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ELECTRONIC TECHNICIAN • September, 1960

STEREO 1961

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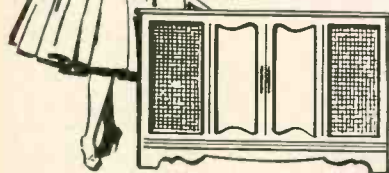
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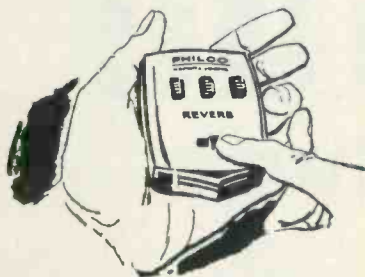
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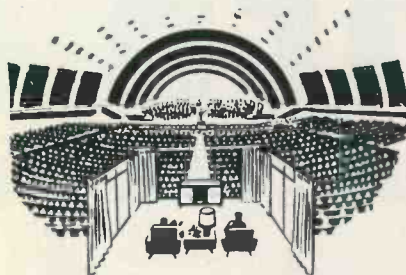
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Adjusting Stereo To The Room Environment

Selection, Placement & Adjustment Of Equipment To Suit Room Acoustics For Optimum Listening Pleasure

• A stereo high fidelity show last year had as its theme, "Decorate Your Home With Music." It emphasized selection of components to *visually* suit a decor.

This theme is certainly not an objectionable one, since visual acceptance brings stereo greater sales acceptance.

What appears more important, however, in the final analysis, is *acoustical* satisfaction for the customer's ears. How a stereo system sounds in the home will determine stereo's "staying power." This means suiting the room decor *acoustically*.

As well as using different colors and styles of furnishing to complement a room, every room must be "adjusted" to complement its sound characteristics, too. It is not too far fetched to say that furnishings must be adjusted to the system for best stereo results. Since the audio professional and technician is limited in this direction, the next best

thing is to adjust the stereo equipment to the furnishings, for optimum results.

Acoustic Treatment

Most rooms can be improved acoustically. If a customer has the money to build and properly furnish a room specially for listening to stereo, skillful use of acoustic tile, drapes, etc., will help achieve the best overall sound effect. But few persons willingly go to this expense. For most, the placement of absorption and reflecting surfaces is limited.

Consequently, a stereo system must be designed and built to suit the room. Primarily, this means proper selection and placement of speakers to provide an optimum listening area. Some arrangements are shown in Figs. 1 through 6 for various type rooms. Since there can be an almost infinite variety of room conditions to satisfy—different sizes, shapes, varying areas of

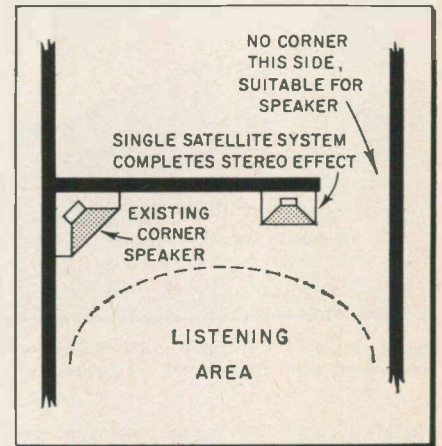


Fig. 3—Unorthodox room area uses single satellite with corner enclosure for completing true stereo listening area.

reflecting and absorbing surfaces on walls, ceiling and floor—these arrangements are to be considered as helpful guides only.

As the professional audio man already knows, a room, in effect, becomes part of a speaker's enclosure. For this reason, rooms with both dimensions less than 10 to 15 feet are best served generally by some form of projection unit. Acoustic boundaries of the room are effectively expanded, and inconsistencies developed by a "big" speaker system are avoided. (See Fig. 5A)

When both dimensions of a room are more than 20 to 25 feet, projection units are not desirable. Speakers should be well spaced, preferably in corner enclosures (See Figs. 4 and 5-B). Reverberant effects of the "big" system (similar to that in a movie theatre) will be acceptable in the large room, although some listeners prefer some absorbing material at the four wall centers to reduce reverberation time and improve intelligibility.

Depending upon a number of factors, rooms of medium size may be easier or more difficult to handle. Either system may be used but each

Fig. 1—Arrangement for a typical oblong room with two doors at one end and picture window at the opposite end.

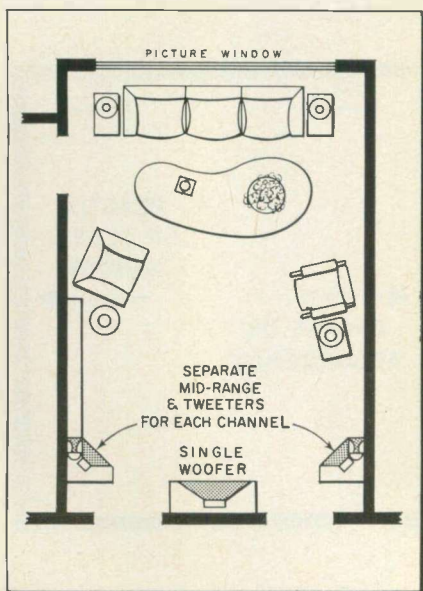
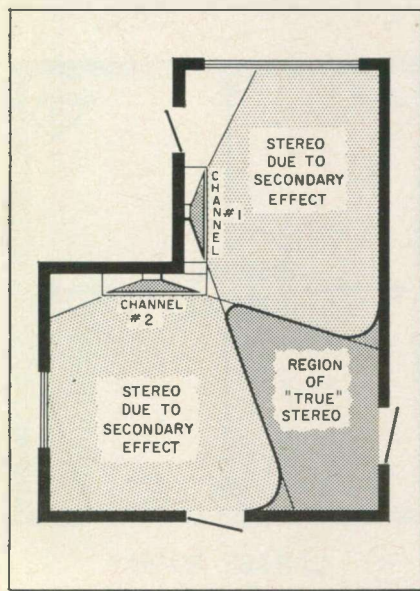


Fig. 2—One arrangement for "L" shaped room with each channel enclosure projecting 90° apart. Note effective listening area.



must be adapted specifically to suit the acoustic properties of the particular room.

Audio text books frequently explain in detail how to set up stereo in a convenient rectangular (oblong) room. But it is surprising how many rooms have some other shape, particularly some form of L-shaping. (See Figs. 2 and 6A). Even when these rooms are oblong,

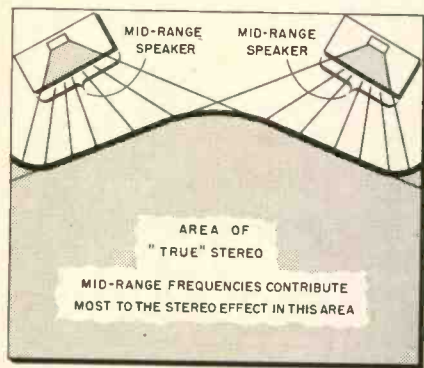


Fig. 4—Typical "average" room stereo arrangement with two corner enclosures.

varying wall surfaces require deliberate out-of-balance treatment. Such an arrangement is shown in Fig. 6B.

Careful consideration of the acoustic characteristics of a room's walls, floor and ceiling height before speakers are selected and located cannot be overstressed. Furthermore, at some point the customer should be advised that an over-stuffed wing or barrel back chair seldom makes a good listening chair—even when located in the best sound area. Absorbing material near the listener's ear is a highly undesirable condition.

Speaker Enclosure Selections

For this discussion, loudspeakers can be placed in three groups, as follows: Omnidirectional—giving smooth radiation in all directions; directional—concentrating the sound into a fairly narrow beam; and semi-directional—usually restricting the sound to horizontal directions, but distributing it well around in the horizontal plane.

When a room's floor and ceiling are absorbent, with carpet and acoustic tile, but with reflective walls (painted plaster or glass windows) diffuse omnidirectional

speakers will probably do the best job.

Where the walls are also absorbent, with drapes, bookshelves, paintings, and other absorbent materials present in wall center areas, omnidirectional speakers frequently seem over "dead." In this case, directional units can be used to beam the sound to null or "dead" points.

The typical "recreation room," having bare composition tile floors and ceiling, with painted or bare wood walls, and metal-canvas-sling furniture, can be helped some by tiling the ceiling. Semi-directional type speakers can also help by horizontal radiation, minimizing reflections from floor and ceiling.

Separate speakers offer greater placement versatility. Conversely, speakers enclosed in one cabinet

have less placement versatility.

Optimizing Equipment

Whether your customer has the new dual units designed specially for stereo, or two of the older monophonic type components, stereo is a more complicated installation. Because of this, many hi-fi listeners have become dissatisfied with stereo, concluding it doesn't work, or feel it is not worth it. Generally, the real cause of this dissatisfaction is that their system has not been optimized to perform as it can and should.

Frequency Balance

Audio professionals know about balancing left and right—even if

Fig. 5 (A)—Two channel angle projection provides optimum results for smaller room. (B)—Larger room gives better results with corner enclosures. Absorbent surfaces are optional in each case for reducing reverberation time constant.

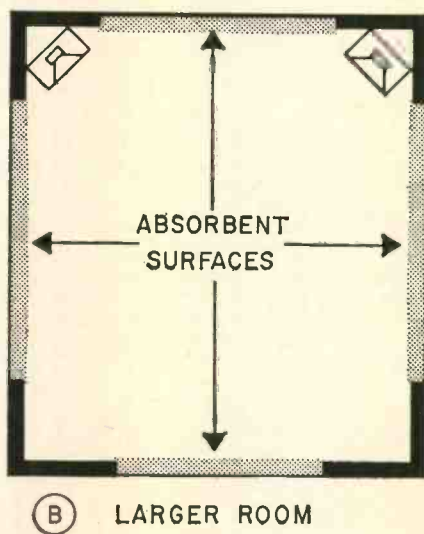
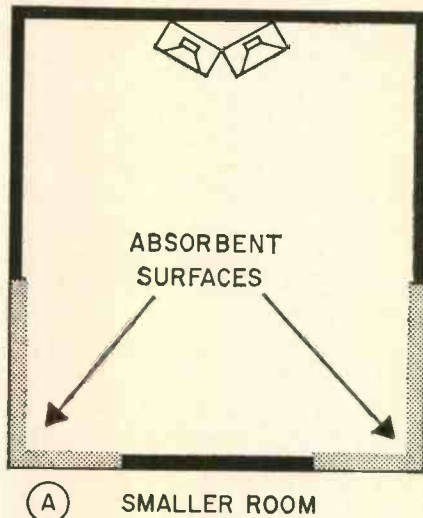
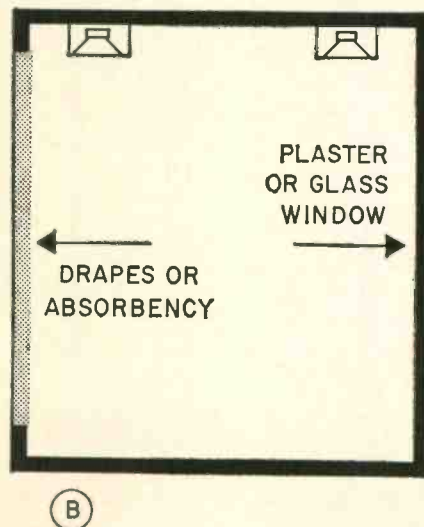
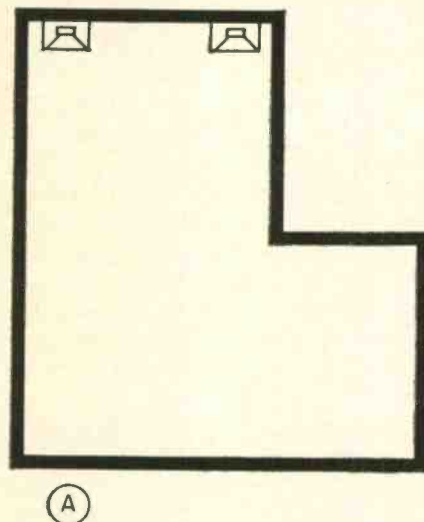


Fig. 6 (A)—Another arrangement for an "L" shaped room. (B)—Arrangement for optimum results where one wall is draped and the opposite wall is reflecting.



they disagree on the best way to achieve this. What is commonly overlooked is balance in the frequency range.

Some hi-fi owners have the habit of working their monophonic system with the maximum bass and treble boost, under the impression this gives them a maximum of "everything." When they have stereo installed they continue the practice—and are, more often than not, disappointed with results. Some call their technician; some give up listening to stereo.

The customer should be advised that operating stereo in this manner leaves a hole in the response, right where it is important for good stereo. The best setting is with bass and treble controls both close to flat—neither boost nor roll-off.

System Phasing

For many reasons, a large amount of confusion exists on the subject of phasing. Some maintain that phasing of stereo systems makes no noticeable difference. There may be some circumstances where phasing makes *little* difference, but it makes a very *dramatic* difference, generally.

With one of the speaker systems out-of-phase with the other, there will be noticeable loss of bass, thinness or unnatural effect in the mid-range and treble, and confusion of sound rather than a clear stereo effect. The easiest way for the technician to check this, if the preamp does not have a phasing switch, is to reverse connections at one speaker and see which is best, as shown in Fig. 7A.

But phasing must be checked throughout. It can be right on phono and wrong on tape. It may be either way on radio, especially the AM/FM type. The system must be phased out so it is right on all modes employed in the system.

An easy way to check phasing on phono is to play a mono record. This will show center location of sound when correctly phased and balanced. There is no such easy way to phase for tape and radio.

On phono or tape, phasing can be switched at either the input or output. But on radio the only feasible place to change it is at the

loudspeaker (see Fig. 7A). Consequently, where radio is used, the loudspeakers must be phased to suit radio, and the phono and tape input connections then used to phase these program sources, as shown in Fig. 7B.

Ground Loop Hum

When hum is a problem the stereo system should first be checked for ground loops. Discon-

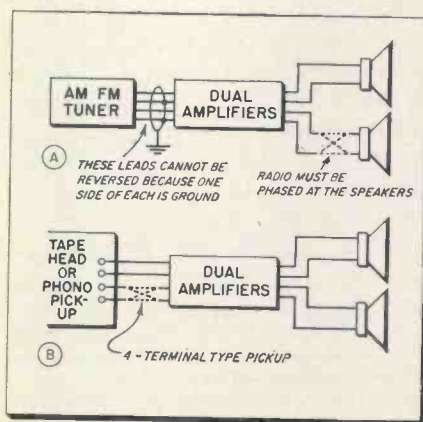
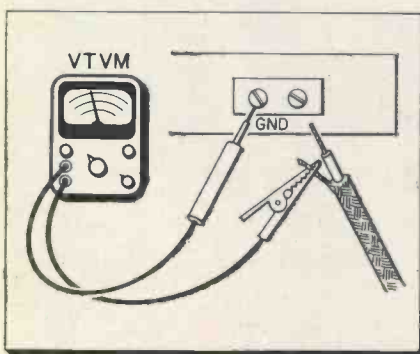


Fig. 7 (A)—First step in proper phasing of a stereo system should begin at voice coils of speakers with radio reception. (B)—Tape player or phono phasing is accomplished at the tape head or phono pick-up.

nect everything except one monophonic channel from one input—say phono. If this clears the hum, it is probably ground loop trouble. If the hum appears only when the stylus touches the groove, it isn't hum at all and falls in the classification of rumble. The rumble may be eliminated by working on the motor, but chances are a better turntable or changer is needed.

Fig. 8—Ohmmeter is used to trace ground loop causing hum in stereo equipment.



Having proved it to be ground loop hum by removing everything but one channel and one input, now connect everything back, one at a time, until the culprit is located. Then trace the ground circuit to see how the loop occurs. Rather than rely on a visual check, an ohmmeter should be used to check the loop, as shown in Fig. 8. The trouble may not be a loop, as such, but a leaky power transformer allowing line currents to stray into the ground system. Sometimes reversing the power plug for the component causing trouble will minimize or eliminate the hum. The best thing is a new transformer.

Remote Control

The nature of stereo motivates the listener's need and desire for remote control. It is difficult to obtain correct balance by walking over to the amplifier to make an adjustment and then go back to the chair to find out what results were obtained. But there are right and wrong ways to solve this problem by remote control from a favorite listening point. Sometimes the wrong way can cause trouble: either a ground loop or loss of highs because of excessive cable capacitance.

There are two ways to avoid loss of highs caused by cable capacitance:

1. Reduce capacitance by employing low capacitance cable.
2. Use a cathode follower at the input to the remote cable.

A listener usually wants the phono, tuner and tape deck controls at the remote location, leaving only the power amplifiers hidden away in the installation. For this combination, the preamp should have a cathode follower output to prevent high frequency loss by the long shielded leads to the amplifiers. If the customer's preamp does not have a cathode follower output, special low-capacitance cable may prove satisfactory if the run is not too long.

Whether or not the hi-fi owner calls because he is dissatisfied, the technician can boost his neighborhood prestige and customer's confidence by suggesting equipment optimization. If not, the listener may be disillusioned with stereo. •

Solving The Stereo Disc Puzzle

Theory And Practice Of Two Channels In One Record Groove

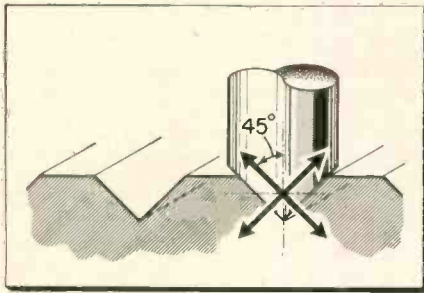
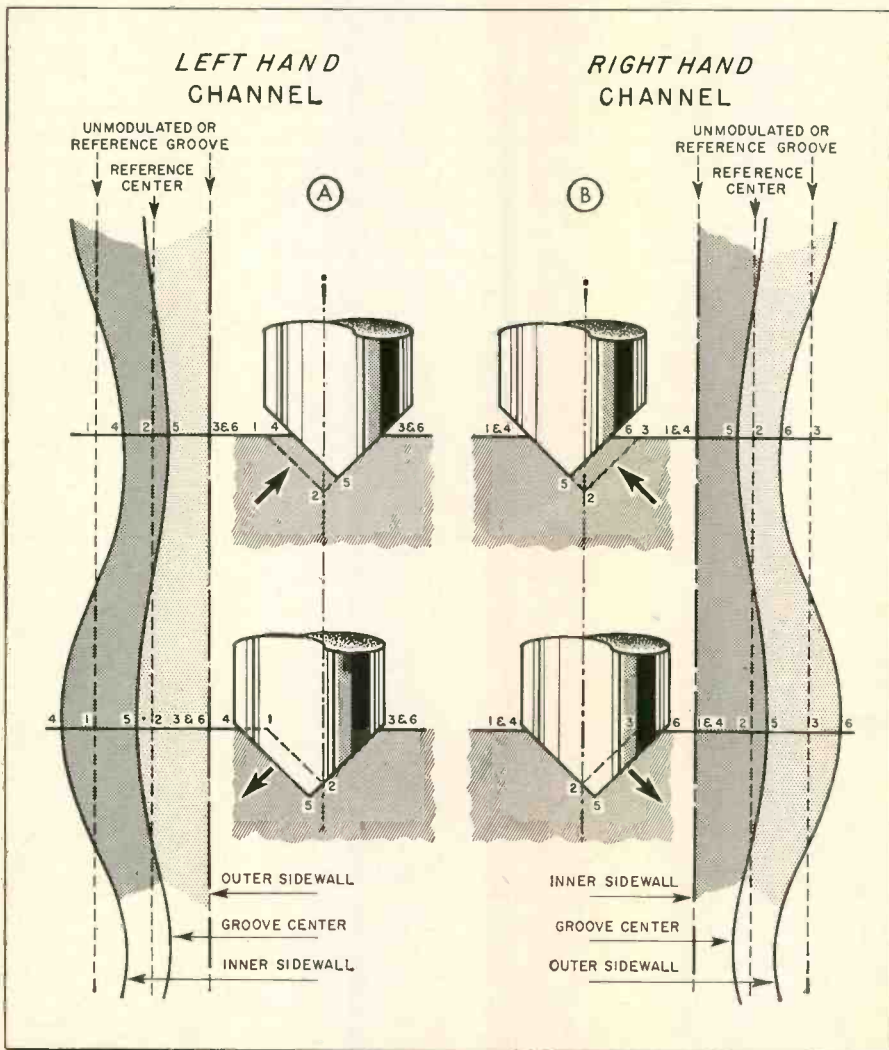


Fig. 1—The standard stereo recording and play-back system is based on the Westrex 45°/45° method of diagonal stylus movement.

• The evolving art of stereo is firmly entrenched in the minds and pocketbooks of consumers. And, in the disc-versus-tape controversy, stereo disc is the sales king, thus far. Therefore, it is especially important for technicians associated with audio sales and service to understand the operating principles of a stereo disc.

Fig. 2 (A)—When the left channel (inner wall of record groove) is modulated, the stylus moves diagonally up to the right or down to the left. (B)—Stylus moves up to the left or down to the right when the right channel (outer groove wall) is modulated. Unmodulated grooves are shown as straight lines to simplify the drawing (they're actually curved).



45/45 System

Getting two channels into one groove isn't as complex as it might initially appear. Record groove modulations can be transmitted by a single stylus to a twin cartridge through diagonal movements, as shown in Fig. 1.

Let's consider the left channel

first, which is identified as the inner wall of the record groove, as seen by the viewer. Fig. 2A illustrates the motion that the stylus will have if only the left hand wall is modulated: the stylus will travel somewhere on an "up to the right" or "down to the left" plane, depending on the inner sidewall's thickness. Fig. 2B illustrates the right hand channel with modulation. This is the outer sidewall of the record groove. Accordingly, the stylus will travel diagonally "up to the left" and "down to the right" if only this sidewall is modulated.

The stylus will travel up, either in the right 45° plane or the left 45° plane, when the groove becomes narrower. Or, conversely, it will travel down when the groove becomes wider. When the stylus moves back and forth, the center line of the modulated groove moves accordingly. The stylus tip, it should be pointed out, is always in the groove center and contacting both sidewalls.

Although it is necessary to first analyze stereo recording principles as a distinct right and left channel, it should be understood that both channels are recorded at the same time; not right and left separately. In a similar manner, both channels are played back at the same time. The stylus is in one position only at any given instant. This position "defines" both walls.

Vector Forces

Fig. 2 clearly illustrated how a stylus can move diagonally by following the groove modulations of either the left hand or right hand channel. A combination of both forces, however, is more likely to occur in a recording. The concept

The Stereo Record

How does the stylus move when:

- Groove width changes?
- Groove center changes?
- Groove changes combine?

For answers to these, and other perplexing stereo questions—see text.

of stereo sound, is, after all, a psycho-physical manifestation. Orchestral instruments don't resound from only the extreme left or right. Some instrument groups are placed at left center, some right center, some at the precise center, etc. For sound direction to appear at other than extreme left or right, *both* channels must be modulated.

Fig. 3 illustrates how this occurs in relation to stylus movement. To reiterate, the stylus can only be in one position at a given instant. The resultant force of the left channel force and the right channel force establishes this position. When both channel walls push up at the same time, with the same force, the stylus will travel straight up. This is only natural since both forces, which are opposite, yet equal, will neutralize each other.

When the grooves are narrow, the stylus is "pinched" and consequently raised vertically. As the grooves widen, the stylus tip low-

ers vertically. This is shown in Fig. 4. An out-of-phase force, that is, one channel pushing up while the other is cut beyond the reference point, resulting in a down force, will cause the stylus to travel laterally. The stylus' horizontal movement will be to the left or right, depending on the direction of the resultant force. Fig. 3 illustrates a stylus movement to the left due to the resultant force being in this direction.

The stylus can, therefore, be displaced horizontally, vertically, or both, from the reference point at any given instant.

Complex Grooves

Thus far, we have discussed left and right sidewalls that are essentially the same, though having a 90° relationship to each other. But how does the stylus operate when both channels are decidedly different? One mental conception that must be overcome to understand how stereo grooves affect stylus movement in relation to the drawings is: horizontal expansion and contraction of the groove sidewalls indicate *vertical* movement. This horizontal motion is frequently misconstrued as stylus lateral motion.

The upper two drawings of Fig. 4 illustrate this point. As the side-

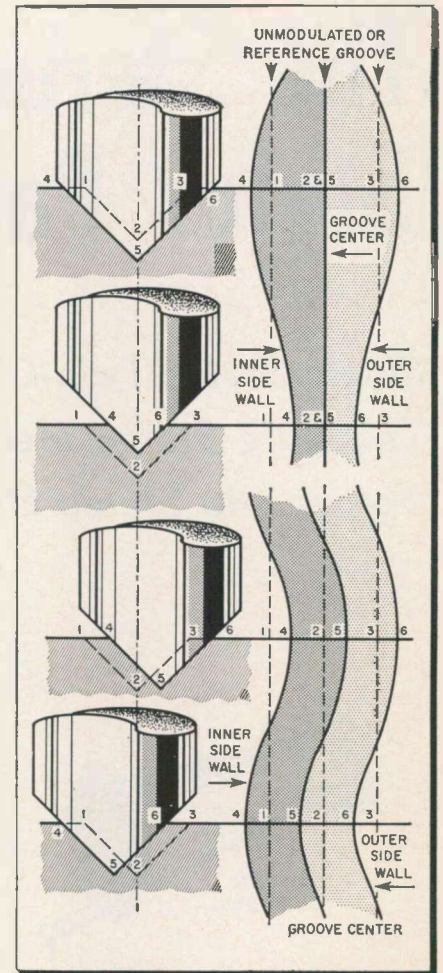


Fig. 4—Pinched and expanded grooves make the stylus rise or fall. A straight center line indicates no lateral motion. Curved center line shows lateral movement. Unvarying reference groove width doesn't displace stylus vertically up or down.

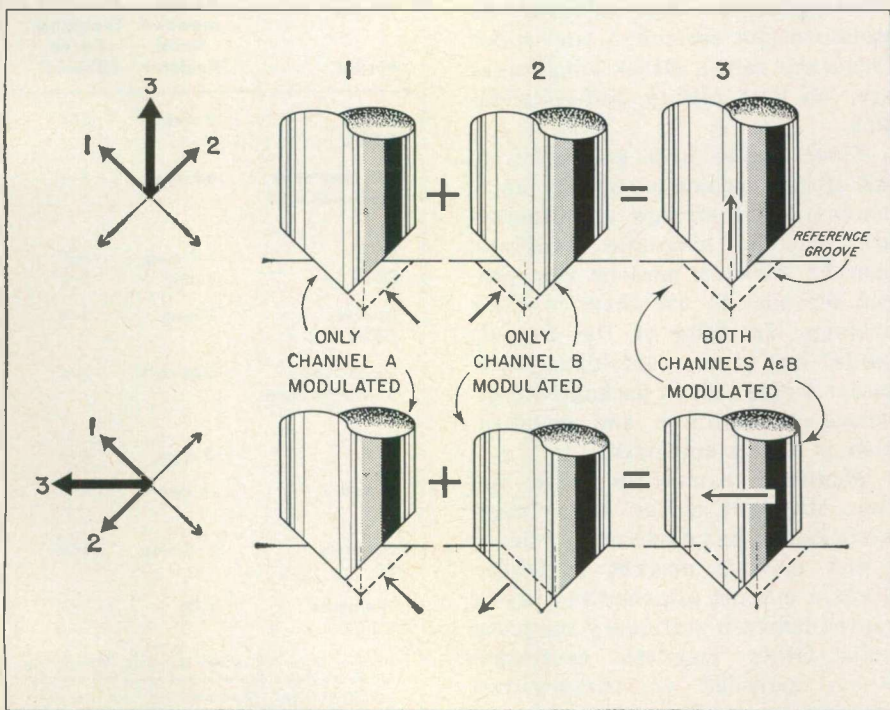
walls widen and narrow the stylus is lowered or raised. It is only where reference or groove center changes that lateral stylus motion is described pictorially, as shown in the lower two drawings of Fig. 4.

The stylus can assume a position that is displaced both horizontally and vertically from a given reference point on a stereo record groove. The position will vary from one instant to the next, depending on the different width and lateral displacement of the groove at a given instant.

Since the groove walls vary from one instant to the next, they do not appear symmetrical, as indicated in Fig. 5. The first stylus drawing shown displays lateral movement to the left and vertical motion down. The stylus obviously traced the groove shown at its right. Notice the displaced groove from the reference groove, indicating later-

(Continued on page 126)

Fig. 3—The instantaneous position of a stylus tracing a stereo record groove is determined by a force which is the resultant of combining both left and right groove forces.



The Stereo Cartridge Stylus Partnership

Single-Stylus Twin-Channel Cartridges Translate Stereo Mechanical Forces Into Stereo Electrical Signals

Stereo Cartridge/Styli

Magnetic

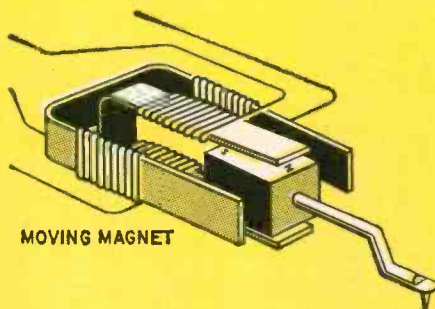
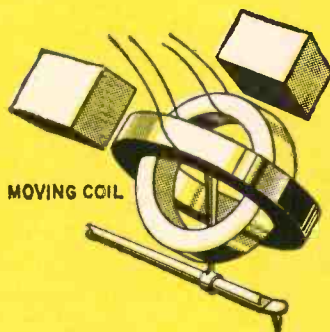
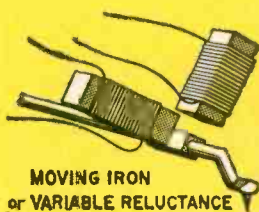
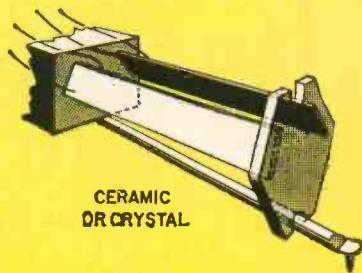
Moving Iron
Moving Coil
Moving Magnet

Piezo

Crystal
Ceramic

Styli Size

0.5 & 0.7 Mil



• Cartridge manufacturers made the transition from monophonic cartridge to stereophonic cartridge production in a remarkably short time (some mono cartridges are still being produced for replacement purposes). However, production is not the only important result; improved quality and new design concepts are major contributions, also.

Piezo-electric cartridges are challenging many magnetic cartridges in today's stereo hi-fi market, whereas hi-fi aficionados formerly held crystal or ceramic cartridges in low esteem. This changing attitude is due to many improvements, such as: lower tracking force, imperviousness to moisture (for ceramics), and wider frequency range. Other advantages are: no hum pickup, self-equalization.

Since stereo hi-fi amplifiers do not always include a ceramic input, some piezo cartridge manufacturers include magnetic adapters, thereby allowing persons who prefer ceramics to use them in their systems. In spite of the inroads made by piezo cartridges, their major use is still in package stereo, where preamplifiers and equalization is rarely employed.

Magnetic cartridges have not been stagnant, either. A new magnetic design has made many friends—the moving magnet cartridge. Here, a magnet attached to a stylus moves between stationary magnetic coils. Other magnetic cartridges were upgraded in performance. Moving iron and moving coil car-

tridges are still very popular transducers.

Operation

Cartridge design changes invoked by stereo discs are essentially internal; externally, only the number of connection terminals, either three or four, identifies it as "stereo." Instead of a side-to-side stylus motion transmitting me-

CHART I

Piezo Type Cartridges		
Model	Recommended Load Resistor	Recommended Tracking Force (Grams)
Astatic 13TBX	2 meg	5-7
CBS Electronics Professional 55	adapters	1.5-4
CBS SC-1	1.2 meg	5-7
SC-7	3 meg	5-7
Duotone GPS 73	2 meg	2-4
Electro-Voice 31MD (for mag. input)	22K-47K	2-4
Erie	3 meg	4-6
Ronette 106	.5 meg	4-6
Sonotone 8T	1-5 meg	3-6
Weathers C-501	47K	1-2 3-6

* Higher force for record changers. Where two forces are indicated, the higher range is for changers; lower range for professional-type tone arms.

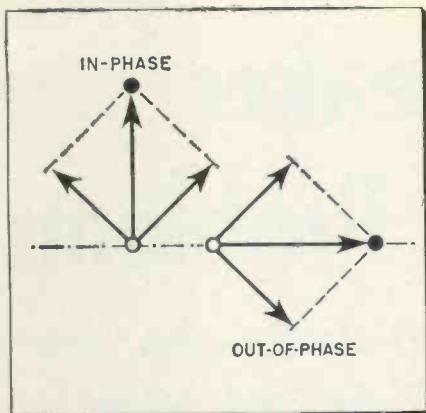


Fig. 1—Equal in-phase mechanical forces result in moving the stylus vertically up or down. Equal out-of-phase forces cause lateral left or right stylus movement.

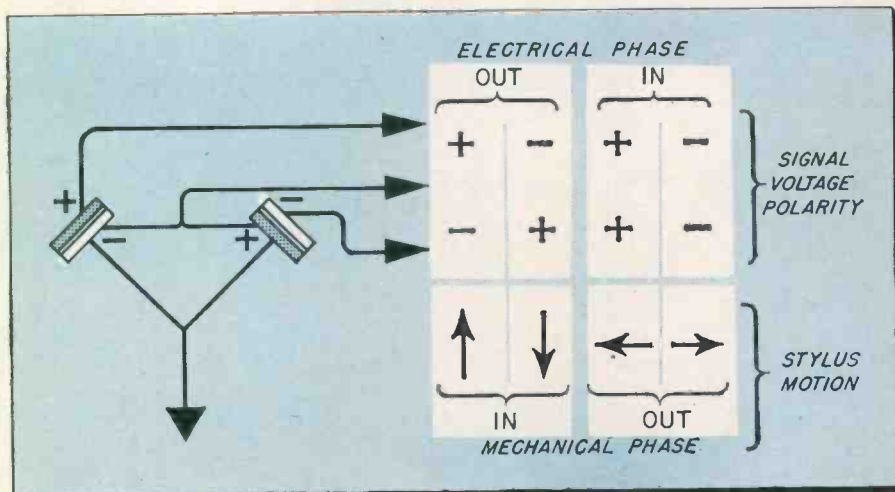


Fig. 2—Stereo recording standards require that in-phase signals result in lateral groove modulation. Mechanical in-phase forces, however, result in vertical displacement, as shown in Fig. 1. To comply with standards, one of the two cutter head coils are reversed. This reversal places the essentially in-phase bass signal modulations in the horizontal component of the disc, therefore minimizing vertical modulation difficulties. To reproduce the original phasing before reversing a cutter head coil, one channel of the playback cartridge is reversed by the manufacturer. Thus, in-phase mechanical forces result in out-of-phase electrical signals, and vice-versa.

CHART II

Magnetic Type Cartridges		
Model	Recommended Load Resistor	Recommended* Tracking Force (Grams)
Audio Empire 88	47K	2-5
Audio gersh Stereotwin	37K	4-6
Dynaco Stereodyne	47K	2-4
Electrosonic C-100	47K	2-4
General Electric GC-7	100K	3.5-7
General Electric VR-225 VR-227	47K	2-4 5-7
Grado Master	5K	3
Norelco AG 3400	68K	3-5
Pickering 371	47K	2-7
Pickering 380	47K	2-5
Recoton RG-745	68K	3-5
Scott-London 1000 (integrated arm)	50K	3-5
Shure M3D	47K	3-4
Shure M7D M8D	47K	4-7
Shure M216 (integrated arm)	47K	1.5-2

* Higher force for record changers. Where two forces are indicated, the higher range is for changers; lower range for professional-type tone arms.

chical energy to the cartridge elements (where mechanical energy is converted to electrical energy) stereo cartridges must respond to horizontal *and* vertical motion.

The stylus displacement, and therefore pressure or position of the cartridge's internal elements, is based on combined mechanical forces, as shown in Fig. 1. In-phase mechanical forces, that is both record groove sidewalls exerting either an upward-diagonal or downward diagonal force, will displace the stylus vertically. Out-of-phase forces occur when one sidewall exerts a down-diagonal pressure and the other sidewall an upward-diagonal force; or vice-versa. This results in horizontal stylus displacement.

To achieve the RIAA's recommendation of equal in-phase signals causing lateral modulation of the record groove, the leads to one of the record groove cutter head's coils are reversed. Accordingly, the playback cartridge terminals are, or should be, reversed in phase by the manufacturer. Consequently, the playback cartridge reproduces a mechanical in-phase signal with a lateral motion instead of a vertical motion (see Fig. 2).

Stereo cartridges can play monophonic records, also. Since vertical motion is not employed in mono grooves the cartridge should be made insensitive to it. This is accomplished by a switching arrangement incorporated in most modern preamplifiers or control sections.

The stereo cartridge elements are connected in parallel, enabling the cartridge to combine lateral information, yet be insensitive to vertical information. (Equal and opposite voltages cancel each other.)

Specifications

Most stereo cartridge/stylus spec terms remain essentially the same as their mono counterparts. A new specification, however, was introduced for stereo—channel separation. Since two channels are activated by one stylus, a degree of cross-talk exists (audio of one channel appearing in the other channel, or vice-versa). In other words, cross-talk states how well each channel's sound is separated from the other. A 20 db or greater channel separation is considered adequate for minimum cross-talk.

Although other specification terminology remains the same, numerically they differ. Stylus pressures, for example, have undergone radical changes. Today, a stylus pressure of two or three grams is not uncommon. In pre-stereo days this would have been fantastic.

Compliance, although not a new term, is a commonly used one today. It indicates the amount of stylus movement per one dyne pressure. High compliance permits lighter tracking. Mono cartridges needed only lateral compliance, since vertical force signals were unnecessary. Stereo cartridges, how-

(Continued on page 121)

Loudspeaker Installation Problems

Enclosure Tuning & Multiple Speaker Feeds Are Some Of The Tasks Confronting Technicians Today

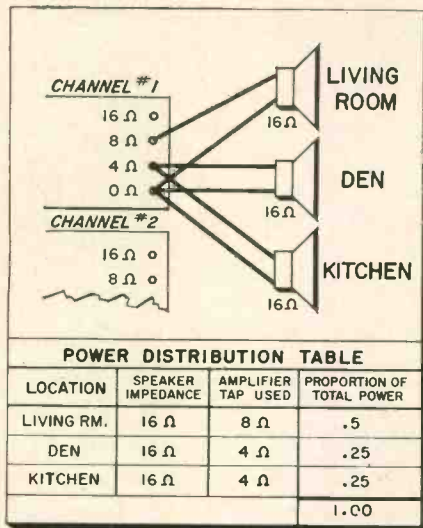


Fig. 1—Arrangement for connecting three speakers to a stereo amplifier's output for proper division of power and correct impedance match. For stereo, three additional speakers are connected to the second channel.

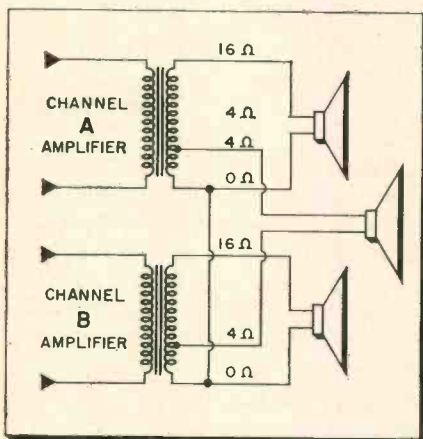


Fig. 2—Connecting one remote speaker to combine left and right channel outputs.

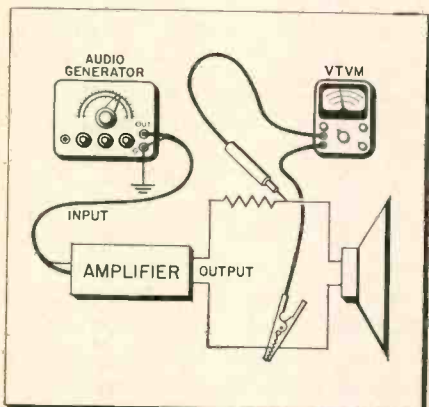


Fig. 3—Test set-up for determining a speaker's resonant frequency. Speaker is removed from enclosure. Cone faces upward on bench.

• Recurrent problems concerning speakers can be disturbing, especially if the answers are not at hand. Some of these problems almost always include the following: multiple feeds, electrostatics, fusing, and baffle tuning.

Multiple Feeds

After getting stereo in the living room, many people would like to have extra speakers so they can listen to it in a dining room, bedroom or any other part of the house.

An important consideration here is having an amplifier with sufficient power to drive all speakers at once, if required. Since most remote speakers are high-efficiency types, this doesn't present any difficulties to today's high power amplifiers. If a low-efficiency speaker is being used, though, be sure the amplifier can drive it adequately when all the other speakers are employed.

Multiple output connections can be arranged so: (a) each speaker gets a proportion of the total power to give equal apparent loudness in each room, and (b) the overall matching on the amplifier is correct, so it can deliver its rated maximum. See Fig. 1.

The remote speakers can be turned "on" or "off" by a few methods. A simple on-off switch may be used, connecting a dummy load resistor to the "off" position circuit. The proportion of power going to the speaker will be maintained. This makes the amplifier deliver its full power, regardless of how many speakers are working . . . even when they're all off!

Another connection method that can be used is the "L" or "T" pad system, whereby each speaker's

volume can be individually controlled without changing the impedance match to the amplifier. Each attenuator-speaker combination draws a constant proportion of power. Pads are available in 4, 8, and 16 ohm impedances and various wattage ratings.

Although stereo hookups may be requested, the probable customer desire is often a less elaborate one; a mono speaker for the remote speaker. This could be accomplished by tapping both channels, consequently feeding both signals into one speaker, as shown in Fig. 2.

Electrostatics

What's the "electrostatic" speaker story? Apart from the fact that they work and can give quite good reproduction, there is still a question of whether a particular amplifier can drive them. Many amplifier makers test for this by connecting a capacitor across the output. If the amplifier works without breaking into oscillation, it may be rated suitable for driving electrostatics.

An electrostatic speaker, though no more likely than a dynamic speaker to cause an amplifier to behave badly, should be checked with the intended amplifier.

Fusing

What about fusing to protect loudspeaker voice coils from blow-out? If someone, say a child, turns up the volume control so that the amplifier is driving the speaker at full power, the speaker's voice coil may be burned out if the wattage greatly exceeds speaker design limits. Ohm's Law enables the tech-

(Continued on page 94)

READY NOW!

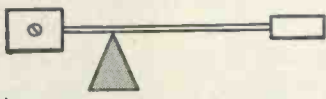
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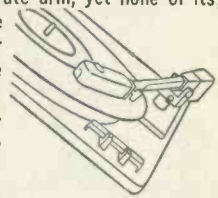
Now, at last, you can enjoy all the advantages of a true, dynamically-balanced tone-arm (with a built-in calibrated pressure gauge), a full-size, heavy-weight professional turntable, a laboratory-balanced precision motor...plus the much-wanted convenience of the world's finest automatic record-player...all in one superb instrument! Δ No one but the Garrard

Laboratories, with their unmatched facilities, could have accomplished it. With 40 years of manufacturing experience, and the highest engineering and precision standards in the Industry, Garrard set out to develop an all-in-one unit that would satisfy every critical requirement, even surpassing the professional turntable standards established by the NARTB.

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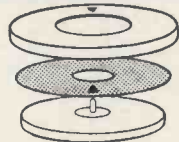


And incidentally, regardless of the number of records on the turntable, the angle at which the stylus meets the record is negligible, due to the unique geometry of this arm. Δ Since all of these engineering requirements guarantee that there is no unequal pressure on the sides of the stereo record grooves... distortion, channel imbalance, record and stylus wear are eliminated, resulting in perfect stereo reproduction. But "perfect performance" also requires minimum friction, and this is assured by the two precision needle pivots on which the arm is set. This arm is precision-mounted for you, thus affording all the advantages of the separate arm, yet none of its inherent disadvantages. The danger of the tracking error which often occurs in the mounting of separate tone arms, is eliminated completely because there is no possibility of even the slightest mislocation of the arm.



FULL-SIZED, HEAVILY WEIGHTED, BALANCED, CAST, POLISHED TURNTABLE The weight of six pounds has been determined as the optimum for perfect balance,

torque and flywheel action in this unit. This combination insures silent, on-speed running. The Garrard engineers have conceived of this new turntable as a "sandwich". It is actually two turntables balanced together...a drive table inside, and a heavy, cast turntable outside. The two turntables are separated by a resilient foam barrier, which effectively damps out any possibility of noise or vibration. Furthermore, being of non-ferrous metal, the cast tables offer no attraction to sensitive magnetic pickups.

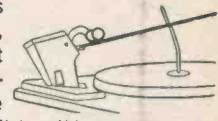


NEW "LABORATORY SERIES" MOTOR The Type A is built around a newly-developed Garrard four-pole shaded motor, which was designed especially for it. This laboratory motor is the perfect match for the new turntable system, and provides quiet accuracy, regardless of load or voltage changes. Constancy of speed is such that this motor will bear the closest scrutiny by sensitive measuring instruments. The armature is micro-balanced on exclusive Garrard equipment, and free of vibration. The total result is true musical pitch and clear sustained musical passages, without the irritation of wow or flutter. The "Laboratory Series" motor is completely shielded, top and bottom, with specially-designed and accurately oriented plates, insuring the absence of hum, even with the most sensitive magnetic pickups. To minimize even the slightest vibrations, the entire motor assembly is isolated from the unit by shock mounts of a special formula and design.



THE GREAT PLUS FEATURE OF AUTOMATIC PLAY—WITHOUT COMPROMISE! The convenience and desirability of being able to play records automatically, and to have the unit shut itself off, have long been recognized and accepted. Certainly, even the most critical user would want these features, but only if they could be incorporated without compromising the quality, performance or inducing record wear. This has now been accomplished in the Type A, by adding Garrard's exclusive pusher platform changing mechanism, with its smooth, one-piece center spindle, to the arm, turntable and motor described above. This unique com-

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Loudspeaker

(Continued from page 92)

nician to calculate the fuse amperage necessary to protect a speaker under these conditions.

A fuse, however, will not protect a speaker voice coil from burning out if excessive parasitic oscillation is present in the amplifier. Nor will sudden unusually large transients blow-out the fuse. They may, however, damage the voice coil connection by reason of the mechanical force they generate.

Baffle Tuning

Baffle tuning is a question often presented by hi-fi technicians who do custom installation work. What kind of speakers can be used to

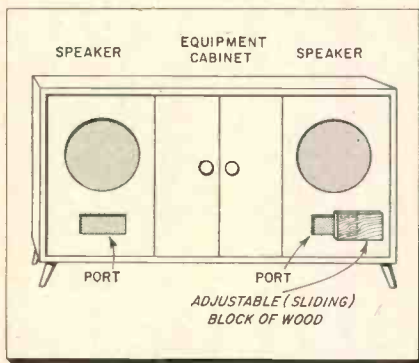


Fig. 4—Adjustable port-tuned enclosure for improved speaker bass response. When proper port opening is determined by adjusting the wood block, it should be secured in the same position inside the enclosure.

obtain high fidelity performance in an enclosure that doesn't match it?

The technician has three practical choices: insert any popular speaker and accept the performance for what it is—less than optimum, place a bookshelf-type speaker, enclosure and all, inside the cabinet, or try to match cabinet and speaker by converting the cabinet into a tuned baffle.

The first two choices are obviously simple . . . and inadequate. The latter choice is not as simple, but can result in satisfactory sound. Perhaps the easiest method to properly baffle a speaker in an enclosure that has already been built is to change the cabinet to a bass-reflex enclosure. The cabinet-mak-

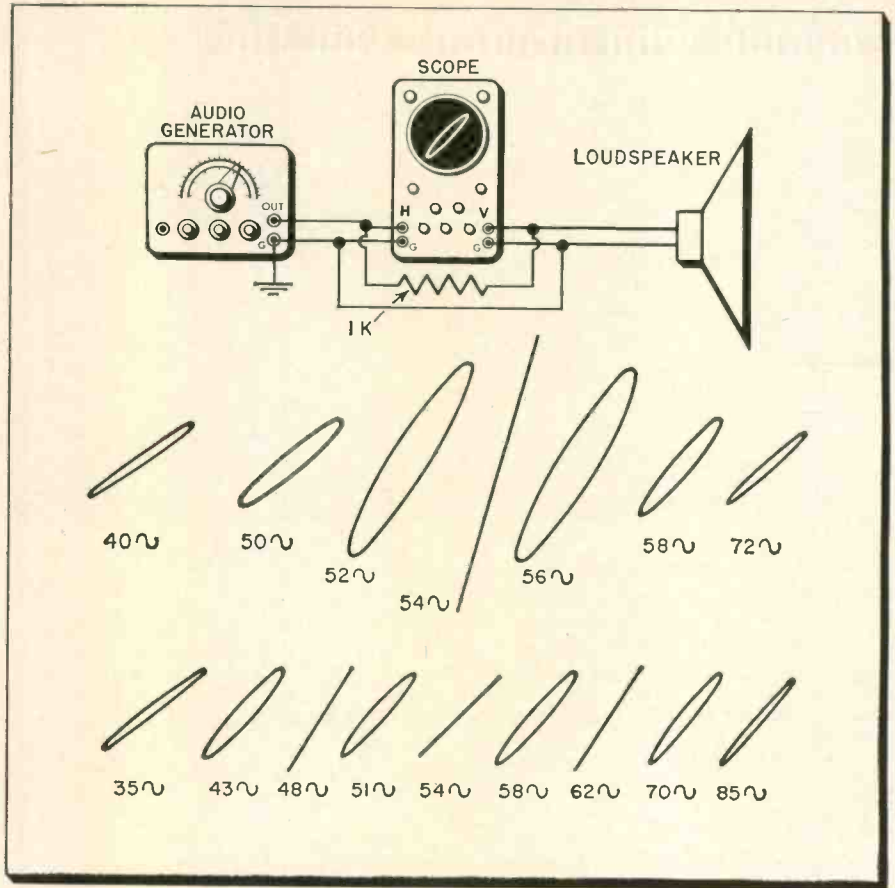


Fig. 5—Test set-up with audio oscillator and scope for adjusting port. Note pattern's increased amplitude as resonance (54 cps) is approached. The bottom row of patterns typify those obtained when the port is correctly tuned.

er's responsibility is to build a cabinet that can withstand the tremendous sound pressures within it by using at least $\frac{3}{4}$ " plywood and proper bracing and damping material. The technician's responsibility is to select a speaker that will operate well in the allotted cabinet space. Speaker manufacturers can help here.

Once the speaker has been selected, it's a good idea to learn its bass resonance point; the lower the better (provided the cabinet is large enough). The simple test setup shown in Fig. 3 will determine the speaker's resonant frequency. The series damping resistor should be roughly 5 to 10 times the speaker's impedance. Tuning the audio oscillator through a series of low frequencies, say, 30 cps through 120 cps, at 10 cycle intervals, will enable the technician to plot a frequency graph. The resonant frequency will be indicated by the maximum peak voltage indicated on the VTVM. Test is made outside the enclosure with the speaker cone facing open air.

The purpose of the tuned enclosure is to reinforce this resonant curve, thereby flattening it and extending the bass response. To accomplish this, it will be necessary to cut a port at the lower front side of the enclosure. Arrange the opening to be adjustable, as shown in Fig. 4.

A compatible port opening can be determined by feeding the speaker from an audio generator through a series resistor, as shown in Fig. 5, and viewing the pattern on a scope. At resonance, the trace
(Continued on page 96)

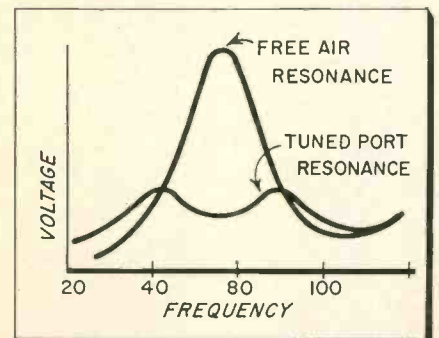


Fig. 6—Voltage-frequency resonance curve of speaker before and after adjusting port.

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Loudspeaker

(Continued from page 94)

will swing 'round rapidly and peak up vertically. Proper port adjustment should affect this in two ways: (1) the resonance should be as low in frequency as possible, and (2) the vertical rise due to resonance peaking should not be as severe as without the port. This can be checked by closing the port completely and noting the difference in the scope trace. When the proper port opening is obtained, duplicate the amount of port closing at the interior side of the port with a block of wood. Repeat this procedure with the second speaker enclosure, also.

Another bass-reflex enclosure tuning method can be employed by using an a-c voltmeter across the speaker's voice coil, as shown in Fig. 3. Here, a constant voltage audio signal is again swept through varied bass frequencies. The wood block that varies the port opening size is adjusted until the smoothest meter reading is noted. When this occurs, transfer the wood block to the inside of the enclosure, maintaining the accepted port size.

A voltage rise will be detected at the speaker's resonant frequency. The port should be adjusted for the lowest, flattest response. Fig. 6 illustrates an idealized final response curve in a properly tuned bass-reflex enclosure compared to the highly-peaked resonant frequency when the enclosure is untuned. Actual curves will, naturally, be jagged rather than the idealized smooth curve shown.

Be sure that no enclosure air leaks exist when making tests except for the port opening. The enclosure back should be sealed with at least $\frac{3}{4}$ " plywood and secured tightly with screws. •

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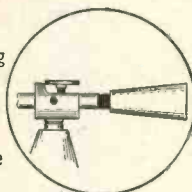
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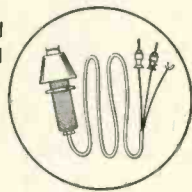
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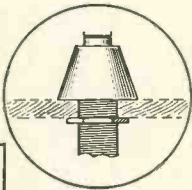
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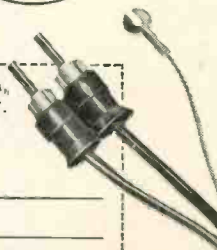
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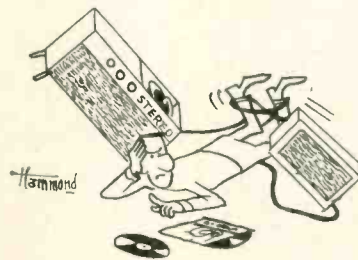
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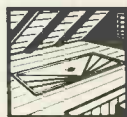
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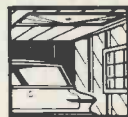
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Status Of Stereo Broadcasting

Numerous Stereocasting Systems Tested & Evaluated By Industry Committee For Recommendation To FCC

• Tuner and receiver manufacturers, as well as the stereo-minded public, are anxiously awaiting the FCC's decision regarding the accepted stereo transmission method. Many systems have been proposed and, obviously, a system cannot be adopted without considerable preliminary investigation.

As an example, the National Stereophonic Radio Committee has evaluated 4 FM/FM, 7 FM/AM and 7 AM stereo multiplexing systems.

Multiplexing Systems

The three FM/FM proposals, excluding the Percival (EMI) system, differ primarily in the bandwidth allotted for the subcarrier. These are the Calbest, Halstead, and Crosby systems.

The Calbest multiplexing system, as shown in Fig. 1, adds a sub-carrier frequency to the MX oscillator

tuned circuit plus the standard 455 kc i-f frequency, and the discriminator transformer is tuned to the sub-carrier frequency. The 25 to 75 kc FM multiplex sub-carrier is tuned.

In the Halstead method, as shown in the simplified diagram at Fig. 2, one wide band and one narrow band channel is used. The system does not give full fidelity and the stereo depth effect is partly lost.

Using the sum and difference frequency principle as carriers for the multiplex stereo signal, the Crosby system (Fig. 3), appears to be a leading contender for selection as the accepted method.

The Percival system (EMI) employs a form of coded stereo and is considered by some as a possible alternative to the Crosby system. The receiver has a signal containing the audio frequency plus 22 kc coupled to the amplifier rectifier. This sig-

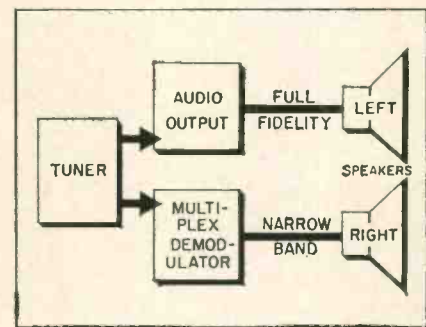


Fig. 2—Functional diagram of Halstead system which employs a wide and a narrow band channel.

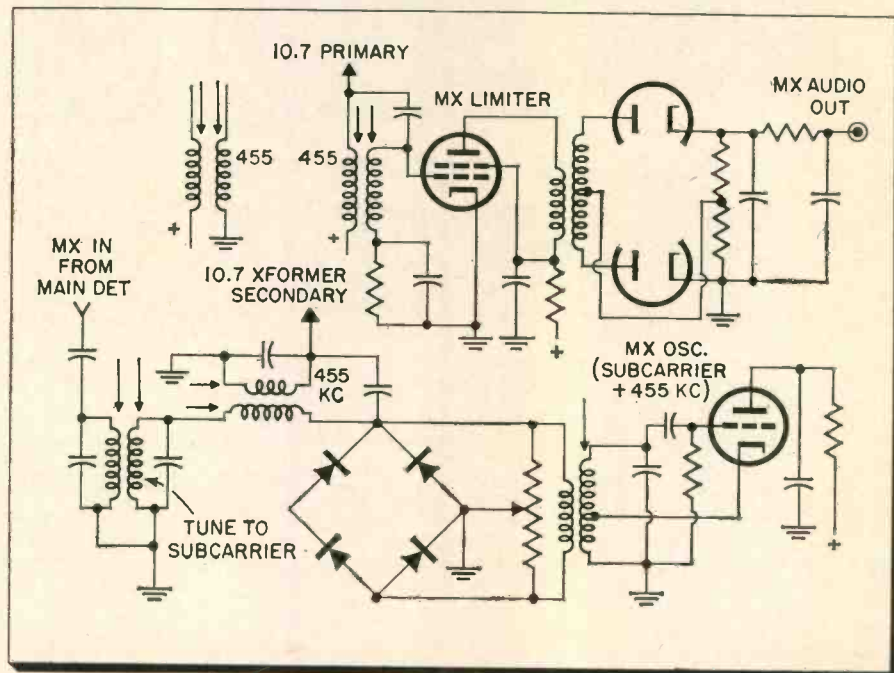
nal is divided into two frequencies after passing through the Hall multiplier, with the outputs fed to the left and right channel amplifiers. As we know, this system was developed in England and has been tested by the B.B.C. The NSRC has indicated some reservations about the system.

As previously mentioned, there are 7 FM/AM systems under consideration: GE employs a full AM subcarrier, Philco a S.S.B. modulated subcarrier system with the subcarrier nearly suppressed. Other systems involved are the RCA, Zenith, Volpe, Svorec, Nealy and Lipencott. The system designed by RCA is shown in Fig. 4. In this method the incoming signal and part is fed to the FM detector while the main signal goes to the matrix network. After de-emphasis, the detected signal is also fed to the matrix stage and its output is fed to amplifier one as $A + B$, while the signal for channel 2 is $A - B$.

Testing of the Halstead, Calbest, Zenith, Crosby, GE, and EMI stereo receivers was performed this summer. Units were checked for frequency response, separation, distortion, s/n ratio, subjective evaluation, cross-talk, r-f spectrum, and ease of tuning. In addition to electronic tests, mechanical design and structure was evaluated and given

(Continued on page 100)

Fig. 1—Simplified schematic of the Calbest multiplexing system which adds a sub-carrier to the multiplex oscillator circuit plus the standard 455 kc i-f frequency. Discriminator transformer is tuned to subcarrier frequency.





REACH

UP TO FOUR TIMES THE WORKING DISTANCE OF CARDIOID TYPES* with the Electro-Voice model 644 sound spot

Of all the audio problems confronting sound engineers, one of the most difficult to overcome is the use of microphones in spacious areas. Churches, auditoriums and amphitheaters present formidable problems in room acoustics and reverberation which degrade audio quality. Consequently, microphones cannot be placed at conventional distances from the source of sound. Under such conditions, loss of level and "presence" further add to the enigma of proper pick-up. The Model 644 Sound Spot is the answer. Here is a microphone providing acceptance within an included angle of 90° at high frequencies, high axial sensitivity, wide frequency response extending from 40 to 12,000 cps and excellent wind noise cancelling characteristics. Its highly directional feature permits unusual microphone working distances as well as startling flexibility in loudspeaker placement. Effective cancellation of sound at the rear and sides for unparalleled rejection of random noise, reverberation and feedback without frequency response loss. See Polar Pattern, Stop at your Electro-Voice distributor today and let him demonstrate the Model 644. Depending on Acoustical conditions.

Other features: Output level—53 db. 150 ohm and high impedance. Impedance changed by moving one connection to connector. Low impedance only: line balanced to ground and phased. Acoustalloy diaphragm, shielded from dust and magnetic particles. Non-welded circuit with Alnico V and Armco magnetic iron. Pressure cast case. 5/8"-27 thread. Satin chrome finish. 18 ft. cable with MC4M connector. ON-OFF switch. Size: 2 3/4" diam. 16" length. Net Wt.: 2 lb. 9 oz. less cable. List Price \$110.00. Desk stand available (extra).

Polar
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ELECTRO-VOICE, INC.
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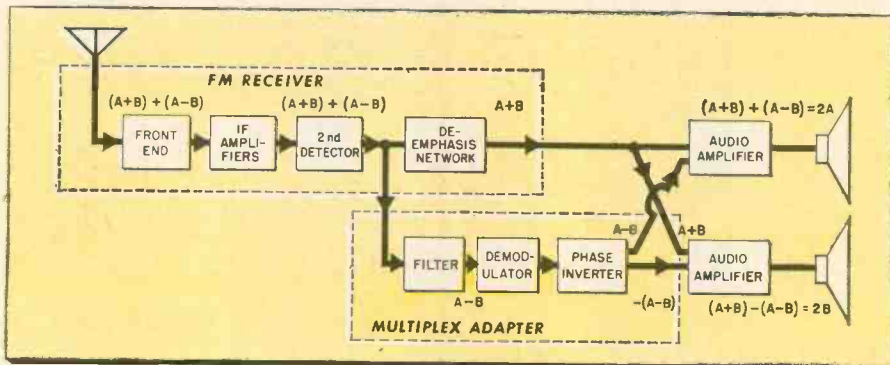


Fig. 3—Functional diagram of Crosby system showing multiplex adapter connected from discriminator output. Proposal uses a sum and difference frequency system for stereo reception.

(Continued from page 98)

strenuous tests. Each unit was also checked for field strength, reaction to airplane flutter, noise ejection and ability to reject interference.

The stereo transmitter used a test tape that put each receiver through a rigorous aural test observed by a panel of distinguished experts in the field. Naturally, the panel was briefed on the testing procedure used and informed regarding variations to expect in test transmissions.

The following is an example of excerpts from actual test tape: "Stereo test 4: Over the course of a two minute duration the tape transmission will shift from straight stereo to stereo with a modification added. The shifts will appear at five second intervals. In this test the low frequencies are processed and will appear to originate from the speaker closest to the listener. In the case where the speakers are equi-distant, the sound will appear to originate from some point between the two speakers." Listeners were seated about 10 feet away from a pair of loudspeakers 7 feet apart.

Other tests included processing of high frequencies and mixture of both signals. The panel listeners were advised of the manner of presentation, before each test, and the deviation from straight stereo to multiplexing appeared in a series of regular and precise intervals. In addition to pre-performance announcements of mixed transmission, each participant was provided with a clock indicating five and ten-second durations for normal and multiplex stereo operation.

Instrumentation for the aforementioned tests was elaborate. This equipment included:

1. Ampex stereo recorders

2. H-P VTVM Model 400
3. H-P Distortion Analyzer Model 330
4. H-P wave analyzer Model 302
5. Stereo monitor amplifier and speaker
6. RCA field strength meter Model BW-7
7. Boonton FM Signal generator Model 202
8. Measurements FM signal generator Model 210

Some deplore the delay in reaching decisions about stereocasting. It could be infinitely worse, however, to have the wrong decisions made in a hurry. All of the various proposals must be properly evaluated to determine what system has the best prospects; both immediate and future potential.

A comprehensive report published in Britain sees the Crosby system as the only sensible multiplex contender. There, the Percival system is considered an alternative to Crosby multiplex.

Fig. 4—System developed by RCA employs A + B and A - B information for two channel stereo reception.

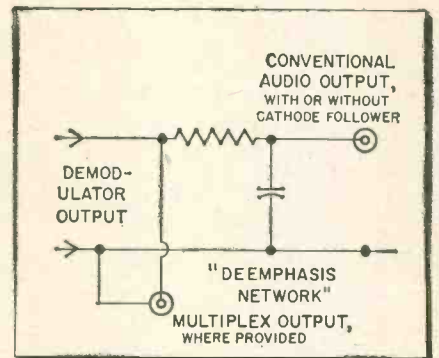
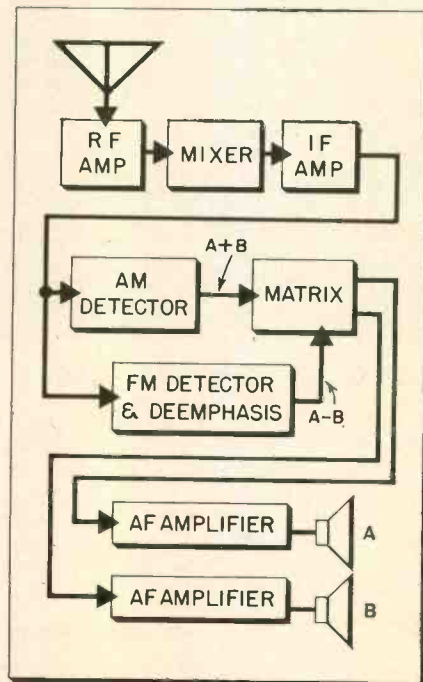


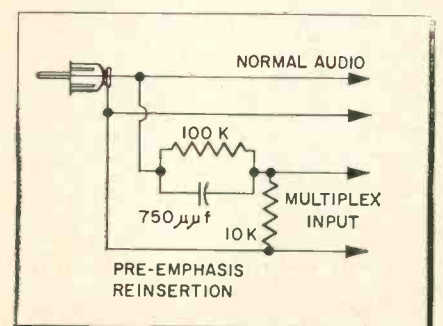
Fig. 5—Basic circuit of provision for multiplex in some tuners. An adapter is needed for whatever system is accepted.

What will be needed to make conversion when the time comes? Tuners presently on the market make various claims about adaptability to multiplex. What do these claims mean?

Actually, conversion to multiplex stereo, whether sum-and-difference Crosby type, or the coded Percival type, is not too difficult with any tuner of reasonable quality. Some units provide a separate output socket for multiple operation, as shown in Fig. 5. This is variously called: "providing for multiplex," "adaptable to multiplex," etc. This extra output socket is merely a connection ahead of the de-emphasis network. A multiplex adapter will still be needed to suit whatever type of multiplex operation is eventually approved.

A tuner that does not have this specific output socket can also be used (see Fig. 6) by tapping in ahead of the de-emphasis, or by using a simple R-C pre-emphasis combination to restore the proper characteristic needed to complete the stereo conversion. Either way, the adapter is needed to complete the conversion, plus the rest of a stereo system, of course. •

Fig. 6—It's not necessary to internally modify a tuner not provided with a conversion adapter output. The network shown here can be used externally. The multiplex adapter, however, needs about 20 db more gain.



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'Electronic Technician' research reveals important side income from sale of sound equipment



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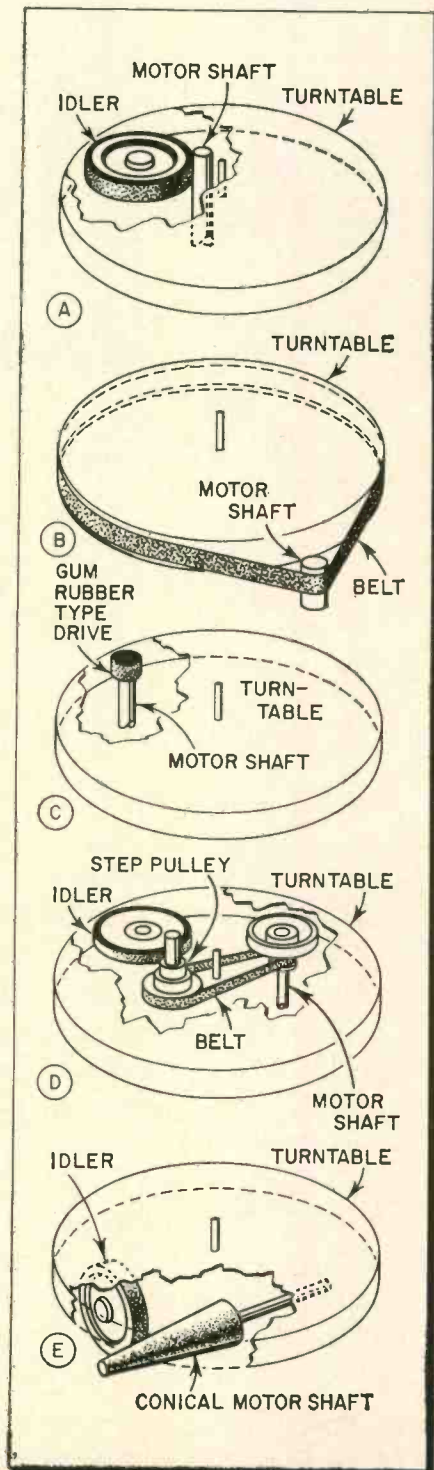
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Stereo Changers, Players & Turntables

A Mechanical Profile Of Stereo Record Playing Equipment

Fig. 1—Some examples of drive devices used to rotate disc turntables are shown here.



• Record changers, players, turntables, and their respective tone arms are the mechanical accompaniments of any disc playing system, whether mono or stereo. Stereo just makes the equipment requirements a little more rigorous.

The concept of stereo sound and increased high fidelity consciousness of our citizenry had a profound effect on disc-rotating equipment. Record changers, for example, now invariably incorporate a mechanical switch to disengage its changer mechanism; in effect, allowing the changer to be employed as a manual player.

Aside from many record changer and turntable innovations since 1958, we witnessed the emergence of another major product—record players. Not the pre-stereo record players that were actually record changers minus changing mechanisms, but units that offer, in many instances, turntable performance, and the convenience of a pre-mounted professional-type tone arm. In fact, some of the “players” are top-grade turntables that incorporate a matched professional tone arm. This relieves purchasers of drilling mounting holes and positioning a separate tone arm, though restricting selection of a specific tonearm.

Turntable Drives

The turntable drive types used with these players are interesting from an operational and service viewpoint. Whereas record changers have essentially maintained the idler-type drive system shown in Fig. 1A, players have adapted both record changer and turntable drive systems: idler drive and idler drive or belt drive, respectively. The latter, belt drive, is illustrated in Fig. 1B. In addition, other type drives are being used, such as those shown in Figs. 1C through 1E.

Variations of the aforementioned drives are, of course, also used. One leading turntable manufacturer

Mechanical Sources

Motive Device
Changer
Player
Turntable

Tone-Arm
Pre-assembled
Separate
Integrated

uses twin precision idler wheels to obtain accurate speed for 33 $\frac{1}{3}$ and 45 rpm speeds, as opposed to one idler wheel and a step pulley arrangement for changing speeds.

It is a simple matter to replace idler wheels when their rubber rims develop “flats,” glazed hardness, or unusual wear, resulting in wow, flutter or incorrect speeds. The same is true of worn and frayed belts.

Idler wheels, or pucks, can wear out-of-round by skidding if the turntable is stopped forcibly while the drive is running, or by being left with pressure on one spot when not running. A puck drive should be disengaged when it is not driving; either automatically or manually. Belts can stretch unevenly, so they “warp,” causing them to ride erratically.

When servicing, never, under any circumstances, apply oil or grease to idlers, belts, or turntable rims. These areas should be cleaned with denatured alcohol to remove any accumulated grime.

As far as record changers are concerned, careful design has upgraded changers so they compare favorably with many turntables. The same drive problems exist with record changers as with players and turntables. Added to the potential breakdown list, however, are numerous mechanical linkages that can frustrate a mechanical engineer. Service literature and practi-

(Continued on page 124)

STEREO STARS!



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Models 1571, 1572.....\$50.00 List*
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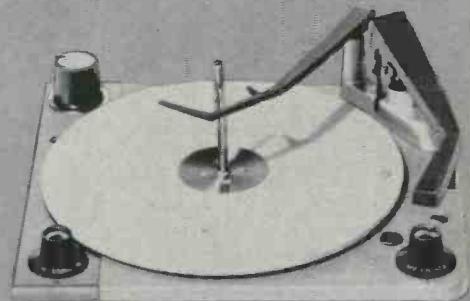
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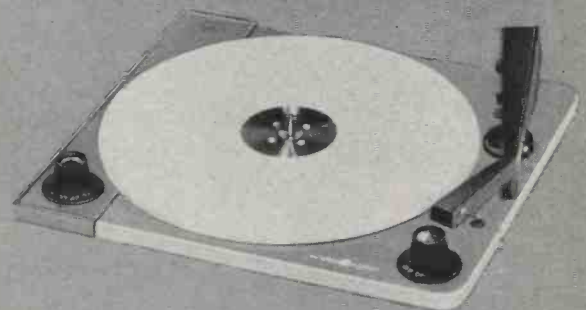
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Analyzing Stereo Tape Equipment

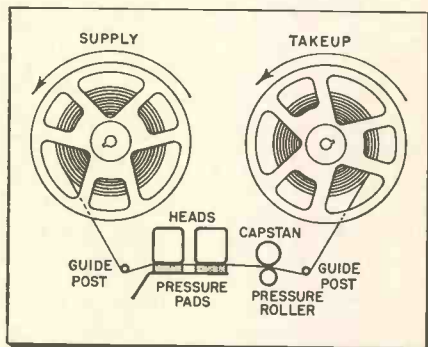


Fig. 1—Basic top-deck components of a typical tape recorder. The capstan—not the take-up reel—pulls the tape past the heads. The takeup reel employs a slipping clutch system to evenly wind used tape around its hub.

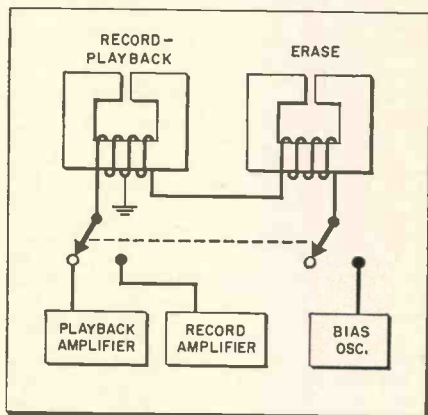
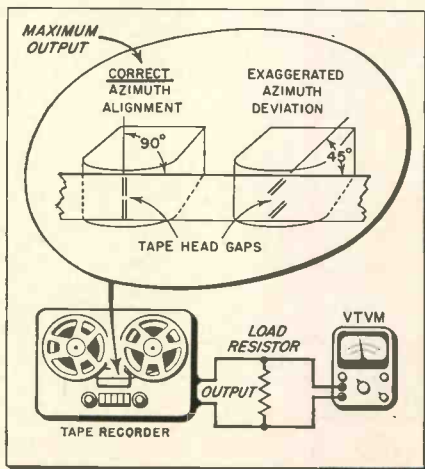


Fig. 2—Electronic blocks of a tape recorder. Four-track stereo players employ twin amplifiers and oscillators, plus quadruple gops and separate channel windings.

Fig. 3—Test set-up for checking head alignment employing a-c voltmeter and test tape. Following manufacturer's recommendations, head bracket screws are adjusted for maximum voltage reading.



Cartridge Innovations And 4-Track Tape Draw Interest. Correcting Mechanical Defects Is A Key Service Problem

• The tape equipment sales recession during the early days of stereo discs is past history. Introduction of four-track tape and agreement among most recording companies to merchandise 7½ ips pre-recorded tape through a central organization, *United Stereo Tape*, made sales figures respectable again.

Reel-to-reel four-track tape equipment is the major seller. Most reel-to-reel tape units incorporate 3¾ and 7½ ips speeds; some also include a 1⅞ ips speed. The fundamental reel-to-reel tape handling methods and electronic circuit blocks are maintained in four-track equipment, as shown in Figs. 1 and 2.

Reel-To-Reel Operation

A full reel of tape is placed on the supply spindle and the tape is placed through an inline slot and threaded on an empty takeup reel. And that's all there is to it!

The purpose of the tape handling mechanism is to feed the tape from the supply reel past the tape heads to the takeup reel—at a constant, unvarying speed. This is the precision-like task of the capstan. The capstan pulls the tape past the heads at a constant speed, aided by a pressure roller which presses the tape against the capstan for traction purposes. Pressure pads maintain the tape against the tape heads.

Cartridge Tapes

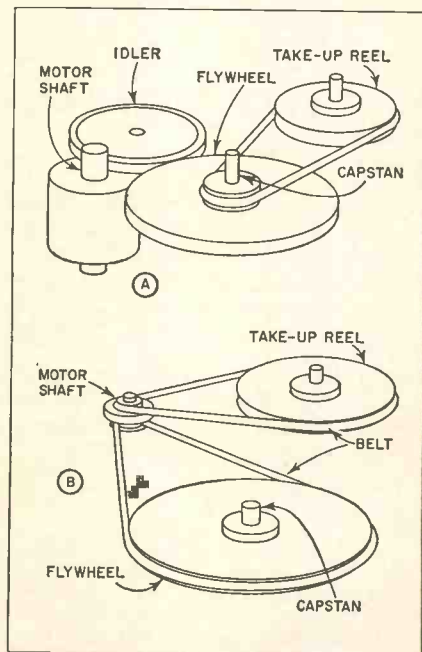
The potential of "automatic" tapes has yet to be fulfilled. The 3¾ ips, four-track cartridge tape playback equipment didn't catch the public eye. It's difficult to determine the specific reason for its failure thus far. Probably, it's due

to combined factors: unattractive packaging, high relative cost, inability to record, only one major supplier of pre-recorded cartridge tape, early production "bugs," lower speed (with less, though good, fidelity than 7½ ips tapes), strong competition by reel-to-reel manufacturers.

But the cartridge tape prospects have not diminished. In fact, another system has been introduced; a 1⅞ ips cartridge that can be stacked like discs on a record changer. The system is not yet in production.

The system employs *three* track tape. Two tracks are used for stereo material, while the third track, located in the center of a 150 mil wide tape, is intended to carry an optional reverberation channel.

Fig. 4—Commonly used tape drive systems are shown here. A precision flywheel typically insures smoother capstan motion.



When the third track is used, it is played on one or more background speakers behind and around the audience. This adds reverberation according to the original program requirements, thereby simulating concert hall or auditorium effects.

Service

Head-cleaning will be a service needed for a while yet. This requires care and should be done with one of the cleaners made for the purpose, *not* a wire brush or other harsh agent that could spoil the head. New tape material drastically reduces the rate at which heads gum up.

Owners should clean their tape recorder heads after a few hours playing time. Unfortunately they don't, though it's just as simple as cleaning a disc. When the heads wear, the frequency response deteriorates because of the widening head gap. Consequently, replacement is eventually required.

When servicing tape recorders technicians should check head alignment, both record-playback and erase or any other head combination used, with a test tape. Alignment procedures vary and the manufacturer's recommendations should always be followed. The alignment set-up illustrated in Fig. 3 is the basic method that should be used. Connect an a-c voltmeter to the output of the tape recorder and, running the test tape, adjust the head bracket screws as

suggested by the manufacturer until maximum output voltage is reached.

Pressure pads are frequent offenders in tape recorders. Their purpose is to maintain the tape against the head gaps and un-wrinkle it, if necessary. After a period of time, they will wear down. When this happens, the felt-like pads should be replaced to avoid pitting of the tape heads. This may be done with either a new pressure pad and arm, or, the pad itself can be pried off and a new pad cemented in the exact same position as the old one. Check the pads to make sure they are properly holding the tape against the head.

Don't oil or grease the capstan, pressure roller, guide posts, or any other surface that the recording tapes will touch. Lubricants should be used very sparingly since contact with rubber will undermine the mechanical purpose of a tape recorder's transport system.

Most performance inadequacies of a tape recorder are related to mechanical deficiencies. They can take the form of wow or flutter, incorrect speed, improper or no tape movement, or rewind, or fast-forward, tape rubbing noise, mechanical gear or drive noise, tape breakage or spillage.

Observing the mechanical operation of the various parts will be an invaluable aid in locating a mechanical defect. Clutches,

brakes, drives, takeup tensions, and other mechanical parts will vary from make-to-make. Some typical capstan drive systems are shown in Fig. 4. The varied motor types employed is emphasized by the motor test and repair bench photo shown in Fig. 5. Mechanical difficulties cannot be solved as simply as electronic problems. No easy solution is available, such as inserting a signal to the input and noting its output. The technician's basic "school" must be manufacturers' service manuals and plenty of practical experience that can be acquired "on the bench" (see Fig. 6).

There are relatively few top service specialists in the tape recorder field. Yet, the average stereo tape recorder often costs more than a TV set. And since the initial cost of the unit is high, customers are less inclined to refuse a job if the service work warrants a relatively high charge.

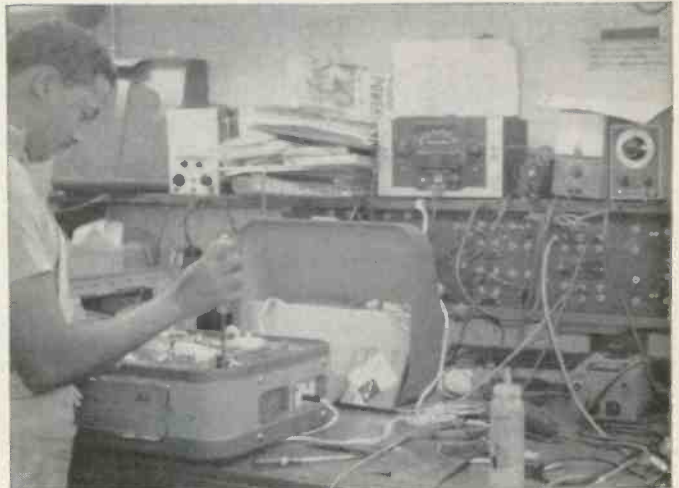
A prominent tape recorder manufacturer recently made a survey concerning tape recorder charges. The results of this survey indicated an average minimum service charge on tape recorder repairs as: \$7.50, with one company charging \$9.00. The average per hour rate charged, plus parts, is also \$7.50, with one company charging \$10.00 per hour. And—customers bring their sets to the shop. •

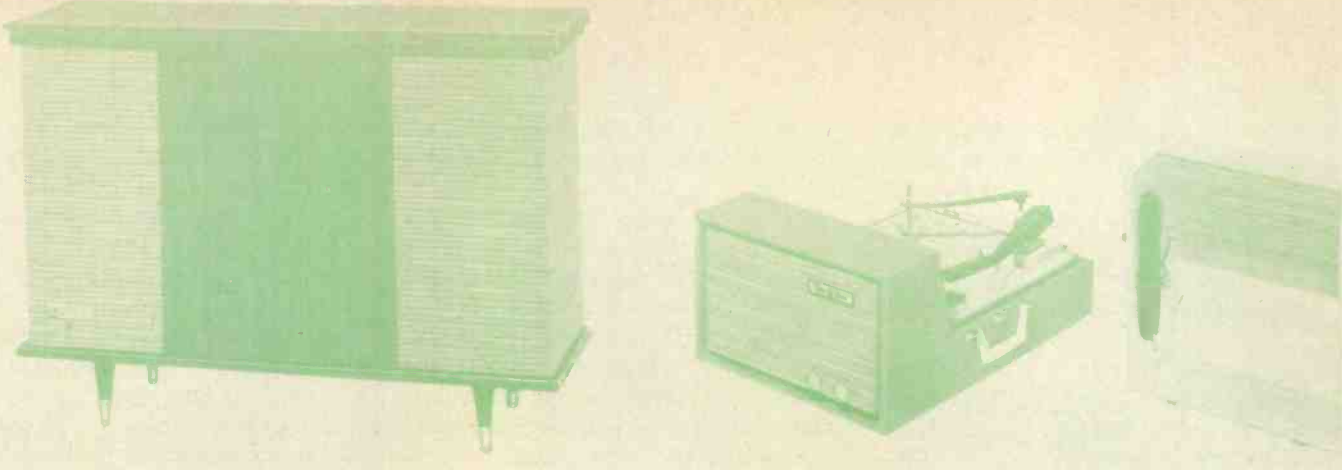
Illustration Credit: Sigma Electric Co., New York, N. Y.

Fig. 5—A motor test and repair bench illustrates the variety of motor types employed in tape equipment.



Fig. 6—Mechanical "know-how" for effective tape recorder servicing is obtained primarily on the work bench.





Evaluating Stereo Packages

Stereo Portable & Console Analysis Provides An Illuminating View Of Services, Sales, And New Developments

• The person who buys component high fidelity stereo can select each component and thus "custom build" a system. For many, however, a package stereo system offers the better approach to stereo. The reason(s) for this choice may vary: lower cost, compactness, aesthetics, no confidence in own "hook-ups," unwillingness to pay extra for installation, confusion over separate component selections, confidence in a "name" brand or retailer. Whatever the reason, though, stereo packages—from the inexpensive manual player to the moderately

expensive console—are big sellers. As such, they are major service money earners for technicians alert to their mass ownership.

Packages come in a very wide price range. But price is not necessarily an index of quality. Many package set prices depend on how well some non-manufacturing merchandisers have negotiated with the suppliers who assemble the sets, profit structure of the company, how much added for "free service," what type of cost cutting, etc.

As an example of good "basic" cost-cutting, take the newly devel-

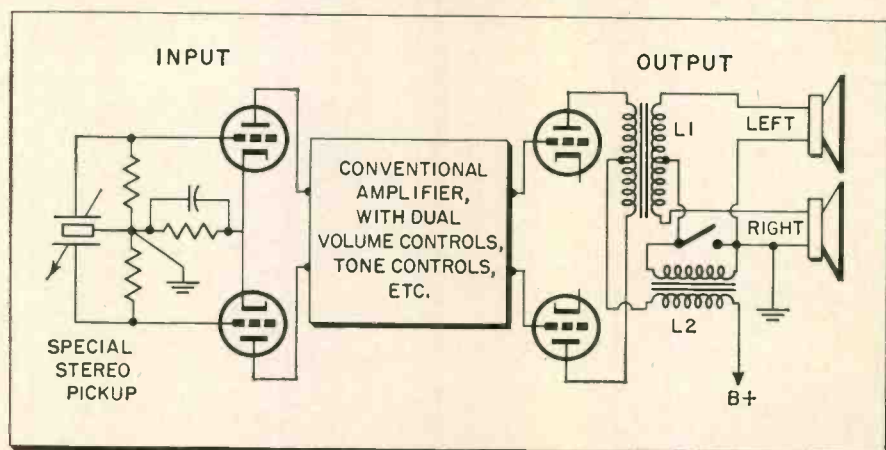
oped type of dual amplifier. It uses push-pull operation for the mono part of the program and push-push to handle the stereo part. This effects several economies, enabling comparable quality to be achieved for much less cost.

This modified form of a push-pull audio output stage is shown in Fig. 1. Unlike the usually designed push-pull output stage, "push-pull" is achieved with only *one* tube, rather than two tubes. Therefore, in a stereo unit, only *two* tubes are needed instead of the usual four tubes—a saving of two tubes.

How It Works

Except for the cartridge connections to the input tubes and the output circuit, everything in between is typical familiar circuitry. Reversing one channel's cartridge connections, as shown in Fig. 2, changes our known phase development. Instead of an out-of-phase signal produced by a vertical cut and an in-phase signal produced by a lateral cut, the reverse occurs: a vertical cut produces an in-phase signal and a lateral cut produces an out-of-phase signal. Consequently, when substituting cartridges, be certain to use either the exact re-

Fig. 1—New stereo input and output circuits achieve push-pull output with only two tubes, instead of four, and one center-tapped transformer instead of two.



placement or a four-terminal one.

This system uses what is sometimes called a double matrixing network, composed of two output transformers. One operates in push-pull and the other in push-push. One speaker voice coil is reversed for proper acoustical in-phase operation. In effect, by phase shifting, the sum and difference signals can be recombined as right and left signals.

When a monophonic record is played, the system operates push-pull and both speakers receive and reproduce identical signals simultaneously from the push-pull output secondary. No output is obtained from the push-push transformer. In this case a switch should be used to short out either the primary or secondary of the push-push transformer to eliminate any vertical component such as rumble, etc.

When a stereo record is played and in-phase signals appear on the two amplifier tube grids, they operate in push-push or parallel. The two in-phase currents appearing across both halves of the transformer primary are cancelled at the center tap and no signal is induced in the secondary. The untapped push-push transformer, however, adds the voltage drops across its primary since they are in phase. Thus, a signal is induced in the secondary. Since the speakers are effectively in series with the secondary they will each receive the same signal.

When out-of-phase signals appear on the amplifier grids, the push-pull arrangement automatically becomes effective. Currents at opposite ends of the push-push transformer primary are opposite in

phase and therefore no signal is induced in the secondary. The center tap of the push-pull transformer is now effectively at ground potential. Out-of-phase signals appear across the push-pull secondary, operating the two speakers as before.

Another example of intelligent cost-cutting is, of course, the use of piezo-type cartridges (crystal or ceramic). Their much higher output, as compared to magnetic cartridges, permits elimination of the standard preamplifier stage. Con-

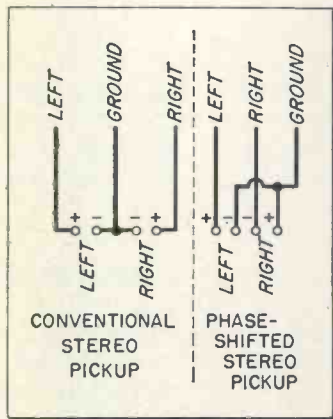


Fig. 2—Modified push-pull audio output circuit shown in Fig. 1 requires cartridge phase reversal of one channel. Unless a specially phased 3-terminal pickup is used, 4-terminal one must be employed.

sequently, cost is lowered and a potential hum stage is removed from the circuitry.

Reverberation Circuits

Stereo package manufacturers are obviously not content to sit back and design modified copies of component equipment circuitry. Reverberation systems can attest to this. Motorola, Philco, and Zenith have already announced incorpora-

tion of a sound delay system in their newest stereophonic sets.

The principle is exciting. In an effort to produce the effect of listening to "live" sound, the acoustical properties exhibited in a hall or auditorium are simulated through an echo-producing system. The degree of echo or reverberation can be adjusted by the user to effect the most pleasing personal sound reverberation [see ELECTRONIC TECHNICIAN, July 1960], thereby "adjusting" sound to the listening area. Figs. 3 and 4 illustrate two reverberation circuits now being used.

Evaluating Packages

Realistic personal appraisal of stereo package sets is invaluable to both dealer and non-dealer service technician. The non-dealer technician must familiarize himself with the capabilities . . . and limitations of new stereo portables and consoles that he will eventually service. The dealer technician must, additionally, select merchandise that will fulfill his sales needs and meet the challenge of competitors. This requires intelligent evaluation of set performance.

Evaluating a package set is more difficult than evaluating a component unit. Package sets aren't subject to the magnified attention that components are given in various consumer publications. It's the rare individual that even knows the name of a speaker in a package set, or the amplifier's output wattage. The real test for a package is to listen to it critically. Use appropriate program material and try to perceive if it delivers solid, clean bass at sufficient volume for your needs.

(Continued on page 122)

Fig. 3—Philco reverberation system adds a controlled amount of echo to the output sound. Permits listener to insert reverberation according to his room size, furnishings and taste.

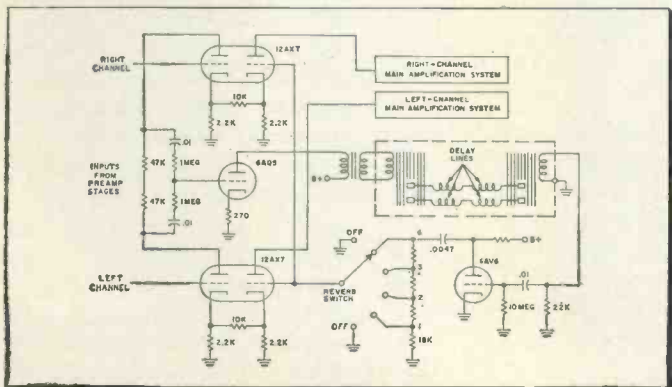
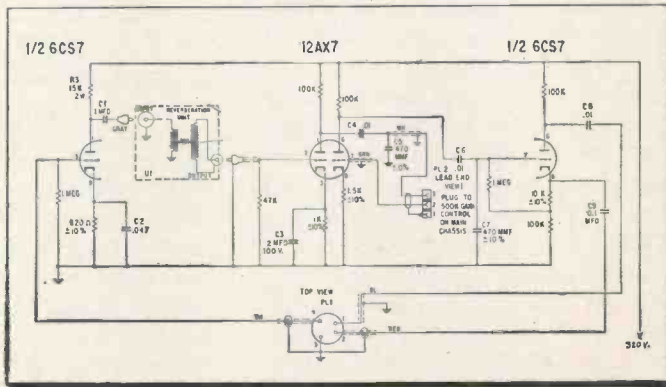


Fig. 4—Zenith also utilizes a reverberation system. As is the current practice with reverberation units, one channel's sound is delayed approximately 33 milliseconds by a mechanical delay line.



Stereo Sales Set-Up For Dealers

Merchandising Techniques For Selling Stereo Equipment & Accessories

• After basic retail sales principles, selling techniques must be based on the type of merchandise being offered. Thus, retail sales of stereo equipment, especially components, require specialized selling methods beyond basic merchandising.

Stereo package equipment generally demands appliance-type salesmanship. Purchasers are usually less audio sophisticated than component purchasers. Additionally, package equipment purchasing is often influenced by brand name, price and "furniture" appeal. Consequently, "packaged" stereo demands on salesmen are limited to a surface knowledge of stereo principals and applying this knowledge to the unit being sold. Standard selling methods are, thus, typically employed, as in appliance, hardware, or department stores.

Component selling, on the other hand, requires additional sales skills. Prospective buyers are often very much aware of stereo hi-fi terminology and applications. Most can detect a salesman not "in-the-know" without difficulty. They've generally been influenced by consumer magazine evaluations, performance specifications in advertising, friends who already own a stereo hi-fi system, and previous hi-fi salon shopping. In substance, they may already have an excellent layman's knowledge of stereo and high fidelity.

This doesn't deny that a large cross-section of component shoppers are unaware of stereo and hi-fi's many facets, but the salesman must be prepared to sell *both* the tyro and experienced customer. The latter customer is usually more difficult to sell since much of his "picked-up" knowledge is misinterpreted by him due to technical limi-

tations. The salesman may, therefore, have to correct some distorted viewpoints of an individual that feels he "knows" the field. This demands patience, tact—and knowledge.

Sales Demonstrations

Stereo component sales (as well as package sales) constitutes an "active" selling field, rather than a passive one. Customers want to *hear* the equipment they're contemplating buying. Thus, the salesman must demonstrate his wares.

Ideally, stereo should be demonstrated in the customer's home.

The demonstration place can be a plush area set aside in a section of the store, or, if space doesn't permit (and it usually doesn't), a shelf display that partially infringes on the selling space of other items. Customers should, however, be able to conveniently stand and listen to the sets without being constantly jostled by other incoming and outgoing customers. Standing and listening space must be provided or the demonstration equipment set-up will be nullified. A typical small-store demonstration area is shown in Fig. 1.

Equipment

We hesitate to say *nobody* will adopt an elaborate demo area, but it is very expensive, and very few dealers are likely to adopt it. The majority of dealers, however, can successfully employ a small-store stereo sales set-up. This can be achieved with a one unit demonstration system.

The single system, minimum investment set-up is simple. A medium power stereo amplifier/preamplifier can be used, with two bookshelf-type speakers, a record changer, and a few interchangeable cartridges. The particular makes can be selected from numerous available units. Dealers choosing the "minimum investment" set-up should be cautious about their single component purchases. The components should be readily available from a local distributor, have reasonably good hi-fi performance, and the discount should enable the dealer to obtain an adequate sales profit.

Other profits, aside from the sale of components, will naturally accrue: accessories, installation, service, and increased store traffic. Total

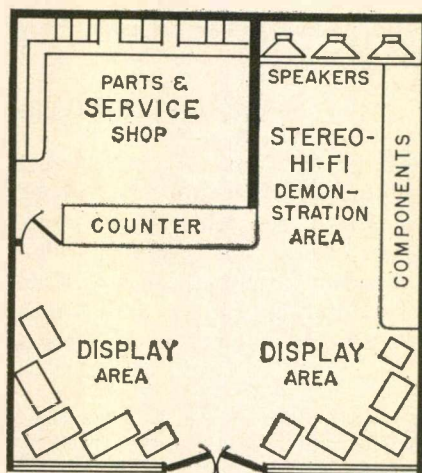


Fig. 1—Stereo components demonstration area in a small service-sales store. Although space may be limited, demonstration areas should not conflict with store traffic.

Since this is impractical, the next best way is to have a demonstration room. Most companies, however, cannot set up a separate listening room in their store. This leaves only one sensible demonstration method, that is, if the sales dealer is truly serious about selling stereo—a demonstration area.

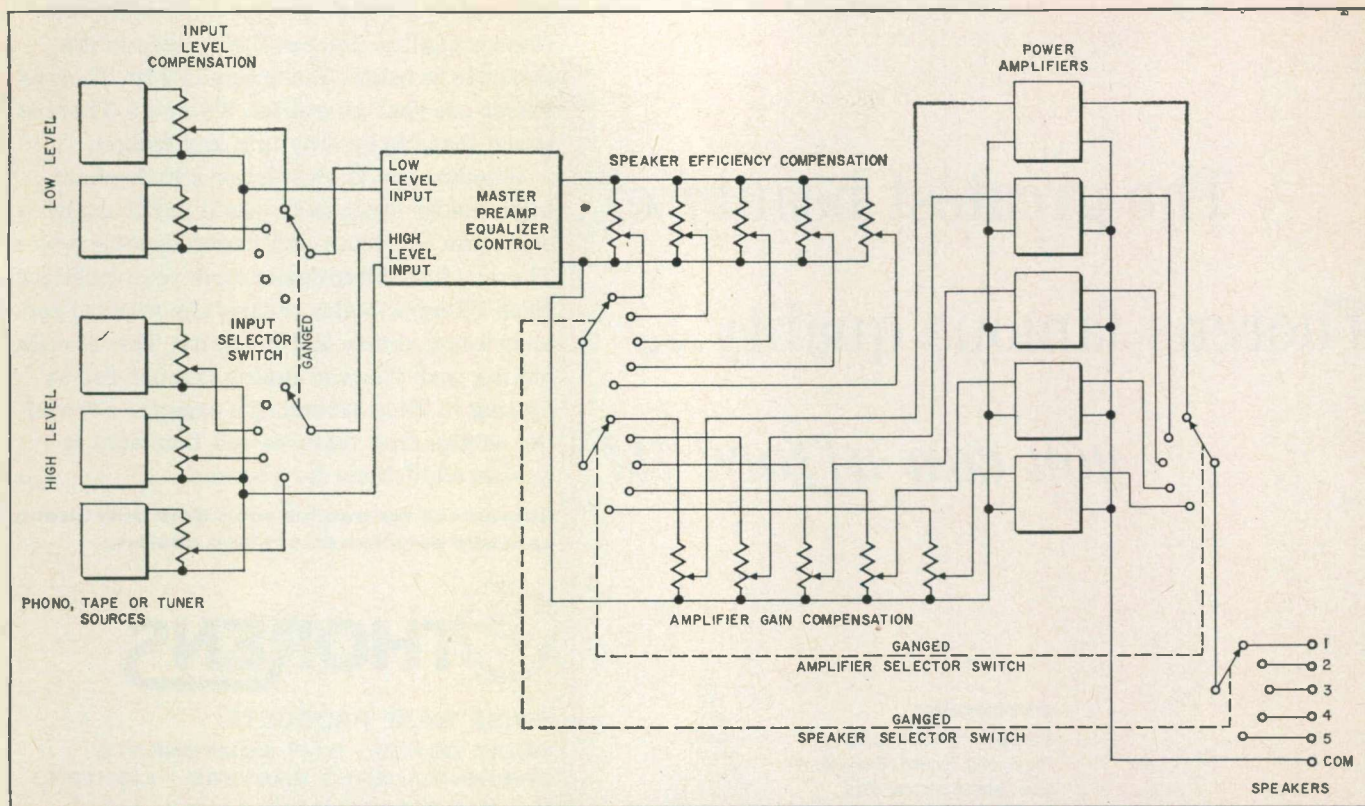


Fig. 2—Modest switching panel for A-B listening tests. Sensitivity and efficiency of equipment is compensated so playing level doesn't change when switching from one component, or speaker, to another. Since

most customers conclude the loudest sound is best, maintaining the same sound level during a comparison demo permits buyers to make unprejudiced selections.

initial investment need not exceed \$400. If the dealer cannot approach this amount for investment purposes, however, he should never hope to establish himself beyond the occasional sales level.

The big, impressive demonstration panel is, of course, a wonderful way to sell stereo. If the dealer really wants to make the stereo hi-fi field sales a major factor in his store, he can do it with a modest version of a switching panel, as shown in Fig. 2. A small representative number of components will be required.

He will want to switch a few amplifiers, speakers, tuners, changers and turntables, and perhaps a tape deck. Tuner and pickup inputs need compensating so the level does not change when switched from one to another. To the unaware customer, nothing is more obvious than change in volume; he may naturally conclude that the one sounding loudest is the best for him.

The same procedure is necessary to compensate for different efficiencies in loudspeakers. The best place to do this is ahead of the main amplifiers. This complicates the switching somewhat, but makes the overall result worth it. Set every-

thing up so the least efficient loud-speaker, with the least sensitive pickup and tuner, gives adequate volume with the compensating controls all out. Then adjust the controls for other units so they all give the same volume when changes are made.

Many demonstrations are spoiled by using poor program material. It can be poor because it is just poor stereo, because the recording is poor in other respects, or because the type of music selected doesn't appeal to the prospect. Don't assume his musical tastes are the same as yours. Have on hand a good selection of recordings that give good stereo at high program quality.

Play what the prospect fancies. And try to give him a cross-section: small intimate presentations, big orchestra and chorus presentations, pop vocals, etc.

Having acquainted your prospect with what stereo can sound like and what he gets for how much, see what else he needs to fulfill his specific requirements.

Accessories

Don't sneer at accessory sales; they're big money makers. Various accessories can be chosen by the

dealer to boost sales profits. But regardless of which ones are selected they must be prominently displayed. Otherwise, how would your customers know you stock them, or make impulse purchases?

Accessories can be roughly divided into four areas: component parts, chemicals, test, and installation.

Component parts consists of replacement or original parts such as phono cartridges, tape heads, audio tubes, microphones, and phono idler wheels; tape splicing equipment, tape head demagnetizers and FM antennas; in other words, service or upgrading aids.

Chemicals, unlike most other accessories, are depleted after a while through use. They are used to clean records, remove record static, clean tape heads, etc. Chemically impregnated record cloths are also popular.

Test accessories are varied. Some of the more popular ones are: record strobes for indicating speed, tone arm pressure measuring devices, tape strobes, level indicators, and stereo balance meters.

Installation parts are becoming increasingly popular, especially since peg-board displays have been
(Continued on page 116)

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For more data, circle 9-110-1 on coupon, p. 78

MANUFACTURER & PRODUCT STEREO DIRECTORY

ACOUSTIC RESEARCH, INC., 24 Thorndike St., Cambridge 41, Mass.—Spkr AR-1, \$185.00. AR-2, \$96.00. AR-2A, \$122.00. AR-3, \$216.00. Spkr-Enc AR-3t, \$92.00. AR-3st, \$35.00.

ACTION SYSTEMS, Meriden, Conn.—Baffles, Record Players, Tuners.

ADVANCED ACOUSTICS CORP., 391 Lakeside Ave., Orange, N.J.—Spkr #440, self-enclosed bi-phonic coupler, \$134.50. Modulaire, self-enclosed, \$120.40.

ALDSHIR MFG. CO., 111 Lake Ave., Tuckahoe, N.Y.—Needles. Cartridges. Acces, phono.

ALL CHANNEL PRODUCTS CORP., 47-39 49th St., Woodside 77, N.Y.—Acces, FM antenna \$19.95, \$29.95.

ALLIED RADIO CORP. (KNIGHT), 100 N. Western Ave., Chicago 80, Ill.—Tuner KN-125B, FM-AM, \$139.95. KN-135B, FM-AM, \$84.50. Rcvr KN-300, \$169.50. Amp stereo KN-728B, 28 watt, \$79.95. KN-740B, 40 watt, \$99.95. KN-775, 75 watt, \$169.50. Spkr KN-2000A, 12" 3-way with enclosure, \$84.50. KN-800A, 12" 3-way, \$44.95. KN-600HC, 12", \$64.50. KN-810A, 15", \$54.95. KN-850, 12" Deluxe, \$79.50. KN-815A, 15" Deluxe, \$89.95. Turntable KN-1000, \$49.95. Cartridge KN-500, \$12.95. KN-500X, \$17.95. Tape Rec KN-4300, \$249.95.

ALONGE PRODUCTS, INC., 163 W. 23 St., New York 11, N.Y.—Acces, tape splicer 800, \$29.95.

AMERICAN CONCERTONE, INC., 9449 W. Jefferson Blvd., Culver City, Calif.—Tape Rec 505, \$495.00. TR-100 \$199.95. 93, \$995.00. 33, \$995.00. Mark VII, \$940.00.

AMERICAN GELOSO ELECTRONICS, INC., 251 Park Ave., South, New York 10, N.Y.—Mike M-60, M-61, \$60.00. M-62, M-63, \$48.00. M-110, \$19.95. M-51, \$14.95.

AMERICAN MICROPHONE CO., Rockford, Ill. **AMERICAN TELEVISION & RADIO CO. (ATR)** 300 E. 4th St., St. Paul 1, Minn.—Acces, DC-AC Inverters 12U-RHG, \$66.34. 12U-RSF, \$50.00. 12T-RME, \$33.00. Tube Protector #250, \$2.63.

AMPEX AUDIO CO., 1020 Kifer Rd., Sunnyvale, Calif.—Amp/Spkr, unmounted #304, \$295.00. #2010 portable, \$199.50. Stereo Preamp/control ctr #404, \$159.50. Tuner, AM-FM stereo, #504, \$249.50. #550 Stereo AM-FM & preamp, \$275.00. Tape Rec #902, unmounted stereo, \$349.50. #910, mounted portable, \$399.50. #952, unmounted stereo, \$499.50. #960, mounted portable, \$495.00. #970 stereo monitoring, \$595.00.

AMPEX MAGNETIC TAPE PRODUCTS, P.O. Box 190, Opelika, Ala.—Tape.

AMPLIFIER CORP. Of America, 398 Broadway, New York 13, N.Y.—Tape Rec TransMagne-mite 612A,B,C,TD,SD,E, \$445.00-\$505.00. TransFlyweight 312A,B,C,TD,SD,E, \$396.00-\$477.00. VU Magnemite 610 AV, BV,CV,TV,DV,EV, \$315.00-\$425.00. Magne-loop 535B,C,D,E, \$315.00-\$810.00. Acces, magnetaser 200-C, \$18.00.

ARGOS PRODUCTS CO., 301 Main St., Genoa, Ill.—Spkr TSE-1S, \$24.95. TSE-2AS, \$39.95.

ARKAY INTERNATIONAL, INC., 88-06 Van Wyck Expwy., Richmond Hill, N.Y.

ASTATIC CORP., Conneaut, Ohio—Cartridge 13TB ceramic, \$7.95. 13TBX ceramic, \$11.95. 86TSTB crystal, \$8.50. 76TSTB crystal, \$7.95. 9-7B ceramic, \$7.25. 9-7BX ceramic, \$13.25. 11T7B ceramic, \$7.95. 13AT ceramic, \$7.95. 13ATX ceramic, \$13.95. Mike 77 dynamic, \$82.50. 788 dynamic, \$78.50. 888 dynamic, \$110.00. 988 dynamic, \$150.00. 333 ceramic, \$17.90. 332 crystal, \$17.90. 335H dynamic, \$26.50. 335L dynamic, \$23.50.

ATLAS SOUND CORP., 1449 39 St., Brooklyn 18, N.Y.—Spkr WT-6, 2 way, \$34.50. DC-5, \$13.20.

AUDIO DEVICES, INC., 444 Madison Ave., New York 22, N.Y.—Tape.

AUDIO-EMPIRE, Div. DYNA-EMPIRE, Inc. (EMPIRE) 1075 Stewart Ave., Garden City, N.Y.—Cartridge 88 stereo-mono, \$24.50. 108 stereo-mono, \$34.50. Arm 98 12", \$34.50*. 98P 16", \$44.50*. Turntable 208, \$87.50. Needles. *Cartridge not included.

AUDIOTEX MFG. CO., Div. G-C TEXTRON INC., 400 S. Wyman St., Rockford, Ill.—Acces, head-demag, 30-112, \$9.95, taperaser, 30-114, \$33.00, care kit 30-098, \$9.95. Control 30-286, \$39.50. Tape.

BECKER ELECTRONICS MFG., 1091 Rockaway Ave., Valley Stream, L.I., N.Y.—Spkr PM.

BELL SOUND Div. THOMPSON RAMO WOOLDRIDGE, INC., 555 Marion Rd., Columbus 7, Ohio—Tape Rec Record/Playback Tape transport T-310 2 track mono, \$129.95; T-313 2 track stereo, \$169.95. T321 Stereo Playback, 2 & 4 track, \$159.95. Preamp RP320 stereo record playback, \$129.95. RP-321, mono record/playback, \$75.00. Mike 45-A1, \$20.00. Amp 2418, stereo 30 watt, \$109.95. 2440, stereo 44 watt, \$179.95. 6060, stereo 60 watt, \$219.95. Tuner 2421, AM-FM stereo \$129.95. 2441, AM-FM stereo, \$179.95.

BLONDER-TONGUE LABS., 9 Alling St., Newark 2, N.J.

BOETSCH BROS. (BIRCH), 115 Cedar St., New Rochelle, N.Y.—Phonos hi-fi stereo SD66, \$119.95. SD654, \$89.95. SA550, \$69.95. SA77, \$59.95.

BOGEN-PRESTO Div., The Siegler Corp., P.O. Box 500, Paramus, N.J.—Rcvr RP-40, FM-AM, \$329.50. SRB40, FM-AM, \$269.50. SRB20, FM-AM, \$219.50. AMP AP-40, 40 watts, \$199.50. BP-50, 50 watts, \$99.50. DB212, 24 watts, \$119.95. DS 265, 130 watts, \$149.50. Tuner TP-40, FM-AM, \$189.50. ST442, FM-AM, \$149.50. FM51, FM, \$115.00. Preamp STP52, FM-AM, \$179.50. Control PR2, \$99.50. Turntable & Arm* B61, \$59.95. B60, \$49.95. B50, \$40.40. Arm* PA1, \$24.95. Turntable T68AH,

\$170.00. TT5, \$129.50. TT4, \$99.50. TT3, \$59.95. *Less cartridge.

BOZAK MFG. CO., R. T., Box 1166, Darien, Conn.—Spkr B-304, \$620.00.

BRITISH INDUSTRIES CORP., 80 Shore Rd., Port Washington, N.Y.—Turntable (GARRARD) Type A, lab series, \$69.50. Model 301, transcription, \$89.00. Spkr (WHARFEDAILE) achromatic series: #60*, full range shelf size, \$109.50. #50*, full range 40 watt, \$94.50. WS/2*, 8" full range 20 watt, \$89.50. Coax 12, full range 40 watt, \$139.50. GARRARD Changers: RC88, \$59.50; RC98, \$69.50; 210, \$49.50; RC121, \$42.50; cartridges extra. Arm TPA/12, \$19.50. *Enclosure included.

CBS-ELECTRONICS, 100 Endicott St., Danvers, Mass.

CHANNEL MASTER CORP., Ellenville, N.Y.—Amp 6600, 2 channel, \$99.95. Tuner 6610, FM-AM, \$84.95. Turntable 6652, 4 speed, \$64.95. 6653, 4 speed, \$79.95. Spkr. Minstrel 6630, \$29.95. Coaxial (CM-10) 6633, \$44.95.

CLETRON, INC., 1974 E. 61 St., Cleveland 3, Ohio—Spkr C-33812, 4 matched spkrs & crossover, \$98.00. Quartet encl kit, includes C-33812, \$158.00. C-18N300, 18" Woofer, \$180.00. C12RW, 12" Woofer, \$59.00. C-12NR, 12" wide range, \$33.50. C-8MFR, 8" midrange, \$13.20. C-12PC, 12" coax tweeter, \$53.50.

CLEVITE ELECTRONIC COMPONENTS, 3405 Perkins Ave., Cleveland 14, Ohio—Acces, headphones, crystal stereophonic, BA-220, \$44.95. BA-206B, \$39.25. BA-200B, \$24.50. **CLEVITE-WALCO**, 60 Franklin St., East Orange, N.J.—Needles.

COMPONENTS CORP., Denville, N.J.—Turntable Mark I, single speed, \$44.50. Mark II, 33/45 rpm, \$54.50. TT, Kit, \$29.50. Arm kit AS-auto set, \$9.50.

CONTINENTAL MFG. INC., 1612 California St., Omaha 2, Nebr.—Spkr CS-14B, \$30.69. Multiplex TN66*, \$112.80. TN-77, with 5 watt amp, \$131.53. TN-88 with 15 watt amp, \$152.33. *Without amp.

CROWN INTERNATIONAL, Box 261, Elkhart, Ind.—Tape Rec 714C, \$730.00. 824, \$1,195.00. Amp A3030, \$195.00.

DERO ELECTRONICS, 10 Woods Ave., Roosevelt, L.I., N.Y.—Adapter phone jack to pin plug PHPJ, \$95. PHJP, \$1.25. Spkr TST-25, extension, \$12.95.

DEWALD RADIO, Div. of UNITED SCIENTIFIC LABS INC., 35-15 37 Ave., Long Island City 1, N.Y.—Tuner N-803B, AM-FM Mono, \$77.95. N-1000B, AM-FM stereo, \$99.95. N-804B, FM, \$74.95. Amp N-1200B, stereo 30 watts, \$99.95. N-2200B, stereo 50 watts, \$139.95. N-5000B, mono 15 watts, \$52.95.

DUKANE CORP., St. Charles, Ill. **DUOTONE CO.**, Locust St., Keyport, N.J.—Needles. Tape. Cartridge GP73, stereo turn-

over, \$14.50. GP73SD, \$24.50. GPS-71-1S, \$20.00. GPS-71-1D, \$31.25. Arm GP2-3, with cartridge, \$14.50. Mike "Lipstyk" MIC39-1, \$20.00. Acces 45 RPM Adapter, 5 to a pkg 24 pkgs to a card, \$6.00. Pocket needle inspection microscope, 6 to a card, \$30.00. Record Brush, 12 pkgs, \$6.00.

DYNACO INC., 3912 Powelton Ave., Philadelphia 4, Pa.—Control DSC-1, kit \$12.95, wired \$18.95. Amp Stereo 70, kit \$99.95, wired \$129.95. Arm TA12, \$49.95 including Stereodyne II cartridge. Cartridge Stereodyne II, \$29.95. Mike #50, \$49.95. #53, \$59.95. Preamp Pas-2, kit \$59.95, wired \$99.95. Tuner "Dynatuner" FM, kit \$79.95, wired \$119.95.

ELECTRON ENTERPRISES, 6917 Stanley Ave., Berwyn, Ill.—Amp #60, 20 watt 4 speed stereo phono, \$159.95. Changer #65, 4 speed 4 spkr portable stereo, \$99.95. #69, 2 speed 45 portable mono, \$49.95.

ELECTRONIC APPLICATIONS, INC., 194 Richmond Hill Ave., Stamford, Conn.—Mike AKG D 11N, dynamic cardioid, \$34.95. AKG D 19B, dynamic broad-band, \$68.00. AKG D 19 BK/Hi, \$74.50. AKG D 88/200 dynamic stereo, \$72.00. AKG D 88/Hi/Z, \$77.50. Tape Rec III B, Nagra, \$1,045.00.

ELECTRONIC DEVELOPMENT ASSOC., 126 E. 46 St., New York 17, N. Y.

ELECTRONIC INSTRUMENT CO., (EICO), 33-00 Northern Blvd., Long Island City 1, N.Y.—Amp* HF-81**, wired \$109.95, kit \$69.95. AF-4**, wired \$64.95, kit \$38.95. HF-86, wired \$74.95, kit \$43.95. HF-87, wired \$114.95, kit \$74.95. HF-89, wired \$139.50, kit \$99.50. Changer 1007S \$49.75. 1007D \$59.75. Preamp* HF-85, wired \$64.95, kit \$39.95. Spkr*** HFS-1, wired \$47.95, kit \$39.95. HFS-2, \$139.95. HFS-3, wired \$99.50, kit \$87.95. HFS-4, wired \$112.50, kit \$98.50. HFS-5, wired \$69.50, kit \$59.50. Tuner HFT-90, FM, wired \$65.95, kit \$39.95. HFT-94, AM, wired \$65.95, kit \$39.95. HFT-92, AM-FM, wired \$94.95, kit \$59.95. ST-96, AM-FM stereo, wired \$129.95, kit \$89.95. *2-channel. **Preamp included. ***Enclosure included. Spkr prices cover Mah/Wal finish.

ELECTRO-SONIC LABS., 35-54 36 St., Long Island City 6, N.Y.—Arm* S1000, \$34.95. S310, \$57.00. Cartridge C99, \$49.95. C100, \$100.00. Mike MDS 1, electrodynamic super cardioid, \$85.00.*

ELECTRO-VOICE INC., Buchanan, Mich.—Spkr SP8B*, \$29.50, SP12*, \$66.00, SP15*, \$89.00. 12TRXB**, \$66.00. 15TRX**, \$149.00. 12BW***, \$35.00. 15WK***, \$89.00. 30W***, \$185.00. 644, \$110.00. Cartridges (ceramic): 31MD5, \$24.00. 31D-5, \$22.50. *Coaxial. **3-way. ***Low freq.

FAIRCHILD RECORDING EQUIPMENT CORP., 10-40 45th Ave., Long Island City 1, N.Y.—Arm SA-12, 12" stereo, \$39.95. SA-16, 16" stereo, \$60.00. Cartridge SM-1, compatible stereo, \$34.95. 225-A, mono microgroove, \$37.50. 225B, mono 78s, \$37.50. 230 Micro 7, mono microgroove, \$42.50. Turntable 412-1A, 1 speed, \$87.50. 440, 2 speed, \$69.95.

FEDERATED INDUSTRIES INC. (CRESCENT), 4477 N. Elston Ave., Chicago 30, Ill.—Spkr 200-1*, 2-way 25 watt, \$119.95. FA3012, 12" 30 watt, \$18.50. FA1512, 12" 15 watt, \$15.50. *Enclosure included.

FEN-TONE CORP., 106 5 Ave., New York 11, N.Y.—Tape Rec Mark IV, 3 speed, \$89.50.

Mark V, 4 speed \$129.50. Mark VI, Truvox stereo, \$149.50. Amp Mark VI Truvox, with preamp, \$129.50. Mike Reslo Celeste, ribbon, \$39.95. Reslo Symphony, ribbon, \$39.95. Cartridge Stereomaster, turnover phono, \$9.95.

FERRO DYNAMICS CORP., Gregg St. & Rte. #17, Lodi, N.J.—Tape.

FIDELITONE, INC., 6415 N. Ravenswood Ave., Chicago 26, Ill.—(PYRAMID POINT) Needles.

FISHER RADIO CORP., 21-21 44th Dr., Long Island City 1, N.Y.—Rcvr TA 800, stereo \$429.50. TA600, stereo \$369.50. Tuner FM 100, \$169.50. FM 50, \$129.50. 100R, AM-FM, \$199.50. 202R, AM-FM, \$299.50. 100-T*, AM-FM, \$249.50. 202-T*, AM-FM, \$349.50. Amp X-100*, stereo, \$159.50. X-202, stereo, \$229.50. SA-100, stereo, 50 watt basic, \$119.50. SA-300, stereo 60 watt basic, \$179.50. 30A*, mono, \$59.50. Preamp PR-6, mono, \$12.95. PR-66, stereo, \$29.95. Adaptor MPX-20, \$49.50. Control RK1, remote, \$17.95. Spkr XP1, \$129.50. XP-2, \$84.50. WS-1, \$49.50 per pr. *Includes preamp-control section.

FOURJAY INDUSTRIES, 2801 Ontario Ave., Dayton 14, Ohio—Spkr-Enc 40 different models, made of fiberglass, \$1.75 to \$22.50.

GENERAL ELECTRIC CO., Audio Products Section, 2200 N. 22nd St., Decatur, Ill.

GENERAL KINETICS INC., 2611 Shirlington Rd., Springfield, Va.—Custom tape recorders.

GLASER-STEERS INC., 155 Oraton St., Newark 4, N.J.—Changer GS77, \$59.50. GS400, \$47.50.

GOTHAM AUDIO CORP., 2 West 46 St., New York 36, N.Y.—Cartridge DST, Neumann double dynamic stereo, \$69.00. Mike SM2, Neumann single unit stereo, \$815.00. Access, stereo headphone DT-48, Beyer dynamic \$79.50. DT 508s, Beyer dynamic, \$27.50.

GRANCO PRODUCTS, INC., 83-30 Kew Gardens Rd., Kew Gardens, N.Y.—Tuner T300, FM, \$21.95.

HARMAN-KARDON, INC., 520 Main St., Westbury, L.I., N.Y.—Amp Citation II, basic power, 2 channel 60 watts per channel stereo, wired \$229.95, kit \$159.95. Citation V, basic 2 channel 40 watts per channel stereo, wired \$179.95, kit \$119.95. A10* \$49.95. A220*, \$79.95. A230* \$109.95. A260*, \$199.95. Preamp Citation I, control center, wired \$249.95, kit \$159.95. Citation IV, control center, wired \$189.95, kit \$119.95. Tuner Citation III, FM, wired \$229.95, kit \$149.95. F10, FM, \$69.95. T220, stereo AM-FM, \$99.95. T230 stereo AM-FM, \$119.95. ST360A, stereo AM-FM, \$199.95. Revr TA224, stereo AM-FM \$199.95. TA 260, stereo AM-FM, \$299.95. *Includes preamp. East Coast prices.

HARTLEY PRODUCTS CO., 521 E. 162 St., New York 51, N.Y.—Spkr #220, \$135.00 #XP, \$75.00. With enclosure: Holton Jr*, \$195.00. Harp**, \$190.00. Capri***, \$120.00 *With #220 spkr. **With #XP spkr. ***With #320 spkr.

HEATH CO., Benton Harbor, Mich.—Kits Amp AA-30, 14/14 watt, \$45.95. AA-40, 35/35 watt, \$79.95. AA-50*, 25/25 watt, \$79.95. SA-2* 14/14 watt, \$54.95. Changer RP-3 series, to \$73.90. Multiplex MX-1, \$31.95. Preamp AA-20, stereo, \$34.95. SP-2A, stereo \$56.95. Tuner BC-1A, AM, \$29.95. FM3-A, \$29.95. AJ-10, AM-FM, \$59.95.

Spkr SS-2, \$39.95. HH-1, \$299.95. Tape Rec TR-1E, mono rec/4 track playback, \$169.95. TR-1AQ, 4 track mono & stereo record & playback, \$149.95. *With preamp, also wired.

HI-PAR PRODUCTS CO., Fitchburg, Mass.—Acces, FM Antennas.

JENSEN INDUSTRIES, 7333 W. Harrison St., Forest Park, Ill.—Needles.

JENSEN MFG. CO., 6601 S. Laramie Ave., Chicago 38, Ill.—Spkr TF-3, 3 way bookshelf, \$79.50. TR-30, 3 way, \$159.50. GS-3, 3 piece complete stereo, \$229.50. TR-10, 3 way, \$119.50. GS-2, 3 piece complete stereo, \$169.50. DF-1, 2 way, \$69.50. CN-100, 3 way, \$159.50. SS-100, 3 way, \$179.95. SS-200, 4 way, \$439.50.

JERROLD ELECTRONICS CORP., 15th & Lehigh Ave., Philadelphia 32, Pa.—Preamp DSA-207, mastmounted, \$47.95. Amp HSA-43, 3 set coupler, \$17.95. HSA-46, TV-FM amp/preamp, \$33.30.

KARG LABS, 30 Meadow St., South Norwalk, Conn.—Tuner CT-3 basic FM, \$99.50. CT-2 Stereo FM, \$139.50. Adapter, MX-1 \$99.50.

KIERULFF SOUND CORP. (CAPKIT), 820 W. Olympic Blvd., Los Angeles 15, Calif.—Phono CK-643, transistor battery operated 3 speed, \$44.95.

KIMBERLEY INTERNATIONAL LTD., 346 W. 44 St., New York 36, N.Y.—Tape Rec Uher Universal, \$299.95. Stereo Record, \$399.50. Stereo 1c, \$279.95.

KINEMATIX, INC., 1616 N. Damen Ave., Chicago 47, Ill.—Converter "Skylark", FM, \$89.95. Acces, stereo balance meter SB-1, \$14.95. CM-2, \$24.95.

KLIPSCH & ASSOCIATES, P.O. Box 96, Hope, Ark.—Spkr Corner horn system with 3 way drive system: K-B-M2, \$792.00. K-BML, \$734.00. K-BMR, \$651.00. K-CM2S, \$693.00. K-CMR \$617.00. K-CFR, \$538.00. SMR15, \$314.00. SM212B, \$205.00. SMR12B, \$165.00. SD12B, \$99.00. Enclosure with 3-way drive system: H-M2-12, \$214.00. H-M2-12B, \$110.00. HD12, \$184.00. CWM215, \$393.00. CWD12, \$242.00.

LAFAYETTE RADIO ELECTRONICS CORP., 165-08 Liberty Ave., Jamaica 33, N.Y.—Amp KT-250A*, 50 watt kit, \$74.50. LA-250*, 50 watt wired, \$99.50. LA-235*, 35 watt, \$69.50. KT-550, 100 watt kit, \$129.50. LA550, 100 watt wired, \$179.50. Arm PK-448, cartridge included, \$32.50. Mike dynamic, \$6.95-\$15.95. Crystal, \$2.95-\$5.75. Preamp/Control KT-600A, kit, \$79.50. LA-600A, wired, \$134.50. Tape Rec RK-103, 2 speed 3 1/2, 7 1/2, \$99.50. Tuner KT-500A, FM-AM kit, \$74.50. LT-50A, FM-AM wired, \$124.50. KT-650, FM kit, \$54.50. *Preamp included.

LANSING SOUND, INC., JAMES B., 3249 Casitas Ave., Los Angeles 39, Calif.—Spkr D46S5*, \$249.00. D45202*, \$868.20. D4-5205*, \$1,183.20. D44000, \$2,070.00. D4-4000BK, \$1,830.00. *Enclosure included.

L.E.E. INC., 625 New York Ave., N.W., Washington 1, D.C.—Spkr Catenoid*, \$495.00. Fantasia*, \$129.50. Trio*, \$119.50. *Enclosure included.

LESA OF AMERICA, 11 W. 42 St., New York 36, N.Y.—Changer CD2/21, \$44.50. Turntable 4V3/11, \$23.25. Cartridge "E", turnover crystal-mono 78LP, \$9.95. "S", crystal stereo LP, \$16.50. Needles.

(Continued on page 114)



Audio NEWS LETTER

AUDAX appoints Syd Jurin Co. as Southern California sales rep.

BOGEN-PRESTO appoints the F. P. Yarussi Co. sales rep for W. Va. and West Pa.

BELL SOUND announces new stereo component line will be distributed through two-step distribution channels.

LAFAYETTE introduces the "Trihelix" 10" 3-way speaker @ \$32.50. Response rating is 30-12,000 cps \pm 3 db, average power 20 watts.

MINNESOTA MINING has purchased REVERE CAMERA, and will use its facilities to produce tape players capable of using the 3M cartridge.

GENERAL ELECTRIC announces production of a transistorized home intercom system, retailing at \$79.95 per pair. Voice signals are carried over existing house wiring, eliminating need for wiring between units.

H. H. SCOTT offers to replace any of the original London-Scott 1000 stereo cartridges with their new, ruggedized version of the unit. The new cartridge maintains identical performance specs of the original.

ARMOUR's tape patent used by 3M was ruled invalid by the U.S. Court of Appeals, and judged not infringed by C. K. WILLIAMS and TECHNICAL TAPE. The patent covers the production of magnetic iron oxide used in recording tape.

PACOTRONICS, INC., which has become a publicly held company, is the new corporate name of Paco Electronics, as well as Precision Apparatus and Pace Electrical Instruments. They will operate as subsidiaries under their own names. There is no management change.

ELECTRONIC INDUSTRIES ASSOCIATION is reported to have scrapped a proposed plan to publicize stereo to consumers. Though a majority of the EIA committee favored the idea, a favorable majority of 75% was not obtained. The plan was contingent on receiving 75% approval.

ROBINS INDUSTRIES introduces new packaging for the "Gibson Girl" Jr. Tape Splicer, Model No. TS4A-JR., following their orange and black motif. Also publishes 16-page phono-recorder drive reference, which aids replacement drive selection for nearly 95% of wheels and belts. It is free with parts deal DD-10RP, or 50¢ separately.

from **EICO**... a completely new CITIZENS BAND TRANSCEIVER



Model 760: 117 VAC
Kit \$59.95, Wired \$89.95
Model 761: 117 VAC & 6 VDC
Model 762: 117 VAC & 12 VDC
incl. mounting bracket: Kit \$69.95, Wired \$89.95

EICO premounts, prewires, pretunes, and seals the ENTIRE transmitter oscillator circuit to conform with FCC regulations (Section 19.71 subdivision d). EICO thus gives you the transceiver in kit form that you can build and put on the air without the supervision of a Commercial Radio-Telephone Licensee!

Highly sensitive, selective SUPERHET (not regenerative) receiver with 5½ dual function tubes and RF stage. Continuous tuning over all 23 bands. Exclusive Super-Hush® noise limiter. AVC:3" x 5" PM speaker. Detachable ceramic mike. 5-Watt crystal-controlled transmitter. Variable "pi" network matches most popular antennas. 12-position Posi-Lock® mounting bracket. 7 tubes and 1 crystal (extra xtals available). Covers up to 20 miles. License available to any citizen over 18—no exams or special skills required, application form supplied free. Antennas optional.

YOU PROFIT WITH EICO

Everything in top-quality
TEST EQUIPMENT for Shop
and Field—at savings of 50%.



COLOR & Mono DC-5MC
Lab & TV 5" Oscilloscope #46Q
Kit \$79.95, Wired \$129.50
5" Push-Pull Oscilloscope #429
Kit \$44.95, Wired \$79.95



Peak-to-Peak VTVM #232
Kit \$29.95, Wired \$49.95
Vacuum Tube Voltmeter #221
Kit \$25.95, Wired \$39.95

More typical EICO values: Signal Generators from \$19.95, Tube Testers from \$34.95, Sweep Generators from \$34.95, Power Supplies from \$19.95, VOMs from \$12.90.

Everything in CUSTOM HI-FI:
finest quality at ½ the cost.



FM Tuner HFT90
Kit \$39.95, Wired \$65.95
Cover \$3.95. Includes FET.

AM Tuner HFT94
Kit \$39.95, Wired \$65.95
Includes Metal Cover and FET.

FM/AM Tuner HFT92
Kit \$59.95, Wired \$94.95
Includes Metal Cover and FET.



Stereo Dual Amplifier-Preamp HF81
Kit \$69.95, Wired \$109.95
Includes Metal Cover.

Stereo Dual Amplifier AF4
Kit \$38.95, Wired \$64.95
Includes Metal Cover.

Write for free catalog ET 9 and name of nearest distributor.
Most EICO distributors offer budget terms.



3300 N. Blvd., L.I.C. 1, N. Y.
Add 5% in the West

For more data, circle 9-113-1 on coupon, p. 78

(Continued from page 112)

LING-ALTEC ELECTRONICS, Anaheim, Calif.

LOWELL MFG. CO., 3030 Laclede Station Rd., St. Louis 17, Mo.—Electric Lamp Post with spkr enclosed PBA-8, \$32.30.

MADISON FIELDING BY CROSBY, 135 Eileen Way, Syosset, N.Y.—Revr #440, \$350.00. #650, \$219.95. Tuner #630, FM, \$84.95. #380, AM-FM stereo, \$160.00. Amp #360*, 2 channel, \$180.00. Multiplex Adapter MX-100, \$49.95. Spkr #660**, \$29.95. Acces #30 transistor single channel preamp, \$11.25. Wood cabinet #350, \$20.00. #450, \$30.00. Metal enclosure, \$11.95. *Preamps included. **Enclosure included.

MAGNECOR SALES DEPT. MIDWESTERN INSTRUMENTS, P.O. Box 7186, Tulsa 18, Okla.—Tape Rec #728*, \$809.00. #101-1, \$479.95. Stereo rec M90-BAC*, \$2,255.00. P75-BAC*, \$1,305.00. Spkr-amp combination #110, \$129.95. *With preamp.

MARANTZ CO., 25-14 Broadway, Long Island City 6, N.Y.—Amp #8, 2 channel, \$237.00. Preamp/contr #7, \$249.00. Prices are East of Rockies. West slightly higher.

McINTOSH LABS., 2 Chambers St., Binghamton, N.Y.

MINNESOTA MINING & MFG. CO., Magnetic Products Div., (SCOTCH BRAND), 900 Bush Ave., St. Paul 6, Minn.—Tape.

MOVIC COMPANY, 12432 Santa Monica Blvd., Los Angeles 25, Calif.—Tape Rec A-2, \$645.00. A-214, \$695.00. A-2-15, \$710.00. A-214-15, \$760.00.

MP ENGINEERING CO., Fairfield Conn.—Phono PB-88, stereo, \$188.00. J602*, \$695.00. G-854*, \$1010.00. *Enclosures included.

NESHAMINY ELECTRONIC CORP. (ZANSZEN), 382 Easton Rd., Neshaminy, Pa.—Spkr Z-400*, shelf, \$149.50. Z-300*, full range, \$199.75. #130*, mid range & highs, \$188.00; #65*, mid range & highs, \$91.50. #350 Driver, \$44.50. #250 Driver, \$69.75. *Enclosure included.

NEWCOMB AUDIO PRODUCTS CO., 6824 Lexington Ave., Hollywood 38, Calif.—Tape Rec SM-310, 1/2 track stereo-mono, \$499.50. SM-310-4, 1/4 track stereo-mono, \$499.50.

NORTH AMERICAN PHILIPS CO. (NORELCO), 230 Duffy Ave., Hicksville, N.Y.—Cartridge AG3400, magneto-dynamic, \$29.95. Changer AG1024, 4 speed, \$39.50. Spkr T-7 Series, 5" to 12", \$6.60-\$59.50. Tape Rec Continental 400, 4 track 3 speed stereo-record, \$399.50. Mike, stereo dynamic, \$39.50.

NORTRONICS CO., 1015 S. 6th St., Minneapolis 4, Minn.—Amp RA-100, mono. Preamp P1-100, mono. Tape.

OXFORD COMPONENTS, 556 W. Monroe St., Chicago 6, Ill.—Horn Tweeter CH26E16, \$21.00 and others.

PACO ELECTRONICS CO., 70-31 84 St., Glendale 27, N.Y.—Amp SA-40, 2-channel. Preamp included, wired \$129.95, kit \$79.95. Revr ST-45, AM-FM stereo, wired \$134.95, kit \$84.95, semi kit \$99.95. ST-35, FM, wired \$89.95, kit \$59.95, semi kit \$69.95. Spkr L-1*, semi kit, \$24.95. L-2*, semi kit, \$69.95. *Enclosure included.

PENTRON CORP., 777 S. Tripp Ave., Chicago 24, Ill.

PERMADYNE DIV., MELODY MASTER MFG. CO., 2149 W. Roscoe St., Chicago 18, Ill.—Acces Headsets, extended range, HS-1, \$36.00.

PERMOFLUX PRODUCTS CO., 4101 San Fernando Rd., Glendale 4, Calif.—Acces, headphone DHS-17, monaural, \$52.50. B-DHS-25M, binaural, \$52.50. Amp RSD-10, \$175.00. Spkr Arpeggio, stereo, \$55.00. Largo, stereo, \$89.50.

PERMO INC., 6415 Ravenswood Ave., Chicago 26, Ill.

PFANSTIEHL CHEMICAL CORP., 104 Lake View Ave., Waukegan, Ill.—Needles

PHILCO CORP., C & Westmoreland, Philadelphia 34, Pa.—Model 1720R reverbaphonic sound system.

PICKERING & CO., Sunnyside Blvd., Plainview, L.I., N.Y.—Arm #198, with integrated 380A cartridge, \$54.00. Cartridge Stereo "90"*, \$16.50. MkIIA*, \$26.40. MkIIC*, \$24.00. 380A*, \$34.50. 380C*, \$29.85. 381A*, \$48.00. 381E*, \$60.00. Needles. Turntable 800 Gyropoise Stereotable, 33 1/3 single speed, \$66.00. Acces 800 CB base for Stereotable, \$15.00. *Stereo magnetic.

PILOT RADIO CORP., 37-06 36th St., Long Island City 1, N.Y.—Amp #260*, 40 watt/channel, \$139.50. #264*, 30 watt/channel, \$179.50. #240*, 15 watt/channel, \$134.50. #248*, 30 watt/channel, \$249.50. Preamp 216A*, \$199.50. Revr #602, 15 watt/channel, \$249.50. #654, 22 watt/channel, \$299.50. Spkr PSV1**, \$139.50. PSV2**, \$69.50. PSV3**, \$64.50. Tuner #480, FM/AM, \$159.50, #590, FM/AM & dual preamp, \$239.50. #690A, FM/AM & dual preamp, \$219.50. *2-channel. **Bookshelf.

PRECISION ELECTRONICS INC. (GROMMES), 9101 King St., Franklin Park, Ill.—Amp 24LJ*, Dual 15 watt stereo, \$89.50. 36PG*, Dual 20 watt, \$189.50. 50PGA*, Dual 25 watt, \$219.95. LJ8, 15 watt monaural, \$69.50. 240A*, Dual 25/watt basic, \$109.95. Tuner 102GTB*, AM-FM, \$129.95. 101GTB*, FM, \$79.95. Preamp 209*, \$159.95. 20LJ*, stereo dual 10/watt, \$79.95. *Does not include cover.

PRO-TEX REEL BAND CO., 2108 Payne Ave., Cleveland 14, Ohio—Acces, tape reels & fasteners.

QUAM-NICHOLS CO., 234 E. Marquette Rd., Chicago 41, Ill.—Spkr 8A10X, \$20.00. 12A6CO, \$34.50. 8A4CO, \$22.95. 3A15T, \$5.75. 5A15T, \$6.50. 12A10X, \$26.00. 12A1OL, woofer, \$26.00. 15A10CO, \$52.50. 10A1OX, \$24.00. 15A1OL, woofer, \$35.00. Acces, crossover network for 3A15T-5A15T, #CO2-50, \$2.00.

RECOTON CORP., 52-35 Barnett Ave., Long Island City 4, N.Y.

REEVES SOUNDCRAFT CORP., Green Pasture Rd., Danbury, Conn.

REGENCY DIV., IDEA, INC., 7900 Pendleton Pike, Indianapolis 26, Ind.

REK-O-KUT CO., 38-19 108 St., Corona 68, N.Y.—Turntable K-33, kit, single speed 33-1/3, \$39.95. K-33H, kit, single speed 33-1/3, \$49.95. L-34, 2 speed, 33-1/3/45, \$59.95. L-37, 2 speed, 33-1/3/78, \$59.95. N-33H, single speed, 33-1/3, \$69.95. L-34H, 2 speed, 33/45, \$79.95. L-37H, 2 speed, 33/78, \$79.95. B-12, 3 speed, 33/45/78, \$84.95. B-12GH, 3 speed, 33/45/78, \$99.95. B-12H, 3 speed, 33/45/78, \$139.95. Arm S-120*, 12", \$24.95. S-160, 16", \$27.95. S-220, 12", \$29.95. S-260, 16", \$34.95.

AUDAX DIV.—Spkr CA-60, bookshelf, \$59.95. CA-60P, \$49.95. CA-80, \$99.95. CA-100, \$139.95. *Does not include cartridge.
REITER CO., F., 3340 Bonnie Hill Dr., Hollywood 28, Calif.—Acces Skila 1/4" tape splicer, \$69.75.

ROBINS INDUSTRIES CORP., 36-27 Prince St., Flushing 54, N.Y.—Acces, M/M R/P heads, 5 models 1/2 track mono, \$14.00-\$16.00. 5 models 1/2 track stereo, \$27.00-\$31.00. 2 models 1/4 track stereo, \$30.00. M/M erase heads, 3 models 1/2 track mono, \$11.00. 2 models 1/2 track stereo, \$15.00. 9QE3, 1/4 track stereo, \$14.00. Replacement parts for phono & tape recorder drives, \$.25-\$6.30. Splicers, recording tape, TSA Series, \$6.50-\$11.50. TS Series, \$55.00. Bulk tape eraser ME99, \$33.00. Head Demagnetizer HD-6, \$10.00.

ROCKBAR CORP., 650 Halstead Ave., Mamaroneck, N.Y.—Changer (COLLARO) TSC-640, \$38.50. TSC740, \$42.50. TC99, \$59.50. Turntable ATR200, \$49.50. Spkr (GOODMANS) Audiom 652, 12", \$69.50. Audiom 755, 15", \$78.00. Axiette 11-8, 8", \$27.00. Midax H-750, mid range, \$58.50. Stereosfere, 30 watt, \$79.50.

ROCKFORD SPECIAL FURNITURE CO., 1803 Belle Plaine, Chicago 13, Ill.—Spkr-Enc #108, for 8" spkr & tweeter, \$26.95. #112, for 12", \$42.95. #101, for 12" or 15", \$54.50.
RYE SOUND CORP., 145 Elm St., Mamaroneck, N.Y.

SARGENT-RAYMENT CO., 4926 E. 12 St., Oakland 1, Calif.—Amp SR5100*, 50 watts/channel, \$183.60. SR540*, 20 watts/channel, \$106.60. SR2051*, 50 watts/channel, \$263.70. SR2040*, 20 watts/channel, \$199.50. Revr SR8000, \$249.40. SR7000, \$199.40. SR1000b, \$184.50. Tuners SR1020, FM, \$97.50. *2-channel.

SAXTON PRODUCTS, INC., 4320 Park Ave., New York 57, N.Y.—Acces, FM antennas, #1124, \$1.69. Tape storage case, \$89.

SCOTT INC., H. H., 111 Powder Mill Rd., Maynard, Mass.—Amp #272*, 88 watt, \$269.95. #299B*, 50 watt, \$209.95. #222B*, 30 watt, \$144.95. #290 stereo power, 100 watts, \$239.95. Preamp/control #122, stereo dynamic, \$285.00. Tuner #314, FM, \$114.95. #330-D, FM-AM, stereo, \$209.95. #310-D, FM, \$184.95. Arm L/S1000, with integrated cartridge, \$87.95. Turntable 710A, 3 speed, \$129.95. *Stereo with preamp.

SCOTT INSTRUMENT LABS, 17 E 48th St., New York, N.Y.—Acces, tape strobe Model A, checks 7 1/2-15 & 30 ips, \$22.50. Model B, 3 3/4-7 1/2-15 ips, \$22.50. Model C, 1 1/2-3 3/4-7 1/2-15 ips, \$24.50.

SETCHELL-CARLSON INC., New Brighton, St. Paul 12, Minn.—Spkr RP91-B*, mono-stereo, \$149.00. 4814-B*, extension, \$78.00. Amp RP90-A**, 2-channel, \$69.95. *Enclosure included. **Preamp included.

SHELL ELECTRONICS MFG. CORP., 112 State St., Westbury, N.Y.

SHERWOOD ELECTRONIC LABS., 4300 N. California Ave., Chicago 18, Ill.—Amp S-5000*, 2-channel, \$189.50. S-4400*, 2-channel, \$159.50. Tuner S-2200, FM/AM/MX, \$179.50. S-3000III, FM/MX, \$110.50. *Pre-amplifier included.

SHURE BROTHERS, INC., 222 Hartrey Ave., Evanston, Ill.—Arm M212 & M216, cartridge included, \$89.50. M232*, \$29.95. M236*, \$31.95. Cartridge M3D**, \$45.00. M3LS**, \$75.00. M7D**, \$24.00. M8D, \$16.50. Mike #333, ribbon, \$150.00. #300, ribbon, \$90.00.

#330, ribbon, \$72.00. #315, ribbon, \$53.70.
 #525, dynamic, \$120.00. #530, dynamic,
 \$66.00. #535, dynamic, \$43.50. #545, dy-
 namic, \$51.00. #55S, dynamic, \$49.80.
 #556S, dynamic, \$81.00. M-60, stereo line
 preamp equalizer, \$19.95. *Does not in-
 clude cartridge. **Stereo magnetic.

SMOLIN LABS., Woodbrook Drive, Springdale,
 Conn.

SONOTONE CORP., Elmsford, N.Y.—Cartridge
 9T Series*, \$16.50-\$19.50. 8T Series*,
 \$14.50-\$16.50. 10T Series*, \$6.45-\$13.45.
 12T Series, stereo crystal turnunder, \$6.45.
 Arm, T1 Series, \$7.45. Mike CMT-10,
 matched pair, \$36.75 per pair. CMT-11,
 matched pair, \$36.75 per pair. Spkr T-64,
 \$9.00. WR-8, \$12.00. CA12A, \$27.50. W12,
 \$16.00. * Stereo ceramic turnunder.

STEPHENS TRUSONIC INC., 8538 Warner Dr.,
 Culver City, Calif.—Spkr 80FR, \$33.50. 80M,
 \$33.50. 80CX, \$53.50. 120FR, \$60.00. 120W,
 \$60.00. 120CX, \$99.50. 150FR, \$87.00. 150W,
 \$87.00. 150CX, \$129.50. 5KT, \$49.50. RT-1,
 \$24.50. E2*, \$275.00. Stereodot*, \$139.50.
 * Enclosure included.

STROMBERG-CARLSON, 1400 N. Goodman St.,
 Rochester 3, N.Y.—Amp ASR-880*, 64 watt,
 \$199.95. ASR-433*, 24 watt, \$129.95. ASP-
 422*, 40 watt, \$99.95. ASR-333*, 24 watt,
 \$99.95. Arm RA-498, cartridge not included,
 \$24.95. Spkr RF-478**, \$39.95. RF-487**,
 \$74.95. RF-484**, \$124.95. RS-406***,
 \$119.95. RS-405***, \$54.95. RS-424, \$199.95.
 Tuner AM-441, \$49.95. FM-443, \$79.95.
 SR-445, AM-FM stereo, \$129.95. Turntable
 PR-500, 4-speed, \$69.95. *2-channel. **2-
 way coaxial. ***3-way with crossover net-
 work. All prices are Zone 1.

SUPERSCOPE, INC., (SONY), 8150 Vineland
 Ave., Sun Valley, Calif.—Tape Rec CS300,
 2 & 4 track stereo, \$399.50. DK300, 2 & 4
 track stereo, \$349.50. 262SL, 4 track mono,
 \$199.50. Mike CR-4, wireless, \$250.00.
 F-3B, \$25.00. C-37A, \$295.00. FP-2, \$35.00.
 F-7, \$15.00.

SWITCHCRAFT, INC., 5555 N. Elston Ave., Chi-
 cago 30, Ill.—Acces Audio Mixer #310*, for
 Pentron, RCA, Wilcox-Gay, \$7.95. #313*,
 for Revere & Wollensak, \$8.95. #326*, for
 Webcor, \$9.95. Audio Mixer 306TR, tran-
 sistorized stereo-mono 2 or 4 input, \$37.50.
 #301TR, transistorized mono 4 input,
 \$30.00. Amp 501 Mix-Amp, transistorized,
 \$20.00. * "Mini-Mix" 2-input audio mixer
 for tape recorders.

TANDBERG OF AMERICA, 8 Third Ave., Pel-
 ham, N.Y.

TANNOY (America) Ltd., P. O. Box 177, East
 Norwich, L.I., N.Y.—Spkr, 15" monitor,
 \$179.00. 12" monitor, \$138.00. 10" monitor,
 \$112.75. 15" woofer, \$123.75. 12" woofer,
 \$78.75. HF tweeter, \$86.00. 12" direct radi-
 ator, \$79.00. Spkr-enc Belvedere, for 12",
 \$65.00. Belvedere Sr., for 12" & 15", \$85.00.

TELECTROSONIC CORP., 35-18 37th St., Long
 Island City 1, N.Y.—Tape Rec MR111*,
 \$89.95. SA121*, \$129.95. MR121*, \$109.95.
 MR511, 2 speed 1 $\frac{1}{2}$ -3 $\frac{3}{4}$ *, \$129.95. SR441**,
 \$239.95. SS461**, \$349.95. MR241**, \$179-
 95. 900 Series**, \$89.95-\$139.00. Spkr
 SP001-1, enclosure included, \$44.95. *2
 speed, 3 $\frac{3}{4}$ -7 $\frac{1}{2}$ *. **3 speed 1 $\frac{1}{2}$ -3 $\frac{3}{4}$ -7 $\frac{1}{2}$.

TETRAD CORP., 62 St. Marys Ave., Yonkers 2,
 N.Y.

THORENS CO., Thorens Ave., New Hyde Park,
 N.Y.—Turntables TD124, \$99.95. TD-184*,
 \$75.00. TDX-101, kit, \$47.50. TD-134,
 \$59.95. Changer CD43NS, direct drive,
 \$79.95. *Arm included.

Sonotone's 1960
 census.....over

10,
 000,
 000

(yes, 10 million)

cartridges
 now in use!

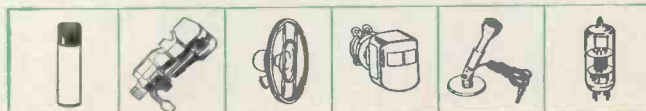


Only a few years ago, Sonotone invented the ceramic cartridge...and has been setting sales records ever since. And no wonder! Over the years, Sonotone has developed its fine cartridge line to the point where today it's the standard of the industry. Models available for virtually every type of phonograph...used as original equipment by over 70 manufacturers. In fact, Sonotone has already sold over 10,000,000 cartridges. Your customers will hear the difference...with Sonotone ceramic or new crystal cartridges.

Sonotone CORP.

ELECTRONIC APPLICATIONS DIVISION, ELMSFORD, N. Y., DEPT. C9-90
 IN CANADA, CONTACT ATLAS RADIO CORP., LTD., TORONTO

LEADING MAKERS OF



BATTERIES • CARTRIDGES • SPEAKERS • TAPE HEADS • MIKES • ELECTRONIC TUBES

For more data, circle 9-115-1 on coupon, p. 78

TRITON TAPE CO., 62-05 30th Ave., Woodside, N.Y.—Tape

TURNER CO., 909 17th St., N.E., Cedar Rapids, Iowa

UNITED AUDIO PRODUCTS (WIGO), 12 W. 18 St., New York 11, N.Y.—Turntable/Changer Dual 1006, \$79.95. Spkr ER-85, \$21.00. ERD-12, \$59.50. CX-212, \$79.50. WD-12, \$59.50. TW-400, \$12.50. CX-2, \$20.00. FW-2, \$5.00.

UNIVERSITY LOUDSPEAKERS, INC., 80 S. Kensico Ave., White Plains, N.Y.—Spkr Series 200, wide range, \$16.95-\$83.00. LC Series, self-contained, \$34.50-\$150.00. Woofers, \$15.00-\$89.50. Tweeters, \$18.00-\$49.50. Networks, \$3.95-\$32.00. Tridimensional System TMS-2*, mah, \$258.00. Medallion XII System*, mah less grille, \$139.95. RRL-12*, 12" 3 spkr system mah, \$119.95. RRL-8*, 8" 3 spkr system mah, \$99.50. S-80*, 2-way mah, \$59.95. S-9S System*, unfinished, \$340.00. SLC*, stereo add-on, \$43.50. Stereoflex II, mah, \$110.00. Spkr Enc, \$37.75-\$120.00. Adapter kit 812A, \$3.75. *Enclosure included.

UTAH RADIO & ELECTRONIC CORP., 1124 E. Franklin St., Huntington, Ind.—Spkr D8J*, \$17.50. D8LA*, \$24.95. D8P*, \$35.25. D12J**, \$19.95. D12LA, \$29.95. D12P**, \$40.75. D15P, 15" full range, \$44.50. CM6J, 6" midrange, \$24.50. CM8L, 8" midrange, \$37.95. Spkr Enc SC102, \$24.90. *8" full range. **12" full range.

VIDAIRE ELECTRONICS MFG. CORP., 44 Church St., Baldwin, L.I., N.Y.—Accessories.

VIKING OF MINNESOTA, 9600 Aldrich Ave., S., Minneapolis 20, Minn.

V-M CORP., Benton Harbor, Mich. (The VOICE of MUSIC)—Tape Rec Model 722, 4 track, \$259.95. Spkr Model 168, \$75.00. Changer Model 1571, 4 speed, \$50.00. Model 1586, \$56.00. Turntable Model 1580, 11", \$35.00. Amp Model 1404*, 2-channel 14 watts/channel, \$89.95. Turner Model 1405, AM-FM, \$99.95. *Preamplifier included.

WEATHERS INDUSTRIES, 66 E. Gloucester Pike, Barrington, N.J.

WEBCOR, INC., 5610 W. Bloomingdale Ave., Chicago 39, Ill.—Tape Rec. #2104, 2 speeds 3 3/4, 1 1/2, \$175.00. #2103*, \$139.95. #2005*, \$169.95. #2001*, \$199.95. #2008*, \$249.95. #2101*, \$199.95. #2108*, \$249.95. #2107*, \$349.95. *3 speeds 1 1/2, 3 3/4, 7 1/2.

Selling Stereo

(Continued from page 109)

used as sales aids in the case of connector cables and smaller articles. Different type jacks are always needed by hi-fi owners, as are cable extensions, etc. Other popular items are: adjustable phono base legs for levelling, splicing tape, drawer slides, solder tools, hand tools, etc. The do-it-yourself kit market is big . . . and growing. Accordingly, it

would be foolish for a dealer to ignore this trend.

The accessory and replacement parts market is varied and profitable. Intelligent merchandising such as fresh displays, display charts, peg-boards, show-case, stylus microscope for free customer styli examination, and other sales aids will certainly multiply sales and help establish your store as the stereo hi-fi center in your neighborhood. •



"Has it started to act up yet?"



MODEL IBR

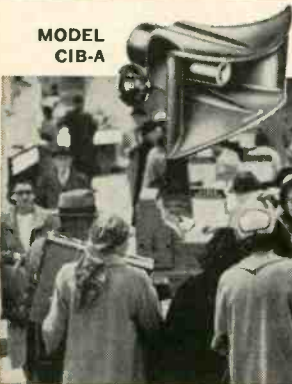
IN WAREHOUSES . . .



IN RESTAURANTS . . .

MODEL MIS

when it comes to paging . . .
UNIVERSITY MEANS BUSINESS!



MODEL CIB-A

IN RETAIL STORES . . .



IN GARAGES . . .

MODEL IB-A

. . . more business for you because you've got the world's widest range of specialized paging and talk-back speakers to choose from. Compact low-wattage units for spot coverage. Medium and high power directional types for penetrating high noise levels. Overhead radials for more coverage at less cost. Bi-directional models to cover two opposite areas economically with a single driver. This complete choice means you can always specify the right speaker for every job. No compromise ever in power, coverage, or performance. Instead, your customer gets exactly what he needs to save valuable time, lower operating costs, increase administrative efficiency.

SPECIAL TALK-BACK FEATURE

Each of these speakers is designed to operate as a highly sensitive microphone for greatest convenience and economy wherever talk-back communication is desired. For example, anyone working in a remote area can talk-back through the speaker to the control point without having to operate a switch. When your employees "talk-back," you save money!

MODEL IB-A New 25 watt version of world's most widely used medium power speaker. Lower frequency response for greater fidelity.

MODEL CIB-A Exclusive University wide-angle horn produces uniform sound pattern with optimum vertical dispersion. Power rating increased to 25 watts.

MODEL IBR Ideal solution for high-ceiling areas requiring wide coverage from minimum number of speakers. Uniform 360° dispersion.

MODEL MIS Compact reflex speaker for flush mounting in cabinets, walls, ceilings, etc. Perfect replacement for less efficient cone speakers.

These are only four of the many University paging and talk-back speakers . . . all described in the latest Product Catalog along with all other University P.A. speakers and accessories. See your distributor, or write: Desk Z-9, University Loudspeakers, Inc., 80 So. Kensico Ave., White Plains, N.Y.



A Division of Ling-Temco Electronics, Inc.

For more data, circle 9-116-1 on coupon, p. 78

GC PHONO KNOBS

As a follow-up to the firm's exact replacement TV knob package: a companion replacement package for phono knobs covering leading makes of record changers. The initial phase of the new knob line includes 36 different



items. Replacements now in the line cover Collaro, Monarch, V-M, and Webcor changers. All knobs are skin-packaged on cards that give full replacement information. GC Electronics Co., 400 S. Wyman St., Rockford, Ill.

For more data, circle 9-117-2 on coupon, p. 78

Additional copies of
STEREO 1961
Available for 50¢

MASCO INTERCOM

Models AC-1013 and AC-1025 are 13 and 25 master stations with 10 watts of power. Installations include: up to 24 remote stations in master-to-remote; up to 25 master stations in



master-to-master; and up to 156 master and remote stations for intermixed installation. Stations can be operated 2,000 feet apart. Other features: volume controls; built-in busy signal light; all-call (optional) button; no interference or crosstalk; and any master station can call another master whose power may be turned off. Mark Simpson Mfg. Co., 32-28 49th St., Long Island City 3, N. Y.

For more data, circle 9-117-3 on coupon, p. 78

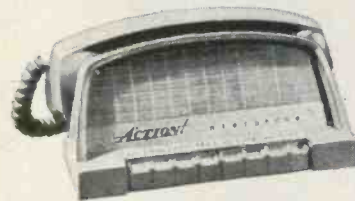
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Now factories, professional and business offices, stores, garages, motels, warehouses can enjoy the most complete combination of essential services in one intercommunication system at a moderate price. ACTION! presents a new concept in flexibility — enables you to connect interphones, paging and 2-way speakers, radio and record players, audible signals, and other useful features in the same system. Only ACTION! gives you the service you need at every point throughout your office or plant. That versatility will help your business operate with smooth, quiet efficiency. Compare services and price — and you'll get ACTION!



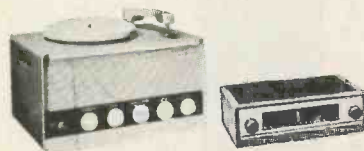
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Handsome, dignified — the modern design for today's offices. Every Interphone is a master station — will call every other phone or speaker. 4 or 8 buttons.



HANDS-FREE VOICE-COM

Answer calls on either the Interphone or the built-in, no-hands speaker, leaving hands free to write or work while conversing.



RECORD PLAYERS, TUNERS

Combination player-amplifiers reproduce records or radio broadcasts over ACTION! loudspeakers. Can be added to system at any time.



VOICE PAGING

You can locate your man or make announcements on the broadcast speaker or the powerful horn speaker in noisy rooms or outside areas.



ELECTRIC CLOCK CHIMES

Dignified chime signals can be installed in executive offices. Mellow chime signal contained in standard wall units or electric clocks on ACTION! circuit.



WALL BAFFLES

Superior tonal quality for reproduction of music, and clarity for paging and announcements. Various baffle and speaker models are available.

SEND FOR ILLUSTRATED BROCHURE

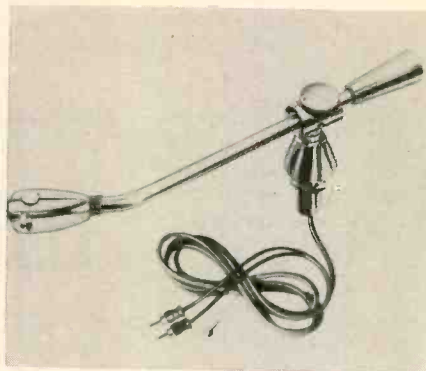
ACTION! SYSTEMS • MERIDEN, CONNECTICUT

For more data, circle 9-117-1 on coupon, p. 78

Rek-O-Kut STEREO TONEARM

Featuring a permanently attached cable that plugs instantly into the amplifier, the "Micropoise" arm is available in two models: S-220, 12"; and S-260, 16". Both incorporate the anchored, single-jacket cable which terminates in two color-coded plug-in leads, two shields, and a ground wire. This exclusive feature eliminates the need for soldering separate wires. Precise dynamic balance and stylus pressure are obtained by dialing the balance control. S-220, \$29.95. S-260, \$34.95. Rek-O-Kut Co., 38-19 108th St., Corona, N. Y.

For more data, circle 9-118-2 on coupon, p. 78



Simpson AC-VTVM

Model 715 AC-VTVM measures a-c sine wave voltages from 0.2 mv through 300v RMS. Frequency response, 10 cycles through 400 kc. A specially designed meter scale provides db marking on both the voltage range positions and the meter scale. Accuracy, $\pm 5\%$ of full scale. Input impedance, minimum 1 meg @ 1 kc. Internal multipliers, $\pm 1\%$ precision resistors. Ideal for hi-fi and general low level audio work such as hum and ripple measurements, i-f gain and vibration analyzing. \$69.95. Simpson Electric Co., 5200 W. Kinzie St., Chicago 44, Ill.

For more data, circle 9-118-3 on coupon, p. 78

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TUBES *in stock*



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To help you achieve optimum results in the repair and servicing of imported electronic equipment utilizing European-made VALVO receiving tubes, your franchised Amperex distributor now stocks the entire line of VALVO types.



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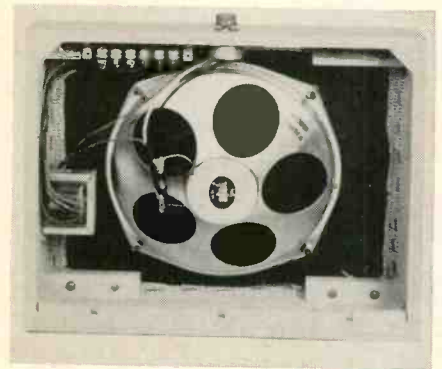
Amperex ELECTRONIC CORP. 230 Duffy Avenue, Hicksville, L.I., N. Y.

For more data, circle 9-118-1 on coupon, p. 78

Utah

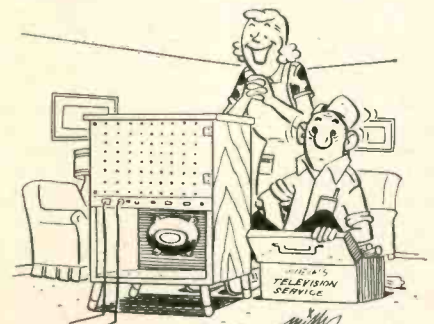
SPEAKER-BAFFLE COMBINATION

Utilizing the new "Magni-Magic" inverted speaker, a ready-to-use speaker and baffle combination is available in four different series: speaker-baffle, 70v transformer and volume control; speaker-baffle and volume control; speaker and baffle only; and speaker-



baffle and transformer only. Dual diameter design features an 8" speaker, 8 ohms power handling 5 watts, and screw type terminals. Completely wired and ready for instant use. Baffle, 12" wide, 9 1/2" high, 4" deep at top, 2 1/4" deep at bottom. Utah Radio & Electronic Corp., 1124 E. Franklin St., Huntington, Ind.

For more data, circle 9-118-4 on coupon, p. 78



"Oh, thank you very much! I don't know how I can ever repay you."

Mullard FRAME GRID TRIODE

A new Frame Grid r-f triode for TV tuners, the EC97/6FY5, features higher gain and lower noise characteristics. The Frame Grid construction assures minimum levels of microphony and cross modulation. Uniformity reportedly makes it possible to change



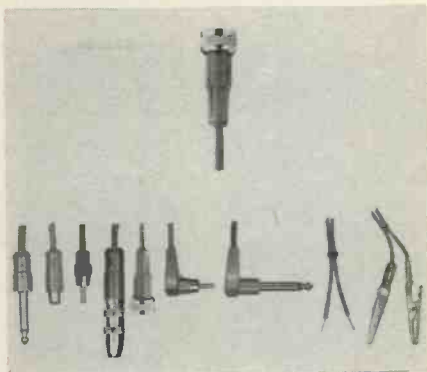
tubes without the necessity of realignment. Typical EC97/6FY5 characteristics: Trans-conductance, 13,000 micromhos; Amplification factor, 70; Plate Voltage, 135 Volts; Heater Current, 200 ma; Heater Voltage, 6.3 Volts; 600 mil and 450 mil series string versions are also available. Mullard International Electronics Corp., 81 Spring St., N. Y. 12, N. Y.

For more data, circle 9-119-2 on coupon, p. 78

Additional copies of
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Switchcraft MICROPHONE CONNECTOR

Announced is a new molded female microphone connector to replace the former connector, used on certain cable assemblies. The conversion feature of female to male, by screwing back the



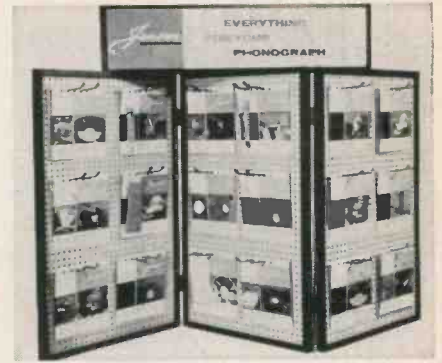
ring, is the same. It is completely shielded and has greater strength. It eliminates solder connections and the need for a strain release spring. Available in popular lengths in assemblies with the opposite end connections as shown. Switchcraft, Inc., 5555 N. Elston Ave., Chicago 30, Ill.

For more data, circle 9-119-3 on coupon, p. 78

Jensen PHONO PARTS

A new line of phonograph parts, displayed on a special 6-sided, 2 ft. high "Access-O-Rack," features 9 new phono accessories mounted on a 4-color parts center. Included in this package deal, for distributors and sales reps, are plastic spindle plugs, tone arm lifters, phono oil, record oil, record covers, needle inspection microscopes, 45 rpm universal spindles and metal 45 rpm inserts. The display contains also the firm's regular line of needles, record brushes and Silcloth. Jensen Industries, 7333 W. Harrison St., Forest Park, Ill.

For more data, circle 9-119-4 on coupon, p. 78



to be equipped
for every call...

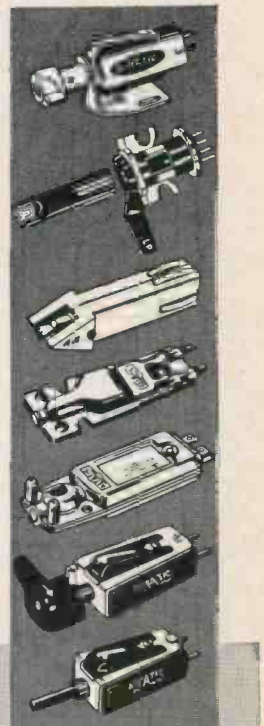
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THE **ASTATIC** LINE

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WORLD'S MOST FAMOUS NAME IN PHONO
CARTRIDGES, NEEDLES AND MICROPHONES

For more data, circle 9-119-1 on coupon, p. 78

YOUR NEEDLE IS DISTORTING SOUND BY AS MUCH AS 85%

(if it isn't a Fidelitone Pyramid Diamond)

A conventional needle with a rounded ball tip can't fit the microgroove accurately. Its rounded shape prevents proper contact in the high tonal passages. Result? Distortion and noise.

But, Fidelitone's new Pyramid Diamond is shaped like the original cutting stylus to fit the record groove exactly. It maintains proper contact in all frequency areas. This lowers background noise and distortion by as much as 85%, and reproduces only maximum true sound—stereo or monaural.

HERE'S WHY...



Fidelitone's new Pyramid Diamond is shaped similar to the stylus that recorded the original sound. It perfectly follows every contour created by the recording stylus.

In an unmodulated, or low frequency groove, the recording stylus (A) cuts a groove (W-1) wide enough to let an ordinary ball point needle (C) and the Fidelitone Pyramid Diamond (B) track the centerline of the groove accurately, and contact all recorded sound impressions.

As the groove is modulated by high tones, the groove width (W-2) cut by the recording stylus (A-1) narrows. This causes the ordinary ball needle (C-1) to rise and "pinch out" of the record groove. It bridges modulation crests, mistracks centerline and distorts sound impressions. The Pyramid Diamond (B-1), because of its new shape, stays solidly in the record groove, smoothly glides along the centerline positively driven by the groove walls.



And the new shape of the Pyramid Diamond allows more surface contact between needle and record, substantially reducing contact pressure. This greatly increases needle and record life.

See your record dealer or hi-fi specialist today. Demand the Fidelitone Pyramid Point. You owe it to your records and your listening pleasure.

For the complete story on the revolutionary new Pyramid Diamond, or the name of your nearest dealer, write Fidelitone, Chicago 26, Illinois.

Fidelitone

"Newest shape on records"

THIS IS THE FIRST
IN A SERIES OF ADS
running in 17 magazines. The combined circulation is over 2,500,000. Take advantage of this powerful selling tool. Order the complete line of Fidelitone needles now. Profit from their sale.

Fidelitone

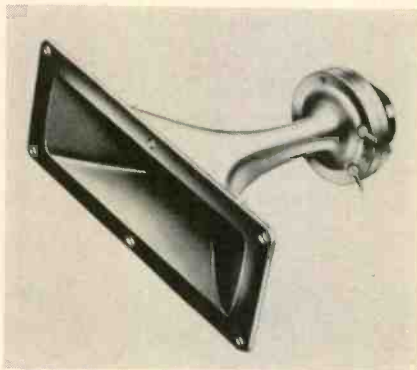
"Newest shape on records"
Chicago 26, Illinois

For more data, circle 9-120-1 on coupon, p. 78

120

Oxford TWEETER

Introduced is a new tempo high note tweeter, said to be designed to deliver outstanding tone fidelity at a remarkably low price. Features include: 2" x 6" horn loaded compression for use in fully enclosed or open baffle; new-



est, completely shielded short path magnetic circuit; wide angle sound dispersion pattern; spherical precision molded phenolic; and radiating diaphragm affixed to layer wound coil support. Oxford Components, 556 W. Monroe St., Chicago 6, Ill.

For more data, circle 9-120-2 on coupon, p. 78

Scott STEREO AMPLIFIER

Model 222B, a new improved version of model 222 dual channel stereo amplifier, is rated at 15 watts per channel; a total of 30 watts by IHFM standards. Features include: tape monitoring facilities; separate tone



controls on each channel; tape head inputs; aluminum chassis; oversized 20 watt transformers; and input for electronic organ. Bandwidth extends to below 25 cycles. \$144.95, east of the Rockies. H. H. Scott, Inc., 111 Powdermill Rd., Maynard, Mass.

For more data, circle 9-120-3 on coupon, p. 78

Additional copies of
STEREO 1961
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Chemtronics CLEANERS

Announced: the availability of a free "spray aid" with each 3 oz. can of Trol Aid or Tun O Lube. Heretofore, the plastic spray adaptor for pin-point applications was available only with 8 oz. cans. Trol Aid cleans and lubricates controls and contacts. Tun O Lube is used for cleaning and lubricating all tuners. Suggested dealer net for each aerosol 3 oz. can, including free "spray aid", \$.98. Chemtronics Inc., 870 E. 52nd St., Brooklyn, N. Y.

For more data, circle 9-120-4 on coupon, p. 78

Centralab STEREO SWITCH

A new remote speaker switch, known as the 1486 stereo speaker switch, enables switching from the "main pair" of stereo speakers. The switch also permits the operation of all four

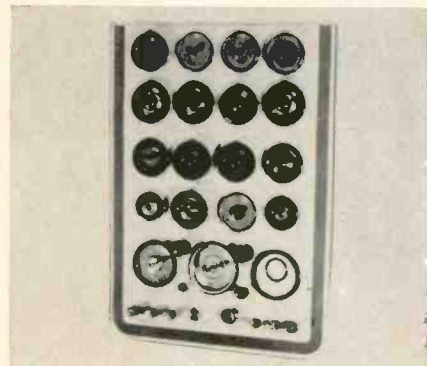


speakers simultaneously. It is 1-1/32" high and 1-29/64" wide. The 1/4" diameter shaft measures 1 1/2" from the bushing with 1/2" split knurl. It is supplied with push-on knob and instructions. Centra-lab, 900 Keefe Ave., Milwaukee 1, Wis.

For more data, circle 9-120-5 on coupon, p. 78

Walsco PHONO DRIVES

A total of 17 additions to the firm's line of replacement phone and recorder drives is announced. These 17 new drives are designed for replace-



ments on Admiral, V-M, Revere, Wolensak and other leading recorders and record changers. Walsco Electronics Mfg. Co., Div. Textron Electronics, Inc., 100 W. Green St., Rockford, Ill.

For more data, circle 9-120-6 on coupon, p. 78

Stereo Cartridge

(Continued from page 91)

ever, use both lateral and vertical motion and, therefore, the stylus must be compliant in both directions.

Dynamic mass is another consideration that is "old hat" but coming into prominence lately. The larger the cartridge mass, the less likely it is to perfectly handle the turn and twist of a record groove. Also, the mechanical resonance point of the cartridge mass can be raised further beyond audibility, lessening the chance of impairing audio quality, as dynamic mass is made smaller.

Stylus size is also decidedly different. The 1 mil LP stylus has been changed to 0.7 or 0.5 for stereo records. Stylus pressure, as

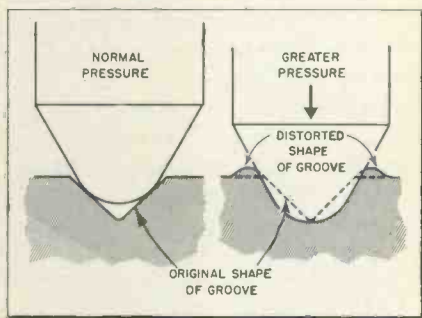


Fig. 3—Abnormally high stylus pressure will damage a disc's soft vinyl grooves.

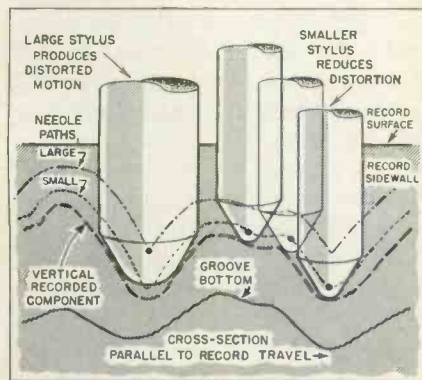


Fig. 4—A smaller stylus tip (RIAA suggests 0.5 mil) can trace a record groove with less error, thereby resulting in lower distortion.

indicated earlier, has been decreased accordingly. Recommended stylus pressures are shown in Charts I and II, together with recommended load resistors. Professional tone arms can, naturally, operate properly at lower tracking pressures than record changers.

Styli

Diamond styli, once thought to be indigenous to audiophiles only, are rapidly displacing sapphire tips in stereo hi-fi pickups. As a result of this trend, service dealers are stocking these "gems" in increased numbers.

Together with the public's current awareness of a diamond stylus' long life, the non-permanency of a diamond stylus is also receiving intensified interest. Thus, many service dealers have added power microscopes to inspect their customers' styli. This procedure minimizes damage of expensive record collections and multiplies styli sales.

Styli can take great pressures without damage to themselves. However, excessive stylus pressure can damage the relatively soft vinyl of a record, as shown in Fig. 3. Therefore, stylus pressure should always be checked when a customer brings his record player into your shop for repairs.

Another record groove destroyer is the too small or too large stylus. Remember, changing a stylus from a 1 mil to a 0.5 mil one without lowering tracking force will result in four times the amount of pressure on the record grooves. Use the correct stylus size, especially in a record changer tone arm, where tracking force must be necessarily higher than in a professional-type tone arm.

The RIAA recommends a 0.5 mil stylus tip, but most tips are 0.7 mil because of the unusually light tracking force requirements of the smaller tip. The smaller tip, however, will reduce distortion, as illustrated in Fig. 4. •



"What's wrong with your stereo?"

LESS HUM LOWEST NOISE with Mullard 7025



An exact plug-in replacement for the most troublesome tube in High Fidelity equipment. Mullard special design and construction, including special mica supports and internal structure make the 7025 superior particularly in critical high gain circuits where lowest level of hum, noise and microphonics are required.

A Plug-In Replacement for
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OTHER Mullard TUBES
designed specifically for High Fidelity:

EB91/6A5	Double Diode
ECC81/12AT7	Low-noise medium μ dual triode
ECC82/12AU7	Low-noise low μ dual triode
ECC83/12AX7	Low-noise high μ dual triode
ECC85/6AQ8	RF Double triode
ECC88/6AQ8	Frame grid RF Double triode
ECF82/8U8	RF triode pentode
ECL62/6BM8	Triode with Output Pentode
EF86/6Z67	Low-noise input pentode
EF94/6AU6	RF AF pentode
EL34/6CA7	High-power pentode, 100 W PP
EL37	High-power pentode, 65 W PP
EL84/6BQ5	Miniature output pentode 20 W PP
EM84/6FG6	Miniature tuning Indicator
EZ80/6P4	Miniature rectifier cathode type, 90 ma.
EZ81/6CA4	Miniature rectifier cathode type, 150 ma.
GZ34/5AR4	Bantam rectifier cathode type, 250 ma.
7189	Miniature output pentode 20W PP

Available at all leading distributors.



NOW AVAILABLE: "Mullard Circuits for Audio Amplifiers"—136 pages of Stereophonic and Monophonic Audio Amplifiers, AM Tuners, Preamplifiers—only \$2.50 from your dealer or by mail.

For detailed technical data and application information write:

INTERNATIONAL ELECTRONICS CORP.
81 Spring Street, New York 12, N. Y.

For more data, circle 9-121-1 on coupon, p. 78

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Stereo Packages

(Continued from page 107)

Does it give good stereo separation and depth? Finally, can it handle the power peaks needed for convincing presentation of "large" programs, such as orchestra with choir?

Check to see that the turntable or changer (usually the latter) operates smoothly, without damage to the record when the stylus is lowered, and without noticeable flutter or wow. Also check rumble. This shows up as a hum that only appears when the stylus touches the record groove.

If it uses sound projection, such as from the ends of the cabinet, check that it gives adequate stereo realism over a reasonable area, large enough to satisfy your needs. Notice particularly how moving around affects listening quality. Some locations may make the treble sound muffled. This depends not only on the system, but to some extent on the acoustics of the listening room. If it is unsatisfactory from this viewpoint, get a package that either has satellites to overcome the difficulty, or makes provision so you can add your own, with jacks.

One problem occurs with many package systems: When you turn the volume up, with bass boost if this is provided, the set will start a buzzing hum, due to acoustic feedback from the loudspeaker to the phono pickup. If it only happens when the volume is unbearably loud the effect may never bother you.

The kind of floor under the instrument can affect acoustic feedback considerably. If it is a wooden floor that can vibrate with the music, the trouble gets much worse. A concrete floor, providing rigidity, will almost eliminate the effect. This distinction may or may not help you cure the trouble, but it will explain why it can happen at home, when it was perfectly all right at the showroom or vice versa.

Servicing

Servicing a package stereo set is not unlike servicing components.

The basic "ingredients" are the same. Ignoring the portable stereo phonographs for a moment, console stereo sets frequently demand in-the-home service due to their pre-installed nature and the usual mechanical-electrical inability of package set owners.

If you intend to make house calls, you must have an audio tube caddy with audio and tuner tubes, selenium rectifiers, cartridges, connectors and standard caddy equipment such as solder gun, hand tools, etc. If you are not prepared to make this small investment in tubes and cartridges, *don't* accept home service calls . . . you'll be wasting valuable time and probably create the impression of, at the very least, being inefficient.

It's a good idea to carry connector markers when servicing consoles in the home. You'd be surprised at the numerous wires that must be disconnected. Marking wires and connection points will save considerable time when re-installing the chassis.

Portable sets are similar to the older monophonic portables, except that two amplifiers and speakers are used. Sometimes the second channel's amplifier and speaker(s) is in a separate case, connecting to an input on the main chassis.

Only a few unusual problems exist in small stereo packages; one is excessive heat. The amplifiers in a small case can throw off a tremendous amount of heat, ruining parts, especially filter capacitors. If this is experienced, it may be judicious to recommend ventilation holes to the customer. The holes can be made decorative by brass or chrome metal inserts, available at most local hardware stores.

Another problem exhibited by some portable stereo packages is silicon rectifiers that "short," taking the fuseohm resistor with it.

Can a stereo package system equal that of a components system? Cost for cost it *can* produce as acceptable sound quality to the customer as components. But finding the good buy in packages is very much a matter of sorting the wheat from the chaff. Really poor components are rarely as bad as really poor packages. Packaged systems, however, are rarely as elaborate as their component counterparts. Nor can they offer that "extra" bass, or

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Stereo via FM multiplex broadcasting is just around the corner. The S-3000 III contains chassis space and all control facilities to plug in a stereo multiplex adapter. Other features include flywheel tuning, plus 7" expanded slide rule tuning scale, cathode-follower output, and front panel output level control. Sherwood Electronic Laboratories, Inc., 4300 N. California Ave., Chicago 18, Ill.

(*) Other fine Sherwood Tuners:
S-2000 II AM-FM Tuner \$145.50
S-2200 AM-FM MX Stereo Tuner \$179.50

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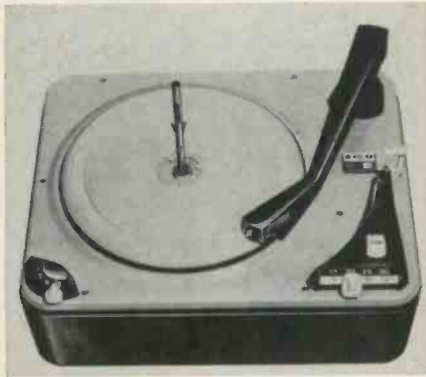
For more data, circle 9-122-1 on coupon, p. 78

the unusually fine tracking of a professional tone arm, or the versatility of positioning speakers, etc. However, not everyone is particularly concerned with these qualities; nor willing to pay for them. Thus, the package market is, and promises to continue, as the major mass audio market. Considering the inherent nature of components, as well as the limited number of dealers selling such units, components should continue to thrive in its more restricted segment of the market. •

Illustration credit: VM Corp.

EICO RECORD CHANGER

Model 1007 is a 4-speed automatic record changer for 10 records and an automatic/manual single-record player. It is supplied with a dual RC magnetic input adapter. The cartridge



easily snaps in and out of the tone-arm without tools. Instead of a conventional stepped motor shaft machined down to increasingly small diameters for lower record speeds, the 1007 employs 4 individual intermediate compound idlers. \$59.75 with diamond and sapphire; \$49.75 with 2 sapphires. Electronic Instrument Co., 33-00 Northern Blvd., L. I. City 1, N. Y.

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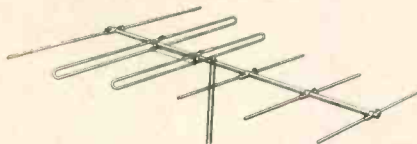
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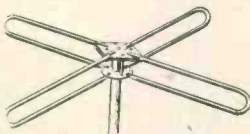
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MODEL F-1 is the original, patented non-directional FM antenna which requires no orientation. It is supplied as a complete installation kit with 5' mast, rugged chimney mount, 60' of 300 ohm lead-in, hardware and instructions.



Other models include an 8-element yagi for specific frequencies, 5-element yagi, and folded dipole-reflector. All are fabricated to exacting specifications, and are favorably priced for dealers.

HI-PAR PRODUCTS CO.

FITCHBURG, MASSACHUSETTS

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Stereo Changers

(Continued from page 102)

cal experience are the technician's best guide when servicing the mechanical aspect of changers.

Motors

A first requirement of good rotating equipment is a motor that has been precision balanced and aligned to give extremely smooth basic drive. One of three types is invariably used: four-pole, hysteresis, or synchronous clock-type motors (used with many unusually light turntable, one speed players).

Most record changer and turntable units use precision balanced four-pole motors. Hysteresis motors are not popular with most consumers today, primarily because of their attendant high cost. Precise speed is, of course, their forte. Clock-type motors are primarily used with single-speed, belt driven players. Their fine performance contrasts with pre-stereo conceptions of attaining smooth speed with only heavy turntables.

If motor lubrication points are provided, the oiling recommendations of the manufacturer should be followed. Few service organizations are equipped to overhaul defective motors, thus, if a motor proves defective, it is usually replaced by a new one or repaired by a specialist.

Tone-Arms

All cartridges must be supported by some form of pick-up arm while tracing the complex modulations of a record groove. Tone-arm performance requirements are even more stringent for stereo than for mono records. The stylus is smaller (.5 mils to .7 mils, as compared to mono's 1 mil) and tracks at a lighter weight. Since the stereo groove imparts vertical as well as horizontal motion to the cartridge, the tone arm must have maximum freedom to move in both directions. Additionally, the lighter weight makes the cartridge/tone-arm combination more susceptible to skipping due to extraneous vibrations.

Integrated cartridge/tone arm assembly are currently popular, as are professional-type tone arms that accommodate various make cartridges. Each has its advocates.

Dynamically balanced arms have stirred great interest, also. An impressive demonstration of what dy-

amic balancing can do is its ability to continue to track a record even when the table is tilted to an extreme degree.

Besides this spectacular demonstration, the dynamically balanced arm has everyday attributes that are commendable. For example, the tone arm can minimize groove skipping. The stylus will not jump grooves if someone walks across the floor, taps the phono while it is be-

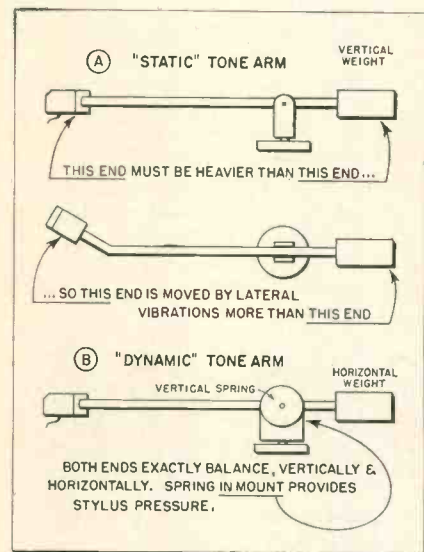


Fig. 2—Amazing tracking ability of "dynamic" tone-arms is due to balancing in two planes.

ing played, slams a door, etc. Advocates of dynamic balanced arms also claim that weight drag is eliminated, such as arm inertia.

Dynamically balanced arms are balanced mechanically, as opposed to static arms' gravity balance. Whereas the static arm is balanced vertically, as shown in Fig. 2A, the dynamic arm is balanced both vertically and horizontally, as illustrated in Fig. 2B.

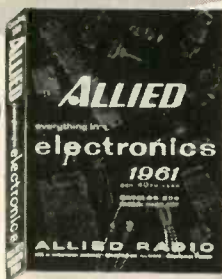
The static arm employs a little more weight at the stylus end than at the counterbalance end (using counterbalance weights) to keep the stylus in the groove. The arm is, therefore, out of balance to vibration.

Dynamic balance overcomes this by eliminating the out-of-balance, as far as weight is concerned. The downward pressure to keep the stylus in the groove is not provided by weight; rather, it is maintained by a carefully adjusted spring, in most instances. Without this spring, the tone arm, with pick-up mounted, would be perfectly balanced and the stylus would not touch the record.

Every shop should have a tone-arm weight measuring device to

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adjust a pickup to its correct pressure. Unless the manufacturer's recommended pressure is maintained, distortion and skipping may result, such as that frequently experienced when loud passages are being played. Also, excessive record wear will be encountered. •



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Stromberg-Carlson STEREO PHONO

Model 900 stereophonic phonograph, an addition to the "Integrity Series" of component ensembles in console cabinets, incorporates a Garrard R-210 changer with diamond stereo cartridge, a Stromberg-Carlson 24-watt ASR-333 stereo amplifier and two RS-401 acoustical labyrinth speaker systems. Zone one prices: \$279.95, in mahogany; \$289.95 in walnut, limed oak or cherry. Stromberg-Carlson, 1400 N. Goodman, Rochester 3, N. Y.

For more data, circle 9-125-3 on coupon, p. 78



American CB MICROPHONES

Announced are six models in the new "208" series of citizens band microphones. Employed is a "slide-lock" switch to assure instant on-off action or lock-on for continuous use. This "slide-lock" switch is claimed to be the only one available in this new field. Frequency response, 40-8,000 cps. Model B-208-A (ceramic) and X-208-A (crystal) with normally open mike and 2-conductor cable, \$12.50; B-208-B and X-208-B, same features and price, have normally closed mikes. B-208 (ceramic) and X-208 (crystal) without the "slide-lock" switch and with single conductor cable, \$10.60. American Microphone Mfg. Co., 400 S. Wyman St., Rockford, Ill.

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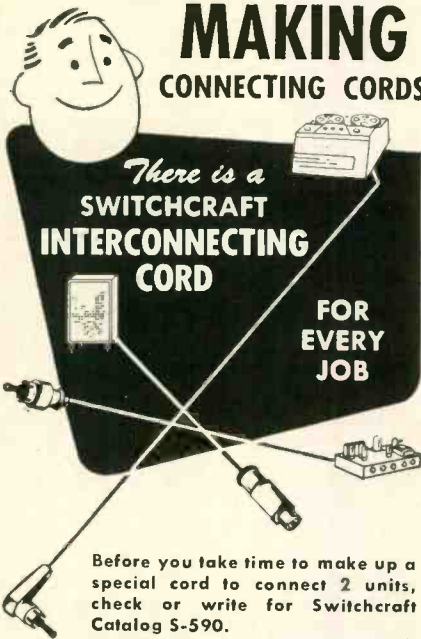
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Stereo Disc Puzzle

(Continued from page 89)

al motion, and the very wide distance between walls, indicating that the stylus will trace the groove at a greater-than-normal depth—or, in other words, vertical modulation in a downward motion.

The second drawing shows the stylus riding high, due to narrow groove walls pinching it upwards.

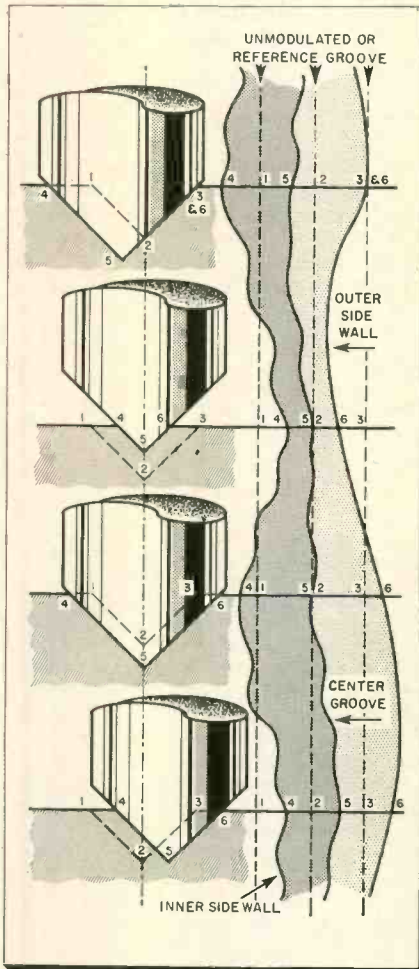


Fig. 5—When simultaneous signals from each groove wall creates lateral and vertical forces—with conditions varying from instant-to-instant—their combined effect establishes the stylus' instantaneous position in the complex record groove. See text!

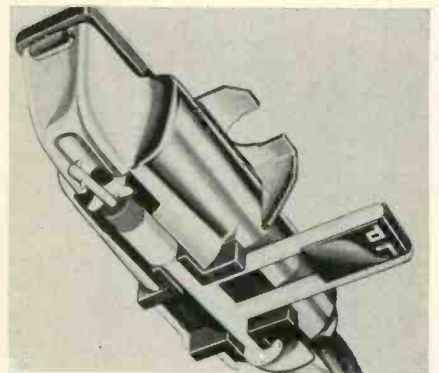
No lateral movement is indicated by the center line not deviating from the reference groove center. Lateral movement is not indicated in the third drawing for the same reason. In contrast to the second drawing, however, the stylus is riding low in the groove because of the great distance between sidewalls. In the fourth drawing, the stylus is displaced to the right since the

groove center is to the right of the reference groove. The vertical displacement is at reference height. This may be seen in the groove drawing by the sidewall-to-sidewall distance being equal to the width of the unmodulated reference groove. The groove extension past the reference groove from points 3 to 6 is countered by the shift of the inner side wall groove from point 1 to 4.

Remembering that the stylus contacts *both* sidewalls at any given instant and its *relative* groove width and groove center transmits intelligence to two cartridge elements at the same time, should forever still the reasoning of only one wall containing the intelligence of one channel, except for initial analysis purposes. The stylus, therefore, moves due to the *combination* of two signals forming the shape and relative position of both sidewalls, rather than two independent signals forming two independent sidewalls. •

Sonotone CARTRIDGE

Model 9T turnover type ceramic cartridge plays all speeds and either stereo or monophonic records. Flat response, ± 1 db over the entire audible recording range of 20 to 17,000 cycles with smooth rolloff to 20,000 cycles. High compliance reduces tracking pressure to 2-4 grams for professional



tonearms. Improvements include: a gold-plated metal cover to shield the cartridge mechanically and electrically; and the unbreakable needle assembly is designed to prevent damage to the styli. \$16.50 with sapphire tips. \$19.50 with diamond-sapphire combination. Sonotone Corp., Elmsford, N. Y.

For more data, circle 9-126-3 on coupon, p. 78

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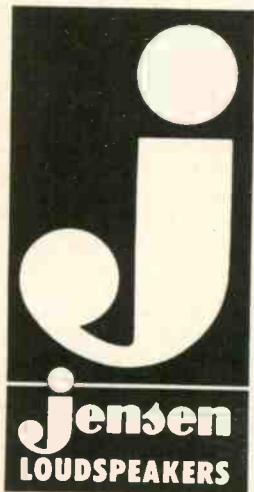
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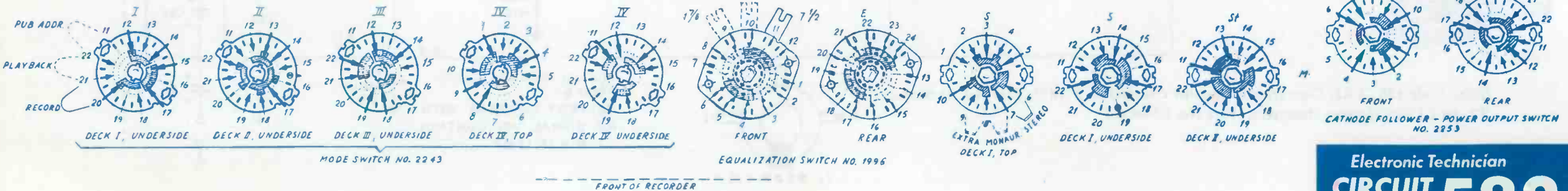
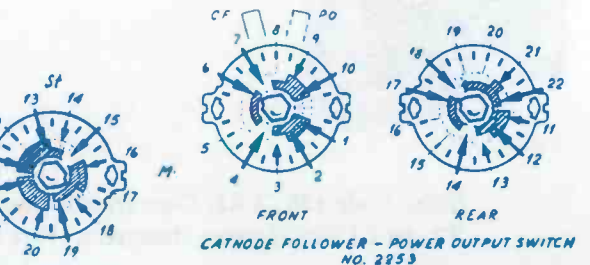
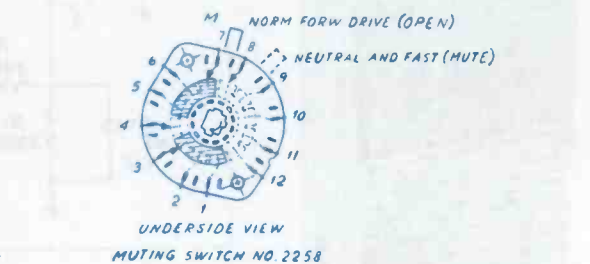
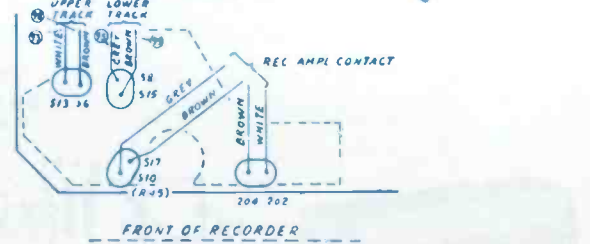
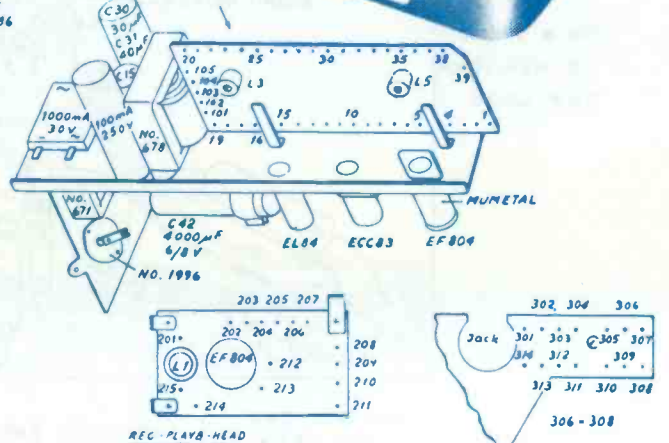
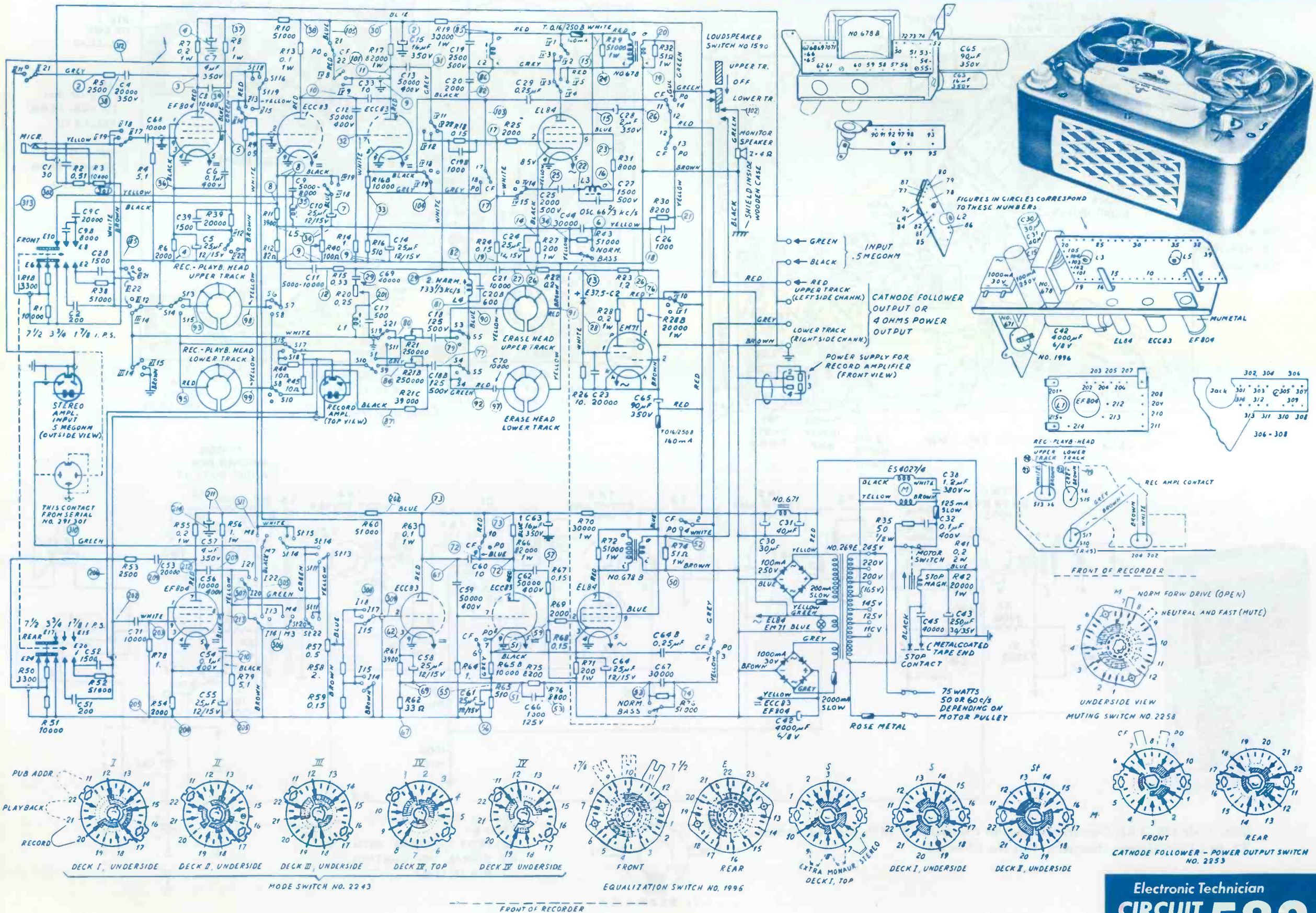
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• IN MEXICO: UNIVERSAL DE MEXICO, S.A., MEXICO D.F.

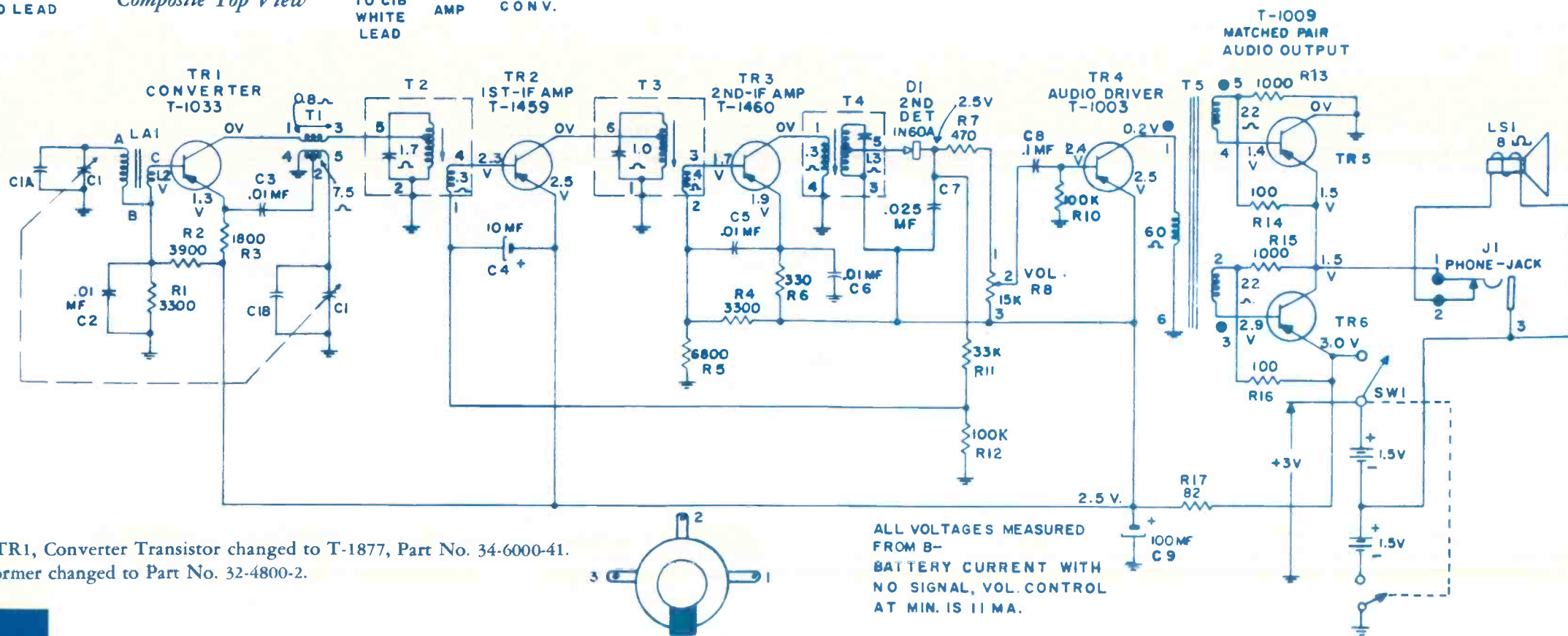
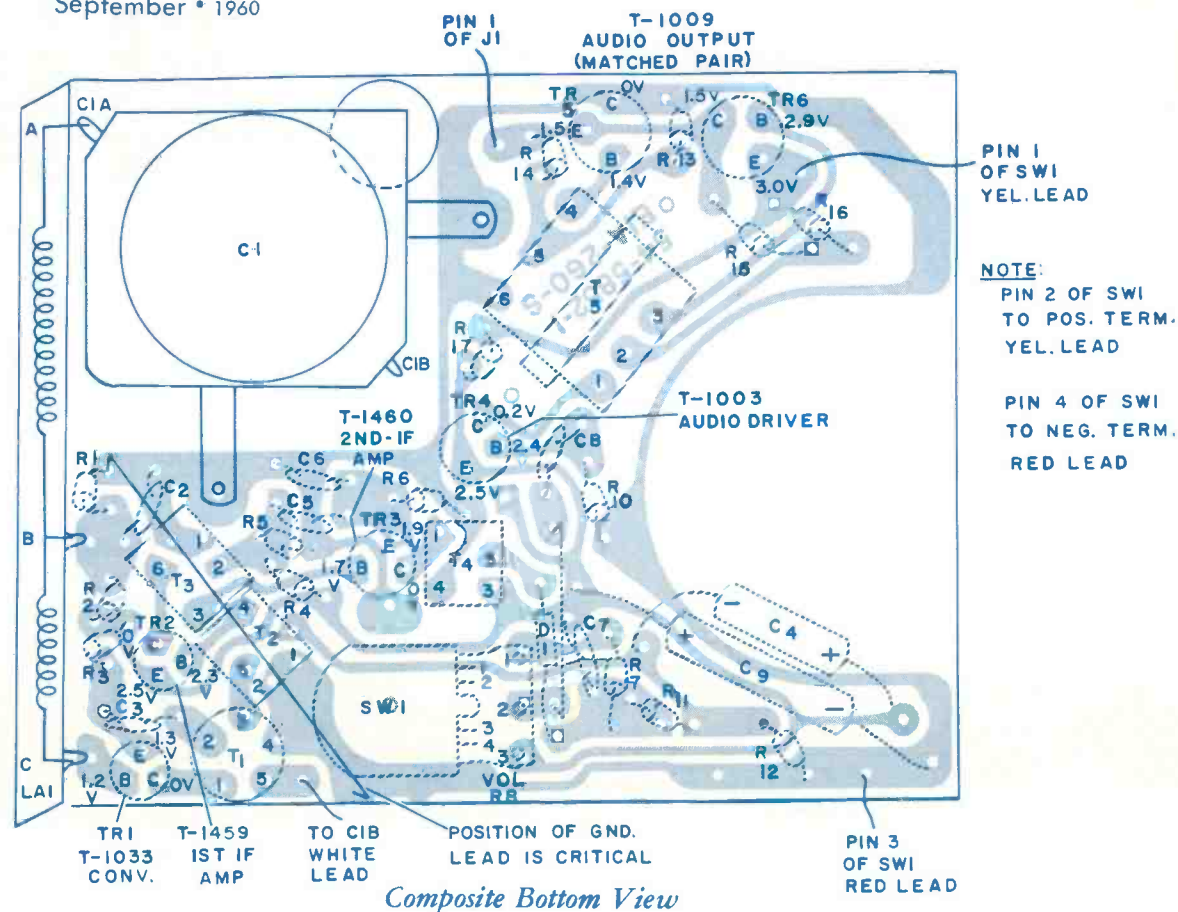
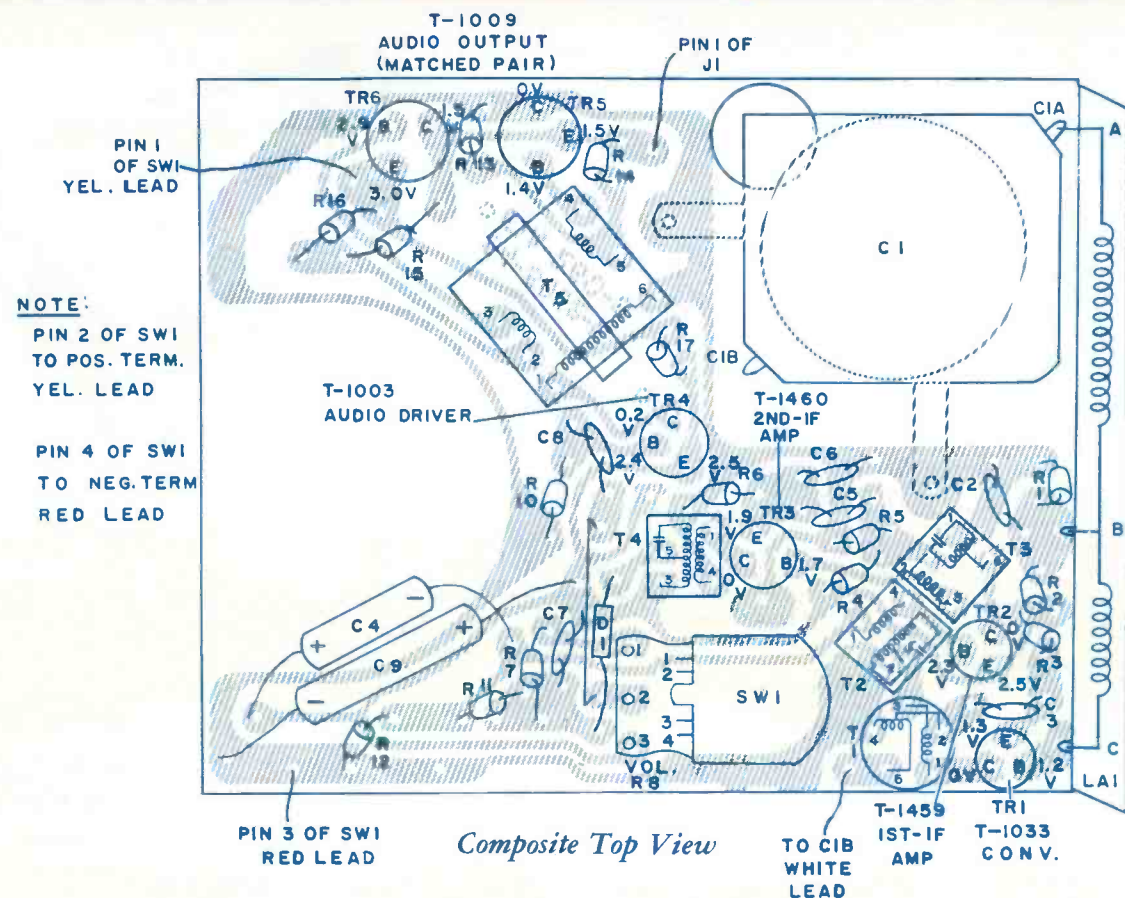
For more data, circle 9-128-1 on coupon, p. 78

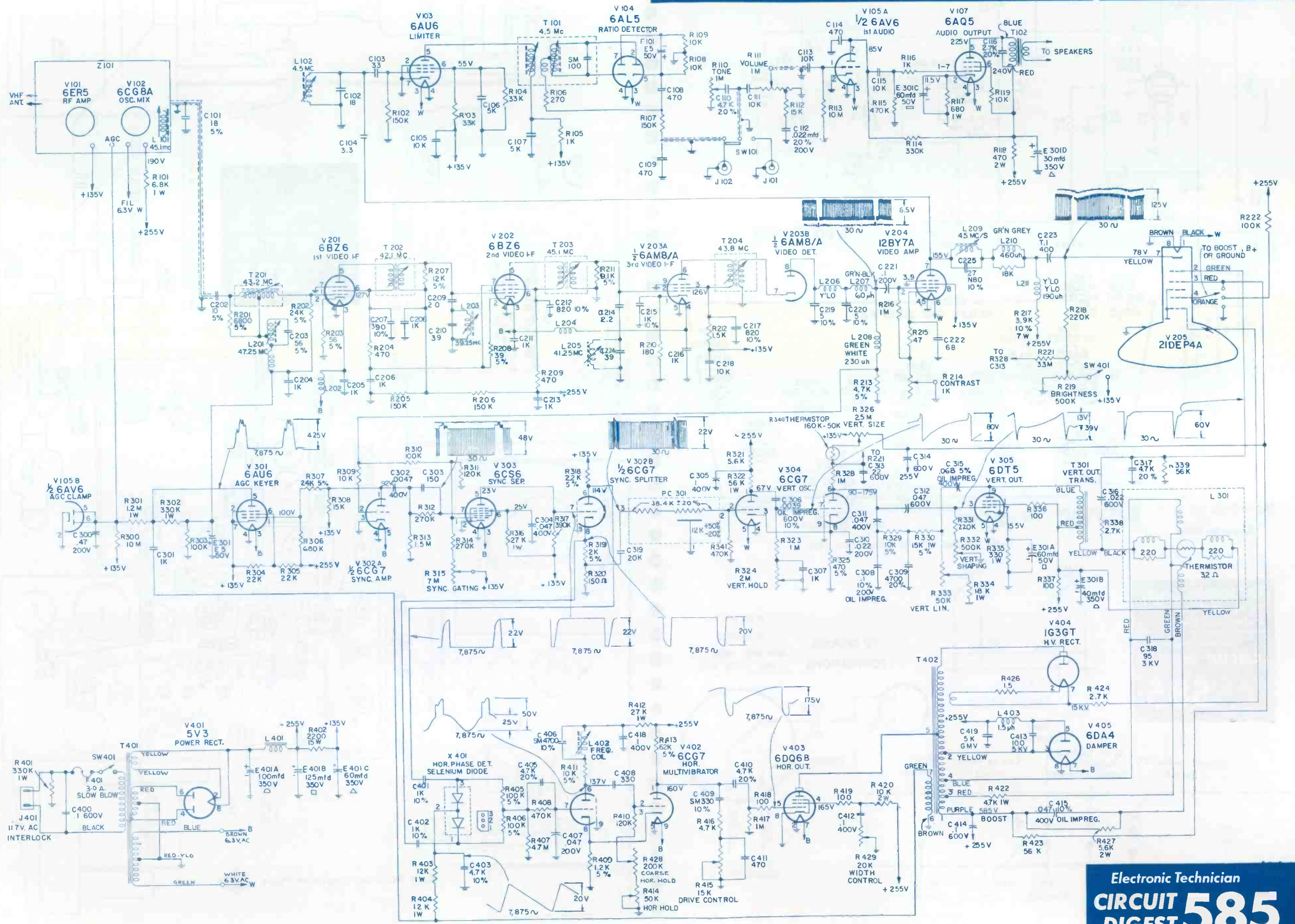
128 (148 pages in this issue, including Circuit Digests)

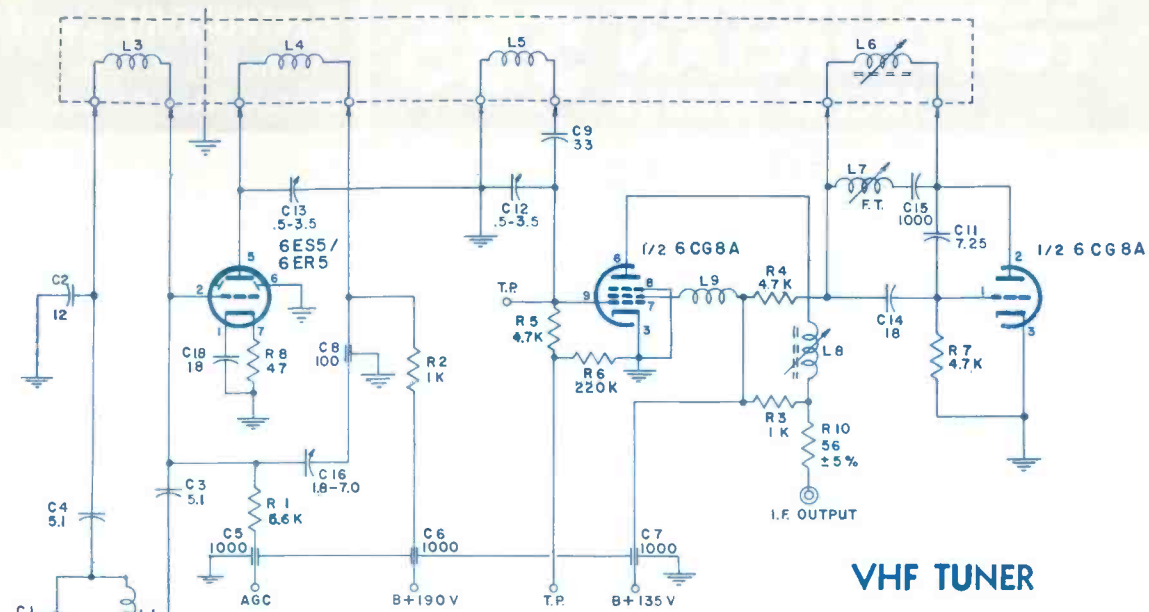
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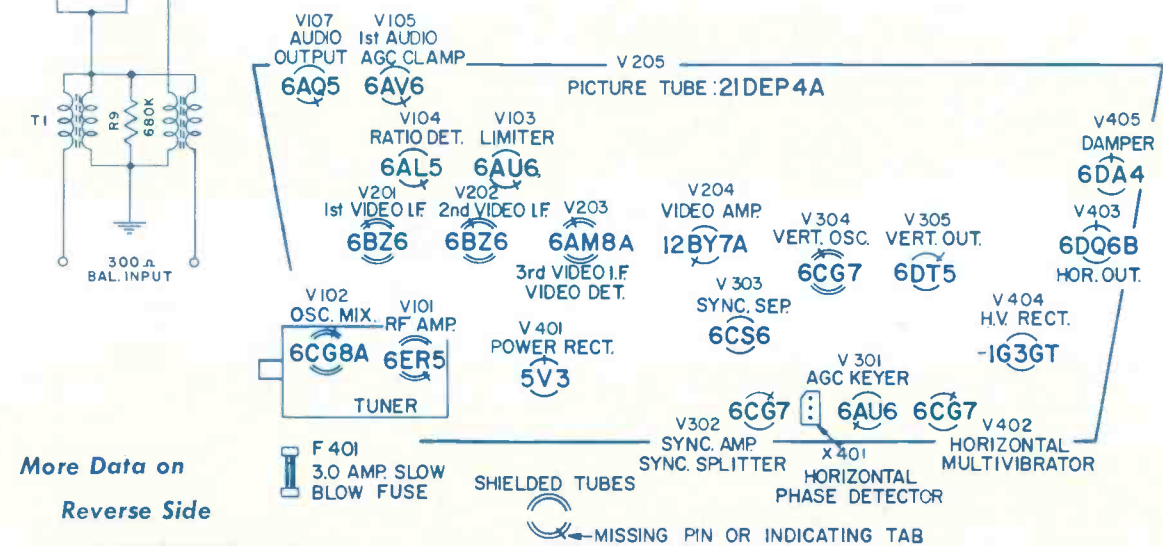
September • 1960







VHF TUNER

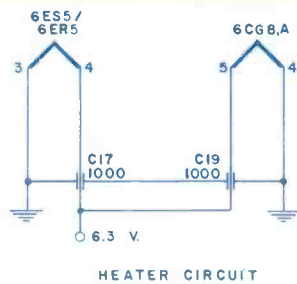


More Data on
Reverse Side

ELECTROHOME, Canada
TV Models Breton,
Breton "A", Burnaby

Electronic Technician
CIRCUIT DIGEST

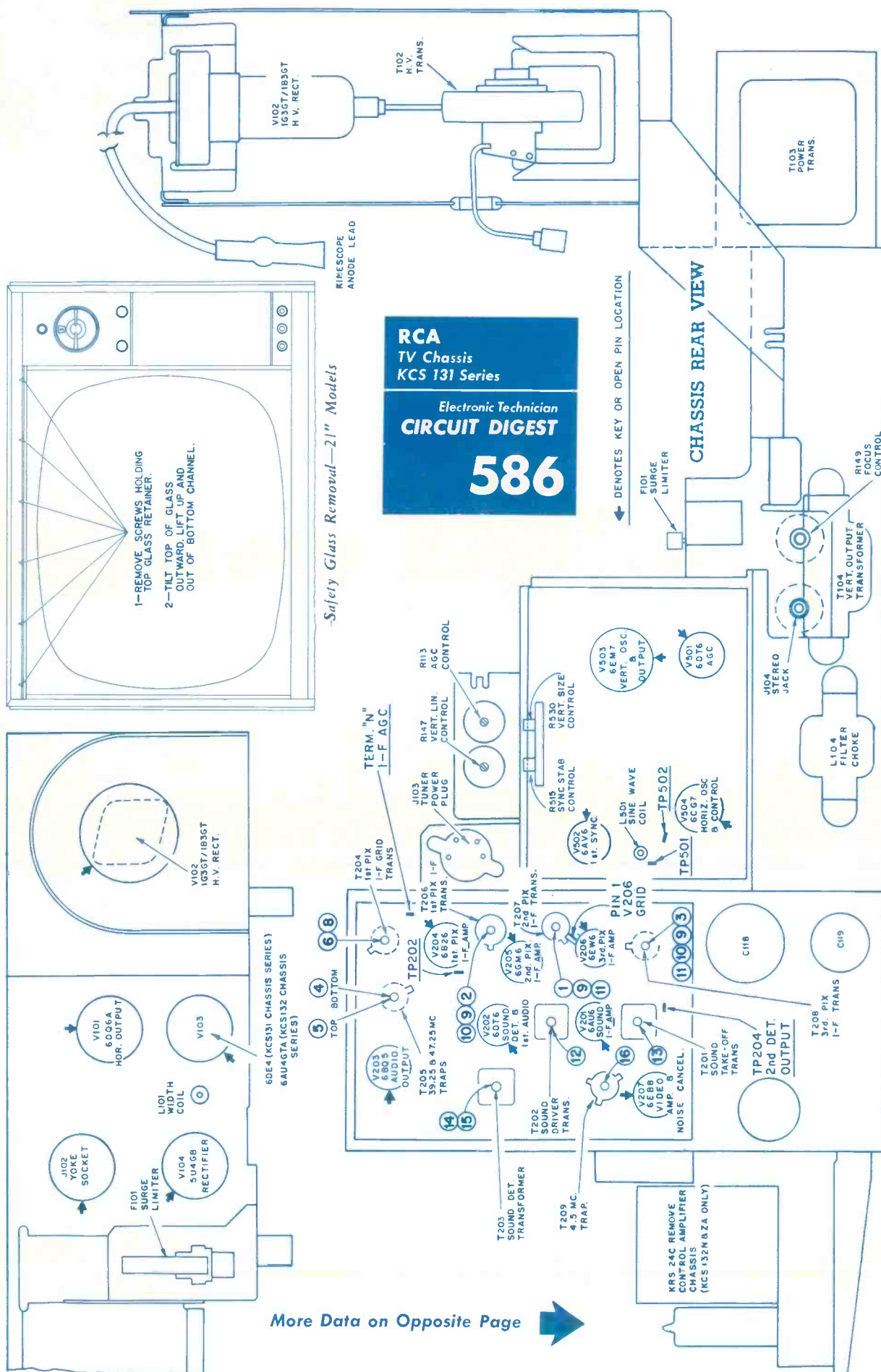
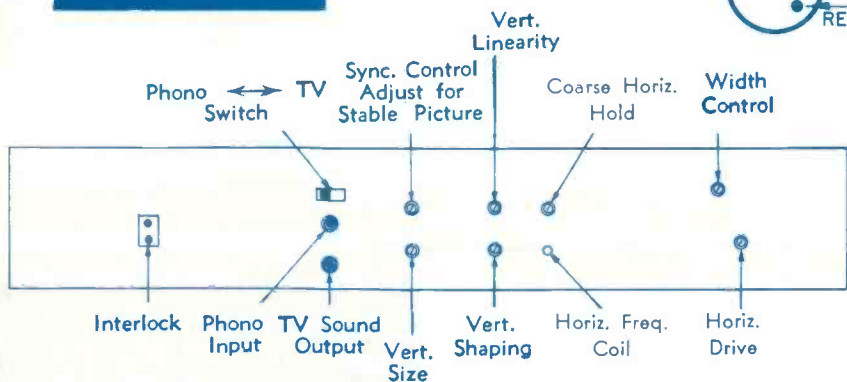
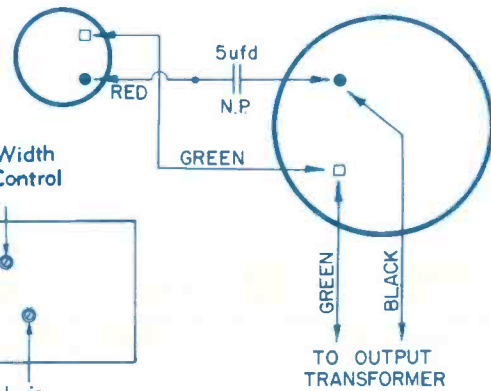
585



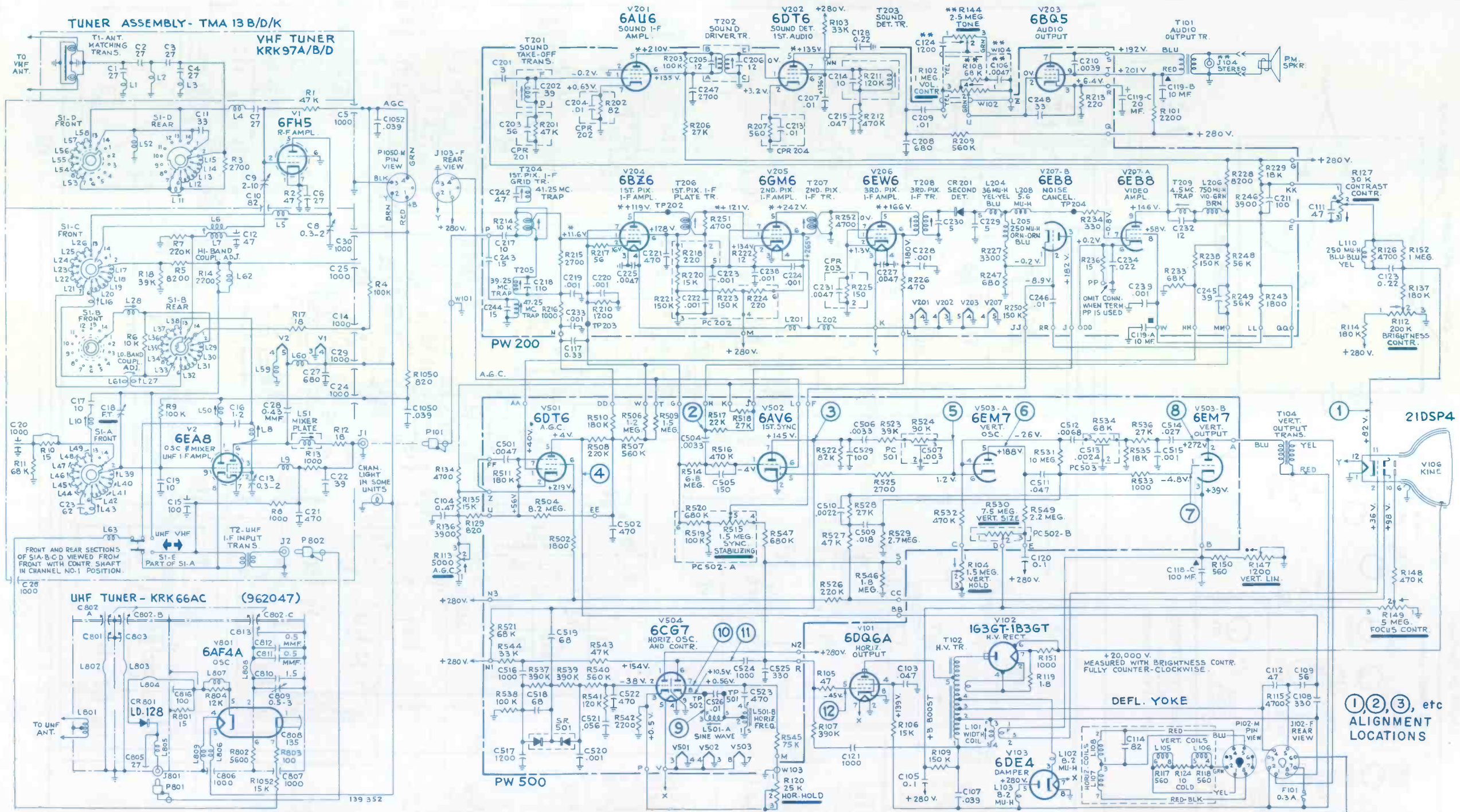
HEATER CIRCUIT

TV SPEAKER CONNECTIONS

- BLACK
- GREEN
- ARROWS INDICATE PIN JACK TIPS

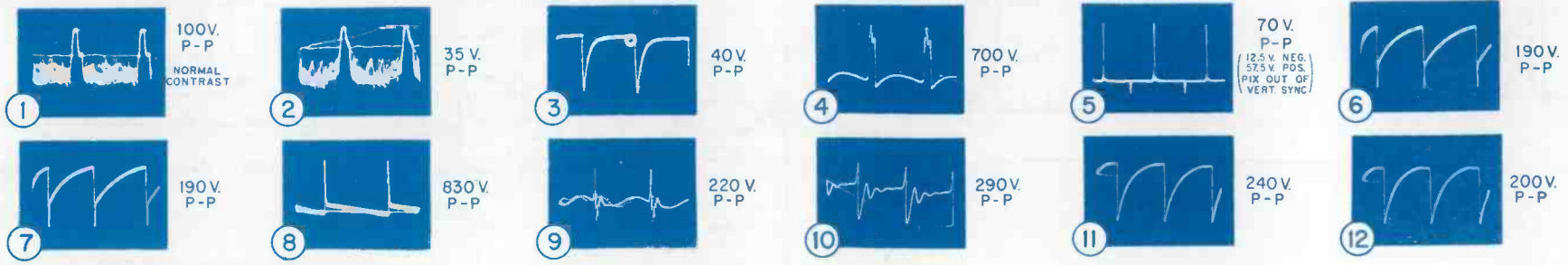


More Data on Opposite Page

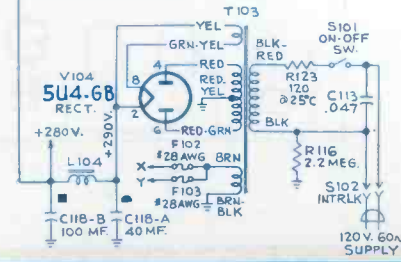


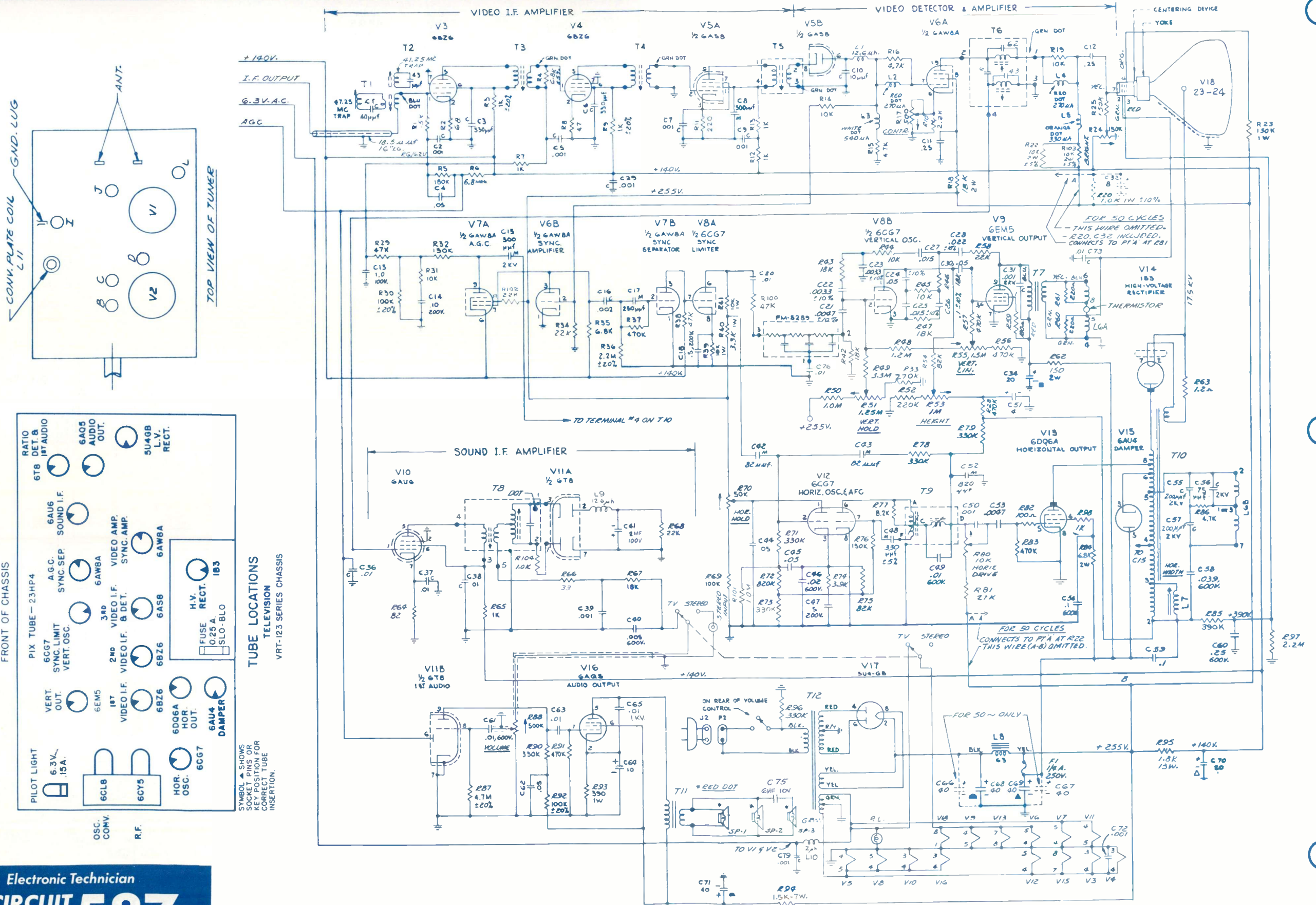
①, ②, ③, etc
ALIGNMENT
LOCATIONS

* VOLTAGES MEASURED WITH 1 MEG.
1/2 WATT RESISTOR IN SERIES WITH
METER PROBE.
** R108, R144, C106, C124, J104
AND W104 OMITTED IN SOME UNITS.

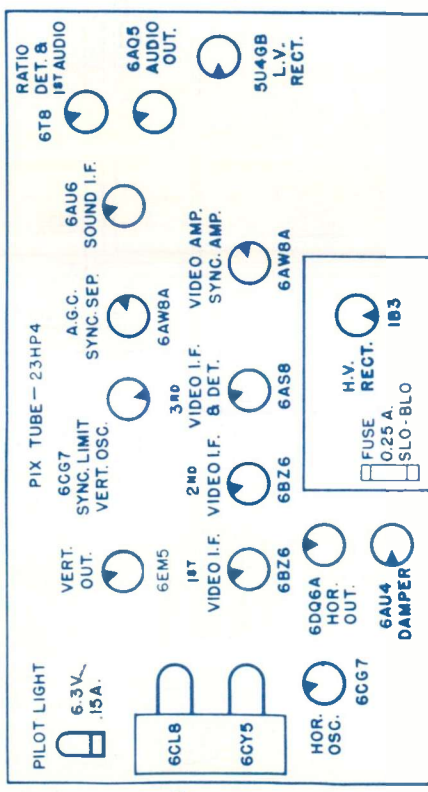


More Data on
← Opposite Page





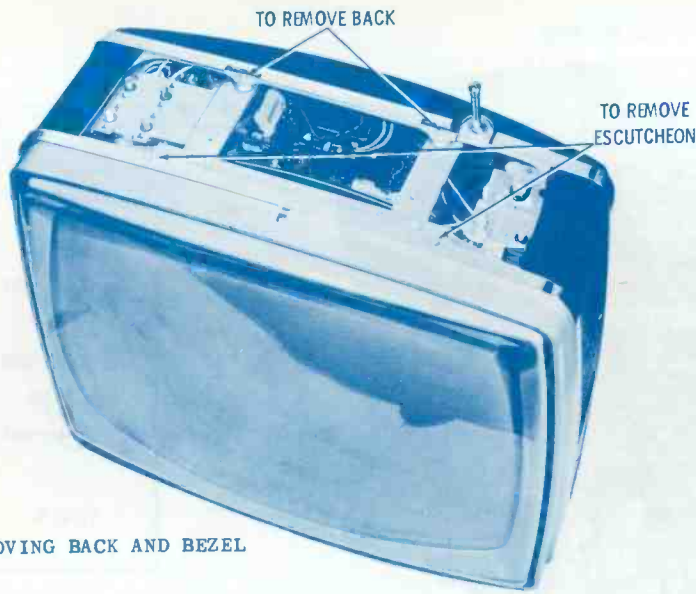
FRONT OF CHASSIS



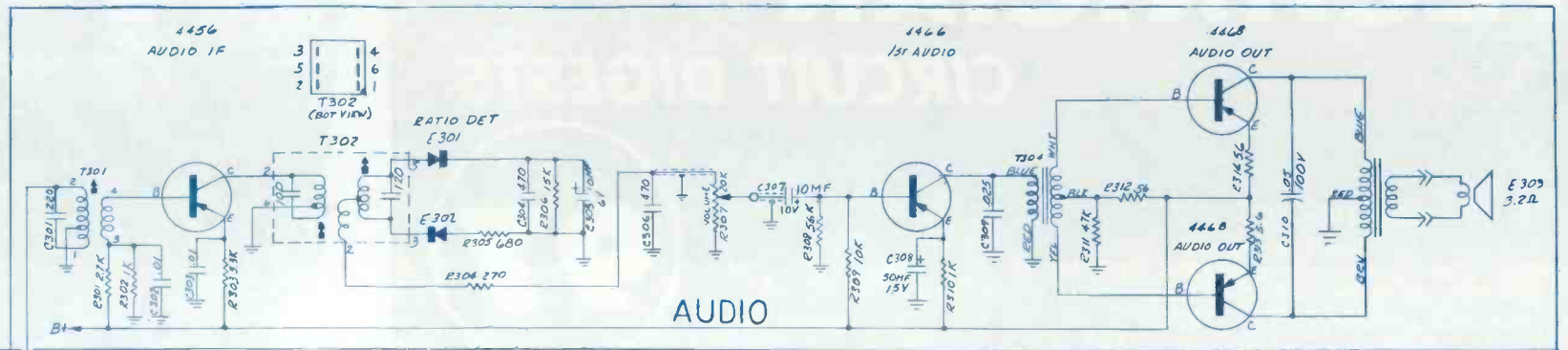
TUBE LOCATIONS
TELEVISION CHASSIS
VRT-123 SERIES

SYMBOL ▲ SHOWS SOCKET PINS OR KEY POSITION FOR CORRECT TUBE INSERTION.

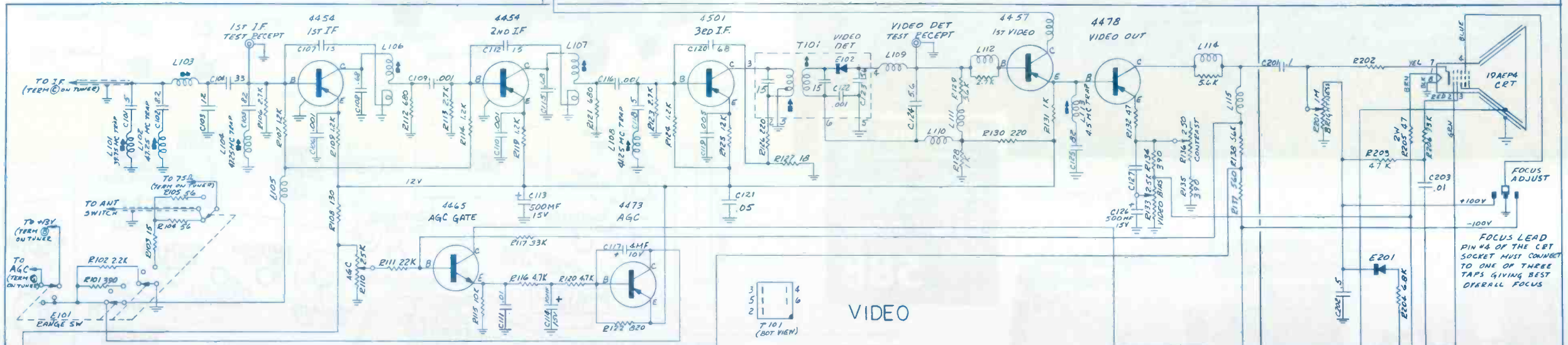
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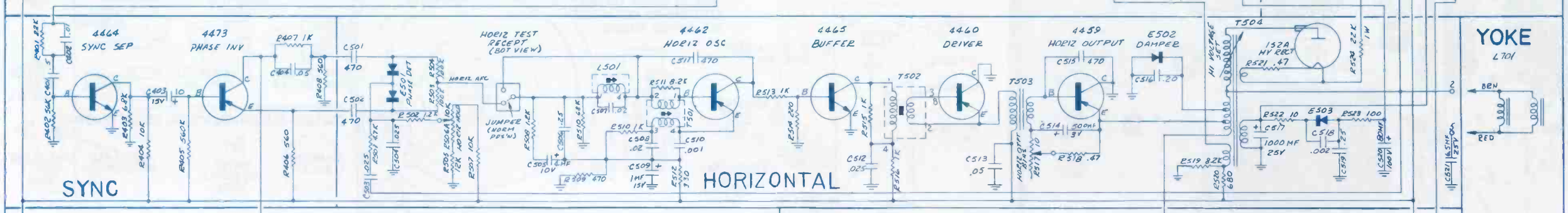
REMOVING BACK AND BEZEL



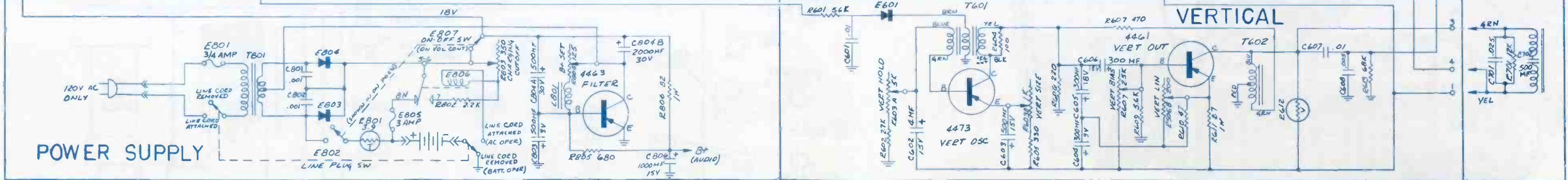
AUDIO



VIDEO



HORIZONTAL



VERTICAL

YOKE

L701

HI VOLTAGE

152A HY RECT

R521 .47

R522 10

E503

R523 100

C518

.002

C519

1000µF

25V

C520

1000µF

15V

C521

1500µF

25V

C522

1000µF

15V

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CIRCUIT DIGESTS

Trademark

GROUP
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MOTOROLA TV (Transistorized) TV Chassis TS-432 Model 19P1 "Astronaut"	588

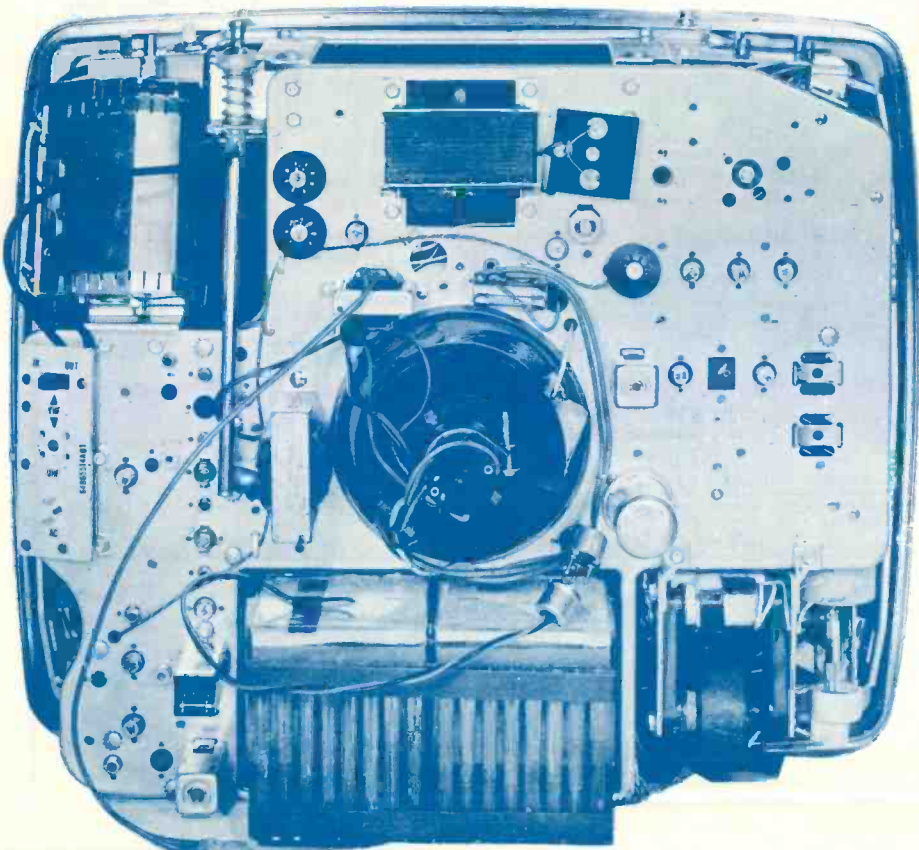
PHILCO Transistor Portable Radio Model T-66	584
RCA TV Chassis KCS131 Series	586
TANDBERG Tape Recorder, 4-Track Model 5	583

More Data on Reverse Side

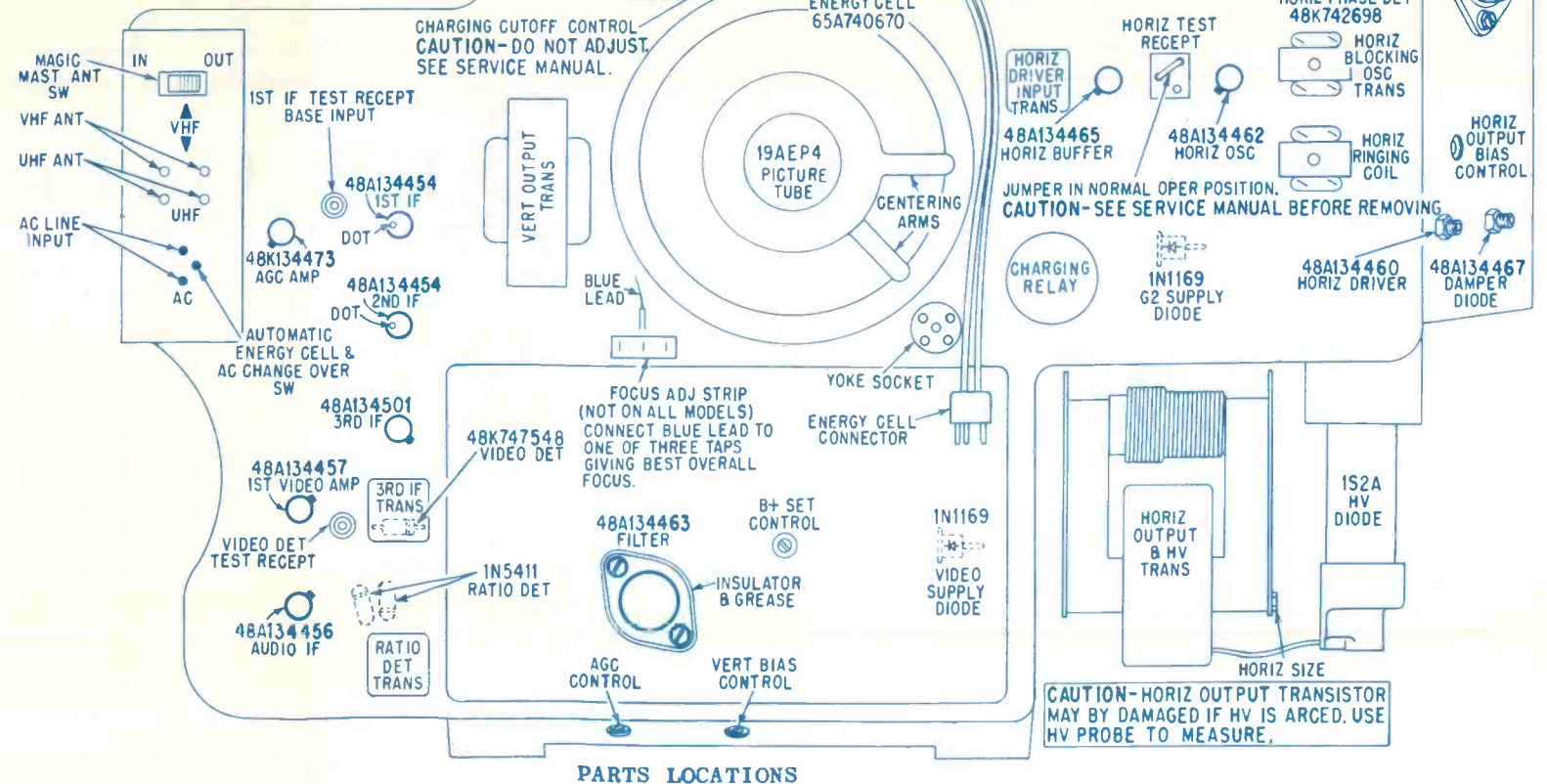
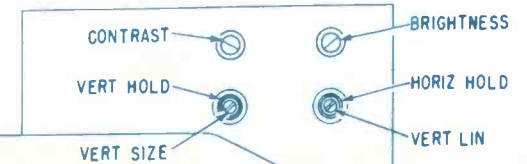
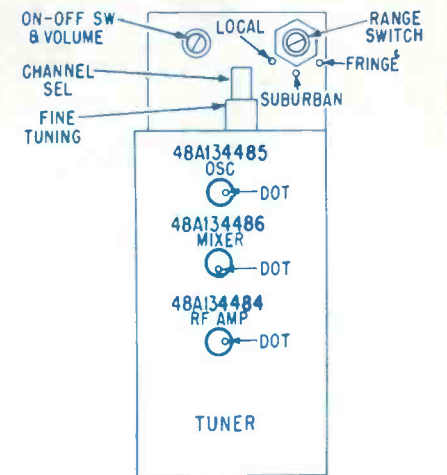
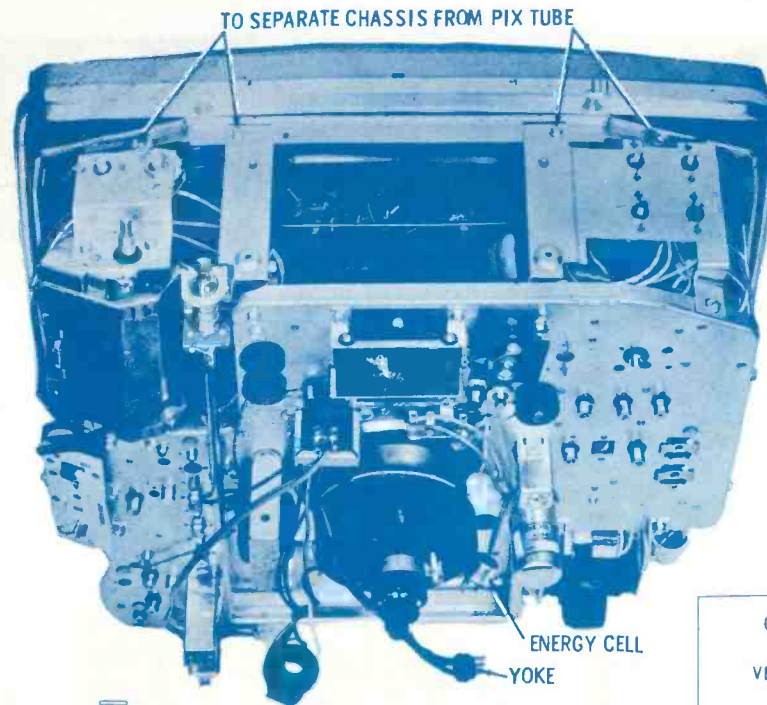
MOTOROLA
TV (Transistorized)
Chassis TS-432
Model 19P1 "Astronaut"

Electronic Technician
CIRCUIT DIGEST

588



SET WITH BACK REMOVED AND ENERGY CELL INSTALLED



PARTS LOCATIONS

2 great **SPRAGUE DIFILM**® tubulars are tops in their field . . . take your choice!

For maximum reliability
and performance
under toughest conditions

SPRAGUE DIFILM® **BLACK BEAUTY**®



Sprague Black Beauty tubulars are missile-type capacitors. Actually, they are low cost versions of the famous Sprague capacitors now being used in every modern military missile. Where positive reliability is important, make no mistake, use Black Beauty Difilm Molded Capacitors! You get the most for the least with Black Beauties!

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For extremely small
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original replacement

SPRAGUE DIFILM® **ORANGE DROP**®



Sprague Difilm "Orange Drops" are a "must" for your service kit where only an exact replacement will fit. They are the perfect replacement for dipped capacitors now used by leading manufacturers in many popular television receivers. And when a dipped tubular is called for, you'll find that Orange Drops outperform all others, safeguarding your work and reputation for quality service.

Orange Drops are specially designed for easiest possible installation. Radial leads are crimped to assure neat mounting parallel to printed wiring boards . . . extremely small size makes them fit handily in tight spots. They'll beat heat and humidity because the solid, rock-hard capacitor section, double-dipped in bright orange epoxy resin, is well protected against moisture. A perfect team-mate for Black Beauty.

The heart of these Sprague Difilm Capacitors can't be beat! It's a dual dielectric combination of Mylar® polyester film and special capacitor tissue—resulting in capacitors which are superior to all other comparable tubulars. Sprague's rock-hard solid HCX® impregnant fills voids and pin holes in the film. Difilm capacitors have high insulation resistance, low power factor, and excellent capacitance stability and retrace under temperature cycling!

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Difilm Black Beauty and Difilm Orange Drops are packaged in sturdy, reusable rigid plastic Klee-Pak® boxes. Your distributor is stocked in all the popular ratings. Order some today. You can count on Difilm.

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THE MARK OF RELIABILITY

For more data, circle 9-C3-1 on coupon, p. 78

FACTS



to help you sell more
RCA Silverama Picture Tubes

... the All-New replacement picture tubes that command premium price and profits.

Here are the facts—proof that RCA Silverama is your customers' best picture tube buy.

1
FREE OF GLASS DEFECTS. Glass cord lines, scratches, chips, or buffed faceplates are common defects found in many brands of tubes made with used glass. Surest way to avoid these defects and also obtain the latest optical advances in faceplate engineering: an All-New RCA Silverama!

2
ALL-NEW. Of the three largest-selling brands of replacement TV picture tubes, only RCA Silverama is guaranteed 100% all-new—new glass, new gun, new phosphor, new everything! You'll get written proof—right on the warranty card.

3
FINEST SCREEN QUALITY. Advanced screen coating and bonding processes combined with RCA's giant vibration-free screen settling machines assure the maximum in picture screen quality and uniformity.

4
RCA "KNOW-HOW". RCA's continuous product research and advanced design engineering have resulted in RCA Silverama picture tubes being steps ahead of all other brands.

5
WORLD'S FINEST. RCA Silverama is manufactured in the world's most modern manufacturing plant using all-new premium-quality materials. Result? RCA Silverama is the world's finest picture tube.

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