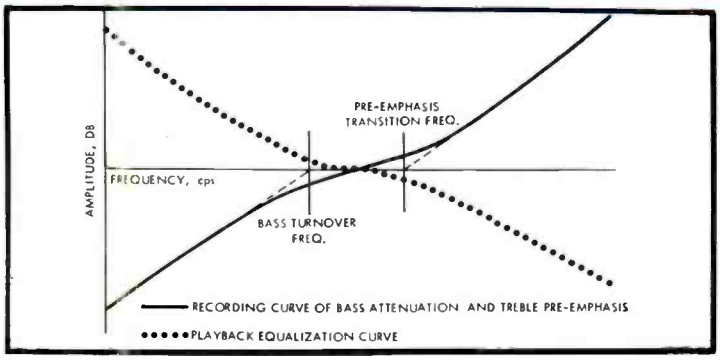
AUDIO

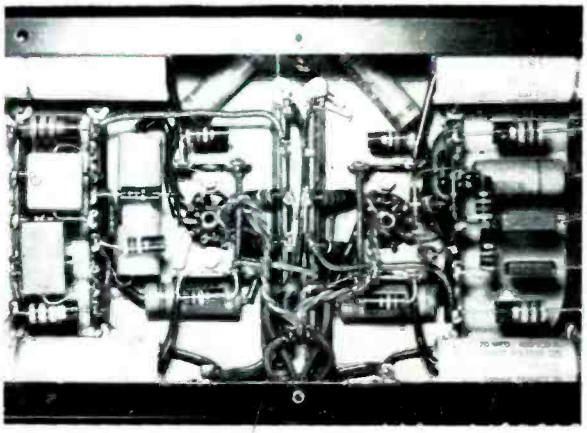
ENGINEERING MUSIC SOUND REPRODUCTION

JANUARY, 1956

50¢



For a down-to-earth explanation of the problems in disc recording, along with a comprehensive treatment of the reasons for pre- and post-equalization—better known as recording characteristic—see Chap. 4 of SOUND on page 17.



One school of thought insists that a high-impedance dividing network such as this ahead of the amplifiers gives better quality, but little information is available. See page 13 for one good method.

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DISC RECORDING—CHAPTER 4 OF "SOUND"

Plus all the regular features—

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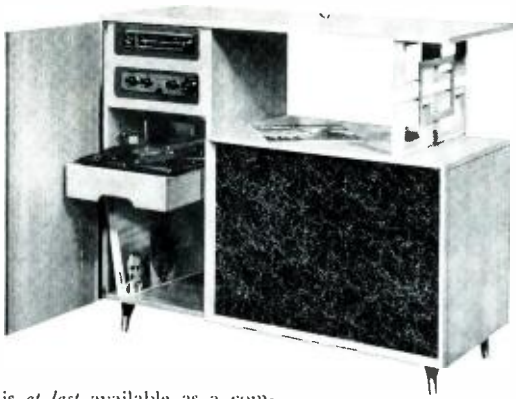

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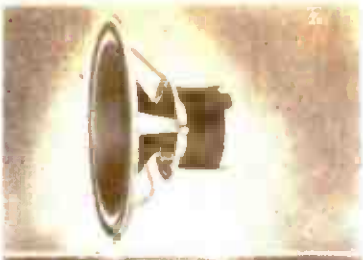

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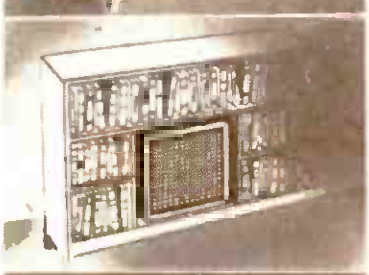

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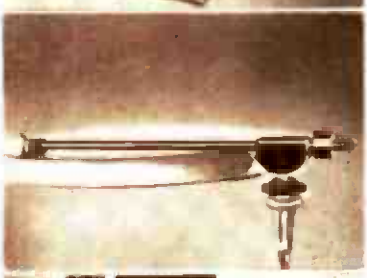

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(see other side, please)

The Sounding Board

JANUARY, 1956 VOL. 40, No. 1
Successor to RADIO, Est. 1917.

AUDIO

ENGINEERING MUSIC SOUND REPRODUCTION

CONTENTS

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RADIO MAGAZINES, INC., P. O. Box 629, MINEOLA, N. Y.

AUDIO PATENTS

RICHARD H. DORF*

TWO INVENTIONS assigned to International Electronics Company have some interest in the field of magnetic recording. The first is the product of Bruce Roberts and is numbered 2,712,572. It is a method of recording two signals on the same portion of tape without mutual interference and with the object of doubling the available recording time on a given length of tape.

In normal tape recording the head gap is perpendicular to the direction in which the tape travels. As the current through the head varies and the tape moves, a series of small magnetized domains are created, each with a field and polarity corresponding to the intensity and phase of the head current at the instant of magnetization. These domains may for simplicity be considered as a series of individual magnets of the requisite field strength and polarity, each, of course, with a north and a south pole. With the usual recorder and head orientation, the individual magnets are oriented in the direction of tape travel; since the flux gap creating the magnetics is perpendicular to tape travel and the lines of force bridge the gap, we may picture many small bar magnets at right angles to the gap.

As everyone concerned with tape recording knows, correct orientation of the playback head is essential in reproducing the higher frequencies to maximum advantage. The reason is, of course, that if the playback head gap is not at exactly a right angle to the small "magnets" a loss in level occurs; and the loss occurs first with those "magnets" which are shorter—representing higher frequencies—because with a given gap width they will more easily fit inside the gap entirely when wrongly oriented so that there is no field across the gap.

It follows—and this can easily be verified—that if the playback head is oriented so that it is at right angles to the recording head there will be no output at all at any frequency. Roberts takes advantage of this fact.

Let us assume two recording heads arranged with their gaps at right angles, each gap making an angle of 45 degrees with respect to the tape, as illustrated in *Fig.* 1. (A) of *Fig.* 2 represents a portion of the tape with a number of radial lines about a point representing possible positions of small "magnets." Since the number of possible orientations is infinite, 12 lines are shown at equal angles from the point. Now let us move the tape of *Fig.* 2 past the Channel B head of *Fig.* 1. Of the 12 possible magnets in (A), eight are now oriented at right angles to the head which just created them. They represent the recording made by the Channel B head. The remaining four possible magnets are unchanged.

Now let us record the same portion of tape with the Channel A head. (C) in *Fig.* 2 shows the result. The remaining four magnets are now oriented at right angles to the new head gap, while the original magnets remain unaltered. Thus two separate signals have been recorded on the same tape. Which one will be played back depends on the orientation of the playback head.

The illustration of *Fig.* 2 proves nothing, of course; it is simply a representation of the inventor's simplified analysis of what happens. He has verified the actual results experimentally, however. The two signals remain distinct, but the second recording plays back at lower level than the first, though the difference is not great. It seems obvious that all the heads could be half-track ones, so that both recordings could be made on half the tape width and two more on the other half, resulting in recording time multiplication of four times over ordinary single-track recording. Multiple heads could be used simultaneously for binaural or stereophonic recording, or single heads could be fitted with mechanical means to change their orientation. Other drawings in the patent specification show ways of doing either.

Tape Amplifier

Daniel H. Dashiell is the designer of a very much simplified electronism for a tape recording, consisting of only three tubes for all functions. The number of the patent is 2,654,003. The scheme is diagrammed in *Fig.* 3. The name of the company and the use of a combination speaker and microphone are clues that this invention is intended for dictating-machine or other non-high-fidelity use.

In the RECORD position of the switch, microphone signal goes to amplifier V_1, through a potentiometer level control and

(*Continued on page 53*)

Fig. 1 (top)

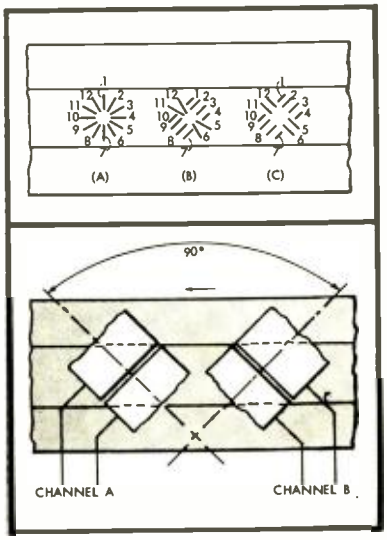

Fig. 2 (bottom)

* *Electronics Consultant, 255 West 84th St., New York 24, N. Y.*

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It's not necessary to be as impressionable as our friend here. But you will feel tempted to wear your so'wester as your favorite orchestra and conductor thunder through the stirring storm sequence in the Pastorale. Bogen hi-fi realism transports you beyond walls into the world of tone that Beethoven created.

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LETTERS

Biflex Cones

SIR:

The system of cone compliances described by Badmaieff ("Design of biflex loudspeakers," November, 1955) in such glowing terms is my invention. It dates back to 1938, when I used a method of "applying a layer of viscous damping liquid to both sides of the cone at the mid compliance." I sold about fifty speakers with such a cone before the war, but then I had to concentrate on sterner tasks. I resumed peacetime development in 1946, by which time I had realized that doping a part of the cone didn't work very well, and I evolved the method of removing a narrow ring of the cone and replacing it with a plastic cement. So was born what came to be called the Hartley 215 speaker.

Apart from the fact that starting in January, 1949, I posted a total of some 10,000 technical data sheets to various hi-fi enthusiasts in the U.S., which data sheets described exactly the system of compliances and the effect they would have on frequency response, there remains the indisputable fact that some thousands of these speakers are in use in the U.S., and they incorporate the mid-cone compliance which Badmaieff now describes in such terms as to lead the reader to believe that he is the inventor. Cones with compliances such as he describes have been in regular use in the U.S. since 1949—many in Los Angeles—and they have been exhibited and demonstrated at Audio Fairs in both New York and Los Angeles, as well as at the Chicago hi-fi show.

However, for the technical guidance of your readers, I must point out some basic errors in his article. His *Fig.* 3, alleged to be an analogue of a speaker with a double-compliance cone, is without foundation. The mathematical exposition is abstruse and out of place in your pages, but a simple practical demonstration is quite easy. Let the values of inductances, capacitances, and resistances in the equivalent circuit be specified, such values being true equivalents of what the speaker is supposed to include; now measure the impedance of this network over the whole audio range and compare it with an impedance curve of the speaker it is supposed to represent. It will be found that the two curves are *not* comparable.

Mr. Badmaieff states that the compliance represented by R_{m1}/C_1 in *Fig.* 4 gives an extended and smoother response in the treble; this is correct and this is why it was incorporated in my own speakers so long ago. His exposition of compliance R_{m2}/C_2 (same figure) is fallacious. The natural resonant bass frequency of a cone is a function of the stiffness of the outer surround. Experts like the famous Hawley Products Company will confirm that within reason this figure can be made what the designer wishes, and the more flexible the paper the lower the resonance; the limit, of course, is the thinnest paper that will stand up to the "bashing" a speaker gets in real life. Thickening or stiffening the paper raises the resonant frequency, and the effect of Mr. Badmaieff's dried viscous plastic layer can be paralleled exactly, and with a great deal less trouble, by adjustment of the paper pulp at the outer edge of the cone and the varnish used to protect it. This I knew when I was developing the 215, but the notion of adding "goo" to the outer edge seems to me to be quite absurd. Here we want freedom of movement, which is why I use a loose flannel surround.

Where a second compliance is truly needed is in the voice-coil itself. With a conventional coil such as described by Mr. Badmaieff, the mass is too great to permit of good high-frequency response, a fact which is demonstrated by his response curve in *Fig.* 5 which shows a severe cutoff at about 13,000 cps. A voice-coil assembly with an included compliance (described by me in *Radio Electronics*, April, 1954) gives a much better output at the top end, my 215 speaker with such a voice coil being only 4 db down at 20,000 cps.

If I may end on a more personal note—I have found in practice as a businessman that the average hi-fi enthusiast doesn't take any notice of subtlety in design. The 215 was the result of twenty five years' experience of speaker design in which every single feature was the result of innumerable experiments and measurements with one aim—to find out what was best. Sales are not greater because many non-discriminating people refuse to believe that a 9-inch speaker can be as good as a 12-inch model; I believe it is better, as do those who own my speakers, but since I have to live I must concentrate now on making more imposing (and more expensive) speakers.

No one could be a more ardent disciple than I in the movement for putting our high fidelity house in order.

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ABOUT MUSIC

HAROLD LAWRENCE*

Opera's Sound and Fury

THUNDEROUS applause welcomed kimono-clad Maria Callas in the Chicago Lyric Theatre on November 17 as she emerged from the wings to take a bow for her performance of *Madame Butterfly*. And what a bow that was! Madam Callas dropped to her knees and lowered her head until it touched the floor, remaining in that position for an eloquent minute or two. Then, as if still overcome by the impact of Puccini's score, she rose and slowly departed from the scene, her brow furrowed with emotion.

A reception of another kind greeted her off stage. Eight process servers armed with summonses issued in a contractual dispute bore down on her. The soprano let loose a verbal barrage as impassioned as her thrilling performance of a few moments before: "I will not be served! I have the voice of an angel! No man can serve me! Get your hands off me!" Quicker than you can say "Gianni Schicchi" members of the opera company swooped down on the invaders and hustled them out of the theatre to the accompaniment of their heroine's trilled outburst in several languages. Next morning, Maria Callas was on a plane bound for Italy. At the Milan airport she told reporters, "Those Zulus maltreated me!"

This latest turbulent episode in the meteoric career of the Greek-American soprano proved once again that the Artistic Temperament, like Chivalry, is not dead. Another diva and arch-rival of Maria Callas, Renata Tebaldi, put on a show of her own at San Francisco last October. A claque was well in evidence during her performance in the title role of *Tosca*. Urged on by the professional applause, Madam Tebaldi repeated the famous aria, "Vissi d'Arte." The critics were not impressed. They brought the claque to task for milking the bows and reprimanded the prima donna for her precedent-shattering and uncalled-for encore.

A claque in reverse was on hand this past summer at the Aix-les-Bains Music Festival in France where a distinguished audience of 4,000, including ex-King Umberto and ex-Queen Marie José, was enjoying a special performance of Monteverdi's *Orfeo*. The hero, baritone Giuseppe Valdengo, strode out on the stage but didn't sing a note. Instead he shouted in Italian-flavored French: "I refuse to go on until the management pays me 75,000 francs extra!" To further emphasize his point, Valdengo threw down his lyre. At first there was a shocked silence. Then the audience exploded in catcalls, hisses and curses, the king and queen rose from their seats, the conductor hurried on stage to apologize and ended by bursting into tears, and Valdengo retreated to his dressing room. But the crowd was not quite through with the singer. They located his expensive automobile and proceeded to take it apart, while Valdengo ran through the streets shrieking: "Help! Police! They are taking the wheels off my car!"

ELISABETH SCHWARZKOPF
Soprano

Americans, Too

An equally volatile personality is Philadelphia-born David Poleri who recently scored a notable success as Michele in *The Saint of Bleecker Street*. Like Valdengo and Tebaldi, he also played "Stop the Music." About two years ago Poleri was portraying the role of Don José in *Carmen* at Chicago when he abruptly cut off in the middle of a scene, marched toward the pit, yelled a few angry words at the conductor and stalked off the stage leaving Carmen unstabbed, and alive and kicking.

The Carmen of that performance, incidentally, was Gloria Lane who later played opposite Poleri in Menotti's opera. It appears to be Miss Lane's fate to be stabbed (on stage) by Mr. Poleri, for as Desideria, the spurned mistress, she is dispatched in this manner by Michele.

Speaking of singer-conductor relationships, Enrico Caruso marked his debut at La Scala in 1900 by demonstrating that he could be just as temperamental as the next singer. The trouble was, he chose to throw his weight around with Arturo Toscanini,

(*Continued on page 52*)

* *26 West Ninth St., New York 11, N. Y.*

by h.h. Scott

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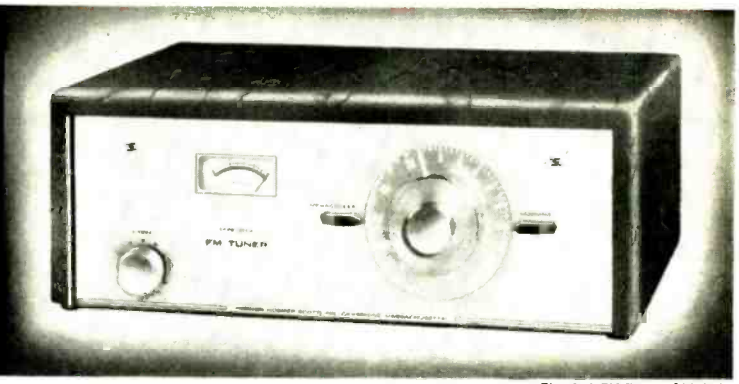

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by h.h. Scott

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NEW LITERATURE

• **Electro-Voice, Inc.,** Buchanan, Mich., in Bulletin No. 211, introduces the new E-V line of do-it-yourself high-fidelity speaker enclosure kits. The bulletin tells just how easily the music lover or high-fidelity enthusiast can build his own speaker enclosure with simple household tools, and save up to one-half the cost. Every piece in each E-V kit is precut, ready to assemble. Finished kits are comparable to Electro-Voice factory-assembled enclosures. Seven kit models are described and illustrated, covering the Patrician IV, Georgian, Centurion, Regency, Empire, Aristocrat and Baronet. Simple step-by-step instructions are supplied with each kit or may be obtained separately at nominal cost. A copy of Bulletin No. 211 will be mailed on request. **J-1**

• **Allied Radio Corporation,** 100 N. Western Ave., Chicago 80, Ill., will mail free a copy of "This Is High Fidelity," a new 100-page book which combines an extensive, illustrated information section explaining high fidelity, with listings of hi-fi music systems and separate components. Among highlights of the book are matched hi-fi systems in a wide range of prices. Product listings include the latest individual components produced by virtually all leading manufacturers. A separate section covers tape recording equipment. Irrespective of the nature of your interest in high fidelity, you should have a copy of this handsome catalog. It will be mailed free on request. **J-2**

• **Alpha Wire Corp.,** 430 Broadway, New York 13, N. Y., announces publication of catalog S-55 which is devoted to audio wire exclusively. It contains descriptions, specifications and illustrations of the company's in-stock line of 145 audio items, among the largest and most complete in the industry. A copy of Catalog S-55, together with price sheet, will be mailed free on request **J-3**

• **Society of Motion Picture and Television Engineers,** 55 W. 42nd St., New York 36, N. Y., is distributing a 12-page pocket-size booklet which describes the several new methods of motion-picture production and exhibition which have come into use since 1952. It covers 35-mm sound pictures only, including Cinerama, Cinemascope, VistaVision, Superscope and Todd-AO. Included are details of camera aperture, projector aperture, aspect ratio, direction and rate of film travel, number and type of film tracks and loudspeakers, and type of screen. Prepared primarily to explain to people in other countries what these systems represent in terms of previous standards, the booklet will also be supplied to domestic readers on request. **J-4**

• **American Standards Association,** 70 E. 45th St., New York 17, N. Y., has available a 60-page booklet titled "The 400 American Standards in the Electrical Field," which indexes and describes each American standard in the area of electrical engineering. It is designed essentially to help the user or prospective purchaser to find applicable standards on products in which he is interested. The book also contains general information on the work of the ASA, the Electrical Standards Board and the International Electrotechnical Commission. Copies will be mailed without charge until the supply on hand is exhausted. **J-5**

• **Triplett Electrical Instrument Co.,** Bluffton, Ohio, presents in Catalog 120 detailed information as well as photographs covering major pieces of Triplett test equipment for radio receivers, audio devices, and black-and-white television equipment. A copy of the 2-color 16-page booklet may be obtained from local Triplett representatives or by writing direct. **J-6**

• **Sun Radio & Electronics Co., Inc.,** 650 Sixth Ave., New York 11, N. Y., now has available for free distribution to industrial users, schools, laboratories, government bureaus, and radio and TV broadcasters the first edition of Catalog 56, a directory of radio and electronic supplies. A triple-index system enables a user to locate any part, by manufacturer, specific product, or general category. To avoid confusion, original manufacturers' part numbers are used. A copy of Catalog 56 may be obtained free by writing on your company or professional letterhead. **J-7**

The British Electronics Industry is making giant strides with new developments in a variety of fields. Mullard tubes are an important contribution to this progress.

Britain's foremost pentode for 25W high fidelity equipment

The Mullard EL34 can be rightly acclaimed as the most efficient high fidelity output pentode tube yet produced in Britain. It is being fitted in many of the British sound reproducing equipments which are becoming increasingly popular in the United States and Canada.

Used in push-pull ultra-linear operation (distributed load), two EL34 tubes will give 32 watts output at a total distortion of less than 1%. The application of negative feedback reduces distortion even further.

The EL34 is equally capable of supplying higher power outputs where an increased distortion level is acceptable. Under class B conditions, 100 watts are obtainable from a pair of EL34 tubes in push-pull for a total distortion of 5%.

Another significant feature of this tube is its high transconductance value of 11,000 μmhos, resulting in high power sensitivity and low drive requirements.

Supplies of the EL34 are now available for replacement purposes from the companies mentioned below.

Principal Ratings

Heater
6.3V, 1.5A

Max. plate voltage
800V

Max. plate dissipation
25W

Max. screen voltage
425V

Max. screen dissipation
8W

Max. cathode current
150mA

Base
Octal 8-pin

Available in the U.S.A. from:—
International Electronics Corporation,
Dept. A1, 81 Spring Street, N.Y.12,
New York, U.S.A.

Available in Canada from:—
Rogers Majestic Electronics Limited,
Dept. HE, 11-19 Brentcliffe Road,
Toronto 17, Ontario, Canada.

Mullard ELECTRONIC TUBES

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MULLARD OVERSEAS LTD., CENTURY HOUSE, SHAFTESBURY AVE., LONDON, ENGLAND

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MEV35

EDITOR'S REPORT

OUTLOOK FOR 1956

SINCE IT HAS ALWAYS BEEN the custom for those in spots where they might be expected to have some inside information to engage in the gentle art of prognostication at the beginning of the year, we shall assay a step in that direction. And while we may be expected to have the "inside information," we hasten to disclaim any such favored distinction—we shall only guess just as you—and you and you—can do.

Predictions about the future run from the ridiculous to the ultra-optimistic, usually. In many instances they result from the predictor having an ax to grind, which is better than plain Pollannaism because one can generally spot the ax if he looks carefully. Pure optimism for the sake of saying something pleasant is less excusable—if there is a bitter pill in the offing, let's know about it as soon as possible so we may prepare for it.

From our editorial "ivory tower" we are sometimes privileged to learn about new developments before they are generally announced—and about these we are duty bound to maintain a rigid silence. Anything said herein may thus be considered to be speculative, and not indicative of anything *known* to be scheduled for early unveiling. These comments are merely the opinions developed by observation of trends in design throughout the audio field as exhibited during the past year.

Phonograph equipment. Much as we regret the coming of another speed in the already-too-many-speeded phonograph field, it appears that we will be exposed to 16⅔ rpm before long. It has already been announced for Highway Hi-Fi—"Muic in your Buick" it might be if General Motors had introduced it instead of Chrysler. (With less intelligent design it might have been a "Scrambler in your Rambler.") And while we may possibly be subjected to sufficient sales talk to convince us that the lower speed is "just as good" as our present LP's, anyone who has ever heard a good recording of 78 microgroove knows that the higher speed has it all over the LP for response. We don't expect it, but we would welcome 78 microgroove releases for super-hi-fi recordings over any further lessening of turntable speed. If for no other reason, the difficulty of obtaining a wowless speed at 16⅔ rpm should be enough to unsell any music lover for his high-quality listening system, especially with changers or low-priced turntables.

Amplifiers. The trend in amplifiers would seem to be for higher power for those who want the best, with 50 or 60 watts becoming the standard in top-quality systems. Simpler 10-watt amplifiers should take over the smaller-system market, with a minimum of complexity in the control department. Since many newcomers to the hi-fi fold will be buying only LP's, a single phono position should suffice on the amplifier, provided a well-designed tone control circuit is built into the unit.

Loudspeakers. From what we have heard in the way of performance of electrostatic high-frequency units already shown, and from what we have heard in the way of rumors of units to be introduced soon (not secret), we are inclined to the belief that the electrostatic will emerge as the top-quality speaker with a full range down to the lowest required. They will be bulky, and undoubtedly they will be expensive, but they will open up a new vista in realistic reproduction. We'll give this one two years. For the middle-fi market, however, we expect the trend toward smaller and more effective cabinets to grow. Some are doing excellent jobs now, and undoubtedly more will become available.

Tape recorders. It is in this field that the greatest gains in usage may be expected. As more and more people become interested in high-quality music reproduction, the versatility and excellent reproduction of the tape recorder will become a desirable addition to the music system. We do not believe that recorded tape will replace the phonograph record until some simple and workable mechanism is developed that will handle a 30- to 45-minute roll of tape in a magazine form. When that comes, we can soon after expect a changer for the tape magazines. But this observer cannot see the lady of the household becoming familiar enough with present-day tape recorders to use one regularly for music reproduction. Record changers are so much easier to load and operate, and over three hours of entertainment can be had with one loading of LP's. We would like to see more tape recorders available as units suitable for building into hi-fi systems easily and effectively. The advantages of tape recorders are not shown off best with even a multiplicity of 3- to 6-inch speakers enclosed in whatever space remains after the tape transport mechanism and amplifier gets put into a 1.5 cu. ft. carrying case.

Radio tuners. We can't see how many of these could be improved upon—some are pretty close to perfection now. Perhaps they can be reduced in cost, since a good tuner now costs more than many a complete radio console which includes a "power" amplifier, speaker, and cabinet.

And that, dear readers, constitutes our outlook on 1956. Some is the result of observing trends, some from projecting what we are told about equipment now, and some pure wishful thinking. Perhaps we may see fit to remind readers a year from now of what we say here. Or perhaps we will recall all January, 1956, issues and rewrite the Editor's Report.

TRUTH IN ADVERTISING?

We have almost given up noticing the new products which are called "high fidelity" since they now seem to encompass everything manufactured—although we don't remember seeing any high fidelity cornflakes . . . yet. However, we have been hearing radio commercials describing a phonograph in, substantially, the following terms: any record sounds better on a . . . response to 50,000 cycles . . . three speakers for true stereophonic reproduction.

Must have our secretary remind us to drop around to the nearest discount house and hear one some time.

the first really new pickup in a decade

THE

fluxvalve

PICKUP

Made by perfectionists—for perfectionists. The FLUXVALVE is literally the cartridge of the future, its unique design meets the demands of all presently envisioned recording developments, including those utilizing less than 1 mil styli.

There is absolutely nothing like it! The FLUXVALVE Turnover Pickup provides the first flat frequency response beyond 20kc! Flat response assures undistorted high frequency reproduction — and new records retain their top "sheen" indefinitely, exhibiting no increase in noise . . . Even a perfect stylus can't prevent a pickup with poor frequency characteristics from permanently damaging your "wide range" recordings.

With this revolutionary new pickup, tracking distortion, record and stylus wear are reduced to new low levels.

The FLUXVALVE will last a lifetime! It is hermetically sealed, virtually impervious to humidity, shock and wear...with no internal moving parts.

The FLUXVALVE has easily replaceable styli. The styli for standard and microgroove record playing can be inserted or removed by hand, without the use of tools.

For a new listening experience, ask your dealer to demonstrate the new FLUXVALVE...words cannot describe the difference...but you will hear it!

"FOR THOSE WHO CAN HEAR THE DIFFERENCE"

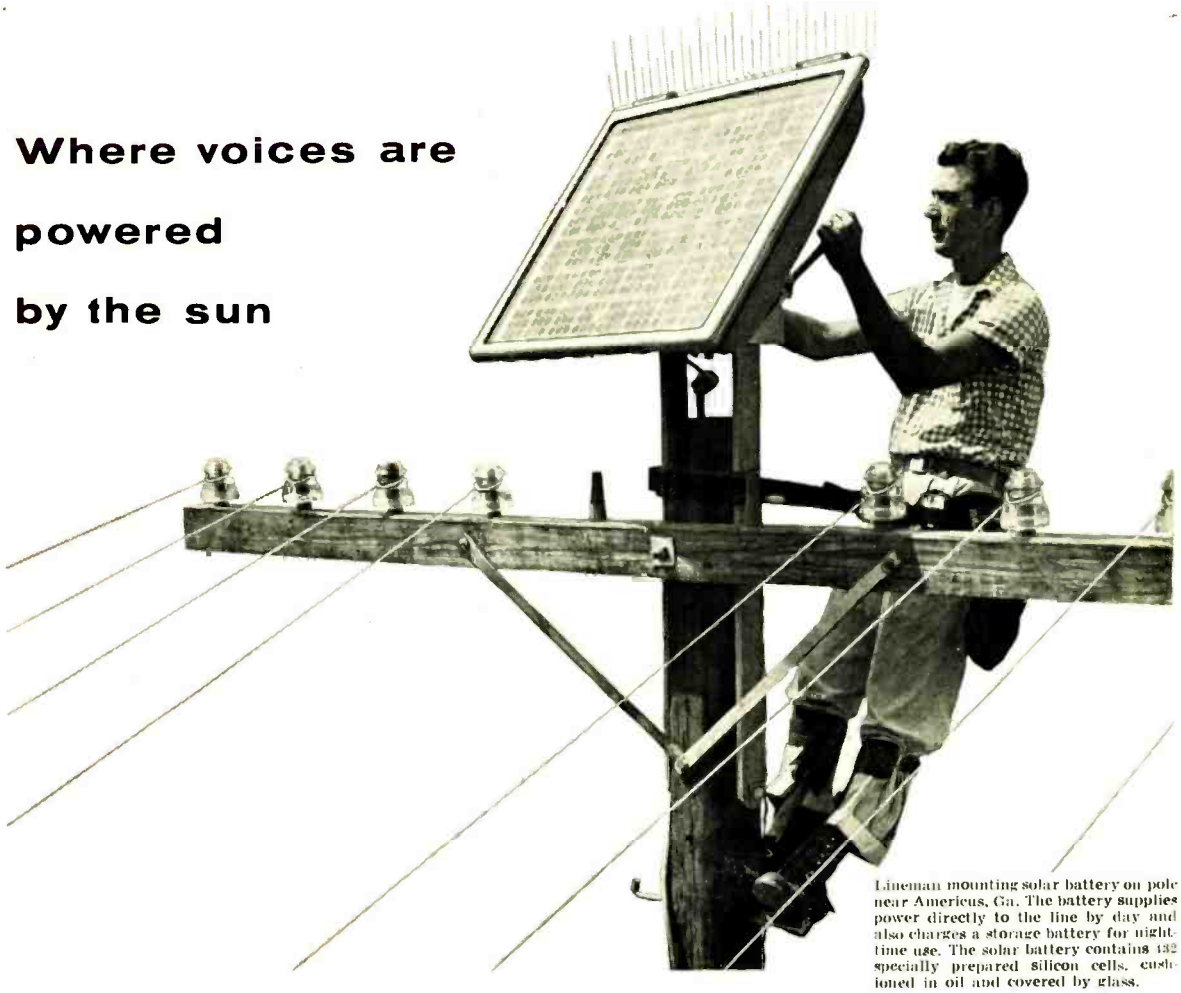
PICKERING & CO., INC.

OCEANSIDE, LONG ISLAND, N. Y.

PIONEERS IN HIGH FIDELITY

...Demonstrated and sold by Leading Radio Parts Distributors everywhere. For the one nearest you and for detailed literature: write Dep. **A-9.**

Where voices are powered by the sun

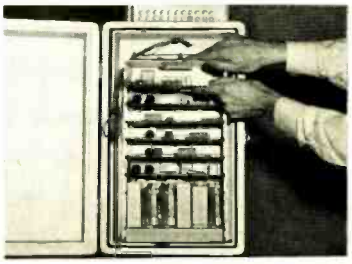


Lineman mounting solar battery on pole near Americus, Ga. The battery supplies power directly to the line by day and also charges a storage battery for night-time use. The solar battery contains 432 specially prepared silicon cells, cushioned in oil and covered by glass.

A new kind of telephone system developed by Bell Telephone Laboratories for rural areas is being operated experimentally by electric current derived from sunlight. Electric current is generated as sunlight falls on the Bell Solar Battery, which a lineman is seen adjusting in position.

The exciting achievement is made possible by two Laboratories inventions—the solar battery and the transistor. The new system uses transistors to the complete exclusion of electron tubes. Transistors require little power and this power can be easily supplied by the solar battery.

Compact and economical, the transistorized system can carry several voices simultaneously without interference. It has proved its ruggedness by standing up to heat, cold, rain and lightning. It promises more and improved telephone service for rural areas and it typifies the Laboratories' continuing efforts to make American telephony still better each year.



In sending and receiving terminals, transistors are used as oscillators, amplifiers and regulators, and for signaling.

One of the transistors (actual size) used in the new system. New ideas, new tools, new equipment and new methods had to be developed for this project.

BELL TELEPHONE LABORATORIES

IMPROVING AMERICA'S TELEPHONE SERVICE PROVIDES CAREERS FOR CREATIVE MEN IN SCIENTIFIC AND TECHNICAL FIELDS

High-Quality Dual Channel Amplifier

Cdr. CHARLES W. HARRISON, Jr.*

A qualitative description of a preamplifier, high impedance R-C dividing network, and power amplifier that are intrinsically simple—yet capable of great performance.

A HIGH-QUALITY AMPLIFIER must be capable of passing rigid laboratory measurements, meet all listening requirements, and be simple and straightforward in design in the interest of minimizing performance degradation and eventual maintenance difficulties.

The circuits of the preamplifier, high-impedance dividing network, and power amplifier described in this paper are not fundamentally new; they represent a synthesis of well-known component circuits of recognized excellence.

In general, the playback system was evolved a "block" at a time after extensive experimentation and listening tests. Each unit had to "test" well, i.e., possess appropriate frequency response, adequate voltage or power output, low distortion and hum level, and then "sound" right when used as an integral part of the sound system. Any unit not meeting these criteria was rejected.

The preamplifier shown schematically in *Fig.* 1, consists of a type 6J7 input tube, followed by two type 6SN7 tubes. "Local" feedback is effective in all stages except the first; however, it is to be observed that the feedback loop never encompasses more than two stages. Unconditional stability, low output impedance and the minimization of distortion is thereby assured. The type 6J7 input tube was selected because it is reliable and quiet in operation. It does not generate periodic "frying" noises and the hum level output is acceptably low. In addition the tube fits a standard octal socket having lugs of sufficient mechanical strength to support one end of a resistor or capacitor. The first stage serves exclusively as a voltage amplifier. No equalization is accomplished. It has been the writer's experience that most preamplifiers featuring a frequency-selective feedback circuit for equalization which connects to the cathode end of the bias resistor of the input tube generate an intolerable hum in any reproducing system capable of good bass response. This statement is sometimes true even when complicated d.c. heater supplies are employed. It appears mandatory that one employ a large bypass capacitor across the bias resistor. Preamplifiers utilizing the method of "contact bias" are rejected because of the excessive intermodulation distortion developed in such circuits. (This bias method permits the direct grounding of the input tube cathode.) The distortion in the 6J7 stage is low even without feedback because the signal voltages rarely exceed 100 mv rms. If desired, the low-distortion input amplifier stage described later may be used, provided the entire bias resistor is heavily bypassed and the volume control is replaced by a resistor matching the pickup impedance.

Frequency correction of 6 db per octave below approximately 500 cps is accomplished by the passive R-C circuit shown between the 6J7 and first triode of the following 6SN7. The second triode furnishes some amplification and permits the application of negative feedback around the two stages associated with this tube. Following the volume control, a 36 position R-C equalizer appears. The maximum bass rise or cut is 12 to 15 db. At high frequencies the available rise is 3 to 5 db, and the cut is approximately 12 db. No interaction exists between the bass and treble sections of the equalizer.

* *Cdr., USN. Electronics Officer, Staff, Commander Operational Development Force, Norfolk 11, Va.*

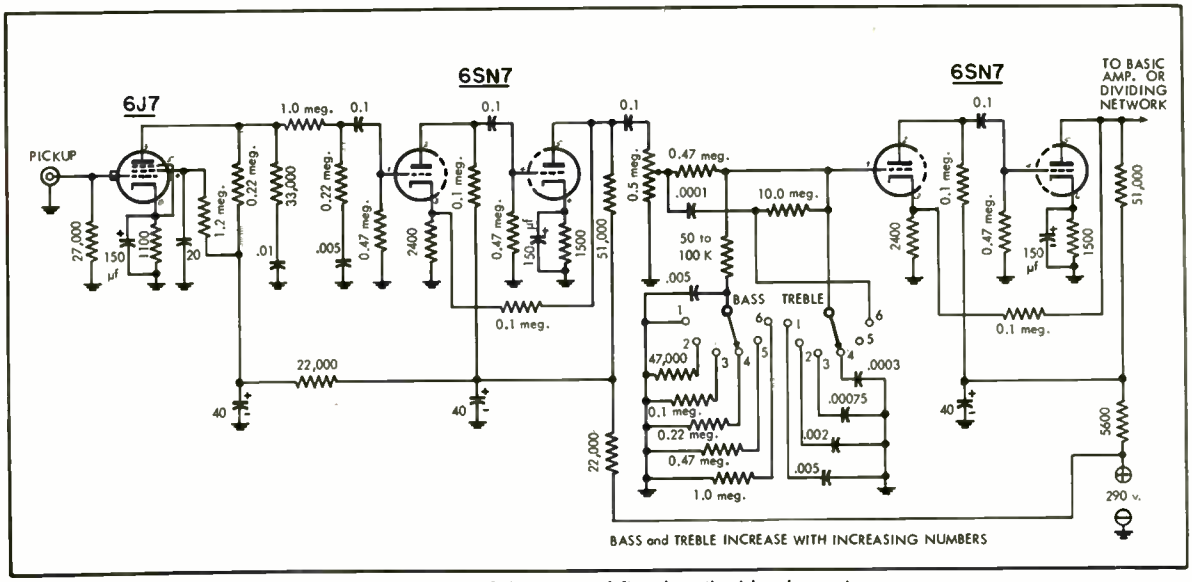


Fig. 1. Schematic of the preamplifier described by the author.

The resistor marked 50,000–100,000 should be selected on the basis of bass equalization required. Bass progressively increases as its value is reduced. The equalizer is followed by a two-stage amplifier, using a second 6SN7. Voltage-controlled feedback is applied around these two stages to minimize distortion and yield low output impedance. A cathode bypass capacitor is used in the output stage to eliminate degeneration at this point which would tend to raise the output impedance. If desired a cathode-follower output stage may be added to this preamplifier provided the power amplifier to be used in not high gain; otherwise hum problems are sure to be encountered. If feedback is not required around the first half of the 6SN7, the second half may be wired as a cathode follower. With slight circuit redesign, type 12AY7 low-noise dual triodes could be used in lieu of the 6SN7 tubes. If an FM tuner input is required, a two-position shorting-type switch should be installed adjacent to the volume control on the left.

The hum level of this preamplifier is extremely low. From experience the author can report that nothing is gained in this respect by the employment of d.c. on the tube heaters. It has been found that less than one-third of the equalizer positions available are needed in practice to compensate for the various recording characteristics in use.

This preamplifier does not feature built-in AES, NAB, RIAA (new orthophonic) response characteristics. The philosophy of precise preamplifier equalization which fails to take into account the frequency response of the pickup, power amplifier, and speaker to be employed is a mystery to the writer. System, rather than component engineering is required. As a practical example, suppose that the AES playback characteristic is specified for a given recording and that this response curve is built into the preamplifier. Excellent results will undoubtedly be obtained provided the pickup, power amplifier, and speaker are flat. Now let it be assumed that the speaker (high-frequency driver in a dual loudspeaker) is down 12.5 db at 12,000 cps, which is not at all unusual. The program material in this frequency region is now attenuated by some 12.5 db more than required by the AES playback curve. Percussion instruments will appear to be in the background, a condition not acceptable to a person who enjoys "high-highs." To approximate the AES play-back curve for a given sound system may actually require a preamplifier having essentially flat response above 500 cps; the high-frequency pre-emphasis used in recording being more or less offset by the high-frequency rolloff of the loudspeaker and pickup being employed. In addition to the factors mentioned above affecting preamplifier equalization, the influence of listening room acoustics must be given due weight.

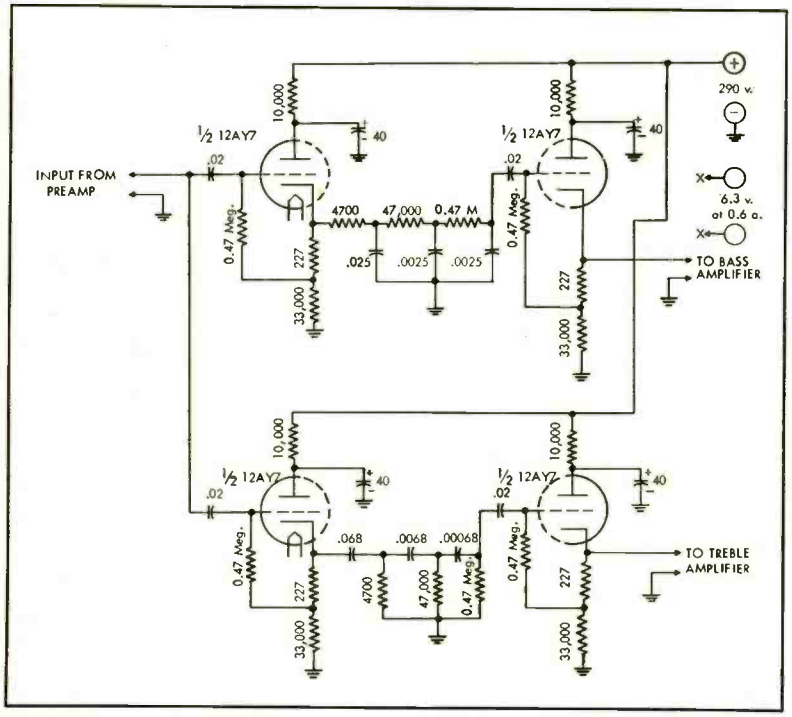


Fig. 2 Schematic of the high-impedance R-C dividing network between the amplifier and the inputs to the two power amplifiers.

A dual-channel amplifier has several advantages over a single amplifier for driving a dual loudspeaker. The use of a distortion-producing dividing network at high signal levels is avoided, as is the power-consuming attenuator normally required in the high-frequency channel to obtain bass and treble balance. The divided transmission system permits exact impedance matching between amplifiers and speakers and additionally permits one to obtain optimum generator impedance in driving the bass and treble speakers. This is generally impossible when a dividing network is interposed between an amplifier and dual loudspeaker. This scheme is a good way of achieving linear transmission of low frequencies (such as emanate from drums, gun shots, explosions, and thunder) together with linear transmission of high frequencies (such as emanate from triangles, castanets, cymbals, and tambourines), without severe modulation of high frequencies by the low frequencies.

The circuit diagram of an R-C dividing network employing cathode follower input and output stages is shown in *Fig* 2. Two type 12AY7 tubes are used; one in each channel. The values of capacitors and resistors shown result in an 800-cps crossover. If, for example, a crossover frequency of 500 cps is desired, the values of the filter capacitors should be multiplied by the ratio 800/500. The resistors do not change value. Similarly, multiplying the capacitor values by 800/1500 yields a crossover frequency of 1500 cps. Each R-C section of both filters should be adjusted to be down 1 db at 800 cps (for 800-cps crossover) by padding the appropriate capacitor and resistor so that the total attenuation for all three sections in cascade is 3 db. The low-frequency filter provides an attenuation approaching 18 db per octave above the crossover frequency, and the high-frequency filter provides an attenuation approaching 18 db per octave below the crossover frequency. By actual measurement on the R-C dividing network constructed by the author, the low-frequency filter is down 11 db at 1600 cps and the treble filter is down 11 db at 400 cps. Thus the attenuation afforded by the three-section R-C filters is 11 db in the first octave, the crossover frequency being taken as reference. The input impedance of the dividing network is extremely high. The output impedance of each channel is low, permitting the use of rather long cables to the bass and treble power amplifiers without deleterious effect on the high frequencies. Ten volts rms will not over-drive the dividing network. If the network is used in conjunction with power amplifiers like the one to be described in the following section the operating level need not exceed one-half volt. Thus essentially distortionless operation is assured.

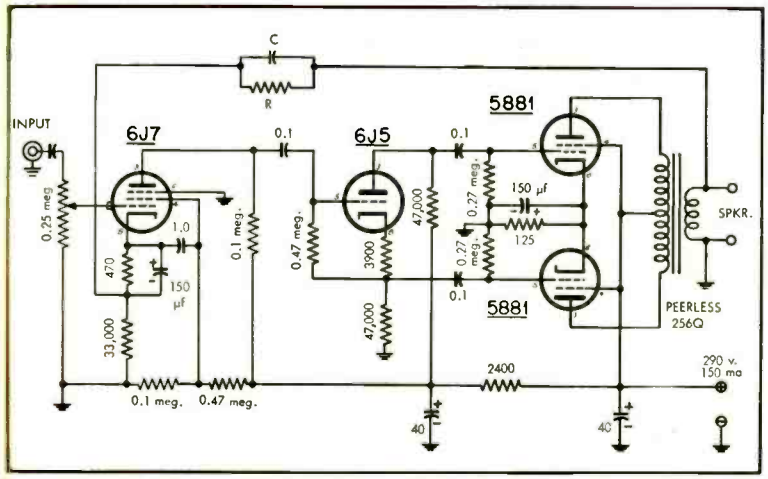


Fig. 3. Schematic of the power amplifier. Values of R and C in the feedback circuit are discussed in the text.

A schematic of the basic or power amplifier is shown in *Fig.* 3. The tubes employed are 1-6J7, 1-6J5 and 2-5881. Using tubes selected at random the amplifier is capable of delivering 10 watts at under 1 per cent intermodulation distortion; 12 watts at under 3 per cent. An 18-watt power output is available over the frequency range 20 cps to 140 kcs (by appropriate adjustment of the input voltage) without visible wave form distortion (estimated at under 3 per cent harmonic distortion). The amplifier is absolutely flat at 12 watts output from below 20 cps to 55 kcs for constant-voltage input, dropping to – 2 db at 125 kcs; – 5 db at 175 kcs and – 6.5 db at 200 kcs. One half volt rms will drive the unit to full power output. It will deliver 12 watts for 0.38 volts rms drive. These performance data are based on the use of 10 db feedback.

The component values, i.e., resistors and capacitors associated with the 6J7 voltage amplifier, were selected to minimize intermodulation distortion. It was found desirable to use a voltage divider to obtain screen voltage and to bypass the screen to the cathode of the tube. The bias resistor is almost entirely bypassed; only a small portion of the total resistance being left unbypassed for the application of negative feedback.

The phase splitter, employing a 6J5, is an excellent method of coupling a single-ended plate circuit to a push-pull grid circuit. (A phase splitter, as well as a cathode follower, is defined for later usage as "one-half" stage.) This circuit is self-balancing, and distortion is low. Any unbalance effects at high frequencies are generally negligible.

The output stage features the use of a Peerless type 256Q 20–20 plus transformer. Note that the bias resistor for the push-pull type 5881 tubes has a value of 125 ohms. The 5881 tube is similar to Western Electric type 350B and are interchangeable. Both have "power filaments" in that 1.8 amperes at 6.3 volts is required for cathode heating.

Feedback is applied around the "2.5" stages; the required voltage being taken from the secondary winding of the output transformer. The values of R and C in the feedback circuit must be selected by test. The value of R controls the amount of feedback (usually expressed in db), and C controls the high-frequency ringing, i.e., for the purpose of damping out any small oscillations that may appear on the leading edge of a square wave. The equipment needed to determine the proper value of R and optimum value of C is: a vacuum tube voltmeter and a sine and square wave generator. It is customary to load the amplifier by a resistor equal to the nominal load impedance of the amplifier when choosing the correct values of R and C, rather than use the loudspeaker as load. Optimum generator impedance can be obtained by varying the value of R in the feedback path and conducting simultaneous listening tests. As R is increased the value of feedback is decreased.

This power amplifier is basically simple and utilizes the minimum number of stages required to do the job effectively. Although feedback is applied around "2.5" stages the amplifier is stable with feedback values up to at least 30 db. Many of the popular circuits of today feature the application of large values of feedback around "3.5" to 4 stages. This is an invitation to serious trouble. Marginal stability obtains and at some signal levels violent subsonic and supersonic oscillations may be generated. Even though these frequencies may not be heard, i.e., they fall outside the audio spectrum, the power delivering capability of the amplifier is largely consumed. Thus little "clean" power is available in the frequency range of interest. This principle is too frequently overlooked in practice. The power amplifier will deliver a clean signal over its entire frequency range even without feedback. This is not true of one well known circuit which utilizes 20 db of feedback. A sine wave input at 60 kc is likely to appear at the load terminals as a series of triangles!

The writer is of the opinion that an otherwise essentially distortionless amplifier does not require the application of large values of feedback. The use of 20, 40 or 90 db feedback is nonsense. Values of 10 to 15 db voltage-control feedback are adequate for two important reasons:

(a) *Instability tendencies are reduced.*
(b) *The experimentally observed bass loss in the frequency region of speaker resonance is minimized.*

It is interesting to note that the designers of theater sound equipment restrict the use of feedback to the 10 or 15 db level.

There may be protests to the effect that the equipment described in this article is not an "all triode" playback system. It would seem meaningless to insist on the exclusive use of triodes in amplifiers until records are available bearing the label "We guarantee all electronic equipments used in making this recording were fitted throughout with triode vacuum tubes." Note also that AM, FM, and TV stations will never measure up to the standards of the perfectionist who insists on the utilization of triode vacuum tubes in every tube application.

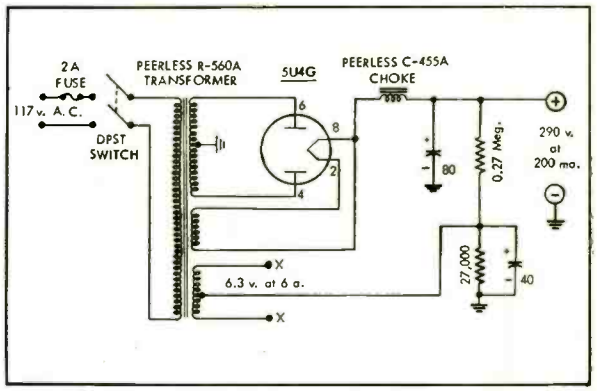


Fig. 4. Power supply schematic. Note that it is of conventional design.

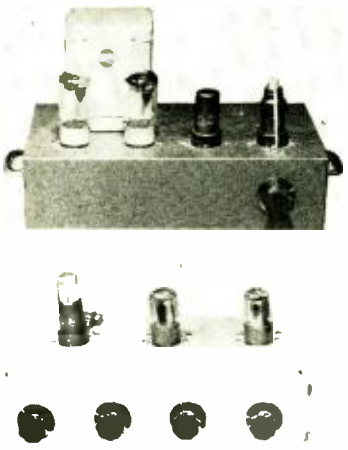


Fig. 5. Above, the preamplifier; below, the power amplifier. "Building block" construction makes for flexibility.

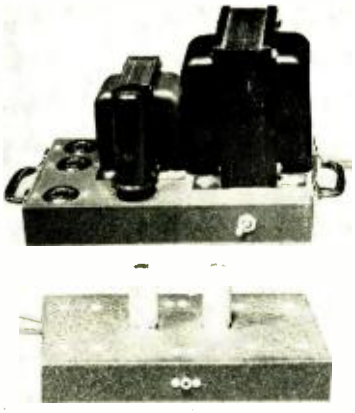
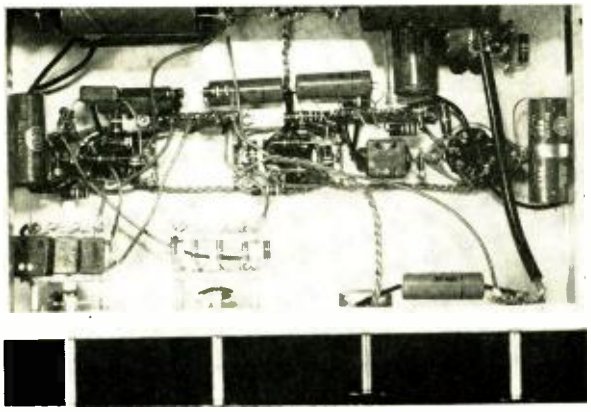


Fig. 6. Above, the power supply is a simple and neat construction; below, the dividing network chassis.

The power supply illustrated schematically in *Fig.* 4 is entirely conventional. It delivers 290 volts d.c. at 200 ma and 6.3 volts a.c. at 6 a. To minimize hum in the playback system, the heater winding is operated at a positive potential of about 29 volts, the center tap of the winding being heavily bypassed to ground. Although often omitted from commercial equipment, the bypass capacitor is a circuit element vital to the successful operation of this hum reduction scheme. Because of the relatively low d.c. voltages required for operation of the preamplifier, R-C dividing network and power amplifier, one may expect that 450-volt electrolytic filter capacitors, if used throughout the equipment, will have exceptionally long life.

The writer believes in building equipment with the best parts available. All coupling capacitors should be rated at 600 volts, and if 0.1 μf and less in capacitance should have a leakage resistance of at least 1500 megohms. The bass



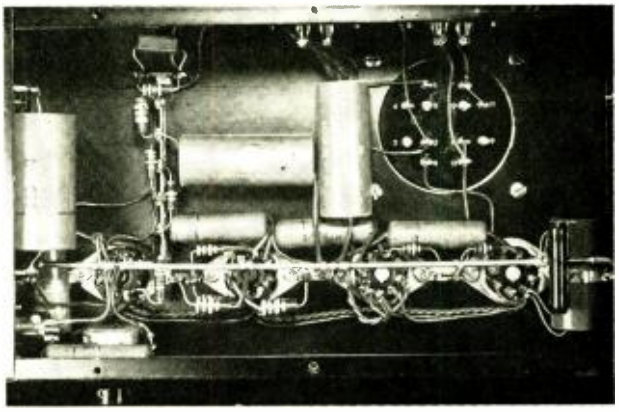


Fig. 7. Above, left, bottom view of the preamplifier with the base plate removed to show layout of parts and wiring. Fig. 8. Above, right, bottom view of power amplifier with base plate removed.

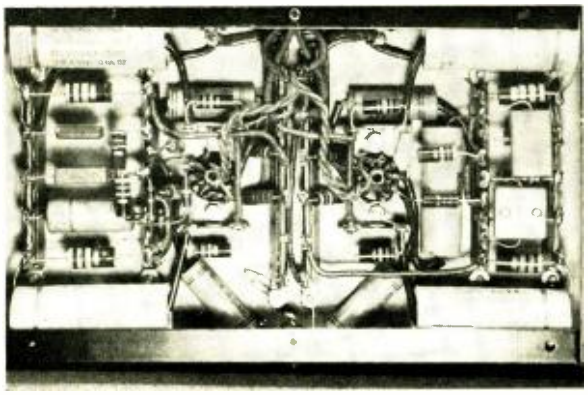


Fig. 9. Underside of dividing network chassis.

and treble controls in the preamplifier should be of the shorting type and feature silver contacts and steatite insulation. Capacitors used in the equalization circuits should be 5-per cent tolerance silver micas (except possibly in the largest sizes). Resistors in these circuits should be within 5 per cent of specified values, or better. Very precise values of resistance and capacitance are required in the filters of the dividing network. In the push-pull portion of the power amplifier the capacitors and resistors used should be selected for balance. The most reliable volume controls that can be obtained should be used, in log-taper form. In general, resistors rated at 1 watt dissipation are adequate, except in the following instances: The 33,000-ohm resistors in the dividing network are 2 watt types as is the 2400-ohm resistor in the power amplifier, and the 125-ohm bias

(*Continued on page 41*)

Disc Recording

SOUND—Chapter 4

EDGAR M. VILLCHUR*

The whys and wherefores of the recording characteristic, together with a presentation of some of the problems involved in making high-quality recordings with a minimum of noise and distortion.

WE HAVE OUTLINED BRIEFLY the functions of each link in the chain of sound reproducing components, from pickup to speaker. It now remains to treat each of these components in some detail, and the reader may have been led to expect a discussion of pickups to follow the last chapter. But pickup design doesn't begin to make sense until the fundamental methods of disc recording are understood.

Variables in Disc Recording

In the earliest days of the commercial phonograph, when recording and reproducing the human voice was for stenographic rather than entertainment purposes, and when the same machine performed both the recording and the reproduction, standardization of record characteristics wasn't important. Records were matched to the playback equipment automatically. The introduction of the prerecorded disc or cylinder, however, which had to be playable on home machines, changed the picture completely.

Features that had to be standardized were:

1. Use of disc or cylinder
2. RPM of turntable
3. Pitch of grooves (number of grooves per inch)
4. Shape of grooves
5. Use of lateral or vertical recording
6. The electrical recording "characteristic"

* *Woodstock, N. Y.*

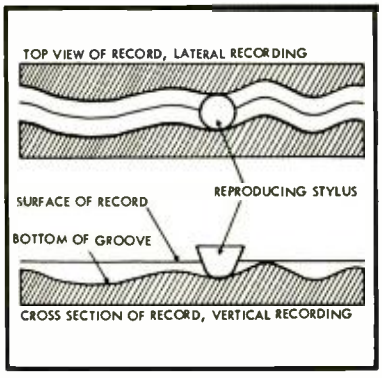


Fig. 4—1. Vertical and lateral recording.

Most modern records are of the disc type, are made to revolve at 33⅓ RPM, are recorded at an average of about 225 grooves per inch, and employ grooves which are shaped to receive a spherical-tip stylus in such a way that the contact is exclusively with the sides and not the bottom of the groove. The recording is of the lateral type, and the recording characteristic seems finally to have been standardized on the RIAA curve.

Lateral and Vertical Recording

The recordings of Young, Scott de Martinville, and Cros were all lateral: the recording stylus moved from side to side in a plane approximately parallel to the record, and inscribed a visible wavy line, a graph of time *vs.* instantaneous stylus position.

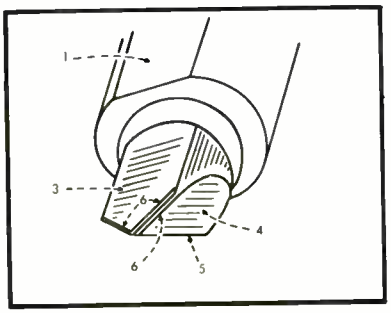


Fig. 4—2. Recording stylus. 1—shank; 3—cutting face; 4—clearance face; 5—back edge; 6—burnishing facets.

The recordings of Edison, on the other hand, were vertical, or hill-and-dale. The vibrations of the recording stylus were in a plane perpendicular to the record, and the groove variations were in depth, up and down rather than from side to side.

These two methods of recording are illustrated in *Fig.* 4—1. Edison was the chief champion of hill-and-dale recording; he used the vertical method in his cylinders and, later, in his heavy discs. Vertical recording gave way entirely to lateral in the commercial home record, but remained fairly popular in broadcast studio use for a while. The death blow to vertical recording was dealt by a classic article on the subject by Pierce and Hunt, which clearly showed that the level of inherent distortion in the record-reproduce process was much lower with the lateral method. The reader may note with satisfaction the power of the just pen.

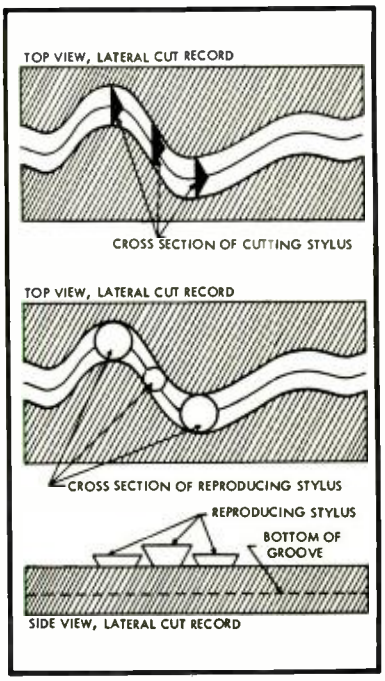


Fig. 4—3. Pinch effect. The recording stylus, of approximately triangular cross section, cuts a groove of varying width. This forces the spherical reproducing stylus up and down twice per cycle.

The main advantage of lateral recording is that second harmonic "tracing" distortion (not to be confused with *tracking* distortion), is drastically reduced or eliminated. Tracing distortion is caused by the fact that the reproducing spherical stylus tip is guided in an imperfect vibrational pattern, by groove walls that were cut by a differently shaped recording stylus. (See *Fig.* 4—2).

In the case of the laterally-cut groove the inaccurate component of the playback needle's vibrations are almost exclusively up and down. This spurious

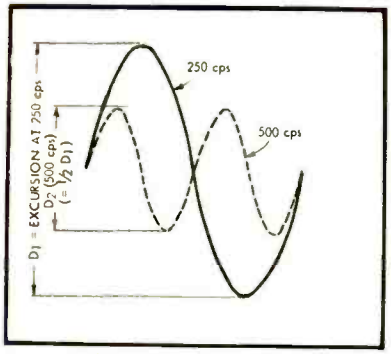


Fig. 4—4. Illustration of the increase of needle excursion at lower frequencies to maintain constant average velocity. At 250 cps the needle travels through only one vibration during the same time that two 500 cps vibrations are accomplished; the distance of travel at 250 cps must therefore be doubled.

mechanical motion, however, is not necessarily translated into an electrical output signal from the pickup. If the pickup has little or no electrical response to vertical stylus motion (a characteristic possessed by modern high-quality pickups, and called "low vertical response"), then the distortion in motion is not allowed to influence the signal.

The channelling of spurious needle vibrations associated with tracing distortion into vertical motion is called pinch effect, and is illustrated in *Fig.* 4—3.

Recording Characteristics

A recording "characteristic" is the curve of frequency response, flat, warped or otherwise, of the recording system; that is, it describes the frequency *vs.* amplitude characteristics of the recorded signal.

In the early days of recording the artist shouted into a horn, and as much of the recording diaphragm vibrations as could be preserved were applied to the wax. There was no problem of what to do with the bass, since so little bass was there in the first place.

There is a definite problem in recordings of wide frequency range, however, with regard to signals at both ends of the frequency spectrum. Both the bass and treble must be doctored in a specific pattern, and for reasons that will be discussed.

Bass Equalization

Below a certain frequency called the *turnover* frequency the bass portion of the recorded signal is progressively attenuated, normally at the rate of 6 db/octave. (This means that the signal voltage of the bass signal is halved, and the bass signal power is reduced to one-fourth, with each lower octave). This is for the purpose of preventing the bass-modulated grooves from cutting over onto each other.

If the vibrations of the recording stylus are to represent equal energy over the frequency spectrum the stylus must have constant average velocity at all frequencies. A little thought will indicate the fact that constant average velocity does not mean constant excursion (distance of travel) at different signal frequencies. As a matter of fact the excursion must exactly double with each lower octave. If the stylus moves from side to side .01 inches at 500 cps, then to record a 250 cps signal at the same average velocity it must move .02 inches.

This is illustrated in *Fig.* 4—4. It may be seen that the average velocity of the stylus is determined by the distance through which it vibrates, divided by the time consumed. Since the time for one

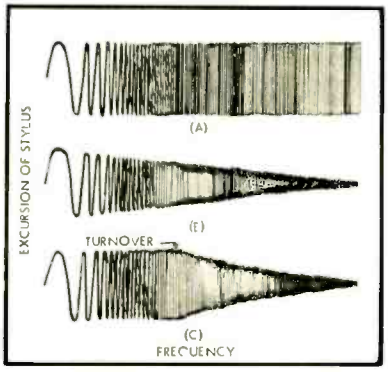


Fig. 4—5. (A) Groove pattern cut with a "constant amplitude" characteristic. (B) Similar pattern cut with a "constant velocity" characteristic. Presently used characteristic, (C) employs a constant amplitude characteristic up to the "turnover" frequency, constant velocity above.

cycle of vibration at 250 cps is double that of the time for one cycle at 500 cps, the distance through which the needle vibrates must also be doubled in a constant-velocity device.

The continual increase of stylus excursion at lower frequencies creates difficulties. It places excessive demands on the recorder cutting head, and the recordist must space his grooves very wide to prevent the large groove deviations of heavy bass passages from overcutting into adjoining grooves. He must either sacrifice playing time by widely spaced grooves, or risk the severe distortion caused by groove cut-overs.

Fortunately there is a solution to the problem, made possible by the versatility of our playback equipment. It is to attenuate the bass at a specified, uniform rate, and to restore the lost bass in playback by equipment which progressively accentuates the lower frequencies, at the same rate and starting at the same turnover frequency. The "equalization" curve of the playback equipment—which is to say its frequency discrimination characteristic—will then be the reciprocal of the equalized pattern into which the recorded signal has been forced. Without any equalization, the amplitude of the recorded grooves would be equal throughout the entire spectrum, as in (A) of *Fig.* 4—5, resulting in what is called "constant amplitude" recording. If equalization is introduced so as to impart a "constant velocity" to the recording stylus, the pattern resulting from a swept-frequency recording is that of (B). Neither of these systems is used in commercial record manufacture, but instead a combination of the two is employed which gives a constant amplitude of the recorded grooves up to the "turnover" frequency, and a constant velocity above that point, as shown in (C). Patterns of the sort shown in *Fig.* 4—5 are made by feeding a constant level to the input of the recording amplifier and sweeping the frequency from the lowest to the highest.

In the usual commercial recording, the low frequencies are equalized to a level which will produce a constant amplitude from the very lowest frequencies up to the turnover point, and above that point they are cut with a constant velocity. Consequently, when using a pickup which has a response proportional to the *velocity* of the stylus, it is necessary to boost the low frequencies, which accounts for the "bass boost" of the usual preamplifier for magnetic pickups—since all magnetic pickups are

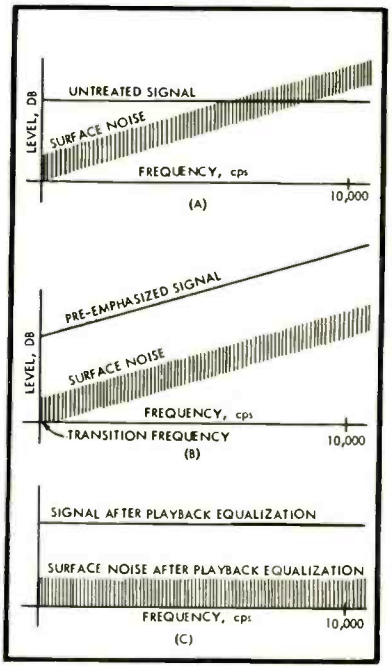


Fig. 4—6. Effect of treble pre-emphasis and playback equalization on level of surface noise relative to signal.

velocity sensitive. Conversely, crystal pickups—which are amplitude sensitive—must be equalized in the high-frequency region in order to produce a "flat" response. Some recent crystal pickups are designed to work into a low resistive load, which reduces their low-frequency response almost to the constant-velocity characteristic so that they work satisfactorily into an amplifier designed for magnetic pickups.

Treble Pre-emphasis

Special difficulties are also involved in recording the high-frequency portion of the signal spectrum. The surface noise that is produced in the course of the needle-record contact is spread quite evenly over the frequency spectrum in terms of *energy per cycle*. This means that each higher octave, containing twice the number of cycles, will have twice as much surface noise. Considering further the increased hearing sensitivity in the higher ranges, the common-sense conclusion must be that record surface noise is primarily a treble phenomenon. This means:

a) The "masking" effect of record surface noise will occur primarily in the treble range. Recorded sound at the higher frequencies will tend to get lost in the mud.

b) An attenuation of treble amplification in the playback equipment will severely reduce the surface noise relative to the total signal.

If the treble frequencies of the recorded program material are progressively emphasized or "boosted," a recorded signal will be created that will sound unnaturally shrill in playback. A reciprocal treble attenuation introduced in the playback chain will make the sound natural again. This record-reproduce procedure is just what is used in modern records, in order to improve the *signal-to-noise* ratio.

The initial progressive boosting of the high frequencies is called treble *pre-emphasis*, and the frequency at which the boost takes hold is called the pre-emphasis *transition* frequency. *Figure* 4—6 illustrates the change in surface noise, relative to the recorded signal, that the pre-emphasis technique brings about. Treble attenuation in playback simultaneously reduces surface noise and corrects the high-frequency level of the signal.

Over-all Recording Characteristic

The over-all pattern of modern record equalization is illustrated in *Fig.* 4—7.

While the principles of bass and treble record equalization have been generally agreed upon for a long time, the best way to introduce such equalization—the turnover and treble transition frequencies, and the rates of attenuation or boost to employ—has been the subject of much disagreement. Recording equalization is a double-edged sword, and can itself cause difficulties. For example, too much treble pre-emphasis increases high-frequency distortion at the same time that it reduces noise, by unduly increasing the sharp, crowded groove excursions required at high frequencies.

For many years there was a variety of recording characteristics in use, and playback equipment had to provide either a single compromise equalization, or facilities for switching from the equalization characteristics of one recording company to those of another. Fortunately agreement seems to have been finally reached by and large, and most modern records use what is known as the RIAA characteristic.

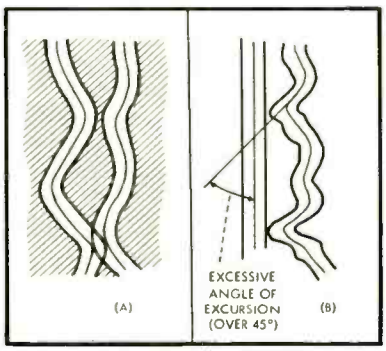


Fig. 4—8. (A) Over-recorded grooves, showing cut-over. (B) Result of over modulation, with excessive angle of excursion.

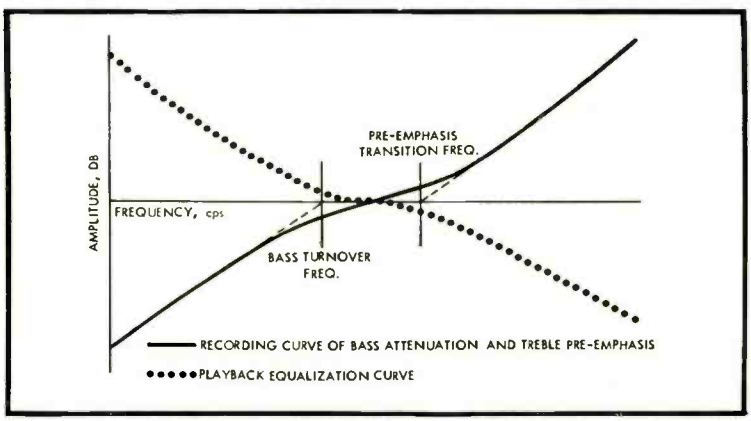


Fig. 4—7. Pattern af recarding and playback equalizatian.

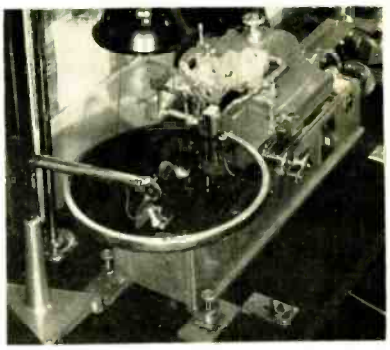


Fig. 4—9. Modern disc recorder—the Scully lathe.

Dynamic Range in Recording

Dynamic range refers to the range of power, from pianissimo to fortissimo, that the reproducing equipment is capable of handling. For disc records it is the ratio of the amplitude of the heaviest recorded signal to the softest.

In a sound reproducing system the upper limit of the dynamic range would be determined by the power capability of the equipment, the lower limit by the noise level. On a disc the upper limit of the recorded dynamic range is determined by the allowable groove excursions, and the lower limit by the surface noise.

In the bass, groove excursions are restricted by the danger of cut-over, as discussed previously, even when there is attenuation below the turnover frequency. In the treble range the groove excursions do not become so great as to involve cutting over into adjacent grooves, but there is another danger, just as serious. The high-frequency groove "wiggles" are very close together, and the greater the excursions of the recording stylus the sharper the corners of the wiggles become. (The condition becomes increasingly aggravated as the inner record diameters are approached). This tends to create a groove shape which cannot be followed faithfully by the reproducing needle, and results in increased distortion and record wear.

The technique of recording with treble pre-emphasis reduces the relative surface noise in the signal, and it would seem that treble pre-emphasis should increase the dynamic range of sound that can be recorded onto a disc. Unfortu-

(Continued on page 53)

Electronic Organ in Kit Form For Home Construction

RICHARD H. DORF*

In Three Parts—Part 2

How the tones generated as described last month are keyed, filtered, preamplified, and "vibratoed" in the Schober Organ.

The tone generators described in last month's article on the Schober Electronic Organ Kits furnish 84 sawtooth tones beginning with low C at 32.70 cps and going up to the high B at 3951 cps. Let us now look at the keyswitch assemblies which channel the right tones to the right places when the organ is played.

When any key is pressed, three different tones are switched, corresponding to either 4-, 8-, and 16-foot or 2-, 4-, and 8-foot pitches. These pitch registers are normal in pipe-organ work. The 8-foot or unison pitch corresponds to the normal pitch of the key pressed; the 4-foot or super register gives a tone one octave above unison and 2-foot two octaves above; and 16-foot pitch is one octave lower than normal for the key.

Figure 9 shows the schematic diagram of the switching system for five G notes of the great or lower manual. Each switch consists of three horizontal fingers normally in the down position so that they do not strike the bus wires which are at right angles to them and run the length of the organ (left-right). When the G3 key (G just above middle C) is pressed the three fingers of the G3 switch rise, each striking one of the lengthwise busses. The center finger carries tone from the generators at a frequency of 392 cps, which corresponds to the normal pitch of G above middle C, and this tone is thus introduced into the center or 8-foot bus. Simultaneously the lower finger, which carries tone from the generators an octave below puts this tone on the 16-foot bus, and the upper finger puts tone an octave above 8-foot on the 4-foot bus.

The same generator tone is obviously used for more than one key switch. The same tone carried to the G3 center finger for 8-foot register is also used by the G2 upper finger as 4-foot tone and by the G4 lower finger as 16-foot tone. Between the generator and each switch finger there is an isolating resistor which prevents interaction and any "robbing" or lowering of the volume of one tone when another is also used, through additional loading on the generator.

The actual circuitry is exactly as shown in *Fig.* 9 except that there are twelve times as many 3-finger switches as shown, one set of five for each of the 12 notes of the chromatic scale. There is also an extra switch at the top for the highest C, since there are six C's on the standard organ manual. Each of the three output busses carries a complete rendition of the selection being played, the only differences being that if an amplifier were connected to the 4-foot bus the music would be heard an octave higher than if connected to the 8-foot bus and two octaves higher than if connected to the 16-foot bus. Precisely the same scheme is carried through on the swell (upper) manual, except that there is a 2-foot bus and no 16-foot bus.

It is interesting to note that on the Schober Organ no system for eliminating key clicks is necessary. Ordinarily, when audio is keyed there is a click when the switch is closed; this is very destructive to musical values. *Figure* 10 shows how the click arises. Assuming that, for instance, a sine wave is being switched from its source to the grid of a tube, the switch may be closed during some part of the time when the wave is not at its zero axis. (The statistical probability of this is extremely high, since the wave passes through zero only at two brief instants.) Grid voltage then changes from its quiescent value instantaneously to some other value, and of course plate current does the same. The almost infinitely steep rise time of this sudden change is in effect a portion of a wave containing an infinity of high-frequency components. These components are heard as a click. In other organ designs it has

* *Electronics Consultant, 255 West 84th St., New York 24, N. Y.*

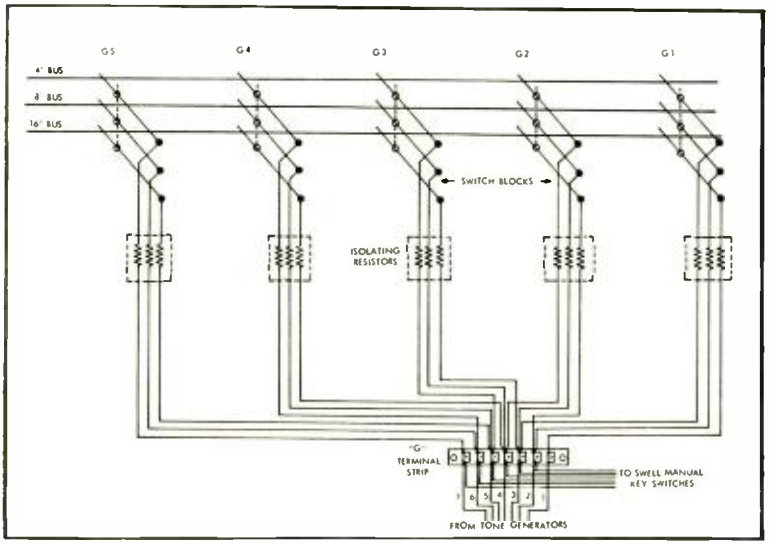


Fig. 9. Simplified schematic of keying circuit for the five G keys on the great manual. This circuitry is duplicated for each of the twelve keys of the octave, except that there is an additional set of contacts for the top C.

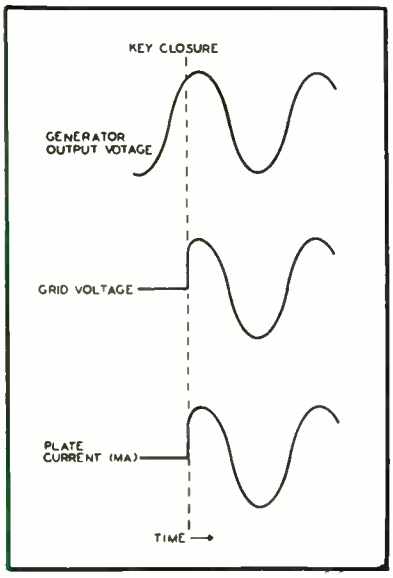


Fig. 10. Effect of keying a sine wave tone, resulting in key clicks in the output.

been found necessary or desirable to place capacitive low-pass filters across the switching systems, use gradual resistive keying, or to key plate voltage on an oscillator rather than direct audio to eliminate or reduce the clicks.

The secret of the Schober's clickless keying is simply the generated waveform. The sawtooth has a very fast flyback—almost perfectly vertical, as can be seen in the drawing of *Fig.* 11. The filter system is designed to take care of this—it can take advantage of the high-frequency components in imparting brilliance to stops that require it and can roll off the highs for less brilliant stops. When the sawtooth tone is keyed at some point in its rise, the vertical rise added by the keying is just like the vertical part of the sawtooth itself, and the filters treat it the same, To say it another way, each wave of a good sawtooth has a built-in key click. When you add another by closing a switch, neither the circuitry nor the ear can tell the difference.

From a puristic point of view there is always, of course, a transient when a switch is closed in that there is a change in the output signal from zero cps to some finite frequency. This frequency transient or discontinuity is not subject to remedy, but fortunately it is practically inaudible.

The switch components themselves are shown in *Fig.* 12. At the right are five of the plastic switch blocks, each with three cured-in fingers of a "springy" silver alloy. At left are the etched bus strips, printed circuits carrying a thin gold wire. These strips are piled up and the switch fingers placed between them. One end of the finished assembly (before wiring) appears in *Fig.* 13. The small phenolic actuators project up when the assembly is mounted beneath the keys at the rear, and the keys press the actuators down keeping the switch fingers clear of the busses. When a key is played, its rear comes up, the actuator is released, and the fingers make contact.

Connections are brought to the switch fingers by means of small etched-circuit panels like the one shown in *Fig.* 14. As the rear view of this panel (*Fig.* 15) shows, the isolating resistors are mounted on it. The whole card is then slipped over the fingers of three adjacent switches (note the nine holes at top) and the fingers are soldered to the foil. Twenty such panels are used for each manual, plus one more with room only for the three resistors and one switch for the high C.

Figure 16 shows a portion of a completed great-manual switch assembly. There are twelve 7-terminal blocks at bottom from which wires go to the twelve tone generators. The wiring harness between the resistor panels on the switches and the terminals is "laced" by a new method especially developed for Schober by C. G. McProud. A plastic book binder is screwed to the metal channel and all wiring is threaded through the flexible plastic rings. This keeps each wire in place as the work progresses and is left in place at the end so that the customary waxed-cord lacing technique is unnecessary.

Wiring the key-switch assemblies is, of course, one of the most time-consum- aspects of the organ construction. However, the instructions have been worked out so that a simple and unmistakable procedure and a chart make the work compound—a number of small, simple, similar operations—rather than complex.

The pedal key switches are of the more rugged flat-blade type and have only two output busses, 8- and 16-foot, but the scheme is electrically the same. This is placed permanently in the console. The pedal clavier is a self-contained mechanical unit and it is simply pushed into place so that the ends of the pedals overhang the switch blades. In this way

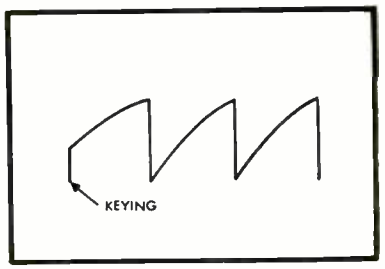


Fig. 11. Keying a sawtooth wave only adds another vertical transient to the many already existing.

necessity for extending wiring outside the console is eliminated. Novel methods of providing mounting lugs for the pedal isolation resistors and the use of large screw-eyes as a substitute for lacing make pedal-switch wiring again a succession of simple operations.

The metallic material used for key switches is a problem in organ design. Low-level audio is always critical to key since the slightest uncertainty of contact results in either noise or complete failure. For this reason silver-against-silver contacts are simply unusable, as is, in fact, any normal coin-silver contact. In the manual key switches the special silver alloy of the fingers does not corrode; neither does, of course, the gold used for the bus wires. In the pedal switches special palladium contact points are employed.

Each of the keying output busses is terminated in a maximum of 1800 ohms to ground. The resistors for termination are on the balance controls, and adjustment of these switches effectively varies the terminating resistances. In the normal position of the Manual Balance Control, all great and swell busses terminate in 1800 ohms. In the clockwise positions the swell termination is reduced so that the great produces relatively more output. In the counterclockwise position the reverse is true. This arrangement takes the place of separate swell shoes for the two manuals, reducing cost and making the organ easier to play. The pedal bal-

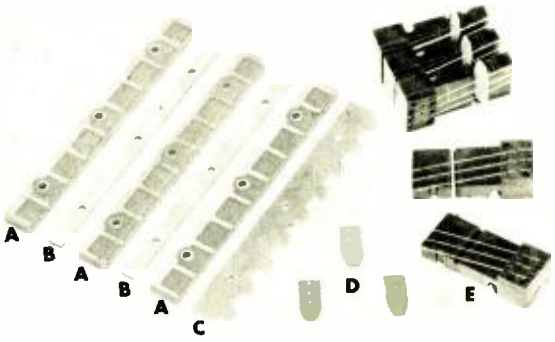


Fig. 12. Key switch parts. (A) Etched bus strips, with gold contact wire; (B) spacers; (C) location strip; (D) switch actuators; and (E) switch blocks.

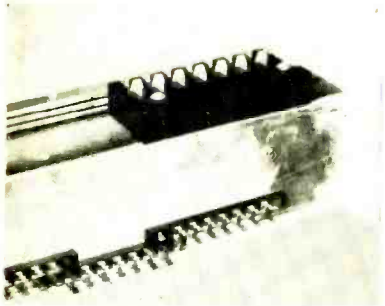


Fig. 13. Portion of switch plate with several of the switch blocks already mounted. Twelve terminal strips are provided for connections to generators.

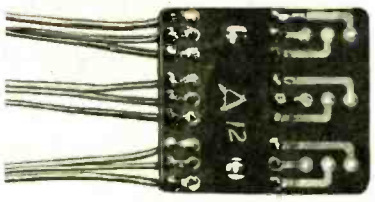


Fig. 14. Resistor card, with printed circuit wiring to provide all connections between switch blocks and wiring.

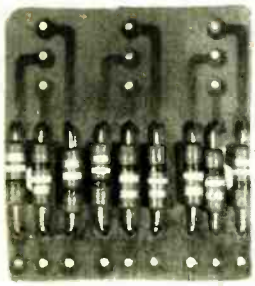


Fig. 15. Rear view of resistor card, showing nine resistors mounted. Each manual key requires three resistors for isolation.

ance control varies the terminations on the pedal busses so that the pedal volume can be balanced with any combination on the manuals without having to depend on the present levels of the pedal stops for the purpose. The idea in both cases is to add flexibility to the playing.

Preliminary Amplifier

The Preliminary Amplifier is an assembly of fourteen 6SL7's which performs three important functions. First, it raises the levels of tones from the keying busses to keep the signal-to-noise ratio high. Second, it isolates the filters from each other positively so that the stops are as independent as in a pipe organ. Third, it is used in the coupler system so that coupling is without effect on other controls or sounds.

Of the 19 stop filters, 16 are fed by one triode plate each, each triode carrying 2-, 4-, 8-, or 16-foot tone from the proper source according to the purpose of the filter. Three filters, the diapasons, carry both 8- and 4-foot tone, the 4-foot tone present in small quantity to give the diapasons the necessary life and carrying power.

Figure 17 shows the scheme behind the system; the entire diagram is too large to print here. The great 8-foot bus output goes to the grids of all the tubes which feed 8-foot great filters through a single 47,000-ohm resistor. The amplified 8-foot great sawtooth tone at the plate of each of these tubes goes to one great 8-foot filter. There is a group of tubes operated in the same way for all the other registers.

Coupling on an organ lends great flexibility—if it is not a substitute for meager resources. The Schober has the following couplers:

Great to Great 4′	Swell to Pedal 8′
Swell to Swell 4′	Great to Swell 8′
Great to Pedal 8′	Swell to Great 8′

The meaning is simple. Ordinarily only tones produced by playing on the great manual will go through the great filters. By using the Swell to Great 8′ coupler, the great keyed tones are made to go through any swell filters in use as well so that the tonal varieties of both great and swell stops are available on the great. The reverse is true for the Great to Swell 8′ coupler. When the Great to Great 4′ coupler is used, all tones heard due to great stops in use are also heard one octave higher as if the player were fingering everything in octaves. The same is true on the swell for the Swell to Swell 4′ coupler. By pulling the Swell to Pedal 8′ or Great to Pedal 8′ couplers, pedal tones will also pass through swell and/or great couplers, adding those tonal resources to the ones normal to the pedals. The flexibilty of registration this adds is obvious.

The coupler system works electrically in a simple way. Refer again to *Fig.* 17. If the Swell to Great 8′ coupler is used, the corresponding switch is closed. Now swell 8-foot tone goes through a 27,000-ohm resistor to the cathode of the great 8-foot coupler triode, operated as a grounded-grid amplifier to keep output phase unchanged. The plate output is fed to the grids of the triodes feeding the 8-foot great stops, right along with the regular 8-foot great tone. The level of the coupled-in swell tone is kept to the same level as the 8-foot great tone by the resistor network. R_1 is the series and R_2 the shunt leg of a voltage divider for the coupler tube output. (The great 8-foot bus terminating resistor at the balance switch is also a part of the shunt leg but since it has a maximum value of 1800 ohms its effect is negligible.) For the 8-foot great tone R_2 is the series leg and the resistance of R_1 plus the coupler-tube plate-ground resistance is the shunt leg of a similar divider. Both operate so that the levels at the amplifier-tube grids are the same.

As many busses can be coupled into the cathode of the coupler tune as necessary, and each bus can be connected to as many couplers as necessary. The 27,000-ohm series resistors do not load the keying busses and, in conjunction with the low dynamic resistance of the tube cathode they isolate the busses from each other as well as keeping coupler-tube output identical to bus output. In the actual circuit each coupler switch has two sections so that, for the Swell to Great 8′ coupler, for instance, not only is 8-foot swell tone coupled to the 8-foot great filters but 4-foot swell tone is also coupled to the 4-foot great filters.

Five small etched-circuit panels are used on the preliminary amplifier chassis

(*Continued on page 36*)

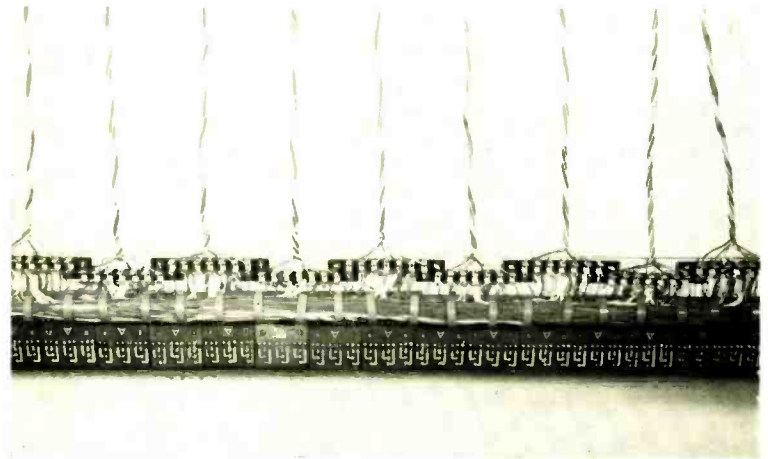


Fig. 16. Rear view portion of completed key switch assembly, showing nine of the twelve cables leading to the tone generators.

AUDIOCLINIC ? ?

JOSEPH GIOVANELLI

Selecting a Tuner

Q. How should I select a high fidelity tuner? Mario Brenes, N.Y.C.

A. There are three possible kinds of tuner for you to choose from: AM only, FM only, and a combination of the two. Since the selection of a tuner is such a highly individual matter, several factors must be taken into account. In locations having no FM stations, obviously only AM is needed. In some of these locations, the AM stations will be weak and so it is important to use a tuner sensitive enough to avoid annoying hiss levels and, at night, complete fading out of stations. Since the sensitivity of a tuner is rated in microvolts, the number of which is a measure of the minimum signal with which clear reception without excessive noise can be obtained, the smaller the microvolt rating, the more sensitive the tuner. A rating of between five and ten microvolts indicates a tuner of quite high sensitivity. However, if price is an important factor in your selection and you are located in a strong signal area, good reception can be expected with a tuner having as poor a rating as 100 to 200 microvolts.

In localities where FM stations can be received there is a decision to be made concerning the use of a tuner which will receive FM only or one which can be used for either FM or AM. If you already have an AM tuner, of course it will be necessary to procure only FM. It may be possible to use the radio frequency portion of an AM radio set as an AM tuner, thus making it unnecessary to employ a combination unit. It is sometimes not as easy to manufacture combination tuners which will have extreme sensitivity as it is to produce such sensitivity in separate AM or FM tuners. The sensitivity of an FM tuner, either alone or in combination with AM, should be between one and five microvolts for good reception. Automatic frequency control (a.f.c.) should be supplied in FM tuners to prevent the tuner from drifting from the selected station. However, it is also important to have the circuit so arranged as to make it possible to render a.f.c. inoperative when it rejects a distant station because of the nearness of a strong local signal.

The use of separate tuners makes possible binaural reception. However, there are also a few combination tuners whose AM and FM sections can be taken from separate outputs and used for binaural reception.

Binaural Broadcasting

Q. What is meant by binaural broadcasting? Barbara Antine, Alhambra, Cal.

A. In a concert hall, because of the fact that he is equipped with two ears, the listener to live music is able to perceive depth and the position of each instrument in the orchestra. Were a wall to be placed between the orchestra and the audience and a single speaker placed in that wall giving as good reproduction of the sound as possible, the listener would hear all of the instruments as coming from the same position; it would no longer be possible for him to locate each one as he could before the wall was present. If, however, instead of one speaker, an infinite number of speakers, each fed by a microphone, were used, there would then exist a wall transparent to sound and making it once again possible for the listener to hear each instrument as coming from its own true location. Such an arrangement, of course, is not feasible but a fairly good approximation of its effect is obtained through the use of a two-channel system (two microphones and two speakers). Since the distance to be traversed by sound is greater than that between audience and orchestra in a concert hall, it is necessary to transmit the sound via radio. Since radio broadcasting studios are equipped with both AM and FM facilities, both are used at the same time to produce the desired two-channel (binaural) effect. Two microphones are used. One feeds sound to the FM transmitter. These sounds are received by an AM receiver and an FM receiver spaced somewhat apart along the same wall, pointing slightly toward the listener. The AM and FM tuners should be adjusted for equal volume. The sounds so transmitted must never merge during transmission or the effect of a third dimension will be lost. The use of two speakers, both producing all of the sound, instead of each producing part of it, will also remove the sense of depth and, although there will be a greater quantity of sound present in the room, it will not be binaural. Actually, the term binaural implies that the two channels be continued separately from the microphones in the studio to the listener's ears. It is mistakenly applied to the use of two channels terminating in *speakers*, which should properly be called "stereophonic." In the stereophonic system, both ears actually hear sounds from both speakers, and it is, therefore not strictly "binaural."

Why Two Needles?

Q. Why must I use separate needles for 78's and LP's? Helen Hammond, Milwaukee, Wis.

A. The purpose of long playing records is to supply greater playing time using the same size disc. In order to do this, the speed was reduced and the number of grooves in a given area was increased. The needle used for playing any record must make intimate contact with the walls of the grooves. Since the grooves of a long playing record are obviously smaller than those of a 78, the needle also must be smaller. If a needle designed to play 78's is used for a long playing disc, it will be too large and will tend to wear away the sides of the groove, whereas, if a needle designed for long playing records is used for playing 78's, it will be so small that it cannot make proper contact with the groove walls and will tend to bounce from wall to wall.

Roll off—Turnover

Q. What are rolloff and turnover? Jeanette Trulo, N.Y.C.

A. When recordings are made, it is necessary to accentuate the high-frequency response. When they are played back, the highs are decreased. This is done in order to minimize the high-frequency components of the noise created by the needle passing over the disc material. This decrease in highs is known as rolloff. Rolloff occurs at so many db down at a specified treble frequency, such as 10,000 cps. Bass response is attenuated during recording and boosted during playback. This attenuation must occur since unaltered bass notes cause wide sideward motion of the recording stylus which would require too much space on the disc. Turnover is the point at which the attenuation or boost starts to take place, usually about 500 cps.

Tape Recorder Maintenance

Q. Please outline some of the steps needed for keeping a tape recorder in good operating condition. Ann Stell, Hewlitt, N.Y.

A. Some tape recorders may require special maintenance procedures and for these, the user should consult his service notes. However, the following steps may be used successfully with most machines: (a) Periodically clean the recording heads with alcohol. Since tape leaves deposits of oxide on the heads, after a period of time the tape no longer makes intimate contact with the heads, resulting in loss of high frequencies. (b) Clean the capstan, pressure roller and all tape guides with alcohol. This will prevent slipping of the tape which, in turn, would cause deviations in the pitch of the recording. On rare occasions, it may also be necessary to open the machine and clean the clutches, idler wheels and motor shaft or shafts with alcohol. This, too, is done to prevent deviations in pitch. (c) Lubrication is important and manufacturer's notes should be observed carefully in this connection. (d) Have tubes tested occasionally, particularly the bias oscillator tube and rectifier tube. (e) Check the tension on the take-up reel and the drag on the supply reel to prevent stretching the tape. Some machines, however, do not employ a drag on the supply reel. (f) On rare occasions, it will be necessary to replace the head or heads. Head wear may be indicated by decreased high-frequency response and/or poor erasure of signal. (g) In order to realize maximum performance from the tape recorder, it is obvious that the tape should have the best possible care. Tape should be kept free of dirt and away from magnetic fields. It should be loosely wound before storage and stored, ideally, at 70° F. in a moderately dry place. Reels of tape should be placed in boxes and stored on edge instead of flat. Tape that will not be used for long periods of time should be stored in sealed containers such as those used for 16mm movie film.

Transistors

Q. Why are transistors not used in high-fidelity equipment at the present time? Robert Haynes, Peekskill, N.Y.

A. It is only recently that transistors which can handle fairly large amounts of power have become available. Because of their high initial cost and their unusual power supply requirements, they have not as yet been used commercially for this purpose. It is probable that within a few years their price will decrease sufficiently to permit their introduction into this market. In a transistorized amplifier there would be transistors analogous to the voltage-amplifier tubes used to drive the power stage. Although the price of such units is quite low, they are still not used because they generate more noise than do vacuum tubes with equivalent amplification factors. When the signal-to-noise ratio of transistors has been improved sufficiently, they will probably be used in high-fidelity equipment, with attendant miniaturization of amplifiers.

How Long is "Permanent" Employment?

ALBERT WOODRUFF GRAY*

Since nearly everyone works for a living, the conditions under which employment is agreed upon may be later found to lack sufficient legal grounds to turn out the way we expected them to.

SUIT was recently brought by a discharged engineer of a radio parts manufacturer to recover damages for what he contended was a breach of contract for permanent employment. He had been engaged by this company for the production of resistors and was to receive as compensation one half of one percent of the gross sales in addition to an annual salary of $10,000. Shortly before the end of this first year of his employment he was told that the manufacture of these resistors was to be discontinued and to his query of what that meant to him, that, "You're through."

In this lawsuit the employee contended that this contract was to continue until the company had fully launched its resistor campaign and for so long as it continued in operation. The Federal appellate court said in characterizing contracts for permament employment and holding that this employee had no grounds on which to recover,

"Nor can it avail this employee that his contract was, in his own words, permanent. In other words the Supreme Court of Illinois has expressly held that a contract for 'Permanent employment' is one at will. This is in accordance with the decisions of other jurisdictions that contracts not expressly made for fixed periods may be terminated at the will of either party."[1]

However, only a few days after that decision was made, the Supreme Court of South Carolina denied another employee a recovery of damages for his discharge from employment under a similar contract. In this instance the employee had been injured by the inhalation of poisonous fumes and in return for his agreement not to claim damages for this injury, he was promised by his employer continuous employment until he died or reached the age of sixty five years.

Under a statute of that state an agreement to withhold a claim under the workmen's compensation act is void. Thus deprived of consideration, his agreement for permanent employment collapsed and his suit for damages was dismissed by the court with the comment,

"A contract for permanent employment which is not supported by any consideration other than the obligation of service to be performed on the one hand and wages to be paid on the other is terminable at the pleasure of either party and not enforceable. However, when an independent consideration passes from the employee in addition to the performance of services the duration of the contract may be optional on his part without impairing its mutuality."[2]

What is the Distinction?

Two earlier decisions by that same court define this distinction in greater detail. In one instance an employee at the instigation of the employer had abandoned a business which he had established in Michigan and moved with his family to South Carolina under an agreement for a fixed annual salary and 50 percent of the net profits in addition. Discharged at the end of ten months he sued for damages. There the court held the contract enforceable and the employer liable for the damages suffered.

"The general rule undoubtedly is that where an independent consideration passes from the employee in addition to the performance of services the duration of the contract may be optional on his part without impairing its mutuality. This rule finds its most frequent application in the case of contracts whereby, on consideration of the release of a claim for damages the employer promises the employee employment but the employee does not agree to serve.

"The abandonment by this employee of his business in Michigan in order to accept the employment which was offered him in a distant state constituted such an independent consideration as to take this case out of the general rule and to render the contract enforceable."[3]

In contrast to the conclusion in this instance is the decision of a recent lawsuit brought by a civil engineer against a South Carolina steel company. Upon receipt of a telephone call from the manager of this company he went to Columbia for an interview and two days later was offered employment with an annual bonus, a commission on sales in addition to his salary and the condition that he report for work the following Monday, five days later.

When he hesitated, saying he should give his present employer two weeks notice he was told, "What do you care? You have a lifetime job here. Come on down."

Two weeks later he was told by the same man, "I'm going to have to let you go," with no reason for the discharge.

In reversing a judgment in favor of this employee the court said,

"Here the employee shows a promise of permanent employment and no more. We find nothing to take the case out of the general rule. His employment at Atlanta was terminable at will. The giving up of friends, church, social, and school connections are such as face every employee when moving from one town to another or possibly from one part of the city to another and it is not a sufficient independent consideration to take the case out of the general rule."[4]

"Annual Salary" Not Sufficient Proof

Attempts are frequently made by employees in suits of this character to establish a contract for permanent employment on the ground that the contract provides for an annual salary. Such an instance was before the Supreme Court of the state of Washington, in which the

(*Continued on page 33*)

* *3712 Seventy Fifth St., Jackson Heights 72, L. I., N. Y.*

[1] Meadows v. Radio Industries, Inc., 222 Fed. 347. May 6, 1955.

[2] Gainey v. Coker's Pedigreed Seed Co., 87 S.E. 2d 486 South Carolina, May 12, 1955.

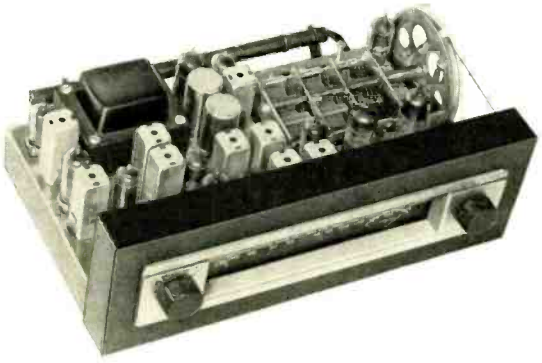
[3] Weber v. Perry, 21 S.E. 2d 193, South Carolina, July 9, 1942.

[4] Orsini v. Trojan Steel Co., 64 S.E. 2d 878, South Carolina, April 30, 1951.

The Theme MODEL A-310

notes & technical specifications

The A-310 Theme has been termed the "definitive AM-FM tuner". Reflecting the most sensitive styling in the high fidelity field, it also delivers the measurable optimum in both AM and FM performance.



View of Model A-310 with cage removed

Model A-310

FUNCTIONAL FEATURES

Functional Features: (a) Illuminated Tuning Meter; (b) Counterweighted Tuning Control; (c) AFC defeat available on function switch or momentarily by depressing tuning knob for center channel tuning; (d) Cathode follower output to drive tape recorder.

RF SECTION

Circuits: FM: Armstrong Circuit with Dual Limiters (Double Tuned) and Foster-Seeley Discriminator. Automatic Frequency Control. Low noise, all triode front end with tuned cascode RF amplifier and triode mixer. AM: Superheterodyne with tuned RF stage, and ferrite loop antenna. Two IF stages. 10 KC whistle filter. AVC operative over three stages.
Sensitivity: FM: 1.8 microvolts for 30 db quieting; 1.2 microvolts for 20 db quieting. AM: Terminal Sensitivity: 3 microvolts. Loop Sensitivity: 15 microvolts/meter.
Selectivity: FM: 200 KC bandwidth: 6 db down. AM: 10 KC bandwidth: 6 db down. FM Discriminator peak to peak separation: 375 KC.
Frequency Range: FM: 88-108 MC AM:530-1650 KC.
FM Drift: ± 2½ KC with AFC on; ± 20 KC with AFC off.
Image Rejection: FM: 50 db. AM: 50 db.
IF Rejection: FM: 70 db. AM: 50 db.
Antenna Input: FM: 300 ohms AM: Built-in low noise ferrite loopstick plus high impedance terminal for external antenna.
Distortion: Less than 1% harmonic on FM. Less than 1% harmonic for up to 80% mod. on AM.
Frequency Response: FM: ± ½ db 20 to 20,000 c.p.s.
AM: 3 db 20 to 5,000 c.p.s.
Hum Level: 65 db below 100% modulation.

AUDIO SECTION

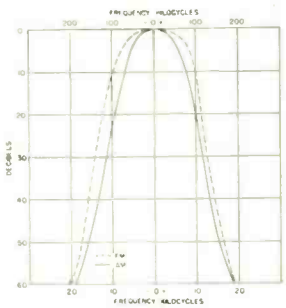
Circuits: Cathode Follower Output
Output Level: FM: 2½ volts for 100% modulation; 1 volt for 30% modulation. AM: 1 volt (average).
Output Impedance: Low Impedance Cathode Follower

OVERALL SPECIFICATIONS

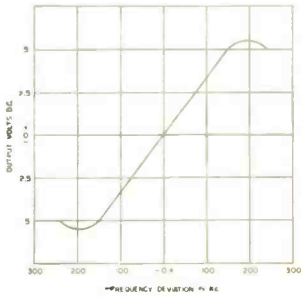
Controls: (Total 2) Function (OFF-AM-FM with AFC-FM without AFC) and Tuning/momentary AFC defeat.
Tube Complement: (Total: 12) 1-6BK7A, 1-12AT7, 1-6AB4, 1-6BE6, 3-6BA6, 1-6AL5, 2-6AU6, 1-12AU7, 1-6X4.
Dimensions: 12½" wide x 4" high x 8¾" deep (including ferrite loopstick—not including knobs).
Power Consumption: 50 watts
Shipping Weight: 14 lbs.
Finish: Chassis, escutcheon and cage: brushed copper—Display panel for escutcheon and knobs: matte black—Edge lighted dial glass: yellow and white.
Hardware and Accessory Material Furnished: Mounting screws, template, FM antenna wire, instruction booklet, shielded output cable.
Special Notes: (a) Can be stacked with C-300 amplifier in total height of 8", with C-100 amplifier in total height of 7¾"; (b) Face up mounting of Theme permissible without special precaution.

OPTIONAL ACCESSORIES

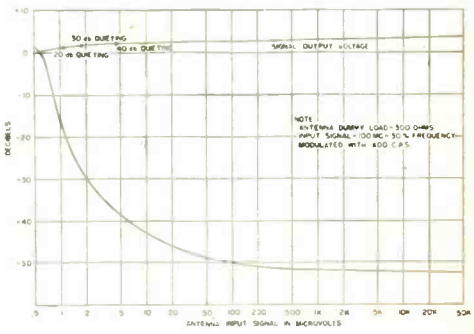
(a) Brass finished escutcheon available on special order.
(b) Brass finished cage available on special order.
(c) Vertically calibrated dial glass available on special order.



AM and FM selectivity characteristics



FM discriminator characteristics



FM detector output voltage characteristics

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Equipment Report

DeJur TK-820 and TM-819 Tape Recorders—Harman-Kardon A-310 AM-FM Tuner—Garrard 301 Transcription Turntable

IN THE COURSE OF TESTING audio equipment, a unit is occasionally encountered over which one enthuses because it offers a number of advantages not common to others on the market. The DeJur recorders —TK-820 in a portable case and TM-819 as a unit to be built into a hi-fi system—fall into this category because of certain features of particular interest.

To begin with, these two models, shown in Figs. 2 and 3, offer a very satisfactory performance, as shown by the curves of Fig. 1. In the playback of an Ampex #5563 standard tape, it will be noted that there is a gradual increase in output at the higher frequencies; similarly there is a slight droop in frequency response on signals recorded and played back. At 7½ ips there are no serious discontinuities in the smoothness of the curves, and both could be flattened out easily by slight amounts of frequency correction applied to associated circuits. Furthermore, while we have not seen a schematic of these instruments, we have studied the chassis carefully and note that there are several tiny potentiometers which are obviously intended for equalization purposes, and it is probable that the playback circuits could be adjusted to provide a perfectly flat playback curve, and the recording circuits adjusted to make a tape with the same characteristics as the standard. Not all tape recorders use the Ampex characteristic, but this is the most nearly standard curve that we have throughout the recorded tape industry, and with such an acceptance it seems desirable to arrange machines to reproduce this characteristic properly.

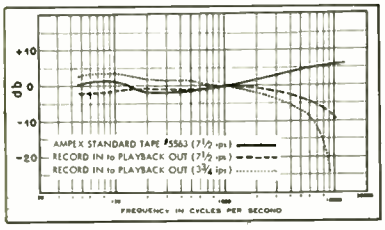


Fig. 1. Performance curves for the DeJur tape recorders.

In any case, the curves show that the performance is excellent at 7½ ips, and satisfactory at 3¾ ips. No one at all familiar with tape recorders would expect any better response at the low speed.

From the operating standpoint, these recorders are quite unusual. In the first place, the single motor employed is a two-speed, reversible hysteresis-synchronous unit incorporating a fly-ball "governor" which senses the motor's operation. When changing from one mode to another, for example, nothing happens until the motor slows down almost to a stop. The governor then permits a contact to be made, and the recorder then goes on with the newly selected mode of operation.

For controls, the recorder is equipped with the conventional playback, record, and stop push buttons; since it is a two-track model, it has two more buttons for selection of the track and the direction of tape movement. Then there are two more buttons for fast wind—one for each direction. In addition, there is a record safety button and a tape stop button, the latter simply releasing the idler roller from contact with the capstan. The two speeds are controlled by a switch at the back of the top panel, which also changes equalization at the same time. Reels do not have to be reversed to play the second track.

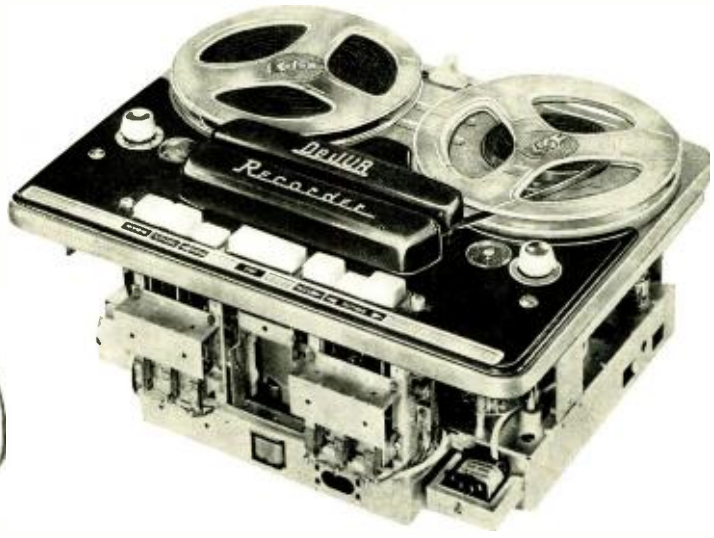
To play back, one simply presses the track button and the playback button, setting volume to the desired level. Pressing the stop button brings the tape to an instant stop by the use of magnetic brakes in the reel hubs. To record, one depresses the safety button and the record button; the circuits are set up for recording, but the tape does not move until the safety button is released, thus permitting the user to set level before starting the tape. Fast forward and rewind are controlled by push-buttons, and the tape stops almost instantly when the stop button is depressed, providing the track button for the same direction of tape motion is in the depressed position.

All of the operations of the recorder are controlled by relays—which gives the general impression that the machine thinks before it acts. For example, you depress the playback button. Tape moves, but you hear nothing until the tape gets up to speed, then the sound is switched on. You are recording and want to rewind; you depress the stop button, then the rewind button. A few clicks are heard, the tape comes to a stop, rests for some five seconds, then starts to rewind.

Since the capstan idler is actuated by a solenoid, this machine is one of the few we have seen that could be clock-controlled without the possibility of developing flats on idlers—the takeups being by means of belts. You simply choose the desired radio station to record, set levels, and have a reel of tape in place. Then without depressing any buttons you disconnect the power by means of the clock switch. At the desired time, the clock turns on both tuner and recorder. The relays operate, the solenoid pulls the idler against the capstan, and by the time the electronic circuits are warmed up, the tape is "up to speed." When the clock swtiches off, everything returns to normal, and there is no deformation of the idler pulley.

The portable model has a built-in power amplifier and a speaker system—a 4 × 6 "woofer", two 3-in. midrange units, and two electrostatic tweeters. It has two outputs: one to feed external speakers and one to feed a power amplifier; a switch selects the local speakers, local and external, or external only, or switches all off. Another serves as a tone control, and another the input selector. Full modulation may be obtained at 1000 cps with an input of 88 mv from radio, phono, or TV, and from 2.5 mv on microphone and tuner positions.

Fig. 2 (left). DeJur Model TK-820, featuring self-contained power amplifier and five internal speakers. Fig. 3 (right). Model TM-819, designed to be installed in a hi-fi cabinet as a component of a complete system.



Playback output to an external power amplifier is 0.7 volts at normal operating level of the Ampex tape.

As a final feature—a strip of foil near the end of the tape will shut the machine off as the foil passes the guides. All of which adds up to an excellent and handsome tape recorder for the home user—the critical type of user who want professional convenience and excellent quality.

HARMAN-KARDON MODEL A-310 AM-FM TUNER—"THE THEME"

The theme of our report on a tuner for this month is The Theme—recently introduced by Harman-Kardon as a companion tuner for the Model C-300 "Trend" amplifier, which it matches in appearance.

This tuner, with its matte black panel, brushed copper escutcheon, cage, and chassis, and softly-lighted yellow and white dial glass is attractive and compact, yet aparently does not suffer in performance from a reduction in size. The unit—shown in *Fig.* 4 without the protecting cage, which is supplied when the tuner is to be used as a table-top installation—is 4 in. high, 8¾ in. deep, and 12½ in. wide. When desired it can be installed with the panel in a horizontal plane and for such cabinets as require a vertically calibrated dial glass, this too can be obtained as an accessory.

But apart from its appearance—which is important to at least half of the people in an average home—its performance is also attractive. To the serious music lover who enjoys what music is available from the radio, a tuner must perform well, regardless of what it looks like. When he can obtain both in the same unit, he is more than satisfied.

The Theme has, first of all, excellent audio quality, both from AM and FM stations. Frequency response on FM is flat from 20 to 20,000 cps, and on AM from 20 to 5000 cps—which is about normal for AM tuners and desirably reduced to preclude undue disturbance from atmospherics. Sensitivity is claimed to be 1.2 μv for 20 db quieting, and this is borne out by comparison testing. High sensitivity on FM results from the use of a cascode input stage, seen in the schematic of *Fig.* 5, and high-efficiency design throughout the i.f. section.

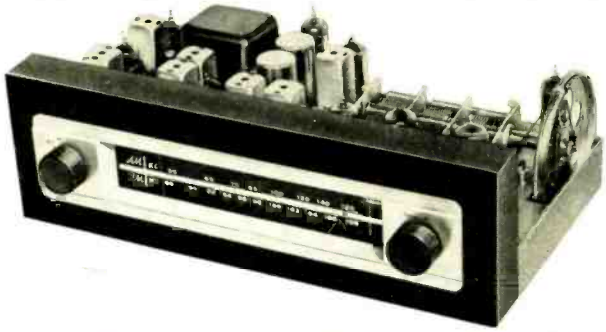


Fig. 4. Harman-Kardon "Theme" AM-FM tuner with protective cage removed to show chassis.

Two limiters are used, together with a Foster-Seeley discriminator.

In operation without AFC, there is a slight drift—approximately 15 kc—from cold start over the first hour. With AFC, the set was tested by running for four hours, turned off and left for 12 hours, and then turned on again. The same station was properly tuned in—a simple test that can be tried by anyone and without any instruments. The tuning meter is extremely sensitive, and for careful tuning the function switch is turned to AFC OFF and the station tuned in; then the switch is turned to FM-AFC again, and no drift is apparent.

Since this is a basic tuner, no tone or volume controls are provided. Oue knob is used for tuning and the other for the function switch—its four positions being OFF, AM, FM-AFC, and AFC OFF. The audio output is from a cathode follower, and two jacks are provided so that one can be connected permanently to a tape recorder while the other feeds, in the normal manner, the control unit or a combined control and power amplifier, such as the companion Harman-Kardon unit, The Trend. FM output level for stations within thirty miles is 2.5 volts on the average, which is under conditions of complete limiting. As signal strength is lowered, the output level reduces accordingly. Actually, however, very few—if any—FM tuners will give satisfactory performance below a signal intensity that will give 20 db of limiting, and while stations as far as 125 miles have been listened to for long periods, we could not consider them good sources for high quality reception—and this applies to any receiver we have ever tried.

The Theme, however, is a unit that has given reliable performance for a period of months, and is capable of providing high-quality audio signals to the complete satisfaction of its user.

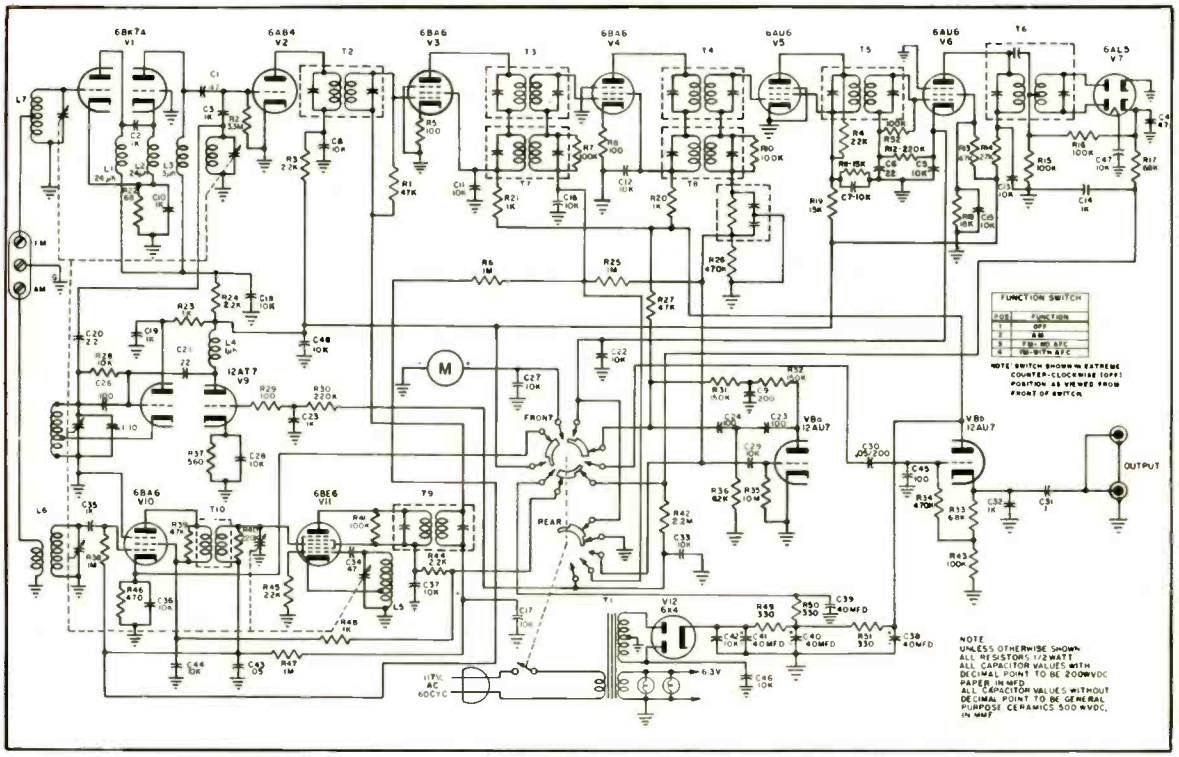


Fig. 5. Complete schematic of the Model A-310 tuner.

Fig. 6. Garrard 301 Transcription Turntable.

GARRARD MODEL 301 TRANSCRIPTION TURNTABLE

Within the past year or so we have witnessed the introduction of several new turntables built on professional lines and to high standards of quality, which is, in itself, an indication of the interest the serious music lover exhibits in the use of the single-play turntable for optimum reproduction of LP records. While all models can be used to reproduce all three speeds, the trouble involved in changing 78's or 45's every few minutes by hand almost rules out the use of anything but a changer. The principal advantage of the transcription turntable is in its lower rumble content, and as a system is improved in low-frequency reproduction, the rumble begins to show up. Additional advantages which are of some importance are the true-running surface of the platter and the increased constancy of speed.

The Garrard 301 is the newest model to be introduced, and it offers many attractive features. As seen in *Fig.* 6, the unit is mounted by means of a cast base plate on which are mounted the controls as well as the mechanism. The turntable is an aluminum casting which is accurately machined and dynamically balanced, and bored out to accommodate a phosphor bronze bushing which seats on the main spindle. This spindle remains in its bearing at all times, eliminating the possibility of contamination if it were removed for installation, inspection, or lubrication. The bearing is lubricated by a pressure system using grease and introduced by a conventional grease cup.

The motor is a 4-pole model, well shielded and dynamically balanced. It is suspended within a cast frame by means of six tension springs, each of which is

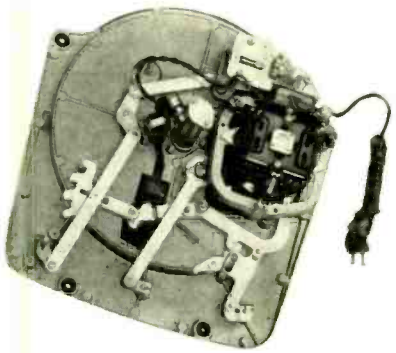


Fig. 7. Underside view of Garrard unit shows interlocking controls and isolation between motor and base plate. Note grease cup on main shaft bearing.

damped by a soft rubber insert. With the turntable removed and the idler held away from the motor shaft, no vibration whatsoever could be felt on the base plate with the motor running. Turntable drive is effected through an idler that bears on stepped motor shaft and against the inside of the turntable rim. The idler itself is mounted on ball bearings, and is lifted away from contact with both motor and turntable when the power is switched off. The speed selector lever, shown in Fig. 7 at the lower left, actuates a cam which raises or lowers the idler so as to make contact with the proper motor-shaft diameter, and is interlocked so it cannot be moved from one speed to another while power is turned on. In the off position of the power switch, a friction brake is applied to the turntable. Absolute speed of the turntable can be varied over a range of about ±5 per cent by means of an eddy-current brake; since this brake is located on the motor assembly and the control is on the base plate, an ingenious vibration isolator is provided between the control lever and the brake mechanism to further ensure freedom from vibration.

The effectiveness of this method of construction and the care in manufacture is borne out by the measurement of noise and rumble, which—by the same method used previously and described in EQUIPMENT REPORT for March, 1955, with additions in the December issue—comes out to be 50 db below a stylus velocity of 20 cm/sec (the standard used in AUDIO's measurements). Since it is very hard to find records that exceed a signal-to-noise ratio of more than 45 db, this turntable would answer the most critical requirement.

A unique method of mounting is used in the Garrard for optimum results—short of mounting the turntable on a half-inch steel plate. The turntable base plate is solidly mounted on a board, along with the pickup arm; then the entire board is suspended on conical springs. This effectively isolates the record playing mechanism entirely from externally caused vibration.

Leak Moving-Coil Pickup

For these measurements, the now-available Leak pickup was used—also a British-made product. This unit has an extremely flat frequency response—extending from 20 cps to 20,000, with only a slight rise beginning at 15,000 cps and reaching 3 db at 20,000, (using Cook frequency test record for the source of signals). Apparently this record must be well recorded up to the highest frequency, for with the Leak pickup a perfect sine wave is visible at 20,000 cps, just as it is all the way down to around 15 cps—a value obtained by playing the glide portion of the Cook record down to 35 cps at 33⅓ rpm instead of its normal 78. With the transformer used with the Leak, the output for a 5.5 cm/sec velocity is 18.5 mv, which is somewhat above the average LP pickup. The low impedance of the moving-coil type is usually less susceptible to hum pickup also, resulting in extremely high-quality reproduction. The Leak pickups operate only with their own arm, and one simply changes heads when changing from microgroove to standard. The most attractive feature of the Leak pickup is, in this observer's opinion, the wide frequency range without any peaks. Of course, wide frequency range in itself is not the whole story, but rudimentary measurements show that the Leak is satisfactorily low in IM distortion as compared to any other pickups tested. Actually, we have noted relatively little difference between most of the well known pickups in this respect.

PERMANENT EMPLOYMENT

(*from page 26*)

president of a corporation was in receipt of an agreed annual salary of $25,000 from January 1st. When he was deprived of his position eight months later he sued to collect the balance remaining unpaid of the $25,000 he claimed to be owed for that year.

In its decision that here was a mere hiring at will and the president of the company entitled to this compensation only so long as he continued as such an officer, the court ruled,

"When a contract for hire provides for payment at a yearly rate with no provision that the hiring is for a specified period it is a contract terminable at the will of either party. An exception to this rule is provided for in those cases where proof is given of a custom in the industry which makes the hiring for a definite period."[5]

In a contract for employment made by a Florida hotel with its manager it was agreed that the employment, though on an annual basis, was subject to termination by the employer in the event of dissatisfaction with the services of the employee. In a suit for breach of contract by this employee who had begun work on April 26th and discharged three months later, the employee recovered a judgment against the hotel. In affirming that judgment the Florida appellate court said of such provisions for discharge,

"While the contract for employment is for a definite term, if it provides that the services are to be performed to the satisfaction of the employer it may be terminated by him at any time that he in good faith becomes dissatisfied with the services of the employee, though no real or substantial grounds for dissatisfaction exist. The employer is in such case the sole judge as to whether the services are satisfactory and the courts will not substitute their judgment for his as to any reasonableness of the grounds of dissatisfaction.

"But the general rule is that such dissatisfaction must be real and in good faith, not merely feigned or capricious or mercenary. A reservation of the right

[5] Rohda v. Boen, 276 Pac. 2d 586, Washington, November 18, 1954.

to discharge for reasons of the sufficieney of which the employer reserves the right to be the sole judge, does not give the employer the right to terminate the contract without a reason or for a false reason. He must act in good faith."[6]

In contrast with this conclusion of the Florida court is the decision of a case in Massachusetts only a few months ago. There the employee had been engaged as production manager for a Bostou broadcasting station and the agreement had been confirmed by the president and general manager,

"This letter will serve to confirm our agreement and understanding resulting from our conference recently held in Lawrence, Massachusetts and your acceptance of the position of program director at a salary payable weekly at the rate of $9,000 per annum beginning January 2nd."

On August 22nd of the fourth year following, the contract was ended with the payment of three weeks salary in advance. In affirming a judgment for the recovery of the salary from the time of this discharge to the end of the year the court said,

"In our opinion the evidence was sufficient to warrant a finding that the parties intended the employment to continue for at least a year. The employee continued to work for the broadcasting company until August 22nd of the fourth year following. If it were found that the original contract was for a year we think that from a continuance of the service it could further be found that there was an implied renewal of the contract from year to year."[7]

The test however that has been generally adopted by the courts in determining whether a contract for permanent employment is merely a hiring at will or a definite long-range commitment, is whether some consideration is given by the employee in addition to the mere rendering of services. This appears clearly in the decision of an action in a New Jersey court in which a salesman had been offered a sales territory on the condition that he finance all the promotional and other expenses in the development of a market in this area and in return for this undertaking by the salesman he was to have the territory for life.

In its recent summary of the law and of this feature of consideration in the decision of this case the New Jersey court said,

[6] Edwards v. Doherty, 74 So. 2d 686, Florida, September 24, 1954.

[7] Mahoney v. Hildreth & Rogers Co., 125 N.E. 2d 788, Massachusetts, April 7, 1955.

"In the absence of conditional, express, or implied stipulations as to the consideration, a contract for permanent employment or for other terms purporting permanent employment, where the employee furnishes no consideration additional to the services incident to the employment, it amounts to an indefinite general hiring at the will of either party and therefore a discharge without cause does not constitute a breach of such contract justifying a recovery of money damages therefor."

Then of the alternative in such circumstances the court added, "Where the employee has given consideration additional to the service incident to the employment or, as it is sometimes stated, where the employee purchases the employment, in the absence of a statute, other terms in the contract or circumstances to the contrary, the contract for permanent employment, for life employment, or for other terms purporting permanent employment, is valid and enforceable and not against public policy.

"Such a contract continues to operate as long as the employer remains in the business and has work for the employee and the employee is able and willing to do his work satisfactorily and does not give good cause for his discharge and a discharge without cause, constituting a breach of such contract, entitles the employee to recover damages therefor.

"Deeming them to be at variance with general usage and sound policy, the courts have shown a marked reluctance to enforce contracts for life employment. In large part this stems from the realization that such contracts frequently are, in practical effect, unilateral undertakings by the employer to provide a job for so long as the employee wishes to continue in it but imposes no corresponding obligation on the latter. In this respect the burden of performance is unequal, as the employer is bound to the terms of the contract whereas the employee is free to terminate it at will.

"Agreements of this nature have not been upheld except where it most convincingly appears it was the intent of the parties to enter into such long-range commitments and they must be clearly, specifically and definitely expressed. Only then is it grudgingly conceded that not all such contracts are so vague and indefinite as to time as to be void and unenforceable because of uncertainty and indefiniteness."[8]

[8] Shiddell v. Electro Rust-Proofing Corp., 112 Atl. 2d 290, New Jersey, November 5, 1954.

ELECTRONIC ORGAN

(*from page 22*)

to carry the R_1, R_2, and associated capacitor components of *Fig.* 17. Other components are mounted directly on tube pins and tie points, so that this assembly is merely another case of making a number of simple connections rather than the complex assembly it appears to be at first glance.

Woodwind Circuit

Two of the stops on the organ—the Clarinet and Stopped Flute—imitate pipe-organ and orchestral tones which have almost no even-harmonic content. A symmetrical wave for this purpose is produced by the woodwind circuit shown in *Fig.* 18. To obtain a symmetrical wave it is necessary to invert a 4-foot signal and reduce its level by 6 db, then mix it linearly with 8-foot tone.[1] Eight-foot tone is taken from the swell 8-foot keying bus and applied to the grid of V_{1B}. It appears in phase on the cathodes of both tubes and thus effectively on the grid of V_{1A} in reversed phase, then on the plate of V_{1A} in the original phase. Swell 4-foot tone is applied through a voltage divider directly to the V_{1A} grid, and appears on the plate reversed. The mixing takes place in this manner and the result, again reduced in amplitude, is the woodwind output, which is applied to the grids of the two preliminary-amplifier triodes feeding the Clarinet and Stopped Flute filters. The woodwind circuit is built on a small chassis with all the components but the tube on an etched-circuit panel.

Next month we shall describe the re-

[1] Acknowledgement is due to Baldwin for this basic idea, though not for the circuitry.

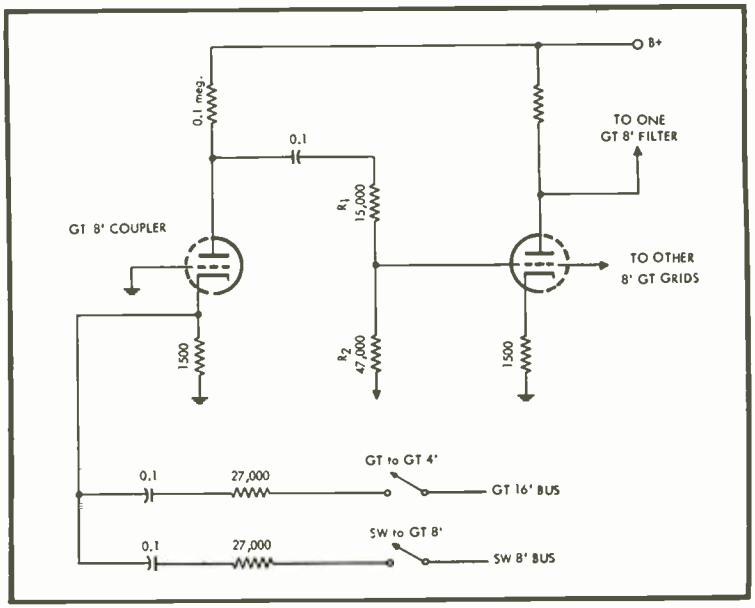


Fig. 17. Simplified schematic of coupler circuit which permits interconnecting manuals or buses.

maining sections of the Schober Electronic Organ Kits.

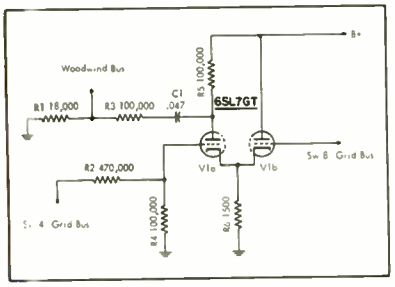


Fig. 18. Schematic of woodwind circuit, which converts sawtooth wave output from generators to square wave for certain tone effects.

BOOK REVIEW

THE FABULOUS PHONOGRAPH, by Roland Gelatt. 320 pp., 8 vo., illustrated. New York: J. B. Lippincott, 1955. $4.95.

Musical instruments have been man's possessions since time immemorial. They have been simple and complex, from a pipe to a pipe organ. When Thomas A. Edison invented the cylinder phonograph 78 years ago, man was for the first time released from the duties of performer. This is the start of, and unfortunately, almost the end of the book.

That Mr. Gelatt has spent a great deal of time in researching to prepare himself to write this book, no one can deny. It is a story crying to be told, but this author fails dismally in writing the history of the phonograph, per se, as it has grown from Mr. Edison's original instrument. Far too many pages are consumed in bringing the reader to the first decade of the present century, and all that has happened since is glossed over or completely neglected.

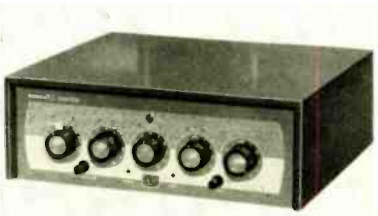
What he fails to tell us, or even show us in pictures, is the fascinating development of the machine once it became spring-driven, of the early attempts of the electrical drive, etc. The renaissance of the phonograph was due in no small manner to the development of a mechanism to handle the playing of records automatically, yet this point is almost completely slighted by the author in his essay at an historical presentation. And finally, one mere chapter is allotted to the completely revolutionary development of microgroove records and the high-quality sound reproducing equipment which is today a $250 million industry in the U. S. alone! Archives full of pictures of the varying sizes of records, historically interesting machines, and the like are overlooked in favor of far too many "shots" of early recording sessions of the great and near great.

Chronological data is interestingly presented in an appendix, and in many respects the book has reader interest. But as a history of the phonograph it fails dismally and serves only too vividly to point up the need for such a story. May some enterprising author now undertake what could become the real reference work in this field. What we have here is a good example of how not to write such a book.

—L. B. Keim

NEW PRODUCTS

● **G-E High Fidelity Amplifier.** Flexibility of installation was given full consideration in design of the new General Electric 20-watt amplifier, which is engineered around a dual chassis to permit its use as a single cabinet-enclosed unit or as two separately installed units. One chassis serves the power amplifier, push-pull drivers, phase inverter and power supply. The second chassis, which can be detached from its companion if desired, constitutes the preamp-control unit. Five separate inputs, three outputs and nine independent panel-mounted controls provide an amplifier adaptable to virtually any combination of tuner, record player, tape reproducer, and the like. Frequency response is within 1 db from 20 to 20,000 cps at moderate listening level. Total harmonic distortion is one per cent at full rated output. The selector control has eight posi-



tions, five of which compensate for variations in record characteristics, one is for tuner, and two are auxiliary positions. Other controls include level, loudness, bass, treble, rumble filter and power. General Electric Company, Electronics Park, Syracuse, N. Y. **J-8**

● **Radial-Motion Tone Arm.** The path of the cutting stylus is traced by the playback stylus when records are played with the new Ortho-sonic Tone Arm. Designed to eliminate tracking error, the arm is so constructed that the cartridge and stylus are moved across the record in a straight line from the edge of the record toward its center. In operation the cartridge is never touched by hand, the stylus being positioned on the record by slightly tilting the tone arm. Friction of the horizontal movement is reduced to a minimum since the carriage assembly rides on four precision ball bearings suspended on a ground-and-polished stainless-steel rod. The cartridge

carriage is independent from the mass of the arm and is hinged on its own needle-point pivot. Reduction of both vertical and horizontal friction assures extended record life. Proper stylus force can be effected through the twist of a thumb screw. The Ortho-sonic arm is easily installed on any turntable mounting board, and will accept practically all popular cartridges. Bard Record Company, Inc., 66B Mechanic St., New Rochelle, N. Y. **J-9**

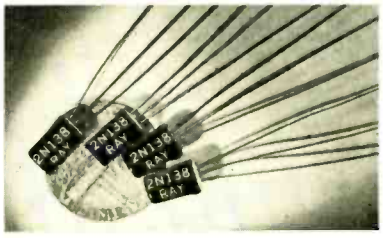
● **Shure Magnetic Recording Heads.** Built to meet the demands of professional usage, the new Shure Micro-Gap recording heads are especially well-suited for applications where miniaturization is a required factor. The Micro-Gap Series is comprised of Models TR30 and TR35 recordng heads, and their companion erase heads TE30 and TE35. The TR30 and

TE30 are base-mounted while the TR35 and TE35 are rear-mounted. The units have high output, excellent response, are easily adjusted, and are shielded against hum pick-up. The rear-mounted heads measure 45/64" from face to mounting shoulder, while the base-mounted heads measure 9/16" from top to mounting shoulder. Both models are 31/64" from top to bottom and 21/32" from side to side. Shure Brothers, 225 W. Huron St., Chicago 10, Ill. **J-10**

● **Improved Miraphon Record Player.** Among many features inherent in the new Model XM-110A Miraphon record player is a special method of motor mounting by means of isomodes for the elimination of chassis vibration, and the turntable bear-

ing "floats" in a spring mount. Both the turntable and tone arm are mounted in double rows of ball bearings. A plug-in head will accommodate the user's choice of cartridge, and an easily reached thumb screw under the tone arm permits instant cartridge pressure adjustment. The turntable is white-rubber matted. The XM-110A is started by moving the tone arm to the right and at the end of each record it automatically shuts off. Audiogersh Corporation, 23 Park Place, New York 7, N. Y. **J-11**

● **Audio Transistor.** Sold only in matched pairs for optimum output and minimum distortion, the new Raytheon Type 2N138 is a PNP fused junction germanium transistor for push-pull class B audio output applications. In a typical class B applica-

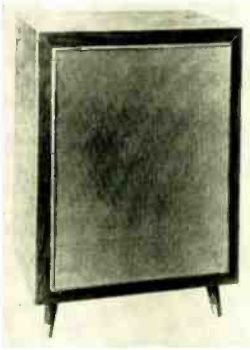


tion using a 4.25-volt supply the average power output is approximately 50 mw with a power gain of 30 db. Physical dimensions are identical to those of the 2N130 series of miniature transistors. Complete information on the 2N138 may be obtained from Technical Information Service, Raytheon Manufacturing Company, 55 Chapel St., Newton 58, Mass. **J-12**

● **Fisher FM-AM Tuners.** Separate tuning meters for FM and AM are among the many unique features incorporated in the new Fisher Models 80-R and 80-T high-fidelity tuners, identical except that the 80-R is for use with external control chassis while the 80-T includes complete audio control facilities. FM sensitivity affords full limiting on signals as low as 1 microvolt, while AM sensitivity provides full output from a signal of the same intensity. Frequency response on FM is 20 to 20,000 cps ± 0.5 db. In broad tuning position AM frequency response is within ± 2 db to 6000 cps. A 10-kc whistle

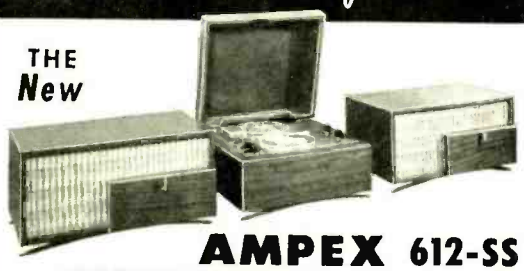
filter eliminates interstation interference. Both tuners are self-powered, are equipped with flywheel tuning mechanism with anti-backlash gear, and feature completely shielded construction including bottom plate and tuning-capacitor cover. The preamp-equalizer incorporated in the 80-T consists of two cascaded triode stages, and has sufficient gain for even the lowest level magnetic cartridge. It affords a choice of six equalization settings. Direct current is supplied to all heaters. Separate bass and treble controls afford up to 15 db boost and cut at 50 and 10,000 cps, respectively. Specification sheet available on request from Fisher Radio Corporation, 21-21 44th Drive, Long Island City 1, N. Y. **J-13**

● **Altec Lansing Speaker Systems.** Two new Iconic speaker systems are recent additions to the broad line of high-quality audio equipment manufactured by Altec Lansing Corporation, 161 Sixth Ave., New York 13, N. Y. The larger of the new systems, Type 826A, contains one 15-in. low-frequency driver, an 800-cps dividing network, and a high-frequency driver mounted on a large sectoral horn. These units are housed in an 8½-cu.-ft. bass-reflex enclosure designed as a low chair-side cabinet. The system is guaranteed by



Altec Lansing to have a frequency range of 35 to 22,000 cps. The smaller of the Iconic systems, Type 824A, uses a 12-in. woofer in conjunction with Altec's well-known 3000-cps high-frequency speaker and matching network. Its small bass-reflex cabinet is only 28 ins. high and 16 ins. wide, yet the system is guaranteed to have a frequency range of 50 to 22,000 cps. Both systems require no assembly on the part of the purchaser as they are delivered completely assembled and wired. **J-14**

HARVEY
The House of Audio



THE *New*

AMPEX 612-SS
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First true dual-channel stereophonic tape system designed specifically for the home, the 612-SS combines the new Ampex 612 stereophonic tape phonograph (playback only) with two complete and independent Ampex 620 amplifier-speaker systems for unrivaled reproduction of stereophonic tapes. The space effects made possible by Ampex stereophonic sound cannot be duplicated on single-channel systems in any price range. The 612 will also play the conventional half-track and full-track tapes with customary Ampex playback quality. Tape speed is 7½ in. per sec.; frequency response extends from 40 to 15,000 cycles. Standard 7-in. RMA reels. Complete with custom-designed cabinets,
as **Model 612-SSF** $699.00

Also available in a completely portable system, with Samsonite cases, as **Model 612-SSP** $694.00

THE *New*

DYNAKIT Mark II
50-WATT Amplifier Kit

Here is something altogether new — a no-compromise "dream" amplifier in easy-to-build kit form at a popular price! The DYNAKIT Mark II employs a special new circuit in conjunction with a newly developed transformer of unique construction. Its beautiful simplicity — it has only three tubes plus rectifier and includes printed circuitry — makes it easy for the home constructor to reproduce the impressive performance characteristics of its laboratory prototype with only three tools: soldering iron, pliers and screw driver.

Rated power output is 50 watts (continuous); intermodulation distortion is less than 1% at rated power; harmonic distortion is less than 1% at any frequency from 20 to 20,000 cycles within 1 db of rated power. Frequency response is within ±.5 db from 6 to 60,000 cycles; ±.1 db from 20 to 20,000 cycles. Square wave response is essentially undistorted from 20 to 20,000 cycles. Output stage has the new 6CA7's in push-pull; output impedance is 8 or 16 ohms.

Complete, with tubes, output transformer and instructions $69.75

THE

Stan White
MODEL 4330

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Complex multi-flare horn system with four separate driver units. Bass horn (30-150 cps) has equivalent axial length of 14 feet. Mouth area is 7 square feet, and is substantially increased with proper room placement. Lower mid-frequencies are handled by two 8" speakers (150-600 cps) located on each side of the cabinet, with a phase shift network between speakers for three-dimensional effect. Higher mid-frequencies (600-3000 cps) are handled by a multi-flare horn with an equivalent axial length of 6 feet. High frequencies (3000-18,000 cps) are handled by a multi-flare horn with an equivalent length of 4 feet. Frequency response is substantially flat from 30 to 18,000 cps. Power handling capacity is 60 watts. Available in four finishes — mahogany, blonde, walnut, and ebony, with three coats of lacquer, hand rubbed. $339.50

Other units in stock priced from $49.50 to $1,500.

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THE *NEW*

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SPEAKER SYSTEM

Embodying several new and unconventional design features, the Pamphonic Sr. Reproducer is a de luxe two-way speaker system with 1500-cycle crossover in an exceptionally rigid enclosure. The treble unit is a special elliptical cone speaker with aluminum voice coil; the woofer is a 15-in. unit with a flux density of 16,000 gauss. The cabinet, constructed of one-inch wood and internally braced, employs a tuned vertical bass-reflex chamber for exceptionally smooth low-frequency response and has the treble speaker oriented for rear-wall reflection to assure unusually wide and even high-frequency dispersion. The speaker units, dividing network and enclosure were conceived from the ground up to function as an integrated system, rather than just a woofer and a tweeter in an all-purpose cabinet. Together they cover the entire audible range of frequencies and are capable of handling power levels in excess of 15 watts.

Available in mahogany or walnut finish $295.00

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'Preamp with Presence'

— as described by C. G. McProud in May Audio Engineering. 3 equalization choices, presence control, volume and loudness controls, and Baxendall-type bass and treble controls.

Basic kit containing the 1.0 henry encapsulated choke, the printed circuit panel completely drilled, and the 4 metal chassis parts. $7.50

The complete kit of parts, including the basic kit and all other parts and tubes as specified by author. With complete, simplified instructions. $35.50

The *New* FAIRCHILD
220XP PHONO CARTRIDGE
with elliptical microgroove stylus

A stylus with an elliptical cross section can follow the violent zig-zags of the modern LP record groove with considerably greater accuracy than one with a circular cross section. The new Fairchild 220XP cartridge features for the first time an elliptical diamond stylus in the 1-mil microgroove size for matchless tracking on LP's. Combined with the additional new Fairchild features of reduced dynamic mass, increased compliance and toroidal damping, the new stylus design enables the 220XP cartridge to deliver a completely distortionless replica of the signal recorded in the groove, so that for the first time the music can be heard as it was actually recorded. $60.00

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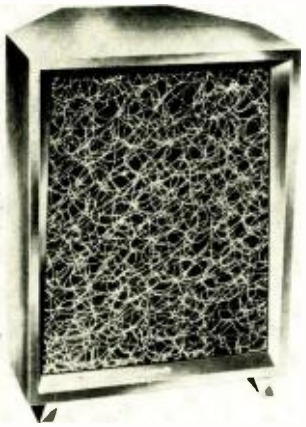
103 W. 43rd Street, New York 36 • JU 2-1500

• **High-Speed Tape Duplicator.** Rapid copy of both single- and dual-track tapes which have previously been recorded at 3.75, 7.5, or 15 ips is facilitated by the new Model DA-11 Tape Duplicator recently developed by Presto Recording Corporation, P. O. Box 500, Paramus, N. J. Now in commercial use, the DA-11 operates at a tape speed of 60 ips. The basic duplicator con-

sists of a tape reproducer to play back the master tape and a recorder which copies the play-back output on new tape. A number of slave recorders may be fed from a single reproducer. The unit produces duplicate tapes which are completely uniform in response with no increase in distortion over the originals. Because it operates at 60 ips, the DA-11 provides a good frequency response up to 120 kc and may be adapted for telemetering or other applications where high-frequency recording is required. **J-15**

• **University "Decor-Coustic" Speaker System.** The "Senior" is the latest addition to the new University line of "Decor-Coustic" speaker systems. Powered by three separate drivers which afford exceptionally wide frequency range, the Senior incorporates the University Model C12W as a woofer, the Model 4408 "reciprocating-flares" horn speaker for mid-range, and the Model HF-206 super-tweeter which extends the upper frequency response well beyond the limit of audibility.



Acoustic balance is achieved by means of the brilliance and presence controls which are incorporated in the Type N-3-L/C 3-way crossover network. The enclosure is University's newest "Decor-Coustic" horn-loaded phase inverter. The design of the enclosure permits optimum performance no matter whether the unit is placed flat against a wall, in a corner, or even in the center of a room. The Senior will handle up to 30 watts of program signal. Manufactured by University Loudspeakers, Inc., White Plains, N. Y. **J-16**

• **Eight-Hour "Secret" Tape Recorder.** Entirely concealed within a false compartment of a briefcase, the new Model 210 two-speed tape recorder was designed primarily for all types of investigative work where secrecy must be preserved. So ingenious is the construction that the recorder will not be visible even if the flap is opened and papers added or removed. The unit may be carried or put down anywhere while operating without exciting suspicion since the quiet motor and ball-bearing construction assure unobtrusive

performance. Maximum continuous recording time is four hours at a tape speed of 15/16 ips on a 5-in. reel. Tape speeds of 15/16 and 1⅞ ips are incorporated in the Model 210-AB, while Model 210-BC affords 1⅞ and 3¾ ips. Tapes may be played back on studio equipment or home recorders. Earphone playback is afforded by a built-in amplifier which is powered by a set of dry cells with 100-hour operating life. The low-drain motor is powered by five mercury cells which last from 2 to 24 hours. Electrical rewind transfers a full reel of tape in less than two minutes. The recorder weighs only 11¾ lbs. and measures 16 x 12½ x 4½ ins. Manufactured by Amplifier Corp. of America, 398 Broadway, New York 13, N. Y. Complete technical specifications and descriptive literature are available on request. **J-17**

• **Program and Sound Effects Filter.** Twenty-two cut-off frequencies ranging from 50 to 12,000 cps make the new PULTEC Type HLF-3 high- and low-pass filter ideal for the reduction of rumble, hum, noise and distortion in music as well

as in other types of program material. Better sound effects are possible because of more mid-range frequencies. Low cut-offs are OFF, 50, 80, 100, 150, 250, 500, 750, 1000, 1500 and 2000 cps. High cut-offs are 1, 1.5, 2, 3, 4, 5, 6, 8, 10, 12 kcs and OFF. Circuit is constant "K," 18 db per octave, 600 ohms. Shielded toroids minimize hum pickup. The unit is mounted on a standard 3½-in. rack panel. Manufactured by Pulse Techniques, Inc., 1411 Palisade Ave., West Englewood, N. J. **J-18**

• **Wireless Microphone.** Little larger than a package of king-size cigarettes, the new Budelman wireless microphone has an output of 75 mw and, when used with a companion receiver, permits high quality transmission over a range of several hundred feet. Audio response is 50 to 12,000 cps ± 2 db. Small and light enough to be easily concealed on the person, the microphone-transmitter overcomes the limitations imposed by conventional microphones, booms, and trailing cables. It measures but 4½" x 2½" x 1", exclusive of battery pack of similar size. Operating frequency is in the FM band of 26.110 to 26.470 mc with a 15-kc nominal deviation. Five hours continuous operation is provided with a single set of batteries. Bandwidth and deviation of the equipment have been selected to permit operation of three units simultaneously without mutual interference. Standard batteries and tubes are used throughout. Specially designed for professional use, the unit is now being used by a number of motion picture studios and TV networks. Further information is available from Budelman Radio Corporation, 375 Fairfield Ave., Stamford, Conn. **J-19**

Dual-Channel Amplifier

(*from page 16*)

resistor in the power amplifier is a 10 watt type. It is a good idea to use wire-wound plate-load resistors in the low-signal-level stages. Although a Peerless transformer and choke are not essential circuit elements in the power supply, the writer built and tested the amplifier with a Peerless 256Q output transformer, and has no data on how another transformer type may operate in this circuit! Small broadcast-type connectors may be used conveniently for inter-chassis connections where audio voltages are involved. Four-conductor cables terminating in male plugs are useful for power connections and the chassis connectors being standard four-hole sockets.

The writer's present dual-channel playback system consists of a turntable, pickup and arm, a preamplifier (*Fig.* 1), an R-C dividing network (*Fig.* 2), two identical power amplifiers (*Fig.* 3), two power supplies (*Fig.* 4), and the dual loudspeaker described in an earlier paper.[1] The equipment corresponding to each schematic presented here was constructed on separate chassis as shown photographically in *Fig.* 5 and 6. This building-block technique was employed so that new innovations may be checked with minimum constructional labor. The preamplifier was built on an aluminum chassis having dimensions of $7 \times 12 \times 3$ inches. The arangement of parts may be seen in *Fig.* 7. If Vector socket-turrets are used the circuit can be built in a $5 \times 10 \times 3$ inch base. The employment of aluminum material that is not painted permits one to make the numerous low-resistance ground connections required by the circuit configuration. It is very important to keep ground leads short in high gain circuits. The dividing network and power supply fit nicely on a chassis measuring $5\frac{1}{2} \times 9\frac{1}{2} \times 1\frac{1}{2}$ inches. The orientation of parts in the dividing network is shown in *Fig.* 8. The power amplifier can be built on a $7 \times 12 \times 3$ inch black-crackle finish steel chassis with room to spare. A bottom view of this unit appears in *Fig.* 9. Since high signal levels obtain in this circuit a ground bus may be used (grounded to the chassis at each end) without development of hum difficulties. The writer finds the use of a ground bus a constructional advantage.

At present four parallel-connected bass drivers are in use in the bass section of the speaker described in reference 1. The driving-point impedance of the array is 2 ohms. Accordingly, the secondary of the output transformer in the bass amplifier is connected for this load, and R and C selected for 10 db feedback and minimization of ringing, respectively. The value required for R is 330 ohms, and for C, 0.005 μf. The high-frequency driver in use is a Western Electric type 594A having an impedance of 24 ohms. A resistor of 48 ohms is connected across the voice coil so that the impedance of the parallel combination is 16 ohms. The output transformer of the treble power amplifier is connected for this load. In this case R is 1500 ohms for 10 db feedback, and the optimum value of $C = 1360$ μf[2].

[1] Charles W. Harrison, Jr., "Coupled Loudspeakers," AUDIO ENGINEERING, Vol. 37, No. 5, pp. 21, May, 1953.

[2] For a load of 4 ohms, R is 1000 ohms and C is 1500 μμf.

A schematic for the 24 volt d.c. field supply required for the operation of the WE 594A driver is not included in this article because this driver is not generally available. Several other makes of high-frequency reproducers are available with permanent magnet fields, however.

Acknowledgment

Technical contributions to this article were made by CDR. S. E. Ramey, CDR. R. R. Potter, CHRELE. J. C. Bradbury all of the U. S. Navy; and Captain Jack Kadey of Capital Air Lines. Photography is by Mr. Lyle Trenchard.

EDWARD TATNALL CANBY*

I. WEEKEND POTPOURRI

(These are the records I played during one active weekend in the country, as foreground to everything from eating dinner to waxing floors. In a reviewer's life, music is the foreground; all other activities form a pleasantly engrossing background.)

Haydn: The Creation. Teresa Stich-Randall, Anny Felbermayer, sopranos, Anton Dermota, ten., Paul Schoeffler, bar., Fred. Guthrie, Bass; Chorus, Orch. Vienna State Opera, Mogens Woldike.
Vanguard VRS 471/2 (2)

This "Creation," sung in German lacks for us the absurdly lovely charm of the well-known English text with its preposterous menagerie of animals right out of Noah's Ark —the tawny lion, the "flexible tiger" and that astonishing bit of creation which "in long dimension creeps, with sinuous trace"—the worm! But those English words are at least available in printed form here, along with the original German (which came in turn from English), for a running visual translation as one listens to the records.

This is a lively, spirited "Creation" with a splendid orchestra, the Vienna Philharmonic in its opera *alter ego*, and a knowing group of soloists. The chorus to me is somewhat disappointing though its singing is precise enough; part of the trouble is an unfortunate balance which places it too far in the background for proper impact. (I've sung in the chorus of this piece in four performances.) The solos tend to drown out the chorus in their many joint numbers.

The all-important archangel Gabriel, soprano in sex, is done beautifully by Stich-Randall with just the right Haydnish combination of angelic purity and peasant earthiness; the Eve, Felbermayer, isn't as good; she's not only earthy but also somewhat inaccurate here as to pitch and voice control. The next-most-important archangel, Raphael, (the tenor) is excellent and the third of the trio, the bass angel (Uriel) is good too along with his cohort Adam, Mr. Schoeffler.

There's none of the oratorio-style stodginess in this performance that we often find in the work, even when done by supposedly notable performing groups, and for this we can be thankful. Yet somehow I don't think the full, breathless freshness and wonder of the "Creation" is brought out here, nor the boundless humor of it either. Could it be that this is too much to ask of a professional opera group, even a Viennese one?

Mozart: Piano Concerti K. 488 in A, K. 466 in D mi. Clara Haskil; Vienna Symphony, Sacher, Paumgartner.
Epic LC 3163

Two more items in Epic's Mozart Jubilee edition, now growing to monumental proportions. The famous and familiar D minor concerto gets what, to my ear, is just about the definitive performance—which is saying a lot, I know. There are ideas and ideas, of course, as to what makes a good playing of this famous piece; for me, this is it. Rich, big orchestral sound but beautifully balanced, the winds shining through the strings as they should, the solo piano unpercussive, big, very natural in sound. Clara Haskil is an impeccable Mozart player and yet a large-minded one too. She is beyond criticism! I can scarcely imagine the music more sweetly phrased, more unaffectedly musical—and more convincing.

Two conductors share the record. Of the two, Paumgartner (director of the Epic series) does his usual top-rank job with Mozart. Sacher's A major (whether his doing or not) seems less focussed, less musically alive by a few notches.

What matter that a string or two here plays a trace falsely, that not every sound is perfect in ensemble? Better this, and a really musical interpretation, than all the sheen of the best orchestra without musical understanding.

Bach: Chromatic Fantasy and Fugue; Italian Concerto. George Malcolm, harpsichord.
London LD 9187 (10")

A pair of intelligent and dynamic performances, these, by a harpsichordist who has the big feel for the works, whose registrations are imaginative and dramatic, his music both authentic in detail and romantic in expression. Two of the best performances I've heard in a long while—piano *or* harpsichord.

The recording is technically interesting—it is an Absolute Recording, that is, a close-up portrayal of the instrument's sound without audible room reverberation. Therefore, if played at the absolute loudness of an actual harpsichord, the recording will freely take on the color of any room you play it in—it will seem to be *inside* the room, without the usual complication of the audible recording-hall sound that surrounds most recorded music. If you keep the volume down *low*, you'll be astonished at the absolute, literal realism of this type of recording.

An Evening of Elizabethan Verse and Its Music. W. H. Auden; the New York Pro Musica Antiqua, Greenberg.
Columbia ML 5051

A good idea, this, to have the Elizabethan poetry read out loud before it is sung in the musical settings of its own day. Auden's excellent written essay, on the jacket, makes some good points, too, about the relationship between written poetry and the music to which it may be set, especially in that fabulous time of the end of the 16th century when, under Elizabeth I, English poetry and music were so extraordinarily close. (They're dismally far apart, nowadays.)

The Pro Musica group (not to be confused with other Pro Musicas, notably the Belgian under Safford Cape) sings expertly and on the whole very musically though for my ear the star countertenor (male alto), Russell Oberlin, sings his solos in a somewhat hard and brassy way with his superb high voice. The vocal ensemble is of the rich, unblended sort with plenty of vibrato, American style, that is what most people take for granted hereabouts, though, as the British know, it is only one way to sing. (British madrigal singing often features close blending with virtually no vocal vibrato.)

There are madrigals and also solos and duets here, the latter two types with harpsichord, playing the original lute accompaniments in a very lutish style. It is astonishing how much the featured prior reading of the texts, by Auden (helps to make the music's intentions clear to the listening ear! And this even though Auden reads with a seeming lisftip which sounds to me like a sounding fault rather than a speech defect. Here's for more and better texts—to go with all recorded vocal music.

The Mitchell Boys Choir Sings.
HIFIrecord R-301
Christmas Music from Trinity-New Haven. G. Huntington Byles, choirmaster.
Overtone 11

How astonishingly differently do we train up that basically uniform organ, the human voice! Here are two groups including kids of tender age—they couldn't have had more than a few years' experience in the training process—and you will be amazed at the divergencies not only in style of singing but in the very sound of the boyish musical instruments themselves, so quickly adapted physically to these utterly different traditions.

In reverse order, the Trinity-New Haven choir from the East Coast (Connecticut) city represents the very best of the Anglican tradition of singing, as re-developed in this country —not so much the music, which includes a good variety of material, as the very sound of the choir. Here are those heavenly, white-gowned little angels (devils, too, behind the scenes) with big black scarf-ties around their angelic necks, who traditionally form the alto and soprano parts of high-church Protestant choir singing; here is the usual excellent pitch, always a bit on the high side, never flat, the high, piping quality, the "boy-singer" tone, that you expect in this all-male church choir tradition, and it is only remarkable that none of these little singers can have been in the business for more than a few brief seasons. It is the tradition itself that goes back and back, into the hallowed past, and it is the tradition that is so familiar to us; these kids fit themselves unerringly into it in no time at all, picking up the whole feeling and style by quick imitation, as kids can always do.

And from the West Coast comes the Mitchell group. More boys, no older, no longer in training, just as recently emerged from babyhood—yet whose small vocal organs, one and all, reflect with utter faithfulness the carefully polished sound of the Hollywood crooner and the lady songbird! As the notes tell us, Bob Mitchell's careful training of his boys emphasizes the all-important full vibrato (missing at New

Haven) and every boy has it to perfection, as though born to croon.

This is the essence of a style! How can they learn it so qickly? Each and every long note begins just so, with that kind of hoarse, very slightly below-pitch attack, followed by a bit of non-vibrato, then, exactly calculated, a "tail" of heavy vibrato to end it off. Complex to describe (and if we lived in another age you'd call me a musicologist) but the sound itself is instantly familiar to every one of us from a thousand films and juke boxes and DJ programs. Every songbird, every groaner in the business has it down cold—even Marlon Brando had to learn it. This is the Absolute Necessity in style for our day in pops singing—the style of our time, though it cannot be written down or indicated in any way on paper for posterity to reproduce. The Mitchell boys merely apply it with precision to an unexpected area in music, and so point it up as a phenomenon of vocality.

Both records have boy soloists as well as ensemble singing: both have organ accompaniment. But, typically, the Trinity organ is one of G. Donald Harrison's classic-style instruments, based upon the principles of 17th century organ building, whereas the Mitchell boys sing with a harp and a Mighty Wurlitzer theatre job. (See below.) The music from New Haven includes "classical" stuff ranging from Victoria and Praetorius through numerous Anglo-American anthems and carol settings, while the Mitchell boys from Hollywood sing "O What a Bentiful Morning," "Irish Lullaby," "Ave Maria" and "When You Wish Upon a Star." But whichever type *you* favor, I strongly suggest a try at the other record as well, just to point up the wonderful contrast between these two traditions, imposed on boys who a couple of years ago were all of them just so many small American brats in the great American melting pot.

Horowitz Plays Clementi Sonatas. RCA Victor LM 1902

Every piano student knows Clementi—or thinks he does. The familiar little Clementi "practice" sonatas are fine for the fingers and very uninspiring to the ear. But Clementi actually was a big musician and a much bigger man than those arbitrarily selected items from his large output might suggest. He was one of those composers who quickly fall out of style after their death and, somehow, get a semi-permanent black eye without ever having a chance to clear their names—until somebody, finally, looks up the facts.

Horowitz has championed the bigger sonatas of Clementi, virtually unknown to pianists today, as fine music and as pioneering writing for the piano that tremendously influenced such greats as Beethoven. Here he plays us some of the evidence and it's convincing.

These works, composed in the late Mozart period, are indeed far more pianistic, technically more modern, than Mozart himself as far as piano style is concerned. At every turn they suggest Beethoven—quite remarkably considering their pre-1800 date. Not "great" music but certainly very good music, and Beethoven-lovers, Mozart-lovers, pianists, all should find this record most interesting in spite of an occasionally anachronistic *rubato* on Horowitz' part. He's a wonderfully intelligent player.

Schumann: Quintet in E Flat, Hummel: Quartet in G. Hollywood String Quartet, Victor Aller, pf. Capitol P 8316

Here's an interesting companion-piece to the above—Hummel is another forgotten composer of the Mozart-Beethoven period who also was among the near-great of the time and wrote really excellent music, if something less than of super-genius grade. The Hummel Quartet here played is an expertly lyric piece, skillfully written, sounding midway between Mozart and Mendelssohn with a good touch of the inevitable Weber in it. (Weber's influence was fantastic at this time.) Very enjoyable.

The ultra-familiar Schumann Quintet with piano gets a vigorous reading and musical, too, but it seems seomehow to be a bit out of touch with the great tradition of Romantic playing that centers upon this work. There are too-pronounced rubatos (slowings-up) in the wrong places; the familiar points of intensity in the expression are often overlooked.

That doesn't mean it's bad playing. Just different, and perhaps a bit unsettling if you've heard the Myra Hesses and the Serkins and Schnabels. The best of Hollywood dry-type recording, a good balance between strings and piano.

Beethoven: Violin Concerto. Nathan Milstein; Pittsburgh Symphony, Steinberg. Capitol P-8313.

Speaking of Beethoven (my weekend listening wasn't chronological but I've arranged the records in part that way for convenience), here is the finest Violin Concerto I've heard—well, if not ever, then for a long time. With Milstein and Steinberg, it is in the modern manner: that is, without fancy flamboyance, a bit on the cool side, stressing the music's big architecture, the soloist remarkably self-effacing in favor of Beethoven—who gives him plenty to do in musical terms as it is.

The Violin Concerto is one of the most leisurely, long-breather works in all Beethoven and therefore is one of the toughest to play, because as always with the composer it has huge architectural lines that must be brought out, leisure or no. Too much lush detail and the piece falls apart into endless bits of lyricism; too much architecture and the wonderful singing quality is sacrified, as of each moment. These two men, it seems to me, have managed to hit in this performance the ideal, hair-trigger balance between these dreadful alternatives. The music sings to perfection without a trace of hurry or nervousness, yet the big lines, the huge over-all building-up of shape, the mammoth conception, the musical girders, are all there. Not a note is overplayed—or underplayed; every note counts in the whole.

In two words—highly recommended.

Schubert: Song Cycle, "Der Winterreise." Laurens Bogtman, bass; Felix de Nobel, pf. Epic LC 3154

Talk about tradition—these fluid, dramatic songs are subject to all the drastic physical variation in performance that can come from differing voice training and production—far more variation than would be conceivable in any instrumental piece. But there is a tradition, even for the piano part.

This basso sings expressively and with an excellent sense of pitch and diction and a good deal of variety, to suit the dramatic changes. But his pianist gives me the creeps. He plays every song like a Sousa march; the delicately alive Schubert piano figures, so poetically descriptive, become so many boogie-woogie obligatos! It's not unmusical in any pounding sense, just hopelessly out of the accepted tradition, which seems and surely is right, even for today.

Beethoven: Gellert Lieder, Op. 48. Schubert: Schwanengesang. Inez Matthews, sopr., Lowell Farr, pf. Period SPL 717

These Schubert songs, sung by a colored soprano, are beautifully done, combining the essence of the Schubert tradition with the warm, special color and the superbly musical pitch-sense of Miss Matthews' voice. Her pianist, no powerhouse, makes an effective accompanist, rather too subdued in the recorded balance. No Sousa here.

In the Beethoven songs, grander, more solemn and aria-like, Matthews sings with a bigger, fuller tone as is exactly proper. In the Schubert she uses an accurate but small-scale voice production. True, an Austrian or German singer of the same calibre could deliver a more authentic and perhaps more effective rendition of these two cycles of songs, but a singer as musical as Matthews is bound to do interesting things with the music. A good record, if not very stunningly recorded.

Debussy: The Blessed Damozel (La Damoiselle Elue). Berlioz: Summer Nights (Nuits d'Ete). Victoria de los Angeles; Radcliffe Choral Soc., Boston Symphony, Munch. RCA Victor LM 1907

If you've tried the gorgeous late-Debussy "Martyre de St. Sébastien" in the complete version with chorus and solos, or Epic's recent

excellent "Pelleas," or if you've enjoyed any of the big Berlioz vocal works of late, then here's a disc to snap up quickly.

The "Damozel" is an early Debussy work, even before the familiar "Afternoon of a Faun" if I remember rightly and much like it in its sweet, lushly youthful impressionism. It plays atmospheric orchestral colors against a women's chorus and soprano solo. The Berlioz fits remarkably well into the same mood, though earlier; it will remind you of his well-loved "Enfance du Christ," now popular at the Christmas season every year.

This is a nicely impressionistic edition though of slightly mixed nationality in the performing. De los Angeles has a perfect command of French style and diction and one of the most wonderfully true voices in the business as to pitch; Munch complements her style with his Boston players. The Radcliffe girls, no French maidens, sing ardently and with enthusiasm, dicting their French almost too energetically; the youthful effect of their voices is well suited to the fresh harmonic colors of the music, if a trace thin and lacking in tonal richness for such a tapestried score.

Gershwin: An American in Paris; Gershwin-Bennett: Symphonic Picture, "Porgy and Bess." Philharmonia Orch. of Hamburg, Jurgen-Walther. **M-G-M E3253**

This and others in a series of Gershwin performances by the same group present a rather interesting contrast between known history—in Europe—and present impact—in the U.S.A. Early last year this orchestra presented an all-Gershwin concert in Hamburg, as an offshoot of the M-G-M recording project, which created a sensation. The Germans raved, overflowed the concert hall, demanded a repeat performance then and another later in the year; finally, a tour of German cities was set up to meet the extraordinary demand for more and more of the same, spreading Gershwin as played by this Hamburg orchestra far and wide over the Teutonic lands.

Yet, to my all-American ear, this is not really good Gershwin, in a subtly continental way, and I think you will be interested to find the same thing when you hear it. It's not merely that the traditional out-of-tune Paris taxi horns, delight of a million listeners, are impeccably in tune and not at all Parisian, nor even American! There is a pervasive Germanic seriousness, thoroughness, a lack of bounce, a skillful—very skillful—but methodical *imitation* of the real American letting-loose that was so happily Gershwin's own. It's strange, to an American ear. Interesting, too.

Of course, the Germans are quite right. The essence of Gershwin's score is here, the notes, the tempi, the main substance. And they rightly recognize him for what he was, a brilliant and original musical mind that lacked only the training and background for extended-length symphonic composition that he tried to manufacture by himself, from scratch.

See also M-G-M E3237, with the Rhapsody in Blue and the Concerto in F, same players and Sondra Bianca, Europe-domiciled American pianist.

Villa-Lobos: Quintette en Forme de Choros, Bachianas Brasilieras #6, Choros #2. Alec Wilder: Quintet for Woodwinds. N.Y. Woodwind Quintet. **Philharmonia PH 110**

(No—here's one small label that hasn't vanished after all. It's still alive, and has some past items of chamber music very much to its credit, with the Stuyvesant String Quartet.)

An oddly interesting wind recording, that contrasts two very opposite composers. Alec Wilder, a brilliant but tender offshoot of the great jazzpops development, long known for his chi-chi Octet recordings with New Yorkerish names ("The Neurotic Goldfish" . . .), jazz harpsichord and jazz oboe (Mitch Miller), before such things were commonplace, has had aspirations towards the classical somewhat as did Gershwin, not to mention Morton Gould and Benny Goodman. This Quintet seems to me to be forced and hothouse, product of too much classical lamp-lighting. A basic "motive" is rubbed in at the beginning and keeps coming back in new guises, not very subtly; the music is contrived, yet not very complicated, and only the few short traces of easy Wilder-style jazz in it seem to me to be unaffected and worthwhile. I'd much rather hear his Octet stuff and I think it's better music, too.

Villa-Lobos is the extreme opposite, a man of enormous, unbelievable technical prowess who writes and writes and writes the most prodigious quantities of music, nominally classical, fusing the classical and Brazilian popular-folklore elements with perfect ease. None of his music (such as I've heard) seems to me very profound, but every bit of it is so expertly, skillfully written that you can't help admiring it.

The three works here are typical of that—a minute's listening will show you how enormously more skillful, more secure, more confident is Villa-Lobos than Alec Wilder. The two works for flute, with clarinet in one, bassoon in the other, fairly titillate the flutist 'till he shines and glitters with pure executant joy! You can almost see his face flushed with pleasure at the end, like a skier's after a good downhill run and some fancy turns, well skied.

Boccherini Quartets. New Music Quartet. **Columbia ML 5047**

Any new release from the Quartet that played such wonderful Mendelssohn (ML 4921) and Schumann (ML 4982) on recent Columbia releases is worth looking into, I'd say.

This review really belongs back at the head of this month's installment along with Clementi and Hummel. Boccherini is another of those second-rank composers of the end of the 18th and early 19th century whose stock went 'way down for a hundred-odd years, is now coming back up with our more wide-ranging interest and appreciation of music. He lived mostly in Spain (like Scarlatti), wrote vast numbers of quintets and many quartets. Like Clementi, he was actually a major force in the development of the modern musical forms—Clementi for the piano sonata, Boccherini for the "chamber music" ensemble. He was slurringly dubbed the "wife of Haydn," meaning a sort of feminine, weaker Haydn, but for our more discriminating ears he has a lot more individuality than that.

Of these four quartets, three are later works. They sparkle with Italian vehemence, good humored violence and sweet lyricism—they'll remind you a bit of the explosive music of Rossini, though that came later. The remaining quartet is his very first, obviously of an earlier period. It evidently stems from the mid-late 1700's, perhaps the time of Mozart's early manhood; it is near to the *galant* in style with rather simple harmonies in the main and fanciful, ornamental melodies. The slow movement is lovely, the last very catchy. (It's odd that at least four notable Italians in this period lived expatriate lives outside of Italy and achieved international fame that still keeps their music alive: Scarlatti and Boccherini in Spain, Clementi in England, Cherubini in France.)

The record? Beautifully recorded and even more beautifully played.

George Wright Plays the MIGHTY WURLITZER PIPE ORGAN. **HIFIrecord R 701**

Well, ever since last September when I ran a review of an earlier MIGHTY WURLITZER record on a somewhat obscure label, we have been besieged with requests for the same, which seems to be mostly unobtainable. (Sometimes I wonder whether my learned disquisitions on Boccherini and Haydn and Clementi ever get read! Just mention MIGHTY WURLITZER and the AUDIO roof practically falls in!) For your benefit, the address of the obscure label is Starlite Records, 858 Vine Street, Hollywood 38, Calif. (*See Fall 1955 issue, Vol. 1, No. 1, of* AUDIO's *new sister publication* The Tibia *for further listings.* Ed.)

Or, don't bother; here's something just as good, if not better. I wonder how many MIGHTY WURLITZERS there are left in the world? This one, "silent for so many years" as the notes have it, seems to have been revived elsewhere than in the Paramount, New York, where this really remarkable organist, George Wright, cut his Wurlitzer eye teeth

and toe nails. This instrument is evidently of California vintage. Wherever it is, it's perfectly enormous and it Has Everything, beyond your wildest dreams. Such sounds! Such fi! (It's in Los Angeles. Ed. ED.)

But the best of it, really, is the superb musicianship of Mr. Wright and his incredible playing skill. The notes say his style is "creative, imaginative and, above all, musical;" I agree completely. His subject-matter varies from "Jalousie" and "Roller Coaster" through "Love for Sale" and "Stars and Stripes Forever" but in all honesty I was delighted to listen to this disc all the way through, both sides, and thoroughly enjoyed the fi. I *always* enjoy hi-fi when it is done musically.

Does this seem a bit odd, coming from Canby? Well, it isn't. Music is music, oddly enough, anywhere and any time. I make no claim to be able to like it all and there are some of the classics I've never learned to take with pleasure, even to my shame. (Let's name no names.) But there's plenty of music that hits me pleasurably just as it does many another musical-minded listener, whether it's "Nyorleans," Calypso or Boogie; it's the genuine musical feeling that counts, wherever and whenever. George Wright has it.

This isn't the only MIGHTY W. record, either. You can fairly swim in MIGHTY WURLITZER sound if you want to. I won't list 'em all—there'll be more coming, surely. Just ask for George by name—that is, WURLITZER. And the company's full name is High Fidelity Recordings, Inc., 6087 Sunset Blvd., Hollywood 28. No roofs falling in this time, please.

SCOUTING AMONG THE OPERAS

Puccini: Manon Lescaut. Albanese, Bjoerling, Merrill; Rome Opera House Orch. and Chorus, Perlea.

RCA Victor LM 6166 (3)

My Scout #2 has been having an opera binge, at my instigation. He is quite enthusiastic about this and the "Aida" following (same performing group, more or less) and highly recommends both. This opera, he feels, is well up to the more familiar Puccini operas —perhaps a bit ahead of them—and this I can understand. The most popular operas on any stage are apt to get their fame from a combination of good stageworthiness, quick, easy, dramatic appeal and nice tunes for the soloists. This doesn't always add up to a given composer's best work in a larger sense, by any means, and LP records are the ideal medium to make this clear to us listeners.

The performance is "sharp and real, sensitive and understanding," he says and he particularly likes Albanese's work in the title role. For those who may quail at too much new Puccini, Scout #2 suggests that he can be wonderful for listening if "all the chicken fat is wrung out of him." This performance, I gather from him, has no chicken fat at all. Good!

Verdi: Aida. Milanov, Bjoerling, Barbieri, Warren, Christoff, Rome Opera House Orch. and Charus, Perlea.

RCA Victor LM 6122 (3)

Here's a companion performance to the above and, as already mentioned, Scout #2 is enthusiastic about it. "Terrific," he says. "Everybody in the performance seems caught up in the spirit of it." That's a lot more than can be said of some other "Aidas," which sometimes seem to be mainly stage pageantry with a lot of musical noise attached. That may be OK in the opera house for a good show, but a recorded "Aida" must stand up on its own musical feet—so take Scout #2's words to heart.

He feels that in particular this recording brings out a maximum of the good material that points to the late Verdi operas, "Othello" and "Falstaff." (This was a transitional opera, between those late works and the long string of early Verdis)—which gives it a maximum of performance solidity. Maybe if you've thought "Aida" was pretty noisy stuff before, you'd better try this one.

Moussorgsky: Khovantchina. Soloists Nat. Opera, Belgrade, Baranovich.
London XLLA 29 (4)

Here's the only complete operatic recording of Moussorgsky's "other" opera—the famous one of course being "Boris Godounov." If you know that work at all, or any other Moussorgsky music with voice, you'll spot here instantly the dark, macabre excitement that is so typically Moussorgsky, the fiery drama, the grand and powerful voice of the people and, needless to say, those great Russian vocalizations that are so thrilling to hear.

I listened to part of this and found the performance excellent, but the Jugoslav voices were somehow a bit on the light side, less weighty than their Russian equivalents though excellent in style. The orchestra is occasionally uneven in detail work but not in any unmusical way.

Scout #2 observes that this opera doesn't spend its vast resources building up one central character of tragedy, as does "Boris." Instead it is a broader work, with more generalized shape, nearer to conventional opera standards than "Boris." It has more flat, weak stretches, too; but the best scenes are as good as anything in Moussorgsky.

I'd say that for anybody who owns a recording of "Boris," this is most important. Also for plenty of others who just like this kind of music.

Borodin: Prince Igor. Soloists, Chorus, National Opera, Belgrade, Danon.
London XLLA 30 (5)

Scout #2 was bored by this one, finds that as a large work of music it doesn't stand up, though there are, of course gorgeous moments including the familiar "Polovetsky Maidens" and so on. That is just as I've always felt about longer excerpts of this opera, or the whole of it. Borodin did not have the large-scale dramatic ability that welds a big piece together, lovely as his melodies are in many spots.

The performance, too, says the Scout, doesn't seem to get off the ground—though I'd suggest it's likely that this is Borodin's fault at base, rather than the Jugoslavs'. The Moussorsky recording above, same performers, has "all the fat suspense and tautness that this one lacks." It sounds "all blubbery," as Scout #2 puts it, in comparison to "Khovantchina."

COMING EVENTS

January 18–20 — Montreal Audio Show. Windsor Hotel, Montreal, Que., Canada.

February 1–3—Toronto Audio Show. Prince George Hotel, Toronto, Ont., Canada. For information about Canadian Audio Shows, contact Emery Justus, 1022 Sherbrooke St. West, Montreal, P.Q., Canada.

February 8–11—Los Angeles High Fidelity Music Show. Alexandria Hotel, Los Angeles. Sponsored by the Institute of High Fidelity Manufacturers and the West Coast Electronics Manufacturers Association.

February 9–11 — Southwestern Regional Conference and Electronic Show. Municipal Auditorium, Oklahoma City, Okla. Sponsored by Sixth Region, IRE.

February 16–17—Conference on Transistor Circuits. University of Pennsylvania, Philadelphia, Pa. Sponsored by PGCT of IRE, AIEE, and Univ. of Pa.

March 19-22—IRE National Convention. Waldorf-Astoria Hotel and Kingsbridge Armory, New York.

AUDIO ETC.

Edward Tatnall Canby

THE HOME-GROWN TAPE PROGRAM II

Scrambled Time

In Part One of this intermittent series I traced the varied history of my present radio program from its 78-r.p.m. "live record" days until I shifted gradually to tape and then, after a long time doing my work with an assistant, to solo tape, relying entirely on editing for the effects that previously had depended on the adroitness of my assistant in platter-spinning.

How does one "edit" tape? The fundamental principle is simple enough and by this time most people know that you can patch up recorded sound on tape to suit yourself—though, to be sure, very few people actually are aware of the extensive editing that they hear every day, via thousands of records and radio programs. People still, I think, assume that the recorded time-sequence they hear is that of the original time—that is, the beginning happened at the beginning, the ending came last. How wrong they are!

(I heard a recorded symphony a day or so ago in which the first ten minutes sounded dreadfully tired, but then the performance picked up life and animation. "Then?" As an old tape hand, I immediately suspected that the opening moments might have been recorded last, not first—or perhaps at the end of a day's work while what followed came from the fresh beginning of a recorded session, a day before or even a week later. Time has precious little meaning any more in recorded continuity.)

To edit, you slice up hunks of recorded time like so much spaghetti, (or should I say noodles), then patch them together again with white sticky tape in any fashion you may please. But you'll have to "please" rather carefully. If your tape joints are clever, you'll have no audible joining—just a smooth, new time continuity all of a piece and unbroken. And very few people will ever stop to think that they're actually hearing time scrambled.

But if your joints are badly chosen, the results can be not only noticeable (which is taboo) but very unsettling; for there's nothing we dislike more instinctively than to have that smoothly eternal mechanism of steadily passing time tampered with! Like the force of gravity, time is with us always and to disrupt its flow in any audible way, to confuse the ear as to *what*, happened *when*, is as devastatingly disturbing as might be a sudden change in the force of gravity.

Just ask the man who's been seasick. He knows all about gravity gone haywire. Bad tape editing—noticeable tape editing where you are aware of the time-tampering—is just as unnerving. It gives our time-sense a stomachache.

How does one get this seemingly unbroken new time continuity? The details are fascinating and very psychological, for this is a matter of fooling the ear or, should I say, satisfying it by tricks, satisfying the imagination. You think you are hearing such-and-such a situation, via a recording, and you want desperately to imagine the continuing sequence of events in an unbroken time-sequence, normally. We cling almost frantically to that normal time-flow and we accept "*substitutes*" very readily, if only they allow us to go on without time-interruption.

I've long since learned, for instance, not to patch my voice, as recorded on a bright, cheery morning, onto the same voice as of the wee, small hours of the night before. I myself am not aware of any special difference as I speak; but the transition, instantaneously, from my night-before voice to my morning-after one can be startling; my whole personality has changed overnight (with a good night's sleep)—and now it changes in a quick flash right in the middle of a word or at a fleeting pause for breath! Listening, you will insist on running the two into the same sequence of time (you reject the idea of a night's time intervening in the middle of an unbroken sentence) and so the change just sounds crazy, disturbing, unnerving.

Similarly, I've learned to look out for strangely disturbing effects produced by overlooking the normal breathing intake of speech. Nobody consciously notices the breaths you take, and they are just barely audible, even hi-fi. But sometimes, by accident, I patch *two* breathing sounds together. Easy to do when you're hooking up pieces of sentences made at different times. As played back, I finish a sentence, take a quick breath—then take another on top of it. *Very* disconcerting; it sounds as if I were blowing myself up like a balloon.

Oppositely, if I fail to allow for that little breath-pause in joining together two pieces of sentences, you will hear a ghastly effect as though I were squeezed completely out of breath and gasping like a fish. (I don't gasp, but you the listener, *want* me to, when you don't hear me take a new breath. You're waiting for that breath, even though you're not consciously aware of it, and you become quite distressed if I go right on talking and fail to take it.)

All of which, you see, points up the fact that the basic purpose of tape editing is to fake a perfect illusion of continuing, *unbroken* time, and by implication, an unbroken continuity of place, or space. Sudden disappearances of background sound between bands of an LP record are very bad for example, because they arbitrarily wrench you out of the concert hall into dead, timeless space, then pop you back

again, in imagination. You very much prefer, as I see it, to remain figuratively in the same spot and in the same stream of time; so you insist on imagining that the intervals between movements on an LP record are actual passages of time—that the orchestra is still there, pausing, getting ready to start again. Continuity of background noise—even when it is faked—will do that for you nicely.

The Set-Up

But away from generalities and let's get to business. Before I get to editing I must speak of the set-up. Not that very many readers are likely to plunge into home solo radio program producing day after tomorrow, but as a basis for new ideas I suspect my set-up may be of interest to a good many amateurs and professionals.

First, I am midway between amateur and professional. Professional output—yes. But with amateur gadgetizing, makeshifts, simplicity. That's my own particular choice and need not be yours.

For solo work, here in my study at home, I have—starting at the outside—a four-panel folding screen of economical cardboard. On the inside there is a quilt, tacked on with a stapling gun. (In New York I have the same screen with a layer of Ozite rug lining glued on.) This screen is placed behind me, quilt-side in, and my equipment is in front of me on a pipe-leg table in a corner of the room. The corner is lined with Ozite, glued to the wall for about five feet out each way, and up and down from below the table as high as my hand might reach, sitting down. The table has a pad of Ozite under the tape recorder. That is my sound proofing and it is excellent. Nothing more is needed. The rest of the room remains just as is, plain plaster, woodwork and wooden floor.

On the table is (at the moment) my converted Magnecorder PT-6, with electronics by Howard Sterling. Optimum sound quality at 7½ ips and—most important—a red safety button that must be pushed in before the machine will record, in record position. This was lacking on the original machine. Separate equalization for Magnecorder-type tapes and Ampex-type (now standard) tapes, which is what I use for the program.

My McProud control box, a foot square, was made for an earlier phase of the program (as already described) in which I had two phono inputs and mike, plus cue channels for headphones, all used by my assistant while I sat back and orated. Now I use, mostly, one phono channel and the mike channel, on adjoining pots. The second phono channel is convertible to a high-level input and this is used for tapes played from another machine. Very important when I make tapes in the field and want to dub in excerpts while I talk. (Also for copying my older programs that are equalized wrongly and won't play on today's standard broadcast machines.)

The control box sits immediately to the right of the recorder and a goose-neck lamp teeters with a wobble on top of it. Every so often it topples off and falls on its face on my tiny typewriter, a Hermes, which sits in front of the recorder, between it and my lap. I got a Hermes for traveling, but now I use it exclusively for these broadcasts—do my typing right at the "console," and read it straight into the mike.

The mike is an Altec, fastened by a goose-neck to the back of the table. Its thin bottle-shaped nose stretches out over the top of the control box, pointing straight at my face, about six inches or so away. (That's a story in itself. It took me many months to discover that at close range the Altec is quite directional and produced an unpleasantly dull off-mike effect if I talked at the side of the "bottle" instead of endwise. Nobody told me. Now that I speak directly at its nose, all is well.)

The mike has a variable bass cutoff, which is indispensable for me. I keep it permanently set at 40-cps cutoff, which takes the boom out of my voice as amplified in playback and makes for a much more natural effect. (In a studio the deader, quieter surroundings allow speakers to work further from the mike; moreover, most professional radio voices have vastly more "projection" than mine and so their owners can speak at a foot's distance with more umph than I have at six inches.) As is well known, the more your voice is amplified in playback over its original absolute level, the more boom will it have.

My show uses records. To the right of my recorder table I have another on which (at the moment) sits a D & R turntable, with (at the moment) an Audak HI-Q 7 pickup and professional arm. A good table is absolutely essential for any sort of work on this line and I still do not trust a changer, or equivalent, to produce broadcast-quality low rumble and, more important, steadiness of pitch.

Finally, off to my left, on the edge of a bureau, is a cheap old amplifier, in excellent condition, into which feeds the output of the recorder. It feeds, in turn, a "bookshelf" type speaker system which stands (at the moment) by my chair and aims the recorded sound under the table, where it sort of oozes up at me from around the edges. Purely arbitrary and a better system is to aim the speaker away from you out into room behind your back, outside the screen. Much more natural playback. (But my speaker cord is too short and I won't bother to change it for awhile, most likely.)

The less said the better about the rest of my work room, which is usually piled up with heaps of old tapes, records, screwdrivers, cameras and what-not. My only point in this respect is that you don't need a whole room, much less a specifically soundproofed room, to turn out rather professional home tapes. Just a corner will do, plus the screen to put around it, and the strategically placed cheap padding on both wall and screen.

Clip vs. Fade

My first move, for any show, is to align the tape recorder heads, a job which I detest and often wish to bypass, but usually don't. One lives and learns. Then comes the theme. Cue up the middle of the scherzo from Schubert's Fifth Symphony (the record is marked), leave the table running but the record slipping, held by one finger. Start the tape rolling with the other hand, open the phono pot and let go of the record simultaneously, and you're off. That is, if the record hasn't jumped a groove while you were getting ready and so starts in the middle of the theme. The levels have long since been pre-marked in red china-marking pencil right on the pot, so I know how far to turn it.

Earphones on my head, one phone off, the other half on, so I can just hear the music. (Forgot to mention this vital bit of equipment. They are the Permoflux hi-fi phones, and their wide tonal range I find essential for accurate listening.) I know that with the phone clamped over my ears I talk less naturally and so I leave 'em half uncovered.

When the theme gets to a certain point I *slowly* open the microphone pot (volume

control to you amateurs) to its predetermined level, also marked in red. Why slowly? Well, most studios *clip* a mike into the circuit via a switch. If there is the slightest trace of studio noise in the background this makes it instantly noticeable. Now I have much more than a trace of noise; indeed, you can hear both the turntable and the recorder itself, as background to my voice.

But if I *fade up* the mike slowly, while the theme plays, then the background steals in quietly and is absolutely not noticeable. At the proper point, as I listen on the phones, I fade the music down to predetermined point B, the level for a music background to my voice (worked out long ago by extensive recording experiment) and I talk. "*Hello! This is Edward Tatnall Canby. . . .*" Meanwhile I am following the theme in the phones, while I talk, and I must quickly turn off the music as it ends, before the next part begins—and at the same time grab the record with one finger to stop it. (Some music leaks through even in the "off" position.) This takes a nice bit of coordination. It was a long time before I learned to stop the music at the right place while continuing to talk unconcernedly into the mike! Either the music stopped wrongly, or I muffed my speech.

Usually the first try sounds like, well, pretty bad. I need some vocal warming-up. The second try is better, maybe, but the music starts wrong. The third try is fine, but I didn't fade down the music quite far enough (in spite of the red mark); the fourth is OK except that my "*Hello!*" sounds sort of silly. Not casual enough. (As if I could *really* be casual, with all those controls and things to be thinking about.) Try, try again. Sometimes it takes an exasperating six or seven attempts before I get my theme down. I just rewind the tape and start once more.

Then—to work. I always end the theme recording with the mike open, for background sound. When the next section is spliced on, it also will have background, open-mike sound on it, even when it is music, without speech. Why? Background-noise continuity, which you can see is a cardinal point in my opinion. If the background sound suddenly stopped as the music began, you would instantly be aware of it. But instead, it continues, and then I slowly *fade* it out, well after the music is under way. Never a so-called "clip," turning off the mike via a switch. In this fashion I am sure that you will never consciously be aware of the background sound at all though, as I say, it is actually quite loud. Pure aural illusion, and it's one of the most valuable tricks in this business of making a semi-amateur job sound professional.

I use the same technique for all subsequent joints. At the end of every section of music I fade open my microphone *before* the music ends, so that when I stop the machine there will already be background sound established, though you will not have been aware of its gradual entrance. Then when I patch on the next piece of spoken comment, the two backgrounds merge neatly and you will not notice a thing—no sudden appearance of background hiss or hum or rumble as my voice starts speaking. It is all camouflaged for your ear, mentally, by the fact that it was already there before you expected it, before the music came to an end. Sneak entrance.

Many a radio station I've listened to could profit by a bit more of this sort of technique. Too often they reach the end of their music (or an ad or plug)—and only then, with a very audible clank, does the studio mike open up by switch, instantly calling attention to every trace of background. It's worth remembering that background sound—even hiss and hum—can be an asset if treated carefully, because it tends to give a sense of space and area, to make you feel that you are "in" some room, not merely off in a disembodied electronic vacuum. Think again of the LP records. Better by far to stay put inside a rustling, noisy concert hall between pieces of music, than to be switched suddenly into that soundless ionosphere for ten seconds of interval, then, instantaneously just as the music begins, back into the concert hall with a thump.

The Vanishing Script

So much for a major, if simple, point of technique. Before I stop this installment I'd better untangle a few doubts I must have stirred up as to the actual "writing" of this home-grown radio program. What about the script? When is that worked up? Directions to myself?

In my more conventional days of assistant-produced shows, first in the studio and later on at home, I wrote out complete scripts ahead of time, as anybody in his senses would do. All the words for me to speak, plus complete music cues for my assistant or assistants. Carbon copies for all concerned.

When we used records (mostly 78's, then), I marked the exact grooves with a marking pencil, and on the groove I indicated the precise point where the music started. The script itself gave the record number and side—"*Columbia MM 369, 2, Band 2 from 2nd line, at "X."*" And in addition I usually put in musical identifications—"*First note of trumpet blast.*" (Even so, I never could avoid a long rehearsal where the actual musical sound was pointed out to the assistant, then more or less memorized by him.)

But when I went solo, these directions became notes to myself. Inevitably I began to simplify them. Somehow, I couldn't get excited over the idea of complete directions for "posterity" or something. I remembered the cues perfectly well—why bother to write 'em out. I soon got down to the minimum, the record number and a couple of words of rough identification. "*Bach, Pr & Fg D mi.*"

But already I had crossed a fatal bridge. I had accepted the fact that my script was no longer intelligible to anyone but myself. It was no longer a script. And with that, I began to ease up all along. I ad libbed, departing from the script, adding words, rewriting (so to speak) as I spoke.

I began to ad lib and then take down the ad lib parts from the tape onto the typewriter, just to have them "on the record." Or I wrote them in, in pencil. Or just wrote "(*Ad Lib here*)", not bothering to put the details. So, you see, it soon began to be a question as to which was "the" show—the script or the actual recorded version, on tape.

There wasn't much doubt, as I continued to work solo. No assistant, no necessity for detailed directions and so no need for a detailed script. My typing began to turn into a set of rough notes, more or less complete, for the actual show which existed only in one form—the taped one. I kept the written work mainly in order to know the gist of what was on the tape without having to play it over, and also in case I wanted to edit or correct or change it later on, for repeat use. (This happens all the time.) The script was merely a convenience, strictly personal.

Now this was getting pretty unconventional, if not downright revolutionary. Perhaps I shouldn't say it in print, but I'll

depend on the Profession's good will to let me continue to get away with it! People write in to me and say they liked so-and-so program—could they have a copy of the script?—assuming, like normal people, that I had one. Well, I did, and do, mostly. But nobody could make head or tail of it but me. Illegible scrawl. And if I were to copy it out neatly, I still would have to go to the tape itself to "correct" it, to get the final, official version of the program itself, It's on the record—literally.

Needless to say, I keep all my tapes, though there was a time when I blithely erased them after they had been used. I'd as soon burn up my entire script pile—sooner—as things now stand.

One final and even more drastic step completes this de-scripting process. I started this one a long while back, out of pure laziness, but now I do it regularly.

I write the show as I record it, section by section. Instead of timing each piece, I look at the tape reels and estimate how far I've gone, how much more time I have left. I write a paragraph, practice-read it, then record it. I play it back for effect, then write another, or add the music that should follow. This goes on, piece by piece, section by section, each one put together on the typewriter, then read directly into the mike before the next one is done. No editing—yet. I leave the patching-up process until later, unless I happen to want to try editing a stretch, to see whether it's going to work out right or not. If I know it will work, I just leave it, and go on to the next slice.

At about twenty three minutes into my 28:30 allotment, judging roughly by reel size, I stop and take stock. Better be rounding out an ending. I usually go back and time with a stopwatch up to that point, skipping the numerous hunks of tape that are going to be taken out, just to see where I am. Then I do a tentative ending—try a short piece of music for size, or take a long one and edit out pieces of it, patching them together to fit the remaining time. Too long? Take out a sentence, or a repeat in the music, or try reading the last paragraph again with a few less words.

And so I get pretty close to that fatal 28:30—the one rigid requirement that *must* be met, within not very many seconds each way. (That's where I bump into my neighbors on the air, after all.) And at this point I go back and begin the hook-up process. Editing.

Cough, Cough

My tape at this point is really an odd creation. No more odd than an unedited studio tape, of course, especially a musical recording—and indeed it is strangely like that ultra-modern interim-product. An unedited symphony tape is made up of many fragmentary "takes," unjoined, with much extraneous clutter and clatter and noise between takes. There is no "script" for a symphony on tapes, only a set of detailed directions, telling the editor where to splice, what to keep, what to discard. Those directions are *not* the recorded symphonic performance itself, nor are they its script. Just notes, directions.

So it is with my unfinished home tape. Play it and you have most of the finished job before you, but the sections bump and bang against each other and there are slices of false beginnings, muttered comments by myself (sometimes unprintable—"*And so, you see, old Bach was really not so mathematical cough cough DAMN! Stupid! Clank Clank, Ah-HUM, (where was I? . . . Oh yeah,) And so, old Bach, you see, was* REALLY *not so mathematical. . . .*" Same with the musical portions. Unedited, they overlap, stop, repeat nonsensically, and there are always fragments of erased commentary here and there that interrupt grotesquely for a second or so, like voices on the radio when somebody's hunting stations. All in all, a very strange sound for those who haven't heard it. For me it just means—more work to come.

And so, when the joints are joined, the extraneous material cut out and heaped all over the floor and the table, when the time-continuity is duly faked up and complete, I re-time. How I hate that final step—because it usually isn't final. Somehow, unaccountably, my program is a minute and three seconds too long. What hours can be crammed into a minute!

Sometimes it takes me two or three of them to get rid of that extra bit. I go back and play through the whole show, editing out a word here, a couple of them there, removing a whole paragraph (after being sure that I'll still seem to make sense); I check the music and, perhaps, take out a slice from some piece, editing the jagged ends together so they fit. (But it may take a half hour to find a good place to do the job.) Each little excision subtracts a few more seconds and, eventually, the total timing is down to the required 28:30, or thereabouts.

Much as I hate to believe it, I must admit that these agonizing prunings-to-fit do more good than harm. They are equivalent to the final revisions and blue-pencilings, on paper, that go into any writer's preparation of a work, or into a musician's composition. But instead of blue-penciling my typed material, I blue-pencil my recorded voice. That's tape editing for you.

* * *

So much for the general approach to the home-grown tape program. Do it in bits and pieces, feeling your way as you go just as many a semi-professional, free-lance, documentary film maker operates. Edit, edit, edit. Shape and mould the material while the show is a-building, while you're recording. Polish it up after recording, as well as on paper, beforehand.

Which leaves me where I had expected to be at the end of this second installment, out of space in which to go on to describe a whole raft of little editing tricks that have sort of worked themselves out as I've gone along. Some of them are nothing new to any professional editor, some are merely variants of standard professional technique. (But who ever gets around to letting amateurs in on professional techniques?) A few may be, as they say, original with me. I'll get to these in Part III, in a forthcoming issue.

ABOUT MUSIC

(*from page 6*)

the fiery young conductor who three years before directed the première of *La Bohème*. At the first rehearsal, Caruso substituted a falsetto for the high C at the climax of "Che gelida manina." "Toscanini," writes T. R. Ybarra in his excellent biography of Caruso, "asked him for a stronger high C. Caruso nodded pleasantly. However, at the end of 'Che gelida manina,' there came no strong C from Caruso. 'How about that stronger high note I asked you for?' inquired the conductor ominously. And the tenor, in his current enslavement to temperament, answered with a touch of petulance: 'I don't feel like singing it just now.' Toscanini bristled."

In four out of the five rehearsals ordered by Toscanini, Caruso sang half-voice. Finally, Toscanini threatened to walk out. This brought on several La Scala dignitaries who managed to soothe the protagonists. But the battle ended in a draw. Caruso came down with a fever the next day and barely made it through the performance.

There are a number of conductors who know how to cope with singers. One of these is the redoubtable Sir Thomas Beecham. A friend once heard an opera conducted by Beecham at Covent Garden. When the curtain fell on the last act, he went backstage to visit the conductor in his dressing room and told him how much he enjoyed the performance, how magnificently the orchestra sounded, etc. "As a matter of fact," he said, "you brought out details in the instrumentation which I don't believe I was ever aware of before tonight. But I have one reservation, Sir Thomas. Your men played so loud that I couldn't hear the singers on the stage." Sir Thomas stroked his goatee, his eyes twinkled, and he said, "That was my intention, old chap. I drowned them out deliberately in the interests of the public."

In Latin countries, the public seems capable of taking care of itself. Over-ripe tomatoes are sold outside provincial Italian opera houses for just such a purpose. Temperament, it appears, can be on both sides of the footlights.

PATENTS

(*from page 2*)

amplifiers V_2 and V_3, to the recording head. V_5 is connected as an oscillator to furnish bias through the output amplifier V_4.

In the PLAYBACK position, the head is switched to the input of the amplifier and the recording level control is eliminated. Since extra amplification is required on playback, V_5 is now utilized as an amplifier, and V_4 feeds the speaker. The tuned circuit still appears to be across the grid of V_3, but the variable capacitor has such a low value that the tank has no effect at audio frequencies.

Copies of U. S. Patents can be obtained for 25 cents each from The Commissioner of Patents, Washington 25, D. C.

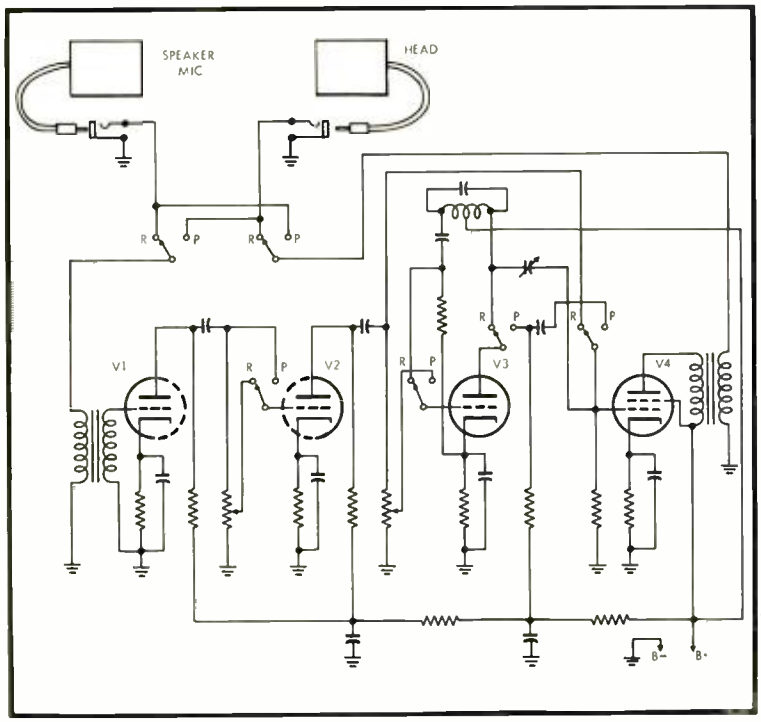


Fig. 3

DISC RECORDING

(*from page 19*)

nately, however, while pre-emphasis does extend the lower limit of the dynamic range by reducing surface noise and allowing softer signals to become audible, i increases treble groove excursions at the same time, thus restricting the upper limit of dynamic range that can be used without distortion. It can be seen that the decision as to the optimum characteristics to use for recording is not a simple one.

Figure 4—8 shows over-recorded grooves which have cut over onto each other along side of normally cut grooves.

Modern Techniques for Increasing Dynamic Range

Older records had a severely limited dynamic range. Not too many years ago recorded orchestral crescendos were considerably watered-down versions of the original, and any really soft passages would have been wasted, as they would have been drowned out by surface noise.

Modern records have increased this dynamic range, approaching that of the original sound, by the use of several techniques. First, the surface noise has been greatly reduced through the use of improved materials. This makes it possible for the recordist to cut soft musical passages at a very low level. It takes a much smaller groove wiggle to override the inherent irregularities of the material of the groove wall itself.

Second, there are methods for extending the upper limit of the dynamic range. One such method is to employ *variable-pitch* recording, that is, to increase the spacing between grooves automatically when a heavily recorded passage appears. Another method, called *quality-control*, is to attenuate instantaneously the dangerous portions of the signal which might create cutover or high-frequency distortion. The use of

improved pick-ups and needles, making it possible to trace heavily recorded grooves more faithfully, also works to increase the allowable dynamic range.

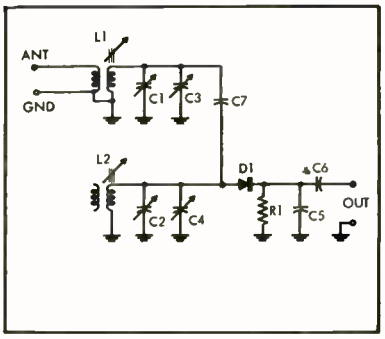
Recording Equipment

The turntables, cutting heads, amplifying equipment and tape machines (the latter almost always make the initial recording) used in recording must be of the highest quality, so that a minimum of limitation is put on the capabilities of the reproducing equipment. While a detailed discussion of recording equipment is not appropriate here, a typical professional recording turntable and cutter is illustrated in *Fig.* 4—9.

AUDIOCLINIC'S AM TUNER

Inadvertently omitted from the question and answer department, "Audioclinic," in the December issue, the parts list for the hi-fi AM tuner described by Mr. Giovanelli has been the subject of numerous inquiries from readers who wished to duplicate the performance attributed to the circuit.

For the benefit of readers so inclined, the schematic is here repeated, together with the heretofore missing parts list:



C_1, C_2 Two-gang variable capacitor, maximum capacitance 360 μμf
C_3, C_4 3–30 μμf trimmers, usually an integral part of C_1-C_2
C_5 50 μμf, mica or ceramic
C_6 .02 μf, paper, 200–400 v.
C_7 "Gimmick" capacitor made by twisting two pieces of insulated wire together. (See below.)
D_1 1N34 germanium diode
L_1, L_2 Broadcast band slug-tuned antenna coils.
R_1 4.7 meg.

C_7 is a capacitor made by twisting two pieces of insulated wire together. The gauge of the wire and the thickness of the insulation are not critical, and there is no connection between the two wires. The pair should be from 6 to 8 in. long as a start. If C_7 is too large—the wires too long—tuning will be broad. Reduce the length a little at a time, realigning C_3-C_4 and L_1-L_2 after each change in C_7. Compromise between selectivity and output signal.

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Hallicrafters Company will soon be purchased by Penn-Texas Corporation, according to William J. Halligan, Hallicrafters president. The boards of directors of both companies have approved the agreement transferring assets, and the proposals will be submitted for approval to stockholders at special meetings to be called shortly. L. D. Silberstein, chairman of the board and president of Penn-Texas, says it is the intention to continue with the present Hallicrafters management.

Industry People...

Jimmy Carroll, Jr., is following in the footsteps of his dad, **Jimmy Carroll, Sr.,** sales engineer in the sound department of New York's Harvey Radio Company—he's installing a complete music system in one of Connecticut's most lavish mansions . . . **Ed Altshuler,** formerly national sales manager for Berlant-Concertone, is the new consumer products sales manager for the marketing division of American Electronics, Inc., Los Angeles, of which Berlant-Concertone is a subsidiary.

Lynn Eaton, vice-president of National Company, Inc., has been appointed assistant to the president . . . Personnel reassignments at Magnecord, Inc., find **George Gynn** named product manager for the tape recorder division, **Michael G. Seidl** appointed product manager for all MagneMusic items, and James E. Steele named Western regional sales manager of the MagneMusic division . . . **Dr. S. J. Begun,** internationally-known authority on magnetic recording, has been appointed director of marketing for Clevite Corporation where he will supervise the firm's patent and research departments.

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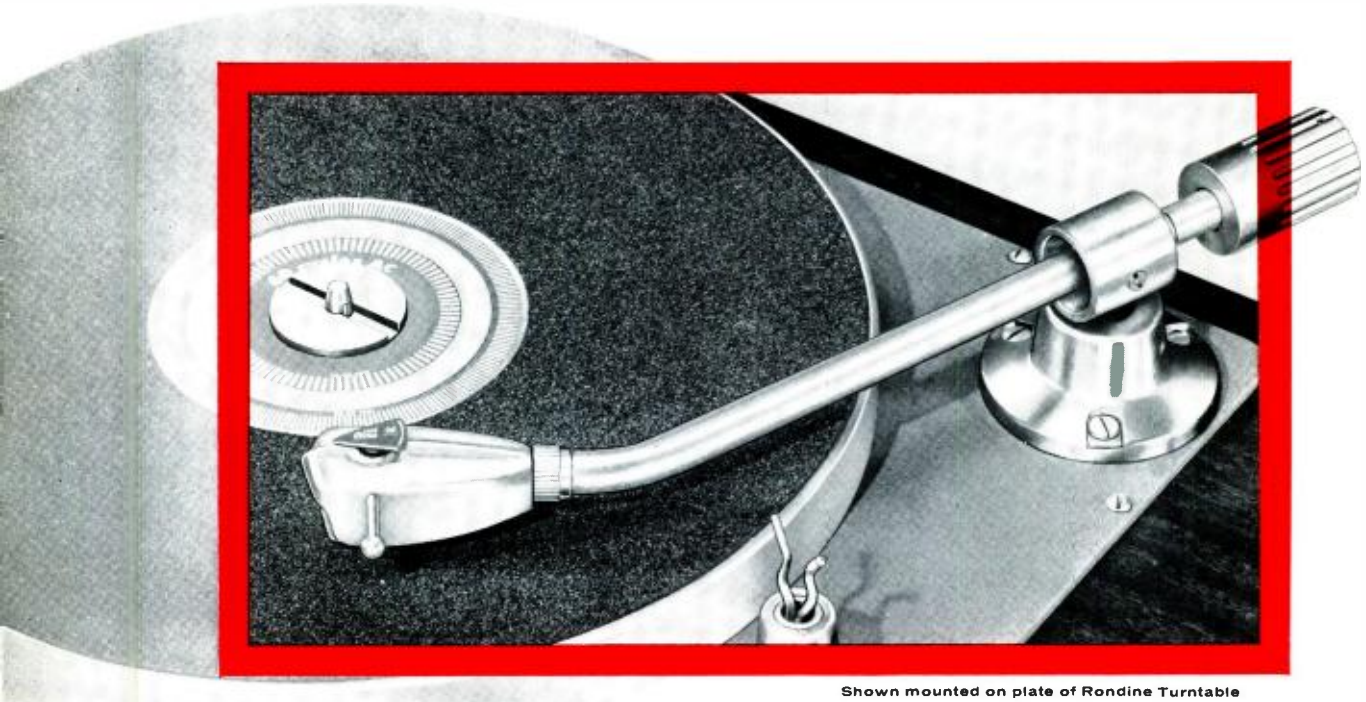

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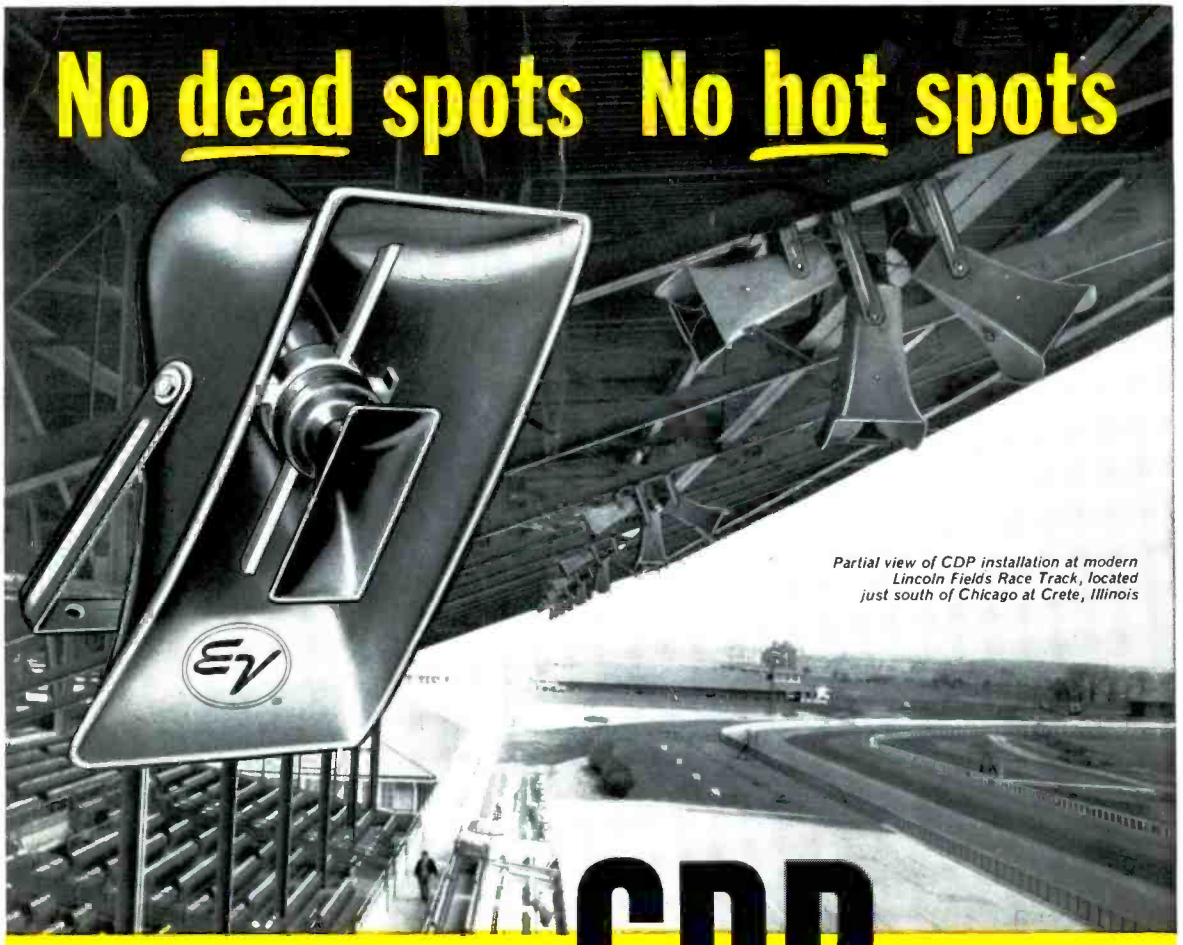

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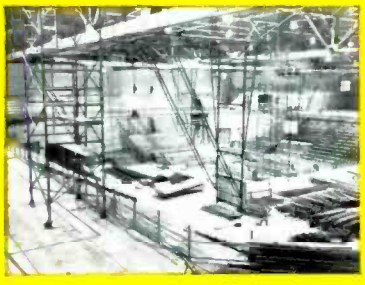

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