter's long life. Bernstein's Mahler is more eloquent, but in a less intense way. Much of it is as lovely as Mahler can be—with his gorgeously transparent orchestration, an orchestra of exalted solo voices, with his lilting slow waltzes, unforgettably tuneful. But oddly, the lack of tension tends to make for a very slightly coarser effect; under Bruno Walter, Mahler always transcends, but here there is an occasional hint of corniness, of over-ripeness. Very minor, and many listeners will like it the better, disagreeing with me.

Columbia's newly imaginative recording does wonders for Mahler's inner textures, and I have only two technical carpings: louder climaxes seem unduly compressed relative to softer passages (the soft parts are brought forward, actually), and the solo violin seems to me too close and loud for musical balance. It's about three feet away—I wouldn't mind ten feet, speaking purely imaginatively; but this is too close even for recorded sound.

Miss Reri Grist is a typically Bernsteinian choice for the soprano solo, suggesting a musical comedy voice out of one of Bernstein's own hits. A novel effect, but on the whole quite good, as per the deliberately child-like intend of Mahler's writing. She seems to have been played down deliberately on the record jacket—they don't even list her name. They should.

Debussy: The Martyrdom of St. Sebastian. Vera Zorina, narr., Guedon, Whitmore, Moechel, Phila. Orch. Chorus, Mus. Arts Soc. Chorus, Phila, Orch., Ormandy. **Columbia M2S 609 stereo**

This major Debussy work, virtually unknown here before the war, has had a surprising number of recordings, an all-French version, a Swiss version (Ansermet), recordings from Boston, Oklahoma City and, now, Philadelphia. It is an immense undertaking if done reasonably complete, even without the huge complexities of the original ballet-pageant-mystery-play stage production; three sopranos, a narrator speaking against music, a large chorus and large orchestra are involved and for even a minimum continuity four record sides barely suffice. Shorter versions, with no narration or truncated short bits, grievously miss the impact of the whole work, which is drama incarnate.

The piece is wierdly polyglot in both language and style—the story is of a Christian martyr but the poet, d'Annunzio, was Italian though he wrote in mystical French; the composer, supposedly an athiest, fell head over heels for this enormously mystical, masochistic, blood-drenched pagan-Christian symbolism —and the Catholic church put the whole thing on the Index two weeks before the first performance. It is, indeed, a fascinating, almost horrifying work, carrying religious symbolism to such an extreme that even the church itself could not approve; taken on its own sheer impact it can be extraordinarily moving even though the "story line" be utterly alien to most of us. There is something more profound—call it "psychological" if you will—that hits almost any listener of whatever conviction. The work is a monument, perhaps, to that martyrdom that is in almost every one of us, somewhere, latently.

Needless to say performance impact is conditioned very strongly by the feeling of participation that can be summoned up by the performers. The Ansermet Swiss version is convincing but not very moving; the French recording (London-Ducretet-Thompson), on the other hand, is almost unbearably poignant, so powerful that I almost shudder to think of hearing it through again.

It must be expected that this Philadelphia portrayal will be too healthy for such an emotional display and in fact it is. Vera Zorina is an effective lady ham, expert in the Helen Hayes manner, her French probably as good as d'Annunzio's was. She overdoes, she is too literally emotional, and I found her near-banal, especially in the dreadful "death" climax. The chorus sings movingly but with an American healthiness—not nearly neurotic enough. Ormandy the accomplished showman, turns out the very same thing from his solidly competent orchestra.

Healthily expressive, openly emotional but not really mystical—nor can more be asked. There are limits, I think, to the amount of "acting" we can expect in our interpretations of art from other times, other places, out of other attitudes towards life than our own. We can go far, and do, with imagination. But an emotional mass-work like this, I suspect can only be done by those most closely identified with its background. Try the French recording (if you can get it) and you'll agree with me.

Wagner: Great Scenes from "Tannhäuser" and "Götterdämmerung." Elizabeth Grümmer, Gottlob Frick; Orch. and Chorus German State Opera, Konwitschny. **Angel S 35844 stereo**

Since Wagner operas are long and do contain large, wobbly voices, there has always been a demand for excerpts, voiceless and compact both in concert and on records. The familiar entries go merrily along today as before—"Meistersinger" *Prelude*, "Siegfried" *Rhine Journey* and so on. But the unbroken length of the LP record, plus the newly effective techniques of vocal recording, make for new excerpt possibilities. An imaginative recording company can now do wonderful things with Wagner, and here is a fine sample.

Each of these sides is devoted to an unbroken stretch out of two very different operas. The "Götterdämmerung" side is ultra-serious, ominous, with men's voices: Hagen ruminates, before the coming fall of the Gods, then summons his warlike henchmen with savage cries—a typically Wagnerian scene, marvellously done here. On the reverse of the record, the gentler, more graceful early music of "Tannhäuser" takes us with Elizabeth through the familiar *"Dich, teure Halle,"* then on to the welcoming of the contestants for the big *Singfest*—another Wagner specialty. Both record sides are performed with tremendous zest and enthusiasm, the vast basso voice of Frick overporweringly real, the gentle and highly musical persuasiveness of Grümmer easily making up for a relatively middle-grade vocal organ. Seldom has the orchestral portion of a Wagner scene been so alive as here —the "Tannhäuser" introduction fairly shines

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with joy. A terrific record and it could be an eye-opener to those who think Wagner is best without voices.

Reiner Conducts Wagner. Chicago Symphony, Reiner.

RCA Victor LSC 2441 stereo

Wagner: Overtures from "Die Meistersinger," "The Flying Dutchman"; Prelude and Good Friday Spell from "Parisfal." Columbia Symphony, Bruno Walter.

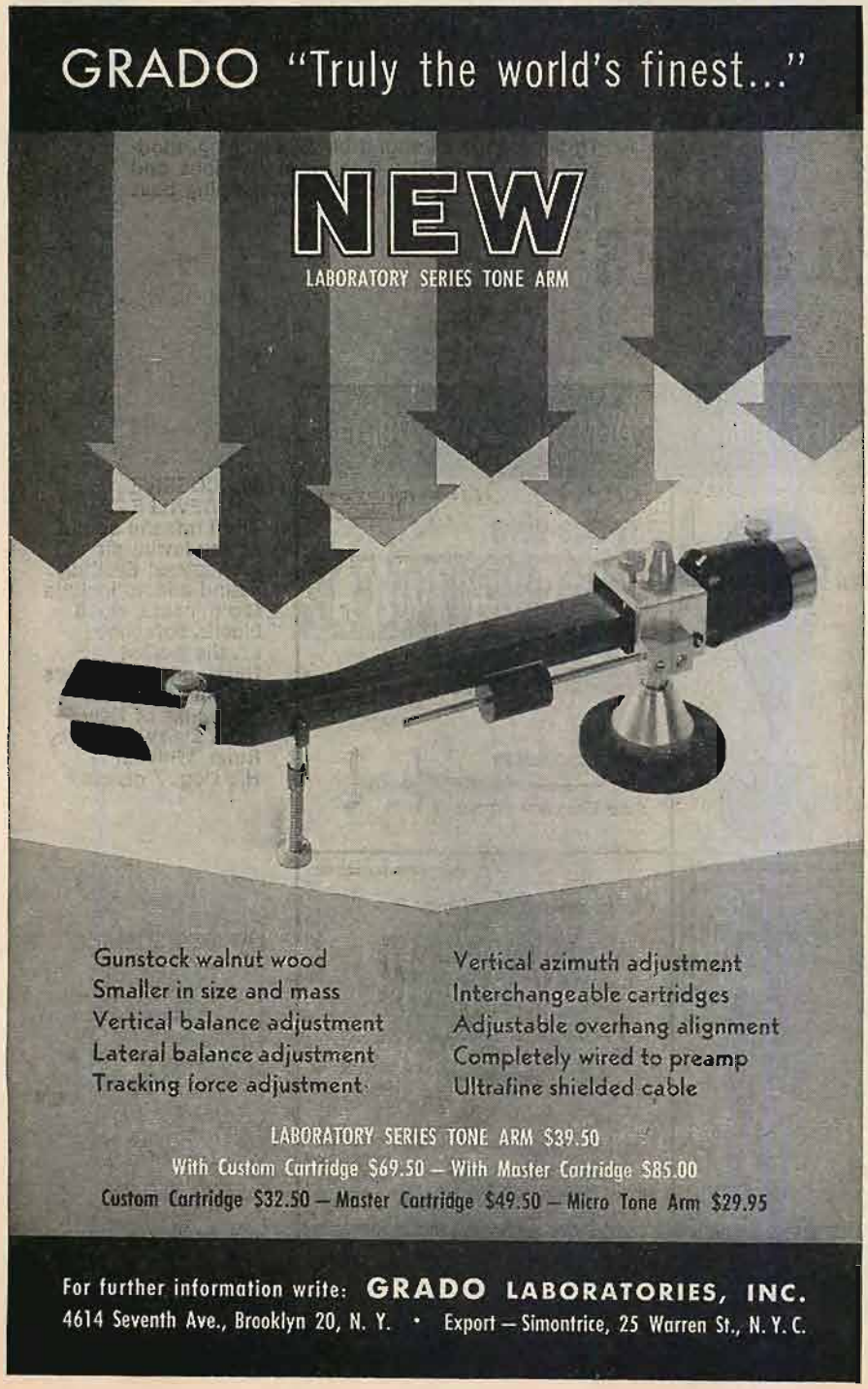
Columbia MS 6149 stereo
(mono: ML 5482)

Our two big companies here enter the competition for the Wagner warhorse market, each featuring a group of familiar instrumental items. Both records have the "Meistersinger" *Overture*, with significant differences both in the musical approach and that of the recording engineers.

Reiner's Wagner is all drive and power, relentlessly pushing forward, disciplined in detail but seldom relaxed. It is surely effective Wagner, though not particularly in the spirit of the stage operas—which hardly plunge forward in any driving sort of way, even in the most modern productions! Nevertheless, Reiner is on legitimate ground, since these are excerpts and recorded, with nary a stage in sight. In addition to the Overture (more properly the Prelude), he completes a full side of "Meistersinger" with the Act III Prelude, Dance of the Apprentices, Procession of the Meistersingers, all familiar excerpts; the second side offers the familiar "Siegfried" Rhine Journey and Funeral Music. Not exactly an original sort of program and perilously close to the potboiler category, though the playing is too good for that.

Bruno Walter's excerpts are not more original, but his playing has greater conviction and faith, reflects more closely the traditional sense of the operas—he was, after all, an opera conductor from the very beginning. His two overtures are on one side; the familiar *Prelude* and *Good Friday Spell* from "Parsifal" fills the other. For the knowledgeable Wagner listener, Walter's grasp of the music is bound to be more satisfying than the non-traditional drive of the Reiner way and this even though in direct comparison the Reiner players are more accurate, better disciplined than the Walter ensemble of Hollywood players.

The recordings are interesting technically. With a relatively advanced sort of close-to pickup, emphasizing the brass, Columbia gets more impact, more seeming volume, than RCA does with a more distant overall pickup. Actually, the RCA record hits higher peaks via a meter; but it sounds less loud, the details are less vivid, the overall impact somewhat dull. Literally speaking RCA is nearer to a normal stage balance and hence more "authentic"—yet Columbia walks away with the musical prize for effectiveness in terms of recorded sound itself. An important moral can be drawn, if you wish; but better listen to both first.



Verdi: Requiem Mass. Vartenissian, Cossotto, Fernandi, Christoff, Orch. and Chorus of the Rome Opera, Serafin.

Capitol SGBR 7227 (2) stereo

The soprano's name is Armenian, the basso's is Russian (and he sings a marvelous Boris Goudonoff), but this is the very essence of a present-day Italian performance, just the same.

It reflects a passionate understanding of the Verdi intention, even if the soprano flats and so does the tenor, the chorus wobbles like a barrage of would-be soloists (which is probably exactly what it is) and the drama sometimes gets positively maudlin. It should, in a manner of speaking.

Yes, Verdi's Requiem, as has often been said, is really an Italian opera. In its expression, it is just that—hence the histrionics, the all-out sobbing sentiment! What really interests me, though, is that we have in this *music* not the Italian opera idiom at all, but the Romantic church tradition straight out of Mozart and Berlioz, who wrote two other famous Requiems. The music itself is clearly related to these, and no doubt at all about it. But the point so well achieved in this recording is a clincher—the spirit, the *expression*, is out of the Verdi opera.

Sing it like Berlioz, like Mozart, and it falls flat into acres of corn mush. Add the genuine glycerine tears, larger than life, and you really have something! Try it and hear for yourself.

Beethoven: Symphony No. 4; Overture "Consecration of the House." Philharmonic Orch., Klemperer.

Angel S 35661 stereo

After I had finished raving over this marvelous performance of the always-difficult Fourth, I looked back and found what I had said of one of the first in the Klemperer series, the Seventh, done back in the mono days for Angel. I raved then, too, quite consistently. It is a pleasure, thus, to be able to recommend the Klemperer series in the very highest musical terms. This elderly conductor, who went through many years of a sort of fanaticism, emerged into a relaxed twilight glow of elder statesmanship that produced some of the finest, most natural, easy, alive Beethoven we've heard for many years.

The orchestra, of course, is one of the world's best and the Angel stereo in this more recent recording is also superb for Beethoven. Can I say any more? (See also Symphony No. 2, Angel S 35658)

Beethoven: The Nine Symphonies. London Symphony, Krips. (In the Ninth: Vyvyan, Carter, Petrak, Bell, BBC Chorus).

Everest SDBR 3065/8 (8) stereo

Here's the life-work in the symphonic form of a great composer and, in his honor, I should take at least three or four years to evaluate the recording! In lieu of an instant review, I've merely been able to play two symphonies, so far, to get an idea of the lay of the musical land in this major enterprise from Everest.

Krips is a distinguished and well known conductor and his orchestral and vocal forces

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are important ones. The recording is big, resonant, tops in sound quality. Rated within a fairly high-echelon area, then, I must say that I'm not enthusiastic about the Krips Beethoven—so far.

Krips writes his own program notes here, and in them mentions his thirty years' experience in perfecting these Beethoven interpretations. With all due respect, I still am not happy. There is a hard, obstinate "beat," in the two I have tried (the First and Fourth), that for my ear lacks plasticity, tends to haul the musicians along willy-nilly. The conductor must lead, of course, But his job, I'd say, is always to lead his men to the music, to allow the music itself free enough play for its own best expression within the ensemble. The impression I have here is that somehow, Krips misses this vital function. He forces the musical details into his own rigid tempo.

Yes—I know this sounds dreadfully vague as an indictment; but to make it more positive I should have to play you the record itself. Not very feasible, right here, is it? So you must ponder my suggestion with grains of musical salt and, perhaps, try for yourself. In all other respects, including handsome get-up and a good-looking booklet, Everest does a superb job.

Haydn: The Salomon Symphonies, Vol. 2 (Symphonies 99–104). Royal Philharmonic, Beecham.

Capitol SGCR 7198 (3) stereo

The second volume of the late symphonies completes Sir Thomas' stereo Haydn legacy, redoing many of the works he recorded before in mono and back in the 78 days. I learned about Haydn from Sir Thomas, still own a number of the old prewar 78 albums of these very works, outstanding classics of their day.

The Beecham Haydn is both highly authoritative and quite old-fashioned, by our rapidly changing standards. The orchestra is relatively large—the same as it has always been with him; but smaller ensembles are now increasingly common. The style is as it has always been with him, urbane, serious with a gentle touch of comedy (very much in Haydn's own image), the minuets on the portly side, the whole done in a relaxed manner that belies the impeccable discipline of detail, the wonderfully careful shaping of every idea for musical impact.

Don't forget that Beecham was once a pioneer Haydn-restorer, almost the first to return him to full concert dignity and repute. It was with these slightly mannered but wonderfully graceful performances that he did the trick. They'll last as splendid examples, within a style and a period no longer with us.

Handel: L'Allegro ed Il Penseroso. Adele Addison, John McCollum, John Reardon; Albert Fuller, harps., Orch. and Chorus, Frederic Waldman.

Decca DXSA 7165 (2) stereo

Decca, at least in its classical department, is mainly an importing agency (Deutsche Grammophon) but every so often the company rears back and does a domestic spectaculnr. This one is a dilly, a fine successor to such as the "Play of Daniel" awhile back. It is well done throughout, music, recording and decor. It's not often that a New York presentation of this sort of music can compete with the more knowledgeable recordings we get from Europe, but this one does, with ease.

The work is a long series of alternating arias divided dually, between a tenor and soprano (and occasionally a baritone), and between Milton's two opposite mood-characters, who might in English be called Mirth and Melancholy. The soprano sings mostly the blues; the two men handle a large part of the gayety. Milton's famous original, out of the 1630's, kept these moods separate; Handel, in 1740, wisely combined them in alternation, for the desired musical variety. The many aspects of sadness and levity, both good and bad on each side, are profusely and refreshingly explored, a kind of debate in poetry on Milton's part and in the sheerest musical beauty on Handel's. Just one lovely aria after another.

The star of the performance is Adele Addi-

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son, who sings the very high soprano music with the purest intonation and accurary, but Frederic Waldman. Viennese by birth, is a sympathetic, knowing conductor who supports his singers with a plastic and musical ensemble accompaniment.

The album is issued with the aid of the Metropolitan Museum, where the work was performed. The decorative cover and booklet, with good notes by the Museum's Emanuel Winternitz, feature William Blake, blue and gold on the outside and—an innovation—black and white prints on each of the three white paper record sleeves. Very attractive, and congrats to all, including the Museum.

Handel: Acis and Galatea. Joan Sutherland, Peter Pears et al., St. Anthony Singers, Philomusica of London, Boult.
L'Oiseau-Lyre SOL 60011/12 stereo

The most popular of Handel's works in his own day, this was an early semi-staged piece, a pastoral "masque," not quite an opera nor yet an oratorio. It's one of those quaint classical stories of shepherds swains, gods, giants —the hairy Polyphemus wants the shepherdess and can't have her, so squashes her shepherd boy with a rock; but she turns Acis into a brook. . . .the charm is not in the story but the musical and imaginative decor as propounded by soloists and chorus. Some famous songs are included, such as *O Ruddier than the Cherry*, Polyphemus' blustering setpiece, which is a baritone standby on many a recital program.

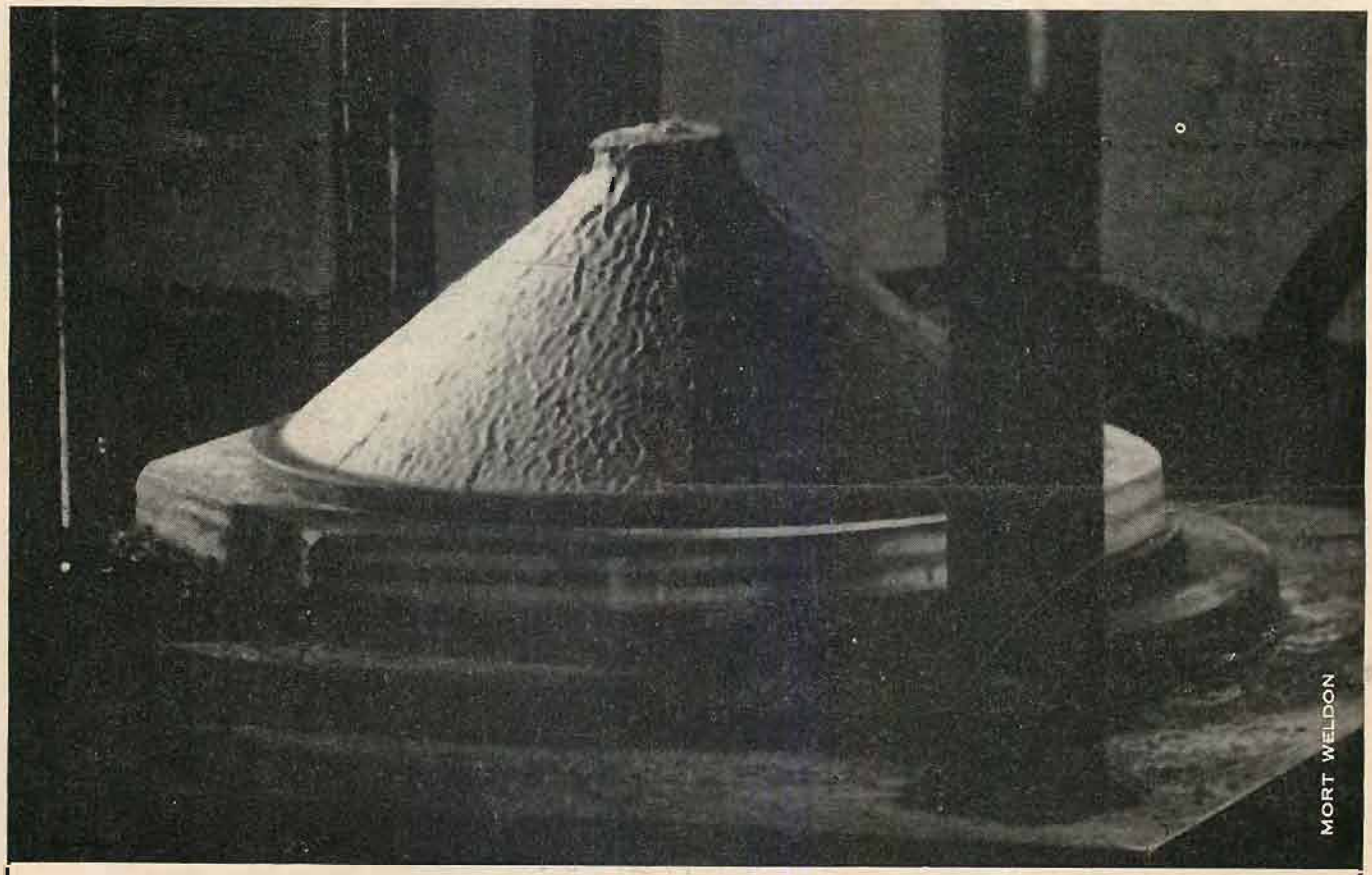
A very British performance here, a proper chorus and ultra-British solo voices. If this annoys you, stay away; otherwise it's a very nice album of music.

Bach: Brandenburg Concertos; Violin Concertos Nos. 1 and 2; Concerto for Two Violins. Reinhold Barchet, Will Beh, vls., Chamber Orch., Horenstein, Davisson.
Vox Box No. 25 (3) mono

This is one of Vox's omnibus collections, bringing together a flotilla of related recordings, economically spaced over long multiple record sides. This one is good. All of the Bach is well worth hearing and there are aspects of the recordings of quite unusual interest.

I have always been partial to Horenstein's complete Brandenburg recordings—these are a re-do in top quality mono sound that's almost as good as stereo. Horenstein's Bach is peculiarly masculine, brash, flamboyant, the details often characteristically rough and impatient but the whole effect strongly musical. In these Brandenburgs the idea of authenticity is carried for the most part a bit beyond the chaste, or the overly Romantic, authenticism practiced elsewhere. Here, for instance, many of the solo instruments—recorder, bassoon, oboe, even the violin in some instances—play virtually without vibrato as perhaps Bach intended. The *First Concerto* in particular displays this raw, vigorous antiquarianism, and those who enjoy old instruments strongly played will rejoice in the listening. It is a fine sound under Horenstein's alive direction, though an opinionated one, so to speak, with much bouncing staccato (a method of Bach playing frowned on by some) and not a few grotesque squeaks and squawks and notes out of tune. Doesn't matter, at least for my ear. I like it. I like anything that is musically strong.

The concertos follow one another, in scrambled order (for timing purposes), with forthright and expressive directness, all of them highly colored as Bach would have wished, all quite authentic, except Number Two, where some strange skullduggery occurs. The high trumpet (clarino), which usually sounds merely desperate—so high is the part and so difficult—here is wiry and complacent, full of little peeps and squeaks; and never before have I heard the trumpet part played



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in distinct octaves! Do I suspect the aid of a high clarinet, à la Toscanini? Hard to tell, 'mid all the fracas, but something is fishy. Maybe the local trumpeter just couldn't take it. Few can.

The three violin concerti are competently played à la Viennoise the double concerto (with Davisson conducting) a bit fuller and bouncier than the others. It's a good box, this, and more power to Vox for it.

High Fidelity Brass/Ancient & Modern. (Buxtehude, Schein, Fux, Shahan). Members Vienna State Opera Orch., Sayard Stone. Westminster WST-14113 stereo

Those familiar with the Westminster label (since 1950) will note evidence here of the new regime that took over the company awhile back—a surprisingly disorganized clutter of information and layout on the jacket's back, an oddly scattered musical aim (high fidelity isn't enough to unify it), and the major effort on the record, the music of the 18th century scholar Fux, split over the break between sides, though it could have made a better impact with more direct emphasis. It isn't even brass music—strings and woodwinds of a standard Baroque orchestra, plus two trumpets.

The all-brass material highlights some good pre-Bach work, from Buxtehude and Schein, plus a noisy, skillful, and windy modern opus by an American, Paul Shahan. There's also an odd bit of a concerto by the clarino ("Bach trumpet") player and authority, Johann Ernst Altenburg, who wrote it at a time when the clarino technique, natural harmonics without valves, was already dead, back 150-plus years. Natch, it's played here on the valved trumpet.

Buxtehude and Schein shine brightest musically here, but Fux's orchestral suites (two) are historically more interesting. He was a renowned theorist of strict counterpoint, supposedly the essence of Palestrina's "pure" church style; his principles and his rules are still used today—I studied them—as they were by Beethoven and many another master. His book was called "Gradus ad Parnassum" and you can get it in any music store right now, a couple of centuries later.

As a composer, Fux writes conservatively in the contemporary style of his day (1707), sounding slightly pre-Bach, post-Purcell, as we hear him. The music is fluent but decidedly of an academic sort—that is, it is complex, cerebral, melodically and harmonically clumsy and unfocussed, even ambiguous, especially in harmonic rhythm. This is no more than pleasant 1707 musical gobbledegook or Washingtonese, and musicians who have sweated hours over Fux's rules for counterpoint will be very happy. Sweet revenge! Like so many big theorists (Rameau not included), this one couldn't practice what he preached. But others could, and still do.

GHOST VOICES

Dylan Thomas Reading "Quite Early One Morning" and Other Memories. Caedmon TC 1132

Will Dylan Thomas' ghost-voice never cease? It is uncanny to hear him once again rise from the grave with something "new" and not previously heard over here (these are culled from BBC files)—especially at such length as this: two whole sides of the very best Thomas story material, and in good sound, too. This is as important as any Thomas record so far issued, and must represent a considerable triumph for Caedmon.

All of Thomas's prose-poetry stories are the one basic tale, a day out of his childhood in Wales. We had it in *A Child's Christmas* and *Under Milk Wood*; we have it here to perfection no less than four times, including two delightful specialties, *A Visit to Grandpa*, who is charmingly balmy, and *Holiday Memory*, concerning a day at a Welch beach and amusement park. The reading is as hypnotic as ever, the images flow so fast and thick that your imagination is set gasping—you can play these a hundred times with pleasure.

The earliest is from 1946 (the others 1952 and 1953) and you can hear, startlingly, the

(*Continued on page 81*)

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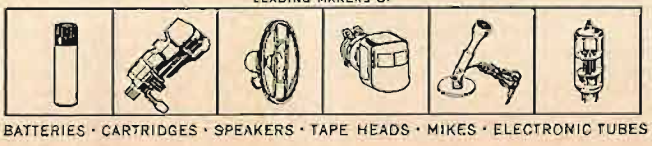
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CHARLES A. ROBERTSON*

STEREO

Duke Ellington: The Nutcracker Suite
Columbia CS8341
Shorty Rogers: The Swingin' Nutcracker
RCA Victor LSP2110

Just how two jazz versions of Tchaikovsky's "Nutcracker Suite" happen to appear simultaneously is a question best answered by pointing to the enormous popularity of the New York City Ballet revival of the complete work. A permanent fixture of the Christmas season in Manhattan, the production also has toured widely and traveled across the nation via television. Many youngsters receive a painless introduction to the world of ballet and classical music at the annual performances. The themes are now familiar enough to be ripe for various interpretations. Both recordings offer different approaches to the material and are likely to become prescribed listening at all modern schools of dance.

The inventive skill of the arrangers involved is sufficient, in either case, to preclude the stigma attached to some attempts at swinging the classics. In fact, Duke Ellington was the first jazz writer to win the admiration of serious composers, and it was not accomplished by overt copying of the classics. When his orchestrations were compared favorably to Delius and Ravel by Constant Lambert, he was almost as surprised as the jazz writers, some of whom have yet to forgive him. Regardless of any critical edicts issued on this full-scale invasion of the romantic Russian's precincts, all faithful followers of Ellington are certain to find much that is vital and arresting in his latest collaboration with Billy Strayhorn.

First of all, the band is back at full strength and ready to grapple with the unusual assignment of a complete album devoted to a composer other than the leader himself. Sam Woodyard is at his drum post again, and the trombone section is bolstered by the return of Lawrence Brown and Juan Tizol. Willie Cook, Andres Meringuito and Eddie Mullins join Ray Nance in the trumpet section. Aaron Bell, having left a lucrative freelance career, takes on the important role of bassist. The band now lacks little in the way of execution and handles the tricky section work with telling effect.

The two arrangers alternate between close adherence to the original score and more fervid expressions of the band's personality. Ellington depends greatly on individual soloists, as always, and gives them more freedom than any ballet master would allow. However, the parts are handed out with care and the themes are always recognizable. Several duets which pair off members of the sax section are wholly delightful in stereo. Paul Gonsalves is the surprise of the session, playing tenor sax with a strictly legitimate tone when teamed with clarinetist Jimmy Hamilton on *Chinese Dance*. Russell Procope whips out a bamboo whistle on *Arabian Dance*. If Peter Ilich had ever heard two trombonists like Brown and Tizol, Russian brass bands would sound quite a bit different today.

Columbia's new studios in Los Angeles were quite possibly used on the date, which would explain an anxiety to ensure adequate bass. This is one stereo recording that may require rolloff on bass notes.

Shorty Rogers takes more liberties with the score and themes frequently turn up in unexpected places. The West Coast trumpeter employs a large force of Hollywood studio musicians, complementing it with a sax quintet consisting of Bill Holman, Richie Kamuca, Bill Perkins, Bill Hood, and Harold Land. The quintet, in part or as an ensemble, absorbs a large portion of solo space and is distributed with terpsichorean license in stereo. A novel idea on the part of the arranger, but engineer Al Schmitt deserves much credit for carrying it off successfully.

All three arrangers took a hand in thinking up new titles for the various dances and one of Shorty's creations is *Pass The Duke*. Ellington and Strayhorn are reputedly at work on Grieg's "Peer Gynt Suite." Has anyone told Mr. Rogers? More comparisons are in order.

Shelly Manne & His Men At The Black Hawk, Vol. 1 and 2
Contemporary S7577-78

Something in the atmosphere of San Francisco undoubtedly encourages musicians to be creative and expansive at the same time. Although few drummers have as extensive a recorded history, Shelly Manne was first recorded on location at The Black Hawk as recently as September, 1959, just a month before Cannonball Adderley arrived at a rival club. Manne's quintet helped the town prepare for the engagement which produced Riverside's "This Here" album, released several months ago. The late arrival of the Manne effort is probably due to the difficulty of deciding how to handle the large amount of material taped on three successive nights.

Contemporary's Lester Koenig, who had planned on only one LP, agreed with the leader that nothing less than four would do. Their reasons become clear, once the two at hand are examined, as all but one of the five tunes runs about twelve minutes or more. Such unedited largesse is impressive even in these days of inflated performances. A high level is maintained throughout, however, and no one is likely to walk away from this repast unsatisfied. Even the confirmed jazz fan will find more than can be consumed at one sitting.

Previous Manne groups were noted for a willingness to attack compositions by jazz composers. The idea at the club was to achieve the spontaneity not always found in a studio and the soloists were given complete freedom. The presence of a receptive audience may have helped, but a great deal of incentive comes from the leader, who follows up his instructions with the sort of drumming that impels a soloist to take another chorus. The only limitations on solo space are those he places on his own, with a remark for the benefit of people who demand more evidence of his prowess: "I feel that if they listen to me in the band they'll see what I'm trying to do and that will be proof enough.

"I feel that what a drummer should add to the band is texture; whether he is leader or sideman, a drummer should give the horns the support, the sound, the sort of sound they need to have in order to say what they have to say. He should be able to hear the chords in advance and know what the front line is going to play next and anticipate it and give them the sort of sound they need to build their ideas.

"It isn't how loud and fast you can play that counts; it's what you've got to say. For me technique is nothing for its own sake. For me the hands are nothing unless they are an extension of the heart."

The most significant factor about the group is that the best elements of West Coast and East Coast jazz are combined, even to the point of presaging the Adderley brothers' visit on Frank Rosolino's *Blue Daniel*, a blues waltz brimming over with gospelizing soul. Richie Kamuca, normally a dulcet-toned tenor player, broadens his style to cope with Benny Golson's *Step Lightly*. Joe Gordon has demonstrated an ability to fit in anywhere and his trumpet solo is warmly lyrical on *Summertime*. Pianist Victor Feldman works well with bassist Monte Budwig, and is highly inventive on Tadd Dameron's *Our Delight*, and *Poinciana*. Also investigated are *What's New*, and Charlie Mariano's *Vamp's Blues*. The stereo placement by Howard Holzer is just right for the club setting.

Down South Summit Meeting
World Pacific 1296

This may not be the first meeting of four blues singers in a studio, but never before have the tape machines remained on while so many informal choruses commenting on the blues were swapped back and forth. It all happened last July in Los Angeles where Sonny Terry, Brownie McGhee, and Big Joe Williams were filling engagements at The Ash Grove. An invitation to the University of California's annual folk festival brought Lightnin' Hopkins to town and into the welcoming arms of McGhee, who eighteen years ago urged him to leave Houston by sending a recorded *Letter To Lightnin' Hopkins*. Arrangements were made for the group to audition for World Pacific with bassist Jimmy Bond. The date turned into a revealing four-way conversation on such subjects as *Ain't Nothin' Like Whisky*, and *Wimmin From Coast To Coast*.

Big Joe Williams hails from St. Louis and once recorded with nine-string guitar alongside Leroy Carr, whose verses he uses to open *Penitentiary Blues*. He should not be confused with Count Basie's vocalist, but it is hoped that the current blues revival will see him represented on LP's of his own. After exchanging greetings with McGhee on *First Meeting*, Hopkins sings alone on *How Long Have It Been Since You Been Home*. While the vocal sorties are noncompetitive, evidently all three guitarists feel placed on their mettle. Their solos and responses to Terry's flights on harmonica, from various stereo vantage points, are magnificent.

Peter Appleyard: Percussive Jazz
Audio Fidelity DFS7002

When instruments wandered from channel to channel during the early days of stereo, engineers reached for the aspirin bottle and went back to work on a cure for the problem. Eventually the disease was brought under control, but the patient is still kicking up. The public demand for new and more sensational effects seems insatiable. It is no longer enough for a ping-pong shot to travel straight across the board. The skilled player must return the ball by means of an under-the-table bounce or a tricky carom off the studio backwall. Depending upon the ground rules in force at the time, sidewalls and ceiling also may be brought into the game. Instead of marching in orderly fashion across the stage, livestock may enter from various points in the rear and charge in any direction required by the script.

After stressing the curtain of sound technique from the start, Sid Frey is now out to show that he can doctor stereo with the best of them. Sir Cooper packs an abundance of percussive schemes into the arrangements, and anything not thought of on paper was added by a good group of idea men in the studio.

* 732 The Parkway, Mamaroneck, N. Y.

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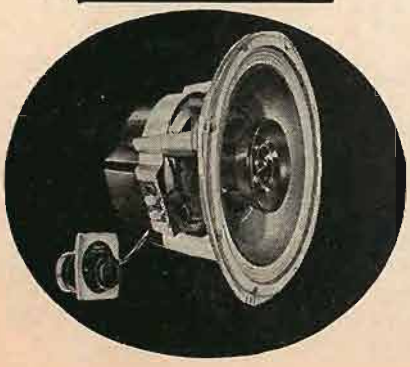
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Ted Shadbolt earns credits for a dramatic *Undecided*. Outlines of the plots followed on each tune by engineer Ernest Oelrich are provided in the liner notes. Any studio system failing to deliver everything listed on the chart as expected is subject to corrective treatment. The audiofan who consistently hears more than the expected should, of course, go back to safe and sane, undoctored stereo.

Peter Appleyard lends his fellow percussionists on a merry chase, heading the pack on vibes or pummeling woodblocks and timbales as the situation demands. Other specialists enlisted in the cause of contrapuntal dialogue are Eddie Costa, Phil Krauss, Bobby Rosengarden, and Buddy Weed. Doc Severinson's driving trumpet is heard on *The Man With The Golden Arm*, while Phil Bodner's baritone sax throatily declares *There Will Never Be Another You*. Jackie Gleason's favorite piccolo player, Romeo Penque, introduces *Witchcraft*, and Sam Most is flutist on *Harlem Nocturne*. As a result of carnage wrought on themes from Dragnet and Peter Gunn, the private eye business will never be the same again.

Buddy Rich: Richcraft
Mercury SR60136

Assembling eighteen men in a studio for a big band date can be a risky business, unless some compelling force exists to weld them together into an exciting and driving unit. Too many such affairs become desultory readings of the scores, regardless of the amount of polish applied. Buddy Rich learned how to strike responsive sparks from the most sophisticated while drumming with Tommy Dorsey and Harry James. His own groups never lack initiative, and the current lot always sounds alive and kicking. The leader subordinates his own solo activities to the cause of shepherding his charges, indulging in only one extended demonstration of the drummer's art on an Ernie Wilkins concoction called *From The Sticks*. In addition to all the arrangements, Wilkins contributes the title tune, and *Sweets Tooth*, an opus for featured trumpeter Harry Edison. While the drums are always heard, they are never too forward, in stereo, when lending support on *I Want A Little Girl, Indiana*, and *Song Of The Islands*.

Jimmy Hamilton: Swing Low, Sweet Clarinet
Everest SDBR1100
Neal Hefti: Left And Right
Columbia CS8316

A sterling upper register and crystalline tone are the qualities which distinguish Jimmy Hamilton among clarinetists, and he shows them off with rare taste and elegance on the first LP to bear his name. His concealed talent as arranger and composer are also revealed, and the imaginative way he utilizes three baritone horns in the octet is bound to attract the attention of his peers. Besides being a resilient cushion for the smooth flying clarinet, their ensemble sound is pure delight and will cause a good stereo system to purr contentedly. Sam Woodyard's drums and Aaron Bell's bass give almost physical support, so well are they recorded.

Although seventeen years have passed since Hamilton joined Duke Ellington, it seems like yesterday that he was spoken of as the youngster whose thin tone would never let him fill the shoes of Barney Bigard. Had he enjoyed recordings of this excellence from the start, it would have taken less time to remove any doubts about his ability to stand on his own. In addition to playing three Ellington tunes, Hamilton further states his allegiance on two originals which speak the same language, even though one bears oriental overtones and the other moves to a Latin beat. Paul Gonzalves, Britt Woodman and John Anderson share in the solos, while Jimmy Rowles is pianist. Hamilton's all-around performance and superb stereo make this wholly pleasurable listening.

Neal Hefti keeps so busy as arranger and conductor these days that his trumpet seldom gets a real outing and is almost as under-recorded with a small group as Hamilton's clarinet. There is nothing serious in his approach to ten standards, and all repressions go out the window during his vocal outburst

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on *Alexander's Ragtime Band.* Assisted by rhythm section, he engages in a stereo duel with an unidentified saxist, who looks like Teo Macero but sounds like Georgie Auld. Updated swing that will do at a dancing party as a change from dixieland.

Dakota Staton: Softly
Capitol ST1427

Cora Lee Day: My Crying Hour
Roulette SR52048

Both programs are designed for late evening listening and present singers with jazz leanings as they establish soft and sensitive moods. After laboring long and hard in quest of an individual style, Dakota Staton abandons the mannerisms picked up along the way and sings naturally for a change. Perhaps it was Benny Carter, arranger and conductor on the date, who told her to just be herself. At least, she seems to be taking the right direction on such tunes as *Solitude, Old Folks, Body And Soul,* and *I Can't Get Started.* Carter deploys flutes, French horns and harp in front of strings grouped for best stereo effect, and his urbane settings never ask the singer to force the issue.

Cora Lee Day will never be able to wear the title Lady because of the late Billie Holliday's prior claim, but the vocal resemblance is marked on her debut album. Only the sultry, white-gardeniaed aspects of the Holliday style are attempted, however, and any decision must wait until she is heard on songs other than laments of love no longer requited that are nearly always sung at unvarying tempos. If attention was paid to the beginnings of her model's career, rather than the later years, more of her considerable promise might be realized. Jimmy Jones conducts a small orchestra on several Jimmy Valentine arrangements, while other numbers find him on piano heading a septet. A good first effort, fine stereo and solos by Harry Edison, Illinois Jacquet, and Barry Galbraith make the album worth investigating.

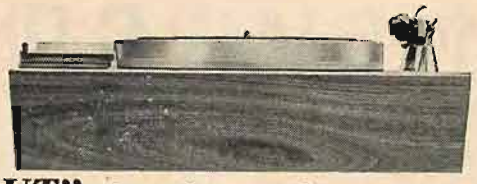
Henry Mancini: High Time
RCA Victor LSP2314

If Peter Gunn and Mr. Lucky examined this latest product of their musical conductor, they would detect that the original movie soundtrack is not involved, nor is the background music billing quite accurate. They know from experience of Henry Mancini's lack of reticence when his scores are allowed to stand apart. As composer of all the tunes of Jimmy Van Huesen's *The Second Time Around,* Mancini is not a bit backward about transforming the lot into a bright and lively dance set, just as he did with his television themes. The sleuths might also deduce from the titles that the film is about a coeducational institution, hence the presence of a vocal choir. But on sighting the name Fabian in the cast, two such discerning investigators will avoid the original soundtrack recording like the plague when it comes around. Even though disguised in collegiate clothes, most of the musicians will be familiar to Mancini fans, as is the excellent stereo of Victor engineers Al Schmitt and Ed Begley.

Miriam Makeba with the Belafonte Folk Singers **RCA Victor LSP2267**

The arrival of a young South African tribeswoman in New York night clubs last season was an event newsworthy enough to attract feature writers from Time, Look, Newsweek, and other national magazines. Fortunately, the singing talent displayed outshone the sensational aspects of a career that began in a barnstorming male vocal troupe called the Black Manhattan Brothers, blossomed in a musical variety show and a lead role in a jazz opera based on the story of an African prize fighter, and eventually drew international attention in "Come Back Africa," a semi-documentary film made in Johannesburg. Resulting articles devoted almost as much space paying homage to Miriam Makeba's lovely voice as they did to relating her unusual saga. Harry Belafonte, whose Folk Singers assist on her American recording debut, is now giving the twenty-seven-year-old singer the benefit of his advice, and she can afford to pick and choose

(*Continued on page 78*)



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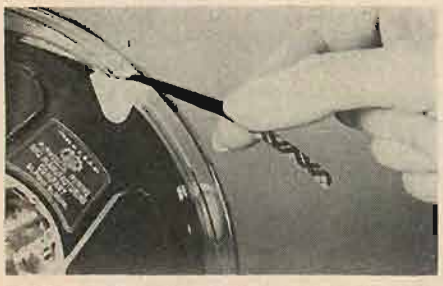
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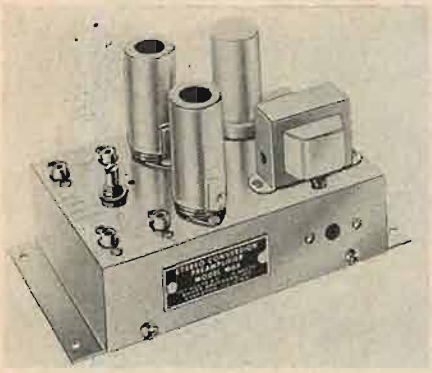
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• **"Scotch" Brand Tape Clip.** The new "Scotch" brand tape clip is a plastic clip that slips between the flanges of tape reels to hold the loose ends of magnetic tape securely in place. The thimble-sized product is being merchandised in packages of ten at a retail price of thirty-five cents. Molded of polystyrene plastic, the triangular shaped accessory is sturdy, yet



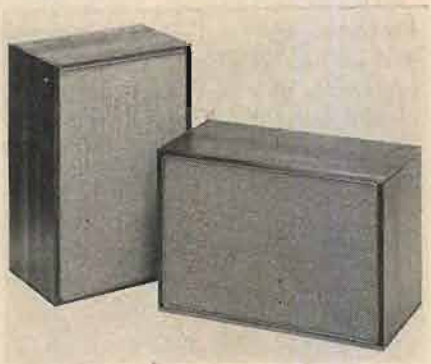
flexible, and easily clips onto tape on reels. All edges are tapered and smooth to prevent any possibility of scratching the tape. The clip was designed as a simple and quick means of keeping tape on either partial or full reels from tangling or unwinding during storage or shipment. Produced in only one width, the clip fits standard ¼-in. recording tape on any size reels. Minnesota Mining and Manufacturing Company, 900 Bush Avenue, St. Paul, Minn. **M-1**

• **Preamp converts Ceramic System to Magnetic.** For those who own a stereo system wherein the cartridge is of the ceramic variety, the new Shure Preamplifier, Model M65, will provide the extra voltage "boost" and equalization needed to operate a magnetic cartridge with an amplifier designed for a ceramic cartridge. The only restriction, because of hum considerations, is that the changer have a 4-pole motor. The M65 can also be used as a preamplifier for tape playback heads with standard audio amplifiers, and can be used without circuit modification as a microphone preamplifier. A single rotary switch



enables selection of any one of the following functions: (1) Phono, (2) Special, for converting from ceramic to magnetic cartridges, (3) Tape, and (4) Microphone. The preamplifier has its own power supply and operates from a 117-volt, 60-cps power outlet. It has dual input and output jacks which accept standard phone plugs. Two stages of amplification are provided in each channel. In the "special" function a modified RIAA equalization is used to compensate for the equalization generally present in commercial amplifiers. Standard RIAA equalization is provided in the "phono" function. NARTB equalization is provided in the "tape" function. Shure Brothers, Inc., 222 Hartrey Avenue, Evanston, Illinois. **M-2**

• **Two-Way Speaker System.** Designed to give maximum stereo effect from a bookshelf-type speaker system, the new Permoflux "Arpeggio" is a two-way speaker system containing a piston-type woofer and a hard-coned tweeter. A built-in crossover network divides the signal into appropriate segments for each speaker. Frequency range is 50 to 15,000 cps. Power



handling capability is 10 watts, and voice coil impedance is 8 ohms. The cabinets are handsomely styled to match any decor and are available in solid walnut, linite gray, or brown. The enclosure is 21-in. high, 14-in. wide, and 10-in. deep. Permoflux Products Company, 4101 San Fernando Road, Glendale 4, California. **M-3**

• **Equipment Furniture in Kit Form.** Stereo furniture in walnut and teak, with features found only in the most expensive furniture, is being manufactured in kit form by Sieler Design Products. Blending contemporary design with the cost-saving advantage of the kit, the Stereo Module units may be purchased as single cabinets or as a complete stereo set. Con-



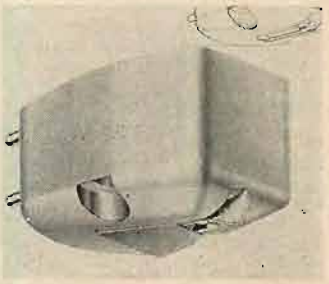
struction is accomplished by interlocking mitres and mortise joints rather than nails. The use of this double interlock mitre makes the finished joint, after gluing, the equal of the factory-made unit. The partitions that divide the interior of the cabinet are made of walnut colored wood laminate and are mortise-fitted into the cabinet. The mortise grooves are arranged to permit a variety of internal spacings. The tambour doors of the equipment cabinet roll back, disappearing inside the cabinet like the cover of a roll-top desk. Sieler Design Products, El Cerrito, California. **M-4**

• **Garrard Automatic Turntable.** Combining a dynamically balanced (counterweight adjusted) tone arm with a fully professional turntable, the new Garrard Type A Automatic Turntable provides all the convenience of a changer plus the quality of a fine turntable and arm. The Type A turntable platter is cast, weighted, and polished—over-all weight being 6 pounds. The table is cast of non-ferrous metal to avoid introducing hum pick-up into sensitive magnetic pickups. The tone arm is dynamically balanced, and is adjustable by means of a sliding counterweight. At this point the arm is in gyroscopic balance. Tracking force is adjusted by means of a calibrated gauge on the side of the arm. Utilizing the pusher-platform changing mechanism exclusive with



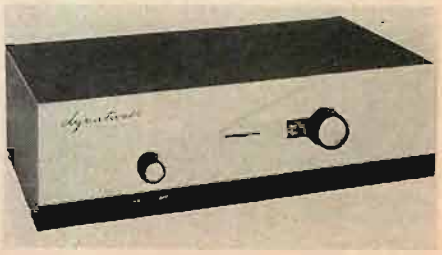
Garrard, the Type A operates as a fully automatic changer when desired. Literature and specifications are available from Garrard Division, British Industries Corp., Port Washington, N. Y. **M-5**

• **New Pickup Can Track at Less Than 1 Gram.** A new stereo cartridge, model ADC-1, that can track at less than 1 gram has been introduced by Audio Dynamics. Featuring extremely high lateral and vertical compliance, 10×10^{-6} cm/dyne, it is said to reduce record wear to a mini-



mum. The low tracking force is attributed to the fact that the dynamic mass of the moving system is smaller than any other cartridge now available. As a result the resonance of the moving system is of small magnitude and has a frequency well above that to which the human ear is sensitive. The stylus of the ADC-1 is easily replaced without special tools; the basic design assures correct positioning. With provision for mounting on either ½-inch or 7/16-inch centers it can be used in virtually all tone arms. Sensitivity of the cartridge is 7 millivolts per channel plus or minus 2 db at 1000 cps and a velocity of 5.5 cm/sec. Frequency response is within ±2 db from 10 to 20,000 cps. Channel separation is 30 db from 50 to 7000 cps. Stylus tip radius is 0.6 mils. Audio Dynamics, 1677 Cody Ave., Ridgewood 27, New York. **M-6**

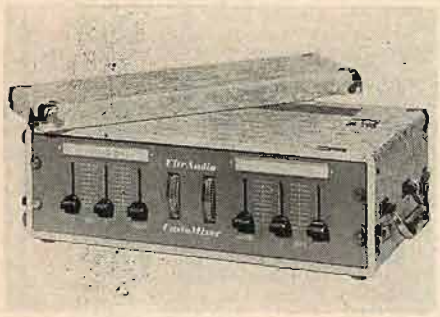
• **New FM Tuner Kit.** Etched circuit design claimed to be so inherently non-critical that it can be completely aligned without test equipment is a feature of the new Dynatuner just introduced by Dynaco, Inc. With a sensitivity of 4 micro-



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volts by IHFM standards (comparable with about 1 microvolt for 20 db of quieting) this tuner should be sensitive enough for all areas. Distortion levels are below 0.1 per cent with 100 per cent modulation; a result of the broadband, bridge-balanced discriminator. A novel construction feature is the planetary drive system for the tuning capacitor which eliminates the need to string dial cords. It is claimed that precise alignment can be accomplished by the user at any time, the performance can be maintained at optimum. The Dynatuner is available either as a kit or factory wired. Literature is available from Dynaco, Inc., 3912 Powelton Ave., Philadelphia 4, Pa. **M-7**

• **Professional Quality Audio Mixer.** A new line of mixer amplifiers for use by recording studios, broadcasters, and audiofans has just been developed by Oliver Berliner, well-known sound systems engineer. The units are called CustoMixers because the user need only buy the specific plug-in units he needs. A feature of both the 5-position single-channel CustoMixer and the 4-position two-channel



stereophonic version is the straight-line volume control. Input and output impedances are from 50 to 600 ohms plus high impedance. Each output line boasts an illuminated VU meter with provision for stereo headphone monitoring and feed to external power amplifiers. The lightweight units contain a fused silicon-rectifier power supply. The 5½ x 19 inch panel has a beige finish with white lettering and incorporates replaceable strips at each mixer position. For further details write to UltrAudio Products, Dept. P-10, 7471 Melrose Ave., Los Angeles 46, California. **M-8**

• **Marantz 70-watt Amplifier.** Providing either 70 watts in distributed load operation, or 40 watts in triode operation, the Marantz Model 9 power amplifier is a highly stable unit which is exceptionally well suited for use with electrostatic loudspeakers. Featuring instant selecion of the 70-watt distributed load or 40-watt



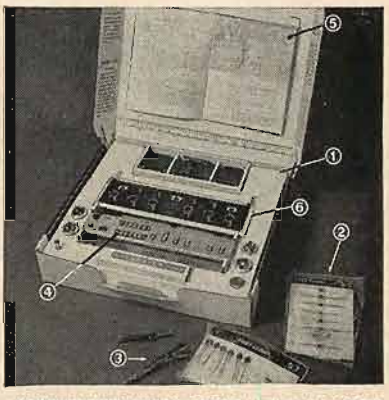
triode options, the Model 9 also provides front panel access to all controls and adjustments. Also of interest is the fact that the bias adjustments, although accessible from the front, are concealed behind a removable panel—thus keeping them out of the line of sight of the nontechnical members of the household who might be tempted to "adjust." Also located on the front panel are a gain control which is isolated by means of a cathode follower; a subsonic filter switch;

(Continued on page 89)



New kind of KIT from H. H. Scott...

EASY-TO-BUILD 72 WATT STEREO AMPLIFIER KIT LOOKS AND PERFORMS LIKE FACTORY-BUILT UNITS! **$149.95***



Here's the kit that makes *you* a professional. Beautifully designed, perfectly engineered, and so easy to wire that you can't go wrong. In just a few evenings you can build a professional 72 watt H. H. Scott stereo amplifier . . . one so good it challenges factory-assembled units in both looks and performance.

H. H. Scott engineers have developed exciting new techniques to ease kit-building problems. The Kit-Pak container unfolds to a self-contained worktable. All wires are pre-cut and pre-stripped. Parts are mounted on special cards in the order you use them. All mechanical parts are pre-riveted to the chassis.

Build a new H. H. Scott LK-72 for yourself. You'll have an amplifier that meets rugged IHFM specifications . . . one that delivers sufficient power to drive *any* speaker system . . . one that's professional in every sense of the word.

IMPORTANT FEATURES OF THE NEW H. H. SCOTT LK-72 COMPLETE AMPLIFIER 1. Unique Kit-Pak container opens to a convenient worktable. Folds up at night like a suitcase. 2. Part-Charts — All parts mounted in order of installation. No sifting through loose parts. 3. All wires pre-cut, pre-stripped to cut assembly time. 4. Mechanical parts all pre-mounted. Tube sockets and terminal strips riveted to chassis. 5. Easy-to-follow full color instruction book. 6. Special features include: Center Channel Level control; Scratch Filter; Tape Recorder Monitor; Separate Bass and Treble on each channel; DC operated heaters for lowest hum.

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TECHNICAL SPECIFICATIONS: Full Power Output: 72 watts, 36 watts per channel • IHFM Power Band: extends down to 20cps • Total Harmonic Distortion: (1kc) under 0.4% of full power • Amplifier Hum Level: better than 70db below full power output • Tubes: 4 — 7591 output tubes, 2 — 7199, 4 — 12AX7, 1 — 5AR4 • Weight of Output Transformers: 12 pounds • Amplifier fully stable under all loads including capacitive • Dimensions in accessory case: 15½ w, 5¼ h, 13¼ d. Size and styling matches H. H. Scott tuners.

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Stereo Record III

does best!

From the moment you hear its incomparable high fidelity performance—from the instant you realize the wide range of capabilities the versatile controls put at your command—you know that the Uher Stereo Record III is an exciting new experience in stereo tape recording.

Here's what the Stereo Record III does . . . and why it does it best!

High Fidelity Performance, Unsurpassed—Broad 40 to 20,000 cps frequency response; negligible wow and flutter 0.1%; high -55 db signal-to-noise ratio and constant speed hysteresis-synchronous motor assure the highest possible performance standards.

Versatility, Unlimited—Sound-on-sound! Play back on one track, record on the other —simultaneously. It plays either 2 or 4-track pre-recorded tape, 4-tracks of ½ mil tape, on a 7-inch reel, played at 1⅞ ips provide more than 17 hours of play. The optional AKUSTOMAT automatically operates the tape transport only when voice or program material reaches the microphone. The Stereo Record III is adaptable for synchronizing-automatic slide projectors.

Flexibility, Unequalled — Fool-proof and jam-proof controls provide individual adjustments of each channel: volume, tone, fade-in and fade-out, channel and speaker selection. Fingertip control of pause, stop, rewind, fast rewind, forward, fast forward, speed selections of 7½, 3¾, or 1⅞ ips, and a recording safety lock. Has an accurate digital cueing meter.

Monitoring facilities, plus dual recording level indicators, simplify making stereo or mono recordings. High and low impedance inputs accommodate any type of program source. Outputs for external speakers and for direct connection to external high fidelity amplifiers are provided. Truly portable—weighs only 33 pounds. *Complete with 2 Dynamic High Impedance Microphones, Amplifiers, Speakers and Carrying Case.* **$399.50**



FAMOUS UHER UNIVERSAL — High fidelity performance—a most remarkable dictating/playback instrument—3 speeds from 15/16 ips—voice activated—automatic continuous playback. With Remote Control Microphone, Carrying Case, Reel, Dust Cover.

$299.95 plus f.e.t.

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For further details write: Dept. A-12, WARREN J. WEISS ASSOCIATES
Sole U. S. Agents, 346 West 44th Street, New York 36, New York

NEW LITERATURE

• **H. H. Scott, Inc.** Dept. P, 111 Powdermill Road, Maynard, Mass. offers a new "Guide to Custom Stereo." Utilizing an interesting format, this booklet is a guide to stereo, decorating idea book, and a catalog, all in one. The guide includes dozens of interesting room arrangements, along with useful decorating tips. There is an article telling how to select stereo components, and what they are. There is a section on kit building and another on technical information. Information is given on how to read technical specifications. The booklet is printed on large pages and copies are free by writing to the company. **M-11**

• **Amplifier Corporation of America,** 398 Broadway, New York City, N. Y. has just released descriptive literature about a new series of ultra-compact tape-cartridge recorders. Complete specifications and price are given for 20 different models designed for industrial and home use. Models are available with monophonic or stereophonic record and play facilities utilizing 1, 2, 3, or 4 tracks on standard ¼-inch magnetic tape. Special uses and technical applications are suggested. Literature is available free. **M-12**

• **Harvey Radio Company,** 103 W. 43rd St., New York 36, N. Y. announces the publication of its 1961 catalog. The 344-page catalog is the largest in the 11-year series of books. Included are complete product and price information on a wide range of electronic parts and equipment. There are comprehensive listings of products for industrial use as well as for professional audio applications. The book features an industrial tube cross reference as well as a guide to military standards. The contents are completely indexed by product and manufacturer. Copies are available at the address given above for industrial buyers, audio engineers, and other interested individuals. **M-13**

• **Allied Radio Corporation,** 100 N. Western Ave., Chicago 80, Illinois, announces the release of its Stereo Record and Tape Catalog No. 104. Included in this catalog are detailed listings of over 1000 of the latest stereo records as well as 400 2- and 4-track stereo tapes. Organized into three sections (records, 2-track tapes, and 4-track tapes), and subdivided into categories of music, the catalog lists classical records and tapes alphabetically by composer. Popular, jazz, and other type sof music are listed by performing artist. Most of the major labels are listed, including RCA Victor, London, Decca, Mercury, Everest, Columbia, Audio Fidelity, Bel Canto, etc. **For free copy write to** company. **M-14**

• **Vega Electronics Corporation,** 10781 N. Highway 9, Cupertino, California has made available its first product literature, a 6-page color brochure describing the Vega-Mike wireless microphone system. The brochure also carries specifications of the complete line of Vega-Mike accessories, and illustrates a number of suggested applications for the system. Areas of applications are radio and TV broadcasting, schools, meetings, and places of worship. The brochure is available free direct from the manufacturer. **M-15**

• **Bell Sound Division,** Thompson Ramo Wooldridge Inc., 555 Marion Road, Columbus 7, Ohio is the publisher of a new booklet entitled "All About Stereo." Answering questions such as "What do I need?", "Where can I put it?", and "How much will it cost?" this 32-page book was written by John Conly, music authority and Music Editor of Atlantic Monthly. The book describes the advantages of stereo components and tells the reader how to go about planning for a stereo system in his home. The book was written in a style understandable by the nontechnical reader. The book is offered for 25 cents to anyone who writes to the company. In addition Bell dealers will have copies available.

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SOUND SYSTEM

(*from page 42*)

amplifier tubes also increases the low-frequency stability of the amplifier. Individual bias adjustments are provided so that the output tubes may be balanced. The fact that almost all of the nonlinear distortion in a power amplifier comes from the driver tubes and the output tubes combined makes the inner feedback loop very effective in providing distortion reduction. The over-all loop corrects for the residual distortion which is not very high. These four amplifiers will provide 50 watts each at less than 0.5 percent total harmonic distortion. The hum level is less than the tube noise and essentially not measurable. *Figure* 13 shows the power supply for the amplifier. Each amplifier has its own power supply and may be operated independently. The power supply is simple and very conservatively designed. Plate power is not turned on until the tubes have warmed up and the bias supply has come up to full voltage. This is accom-

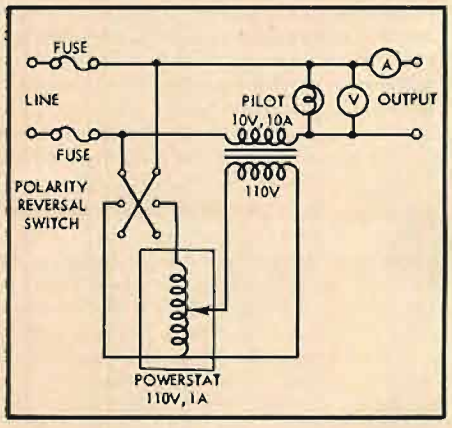


Fig. 14. Schematic diagram of control for regulating line voltage.

plished by means of the relays shown. The 6X4 is operated with 5 volts on the heater so that sufficient time delay is provided. This low heater voltage is not detrimental to the tube because the current drawn from the bias supply is not very large. The bias supply is regulated.

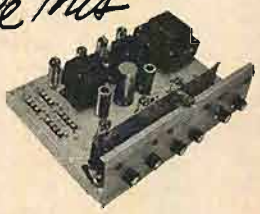
Line Control

A line control is provided for the entire electronic part of the system. The voltage can be adjusted over a small range around the nominal line voltage. The main purpose of the control is to insure proper operation of the tape recorders since they are not electronically regulated. The line control schematic is shown in *Fig.* 14. This schematic is self explanatory. Æ

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40-watt stereo preamp-amplifier in kit form. Harmonic distortion, less than 0.5% 14 controls. Hum and noise inaudible.
MODEL SA-40—Kit .....$ 79.95
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MODEL ST-45
AM-FM SIMULCAST stereo tuner in kit form. Sensitivity—2 μv for 30 db quieting. MPX facilities.
MODEL ST-45—Kit $84.95
MODEL ST-45PA — Semi-Kit, with AM and FM tuner sections wired, prealigned and calibrated. .$99.95
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MODEL ST-35
FM TUNER KIT. Sensitivity, 2 μv for 30 db quieting. Easily adapted for MPX and stereo.
MODEL ST-35—Kit $59.95
MODEL ST-35PA — Semi-Kit, tuner section wired, prealigned. .$69.95
MODEL ST-35W—Wired, aligned, calibrated, ready to operate. .$89.95



MODEL L-2
2-WAY, SPEAKER-SYSTEM SEMI-KIT. 10" Jensen woofer and horn-type tweeter. Response, 45 cps to 15 Kc. 23½" W x 13" D x 12" H.
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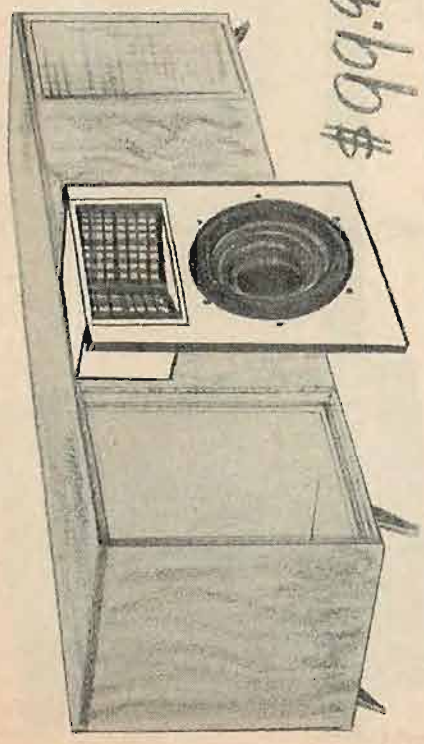
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mounted on a 19½" by 16" panel for easy installation.

a complete component speaker system in kit form for installation in your own cabinet or for custom installation where the very best sound is desired in minimum space.

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ABOUT MUSIC

HAROLD LAWRENCE*

Play, Doctor, Play

"If I hear that tune once again, I'll go out of my mind!" This familiar cry could have been uttered by Father trying to read his newspaper while Junior is playing his favorite hit record in the next room for the ninth time; by the passenger waiting between flights in the airline terminal, listening to a ticket attendant whistling the 16-bar theme of a filter cigarette commercial at regular intervals; or by the man hearing his neighbour's child practicing Mozart's *Turkish March* and committing the same errors with every repeat.

Played at the right time, in the right place, and to the right person, all but the most abrasive musical piece can produce an entirely different reaction, as when the eighteenth-century male soprano, Farinelli, cured "mad" King Philip V of Spain with a song. The curative effects of music were already recognized in ancient times. Plato and Aristotle praised its health-giving qualities; Greeks employed music to calm psychotic patients; and, as far back as 1500 B.C., Egyptians prescribed certain melodies to induce fertility in women. The relief and cure of sciatica, gout, and hemorrhage were also recorded. Probably the most famous incident of music therapy may be found in the Bible: "And it came to pass, when the evil spirit from God was upon Saul, that David took a harp, and played with his hand; so Saul was refreshed and was well, and the evil spirit departed from him."

Contemporary interest in mental and physical therapy through music dates back to the turn of the century when physiologists gathered data on the physical effects of music. Guibaud in 1898 observed how scales, melodies, and musical phrases affected breathing and blood circulation. Using a plethysmograph, an instrument designed to record pulse-volume and vasoconstriction, the Frenchman discovered that subjects reacted differently to the same test pieces—an easily predictable fact. To a well-rounded musician or concert goer, dissonances in themselves were not upsetting, but they produced a clear reaction in less musical subjects. Guibaud also found that there was a correlation between scales and physiological activity: breathing and pulse-volume increased when minor scales were played, but returned to normal at the sound of major scales. Agitated pieces in fast tempi resulted in quickened pulse and breathing, as was to be expected.

In 1929, Dr. Vincent and Dr. Thompson pursued Guibaud's line about physiology and musical knowledge. They divided their subjects into three rough categories: 1) musical, 2) moderately musical, and 3) unmusical. Sheer volume of sound, they learned, wrought no changes in Group 1, but had a decided effect on the others. On the other hand, Group 1 followed the course of a melodic line, reacting definitely to underlying harmonic changes and to the rise and fall the phrase, while the others remained relatively unaffected. The use of vocal music was judged less than satisfactory since the subject might be stimulated by the words rather than by the music alone. All scientists agreed that those who are indifferent to music fail to react with sufficient intensity to make their tests worth while. The "Memoirs of Hector Berlioz indicate that the French composer would have been a fascinating subject for the physiolgists: "Music causes a strange commotion of my circulation; my heart beats violently; tears usually announce the end of the paroxysm and are sometimes followed by muscular trembling, shaking of the limbs, swelling of the feet and hands . . . I see no more; I scarcely hear; giddiness and almost fainting follow."

While the tests of Guibaud and others are instructive to physiologists and doctors, it is doubtful that they impart anything new to the professional musician or to the musically sensitive layman, to whom the effects of pitch, harmony, rhythm, melody, volume of sound, and instrumentation are well known. In fact, the language of composers and performing musicians includes expressions which are close, if not identical to those found in the laboratory reports. In his book, "Harmonic Practice," the American composer, Roger Sessions, wrote: "The principle of tension and relaxation is perhaps the most important single principle of musical rhythm, and its bearing on all questions of musical expression and interpretation cannot be over-estimated." This is the principle that is so relentlessly used by composers of TV commercials. The next time you are caught watching a commercial, pay particular attention to the music accompanying the picture of Brand X; it will probably be in a minor key, contain clashing discords, and move along either at a snail's pace or in hysterical fashion. But, at the appearance of the sponsor's own product, note how the harmonies clear up, the key changes to major, and the tempo becomes relaxed and regular. Perhaps the best example of music translated into physical energy is to be observed on the ballet stage.

The physiologists nevertheless focused attention on the interrelationship of music

* *26 W. 9th St., New York 11, N. Y.*

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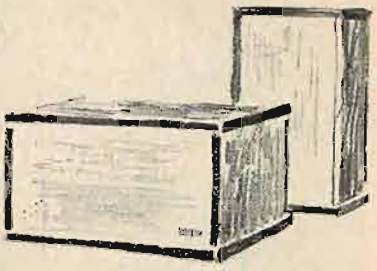
and medicine and may have helped to bring about the extraordinary growth of music therapy during the past decade. Music today has found its way into clinics, dental offices, convalescent homes, hospital wards, and even the operating room. It performs the role of an anodyne, a speech corrective, a shock remedy, and a sedative.

Many dentists now provide their patients with high-fidelity earphones with which to listen to stereo recordings while their teeth are being drilled. An Atlanta dentist recently estimated that, since he installed a music system into his office, he noted a fifty per cent drop in the use of anesthetics. A surgeon from the same city brought a tape recorder into the operating room. "About half my patients have plastic surgery under local anesthesia," he said to Katherine Barnwell of the *Atlanta Journal and Constitution magazine*, "For them the music is very calming. A patient is more relaxed when he's listening to soft mood music. If we begin to play something loud and bouncy, the patients begin to get tense and jittery. . . . The operating team as well as the patients enjoy music during surgery. Sometimes doctors in the next operating room ask me to turn up the volume so that they can hear it, too!" Three of the numbers on the surgeons' "Hit Parade" are Brahms' *Lullaby*, Mendelssohn's *On Wings of Song*, and the second movement ("By the Brook") of Beethoven's *Pastoral* Symphony. Miss Barnwell reports that about 150 physicians and dentists in the Atlanta area have piped-in music in their offices, and one hospital (Grady Hospital) funnels music to all parts of the building.

The sedative aspects of music are dwarfed in importance, however, by its healing qualities. In the treatment of psychological disturbances, for example, music has become a vital adjunct to medicine. Proof of its beneficial effect is the fact that it has often *replaced* sedatives, as Burris-Meyer and Cardinell noted in a series of tests they conducted in 1946. Isolating two wards of psychoneurotic patients, they introduced music into one only. In both wards, sleeping drugs had been given to the patients every night. After a short period of time, the amount of sedatives used in the "music ward" decreased, while remaining constant in the other. Furthermore, psychiatrists have now recognized the fact that music can become a positive force in re-establishing a patient's *rapport* with society. A California music therapist, Margaret Tilly, described music as a language which can be understood by patients on the level of the unconscious. To psychotics, whose lives take place in a world of unreality, this is often the only method of approach. Unlike words, the language of music is not subject to the kind of ambiguity that can, at any point, upset the most carefully constructed relationship between physician and patient.

Note to music therapists—it would be most enlighteing to compare the effects on mental patients of live vs. recorded music. Would the former have a greater impact on the subject, or would the addition of a performing musician be a disturbing element? Æ

Z-400



Most authorities look to the JansZen* Electrostatic as the standard of comparison for mid + high frequency sound reproduction.

Other manufacturers, either by recommendation of independent research organizations or by their own choice, advocate or include the JansZen* as an integral part of their best speaker systems.

The Z-400, however, integrates the JansZen* Electrostatic with our own complementary woofer. Result..the best possible speaker system, already assembled and, naturally, at a far better price -- from $134.50

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...first truly reliable method for checking stylus wear!



NEW ROBINS *SYL-A-SCOPE

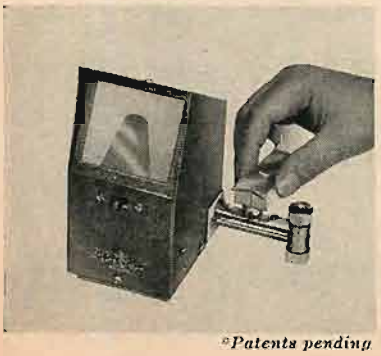
...in most record players no need to remove the stylus from the cartridge or the cartridge from the arm... ONLY $6.75 list

In seconds, the Robins SYL-A-SCOPE provides a magnified, illuminated image showing the detailed contour of your stylus . . . and, in most record changers and turntables you don't have to remove the stylus from the cartridge, or the cartridge from the arm. This precision instrument, based on the same principle as optical equipment used by industry for small parts quality control, is now available to every record collector—high fidelity enthusiast—to anyone who wants to protect their treasured records and retain the high standard of performance of their hi-fi system. The cost of this protection is about equal to a stereo record album—only $6.75!

Here's how simply it works. Place the tone arm on the rest bar with the stylus in the aperture provided, switch the SYL-A-SCOPE on and, instantly there's a clear, magnified picture of the stylus on the illuminated screen for easy, rapid examination. Detecting flaws and 'wear' is as easy as checking a test pattern on a TV screen.

TWO MODELS — THE ULTIMATE IN DETECTING STYLUS WEAR

Model SG-33 the "Audiophile"—Portable, battery-operated unit provides a clear, sharp image on its large illuminated screen. It's a must for every audiophile, record collector and phono owner. List (less batteries) **$6.75**



Model SG-66, the "Professional"—Compact unit with line cord operates on 110 volts AC. Provides a clear sharp image on its large illuminated screen. A precision optical tool ideal for use in recording studios, broadcast stations, by advanced audiophiles and at the bench for service-technicians. Can also be used for small part inspection in industry. List **$19.95**

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*Patents pending

JAZZ

(from page 71)

from among the numerous offers coming her way.

The medium of stereo is also an aid in the fashioning of a program that would overrun the dimensions of an ordinary night club floor. Her native Xosa tongue is heard on a humorous tale of a warrior's defeat, wedding and love songs. Some dialect peculiarities are carried over into English, adding to the quaint appeal of *House Of The Rising Sun*, a calypso about a naughty flea, and a satiric commentary of Austrian origin called *One More Dance*. Perry Lopez accompanies on guitar, and the Chad Mitchell trio takes part in a Zulu song about a lion hunt. Unmatched anywhere is the sensitive artistry of her voice when unfolding a lullaby, and few will forget having experienced it.

Jimmie Driftwood: Tall Tales In Song
RCA Victor LSP2228

The Kingston Trio: The Last Month Of The Year
Capitol ST1446

Folksongs that reflect Yuletide sentiments or tell of legendary figures are adapted and restored on these enjoyable albums. Jimmie Driftwood, a wholly authentic singer and composer, dips into his songbag for stories of fabled characters less widely heralded than Paul Bunyan, Johnny Appleseed, or John Henry. Playing his own accompaniment on the picking bow, guitar or banjo, the bard of the Ozarks creates *Big River Man* a composite portrait of Mississippi River steam boat captains, *Banjer Pickin' Man*, whose music brought the angels down from heaven, and *Big John Davey*, a jumper of mountains whose dancing feet made thousands of lakes. Not all his heroes are human and the capture of the world's largest fish is related on *St. Brendon's Isle* while the deeds of a horse named Old Teddy are told on *Battle Of San Juan Hill*, and Tennessee Stud's son is celebrated on *Big Horse*. But Driftwood, even after consulting Alan Lomax, has yet to decide upon the real meaning of *He Had A Long Chain On*. Listen and learn why Lomax calls it one of the greatest songs he ever heard.

The youths of the Kingston Trio are relatively restrained when it comes to Christmas and carol sweetly on *Bye Bye Thou Little Tiny Child, All Through The Night*, and *Goodninght My Baby*. Once the presents are unwrapped, however, a bouzouki discovered under the tree is tried out immediately on the lusty *Sommerset Gloucestershire Wassail*. Other gifts received include The Weavers own arrangement of *We Wish You A Merry Christmas*, while the title tune was sent along by Alan Lomax.

Peggy Lee: Christmas Carousel
Capitol ST1423

Nat King Cole: The Magic Of Christmas
Capitol SW1444

Two of the brightest stars in the Capitol firmament are singled out to light up the tree at Christmas. Peggy Lee adds five new songs of her own to the decorations, assisted by the festive voices of a children's choir. Other recent efforts at swelling the list of holiday music are Jule Styne's *Christmas Waltz*, Mel Torme's *Christmas Song*, and Alfred Burt's *Star Carol*. All the new songs and youthful voices make it seem centuries ago that Irving Berlin wrote the concluding *White Christmas*. The plump and joyful fellow leading lively strings and woodwinds from behind a white beard is Billy May.

Nat Cole treats time-tested hymns and carols with due respect and reverence, programming such old favorites as *I Saw Three Ships, Away In A Manger*, and *The First Noel*. Everyone who enjoyed his LP of spirituals will find equal rewards on this companion volume. Various supporting groups include a forty-piece orchestra, a complement of twenty-seven strings, and a large choir. Not all is pomp and circumstance, however, as separate male and female choruses are heard *a capella*. Directed by Ralph Carmichael, the whole assemblage provides a glorious stereo panorama.

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MONO

Pee Wee Russell: Swingin' With Pee Wee
Prestige/Swingville 2008

Listening to Pee Wee Russell is like watching a World Series. The clarinetist mixes curves with fast balls in bewildering array, always wipes the slate clean so each tune becomes a new experience, and is apt to make the unexpected happen at any moment. At the age of fifty-five, he bears the same craggy physiognomy as Casey Stengel and is equally voluble. He is as unique a figure in jazz as Casey is in baseball. Let's hope his contract is good for another fifteen years.

All that he asks of life is adequate solo space and no one on the base path to interfere with his progress. As there are no weighty ensembles to carry this time, he picks his own pace and varies it at will. The only other front runner is Buck Clayton, who deserves equal billing except that he made the line-up on waivers from Columbia. After his chores on *Wrap Your Troubles in Dreams*, and *What Can I Say Dear*, Clayton finds time to remove mute from trumpet and wave his partner on. They make a formidable team on two original blues brought in by Russell.

Tommy Flanagan, a comparative rookie in these surroundings turns out to be the year's most promising pianist, following in Fats Waller's footsteps on *Lulu's Back In Town*. Russell is especially relaxed and lyrical on *The Very Thought Of You*, and *I Would Do Most Anything For You*. Wendell Marshall, bass, and drummer Osie Johnson complete the quintet.

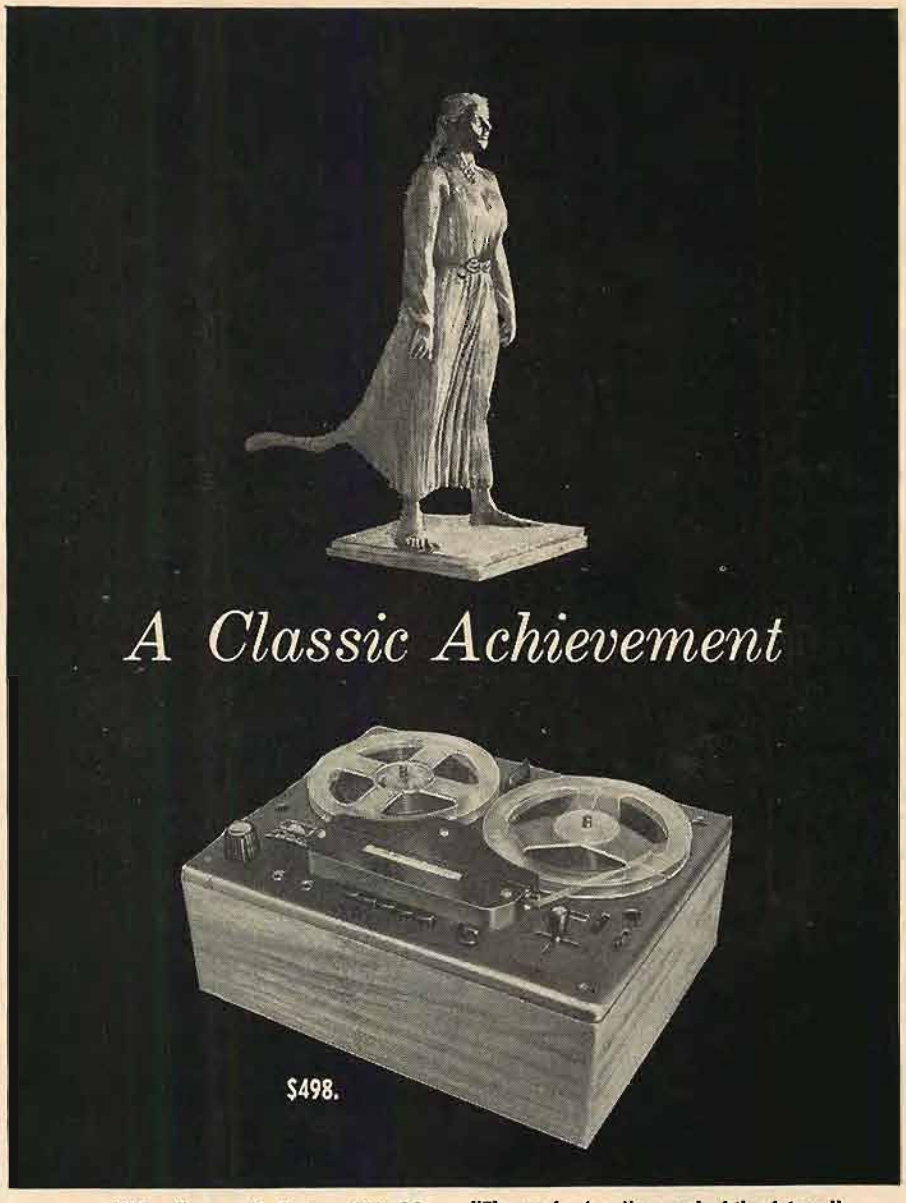
Horace Silver: Horace-Scope
Blue Note 4042
Horace Silver: Silver's Blue
Epic LA16005

At least one original Horace Silver composition on each of his recent albums has rapidly become a jazz standard to be adopted and played regularly by other groups. This is better than par for the course, and he frequently improves upon his score. Two new works in the present collection seem destined to survive the snows of winter. One is *Me And My Baby*, a happy, pulsating blues that swings at medium tempo. Characteristic of the pianist's best work, it calls out for the attentions of a lyricist. The other is a tricky Latin tune with puzzling changes and a mambo beat called *Where You At?* The balance of the quintet asked Silver the question often during rehearsals. Once George Shearing hears it, he should put conga drummer Armando Peraza to work on the complex rhythms and make it into a real showpiece. While still in high school, Silver wrote *Yeah*, and the title tune, recorded both with a trio on his first album, and now gives them full-dress treatment. Another revival is *Nica's Dream*, while tenor-saxist Junior Cook walks unhurriedly through *Strollin'*. Blue Mitchell, trumpet, helps out on Don Newey's *Without You*. Gene Taylor plays bass, and a new drummer is introduced in Roy Brooks.

Now that Silver limits himself to two albums a year, Epic is reissuing one of his first quintet dates, hold about four years ago. His teammates at the time were Donald Byrd, Hank Mobley, Doug Watkins, and Art Taylor. Silver also no longer records popular tunes (unless they are done secretly and salted away for the future), but the older LP lists *I'll Know, Night Has A Thousand Eyes*, and *How Long Has This Been Going On?*

Claude Hopkins: Yes Indeed!
Prestige/Swingville 2009

In the days when movie palaces could support stage shows and big swing bands were in demand to head the bill, Claude Hopkins sat in the spotlight and tossed off tuneful piano choruses that were assured crowd pleasers. He organized his first band in 1927 and was a successful leader until a decade ago. The same showy style was featured on most of his early recordings and his full powers as a jazz pianist were rarely disclosed. Working of late with various small units at the Metropole and other spots in the New York area, he was by-passed by record companies until this LP placed him at the helm once again.



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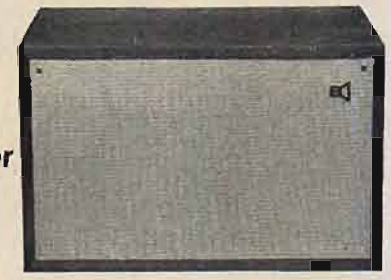
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A quintet setting is used to introduce Hopkins to a new audience, allowing complete justice to be done to his fine talents as an accompanist and ensemble pianist for the first time on records. He lends a comforting voice to the lament of Buddy Tate's tenor sax on *Empty Bed Blues*, and gives firm support to Emmett Berry's trumpeted shout on *Yes, Indeed!* The jubilant gospel spirit of the time-tested Sy Oliver tune should be enough to convince anyone that the newest thing about current soul music is the publicist's copy.

Listeners who remember the Hopkins of old will find his knack for drawing out the best in a melody is unimpaired. Due to the ample solo space allotted, he no longer feels obliged to cram all his ideas into one or two choruses and relaxes thoroughly on *Willow Weep For Me*, and *Morning Glory*. Once a clever stylist at best, Hopkins emerges here as a seasoned veteran in his prime and contributes the crisp original, *Is It So?* Wendell Marshall, bass, and drummer Osie Johnson show that they have absorbed, both in theory and practice, the axioms of Ellington's *It Don't Mean A Thing*.

Gerry Mulligan: The Genius Of Gerry Mulligan **Pacific Jazz PJ8**

Now that Gerry Mulligan is touring with a concert band, the time is right to trace the recorded history of various quartets which the eminent baritone saxist headed during the last eight years. Eleven numbers not available on LP are taken from the vaults and placed in sequence to mark the high points of his career in this ready package. Many first see the light of day, and the leader also is heard vocalizing *a capella* as part of a trio behind Chet Baker's trumpet, or as a blues pianist at Boston's Storyville in 1955. The concluding episode finds Annie Ross declaring *The Lady's In Love With You*. The quartet's first date resulted in *Get Happy*, and pays tribute to the engineering abilities of Richard Bock, who recorded the group at Phil Turetsky's bungalow with an Ampex and one RCA 44-B microphone. Along with *Bernie's Tune*, from another 1952 session at the same location, it remains notable today for good balance, while the sound is benefited further by improved mastering techniques.

Coleman Hawkins All Stars, featuring Joe Thomas & Vic Dickenson **Prestige/Swingville 2005**

Although Coleman Hawkins wields his tenor sax with accustomed aplomb on ballads, blues, and swingers to head the sextet, much of the interest on this date centers on two lesser luminaries. One is battle-scarred Joe Thomas, veteran of many a trumpet war since working with Cecil Scott in 1928, whose representation on LP is woefully thin. So much so that his work often sounds a trifle rusty and he never hit his stride during a recent appearance on Atlantic. Two long blues give him a chance to settle down this time and healthy samples of his true capabilities are heard on Jerry Valentine's *Cool Blue*, and the ad-lib *Some Stretching*. One of the reasons why Thomas seldom does his best work in a studio is that few recording directors take the trouble to handle him properly. In spite of his real affinity for a foot-dragging pace, even in this instance both blues are medium-tempo. When so few of today's trumpet players are able to cope with a genuine slow blues, Thomas might surprise the lot if let loose on a tune as toothsome and chewy as Alex Hill's *Song Of The Plow*, a collector's item which he recorded twenty-five years ago.

The other matter that merits consideration is the inclusion of Tommy Flanagan, who seems to be Prestige's choice of a pianist to follow on the heels of Ray Bryant. This means the young Detroiter will be thrown in with traditional and mainstream musicians as well as the modernists who are his usual associates. If his style consequently becomes more personal and increases in scope, the process should be well worth watching. For a starter, he fits right in rhythmically with Wendell Marshall, bass, and drummer Osie Johnson. Hawkins rhapsodizes on *You Blew Out The Flame*, and *I'm Beginning To See The Light*. Trombonist Vic Dickenson growls convincingly as he bounces on Johnson's *More Bounce To The Ounce*. E

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RECORDS

(*from page 67*)

familiar voice suddenly younger, lighter, more buoyant. This great poet-speaker is truly the phonograph's most distinguished ghost—for his enormous vocal reputation has come since his untimely death.

F.D.R. Speaks (Authorized edition of Speeches, 1933–1945, ed. Henry Steele Commager). **Washington WFDR (6)**

This has been a long time in coming, but it was as inevitable as Collected Shakespeare, the Bach Geselleschaft and perhaps Twenty Five Years of Mutt and Jeff. The stuff has been lying around here and there for ages: now it is brought together and published. About time.

I've only listened to two of these memorable twelve LP sides and I am already shaken—so dramatically do these complete speeches (not excerpts) take me back in person to the well-remembered and easily forgotten days. With that pioneer mike technique that he possessed so compellingly, the first President to reach out to people person-to-person via radio's livingroom intimacy, FDR is positively uncanny in these full-length recitals of policy and presidential comment, on so many occasions. This is indeed a speaking image, ranging over the dozen years from the high-pitched First Inaugural, on that day of pouring rain (you can still hear it splashing), through the first of all the fireside chats—what an astonishingly simple and effective new medium!—to the low-pitched and weary Yalta report and, *post mortem*, the undelivered Jefferson Day speech of 1945, here read by FDR, Jr.

To say that these speeches are important far beyond any political issue is merely to emphasize, of course, that they are full of politics. But, listening to this incredibly alive voice, you'll be struck with awe that, after all, this is already history itself, a ghost sound from another age speaking words of unintended application to our distant time, so near and yet already so far.

Aside from superb mike technique and delivery, I'd credit FDR with one potent speech weapon we've lately abandoned—the positive use of the negative. This man was always ready to talk about things not yet perfect. He didn't "admit" imperfection—he stated it right out loud, again and again. He flaunted it, triumphantly.

You don't have to agree with what he says in order to apreciate the stunning impact of this simple *technique* of argument, this means of communication in words and ideas. We could use a lot of it today, with our eternal betters and bests and totally-completely-new supersuperlatives. FDR, at least, understood that there can't be "more" of anything whatsoever without "less" of something else! The way to be positive, he knew (and we don't) is to accentuate the negative—positively.

LOOKING HERE AND THERE . . .

Carols for Christmas. Eileen Farrell Orch., Chorus Luther Henderson.
Columbia MS 6165 stereo
(mono: ML 5565)

An Eileen Farrell Song Recital (Schubert, Brahms, Debussy, Poulenc). With G. Trovillo, pf. **Columbia MS 6151 stereo**
(mono: ML 5484)

Eileen Farrell Puccini Arias. With Columbia Symphony, Rudolf.
Columbia MS 6150 stereo
(mono: ML 5483)

There's one disc missing in this panoply of Farrell—it wasn't sent to me because it's a pops record. The genial, plump, round-faced Mrs. Robert Reagan (her married name) can sing any old thing, and often does; she's out with a night club blues record now, to beat Helen Traubel herself.

The Farrell personality is comfortable and family-style. She's no Callas. Her gorgeous and opulent voice is very American in its color, her diction has that serviceable quality that suits almost any language that happens along and her singing style is the same in flexibility.

The penalty for all this, as I hear it, is a lack of real vocal character. She has one, decidely, and it shows up best in the Puccini, where her big, wide-open singing is wonderfully easy and fully dramatic. In the song recital she is, I feel, out of her best element—particularly in the German songs. To be sure, her German and her French styles are outwardly authentic enough. But hers is a big voice, a big frame, a too-broad personality for the intense and subtle intimacy of the lied, not to mention the French song. Good—very good. But others more specialized in their approach can do more.

As for the Xmas carols—pure sweet corn, very sweet and *very* corny. Harps harping, angels singing, the big Farrell voice as pure as a lamb. But, really, she's no lamb of this sort though she can sing rings around most of the other Christmas lambkins—even Bing Crosby. This one is for the millions, and God bless 'em for a merry Xmas.

Piano Concertos—Honegger, Janacek, Stravinsky. Walter Klein; Pro Musica Orch, Vienna, Hollreiser.
Vox STPL 510.840 stereo

Three interesting and amusing short piano concertos from the mid-Twenties on this imported disc, two of them of real importance. All three are from that snazzy, brassy, nose-thumbing time when the musical revolution against elegance was in full sway. All of them sound more wistful than shocking to us today—we've come a long distance.

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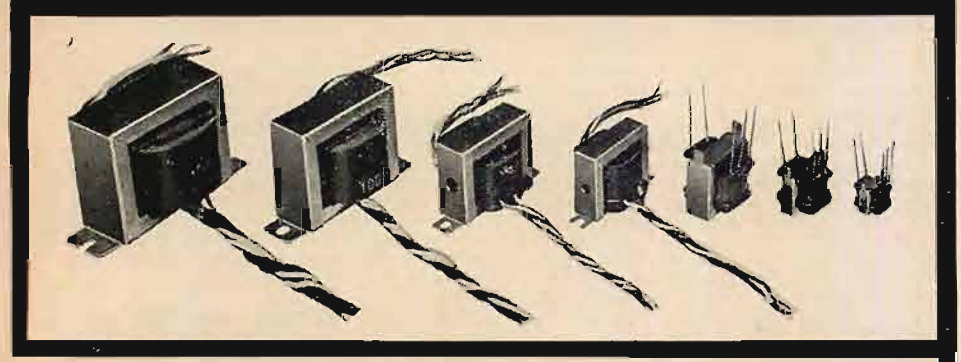


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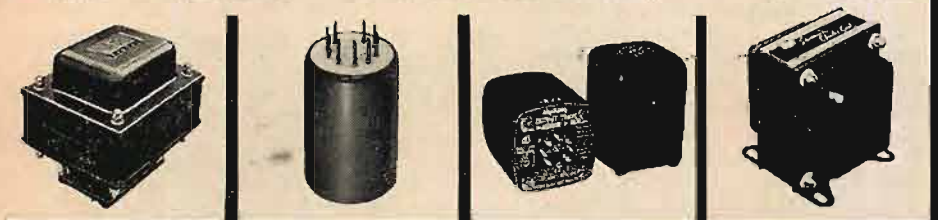
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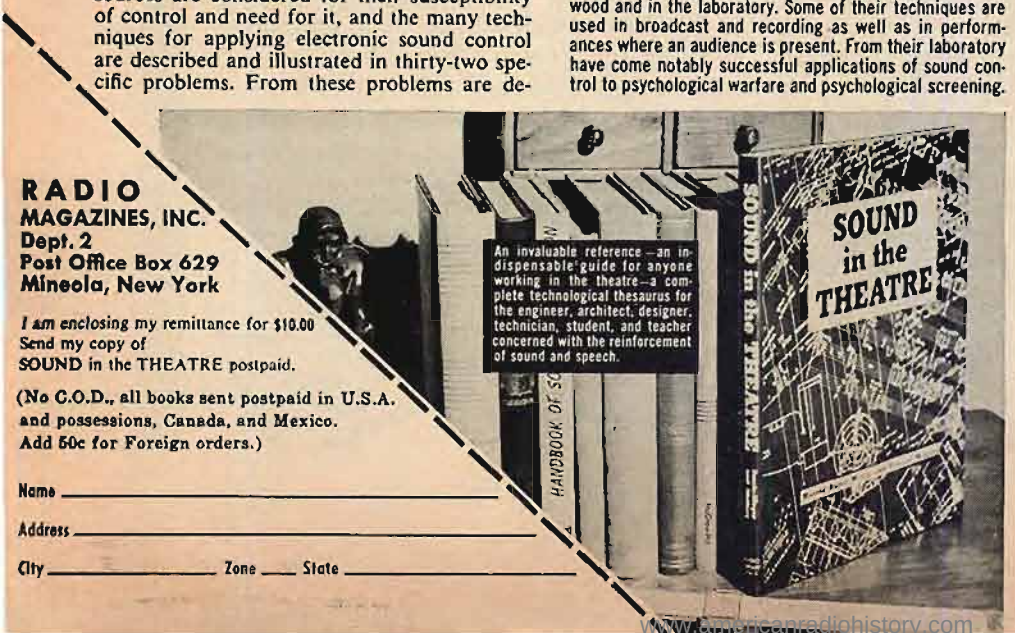
SOUND in the THEATRE

by Harold Burris-Meyer and Vincent Mallory

Nothing like SOUND in the THEATRE has ever been published. It is the first book to set forth in authoritative detail what you can do with sound by electronic control, and how to do it whenever the source (singer, musician, speaker, etc.) and the audience are present together. The book develops the requirements for electronic sound control from the necessities of the performance, the characteristics of the audience (hearing and psychoacoustics), and the way sound is modified by environment, hall, and scenery. Sound sources are considered for their susceptibility of control and need for it, and the many techniques for applying electronic sound control are described and illustrated in thirty-two specific problems. From these problems are derived systems and equipment specifications. Complete procedures are given for: Planning, assembling, and testing sound control installations—Articulating sound control with other elements of production—Rehearsals and performances—Operation and maintenance of sound control equipment.

THE AUTHORS

During the past thirty years, the authors have developed the techniques of sound control in opera, open-air amphitheatres, theatres on Broadway, theatres on-the-road and off-Broadway, in concert halls and night clubs, in Hollywood and in the laboratory. Some of their techniques are used in broadcast and recording as well as in performances where an audience is present. From their laboratory have come notably successful applications of sound control to psychological warfare and psychological screening.



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seriously revolutionary and also the emptiest. A large amount of brassy, twangy, blatty noise covers up a very slim budget of ideas. However, it doesn't last long, which is a proper saving grace. Honegger's more docile, more humorous little piece is another story altogether. It's really a charming work, serious and yet full of twinkling and gentle humor under the blats and wooos and the gentle touches of jazz. It could become anybody's favorite party piece.

Stravinsky, as befits his high status, takes up all of one side here. His concerto is also of the blatty, bumpy sort but this was a very serious experiment, even a bit ponderous in its consciously dissonant revival of the spirit of Bach. It's a very good piece but not exactly a grateful one in the listening. Few really important innovation works are, and this was the beginning of much of later significance in the musical world.

Vox's Viennese recording, out of France, is beautifully taken down and imaginatively played throughout. The sound is big, live, massive, the piano realistic. Mr. Klein shows a strong leading personality at his keyboard and Herr Hollreiser whips up the sometimes-lethargic Viennese (the last harborers of old-time elegance) into a really convincing display of high-Twenties style. Nice cover by Chagall, notes in French and English for the international market.

Brahms: Piano Sonata in F Minor, Op. 5; Intermezzo, Op. 116, No. 6; Romance, Op. 118, No. 5. Artur Rubenstein. **RCA Victor LSC 2459 stereo**

It's strange to hear the veteran Rubinstein play this brashly youthful monument to the exuberant spirit of the young Brahms and I wonder a bit whether *any* pianistic veteran can do it full justice—the piece is so blatantly loud, so youthfully long, so reckless, so outrageously uneconomical! Brahms learned better, later, but he was, after all, the same musician who later wrote quiet music that sits gratefully beneath the fingers and makes more effect in sound than it does on paper; Rubinstein can at least, recognize the strong signs of coming maturity in this early Brahms and his playing is, shall I say, tolerant of the youthful exuberance, if not wholly with it.

Perhaps it was the recording director's idea, (to fill up space), but the inclusion of two quiet late-Brahms piano pieces at the end of the record makes a striking bit of contrast in the listening, pointing up the character of the sonata itself most effectively. Good idea.

Schubert: Piano Sonata in D, Opus 53. Sviatoslav Richter. **Monitor MC 2043**

This leading Russian pianist has been surveyed on discs for several years via Monitor's pipeline into the Soviet—now he has arrived in person and is suddenly famous. As so often happens, his fame began over here with his recordings. This one, and another Schubert disc (the A Minor Sonata, MC 2027) show one aspect of the Richter piano personality, in case you're curious after all the hoopla attendant on his American tour. Monitor's mono piano records are top quality in sound and pressed on very silent plastic, so have no qualms about Richter-via-LP.

He's a top pianist and no doubt about it; but he is characteristically Russian, as of this generation. His Schubert shows most interestingly what appears often in Russian interpretations of Romantic Western music—a curiously old fashioned poetic delicacy, an eloquence in expression, that smacks to our ears of bygone music-making, back in the early days of the century. There is an absence of the hard, steely quality we often prefer in our musical portrayals; there is much *rubato*—poetic unevenness in the rhythm—where we tend towards rigid, driving tempi. Both extremes can, of course produce fine musical expression, given a fine artist. But the difference is striking, nevertheless.

In the Richter Schubert, this "keyboard poetry" is somewhat at a disadvantage. The absence of severity, even in the loudest portions, the continuous *rubato* effects, make the

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notoriously diffuse Schubert sonata form difficult to follow over its long length, though details are lovely. Schubert, of all the Romantics, can take a bit of drive, can carry a strong "beat" to advantage. He needs granite shaping; he is always incipiently in march time.

I found that I frequently lost track of the sonata's continuity in this reading. It's partly Schubert's fault, but also partly Richter's.

In much other Romantic music, Richter and his like are superb, where we often flounder. In Schumann, for example, the Russian approach offers fruitful listening, as well as in Brahms, Tchaikowsky, even César Franck. Richter has recorded these composers, too.

TAPE GUIDE

(*from page 35*)

machines will exist for a long time to come. . . . As regards the tape changer, it has been demonstrated and unquestionably will reach the state of perfection in the not too distant future."

"We feel that the open reel deck will remain the media and the favorite of the more serious recordist. This because of the fact that tapes are more easily edited on open reels and because performance is more than a little better on the average open reel machine than on the average cartridge machine. It would appear that the standard reel-to-reel deck will remain equivalent to the transcription table in the record player field. The tape changer or the cartridge machine is more in the same category as the automatic changer."

". . . we believe that open reel is the medium for the immediate future. There is a certain feeling, however, that cartridge machines are easier to use, which of course will give impetus to the latter type."

The strongest leaning to the cartridge player was expressed as follows. "The general quality of performance, the advantages of tape, and the unusual handling ease of the tape cartridge system has proven itself quite suitable for music reproduction in the home. If tape reproduction is ever to become popular with the mass market, it will be with the tape cartridge system."

Turning to changes of the evolutionary sort, the respondents stated their expectations of further inroads on noise, despite the fact that the better machines are already very good in this respect; of continued reduction in distortion; of continued extension of treble response at the slower speeds; and of further reduction in wow and flutter.

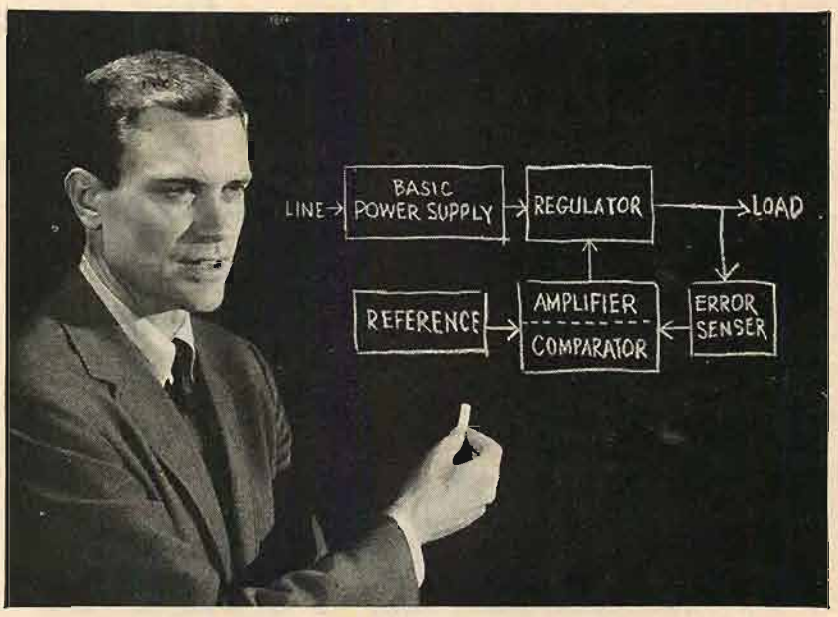
There was indication that the use of transistors is about to become substantial. One manufacturer stated, "The use of transistors in tape recording will, I believe, increase greatly in the forthcoming months. (My company) has done a considerable amount of work in this di-

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PICTURED above is a block diagram of an electronically regulated power supply. It's the subject of the latest issue of Tung-Sol's monthly series for the industrial serviceman, *Tung-Sol Tips*. And it's must reading if you're going to deliver fast and efficient trouble shooting service to your customers.

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Then, to top things off: a lengthy description of how designers design regulated power supplies. Right in this issue, the author takes you through a step-by-step analysis of designing procedures. You actually design a power supply with him. He shows you how circuit elements are selected through graphical means. He explains why particular tubes are suited for the design. And finally, to cap it all, you get a complete circuit diagram of the finished design . . . a tried and tested regulated dc power supply that delivers a 250 volt output at 50 to 250 mA.

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rection and we are now offering components such as bias oscillator coils, heads, power transformers, and schematic diagrams for a complete NAB type transistorized preamplifier with separate record and playback. This, of course, includes a push-pull transistorized bias-erase oscillator."

Another stated, "Transistorization will certainly reduce size, weight, and eventually cost."

On the other hand, a manufacturer expressed the opinion that "At this time, the advantage of transistors is only space savings."

One of the respondents expects improvements and changes in tape heads by the end of the coming decade. "Tape heads of the future will utilize new and improved magnetic materials and manufacturing techniques to provide greatly improved signal-to-noise ratios and high-frequency response. . . . By the end of the decade completely new head designs utilizing magnetic-field-sensitive semiconductors will be in use." The same person also stated his expectation that tape recorders will make increasing use of separate record and playback heads, each specifically designed for its function in order to maximize quality of performance.

5. *Changes May Be Expected in Tapes?*

On the whole, it is believed that tapes will continue to improve slowly but steadily in such respects as reduced distortion, better treble response at slow speeds, less hiss, less print-through, greater strength, and other desired physical characteristics (such as smoothness, limpness, etc.).

A leading tape manufacturer stated, "There has been a slow but steady improvement in tape quality over the years, and it will undoubtedly continue in (the next) ten year period."

Another stated, "I know we are, and I am sure competition is, working to improve the tape media itself. We are carrying on both fundamental research as well as application development work to improve resolution and distortion characteristics of our present tape products." This individual also noted the increasing trend to the use of superior backing material, such as Mylar, to give tape superior physical characteristics.

A third tape manufacturer wrote, "We are constantly working on improved tapes to reduce noise level, improve high-frequency overload characteristics, etc. Different film bases are being explored; print-through characteristics are being lessened and improved. The physical properties are being improved through better backing material."

6. *What Possibility Is There of a Radical Change in the Technique of Magnetic Recording?*

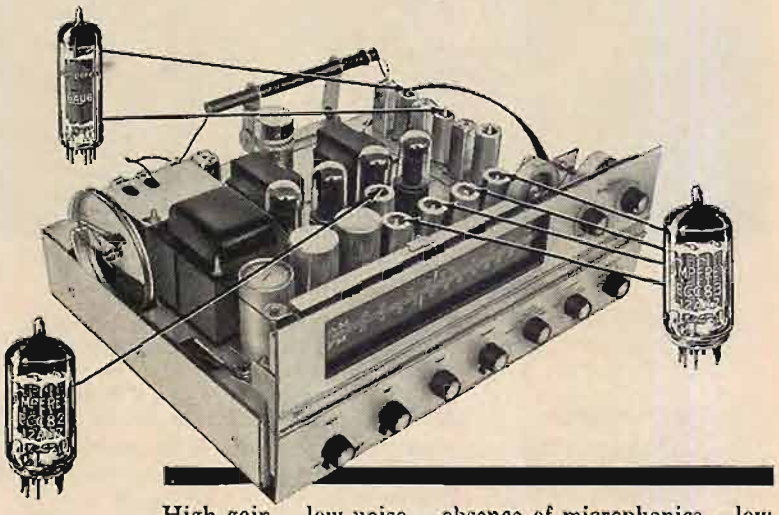
The possibility of a complete revolution in the method of magnetic recording of course cannot be said to be nonexistent. Conceivably, for example, a material might be developed that retains electrostatic impressions which can be scanned by an electron beam.

The respondents, however, were confident that even if such a new technique were introduced, it would take the better part of the next decade or more to make it commercially feasible. As one stated, "We don't see in the immediate future any radical change in the process of magnetic recording for the home."

In sum, it appears that tape recording and playback as we know them today will remain with us for at least the next decade in substantially the same form, subject to changes that will improve performance without producing rapid obsolescence. Æ

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12AX7/ECC83: } microphonics
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6EJ7/EF184: Frame grid pentode for IF, sharp cut-off
6AQ8/ECC85: Dual triode for FM tuners
6DC8/EBF89: Duo-diode pentode

RECTIFIERS
6V4/EZ80: Indirectly heated, 90 mA
6CA4/EZ81: Indirectly heated, 150 mA
5AR4/GZ34: Indirectly heated, 250 mA

INDICATORS
6FG6/EM84: Bar pattern
IM3/DM70: Subminiature "exclamation" pattern

SEMICONDUCTORS
2N1517: RF transistor, 70 mc
2N1516: RF transistor, 70 mc
2N1515: RF transistor, 70 mc
IN542: Matched pair discriminator diodes
IN87A: AM detector diode, subminiature

PRO & CON

(from page 30)

well be carried by little green men using purple wine skins. The thing that *does* matter is the algebraic sign convention. For those who are used to it, nothing could be more annoying than having to

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unlearn a habit of thought only to replace it with something similar but slightly different. When no motivation is present, the situation can be viewed in its proper perspective.

As far as engineers and scientists are concerned, the present convention is perfectly satisfactory. Any major shift in notation would be a great disadvantage. A certain amount of concentration would be required for trivia and this effort would have to be subtracted from interesting and difficult problems not of such synthetic origin. Further, if the electron flow convention were adopted, all the existing literature would be greatly reduced in utility. The price is high when nothing is gained in return.

This states the case for the defense. But what conclusions can be drawn by the person who has just become interested in electricity? He has a wide choice of elementary books in both conventions, and he has no particular reason to prefer electrons to current or vice versa. A suggestion might be in order.

If the beginner does not plan to go

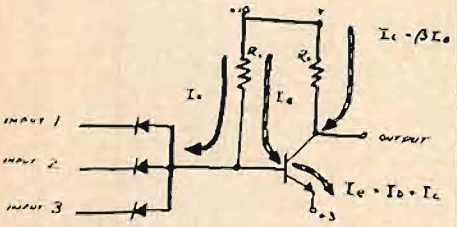
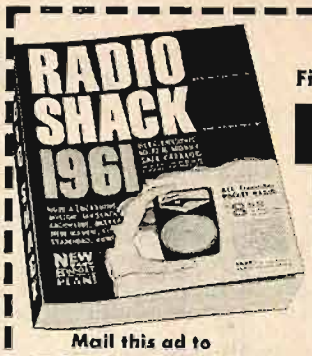


Fig. 4. This is a logic circuit. If any input is grounded, Io flows down through R1 to ground. The transistor base-emitter junction is back biased, the transistor is cut off, and the output is +10 volts. If all the inputs are raised above +3 volts, the lower end of R1 is clamped to +3 volts through the transistor base-emitter junction, the diodes are back biased and the Ib flows into the transistor base. It produces the collector current Ic and the output voltage falls to 10 volts minus IcR2. Try this one with electron flow and you may miss the whole point: current R2 is switched into the transistor base when an output is desired.

into engineering or science and if he does not have to work with engineers and scientists, he can choose either convention that strikes his fancy. However, if there exists a high probability that he will need professional books, journals and personal contacts, he should avoid the electron-flow convention like the plague. Otherwise he will have to face years of trying to break the terminology barrier.

That, at least, is my opinion. Many of my acquaintances who have also learned and then had to unlearn electron-flow are in agreement. I have never encountered any disagreement from engineers. But it is a free country and only the future will decide the fate of the unconventional solution offered to the current problem. Æ



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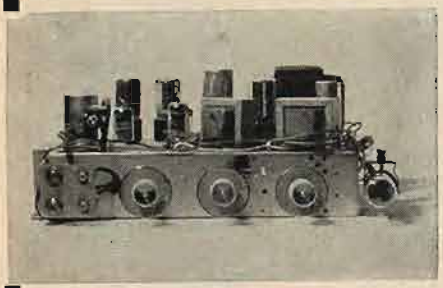
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LIGHT LISTENING

(*from page 8*)

fancy of the general public. The entire Schory series made in Chicago's Orchestral Hall, when heard on proper equipment, can give you results fully as hair raising as the most complicated studio recording. More important, it preserves the acoustical environment of the room. Most percussion projects in recent months have introduced carloads of gear into the circuits that lead from the mikes to the final tape recording head. Considerable evidence has been compiled by the gear-happy boys indicating that novelty stereo discs can be cut at higher levels with less risk of overload on peaks if you assign a platoon of engineers to ride herd on each group of instruments in the orchestra. If limiters, equalizers, and compressors fail to bring an instrument into line, the echo chamber stands ready to bring about the desired effect.

This Chicago session is a valuable reminder that it is possible to get a rare degree of excitement into the grooves of a stereo disc with nothing more than the actual sound of the performers piped directly from mike to final tape.

Dancing on the Ceiling has a tap dancer moving from speaker to speaker. An assortment of thirteen cymbals imitate moving waves in the arrangement of *Beyond the Sea*. There are trumpeters all over the place in *Peanut Vendor* and the element of comedy crashes in as the orchestra draws to the end of *Stumbling*. An undesignated member of the group staggers across the width of the stage through an obstacle course of instruments only to end up inside the bass drum. Clean fun for the entire family.

60 Years of Music America Loves Best, Vol. 2 — RCA Victor LM 6088

Another volume of Music America Loves Best was inevitable in view of the acceptance of the first set. A few scoffs greeted the earlier two-record album when it came out about a year ago. It was felt that listeners in this sophisticated age would pay little attention to a sampling of the entire contents of a sixty-year-old record catalog. The scoffers (I was tempted to join them before I unsealed the package) underestimated the power of nostalgia and the overwhelming versatility of such a collection as a gift item. During this season of the year, it's very handy to know that just about any inhabitant of this planet is apt to find something he likes in a cross section of the oldest catalog of pop, classical and in-between artists. Thirty-three performers parade through this two-disc set. The reproduction values range from the Caruso period to a modern-sounding Rise Stevens excerpt from Carmen which has been updated at least five years in the reprocessing. One of the major surprises—the nearly complete range of the piccolos in Sousa's Band as heard in *Stars and Stripes Forever*.

The Sound of a Marching Band — Medallion MS 7507
Frederick Fennell: Sound Off — Mercury SR 90264

With the help of an electric metronome, all the marches in the Medallion disc were recorded at the marching tempo of 120 steps per minute. Dubbed crowd noises and a fair amount of channel hopping set this session apart from standard recordings of a brass band. A mixture of microphones and the extra step in the process created by the current vogue for re-recording tend to subtract a certain amount of naturalness from the finished sound. Some listeners may find such studio work very effective but I prefer a caught-in-the-open effect in band recordings.

Fennell's Eastman Wind Ensemble, comprising fifty-two players, offers a more conventional treatment of lesser-known marches by John Phillip Sousa. Concert hall ambience makes it easier for the recording crew to get a smooth spread of stereo. The three tiers of bells that form the instrument known as a Turkish Crescent pictured on the cover add a novel touch in *Nobles of the Mystic Shrine* —an infallible indication that Sousa was a Shriner.

Fred Waring: Keyboard Chorale — Capitol ST 1452

The Waring organization deserves credit for a novel wrinkle in this release. They've concocted a recording that gives us an exceptional opportunity to gauge the amount of dynamic range now possible on stereo discs in the non-classical category. (As a rule, dynamics are an unlooked-for commodity in the pop field.) In this project, Fred Waring engaged the services of another Capitol artist—concert and supper club pianist Evalyn Tyner. The Pennsylvanian's orchestra was furloughed for the occasion. The piano was placed in a prominent spot and the rest of the stage occupied by the mixed chorus. Skip any notion that this was a typical glee club with piano accompaniment. Waring and his roster of arrangers that reads like an ad agency—Ringwald, Ades, Naylor and Hayward—had a far more elaborate scheme. The piano was to be starred in big pieces: *Warsaw Concerto, Cornish Rhapsody, Slaughter on Tenth Ave.* as well as favorites of more modest proportions such as *Ruby* and *Deep Purple*. The chorus was expected to make itself useful in the new role of accompanist in the concerto and standard tunes.

As for the recording, once the level was set for the top vocal peaks, a rare degree of discipline was observed by the console engineer in resisting the temptation to bring up the gain in the choir's hushed moments. Of course, such discipline is easier to maintain now that the producer has better assurance that the finished disc will have a satisfactorily low figure of background noise. The diction and style of the Waring gang is still tops even at the threshold of the VU meter's low end.

Sounds From The Alps — Westminster WST 15057

There's a fresh breeze blowing through the reorganized Westminster catalog. Their long-standing reputation for progressive attitude in technical matters is considerably enhanced by this latest release. The music is aimed at a specific audience. A brother and sister team of yodelers carries the main assignment with the help of a small native band that avoids the "oompah" style frequently associated with Swiss and Austrian outfits. If you don't get response of remarkable flatness and transparency while playing this release, the fault does not lie with the recording.

Living Strings Play Music For Romance — RCA Camden CAS 637

Things continue to look up in the lower-priced stereo disc territory. This $2.98 item is the latest in a series of releases by a British string orchestra that can match in lushness anything we have over here. It's a pleasure to note that surfaces on economy pressings are no longer a widespread problem. Difficulties that used to crop up due to use of cheaper materials in the pressings have been solved on several labels. A further help in the matter of signal-to-noise is the specific equalization used on this disc. At normal volume, the slight rise in treble and bass characteristics on the record is quite evident. It acts in much the same manner that a loudness compensator does in a playback circuit. Try it at several levels and you'll notice the disc sounds flatter at a volume suitable for background listening. The novelty in the program heard here is a tune borrowed from the light classics. *A Swedish Rhapsody* based on Hugo

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Alfven's *Midsummer Vigil* adds a bucolic touch to what otherwise is a slick job of continental musicmaking in a pop and movie vein. A few uncharitable souls, upon hearing this not-over-three-buck morsel on a good rig, will be moved to wonder why other stereo discs still require a price tag several dollars higher.

Guy Lombardo: Sing the Songs of Christmas **Capitol STAO 1443**
The Sound of Children at Christmas RCA Victor LSP 2254

The youngsters are taking charge of more of their own entertainment on holiday records this year. One-hundred children's voices join the Lombardo orchestra and vocalist Kenny Gardner during one of their annual visits to St. Patrick's Parish at Stoneham, Mass. The impromptu atmosphere of this gathering in the community's Town Hall will appeal to anyone searching for a recording of carols performed without slickness.

The children's chorus assembled by Victor in New York's Webster Hall numbers twenty-two individuals between the ages of eight and twelve. The group is smaller but the percentage of artists operating at only half or quarter voice is far less than that of the Lombardo session. Although neither album is lacking in spontaneity the edge for naturalness goes to Capitol.

Kingston Trio: The Last Month of the Year **Capitol ST 1446**

Acknowledging the sizeable audience that exists for Christmas music of a non-deeply religious nature, the Kingston Trio has devoted considerable thought to the selections recorded here. Any one who has shopped for a collection of this kind will feel indebted to the trio for their initiative and their presence of mind in excluding items such as *Jingle Bells* and *Rudolph the Red Nosed You-Know-What*. Most of the tunes are folk songs and ballads associated with the month of December in countries around the world. In keeping with the heightened international flavor of the program, the accompaniment includes a celeste and the Bouzouki—a Greek string instrument with a tonal characteristic similar to the lute or mandolin. Æ

HUM CHASING

(from page 28)

External to the tube, heater wiring may induce hum due to poor lead dress. (*Fig.* 7 shows an example). Heater wiring should be twisted and kept well removed from signal circuits. In watching heater wiring, don't forget also the primary power leads—they can cause trouble too. Pilot lights and fuse connections, as well as an on/off switch on the back of a rotary control, can bring a.c. wiring into danger areas.

The remaining possible ways for hum to get in are by direct induction in the signal circuits, either magnetic or electric. Where magnetic induction is a strong component. trial shorting of a grid, or other point of relatively high impendance (taking care not to short down a d.c. supply voltage that might cause some other change in circuit operation) will probably increase the hum. Where the induction is electric, it will practically eliminate the hum.

The way to eliminate magnetic induction is by shielding, twisting leads, and use of proper lead dress for the purpose. Electrically induced hum can also be eliminated by shielding, but to be effective, the shielding must be complete. Sometimes this is impractical, and a reduction in circuit impedance is a more effective approach.

In figuring circuit impedance for this purpose, don't forget the active elements or reactances. Plate resistance of a preceding stage can keep impedance down just as effectively as using a lower resistance value somewhere (*Fig.* 8). Or feedback may help. Low plate resistance is one good reason for using triodes in preference to pentodes. Two triodes can replace one pentode, with less susceptibility to some hum problems.

Feedback circuits can increase, as well as reduce, the output hum, because of interaction with other factors. The best way to figure out what happens when feedback is connected is to develop a complete phase diagram (as at *Fig.* 5) for the hum frequencies. Then work out a way so that any possible points where residual hum may get injected will buck, rather than add.

That about covers the main possibilities. We could elaborate by giving a whole pile of case histories. But chances are we would still not give one like the next problem you'll encounter—there are never two alike! The main thing is to keep aware of *all* the possibilities. Don't get the notion there's something mystic about hum, although sometimes it does seem to come "out of the ground" (using that word literally and in its technical sense)! Keep a sound engineering approach and you'll chase it! Æ

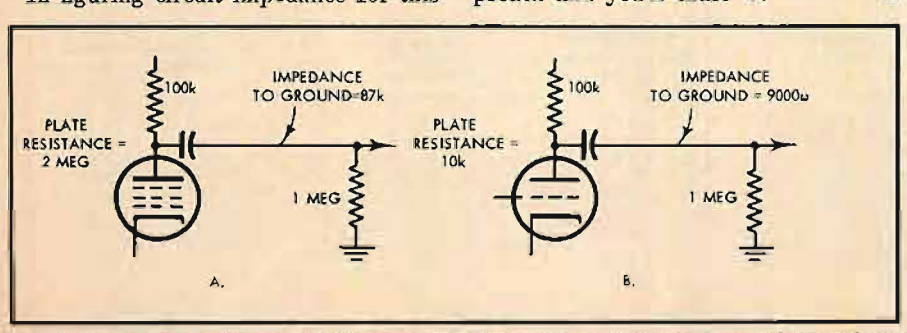


Fig. 8. Hum pickup due to circuit operating impedance depends on total impedance to ground. Don't forget that active impedances are part of this. The triode (b) allows lower impedance to ground than the pentode (a).



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POWER REQUIREMENTS

(*from page 48*)

readings are multiplied by 0.89). Until amplifier manufacturers begin to specify the maximum instantaneous output voltage of their amplifiers, it is best determined by $E_{max} = \sqrt{2\,P\,R}$ where P is the rated sine wave (not peak) output power of the amplifier and R is the rated output impedance. (*Table* 1 also shows the equivalent power reserve between the peak power output and the average power inferred from a VU meter reading (by $\frac{V^2}{R}$), and shows either of these ratios in terms of db of indicated reserve power (or voltage).

As an example of the use of this table, consider a 10-watt amplifier which is found to develop 3 volts across its 8-ohm speaker terminals during normal loud passages. The maximum output voltage of the amplifier is $\sqrt{2 \times 10 \times 8}$ or about 12.6 volts. Thus the voltage reserve ratio as defined in *Table* 1 is $\frac{12.6}{3}$ or 4.2, and the amplifier may thus be seen to be overloaded about 0.0003 or 0.03% of the time.

An interesting thing to note about *Table* 1 is the rapid decrease of overload percentage when the reserve becomes larger than about 10 db. It also should be emphasized that the overload percentages occurring in the lower part of the table are really extremely small numbers! For instance if one considered the shortest overload that could be detected by ear to be about 50 microseconds (one cycle at 20 kc), then with an 18-db safety factor the mean time between these 50-microsecond overload periods would be about a year. Even at 14-db reserve the mean time between overloads would be on the order of several seconds, again assuming only 50 microseconds for each overload. Thus it is clear that 14-db reserve is certainly adequate for any purpose, and it is also plain that 6-db reserve would be inadequate for high-quality reproduction as the signal would be overloading the amplifier over 7 per cent of the time.

In the range between these two obviously limiting values the actual reserve chosen is to some degree a matter of the quality of reproduction desired, but by the treatment here we have reduced this range to just a few db rather than the nearly 20-db range of previous estimates. It is likely that the range could be reduced still more by some controlled subjective experiments, but until that time it is interesting to note that a certain overload percentage seems to have roughly the same effect as the same percentage of harmonic or intermodulation distortion at the listening level. On this basis it would seem that a reserve of 10 to 12 db would be sufficient without being excessive. This brackets the required reserve power rather closely as being 10 to 16 times the measured average output power.

Although we have been able to determine reasonably accurately the power reserve required by the above statistical approach to complex signals, there is considerable further work to be done in establishing the relation between percentage overload time and subjective listening reactions. The aim of this article has been to provide the basis for the statistical treatment of complex signals, as this is the only way that such signals may be safely handled. The author would like to encourage any comments and further development of this approach.

Æ

TABLE 1

PROBABILITY OF OVERLOADING AMPLIFIER AS A FUNCTION OF AMPLIFIER RESERVE CAPACITY

Voltage Reserve Ratio*	Equivalent Power Reserve Ratio	Equivalent Reserve in Decibels	Fraction of Time Amplifier Overloaded
1.00	1.00	0	0.373 5
1.26	1.59	2	0.262 7
1.59	2.51	4	0.158 5
2.00	4.00	6	0.076 7
2.51	6.30	8	0.025 1
3.16	10.0	10	0.005 11
4.00	16.0	12	0.000 385
5.00	25.0	14	0.000 009 424
6.30	39.8	16	0.000 000 037 98
7.90	62.5	18	0.000 000 000 002 56
10.0	100	20	less than 10^{-18}

* Ratio of maximum output voltage of amplifier to signal voltage indicated on VU meter.

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VARIABLE PITCH RECORDING

(*from page 48*)

and the flexible-belt coupling to the lathe, no vibration or rumble is introduced into the turntable. In our experience there have been no patterns whatsoever as a result of this installation. This feature is important as other types of drives can become worn and thus introduce rumble and visible patterns into the recorded disc.

Operation

In the past, engineers have shied away from cutting at pitches in the neighborhood of 250 lines per inch or greater. They did this because it was necessary to reduce the groove size from the usual 2.7-mil to 3-mil groove width in order to be able to have room for modulation or groove "swing" at this fine pitch. This caused tracking problems for the general run of reproducers. As a result, the majority of microgroove recordings are cut with a 3-mil width. This 3-mil width is not to be confused with the 3-mil stylus radius used to reproduce the old 78 rpm discs and present day radio transcriptions. The 3-mil groove width is the measurement made by the recording engineer through a calibrated microscope for microgroove recordings. This groove width is played with the standard microgroove point with a 1-mil radius tip. As mentioned previously, this limits the amount of time that can be recorded per side.

With the variable pitch method, the same groove dimensions are used as for the 180- to 210-line cutting. In fact, when adjusting the lathe, the groove depth is set for standard microgroove depth, that is, the usual 2.7-mil to 3-mil groove width. The variable pitch control merely conserves the "land" between the grooves when it is not needed. A few experimental cuts will indicate the maximum number of lines which can be cut by increasing the pitch to a greater number of lines. A point will be reached when almost no "land" exists between grooves. The setting of the pitch dial can then be noted.

Manual operation of this system can be quite effective once the operator learns the capabilities of the system. An advance tape head can be installed on the tape reproducer machine about one or two seconds ahead of the standard playback head feeding the disc cutter to allow the operator to monitor and adjust the cutting pitch before the material actually reaches the cutter head. This method need not be used if the operator is familiar with the program material or has previously auditioned the tape and made a schedule of "pitch" notes versus elapsed time.

We are also working on an automatic feature which will eliminate necessity for hand control of the pitch. Even more time per side can be obtained with the automatic version because the electronic control is more accurate in calculating variations in level and low frequency content of the program material than the human operator. When properly adjusted, the automatic system can compensate very accurately and adjust the pitch accordingly. However, in some applications, the manual method will prove to be highly satisfactory and accurate.

Conclusion

The accompanying circuits, drawings, and photographs are, in a way, self-explanatory. However, each installation is a custom job depending upon the type of cutting lathe and the features the owner wishes to incorporate. We have presented here a "basic" idea and system. This type of installation not only gives more cutting time but even more important allows for a greater dynamic range as peaks and low frequency material may be recorded without fear of overcutting. Naturally, variable pitch is not practical on all types of program material. However, the average studio which handles a great variety of work will find much use for such a system.

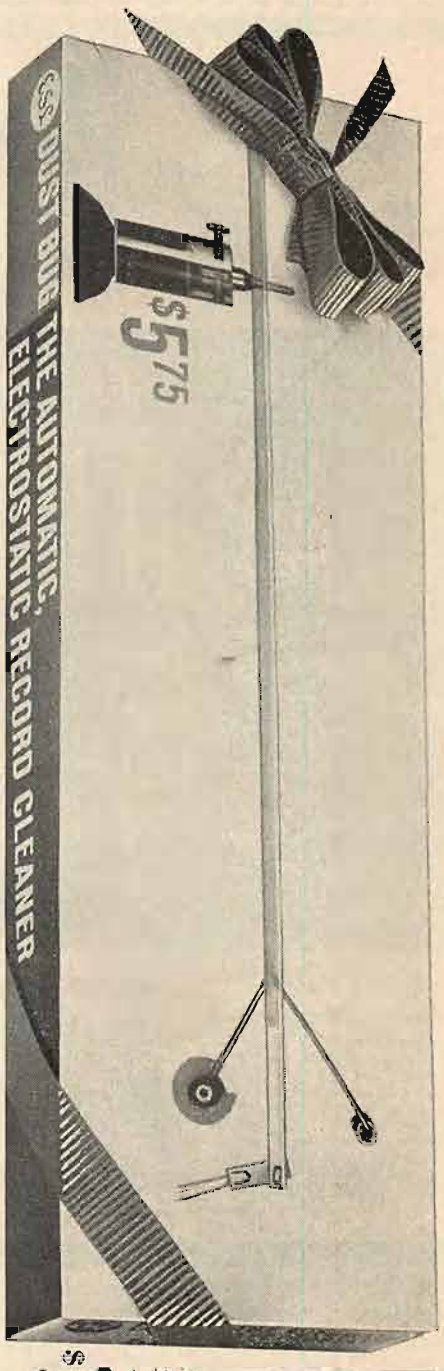
The appearance of new stereo cutters on the market will require widespread use of such units. Variable pitch is a necessity for stereo mastering. *Æ*

NEW PRODUCTS

(*from page 73*)

a test switch to select one of the six adjustments possible; and the triode switch previously mentioned. Distortion is claimed to be virtually measurable because of a newly developed circuit. The output stage uses EL34's in push-pull parallel configuration. Marantz Co., 25-14 Broadway, Long Island City, N. Y. **M-9**

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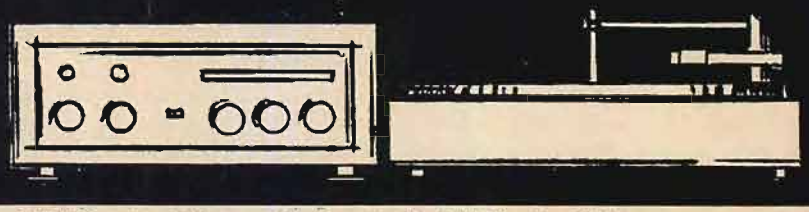
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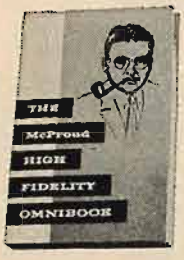
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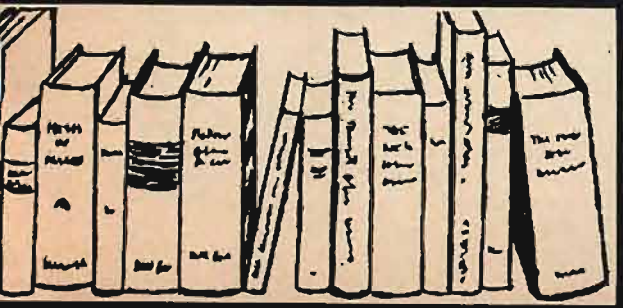
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JUNK-BOX FM ALIGNMENT UNIT

(*from page 23*)

the desired points are marked on the celluloid scale of the dial.

Although the builder of the unit sees no particular reason for using a test oscillator to check the dial calibration of a tuner, a scale of FM frequencies was added to please any reader who might think it convenient. A separate inductor was used for this purpose, and because of the high frequencies, recourse was had to the dodge of using an inductor of such value that the frequencies produced by the oscillator were one-third of those in the 88–108 megacycle range; therefore third harmonics were used for measurements. By a stroke of luck, one of the "surplus" slug-tuned coils had such inductance that it provided third-harmonic signals in the FM range; it was therefore used without alteration. This coil had 11 turns of a fabric-insulated wire, occupying ¾ inch on a ⅜-inch diameter form. The frequencies marked on the scale do not cover the entire 88–108 megacycles, because FM signals from stations at both the low and the high end of the range were unavailable at the location where this unit was built. Extrapolation from known frequencies would of course be possible, but values so obtained should not be taken too literally.

Although this is by no means precise equipment, it is capable of doing an acceptable job on an FM tuner.

Figure 2 shows the front of the unit; the dial at the upper left is marked for 10.7 megacycles minus and plus the required deviations on one scale, and FM frequencies on a second scale. The small knob below the dial operates the potentiometer that varies the output. The knob at the upper right is the bandswitch. The knob at lower right is the on-off switch for the power line.

Figure 3 shows the shelf behind the panel. The socket for the 6AF4A tube is at the right, and the socket for the 6C4 tube is at the left, of the variable capacitor; tubes are below the shelf. At the left of the shelf are the two inductors, fastened to the bandswitch, and the filament transformer. The separate plate supply transformer, the silicon rectifier, and the electrolytic capacitor are below the shelf. Æ

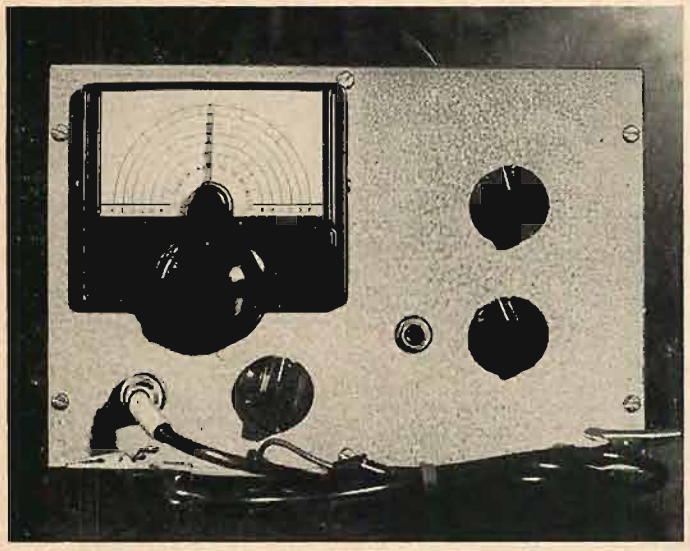


Fig. 2. Front view of completed unit.

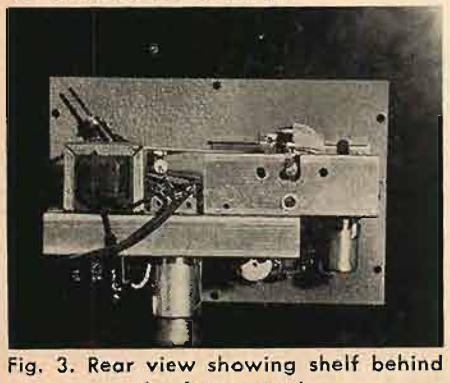


Fig. 3. Rear view showing shelf behind the front panel.

PARTS LIST

L_1	10.7 megacycle coil	
L_2	88–108 megacycle coil	
C_1, C_2	20	μμf (5%)
C_3, C_4	25	μμf
C_5, C_6	100	μμf
C_7	5	μμf
C_8	2000	μμf
C_9	1100	μμf
C_{10}	10/450	electrolytic
C_{11}	40/450	electrolytic
R_1	8500, 1 watt	
R_2	100k, 1 watt	
R_3	3300, 1 watt	
R_4	100 ohm potentiometer	
R_5	2200, 5 watt	
Sw	d.p.d.t. bandswitch	
Dial	Millen 10039	
2 tube sockets, 7 contact		
Silicon rectifier, 150 watt		
Filament and plate supply transformers		

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AUDIO ETC

(*from page 52*)

tors, in speaker terms. You can argue about them—they are there. But they simply are not to be classed as gross, by any stretch of the imagination. This is good.

The essential features of this modestly capable speaker are, in the bass, a solid enclosure with tubular port. The currently excellent modification of what used to be, if I remember rightly, Jensen's own original bass reflex. In the treble, Jensen has converted to the new type of dome tweeter and I am all for it. These little domes may not in themselves be perfect, but they do again limit imperfection to a relatively micro range. There are two 3½-inch mid-range direct radiators here and a single phenolic dome tweeter for the ultra-top, all of these controlled for balance by a single volume knob on the back.

May I suggest that this is an excellent idea. In theory, separate controls for highs and mid-range give more flexibility; but I've found that I am more confused than enlightened by such dual controls most of the time. Too many variables for the timid ear—mine's timid in such cases. I like Jensen's balancing and would find it adequate, I think, in 95% of common situations.

The Jensen cabinet was originally available unfinished only, but now is out in finished form, at a higher price. It's serviceably light in weight—I can carry the thing—and seems solid, though the back board appears to be removable (angled screws) and does occasionally vibrate to the touch on really heavy bass passages. A trace of reflex-type softness in the bottom sound, but really only a trace and of strictly micro-style significance for general listening.

What else is there to be said? Simply that this speaker's personality is "micro" enough so that with very little trouble I could interchange it with others in my speaker roster. I listened for weeks to all my records on the pair of Jensens. Then I tried one Jensen and one of a more expensive bookshelf brand. The differences were there (and the Jensen was more efficient, louder, requiring re-balancing). But I found even so that the stereo mix was quite satis-

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factory. Only micro-differences, reasonably small ones. That's what I like.

I noticed only one slight aberration in this speaker, an effect that so far I have not been able to account for. Very minor, again, but there is a just-noticeable "hollow" sound, a very slightly metallic, mid-range phenomenon that could in theory be an accoustical cavity resonance caused by some space in front of the speakers. Can happen, and has, many times. Nine persons out of ten would not notice it (a strictly micro-aberration) but possibly Jensen can make a minor change that will remove this slight color. Other than that, I am happy to be able to include this speaker among those that for my ear are in the micro category as to variations from the ideally perfect and transparent speaker reproduction, a sound that to my knowledge has not yet been achieved.

Audio-Tech ME-12

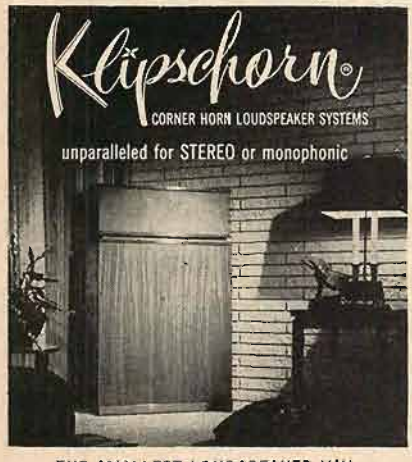
I must add brief mention of another pair of speakers I've had around for an unconscionably long time and find rather difficult to describe—because they clearly lack any describable sound color. I might be more definite as to their sound if I had not received them in the city, where noise levels are dismally high all day and my apartment neighbors don't like hi fi by night. These are the Audio-Tech ME-12, a bookshelf speaker designed by our own Joseph Giovanelli, which should be considerable recommendation to any AUDIO reader.

The ME-12 sells for just about $100 and is a full-sized model—not really for any bookshelf I've ever seen, of course—about an inch deeper to the rear than my other full-sized models. The front panel tilts upward slightly, or at an angle sidewise if you see the speakers horizontally—good in stereo. Color-coded terminals and balance controls on the rear, a nice looking heavy cabinet, a 12-inch woofer (pre-aged via a 20-cycle tone) in a sealed infinite baffle, a cone tweeter, the whole fused for overload.

I've been able to listen to the ME-12s when city noise has momentarily faded and I'm aware of a very smooth sound, that surely falls well within my private micro-factor category as to degree of coloration and distortion. I'll get the pair to the country when I can find space and muscle, but didn't want to wait for that. For a hundred bucks, the ME-12 looks like a respectable buy. AE



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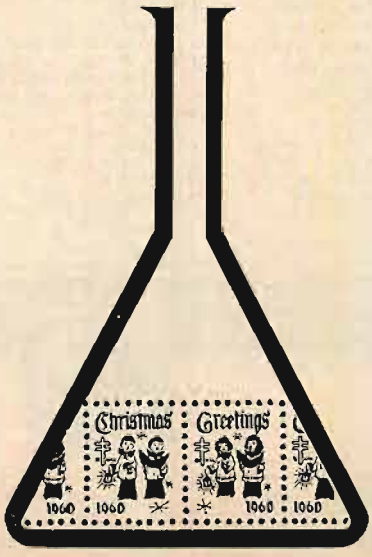
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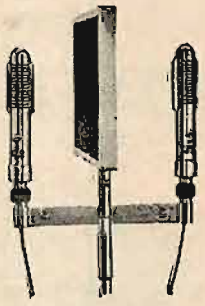
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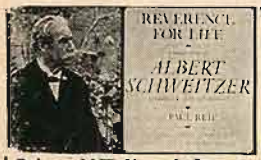
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Industry Notes . . .

Shure Begins Factory Addition. Construction has started on a 38,000 square-foot addition to the Evanston, Illinois, plant of Shure Brothers, Inc. Ground was broken Friday, Nov. 4, for the two-story addition which will add 43 per cent more space to the company's present 88,000 square-foot building. Completion is scheduled for July 1, 1961.

Benjamin Electronic Sound Corp. Formed. Joseph N. Benjamin, a well-known figure in the high-fidelity field, formed this company to import, manufacture, and distribute electronic sound products. Facilities have been established at 97-03 43rd Ave., Corona, N. Y. Distribution of the Miracord record changer and the Stereotwin cartridge will be the first product line the company will handle. The Elac products were previously distributed by the Audiogersh Corp. Associated with Mr. Benjamin will be Gershan T. Thalberg as Sales Manager and Treasurer.

Vidaire Moves Plant. In a move that doubles the available floor space, Vidaire Electronics Mfg. Corp. has recently occupied a plant at 365 Babylon Turnpike, Roosevelt, N. Y.

Sarkes Tarzian to Manufacture Tape. A new division has been organized by Sarkes Tarzian to manufacture professional quality magnetic recording tape. Initial offering in the line is a ¼-inch tape with 1½ mil acetate base, available in 150-, 600-, and 1200-foot lengths, on 3-, 5-, and 7-inch reels.

Ercona Sole U. S. Agent for Beam-Echo. Ercona Corporation, a specialist in the sales of high quality English and other foreign electronic products, has just been named as sole U. S. sales agent by Beam-Echo. The Beam-Echo line consists of stereo amplifiers, preamplifiers, power amplifiers, and AM-FM tuners developed in conjunction with Mullard.

Industry People . . .

Les A. Thayer was elected Vice President for Sales at the November Board of Directors meeting of the Belden Manufacturing Company. Mr. Thayer has been with Belden for 30 years, starting as Territory Salesman in Texas. He has served as Chairman of the Electronic Parts and Equipment Manufacturers Association, Director of the Manufacturers Council, and Chairman of the Sales Development Committee of the National Automotive Parts Association. He is currently President of the Automotive Service Industry Association . . . Amperex Electronic Corp. has announced the promotion of **Tom O'Connor** to the position of Distributor Sales Specialist. Mr. O'Connor was formerly Manager of the Sales Order Department. Good luck, Tom.

Ampex Professional Products Company has appointed **Frederick B. Ramback** national sales manager. In this newly-created position, Mr. Ramback will direct sales activities for all professional audio and video equipment.

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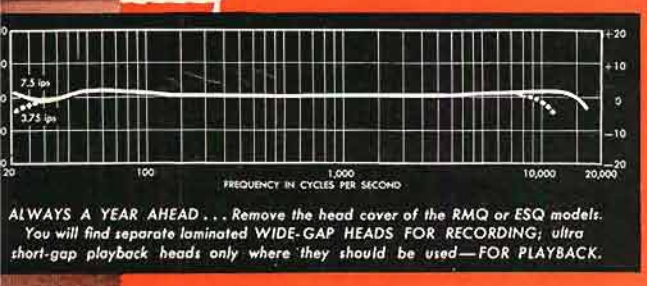
THE "STEREO-COMPACT"

BASIC DECK for HOME or COMMERCIAL, MONO or STEREO

The identical transport used in Viking integrated models. This deck represents a truly economical way to "get into tape." Flexible head assembly permits conversion to virtually any recording or playback functions when desired. A Viking built companion line of critically-tape-equalized recording and record/playback amplifiers is available to assure top performance.



THE VIKING MODEL 85'



ALWAYS A YEAR AHEAD . . . Remove the head cover of the RMQ or ESQ models. You will find separate laminated WIDE-GAP HEADS FOR RECORDING; ultra short-gap playback heads only where they should be used—FOR PLAYBACK.

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Wherever you Go

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