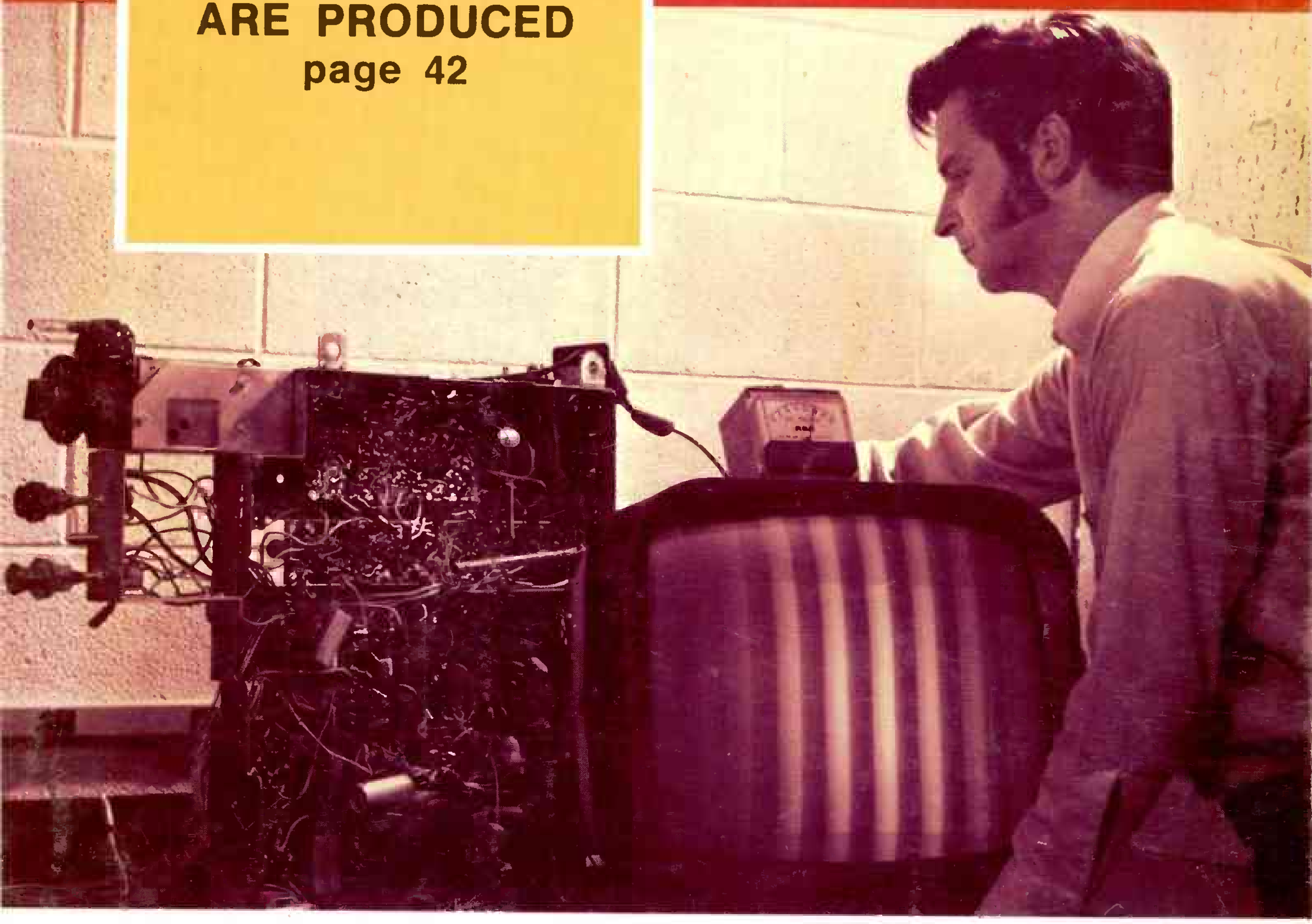
July, 1972 75 cents
A HOWARD W. SAMS PUBLICATION

Electronic Servicing

Find chroma troubles by sweep alignment page 49
Flat-Rate pricing page 26
Principles of phase made easy page 16

HOW COLOR BARS ARE PRODUCED
page 42



Circle 4 on literature card

Electronic Servicing

DEPARTMENTS

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Robert E. Hertel, Publisher

Intertec Publishing Corp.
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Circle 5 on literature card

electronic scanner

news of the industry

Carl Babcoke To Managing Editorship

Carl Babcoke is the new Managing Editor of Electronic Servicing. You're probably already familiar with his test bench articles, but did you know that Carl was an RCA service and training manager for 14 years? Before that, he built test equipment and worked in inspection for another manufacturer.

But it was over 30 years ago when our new editor opened his own radio repair shop. So except for during the war years, he has seen both sides of the industry. He brings his vast experience to the editorship at a time when it is important to find perspectives that are meaningful to the industry. Carl has been a regular full-time staff member since July, 1969.

Sharp Electronics will feature new-type color TV picture tubes in their 1973 line. Two color television receivers equipped with 9-inch and 13-inch **Linytron** picture tubes have been introduced, according to **Home Furnishings Daily.** The guns of the picture tubes are arranged horizontally in-line. More accurate color registration and brighter pictures are claimed for this new type of picture tube.

A 25-inch color TV with the Cartrivision system of recording and reproducing video tapes has been announced by the Admiral Corporation. Although the model 5VT5608 has an open list price, it is said to retail for about $1700. The deck of the VTR is manufactured by Cartridge Television, Inc., according to **Home Furnishings Daily,** and will playback pre-recorded cartridges or record off-the-air programs in either b-w or color. A b-w camera is included also for "live" recording in b-w.

Better Business Bureau and TESA of Memphis join in seeking a city ordinance that would require TV technicians to be licensed. An article in **Radio & Television Weekly** quotes J. B. Myers, the executive vice president of the Memphis BBB, as saying that the majority of TV servicemen are reliable and honest, but that the bureau had received more than 1,000 complaints during 1971 about the servicing of TV receivers. The president of the Memphis chapter of TESA, James E. Beck, replied that the members of his organization had worked for years to obtain such an ordinance and objected only to any possible connection with politics.

(Continued on page 6)

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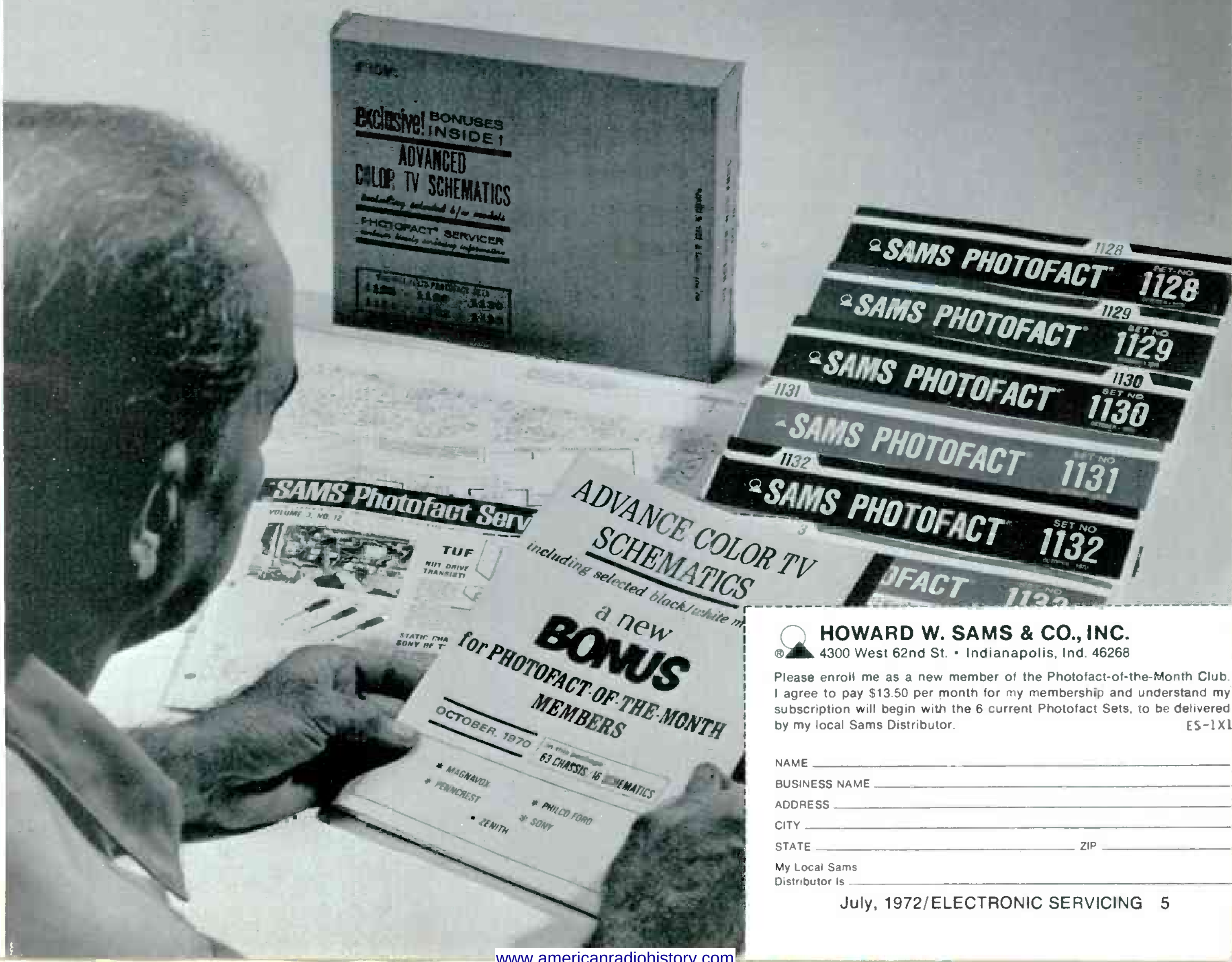

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(Continued from page 4)

electronic scanner

news of the industry

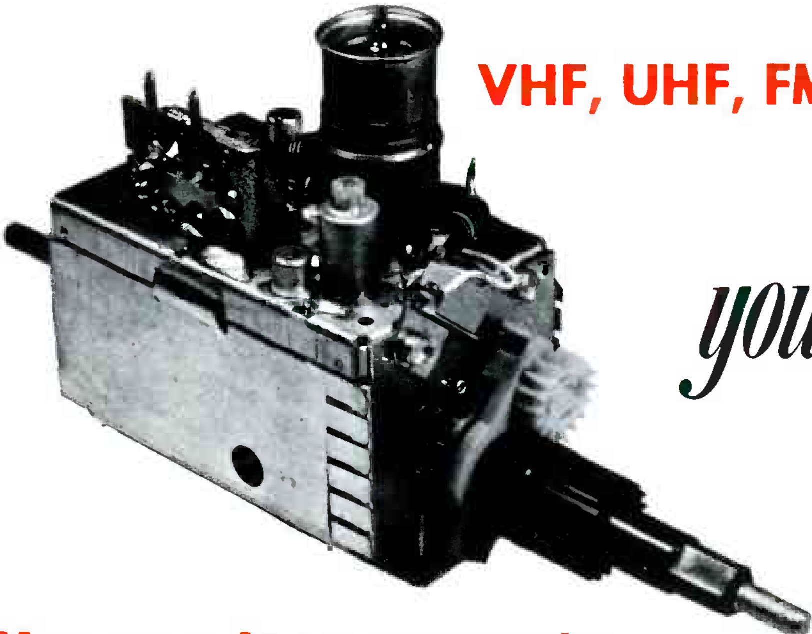
Electronic tennis, anyone? Yes, tennis and 11 other games can be played on the screen of any TV receiver larger than 18 inches. Magnavox has introduced "Odyssey", an all-electronic simulator of games, as reported in the **Wall Street Journal** and **Home Furnishings Daily.** The master-control unit is connected to the antenna terminals of a TV receiver, and is programmed for the game desired by insertion of one of the programming cards that are supplied. Mylar overlays are placed on the screen of the TV (which is tuned to an unused channel), and the contestants operate vertical and horizontal controls of the player units to move spots of light to the required areas of the screen. Most of the games are intended to be played by two persons, but some games can be played by more than two. The Odyssey game simulator is powered by six size "C" batteries, which are supplied, and the retail price is said to be under $100.

Xerox course trains service representatives to work with people. A new course, entitled "Customer-Management Skills" developed for the Xerox company by behavioral psychologists has been released for use in other industries. This course is self-contained and can be given in half-day units over a period of several weeks, or it could be given during an intensive three-day session. It includes written instructions and taped interviews with role-playing and case-study. Further information can be obtained by contacting: Roberta T. Waldman, Stamford, Connecticut by phone at (203) 329 0951, or Donald S. Hammalian, New York at (212) 758 7100.

TV technicians might be called on to repair film cameras, if the present trend to automatic, electronic cameras continues. Transistors have been used to set the aperture for some time. In other cameras, transistorized circuits time the shutter closing. Now, a new Polaroid camera has been announced, as reported in the **Wall Street Journal,** which contains integrated circuits to adjust automatically the exposure, and control the in-camera film developing.

A slide/cassette teaching aid in three parts covering transistor servicing is offered by RCA Electronic Components. Each of the three lessons has a Carousel-type slide tray containing color slides, a pre-recorded cassette tape (keyed to the slides) and booklets for use by the instructor and students. These are the titles: Part 1, Basic Techniques For Transistor Servicing; Part 2, Identifying The Defective Stage; and Part 3, Identifying And Replacing The Defective Component. Each part is about 25 minutes in duration and can be obtained for $39.95 from the distributors of RCA parts and accessories. □

TV TUNER SERVICE



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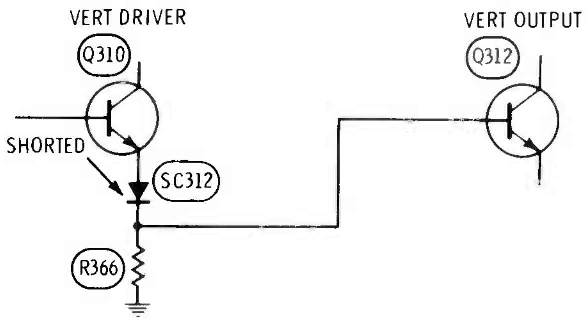
Circle 7 on literature card

sym cure

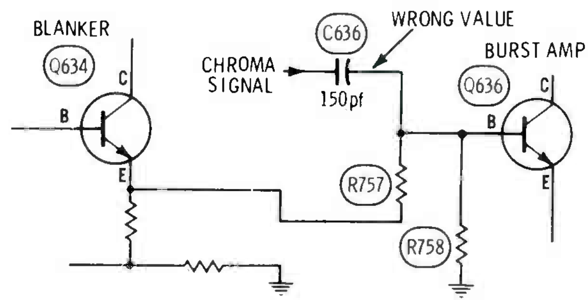
Symptoms and cures compiled from field reports of recurring troubles

Chassis—Sylvania E01
PHOTOFACT—Not yet available



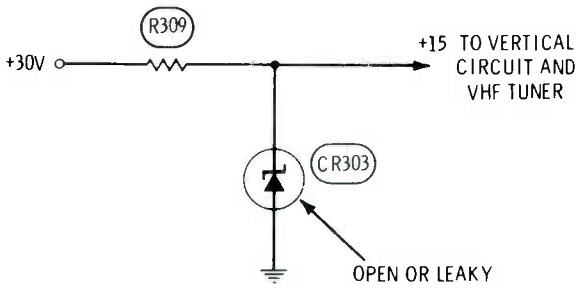
Symptom—Vertical foldover
Cure—Check diode SC312, and replace, if shorted

Chassis—Sylvania E01
PHOTOFACT—Not yet available



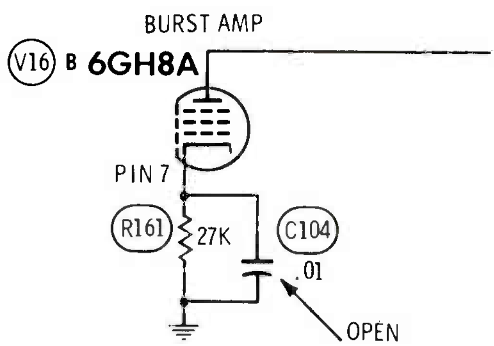
Symptom—Red bars on left side of screen
Cure—Check the value of C636 and replace, if higher than 150 pf

Chassis—RCA CTC46, CTC54, CTC59
PHOTOFACT—Not yet available



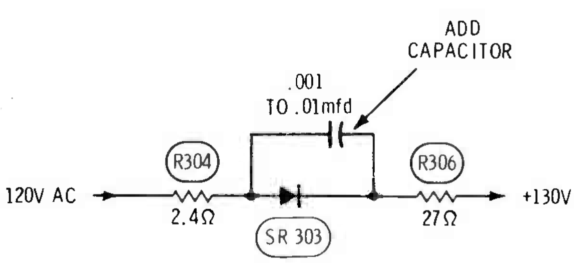
Symptom—Excessive or insufficient vertical height
Cure—Check zener diode CR303 and replace, if leaky or open

Chassis—RCA CTC24
PHOTOFACT—912-3



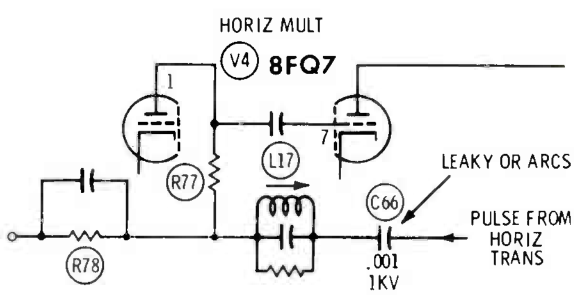
Symptom—No locking of the color
Cure—Check cathode-bypass capacitor, C104, and replace, if open

Chassis—Magnavox T950
PHOTOFACT—1189-1

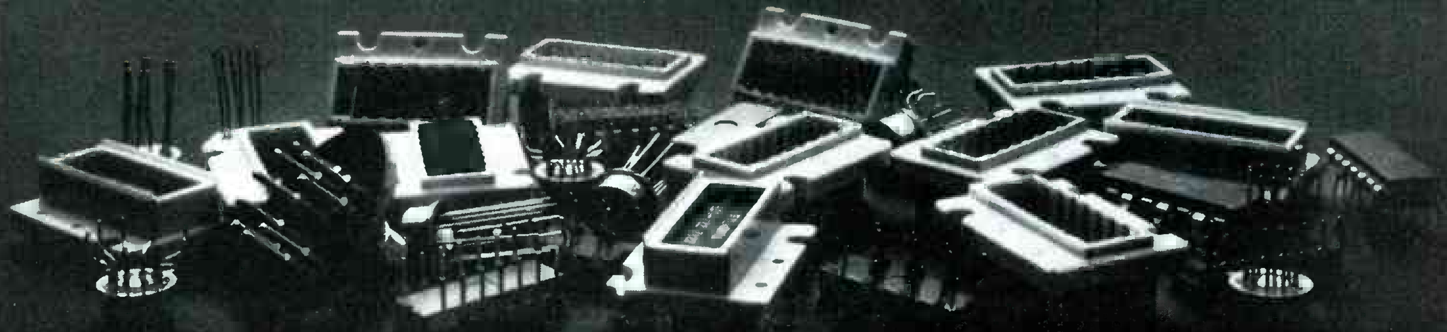


Symptom—Silicon-diode radiation bars moving up screen
Cure—Add a capacitor across SR303; do not use value larger than .01

Chassis—Magnavox T946 b-w
PHOTOFACT—1182-3



Symptom—Erratic displacement of some horizontal lines
Cure—Test C66 by replacement



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CA305[illegible]	[illegible]	LM3028A	724
CA305[illegible]	724	LM3028B	724
CA3065	712	LM3053	724
CA3070	714	LM3065	712
CA3071	715	MC1303L	725
CA3072	713	MC1303P	725
CA3075	723	MC1304P	718
DM—11	709	MC1304PQ	720
DM—14	718	MC1305P	720
DM—24	719	MC1305PQ	720
DM—26	721	MC1307P	722
DM—30	721	MC1307PQ	722
EX4053	722	MC1314G	704
FF274	715	MC1328G	707
FL274	712	MC1328P	713
GE—IC2	712	MC1328PQ	713
GE—IC3	705A	MC1357P	708
GE—IC4	714	MC1358P	713
GE—IC5	713	MFC6010	703A
GE—IC6	715	N5111	708

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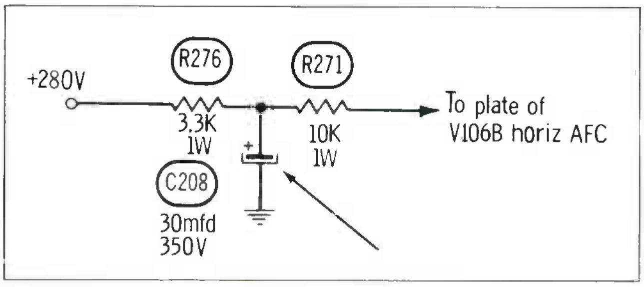
service bulletin

a digest of info from manufacturers

Safety modification
Magnavox T952 color TV chassis

Magnavox has requested removal of C208 in the following color receivers: models 1C6270 and 7C6270, runs 1 through 6; models 1C6272 and 7C6272, runs 1 through 3; models 1C6274, runs 1 through 4; models 1C6276 and 7C6276, runs 1 through 6; models 1C6277 and 7C6277, runs 1 through 4; models 1C6278 and 7C6278, runs 1 through 5; model 10T972, runs 1 through 5; model 20T972, runs 1 and 2.

This modification should be done for reasons of safety, according to Magnavox.



Excessive failure of fuses
Magnavox television receivers

Repetitive failure of fuses can be caused by defective fuse clips. Poor contact between the fuse and the clip can cause excessive heat, which can cause premature failure of fuses.

Magnavox advises against bending the sides of the fuse clips to tighten the contact. Instead, replacement of the fuse-holder block is recommended. New, one-piece fuse holders reportedly are available from Magnavox parts division branches.

Cleaning the edge connectors of modules
RCA color chassis

RCA advises that salt or sulphur compounds in the atmosphere can cause corrosion of the edge connectors on plug-in modules. This corrosion can cause intermittent operation or it can simulate a defective component.

According to RCA, these edge connectors should be cleaned by applying isoproply alcohol with cotton swabs. Do **not** use spray chemicals.

After the modules are replaced in the sockets, be sure that they are seated correctly and that the spring-clip locks are in place.

Insufficient or excessive height
Magnavox T936 and T956 color-TV chassis

The screen grids of both the vertical-output tube

(Continued on page 12)

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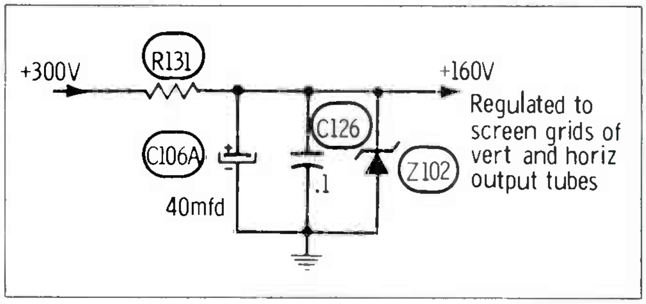
(Continued from page 10)

and the horizontal-output tube are supplied from a 160-volt supply regulated by a zener diode.

Leakage in zener diode Z102 reduces the voltage supplied to these two grids. However, a reduction of height is the symptom which is the most notice-



able. This zener diode should be tested when the 160-volt supply is either excessively high or low.

A shorted zener diode eliminates the raster and the high voltage. An open zener diode produces excessive height and increases the dissipation of the horizontal-output tube, which can cause early failure of the tube.

Troubleshooting focus problems
RCA CTC46 and CTC54 color chassis

A leaky or shorted spark gap which is connected to the focus pin inside the CRT socket can cause poor focus or loss of the raster.

To test for this leakage, disconnect from the chassis the ground strap of the CRT socket. Measure the voltage between the chassis and the strap. The presence of **any** voltage indicates leakage inside the socket, and the socket should be replaced. New sockets, including the lead wires, are stocked by the distributors of RCA parts and accessories (stock number 135506).

Caution: If there is severe leakage across the spark gap of the focus pin, up to 6K volts of focus voltage can appear at the ground strap. Use a high-voltage probe for the first test. If no voltage is measured, for greater accuracy, change to the normal meter probe and test again for voltage.

If the socket is not leaky, and the focus problem remains, test the quadrupler assembly.

A defect in the resistive element of the focus control can cause poor or intermittent focussing. A crack in the substrate portion of the control also will cause poor focussing. □

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Joint industry convention set for August

The joint convention of NEA, NATESA, ISCET and ETA is to be held at the Jung Hotel in New Orleans August 7 through 13.

The following schedule of events has been supplied to ES by the sponsoring organizations.

MONDAY and TUESDAY – AUGUST 7 and 8

Vacationing families and "Early Bird" arrivals; Get together with old friends, sight-seeing, tour the Vieux Carré, eat in world famous restaurants, drive across the world's longest bridge (Lake Ponchatrain Causeway) drink cajun coffee and eat French donuts at the French Market Coffee House; paint-the-town and have a grand time. All on your own.

WEDNESDAY – AUGUST 9

8:00 AM	Breakfast (dutch)
9:00 AM	Registration
10:00 AM	EIC Meeting
	CET Tests –ISCET
Noon	Luncheon (dutch)
5:00 PM	Registration NEA Business Management School
6:00 PM	Dinner (dutch)
8:00 PM	Early-arriving Committee Chairmen meet to finalize past year reports and convention arrangements
	Singing fun – Hospitality Room

THURSDAY – AUGUST 10

8:00 AM	Breakfast (dutch)
	Registration for Convention and Business Management School
9:00 AM	NEA-NATESA "Open" Golf Tournament. Gene Decker: Chairman
	NEA Business Management School. Les Nesvik: Coordinator
10:00 AM	Coffeebreak
12:15 PM	Luncheon (sponsored)
1:15 PM	NEA Business Management School
4:00 PM	Coffeebreak
5:00 PM	Convention Official Call to Order
5:15 PM	Keynote Addresses: Leo Shumavon, President – NATESA Norris Browne, cet, President – NEA
6:00 PM	Dinner (sponsored)
8:00 PM	NATESA Executive Council Meeting
	NEA Executive Committee Meeting
	M&M Business Forms Bowling Tournament. Pete Fabbri: Chairman
	CET Tests – ISCET
	All Hospitality Rooms Open. *Attendance Awards

*All attendance awards to be drawn in Hospitality Rooms

FRIDAY – AUGUST 11

8:00 AM	ETA of Louisiana Breakfast Sponsored by RCA
	Registration
9:00 AM	NEA Business Management School (continued from Thursday – concludes noon)
	Hospitality Room for Teen & Sub-Teens (Sponsored by The Finney Company) Adult Supervision by ETA of Greater New Orleans. Note: – Off Limits to All Adults
	Electronic Trade Show Opens (open until noon) Sixth Floor Terrace Suites
9:15 AM	NATESA Executive Council Meeting
9:15 AM	NEA Board of Directors Meeting
	Technical Seminars – ISCET (subjects and rooms to be announced)
10:15 AM	Coffeebreak

10:30 AM	Publications Editors Seminars. Directed by: Phil Dahlen, Editor Electronic Technician/Dealer Magazine
	ISCET Technical Seminars (subjects to be announced)
Noon	NEA Luncheon, Sponsored by Magnavox
1:30 PM	National Electronic Service Conference. Sponsored by NATESA
	Electronic Trade Show Open. Sixth floor Terrace Suites
3:00 PM	Coffeebreak
3:30 PM	Electronic Trade Show open
6:00 PM	Cocktail Hour. Sponsored by Howard W. Sams
7:00 PM	NATESA Dinner. Sponsored by Zenith Radio Corporation
8:30 PM	ISCET Annual Meeting and Election of Officers
	Hospitality rooms open. Drawings for Attendance Awards.

SATURDAY – AUGUST 12

8:00 AM	Registration
	ISCET Breakfast Sponsored by Sylvania. Feature film on Hawaii
9:00 AM	Teen & Sub-Teen Hospitality Room Open. Sponsored by the Finney Company
	NATESA Annual Corporation Meeting
	NEA Annual Corporation Meeting
	Electronic Trade Show Open until noon.
9:15 AM	ISCET Technical Seminars (subjects to be announced)
	Symposium for License Board Executives
10:30 AM	Coffeebreak
Noon	Hall of Fame Banquet. Sponsored by Amperex Electronic Corporation. Mr. M. L. Finneburgh, Sr., EHF, Speaker
1:30 PM	NEA Election of Officers
	NATESA Election of Officers
	ISCET Technical Mini-sessions: 1) Tape-deck servicing 2) Transistor testing and servicing 3) Testing stereo & Hi-Fi to specifications 4) Alignment - IF, Color & AFPC 5) Scope usage 6) CET Test Review
	CET Tests – ISCET
2:30 PM	Coffeebreaks
3:00 PM	Electronic Trade Show Open
4:00 PM	Louisiana State Radio & TV Technicians Board Meeting
6:00 PM	Cocktail Hour. Sponsored by Howard W. Sams
7:00 PM until??	ETA of Louisiana Fais-Do-Do Banquet & Dance. Sponsored by General Electric

SUNDAY – AUGUST 13

8:00 AM	Louisiana State Board Meeting continued
9:00 AM	NATESA Breakfast (Sponsored)
10:00 AM	ISCET Annual Meeting continued
	Meeting for all State Presidents (presidents only, please)
	NEA Meeting continued
	NATESA Meeting continued
	ETA of Louisiana meeting
Noon	Planning Meeting for new NATESA Executive Council
	Planning Meeting for new NEA Board of Directors
3:00 PM	Adjournment for All
	Check-out time

All Coffeebreaks are sponsored by The Finney Company shop talk

Phase, the relationship of electronic signals to time

Authors Notes

I believe that electronic theories and circuit actions, even complex ones, can be understood **without** mathematics, if voltages and scope waveforms of the right kind are analyzed. Read the following article and then determine if you agree with that assertion.

Don't let the textbook appearance of the article mislead you; this is not the usual approach to the subject. Although some traditional material is included to make the subject complete, there is also much that is new.

These are the general subjects discussed:

- **How** phase can be changed,
- **Proof** by scope waveforms that phase actually is made "leading" or "lagging,
- A **theory** supported by scope waveforms of **why** phase is changed by the time-constant action of filters,
- The connection between the action of time-constant filters and the analysis of frequency response by the effects on square waves.

Next month in Shop Talk, actual scope waveforms taken from the operation of various basic chroma demodulators will be shown and explained. Practical information about methods of troubleshooting chroma demodulators also will be included.

By Carl Babcoke

Phase describes the leading or lagging positions, relative to one another, of two or more AC signals. Alternately, phase values can be assigned, according to a standard of reference, to various portions of one signal.

An AC signal of any waveshape can have a phase relationship. However, because they have only one frequency, sine waves are used most often in explanations of phase. For convenience in calculations, the 360 degree calibration of a compass has been adopted universally to identify the phases of sine waves.

The change from a circle to a sine wave can be illustrated by dividing a circle in half, and flipping over the lower half, as shown in Fig. 1. Of course, the resulting waveform is not a sine wave, but it does show the principle.

For use in color TV theory, a sine wave is often assigned the degrees shown in Fig. 2.

Phase can be changed by several methods

A tube or transistor operating in a common-cathode or common-emitter amplifier circuit produces an output signal which has been changed in phase by 180 degrees from that of the input signal. Signals which have a 180 degree relationship can be obtained from two windings of a transformer. For example, the two outputs from a push-pull audio transformer are 180 degrees out-of-phase.

Phase can be changed (or shifted) by smaller amounts than 180 degrees when an AC signal passes through filters which use resistance/capacitance, resistance/inductance, or capacitance/inductive elements. Resistances without inductances or capacitances cannot change phase. Only capacitances and inductances can change phase. Each capacitance and inductance in a circuit **can** change the phase of a signal by a **maximum** of 90 degrees. However, these components **do not always** cause a measurable phase change. Some circuits, because of the values of the components relative to the frequency of the signal, produce virtually no change of phase.

To shorten the explanations, only resistance/capacitance filters will be analyzed here. However, inductances can be visualized conveniently as having characteristics which are exactly opposite to those of capacitances.

Two signals are required

Two or more signals are required for a phase relationship to be real, rather than mathematical. These signals might come from entirely different sources. They might be the voltage and current from just one signal. Or, they might be the same signal before and after a phase change has occurred.

Low-pass filters cause lagging phase

A simple, low-pass, high-frequency-rolloff filter, such as the one shown in Fig. 3A, can produce (at some frequencies) as much as 90 degrees of delay to the phase. In this type of circuit,

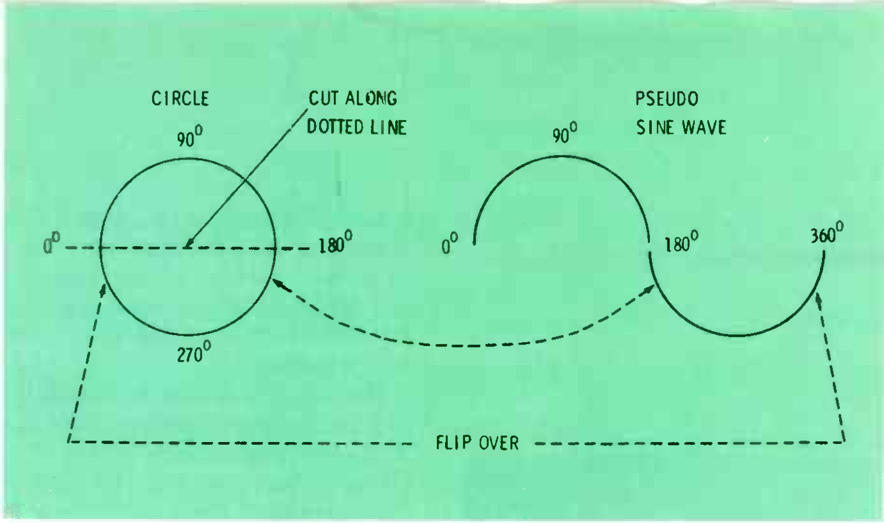

Fig. 1 The degree markings of a compass can be transferred to a sine wave by this method.

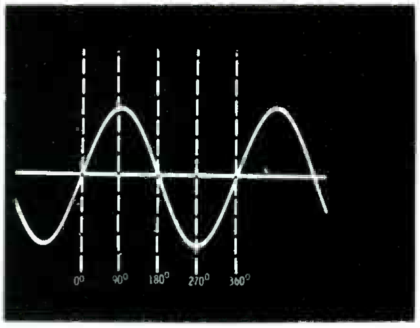

Fig. 2 For use in the theory of color TV, the various phases of a sine wave usually are designated by degrees as shown here.

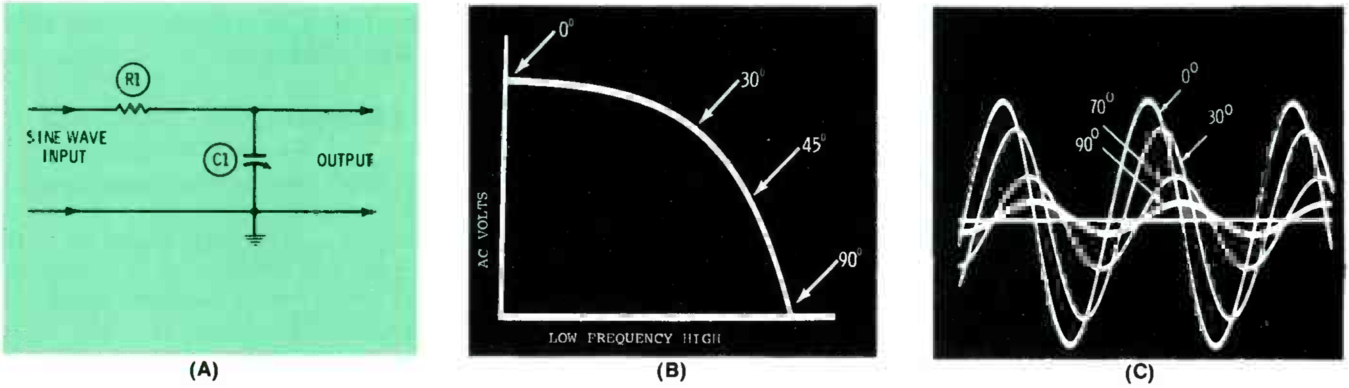

Fig. 3 Attenuation according to frequency, and phase shift are proportional in simple filters. **(A)** The schematic of a low-pass, high-frequency-attenuation circuit used to demonstrate lagging phase. **(B)** This is the frequency response curve of a low-pass filter showing the amount of lagging phase shift at various points of attenuation. **(C)** Four amounts of lagging phase shift are shown here by the positions of the sine waves.

loss of amplitude and the degree of phase shift occur in the same proportion, as shown on the frequency response curve in Fig. 3B. Before a 90 degree phase shift occurs, increased phase shift by the filter also increases the attenuation. Beyond the point of the 90 degree phase shift, the attenuation continues with an increase of the frequency, but the phase shift remains at 90 degrees.

A picture of lagging phase

A demonstration of lagging phase is shown by multiple camera exposures in Fig. 3C. The combined waveform was made by connecting a sine-wave generator to the input of the filter shown in Fig. 3A, and connecting a scope to the output of the filter. The horizontal sweep of the scope was locked (by means of the external/sync input) to the signal from the generator. Therefore, any change of the phase moved the waveform laterally on the screen. The value of the capacitance was increased in four steps, and the position of the sine wave photographed each time. It was possible to achieve one-fourth cycle (90 degrees) movement to the right. No further movement was possible regardless of the increased value of the capacitance.

This demonstration proves that a low-pass filter can produce up to 90 degrees of lagging phase shift. However, it does not show **why** the phase changed. That explanation is given later.

High-pass filters cause leading phase

A high-pass, low-frequency-attenuation filter, such as the one shown in Fig. 4A, can produce up to 90 degrees of leading phase shift. The multiple-exposure waveform in Fig. 4B shows four different amounts of leading phase. The amplitude of the 90-degree sine wave was less than 5 percent of the input amplitude; a very large attenuation.

As the resistance value (shown in Fig. 4A) was decreased, the amplitude of the sine wave decreased, and the sine wave moved to the left. It was impossible to move the sine wave more than one-fourth cycle (90 degrees) to the left regardless of the value of the resistance. This demonstration proves that a phase shift up to 90 degrees can be produced by a high-pass filter. Again, as in the example of the low-pass filter, no reason for this action is indicated by these results.

Can a signal arrive before it starts?

Can a voltage arrive before it starts? Can a current flow before the voltage arrives to apply the force?

In the preceding demonstration of leading phase, the output voltage reached its maximum peak before the input voltage reached maximum peak. This statement was phrased very carefully so it would be correct, and not be misleading. However, the condition of leading phase appears illogical.

Fortunately, there is a reasonable explanation for this paradox. A part of the answer is this: The circuit shown in Fig. 4A causes the **current** of the capacitance to be the output signal which is observed on the scope. The remainder of the explanation can be found in a study of time-constant networks.

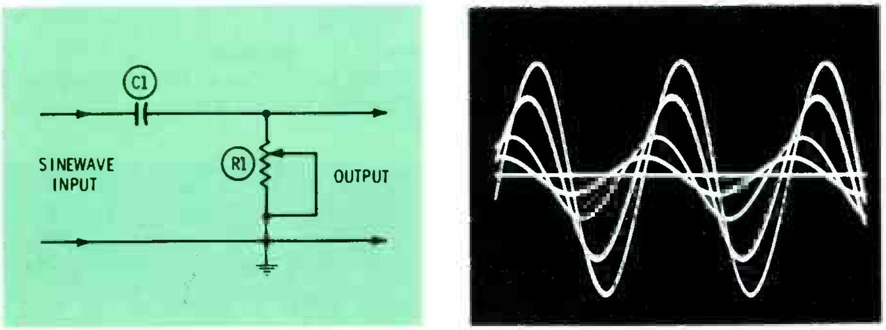

Fig. 4 Leading phase is produced by high-pass filters. **(A)** The schematic of a high-pass, low-frequency-attenuation circuit used to demonstrate leading phase. **(B)** Four amounts of leading phase are shown here by the positions of the sine waves in this multiple-exposure photograph.

Time Constants: The Cause of Phase Changes

The charge/discharge switch and the low-pass filter shown in Fig. 5A are often used to illustrate the actions of a time-constant circuit which uses resistance/capacitance (RC) components. Also, most textbooks accompany this schematic with graphs drawn to show the capacitance voltages and currents obtained during a charge time of 5 RC time constants, and 5 RC time constants of discharge time. Figures 5B and 5C show similar graphs. However, these curves are unique, because they are not drawings. They originated as photographs taken from the screen of a scope. The graph lines were added by an artist.

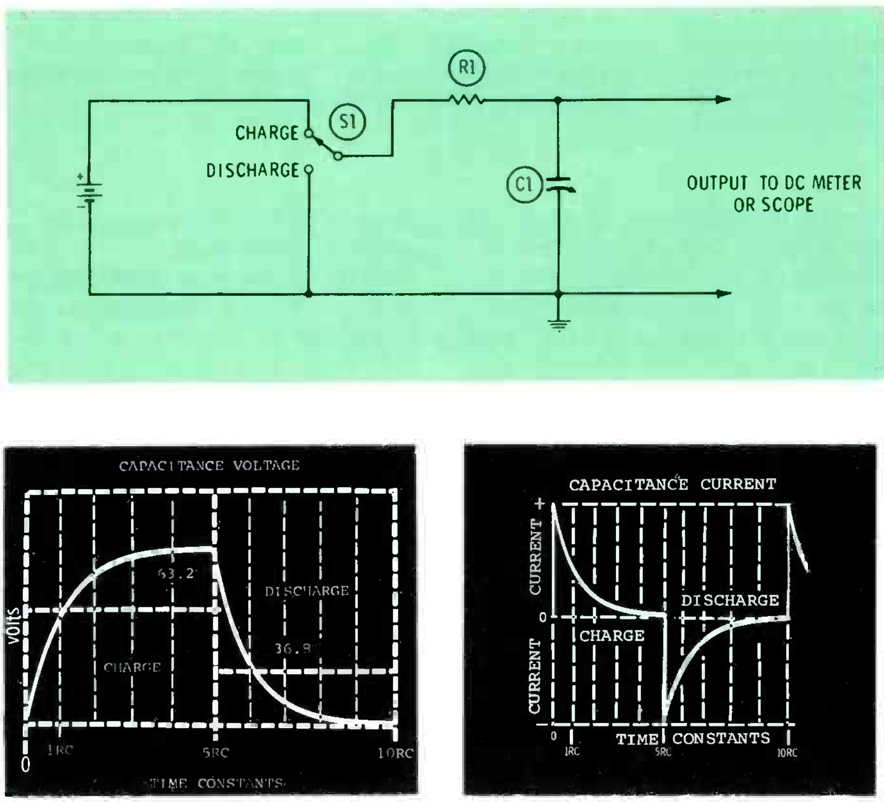

Fig. 5 Phase shift produced by filters is caused by the actions of time-constant circuits. **(A)** This is the schematic of the circuit used to display the charging and discharging voltage curves of capacitances. It produces lagging phase. **(B)** Most textbooks show a graph like this to illustrate the voltage curve during the charge and discharge of capacitances. This curve was photographed from the screen of a scope. **(C)** A graph similar to this one is often used to illustrate the capacitance current during charging and discharging cycles.

Basic facts about time constant

Time constant, expressed in seconds, equals the resistance in Ohms multiplied by the capacitance in Farads. The formula is $T = RC$. This is easier to use if it is expressed as: The time in seconds equals the resistance in megohms multiplied by the capacitance in microfarads.

One time constant represents the amount of time necessary for a capacitance to charge to 63.2 percent of the applied voltage. Also, it is the amount of time necessary for a charged capacitance to discharge to 36.8 percent of the fully-charged voltage. A capacitance is considered to be charged or discharged completely after 5 time constants.

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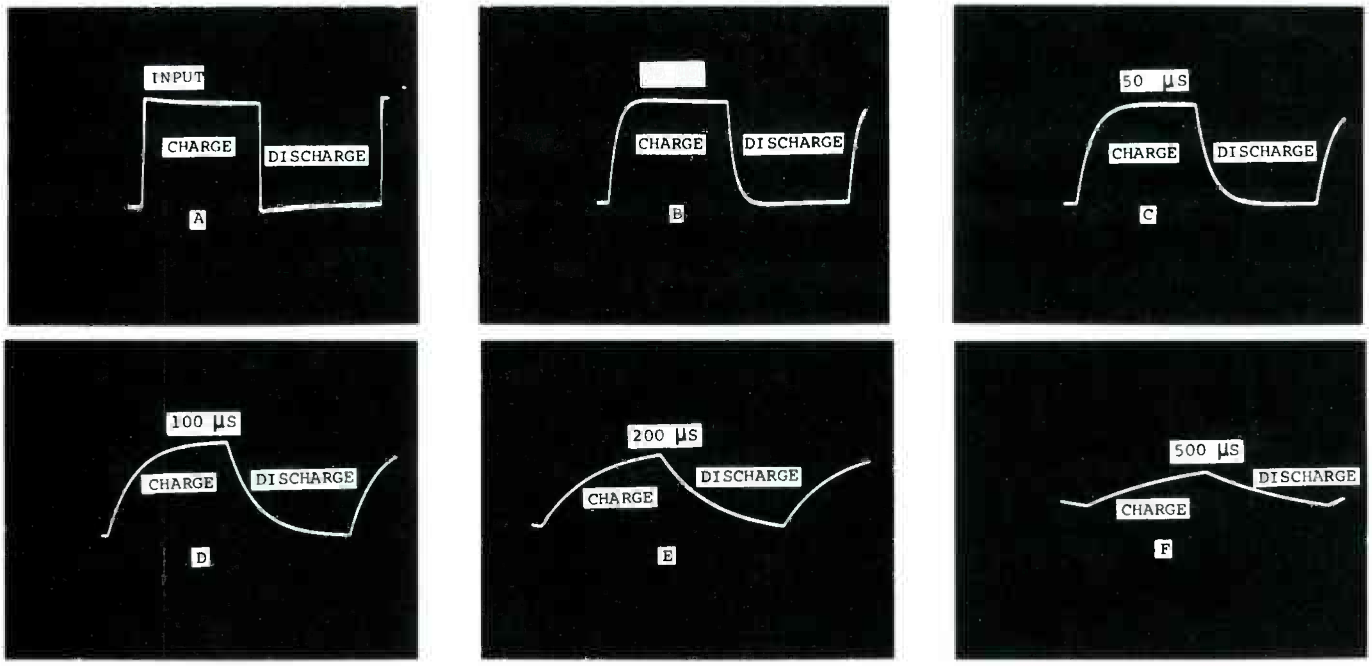

Fig. 6 Square waves can be used to produce quickly the voltage charge and discharge curves of capacitances. The circuit shown in Fig 5A is used, with the square wave generator replacing the switch and battery, and a scope used for a readout. The time constant of the filter by steps was increased in microseconds, as shown, and the repetition rate of the square wave was 1000 Hz. **(A)** The input square wave, shown for comparison with the other waveforms. **(B)** A low-pass filter of 25-microseconds time constant produced a rounding of two corners of the square wave. **(C)** More rounding of the corners was produced by a 50-microsecond filter. **(D)** This waveform represents 10-RC time constants of the 100 microsecond filter to a 1000 Hz switching rate, and will be explained later in this article. **(E)** A 200 microsecond filter produced a near-triangular waveform. **(F)** A triangular waveform of only 20 percent of the amplitude of the input was produced by a 500 microsecond filter.

The charging and discharging of capacitances

Current cannot flow without voltage to supply the force, although the graphs shown in Figs. 5B and 5C appear to imply this by showing maximum current flow when the voltage is near zero. When voltage to the circuit is initially applied by operation of the switch shown in Fig. 5A, the **current** through the capacitance is maximum, although the **voltage** across the capacitance is small. This condition has been called: "current leading the voltage". However, such a phrase can be misleading. The previous statement about maximum current and minimum voltage is more appropriate.

Any capacitance **can** store DC voltage. However, a capacitance appears reluctant to accept a voltage charge, and is equally reluctant to release the charge.

At the beginning of a charge cycle, an uncharged capacitance passes a large flow of current, although the applied voltage is very small. Immediately, the current begins to decrease, and, in the same proportion, the voltage charge across the capacitance increases. At the end of 5 time constants, the voltage is maximum and the current is zero. This action is the same for high-pass as it is for low-pass filters. The difference is that the voltage charge is measured at the output of a low-pass filter, and the capacitance current is measured at the output of a high-pass filter.

Capacitance current reverses

Although the capacitance voltage in the circuit of Fig. 5A changes only from zero to a maximum positive value, and returns to zero, the capacitance current reverses direction (polarity) during the discharge portion of the cycle.

During the charge time, electron current flows from the negative terminal of the battery to the grounded terminal of the capacitance, through the capacitance, the resistance and the switch, and returns to the positive terminal of the battery. During the discharge time, the electron current flows from the grounded terminal of the capacitance, through the switch and resistor to the positive terminal of the capacitance. In high-pass filters, the voltage drop across the resistor, caused by the capacitance current, is the output signal.

Capacitance actions during slow switching

Variations of the voltage across the capacitance shown in Fig. 5A will be traced as they occurred when the circuit was switched to charge position, permitted to remain there for 100 time constants, and then switched to discharge position for another 100 time constants.

By the end of the first time constant, the voltage across the capacitance had increased to 63.2 percent of the battery volt-

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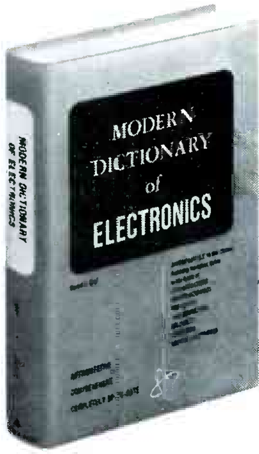

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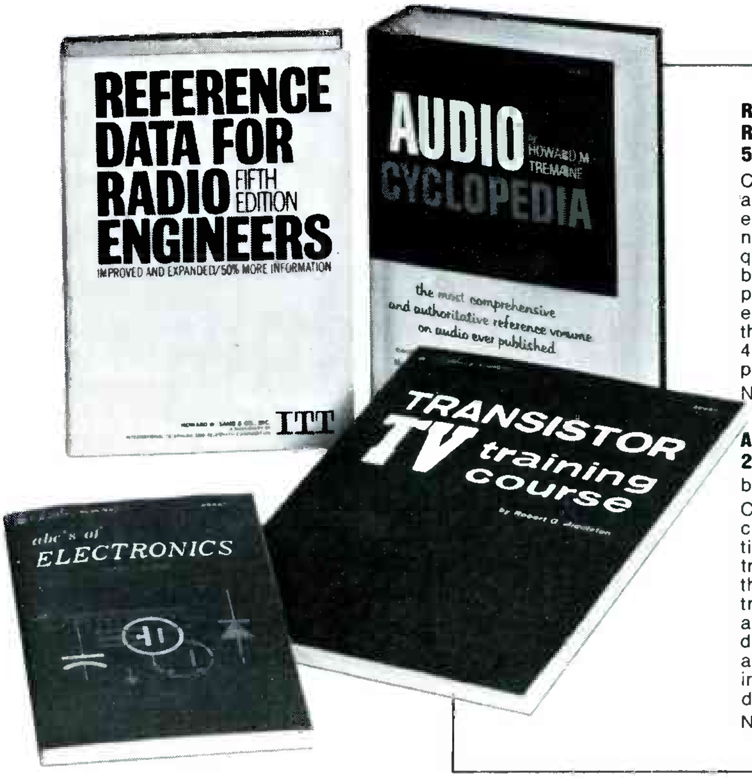

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age. At the end of the first five time constants, the voltage was virtually 100 percent. During the additional 95 time constants, the voltage remained at 100 percent.

When the circuit was switched to discharge, the capacitance voltage decreased to 36.8 percent by the end of the first time constant, was zero percent at the end of the first five time constants, and remained at zero voltage for the additional 95 time constants.

If these voltage changes were plotted on a graph, the result would be a near-perfect square wave. Of course, the corners would be slightly rounded. However, for most practical purposes, the output voltage would be a duplicate of that at the junction of S1 and R1.

Because the filter did not appreciably change the waveform of the input voltage, it can be concluded that a sine wave of the same low frequency as the repetition rate of the switching would not be changed in amplitude, waveshape or phase by passage through the filter.

Capacitance actions during rapid switching

Again using the circuit shown in Fig. 5A, the variations of the voltage across the capacitance will be traced when the circuit was switched rapidly to provide one time constant each of charge and discharge.

At the end of the time constant of the charge cycle, the voltage at the capacitance would be 63.2 percent of the battery voltage. At the end of the time constant of the discharge cycle, the voltage at the capacitance would be 36.8 percent. (There is some approximation here, for the voltages rise in steps to a point of equilibrium; however, these figures will serve as an example.) Because the rate of charge and discharge of the capacitance voltage during the first time constant is nearly linear, the output voltage from the filter will be in the shape of a small triangle.

Square waves produce the effects of switching a DC voltage

Checking the performance of time-constant filters by graphing the voltages is very time consuming. There is an easier method. Square waves from a generator are used to replace the charge/discharge switching voltages, and a scope is used to give an instantaneous readout.

Square waves can produce time-constant curves

The series of waveforms shown in Fig. 6 were produced by a square wave of fixed frequency which was channeled through a low-pass filter whose time constant was changed in steps.

The waveform of Fig. 6B illustrates the previously-described condition in which the DC charging and discharging voltages were cycled very slowly relative to the time constant of the filter. Because there was such an insignificant change in the appearance of the square wave, it can be concluded that a sine wave having the frequency of the repetition rate of the square wave would be relatively unchanged in amplitude or phase by passage through the same filter.

Also, the triangular waveform shown in Fig. 6F is similar to that obtained by rapid operation of the charge/discharge switch shown in Fig. 5A.

A double-trace picture showing a 1000 Hz square wave at the input and output of a 500 microsecond filter is shown in Fig. 7.

Maximum voltage at the input to the filter occurred at the **beginning** of the charging time. However, maximum voltage at the output of the filter occurred at the **end** of the same charging time. This indicates that the output voltage was lagging in phase. Also, the difference between the average input voltage and the maximum output voltage is ¼ cycle (90 degrees). A sine wave, of the same frequency as the repetition rate of the square wave, emerged from the same filter with greatly decreased amplitude, and a lagging phase of 90 degrees.

One cycle is required for a change of phase

The first cycle of a sine wave, which has the phase delayed by passage through a low-pass filter, is stretched laterally. Figure 8 shows by means of an artists touchup how this elongated cycle would appear, if it could be seen on a scope.

Capacitive current in a high-pass filter during slow switching

The output voltage from the high-pass filter shown in Fig. 9A is actually the current of the capacitance which causes a voltage drop across the output resistor.

Variations of the voltage at the output of the high-pass filter will be traced as they occur when the circuit is switched to the charge position, permitted to remain there for 100 time constants, and then is switched to the discharge position for another 100 time constants.

When the circuit was switched first to the charge position, electron current from the negative terminal of the battery flowed through R1, C1 and S1 to the positive terminal of the battery. At the beginning of this action, the capacitance current (and the output voltage) was maximum. However, the current immediately started to decrease. At the end of the first time constant, the output voltage was 36.8 percent of the input voltage. After 5 time constants, the output voltage was zero. The capacitance was completely charged. Therefore, the full voltage is developed across the capacitance; no voltage is developed across the resistance. During the additional 95 time constants, the output voltage remained at zero.

When the switch was changed to the discharge position, the total battery voltage, which had been stored in the capacitance, was connected through S1 to the output resistor. Electron current, from the capacitance, flowed from the negative terminal of the capacitance, through the resistor to ground, and from ground through the switch to the positive terminal of the capacitance. Notice that the current flow through the output resistor during the discharge time was opposite in direction (reversed polarity) from the current which flowed during

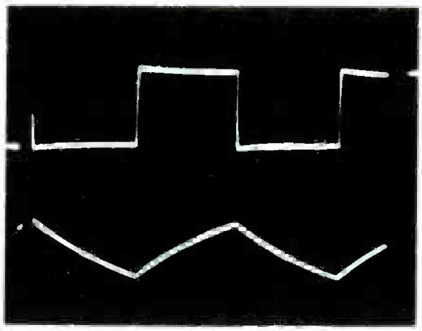


Fig. 7 A double exposure of the input waveform and the triangular waveform produced when the filter had a 500-microsecond time constant shows that the arrival of the voltage of the square wave has been delayed. This indicates a lagging phase change.

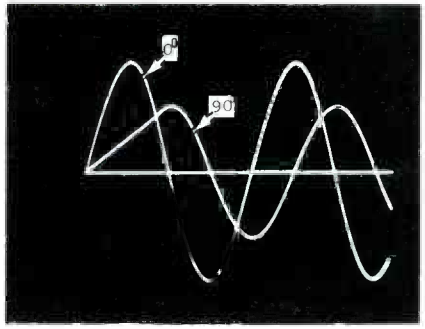
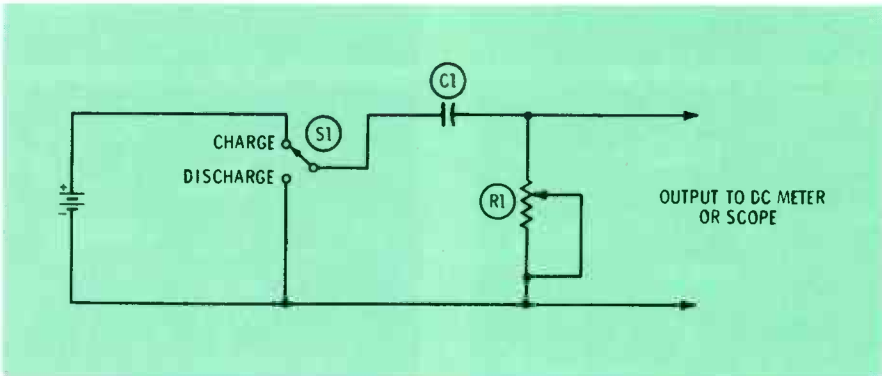


Fig. 8 The slow charging of the capacitance of a low-pass filter delays the arrival of the maximum voltage peak of a sine wave; therefore, the first cycle of a series of sine waves is elongated by this action.



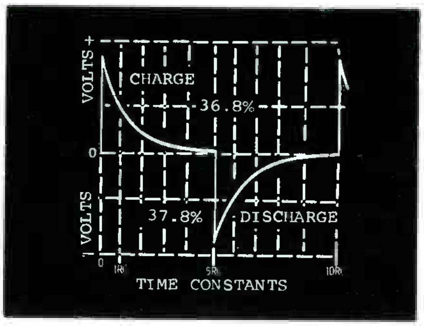


Fig. 9 Leading phase caused by high-pass filters is produced by the action of the time-constant components. **(A)** The schematic of the high-pass filter used to demonstrate by graphs the waveform of capacitance current during the charge and discharge cycles. **(B)** This graph of the output voltage of the filter is similar to those in many textbooks which illustrate capacitance current in time-constant circuits. In this case, the curve originated as a photograph taken from the screen of a scope.

the charge cycle. Therefore, the output voltage which appeared instantaneously when the circuit was switched to discharge was **negative** in polarity.

At the end of the first time constant, the output voltage was 36.8 percent of the previous maximum **negative** voltage. After the first 5 time constants, the output voltage was zero, and it remained zero for the additional 95 time constants.

Therefore, the output of a high-pass filter, when the input voltage is switched slowly, consists of very narrow, alternately positive and negative pulses.

Because the **average** voltage at the output becomes maximum before the **average** voltage at the input, a leading phase of the output signal is indicated.

A sine wave of the same frequency as the repetition rate of the voltage switching was greatly reduced in amplitude and changed to a 90 degree leading phase by passage through the same filter.

Ohmmeter testing of capacitance

The pulses of voltage from the charge and discharge of the capacitance of a high-pass filter are of the same nature as the quick, short-duration bounces of the pointer of an ohmmeter when the test leads are connected to an uncharged capacitance.

Starting on page 34, the July 1970 issue of ELECTRONIC SERVICING gave the details of a quick test of fair accuracy for checking the capacitance of large electrolytic capacitors.

Capacitive current in high-pass filters during rapid switching

Variations of the output voltage from a high-pass filter, such as the one shown in Fig. 9A, were traced during charge and discharge cycles of only 1/10 time constant.

When the circuit was first switched to charge, capacitance current and output voltage both were maximum. Instantly, they started to decrease. However, at the end of the 1/10 time constant, they both remained nearly at maximum.

The time was insufficient for a voltage charge to build up in the capacitance. Therefore, all the voltage appeared across the output resistor. Also, there was no voltage stored in the capacitance which could be discharged, when the switch was changed. Both the voltage across the output resistance, and the capacitance current decreased rapidly to zero.

When tnis circuit is switched rapidly, the output waveform is nearly the same as the input switching voltage at S1 and C1.

A sine wave of the same frequency as the repetitive frequency of the switching emerged from the same filter with no discernible change of amplitude, waveform, or phase.

Capacitance current during moderate switching speeds

When the circuit is cycled

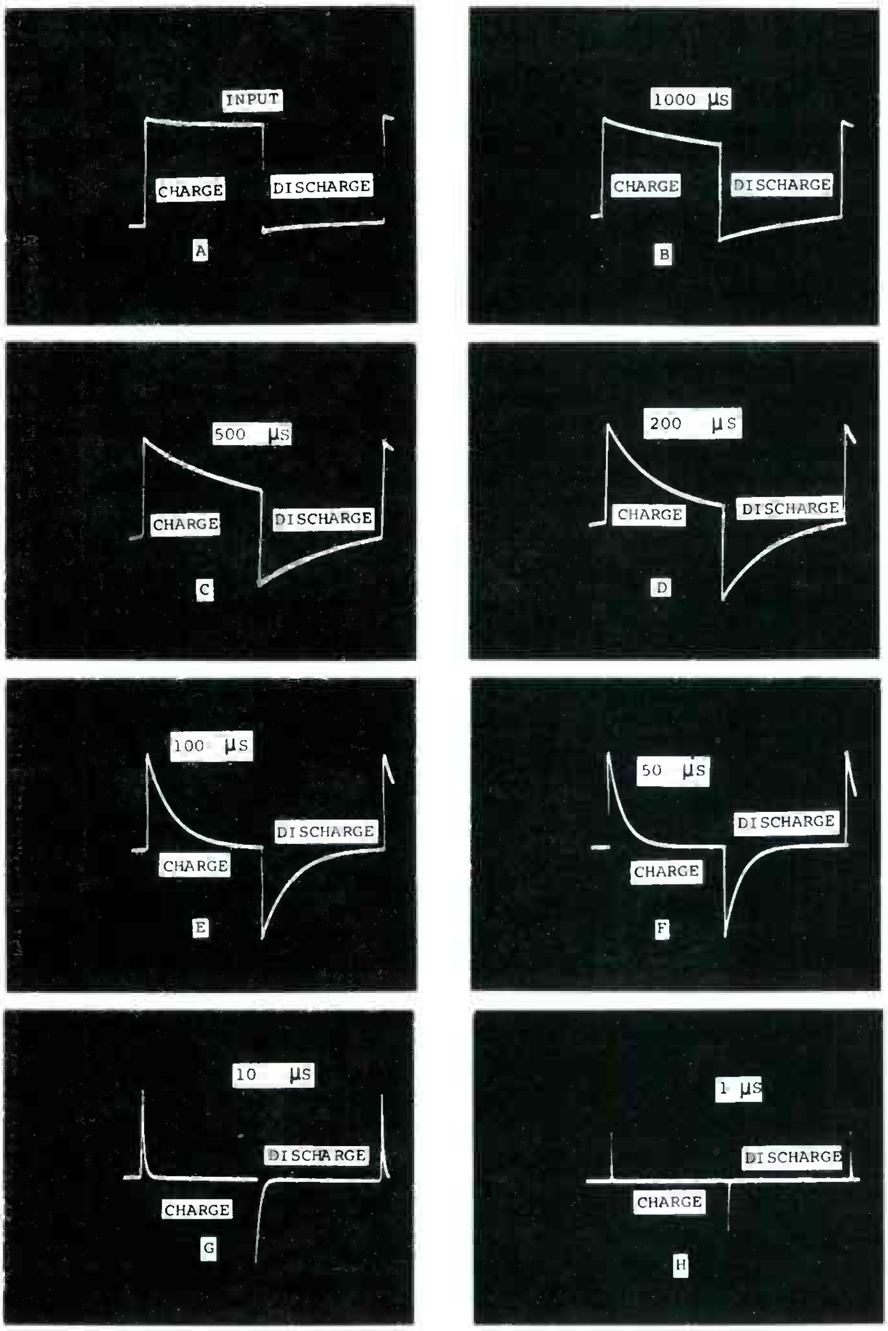


Fig. 10 Square waves can be used to produce quickly the output voltage curves from high-pass filters. A generator of 1000-Hz square waves was connected to C1 (S1 was disconnected) in the circuit shown in Fig. 9A, and the value of R1 was changed to produce the time constants listed. **(A)** The waveform of the input square wave is shown for comparison with the following waveforms. **(B)** A high-pass filter having a time constant of 1000 microseconds tilted slightly the top and bottom of the square wave. **(C)** Tilting of the top and bottom lines was increased, and the lines showed a slight amount of bending, when the time constant was decreased to 500 microseconds. **(D)** A change to 200 microseconds produced increased tilting and bowing of the top and bottom of the square wave. **(E)** A 100 microsecond filter provides 10-RC time constants at 1000 Hz; this will be explained further along. **(F)** A time constant of 50 microseconds changes the square wave into the beginning stages of positive and negative pulses. **(G)** Recognizable pulses are produced by a time constant of 10 microseconds. Amplitude was not decreased very much. **(H)** Narrow positive- and negative-going pulses of decreased amplitude are produced by a time constant of only 1 microsecond. The phase shift at this point was 90 degrees leading.

more slowly than stated in the previous example (or when the time constant is made shorter and the same switching cycle retained), the output voltage decreases more before the next switching. However, the rate of decrease is linear. Therefore, a graph of the output voltage would show a square wave whose top and bottom lines are straight, but tilted. This is the classic symptom, when square wave analysis is used, of loss of frequencies below the repetition rate of the square wave.

Square waves and high-pass filters produce capacitance current waveforms

In Fig. 10 are shown the changes to a 1000-Hz square wave produced by a high-pass filter when the time constant was decreased in steps.

Glance along the row of waveforms and notice that the square waves first tilt at the top and bottom. Then the tilt becomes a parabola, and finally, the parabola becomes a sharp pulse.

A visual illustration of leading phase

The double trace waveform in Fig. 11 shows the input square wave in relationship to the positive and negative output pulses which resulted when the high-pass filter had a very short time constant. The pulses of the output signal are ¼ cycle (90 degrees) to the left (leading phase) of the center (average) of the input voltage. This is an indication that the output pulses have a leading phase of 90 degrees relative to the input signal.

When a sine wave of the same frequency as the repetition rate of the square wave was channeled through the same filter, the amplitude was reduced to less than 5 percent, and the phase measured a leading 90 degrees.

One cycle is required for a change of phase

The first cycle of a sine wave which passes through a high-pass filter is narrowed by the leading phase action so that it is narrowed laterally, as shown by an artists touchup in Fig. 12.

One Proof Of The Time Constant Theory

The output waveform produced by the charging and discharging of a high-pass filter, such as the one shown in Fig. 9A, usually is graphed as shown in Fig. 9B. One question arises: How does such a curve relate to frequency? An experiment and the use of some simple mathematics answered the question.

A 1000-Hz signal requires 1000 microseconds for the completion of each complete cycle. Also, one complete charge-and-discharge period of a time-constant circuit requires 10 time constants.

Therefore, 1000 microseconds divided by the 10 time constants equals 100 microseconds. This is the time constant required, according to theory, to produce the classic graph-type display of one charging and one discharging cycle.

A 100 microsecond high-pass filter, using the circuit shown in Fig. 9A with a .01 capacitance and a 10K-ohm resistance, was constructed and supplied with a 1000 Hz square wave. The resulting waveform is shown in Fig. 9B, complete with the graph lines as proof of the performance. One time constant is the amount of time necessary for the output of a high-pass filter to decrease to 36.8 percent of the input voltage. Also, at the end of the first 5 time constants, the output voltage should be zero.

In this case, theory and practice were in agreement.

Square wave analysis

Analysis of the frequency response of video and audio amplifier circuits by the change of waveform of square waves passed through the circuit is an old and time-tested technique. Refer to the May, 1971 issue of ELECTRONIC SERVICING starting on page 56 for a complete discussion of that subject.

If you noticed some similarity of the waveforms in the previous article and the ones here, you have a good memory.

Square-wave analysis actually is a rapid method of graphing the **composite** of all the time-constant filters in the circuit under test. The graph of the time-constant, in turn, indicates the approximate frequency response and the phase response.

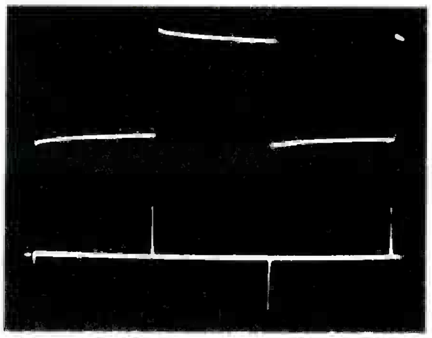


Fig. 11 This double-exposure photograph shows the input square wave and the pulses produced by a time constant of 1 microsecond. Considering the portion of the cycle which represents the average voltage, the average pulse voltage occurs at nearly 0 degrees, and the average square wave voltage occurs at the center of the top line, or 90 degrees. Therefore, a leading phase of 90 degrees of the output waveform relative to the input waveform is indicated.

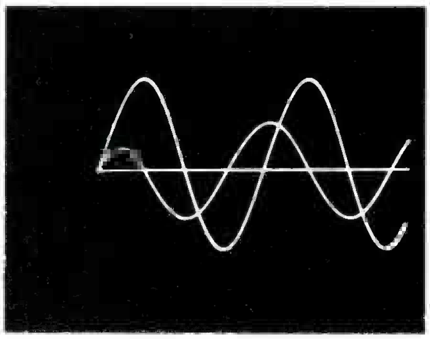


Fig. 12 The first cycle of a series of sine waves which has the phase made leading by passage through a high-pass filter is narrowed by the action of the short time constant. If this action could be seen with a scope, it would appear somewhat similar to the artists touchup of the first cycle.

Comments

Time-constant filters appear to affect sine waves and square waves differently. A low-pass filter which greatly decreases the amplitude of a sine wave and delays its phase, seems merely to round the corners of a square wave without changing either the amplitude or phase.

The explanation for this paradox can be found in the composition of the frequencies in these two waveforms.

A pure sine wave has only one frequency, the fundamental, which is also the repetition rate.

A square wave is very different. It is composed of a fundamental (also called the repetition rate) and dozens of odd harmonics. The even harmonics, 2nd, 4th, etc. are missing. The following is a partial listing of the harmonics and their percentages of amplitude relative to the fundamental:

- fundamental 100 percent
- 3rd harmonic 33 percent
- 5th harmonic 20 percent
- 7th harmonic 14 percent
- 9th harmonic 11 percent
- 11th harmonic 9 percent
- 99th harmonic 1 percent
- higher harmonics are present also in proportional amounts.

A filter affects differently the amplitude and phase of each individual harmonic. The higher harmonics are affected the most.

Consider a low-pass filter of 100 microseconds (which produced the square wave shown in Fig. 6D). The amplitude of the square wave is unchanged, but a sine wave of the same frequency was attenuated about 15 per cent. Also, the higher harmonics of the square wave are greatly attenuated and moved to the right because their phase has been delayed.

Use the analysis of square waves to estimate frequency response. But just remember that the change in waveform is due to the action of the time constant (the charging and discharging of the capacitance). The change of frequency response is the by-product of the time constant, not the reverse.

Next Month

Addition and subtraction of sine waves having various phase relationships, and a description of the actions in chroma demodulators will be discussed next month in Shop Talk. For the first time, we believe, actual waveforms obtained from various types of chroma demodulators will be featured. □

better
management guides

by Robert G. Amick/ES Business Consultant

FLAT-RATE PRICING

The hourly rate, and starting an incentive plan

In previous parts of this article, the ES Business Consultant explained the reasons why pricing service by the hour limited potential profits, and why shop owners should switch to a flat-rate pricing system.

Part 3 tells you how to start an incentive-pay plan for your technicians, and gives a method of calculating the hourly rate you should charge to provide the profit you need and desire.

Starting An Incentive-Pay Plan

An incentive-pay plan for your employees means that your technicians will earn according to how they produce. Such a plan is essential to encourage them to spend less time on each job, and that is necessary if you are to profit from using a flat-rate system.

Most incentive-pay plans compensate each technician with a percentage—usually 45 to 50 percent —of the gross labor income he produces. This percentage covers labor income only. Many consumer-protection groups disapprove of any incentives which might lead to the excessive sale of parts.

If your business activity is seasonal, or subject to large fluctuations, you also might guarantee a minimum wage. This minimum could be 75 to 80 percent of his average earnings.

Details of any incentive plan you develop must be set by **your** shop conditions: cost of doing business, required profit margin, and similar factors. And, of course, it must meet current requirements of federal and state labor laws.

As a general rule, direct labor costs (compensation to technicians) should not run higher than 60 percent of the total service labor sales. Fifty percent is probably ideal. This percentage represents his total compensation for the settlement period (week, month, or quarter, as best suits your operation). You deduct whatever he's drawn under his guarantee, and pay him the difference. If slack business means his guarantee isn't met, or is barely met by his percentage of gross, you pay the guaranteed amount and forget it. After all, it **is** a guarantee—and your situation is no different than it would be if you were paying him a salary during a slack period.

Since direct compensation is tied to service labor sales, direct service labor **cost** does not rise as your shop performs more work. Productivity rewards you with higher net income from labor sales, and also rewards your technicians.

Some of these previous points need to be clarified by additional details. First, the incentive-pay plan.

Your payroll records should include a worksheet (similar to the one shown in Fig. 1) in which the service labor sales of each technician (jobs performed and labor charged) are listed. At the end of the settlement period, you compute his earned share of labor sales, and pay the excess over his guarantee. His worksheet also should include the normal accounting record of total compensation, withholdings and net pay as it does in the case of a regular hourly-wage worker.

Two points are worth special attention. A job record is necessary to furnish a check against errors, and to keep track of callbacks. Naturally, an incentive pay program includes a penalty for callback work, to discourage loss of work-quality for the sake of faster work. If the same job must be redone at no charge and is assigned to the same technician, he certainly can't be paid for the rework. However, if the rework must be assigned to someone else, this second technician should not be penalized for the failure of the other.

Whatever formula is evolved should take into consideration that the shop loses money on rework; therefore, the first technician must be penalized. This is the reason some shops have an inverse relationship between incentive pay versus the callback rate. That is, the penalty for a callback is larger than was the original incentive reward. This en-

PAYROLL WORK SHEET—Fred Ohm, April

Date	Job Ticket	Operation	Type, Make Chassis	SERVICE LABOR SALES: Service Labor (Customer)	Service Labor (Internal)	Total
Apr. 1	#3031	Diagnose and replace defective horizontal output transformer	Color TV RCA CTC16	24.50		24.50
Apr. 1	#3032	Complete IF and Chroma alignment	Color TV Zenith 25LC30	38.50		38.50
Apr. 1	#3033	Clean tuner, check and replace defective tubes	B-W TV (trade-in) Admiral ID7		12.50	12.50
Apr. 1	#3034	Replace defective CRT, color setup	Color TV Magnavox T920	32.50		32.50
Apr. 2	#3035	Diagnose and replace defective capacitor in video amplifier	Color TV GE CB	22.50		22.50
Apr. Total to Shop LABOR SALES				$1643.00	$152.00	$1795.00
Apr. Total to COST OF SHOP LABOR SALES				$739.35	$68.40	$807.75*

Summary of Fred Ohm's Payroll and Earnings Record:

April	Guarantee	DEDUCTIONS: Social Security	Fed. Income Tax	State Income Tax	Group Insurance	Total	Amount Paid
1st week	140.00	6.72	21.00	2.80	1.90	32.42	107.58
2nd week	140.00	6.72	21.00	2.80	1.90	32.42	107.58
3rd week	140.00	6.72	21.00	2.80	1.90	32.42	107.58
4th week	140.00	6.72	21.00	2.80	1.90	32.42	107.58
Total Guarantee	560.00	26.88	84.00	11.20	7.60	129.68	430.32
Earned share of service labor sales*	807.75						
Difference owed Ohm	247.75	11.89	37.16	4.95	....	54.00	193.75

NOTE: * $807.75 (45% of labor sales) has been earned during period. Against these earnings technician has drawn his guarantee. If earnings should be less than guarantee, technician retains guarantee drawing and does not owe shop anything.

Fig. 1 Above, sample of a payroll work sheet to be made out for each technician.

1) Technician Wages and related payroll expenses	+	Shop Operating Expenses	+	General and Administrative Expenses	=	Total Cost to Produce Service Labor
2) Total Cost To Produce Service Labor	+	Desired Profit	=	Total Service Labor Revenue Required		
3) Manhours available during period	×	% of labor recovered for direct sale to customers	=	Manhours available for direct sale		
4) Total Service Labor Revenue Required	÷	Manhours available for sale	=	MINIMUM HOURLY RATE REQUIRED TO PRODUCE DESIRED PROFIT		

Fig. 2 Left, method for computing hourly service labor charge.

Fig. 3

FACTOR	UNDER HOURLY RATE	UNDER FLAT RATE
1. Hourly Yield (Total Labor Sales per Hour)	Variable. Low until it equals hourly rate, which it cannot exceed	Variable. Limited only by productivity, it exceeds hourly rate with high productivity
2. Labor Recovery Rate	Variable, but immaterial since it penalizes customer for your inefficiency, or rewards him for your efficiency	Variable. Bears directly on profit; rewards or penalties accrue to the worker and shop
3. Direct Labor Cost	Constant where it hurts you—variable where it hurts you. Up to point where all available hours are sold, it is constant. Rises with overtime to reduce profit	Constant at low volume (because of workers' guarantees) and a constant percentage of sales at high productivity levels
4. Profit	Variable. When all hours are not sold it is low, rises to maximum when all hours are sold. Drops again, above this point	Variable. Once productivity exceeds level needed to meet guarantees, profit rises directly with productivity

Fig. 3 A comparison of the variable and constant factors affecting profit in hourly versus flat-rate pricing systems.

courages better work, as well as faster work.

The other point applies to shops which also sell merchandise. If you recondition and sell trade-ins, your technicians should be compensated for this work at the same rate as that for outside labor sales. Otherwise, the low-paying jobs (internal labor sales) will log-jam and be neglected.

The uniform price for external and internal labor sales also applies to maintaining sales and service departments as separate profit centers. Neither should subsidize the operation of the other.

Figuring The Hourly Rate

Your hourly service charge should be determined by **your** costs, **your** labor recovery rate, **your** desired level of profit, and **your** market conditions.

This means you'll be using your previous year's records to furnish part of the data upon which your hourly rate is to be based.

In turn, you must review cost and productivity data periodically and adjust your rate, if necessary, to keep it up to date.

Most of the steps necessary to figure your hourly service labor charges are fairly simple. However, the calculation cannot be made without your past expense records.

The total cost of producing service labor is the total of: the technician's wages plus your related payroll expenses; shop operating expenses and administrative expenses. This is shown as Item 1 in Fig. 2. Your annual summary for the previous year provides this information.

Next, you compute the total service revenue required, by adding the total cost to produce service labor to your desired profit, as shown in Item 2 of Fig. 2. Desired profit can be derived by computing return on investment, or by using industry averages for your type of business. Return on investment isn't too desirable for small businesses with small total investments. It doesn't produce much return. Industry averages usually give you a profit figure as a "percentage of total labor sales receipts before taxes". Some figures, published by industry associations or business data services, classify individual businesses by size. That is, they give data on groups within each category on the basis of annual volume, number of employees (or payroll), or other factors, to make the data more useful. In other words, you must make allowances for the differences between your shop and the "average".

Next you determine the manhours available for direct sale. From your payroll records, you figure how much time you bought last year. Not all of this time, as pointed out earlier, is productive time. It must be reduced for vacations, which are predictable. Then again it must be reduced for lost time such as sickness, coffee-breaks, parts chasing, phone calls, time-card keeping, and other time lost in non-productive activities. These are all variables and not very predictable.

The variables can be averaged out by using the ratio of hours actually sold to the hours available for sale. The easiest way to figure hours sold is to use your last year's records, and divide your total annual labor receipts by your hourly service labor charge. Then dividing what you sold by what you had available to sell gives you the percentage of the total labor time that actually was used. This is known as the labor-recovery rate, and is expressed as a percentage of the total time for sale. Total hours for direct sale (productive work-hours) is the product of total hours available times the labor recovery rate. This is covered by Item 3 in Fig. 2.

You know the total service labor revenue required. Also, you know the work-hours required to produce it. So the final step, as shown in Item 4 of Fig. 2, is to figure the minimum hourly rate you must charge to cover your costs and produce the

Here is an example showing the complete computation of a profitable hourly labor charge.

STEP 1A—Computing Service Labor Costs for Ohm's TV and Radio

WAGES				
Technician	Bob	Joe	Sam	TOTAL
Hours per year	2496	2496	2496	
Multiply by hourly wage	× $4.00	× $3.50	× $3.00	
Annual wages	$9984	$8736	$7488	$26,208
OTHER PAYROLL COSTS				
Social Security	$317	$317	$317	
Life & Medical Insurance	120	120	120	
Unemployment	299	262	224	
	$736	$699	$661	$2,096
Total Service Labor Costs				$28,304

1B—Computing Total Operating, General and Administrative Expenses for Ohm's TV and Radio

OPERATING EXPENSES		
Owner's salary (including all payroll costs)	$13,114	
Vehicle operating and maintenance	1,400	
Vehicle depreciation	1,600	
Shop equipment depreciation	900	
Expendable items, shop	350	
Service literature	75	
		$17,439
GENERAL AND ADMINISTRATIVE EXPENSES		
Secretary wages	5,200	
Lease	3,600	
Utilities	1,000	
Telephone	550	
Office equipment depreciation	100	
Office supplies	450	
Advertising/Promotion	600	
Legal, Audit fees	300	
Insurance (all other than employee)	250	
Taxes (other than Fed. and State income)	600	
Interest and Bank Charges	500	
Dues, subscriptions, license fees, etc.	250	
Misc. (bad debts, etc.)	250	
		13,450
Total Operating, General and Administrative Expenses		$30,889

1C—Computing Total Cost of Producing Service Labor—Ohm's Radio & TV

Service Labor	$28,304
Operating, General and Administrative (Fig. 3)	30,889
Total	$59,193

STEP 2—Computing Total Annual Service Labor Revenue Required to Produce Desired Profit For Ohm's TV and Radio

Total Cost of Producing Labor	$59,193
Profit Desired (20% of Labor Sales before Taxes)	× .20
	$11,838
Total Expenses	$59,193
Desired Profit	+ 11,838
Service Labor Revenue Required	$71,031

STEP 3—Labor Recovery Rate: Computing Service Labor Manhours That Actually Will Be Available For Direct Sale

Hours worked per year per technician	2496
Number of technicians	× 3
Shop service labor manhours per year	7488
Minus manhours lost to vacations (2 weeks per technician)	— 288
Manhours on job	7200
Labor recovery rate (80%)	× .80
Total service labor manhours available for direct sale	5760

STEP 4—Computing Minimum Hourly Rate Required to Produce Desired Profit

$$\frac{\text{Total Service Labor Revenue Required}}{\text{Service Labor Manhours Available for Direct Sale (Fig. 6)}} = \frac{\$71{,}031}{5760 \text{ hours}} = \$12.33 \text{ Minimum Hourly Service Labor Charge}$$

Minimum Hourly Service Labor Charge Varies With Labor Recovery Rate*

Labor Recovery Rate (%)	Minimum Hourly Service Labor Charge
70	$14.09
80	12.33
85	11.61
90	10.96

*To determine labor recovery rate, divide last year's total annual receipts by the hourly service labor rate charged; then divide the resultant figure by the manhours actually available for sale:

$$\frac{\text{Total Annual Receipts}}{\text{Hourly Service Labor Charge}} = \text{Manhours Actually Sold}$$

$$\frac{\text{Manhours Actually Sold}}{\text{Manhours Available for Sale}} = \text{Labor Recovery Rate (\%)}$$

profit you want and need. This minimum hourly rate is the revenue-producing hours divided into the service revenue that is required.

When you think about these factors, you'll see that some are constants, or are variable only up to the fixed limit under an hourly-rate labor charge plan. But, under flat-rate pricing, some of the key factors become variables which **you** can manipulate so they favor **you**. This change is charted in Fig. 3.

Good management, constant improvement in productivity, careful cost control, and aggressive advertising and promotion can push profits up near the maximum potential of your market. By contrast, hourly-rate pricing clamps a limit on the variables you want to control. Just when you'd like them to rise, they're turned back at the low ceiling.

It's not a case of "the sky's the limit" with flat-rate pricing. But the system will get you out from under that low ceiling. □

test equipment report

Features and/or specifications listed are obtained from manufacturers reports. For more information about any product listed, circle the associated number on the reader service card in this issue.

Miniature FET Multimeter

Product: Little Henry Model FE23
Manufacturer: Sencore, Inc.
Function and/or Application: Measures voltages, currents and resistances.
Features: Pushbutton selection of functions and ranges, meter-overload protection, a lead compartment with an interlock switch

to turn off all batteries, a lighted meter scale with on-off switch, durable plastic case, and a high-sensitivity of 15 megohms on the DC voltage ranges.
Specifications: Not available.
Price: Model FE23 sells for $80.00.

Circle 50 on literature card

Transistor/Diode Checker

Product: Model WC-528A Quicktracer
Manufacturer: RCA Electronic Components
Function and/or Application: Checks diodes and transistors (except FET's) either in- or out-of-circuit, when a scope is used as a read-out.
Features: Checks the base-emitter or base-collector junctions

for diode characteristics, includes a built-in transformer and test leads, the case is impact-resistant plastic, and the power applied to the transistors is limited to prevent damage. An instruction book is included. Also enclosed is an extensive application section prepared by the RCA Consumer Electronics group which gives in-circuit waveforms for the RCA CTC44, 51, 52, 53 and 54 solid-state receivers.
Specifications: Not available.
Price: The WC-528A Quicktracer sells for $14.75.

Circle 51 on literature card

Test Clip For Integrated Circuits

Product: Model 3916 Test Clip
Manufacturer: Pomona Electronics Co., Inc.
Function and/or Application: Provides elevated test points for testing of the 14- or 16-lead integrated circuits.
Features: Works similarly to a clothes pin: you squeeze the top together to open the jaws, then position the clip over the IC and release. Body of the clip is molded of high-density acetal copolymer, and the contact wires are of gold-plated phosphor bronze.
Specifications: Not available.
Price: Price of each Model 3916 Test Clip is $4.95. ☐

Circle 52 on literature card

For more information about above products use reader service card

bookreview

Fire & Theft Security Systems
Author: Byron Wels
Publisher: Tab Books, Blue Ridge Summit, Pa.
Size: 5 5/8 × 8 3/4 inches, 176 pages
Price: Softcover $4.95; hardcover $8.95.

All basic systems of fire and theft protection from simple door and window switches to elaborate microwave sensing systems are described in extensive detail. Other related facts ranging from how to develop your own system, or obtain a patent on your security invention, to installation tips also are covered. Electronic technicians will find enough solid information here to enable them to protect their own shops, or to enter the field of installing and repairing security systems.

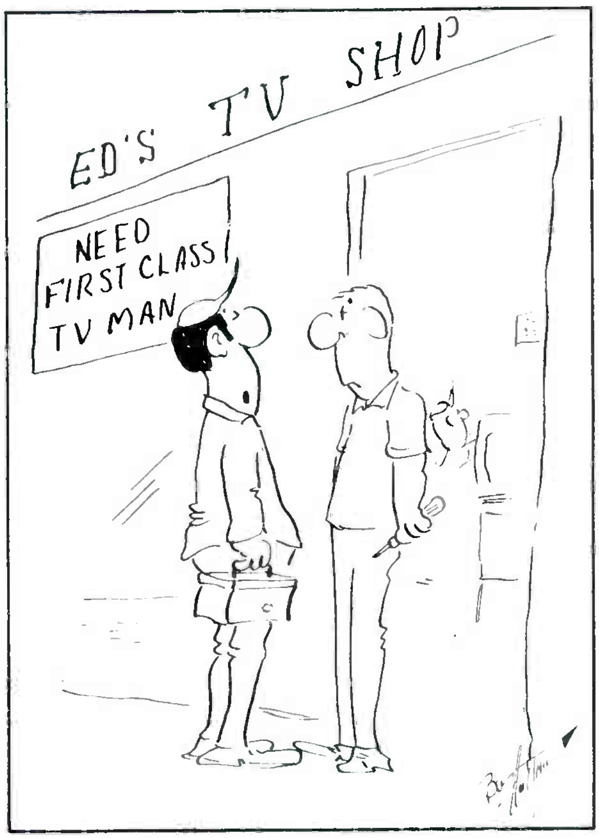
Contents: Personal & Property Security Systems—Selling Protection—"Rolling Your Own"—Service & Maintenance—Detectors—Control Units & System Considerations—How Much Must You "Pay"?—Commercial Equipment.

Transistor TV Training Course
Author: Robert G. Middleton
Publisher: Howard W. Sams & Co., Inc., Indianapolis, Indiana
Size: 8 1/2 × 11 inches, 136 pages
Price: Softcover $4.50.

This second edition of a popular training manual for transistorized television receivers has been revised to include: integrated circuits; dual-gate MOSFETS, SCR sweep circuits, and other new developments of the solid-state field. All sections of television receivers are explained, and many illustrations are included. Review questions are included at the end of each chapter.

The training course is intended for use by television technicians and technical schools.

Contents: Transistor Applications In Television Receivers—Tuners—Video IF And Detector Sections—Video Amplifiers—AGC Systems—Horizontal- And Vertical-Sync Sections—Vertical-Sweep System—Horizontal-AFC And Oscillator Sections—Horizontal-Output And High-Voltage Sections—Transistor Color-TV Receivers—Low-Voltage Power Supplies.□



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Circle 17 on literature card

New in home cassette machines . . .

The bi-peripheral drive

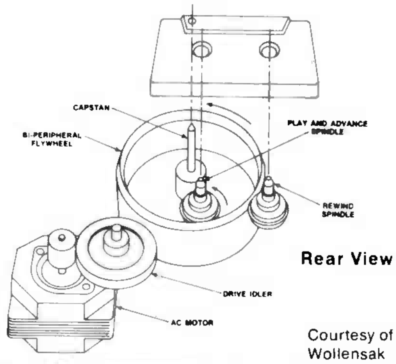
by Forest H. Belt

There is no mystery about the bi-peripheral drive system for tape cassette machines. But it is new enough that the following descriptions of the mechanical actions might save you hours of trying to analyze a defective unit.

Cassette tape players are gaining popularity, there's no doubt about it. Microgap heads, Dolby circuitry, and chromium-dioxide tapes extend the high-frequency response and reduce the hiss. And these features, along with increased programming in stereo, have attracted even the "golden ear" hi-fi buffs to cassettes. So much consumer interest stimulates the manufacturers to make continual improvements.

One of the latest improvements is in tape-speed control. This one was engineered by the Wollensak Division of the 3M Company. They have designed a different type of drive mechanism for home cassette machines.

Many cassette mechanisms use a flywheel to hold the capstan speed constant. But compact unit designs prevent the use of large, heavy flywheels, and that slow 1⅞ inches-per-second tape speed might vary just enough to annoy critical music listeners.



Courtesy of Wollensak

Fig. 1 This simplified drawing of the patented Wollensak bi-peripheral drive mechanism shows the AC motor, rim-driven flywheel, and the positioning of the spindles relative to the flywheel.

Cassette decks for use in homes have more interior space than do portables. Their AC-powered motors and larger, more-precisely-balanced flywheels help to stabilize the tape speed. Less than .25 per cent wow and flutter are claimed for some machines.

From Belts To Tires

The basic mechanical operation of the Wollensak tape recorder is shown in Fig. 1. An AC motor friction drives a rubber-rimmed idler wheel. In turn, the rubber tire of the idler wheel presses against the outside of the flywheel and rotates it. This type of drive has the potential for producing a more even speed than has the type with a DC motor and a belt drive.

That unique flywheel is the big difference. It is called bi-peripheral. The periphery has inside and outside beveled edges that are used in the operation of the mechanism. Hence, the term bi-peripheral.

One action not shown in Fig. 1 is that of the large center hub of the flywheel. Also there is a pulley groove on the underside of the flywheel which can't be seen in the sketch. These features will be shown in pictures.

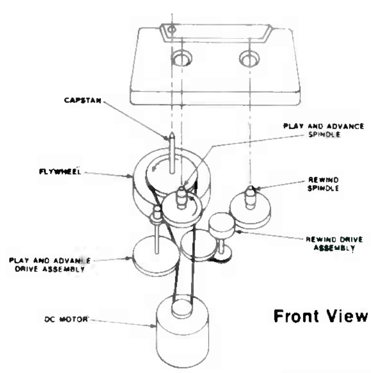
A Typical Cassette Mechanism

If you have worked on cassette machines, you're familiar with the typical drive mechanism shown here. A DC motor with a pulley on its shaft drives a rubber belt. The belt goes around a pulley that is part of the flywheel. When the motor runs, the flywheel turns. The capstan, an extension of the flywheel shaft, rotates to drive the tape.

A third pulley is driven by the same rubber belt. This pulley is a part of the Play And Advance Assembly, and it is rotated by side pressure of the rubber belt. A fourth pulley on top of the assembly rotates the Play And Advance Spindle which winds the tape inside the cassette. To accommodate the changing size of the diameter of the wound tape, slippage occurs between the Advance Drive Assembly and the Advance Spindle.

When the capstan is disengaged during Fast Forward operation, the friction between the Play And Advance Drive Assembly and the Play And Advance Spindle is sufficient so there is no slippage between them, and the tape is transported rapidly forward.

During tape rewind, the flywheel rim-drives another (not shown) and it belt-drives the Rewind Drive Assembly. Contact between the top wheel of the Rewind Drive Assembly and the wheel of the Rewind Spindle rapidly rotates the Rewind Drive Assembly to provide Fast Rewind.



Courtesy of Wollensak

Normal tape movement

Stereo cassette decks that use this patented drive (only Wollensak and Advent do, as of this writing) have all the usual functions. They include Play, Record, Fast Forward, Rewind, Pause, and Stop.

The motor, the drive idler, and the bi-peripheral flywheel turn constantly while the machine is on. Install a cassette and push down the Play button (shown in Fig. 2A) to start the tape motion and turn on the amplifier.

The Play button rocks a Teflon pivot arm. A flat metal lever, pushed by the pivot arm, moves a flat metal arm that connects to the play slide. You can see them all in Fig. 2A. The movement of this lever assembly shoves the play slide backwards.

Fig. 2B shows the long, narrow plate on which the heads and pinch roller are mounted. A cassette has been inserted to illustrate relative positions, and the Play button has been pushed down. The heads are against the tape and the pinch roller is pressing the capstan. With the motor running, the tape is moving at a steady 1⅞ ips.

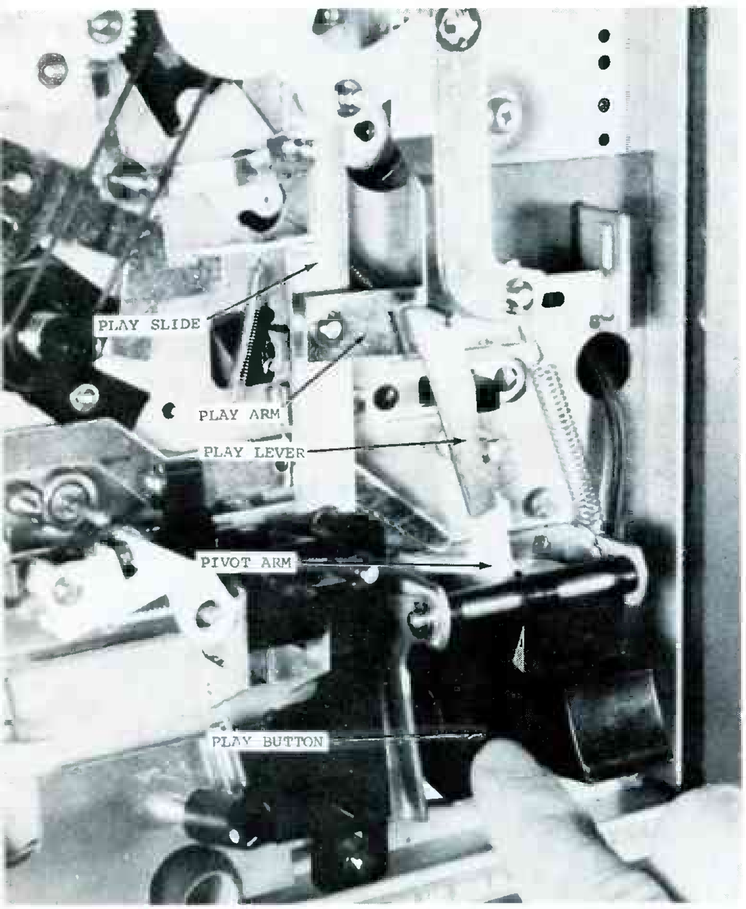
Something else is happening down inside. Remember the enlarged hub at the base of the capstan? A rubber-tired idler (not shown in Fig. 1) has moved over to that hub. You can see the top of the idler in Fig. 2C. Pushing the idler against the hub also places it in contact with a rubber tire on the base of the play spindle (in most machines is called a **takeup spindle**). The revolving flywheel spins the idler, which turns the spindle to wind the tape inside the cassette.

Stereo Recording

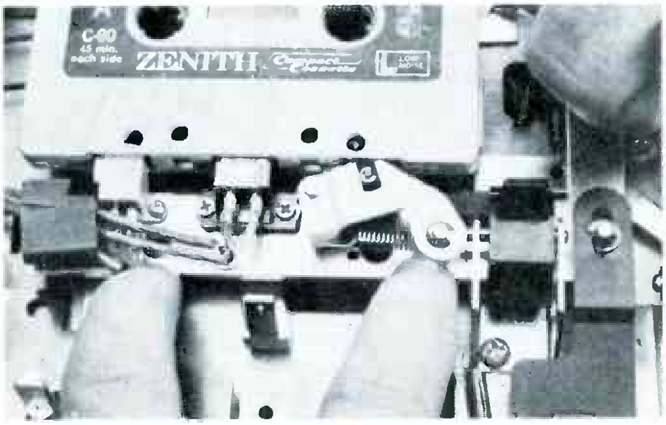
The tape drive is the same for recording as for playback. You merely hold down the Record button (shown in Fig. 3A) before you push the Play button. Notice the large shift plate the Record button pushes down.

Of course, if you've inserted a prerecorded cassette, the automatic lockout system prevents you from depressing the Record button. Fig. 3B shows the anti-record feeler pushed back by the tab in a blank cassette. As you probably know, the tabs are removed from an already-recorded cassette. In that case, the feeler fits into the hole and is not pushed backwards. Fig. 3C

Fig. 2 The location of the parts used in the play function.



(A) When the play button is depressed, the play slide, play lever and the pivot arm move to release the brakes, apply drive to the wind assembly and move the capstan roller.



(B) A mounting plate contains the erase head, playback/record head and the capstan pinch roller.

(C) This picture shows the take-up idler which was not included in Fig. 1.

shows the block that prevents downward movement of the record-shift plate.

When a non-recorded cassette is used, the shift plate goes down and is locked down by the Play button. Then a below-deck slide switch transfers the connections of the record/playback head from the input to the output of the amplifiers. The same switch connects the input jacks. The unit obtains recording signals from external hi-fi amplifiers. Mechanically, the Play button has moved the heads and pressure roller into position and activated the takeup-drive idler. The tape moves the same as it does for playback.

Fast forward and rewind

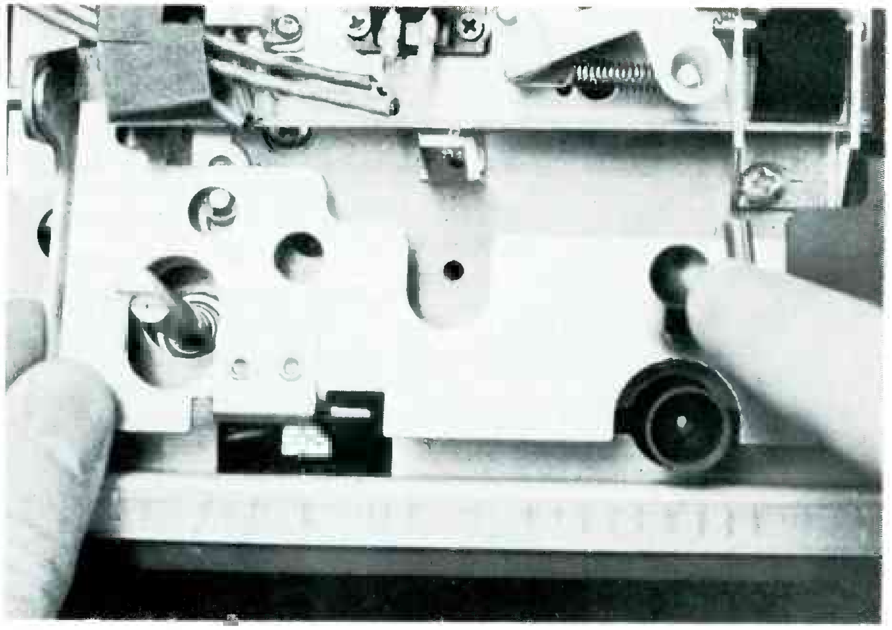
Here's where the bi-peripheral characteristic of the flywheel comes into play. The shifting of fast-speed drives shows no resemblance to the action in other machines.

Fig. 4A pictures the fast-speed lever, the spindle-shift bars, and a play-lockout lever. You can see the advance and rewind spindles, and the brake assemblies. You have to look closely to see that the shift bars each have an arm reaching underneath the visible part of the spindles. These arms act as brakes, when they touch the tires of the spindles. A still photo can't illustrate the spindles' actions, so I'll describe them.

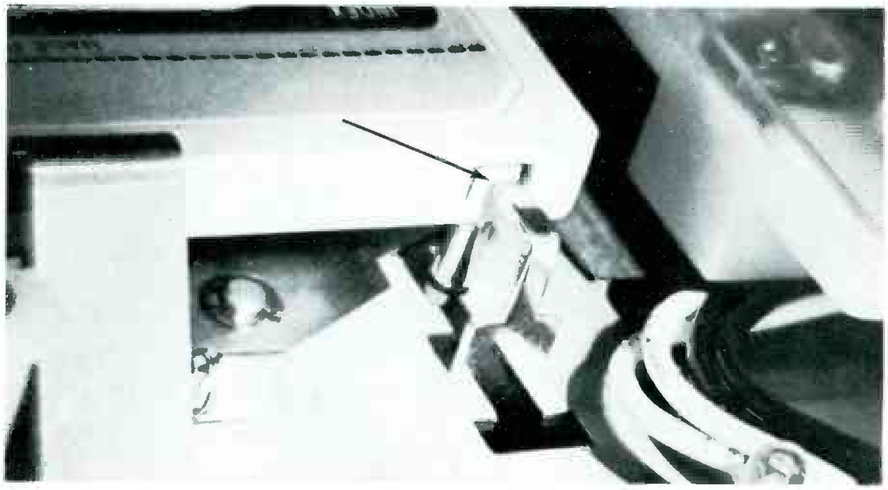
You push the fast-speed lever to the left for Rewind (refer to Fig. 4B). The lockout lever is blocked if the Play button is down. But a little extra pressure on the fast-speed lever causes it to move the Teflon pivot arm (at the Play button), which releases the playback function.

The fast-speed lever pushes the left spindle-shift bar outward. A feeler from the rewind brake is pushed back, and the interlocking construction causes the other brake to move away from the advance spindle. A shift-bar arm down inside pivots, pulling the rewind spindle down into the machine about 1/8 inch. You can see in Fig. 4B that the rubber rim of the spindle contacts the **out-**

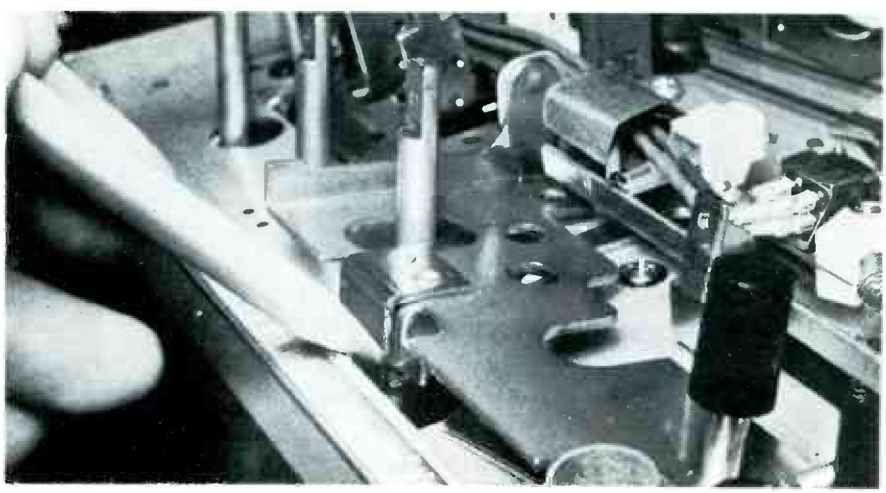
Fig. 3 Additional actions during recording.



(A) Pressure on the recording button pushes the shift plate flat against the deck.

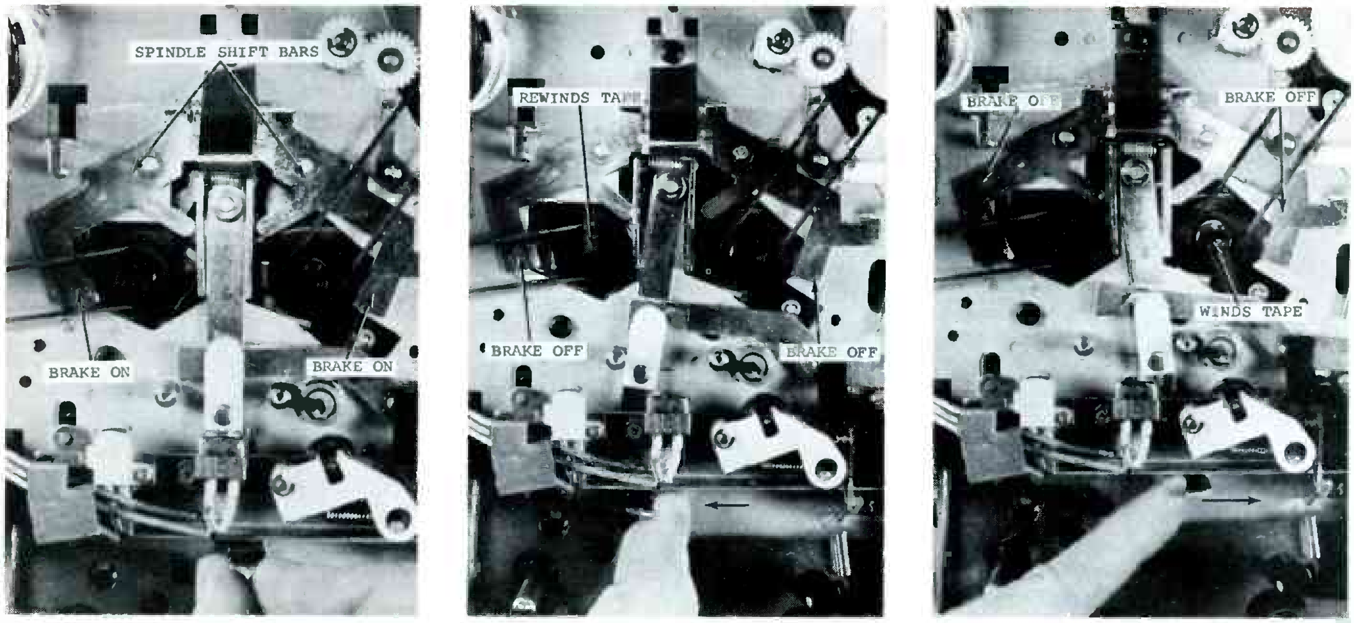


(B) However, the shift plate cannot move unless the tab of a blank cassette pushes the anti-record feeler backwards.



(C) Motion of the shift plate actuates the recording switch.

Fig. 4 Fast-speed wind and rewind actions operate from a shift lever which has shift bars.



(A) Before the fast-speed action is started, the brakes lock the spindle assemblies, and the tires of the spindles do not touch the bevels on the flywheel.

(B) When the lever is moved to the left, the brakes are withdrawn by the spindle-shift bars, and the tire of the rewind-spindle assembly contacts the outside bevel of the flywheel causing fast rewind of the tape.

(C) When the lever is moved to the right, the brakes are unlocked, and the tire of the wind-spindle assembly contacts the inside bevel of the flywheel causing fast-forward winding of the tape.

side of the beveled flywheel periphery. When the flywheel revolves, the spindle rotates and rewinds the tape. The flywheel is large and the spindle circumference is small; therefore, the spindle rotates rapidly in a CW direction.

You push the fast-speed lever to the right for fast forward operation. (See Fig. 4C.) Lockout works the same, preventing playback (or recording) simultaneously with fast speed. The right shift bar moves outward at the top, pivoting the arm underneath. The arm pulls the advance spindle down so its rubber rim contacts the **inside** bevel of the flywheel. The spindle rotates opposite in direction to the rewind spindle, but just about as fast. The shift bar pushes back the takeup brake which, in turn, also pushes back the other brake.

Auxiliary operations

The Pause function operates only during recording or playback. The black-plastic lever is pictured in Fig. 5. Pull the lever toward you to stop movement of the tape. Then move the lever to the left to lock it in Pause position, if desired.

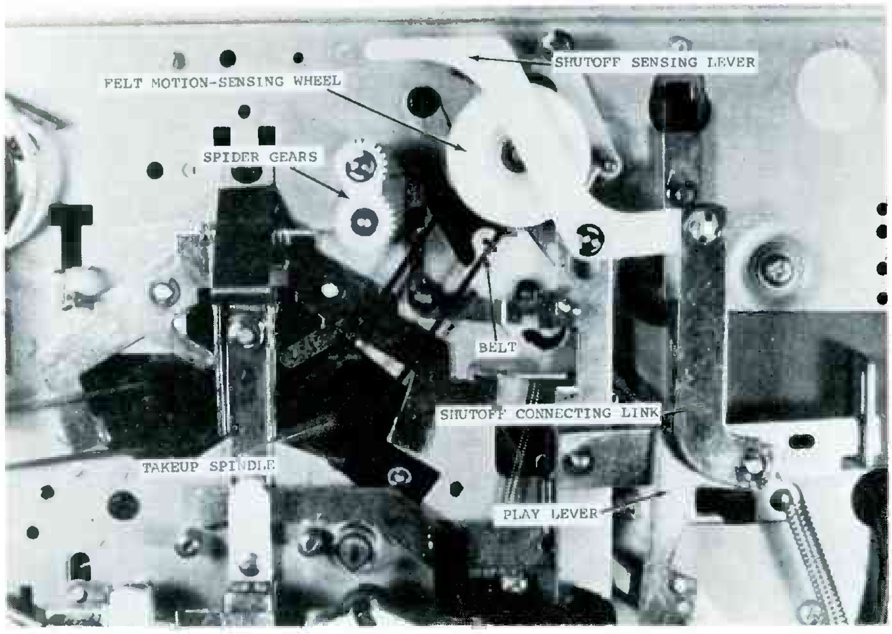
Here's what the lever does. It's mounted on the play slide. Pulling it moves the play slide forward to the Stop position, but without affecting the play pivot or lever (Fig. 2A). The amplifier stays on. But the heads and pinch roller move away from the tape and capstan, and the takeup-drive idler moves back from the takeup spindle. Both brakes move in against their spindles. Tape movement stops until you're ready to end the pause. Release the Pause button, and the recording (or playback) continues.

The bi-peripheral machine also has an unique, automatic shutoff mechanism. It's wholly mechanical, whereas the Staar-type cassette machines use an electronic/electromechanical shutoff system.

The shutoff mechanism consists of three major assemblies. One, a large white Teflon sensing lever, is shown clearly in Fig. 6A

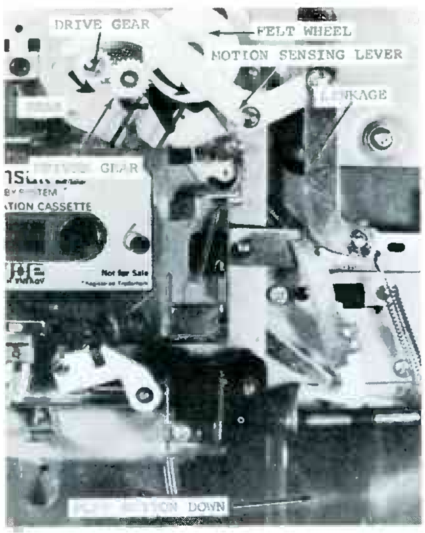
Fig. 5 To stop movement of the tape without causing a popping noise to be recorded on the tape, pull the Pause control towards the front of the machine. Move it sideways to lock it in the pause position. During this function, the play slide pulls back the heads and the pinch roller and stops the takeup spindle, but doesn't shut off the amplifiers.

Fig. 6 Details of the all-mechanical automatic shutoff.

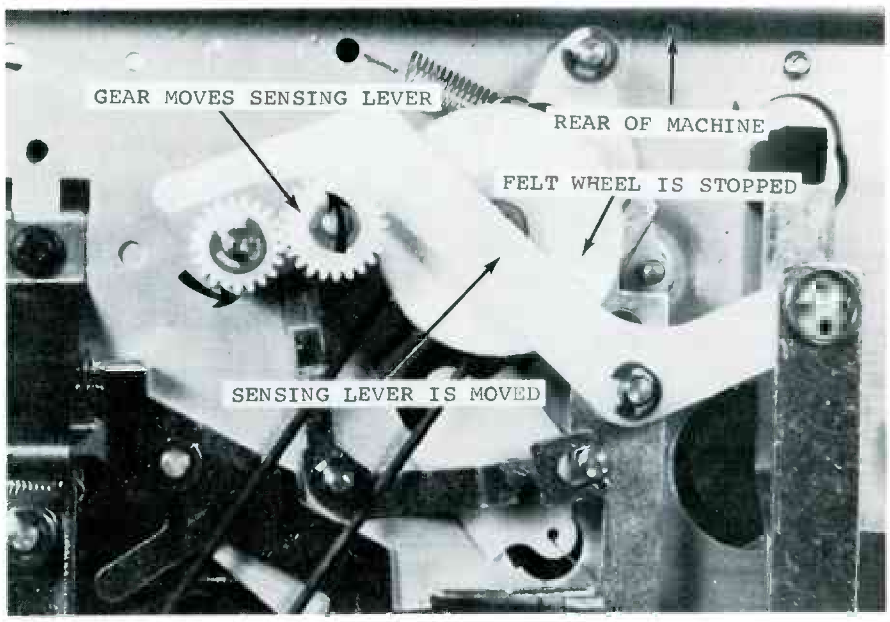


(A) The two spider gears turn all the time the flywheel runs.

(B) But the large, white, felt wheel turns only so long as the takeup spindle turns.



(C) When the tape comes to the end, the felt wheel stops, the driven spider gear "climbs" the felt wheel and pushes the shutoff lever.



(D) A connecting link moves the play lever to shut off the mechanism.

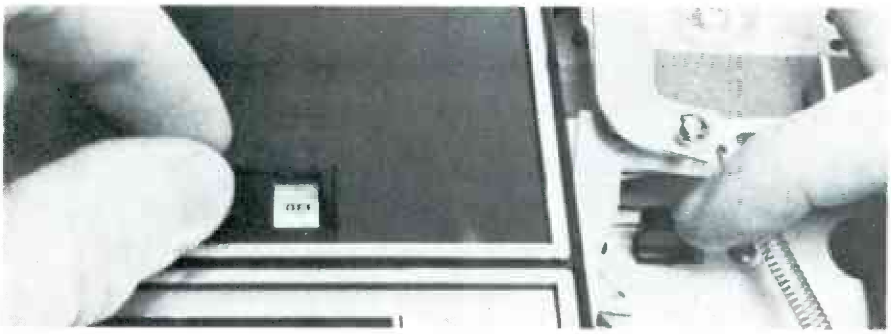
at the resting position. It connects by a metal link to the metal play lever.

The second assembly also can be seen in the same photo. A large felt wheel, called the motion-sensing wheel, is rotated by a rubber belt from the takeup spindle. During play or record operation, this felt wheel turns continuously as the tape winds on the takeup reel in the cassette.

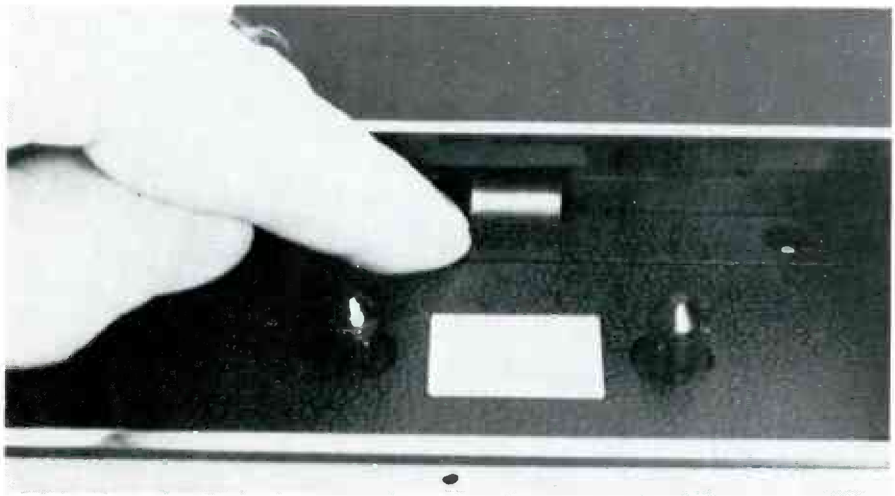
The third assembly of the shutoff mechanism consists of a set of spider gears, a pulley and shaft to turn them, and a belt to rotate the pulley. The spider gears can be seen in Fig. 6A, but the pulley and belt are underneath the chassis; they're pictured in Fig. 6B.

Now, study Fig. 6C. The play button is down, and the machine is operating. The shutoff-sensing lever remains near the two spider gears. They and the motion-sensing wheel are turning the left spider gear (drive gear) counterclockwise, the other gear clockwise, and the felt wheel counterclockwise. In addition, the drive gear, which is the one farthest from the felt wheel, is attempting to swing counterclockwise around itself the bracket holding the other wheel. When the driven gear touches the felt wheel, its circular motion around the driving gear is halted. Whenever a moderate force is encountered, slippage between the driving

Fig. 7 Tips to help in the reassembling of the top.



(A) Align the switch handle with the on-off switch.



(B) Slip the top down from the front over the cassette-pressure spring.

(C) Hold the Rewind/Fast-forward knob forward while you lower the top, then align it so the set screw fits the handle.

gear and its shaft permits the driven gear to stop. Because they are rotating in complementary directions, the driven gear and the felt wheel do not mesh.

When the end of the tape is reached, both spindles stop because the tape is firmly anchored in the casette. The felt wheel stops when the takeup spindle stops. The driven gear is still rotating, so it "climbs" the motionless felt wheel and the entire gear moves in a counterclockwise direction around the drive gear, as shown in Fig. 6D. Quickly, the driven gear encounters the sensing lever and pushes it towards the rear of the mechanism. The sensing lever moves the metal linkage, and in turn, the linkage moves the play button to the Stop position.

The driven spider gear continues on around CCW and positions itself ready for the next sequence of operations.

Reassembling The Machine

Several models of Wollensak cassette machines now use this bi-peripheral drive. In case you work on one, or on an Advent or other brand licensed by 3M to use the mechanism, here are a few hints on getting it apart and back together.

The round knobs, and the flat knob on the Fast Forward/ Rewind lever (Fig. 7C), are set-screw types. Don't try to pull the FF/R knob completely off, however, leave it with the top. Once the top is removed, screws at the four corners hold the chassis to the wooden base.

When reassembling, put the chassis in the base, clearing the line cord through its hole in the bottom. Install the four chassis screws. Fig. 7 illustrates three aids for getting the top back on correctly. (A) Align the on-off switch handle with the position of the slide switch on the chassis. (B) Slip the top down from the front over the cassette-pressure spring. (C) Hold the Fast Forward/Rewind knob all the way forward while you work the top down into place; afterwards you can align it so the set screw fits into the lever handle. □

Decibels in MATV systems

MATV Systems, part 2

by John Rogerson
Technical Director, MATV
Channel Master Div. of
AVNET, Inc.

Measurements of the signal levels obtained from antennas usually are expressed in millionths of a volt (microvolts). However, if readings in microvolts were used in the calculation of gains and losses in the various sections of MATV and CATV systems, it would be necessary to multiply or divide numbers having as many as seven figures. This is not an easy task.

Therefore, calculations of the gains or losses encountered in MATV work are made most often by the addition or subtraction of decibels. There is another reason for the use of decibels in the rating of these signals: The visible effect of the signal strength on the picture quality more closely follows the rating in decibels than it does the rating in microvolts.

The Decibel

A decibel is 1/10 of a bel, a term used by pioneering telephone and telegraph engineers when measuring the amplitudes of audible and electrical signals.

Decibels are the logarithmic ratios between two quantities of voltage, current, or power. Therefore, they have no absolute values. The number of decibels merely shows how much greater or lesser is the amplitude of a signal relative to a pre-established reference.

As a result, decibels do not express this change in the strength of the signal in a linear fashion. For example, a signal of 40 dB is not twice the voltage of a signal of 20 dB. Notice the relationships between voltage and decibels shown by the dual calibration of the meter scale in Fig. 1.

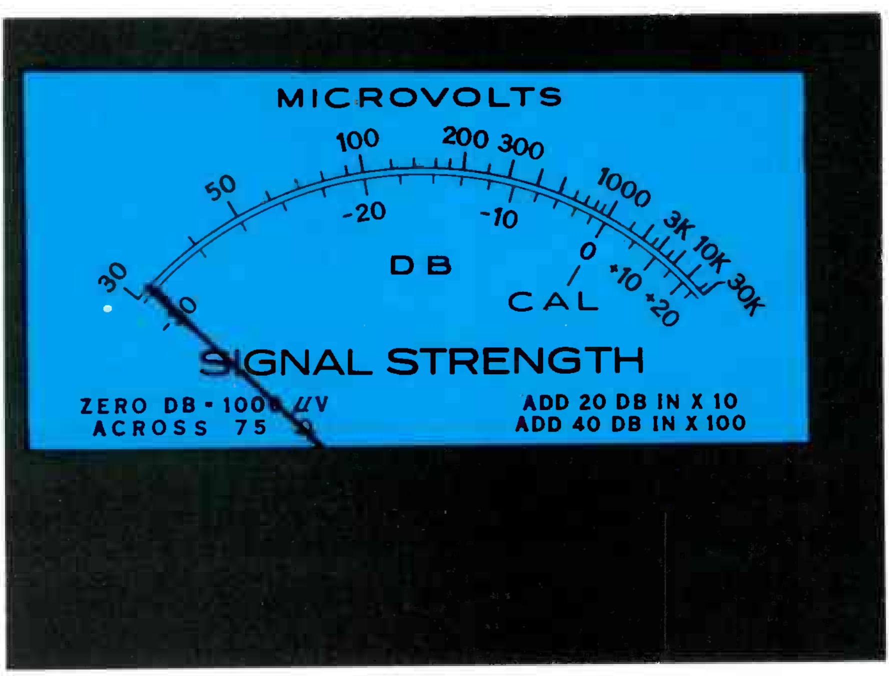


Fig. 1 These are typical calibrations in both dB's and microvolts found on the face of a field-strength meter.

For use in MATV work, zero dB has been chosen as 1000 microvolts across 75 ohms of impedance. The reason this arbitrary figure was selected dates from the early years of television when a signal of approximately 1000 microvolts was necessary to produce steady, snow-free pictures.

The figures in Chart 1 should be used when it is necessary to change from microvolts to decibels, or from decibels to microvolts. For convenience, the microvolts readings have been made approximate.

Decibels To Remember

Some convenient decibel ratios are the following:

- A voltage change of about 11 percent is 1 decibel,
- A voltage change of 1 to 2, or 2 to 1 is 6 dB,
- A voltage change of 1 to 3, or 3 to 1 is about 10 dB,
- A voltage change of 1 to 10, or 10 to 1 is 20 dB.

We recommend that you memorize these few decibel ratings for use in situations where an approximation is sufficiently accurate, and the figures shown in Chart 1 are not available.

dBmV	uV	dBmV	uV	dBmV	uV
-40	10	0	1,000	40	100,000
-39	11	1	1,100	41	110,000
-38	13	2	1,300	42	130,000
-37	14	3	1,400	43	140,000
-36	16	4	1,600	44	160,000
-35	18	5	1,800	45	180,000
-34	20	6	2,000	46	200,000
-33	22	7	2,200	47	220,000
-32	25	8	2,500	48	250,000
-31	28	9	2,800	49	280,000
-30	32	10	3,200	50	320,000
-29	36	11	3,600	51	360,000
-28	40	12	4,000	52	400,000
-27	45	13	4,500	53	450,000
-26	50	14	5,000	54	500,000
-25	56	15	5,600	55	560,000
-24	63	16	6,300	56	630,000
-23	70	17	7,000	57	700,000
-22	80	18	8,000	58	800,000
-21	90	19	9,000	59	900,000
-20	100	20	10,000	60	1.0 volt
-19	110	21	11,000	61	1.1
-18	130	22	13,000	62	1.3
-17	140	23	14,000	63	1.4
-16	160	24	16,000	64	1.6
-15	180	25	18,000	65	1.8
-14	200	26	20,000	66	2.0
-13	220	27	22,000	67	2.2
-12	250	28	25,000	68	2.5
-11	280	29	28,000	69	2.8
-10	320	30	32,000	70	3.2
-9	360	31	36,000	71	3.6
-8	400	32	40,000	72	4.0
-7	450	33	45,000	73	4.5
-6	500	34	50,000	74	5.0
-5	560	35	56,000	75	5.6
-4	630	36	63,000	76	6.3
-3	700	37	70,000	77	7.0
-2	800	38	80,000	78	8.0
-1	900	39	90,000	79	9.0
-0	1,000	40	100,000	80	10.0

Chart 1 Use this chart to change dB readings to microvolts, or microvolt readings to dB's when the impedance is 75 ohms. To use the chart for 300 ohms impedance, double the figures in the microvolt column.

Calculations In Decibels

In calculating MATV signal levels, amplifier gain, cable losses, and isolation-pad losses are all expressed in decibels. The gain in dB's are added, and the losses are subtracted. Only at the input and the output of a system are the levels alternately rated in microvolts.

Let's assume we're measuring a MATV system in which the input to the amplifier is 0 dB, the gain of the amplifier is 50 dB, and the total loss before the signal reaches the last television receiver is 36 dB. What is the signal strength at the last receiver? Here is the solution:

input signal	0	dB (1000 µV)
amplifier gain	+50	dB
output signal from the amplifier	+50	dB
losses of the system	−36	dB
signal at the last receiver	+14	dB (5000 µV)

All other systems, regardless of how complex they are, should be calculated in the same way. □

HOW COLOR BARS ARE PRODUCED

By Carl H. Babcoke

The omnipresent color-bar generator has been in use for so many years that we tend to forget the ingenuity required in the evolution of such an essential pattern. In this article, we are explaining, in a different way, how the simple signals from an inexpensive generator can produce the color bars which are so helpful in the adjusting and repairing of color TV receivers.

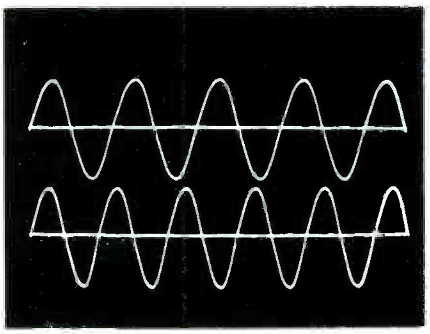
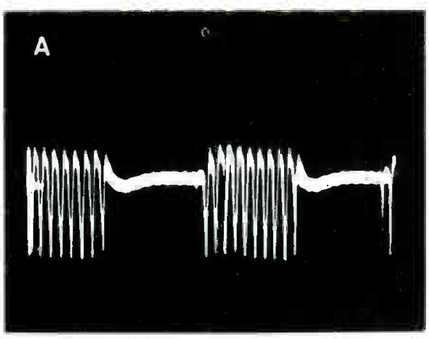
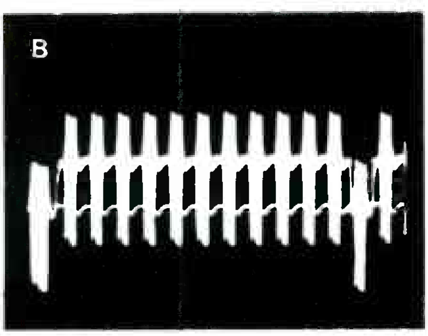
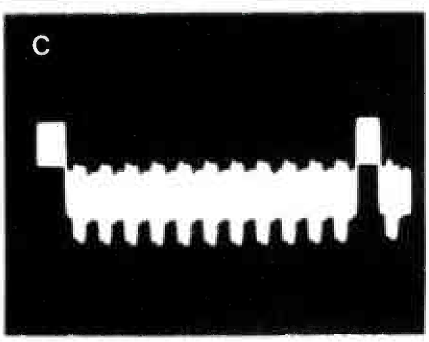


Fig. 1 These scope waveforms show how two sine waves of different frequency can begin in-phase, gradually become out-of-phase, and after a definite time period, become in-phase again.

Fig. 2 Waveforms at various points in the circuit of a RCA WR64B color-bar generator. **(A)** The 3.56M-Hz signal is gated to provide envelopes having about 10 cycles of sine waves. This signal is used in the receiver for burst and for a simulated-chroma signal. **(B)** The 12 envelopes at the color control in the generator are shown here. **(C)** The composite signal obtained by demodulating the generator output signal shows the horizontal blanking pulse and the 11 envelopes of 3.56M-Hz signal. The corners are more sharp than those of a signal that has passed through a receiver.







The Rainbow Pattern

A "rainbow" display on the color CRT is the most simple color test pattern. The generator circuitry which produces this pattern is also relatively simple.

The output signal of a rainbow generator is an amplitude-modulated carrier whose frequency is the same as one of the low-band TV channels. Consequently, the output leads of the generator are connected to the antenna terminals of the receiver, and the receiver then is adjusted as though tuned to a colorcast from a TV station.

The modulation of the carrier in the generator consists of vertical and horizontal blanking pulses (used in the receiver both for blanking and locking), and a sine-wave subcarrier of 3.563811M Hz.

In the receiver, this subcarrier has two very different uses. About 10 cycles are used as "burst" to lock the color oscillator, and the remaining sine waves, which we call "simulated chroma", produce the color tints when demodulated. There is no video signal.

Theory Of Operation

Two unrelated electronic facts permit such an uncomplicated signal to show a rainbow color pattern on the screen of the receiver. **Fact one:** The relative phase of two sine waves which have different frequencies changes constantly. **Fact two:** In color receivers, each phase of the chroma signal produces a different voltage output from a demodulator.

Therefore, a rainbow of color is produced when the frequencies of the color oscillator and the simulated-chroma signal are selected so the relative phase between them changes 360 degrees during each cycle of horizontal sweep. Figure 1 shows how the phase of two sine waves can change from in-phase, to out-of-phase, and back in-phase again when their frequencies are not the same.

Of course, the frequency of the chroma-reference oscillator signal is specified by the system of color television. The oscillator must be locked either by a TV-station or a generator signal to 3.579545M Hz (usually shortened to 3.58M Hz). This frequency, minus the 15,734-Hz horizontal-scanning frequency used during color broadcasting, produces 3.563811M Hz as the required frequency of the simulated-chroma signal. A rainbow pattern results from demodulation of these 3.58M-Hz and 3.56M-Hz carriers.

The burst amplifier stage in the receiver accepts and amplifies 8 or 10 of the first sine waves of the simulated-chroma signal which follow the blanking pulse. These sine waves are the "burst" signal which is used to lock the chroma oscillator; all other signals are rejected by the burst amplifier.

How Can 3.56M Hz Lock 3.58M Hz?

It seems impossible that signals of these frequencies could be locked together. However, they lock because they are **in-phase** during the time the burst amplifier has output. At all other times, there is no burst, and no comparison between the two signals is possible. In other words, there is **phase** locking, not frequency locking.

Limitations Of The Rainbow Pattern

You can use the rainbow pattern to determine color locking,

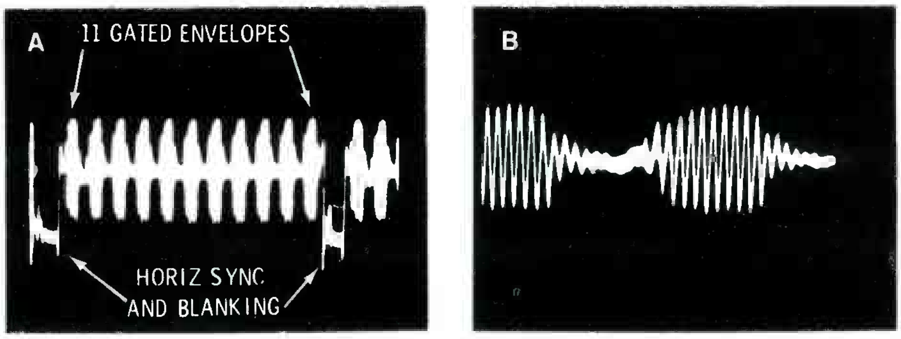
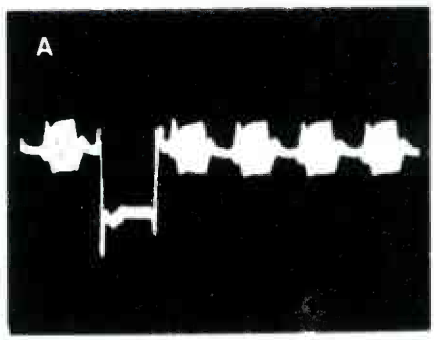
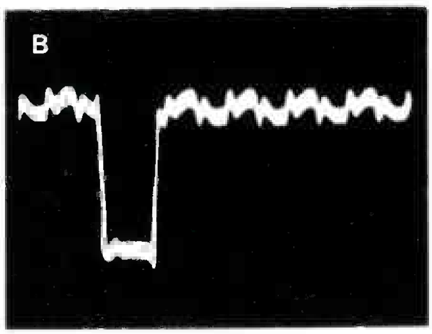
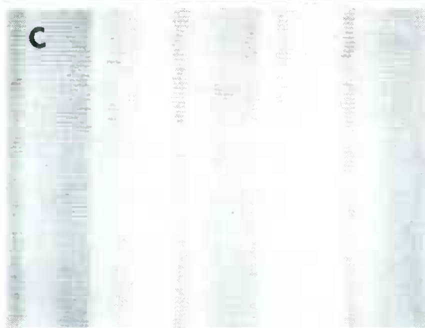


Fig. 3 Typical waveforms of the color-bar signal in the video amplifier stages. **(A)** The horizontal-blanking pulses and the 11 envelopes which are composed of simulated-chroma sine waves. **(B)** One-and-a-fraction envelopes expanded by use of the 5X feature of a triggered-sweep scope show the individual cycles.

Fig. 4 Two typical waveforms of the bar signal at various points in the video circuit, and the appearance on the CRT screen of the video pulses which mark the desired location of the bars. **(A)** The composite waveform at the video detector shows that the video pulses are nearly obscured by the 3.56M-Hz sine waves. **(B)** After removal of the higher frequencies by the peaking coils in the video amplifier, the video pulses are more easily seen. **(C)** When the color control is turned down to eliminate the color bars, these black and white vertical lines can be seen on the screen of the CRT where they mark the location of the bars.







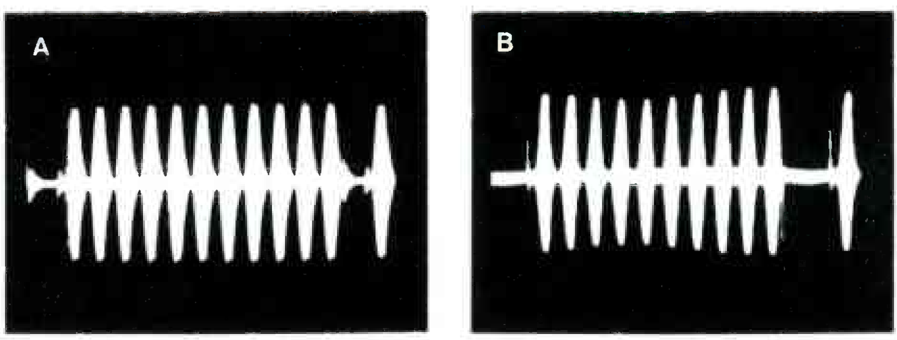


Fig. 5 Waveforms typical of the color-bar signal in the chroma channel. **(A)** 11 envelopes of 3.56M-Hz signal, without the blanking pulse and video pulses, remain after the first tuned circuit in the chroma channel. **(B)** After blanking in one of the chroma bandpass stages, only 10 envelopes remain.

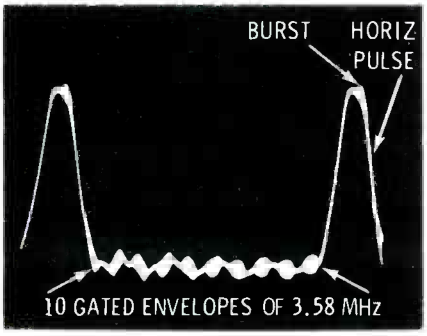


Fig. 6 The waveform at the input of the burst amplifier stage is composed of horizontal-keying pulses and some ringing between the pulses, and the 11 envelopes of 3.56M-Hz signal. The envelope used for burst must be near the tip of the horizontal-keying pulse.

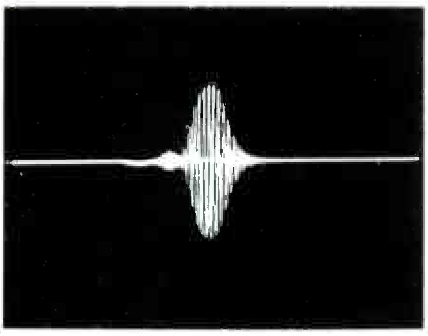


Fig. 7 After expansion by 5X in the scope, this is the appearance of the envelope of burst at the output of the burst amplifier stage.

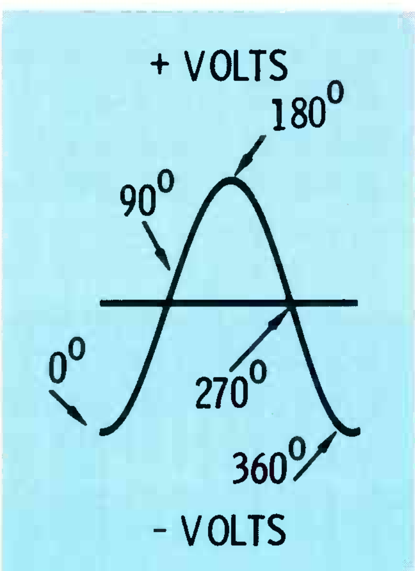


Fig. 8 The graph of the output voltage from a demodulator when the phase of the two signals is changed gradually is in the shape of a sine wave. This is the output when an un-keyed rainbow signal is used.

because large stripes of diagonal rainbows are on the screen when the color is not locked. And some approximation of the relative amplitudes of the red, blue, and green signals can be obtained. However, a rainbow pattern does not permit any accurate evaluation of the tint control action. Also, the waveform of a rainbow signal in the chroma IF stages is a meaningless blur which cannot effectively be used for signal tracing with a scope.

Now, if the rainbow were broken into vertical bars of color with spaces of no color between, a much more useful pattern would result. This is the result achieved in keyed-rainbow generators by a near-square wave which keys on and off the simulated-chroma signal.

Keyed-Rainbow Color Bars

Each "envelope" produced by keying the simulated-chroma signal contains about 10 sine waves of the 3.56M-Hz carrier. On the screen of the picture tube, each envelope becomes a vertical bar of color. Fig. 2A shows the 3.56M-Hz envelopes in an RCA WR-64B generator. In this generator, the spaces between the envelopes have the same width as the envelopes.

When the horizontal scanning frequency of 15,734 Hz is multiplied by 12 (the desired number of color bars), the product is 188.81K Hz. This is the repetition rate of the gating square wave, and it is usually rounded off to 189K Hz.

Many models of color generators use different frequencies from those given here. However, these frequencies are within the permissible tolerance and they produce bars of equal quality.

Not All Envelopes Become Color Bars

Only 10 of the envelopes of 3.56M-Hz signal (such as those shown in Figs. 2B and 2C) produce color bars. One of the 12 envelopes is on top of the horizontal-blanking pulse; therefore, it is eliminated. The first envelope to the right of the blanking pulse is used for burst. If, in addition to the use as burst, the envelope also reached the demodulators, it would be demodulated as a green color bar. Because the bar would occur during the horizontal retrace time, it might be visible on the screen as a faint, wide, and blurred vertical green bar. Horizontal blanking usually eliminates this possibility.

In many receivers, blanking is applied to one of the chroma bandpass amplifiers to eliminate the burst envelope from the simulated-chroma signal. Although such blanking appears to be unnecessary because of the horizontal blanking in the video circuit, it is used to prevent any unbalance of the DC restoration action in the −Y amplifier stages.

Phase Values Can Be Assigned To The Bars

Because 12 envelopes of simulated-chroma signal are generated during each horizontal cycle, each represents 30 degrees of phase. On the screen of the picture tube, each bar is 15 degrees wide, and each space between bars is 15 degrees wide. From center-to-center adjacent color bars are 30 degrees apart. These figures are helpful in analyzing demodulator phasing. For example, the 3rd and 6th bars are separated by 90 degrees.

Signal Tracing Color Bars

The amplitude and waveshape of the color-bar signal often is changed during passage through the receiver.

A typical video detector waveform is shown in Fig. 3A. There are 11 envelopes of the 3.56M-Hz signal and one horizontal blanking pulse for each receiver horizontal scanning line.

Amplitude of the envelopes of 3.56M-Hz signal relative to the amplitude of the horizontal blanking pulse is determined by the design of the receiver and the bandwidth of the video IF stages. Non-symmetrical envelopes can be caused by incorrect fine tuning adjustments.

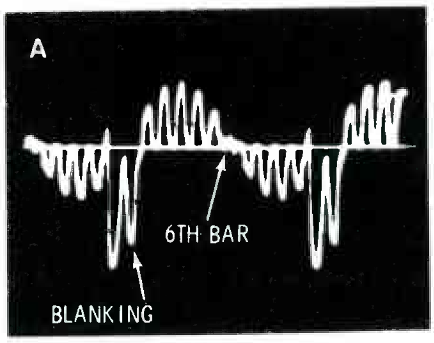
Because of the restricted bandwidth of the video IF stages, the edges of the envelopes in the receiver (shown in Fig. 3A) are not so sharp as those of the generator which are shown in Fig. 2.

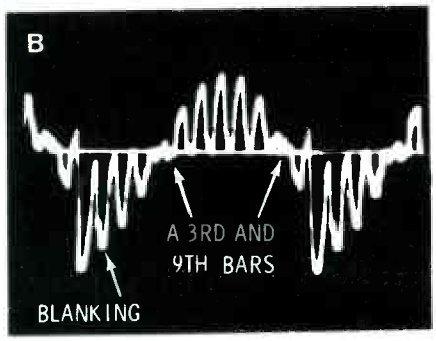
A Video Signal Also Is Present

Narrow video pulses (obtained from the square waves which gate the envelopes) are added in the generator to the edges of the envelopes of 3.56M-Hz signal. Usually these narrow pulses have a low amplitude and seldom can be identified separately in the composite signal.

However, in the video circuit of the receiver after the amplitude of the 3.56M-Hz sine waves has been reduced by the filtering action of the peaking circuits, the pulses (Fig. 4) can be seen on a scope.

On the screen of the picture tube (see Fig. 4C), the pulses produce faint, vertical black and white lines which mark the areas within which the color bars should appear. A defective delay line can move the video signal, or poor video IF alignment can move the chroma signal, so the marker lines and the color bars are not in register.





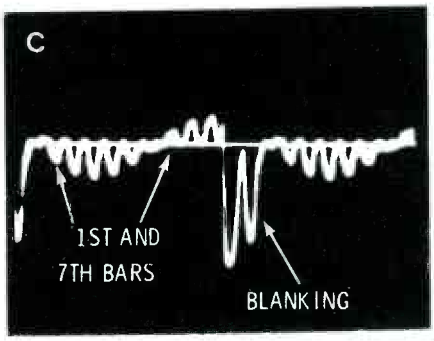


Fig. 9 Typical waveforms at the control grids of a color picture tube when a keyed-rainbow pattern is displayed on the screen. **(A)** At the red grid, the 6th bar is at zero, and the 3rd is brightest. **(B)** At the blue grid, the 6th bar is brightest, and the 3rd and 9th bars are at zero. ATC action often moves these one bar to the right. **(C)** At the green grid, the 10th bar is brightest, and the 1st and 7th are at zero.

Chroma Waveforms

The waveform in Fig. 5A is typical of those following the first tuned circuit in the chroma bandpass stages. Loss of low frequencies, because of the tuned circuit, has eliminated the horizontal-blanking pulse. Also, the envelopes of the 3.56M-Hz signal are more rounded and symmetrical.

There are 11 envelopes at this point in the circuit. The first envelope, in many models, is eliminated by blanking of a following stage, as previously explained. The waveform of Fig. 5B is typical of those at the output of the chroma-bandpass amplifiers.

Burst Circuit Waveforms

A waveform typical of those at the input of the burst amplifier stage is shown in Fig. 6. It is a composite. The large pulse is obtained from the horizontal-sweep circuit and is used to eliminate the cutoff bias of the tube or transistor. This pulse often is called a gating or keying pulse. The crooked base line between the horizontal pulses consists of ringing from the horizontal circuit plus 10 envelopes of the 3.56M-Hz signal. Near the tip of each horizontal pulse is the 11th envelope.

Since the burst amplifier stage has no gain except during the time the tip of the horizontal pulse is present, the envelope of burst **must** be located near the tip. Otherwise, the burst will not be amplified, and there will be no color locking.

At the output of the burst amplifier stage, a narrowed and amplified single envelope (see Fig. 7) should appear. This envelope of burst is used to lock the color oscillator.

The continuous carrier from the color oscillator, and the chroma signal from the bandpass stages are applied to the demodulators where the envelopes of simulated chroma are changed to chroma-signal pulses.

Waveforms After Demodulation

When the relative phase between the two signals that are applied to the demodulators is varied over a wide range, the demodulator outputs are sine waves, as graphed in Fig. 8. Consequently, a sine wave also is the output signal of each demodulator when an unkeyed-rainbow signal is used. And, when the signal is from a keyed-rainbow generator, the **tips** of the color-bar pulses trace a sine wave.

The waveforms in Fig. 9 are typical of those at the grid of a color picture tube when the chroma circuit also supplies horizontal-blanking pulses.

All color-bar pulses above the zero line produce color bars that are brighter than the spaces between the bars, and those pulses below the line produce bars which are darker than the spaces. When viewing color bars on a picture tube, you should advance the brightness control so the spaces between the bars are moderately bright.

One Limitation Of The Keyed Rainbow

Because the vertical and horizontal blanking pulses in the generator must do double duty also as sync pulses, a color-bar or crosshatch pattern should not be used to judge centering of the picture.

Extra Features Of Some New Generators

Keyed-rainbow color-bar generators are available in a bewildering assortment of features and prices. Some are equipped with tubes, many are all-transistor, and others have IC's.

All generators offer 10 color

(Continued on page 46)

(Continued from page 45)

bars, white crosshatch lines and white dots. Beyond these basic patterns, you must decide which additional ones you want or need.

Here are some of the features of individual models:

- only three color bars; R-Y, B-Y and G-Y,
- vertical or horizontal lines,
- black crosshatch and dots,
- a single crosshatch junction or dot which can be moved to almost any area of the raster,
- a combination of crosshatch and dots,
- a large, white rectangle used for horizontal centering and tracking and,
- various patterns at video frequency without the RF carrier.

Some generators have a 4.5MHz unmodulated carrier which simulates the sound carrier of a station. With this carrier, wrong fine-tuning adjustments or poor IF alignment produces beat patterns which aid in the diagnosis of defects. The carrier also is necessary to find the correct point of fine tuning when you evaluate the overall performance of a receiver or use vector patterns.

Two general types of circuits are used to obtain correct and stable vertical and horizontal sync pulses. Some generators use locked oscillators and others have digital count-down circuits starting with the 189K-Hz gating frequency. Although the digital type might be more stable over a long period of time, there is no difference in the appearance of the patterns, so long as they are locked.

Additional Information About Color Bars

Practical uses of color-bar patterns have been featured in previous issues. We suggest you review these articles:

- "Using Color-Bar And Crosshatch Patterns To Evaluate Color TV Performance" starting on page 26 of the June, 1971 issue, and
- "What Color Bars Reveal About Hue Defects" starting on page 14 of the February, 1972 issue of ELECTRONIC SERVICING. □

audio systems report

Features and/or specifications listed are obtained from manufacturers' reports. For more information about any product listed, circle the associated number on the reader service card in this issue.

Flat And Square Rubber Drive Belt Kit

Product: ORK-2 Kit
Manufacturer: Oneida, Inc.
Function and/or Application: Drive belt replacements for cassettes and tape recorders.

Features: The kit has three sizes of square, and three sizes of flat rubber stock, a cutting fixture, blade, and adhesive in a carrying case for the fabrication of belts as needed.
Specifications: Not available
Price: The ORK-2 kit sells for $19.95.

Circle 60 on literature card

Intercom Starter Pack

Product: IN-603 starter pack
Manufacturer: Fanon/Courier Corporation
Function and/or Application: Three masters and two cables with plugs can be used as a three-master system, or two additional masters with cables can be added for a five-master station system.

Features: Installation is by the use of plug-in connectors, no wiring or soldering is required. Two separate station-to-station calls can proceed simultaneously. IC's are used in the AC-operated masters.
Specifications: Not available.
Price: The IN-603 starter pack sells for $74.95.

Circle 61 on literature card

Ceramic-Magnet Speaker

Product: Model WS-110
Manufacturer: The Weltron Company
Function and/or Application: For use in monaural or stereo sound systems.
Features: The speaker has a ten-ounce ceramic magnet, cloth edge, and air-suspension "whizzer" cone.
Specifications: The 6 inch × 9 inch speaker is rated at 8 ohms, and has a maximum power capability of 15 watts.

Price: The Weltron WS-110 speaker sells for $9.95.

Circle 62 on literature card

Acoustic Equalizer

Product: Model Five audio acoustic equalizer
Manufacturer: Norman Laboratories, Inc.

Function: Speaker equalizer.
Features: Ten bass equalization curves, which complement the bass response of ten small speaker systems, are provided. In addition, five-position switches are provided for the bass, mid-

range, and treble frequencies. These three controls act as broad-band tone controls.
Specifications: Extends the bass response of the speaker systems for which it is designed by one octave.
Price: The Model Five Acoustic Equalizer sells for $87.00.

Circle 63 on literature card

Sound-Level Meter

Product: Model WE-130A
Manufacturer: RCA Electronic Components
Function and/or Application: Measures the level of environmental sounds and noises.
Features: The scale is color coded, in addition to the dB calibrations, to indicate safe, possibly unsafe, and dangerous sound levels. Type "A" weighting is used to approximate the frequency response of the human ear, and the action of the meter pointer is slow to provide an average

indication of rapidly changing levels. The case is made of high-impact blue plastic.
Specifications: Calibrated from 70 to 110 decibels. Supplied with four "AA" penlight batteries and carrying case with a shoulder strap and belt clip. Dimensions are 3 inches x 6 7/8 inches x 1 15/16 inches, and the weight is less than 12 ounces.
Price: Model WE-130A sells for $75.00. ☐

Circle 64 on literature card

Circle 19 on literature card

Circle 20 on literature card

Circle 21 on literature card

Circle 22 on literature card

Circle 23 on literature card

antenna systems report

Features and/or specifications listed are obtained from manufacturers' reports. For more information about any product listed, circle the associated number on the reader service card in this issue.

Jumper Cables With Connectors

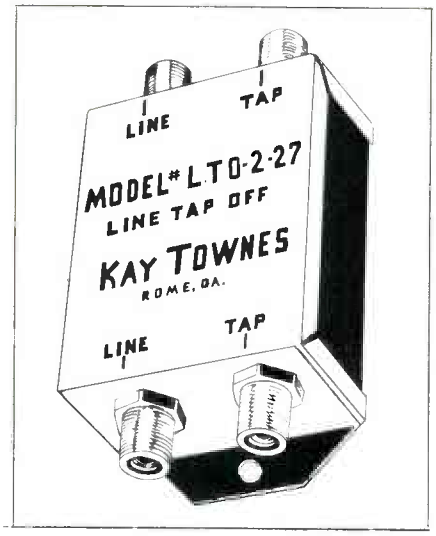
Product: CAD-6MF and CAD-6FF
Manufacturer: Jerrold Electronics, Corp.
Function and/or Application: Cables for connecting TV receivers to MATV systems.
Features: Model CAD-6MF is a 6-foot jumper cable with a Motorola-type male plug on one end and

a "F" male connector on the other end. Model CAD-6FF is a 6-foot jumper cable with "F"-type male connectors on each end.
Specifications: Not available.
Price: Model CAD-6MF sells for $3.50, and Model CAD-6FF sells for $3.15.

Circle 70 on literature card

Line Tap Offs For CATV And MATV

Product: Model LTO Line Tap Offs
Manufacturer: Kay-Townes, Inc.
Function: Connects and isolates a MATV or CATV cable to one, two, or four outputs.
Features: Covers all 82 channels of TV, and FM band. Isolations of 27 dB, 20 dB, 15 dB, and 10 dB are available. 12 variations of the line tap offs are available.
Specifications: Not available

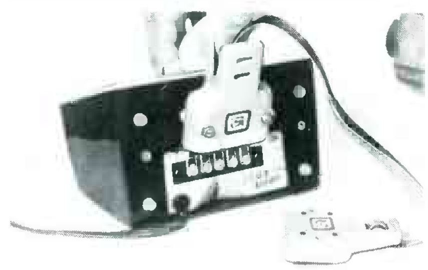


Price: Model LTO-1 Line Tap Off sells for $5.36, Model LTO-2 sells for $7.47, and Model LTO-4 sells for $10.46.

Circle 71 on literature card

Test Cord For Rotor

Product: Model TR-1 Test Cord
Manufacturer: Alliance Manufacturing Co., Inc.
Function and/or Application: The test cord enables bench testing of Alliance "Tenna-Rotor" controls and rotor operation.



Features:
Specifications: Not available.
Price: Model TR-1 Test Cord sells for $4.95. □

Circle 72 on literature card

"WHAT DO YOU MEAN, 'IT HAS TO GO BACK TO THE SHOP'? THIS IS THE SHOP."

Find Chroma Troubles with . . . .
SWEEP ALIGNMENT TECHNIQUES

Veteran television technician Allen gives helpful tips about chroma alignment using the newer types of sweep generators, and how to use the curves obtained to spot the stage or part causing the trouble. **By Larry Allen**

Several months ago, two articles of mine about troubleshooting video IF stages by analyzing sweep alignment curves were published. In this article, I am analyzing in the same way the sweep alignment curves of the chroma circuits in color TV receivers.

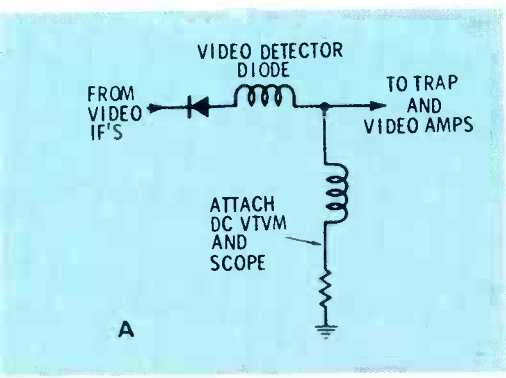
Several of you have written to me about difficulties you experienced while aligning traps in the video IF's. You might try an alternate method that I use.

IF Trap Adjustment

First, I connect the test equipment much the same as for sweep alignment of the video IF's. That is, the output of the marker generator goes to the mixer-grid testpoint. In some sets, this is a terminal, or the top of a feed-through capacitor. In others, the generator lead should be connected through a .001 mfd capacitor to the grid pin of the mixer tube, or to the coils that tune the mixer grid circuit. Check the PHOTOFACT folder for the model being tested to find the suggested point. Apply normal AGC bias to the first IF tube.

At the video detector, as shown in the schematic of Fig. 1A, I attach a VTVM (or FET meter) with a low DC scale selected, and the direct probe of a scope. Next I switch on the marker for the trap frequency required and add audio modulation. The pattern on the scope will be similar to that in Fig. 1B, although the sine waves probably will drift. Then I adjust the core of each trap of that frequency (and the balancing resistor, if used) for minimum height of the sine waves on the scope, or a minimum DC reading on the meter. The same adjustments are done for each trap frequency.

There is one precaution. A false indication of the trap null can be obtained if a stage prior to the trap is overloaded. Use the lowest possible output from the marker generator and select the



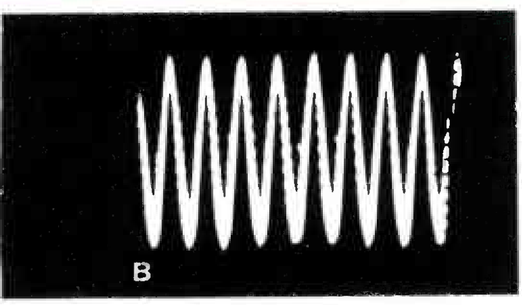
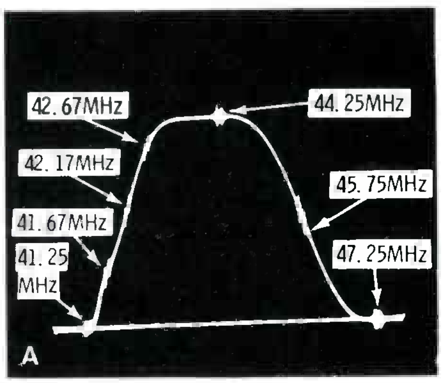
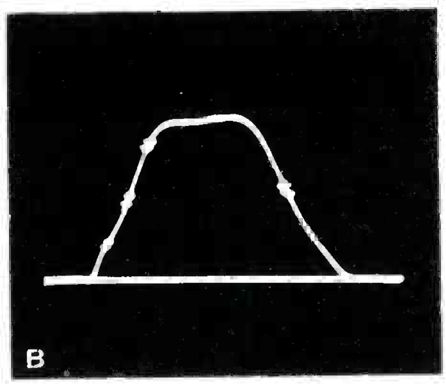


Fig. 1 Connection point and the waveform expected when aligning traps by the use of modulated markers. **(A)** Schematic of a typical video detector showing where the scope and VTVM should be attached. **(B)** Adjust the traps to minimize the sine waves and the DC voltage at the video detector.





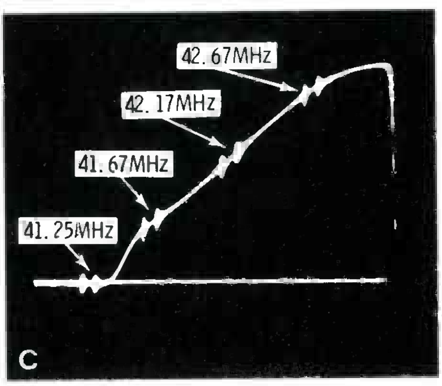


Fig. 2 Variations of video IF alignment curves. **(A)** A normal flat-top video IF curve showing the marker frequencies. **(B)** Some newer generators with post-injection of the markers can apply the markers laterally, as shown. They are easier to see when the skirts are steep. **(C)** Reduce the sweep width and readjust the center sweep frequency to produce a closeup of the chroma side of the video IF curve. The 41.67M Hz, 42.17M Hz, and 42.67M Hz markers should be evenly spaced in a straight line.

most sensitive scope and meter ranges.

After the traps have been set by this method, I don't touch them during the sweep alignment.

Tips For IF Sweep Alignment

I have found by experience that all parts of the video IF sweep curve are not equally important. Certain variations from the ideal are permissible. Many curves should resemble the one shown in Fig. 2A, which has a flat top. The curves in other sets tend to peak near the center of the curve. The **correct** curve depends on the design of the receiver and the characteristics of the IF coils. But usually the receiver will not align to the wrong curve.

Incidentally, some of the new-type sweep generators which use post-injected markers can be switched to give **horizontal** markers, as shown in Fig. 2B. These markers are useful on the steep skirts of some curves.

For good color quality, the most important area of the IF curve is the edge with the color markers, the 42.17M-Hz side. Very important are the position of the 42.67M-Hz marker relative to the corner, and the position of the 41.67M-Hz marker relative to the base line. Also, the side of the curve must have the right angle

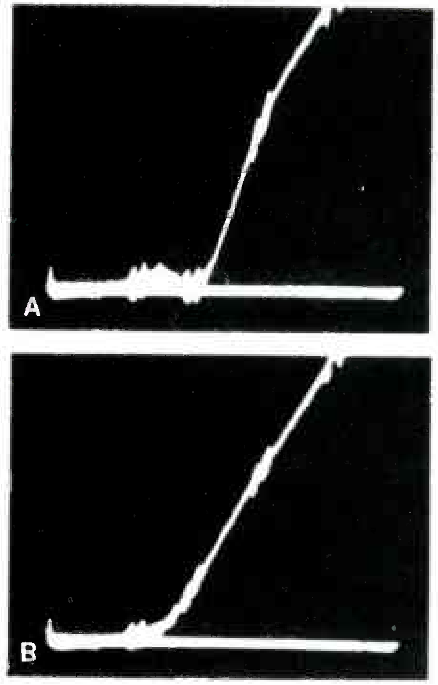
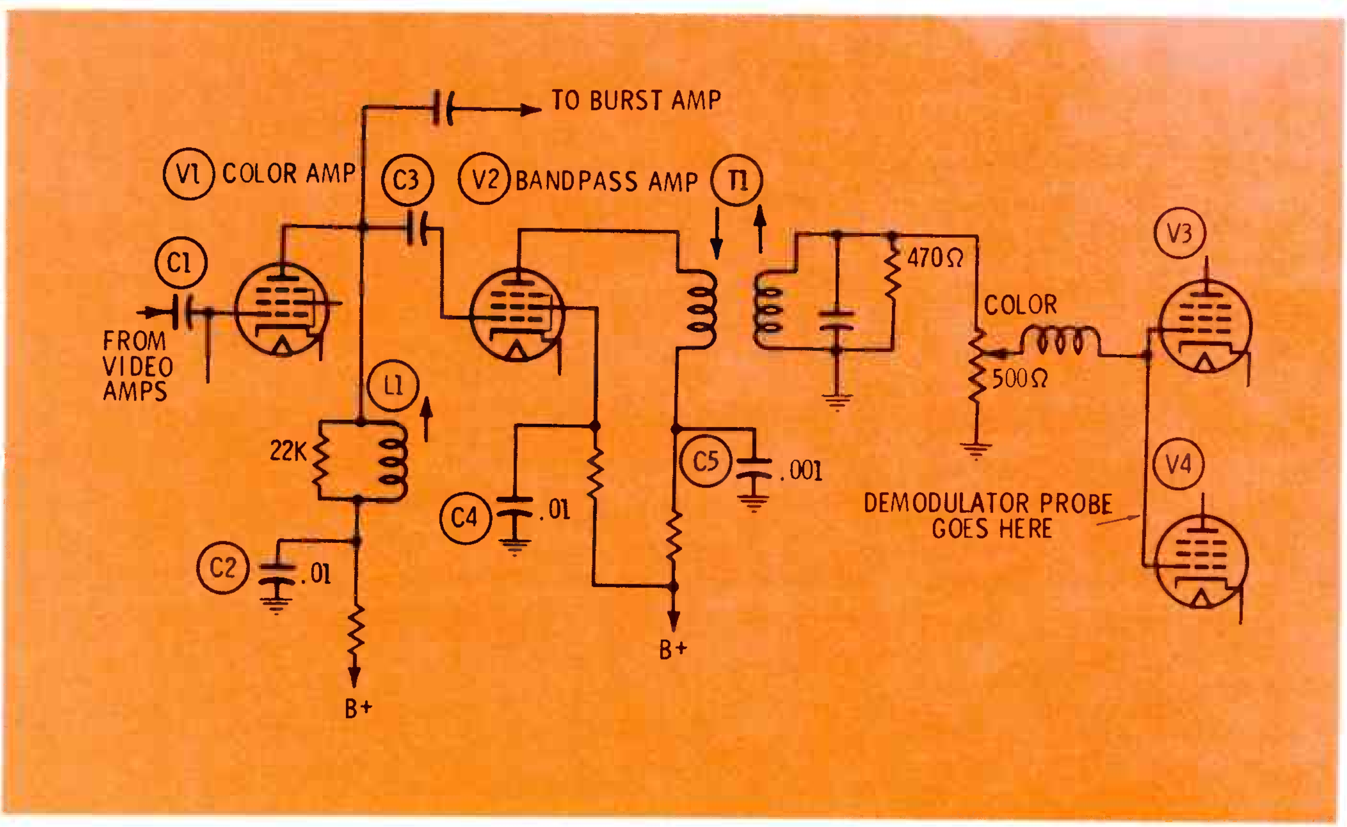


Fig. 3 The 4.5M-Hz trap can be adjusted by connecting the equipment for overall chroma sweep (sometimes called VSM) and using a demodulator scope probe connected to the video detector. **(A)** The trap has been adjusted incorrectly to 4.08M Hz. **(B)** The trap has been adjusted correctly to 4.5M Hz.

Fig. 4 This is a partial schematic of a typical chroma IF circuit. There are only three alignment adjustments.



of tilt and should be fairly straight.

After the entire curve looks good, I usually spread the curve and re-center it so the color side occupies the entire scope screen, as shown in Fig. 2C. Then I analyze it carefully.

Only after this side of the curve is perfect, and the picture carrier at the other edge is at the 50 percent point, do I check the chroma alignment.

Alignment Of The 4.5M-Hz Trap

Because the 4.5M-Hz trap follows the video detector, adjustment of this trap is not a normal part of the overall IF alignment. I usually adjust the trap after all the other steps of the video IF alignment are completed. I do the adjustment on a station, and this is the only adjustment which can be done safely on station. I tune slightly into the sound bars and then adjust the trap for minimum 920K-Hz beat patterns. These are the patterns that resemble the weave of cloth, and they move with the audio modulation.

However, I have found a way of adjusting the 4.5M-Hz trap just before the chroma alignment. Here is the method:

- Set up the equipment for overall chroma sweep,
- Connect the **demodulator** probe to the output of the video detector (grid of the video tube in Fig. 1A), and
- Adjust the trap for minimum response at the 4.5M-Hz marker, as shown in Fig. 3.

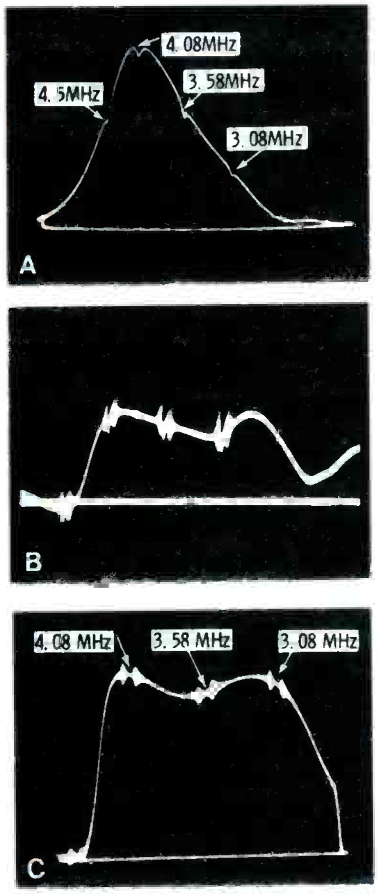


Fig. 5 Alignment curves at various points in the chroma circuit. **(A)** This curve is of L1 and V1 only. The slope should complement the falling chroma side of the video IF curve. **(B)** Measured at the plate of V2, the chroma bandwidth is flat because of L1. **(C)** This is a normal, typical curve of the total response from the mixer to the demodulators.

The Normal Overall Chroma Curve

Most chroma circuits have only three alignment adjustments, as shown in the partial schematic of Fig. 4. L1 is peaked to about 4.08M Hz, as shown by the curve of Fig. 5A. Because this frequency corresponds to 41.67M Hz of the video IF curve, the correct tuning of L1 provides a relatively flat curve from zero to 4.08M Hz from the tuner to the demodulators. This response is shown in Fig. 5B. A low-value swamping resistor was paralleled across the primary of T1, and the demodulator probe was connected to the plate of V2. The rising curve of L1 compensates for the falling edge of the video IF curve to provide flat response over the chroma frequencies.

T1 is of overcoupled design. This gives a flat-topped response curve between 3.08M Hz and 4.08M Hz for the bandpass stage alone. The curve resembles the overall curve shown in Fig. 5C, except the skirts are not so steep.

Typical of the overall response curve of most good-quality color receivers is the curve shown in Fig. 5C, which was a sweep from the mixer grid point to the demodulators.

What An Abnormal Curve Shows

To analyze chroma troubles by looking at the response curve, you must know the effect on the curve of each adjustment.

The primary (bottom) core of T1 moves the chroma curve laterally, relative to the markers. Two examples are shown in Fig. 6. During this step, pay no attention to the **shape** of the curve, but notice how the curve in each case extends considerably beyond the corresponding marker. Adjust this bottom core, when necesary, by adjusting to center the curve between the 3.0M-Hz and 4.08M-Hz markers.

Adjusting the secondary (top) core of T1 should tilt the curve without moving the curve laterally. Two examples of extreme tilting are shown in Fig. 7.

Although L1 is actually tuned to about 4.08M Hz, the apparent action when it is adjusted is to slightly tilt and bow the curve. Correct adjustment is the one which gives the most amplitude at the 4.08M-Hz marker.

Another tip: Better color is obtained when the curve is nearly symmetrical across the top. A slight sag or hill in the center of the chroma curve is preferable to a curve with a marker high on one side and low on the other. Fig. 7C shows the best overall curve that it was possible to obtain in one model.

carr electronics

by Joseph J. Carr/ES Auto Electronics Consultant

Understanding Signal-Seeker Car Radios

Servicing auto radios can be very profitable, especially when the peak activity occurs at a different time of the year from that of television servicing. And yet many competent technicians shy away from repairing car radios that have signal seekers. If the technician has no data about the mechanisms involved, there is some justification for this attitude. Radios with signal seekers **are** more complicated than others. However, the information given here can supply enough data to help you avoid the pitfalls.

Extra Functions

Signal-seeking radios have only three functions not found in standard pushbutton radios. These functions are:

- power to move the tuner,
- recocking of the mechanism after a cycle of operation, and
- automatic stopping at the station.

Power to move the tuner comes from a stretched spring, a worm gear to drive the pushbutton clutch, and a gear-train type of governor to limit the forward-travel speed of the worm gear.

The recocking function is performed by a powerful solenoid which is connected to both the clutch and the power spring. The solenoid is turned on at the high end and off at the low end of the dial by a tang-operated switch. The tang is mounted to the bar which moves the tuning cores. The solenoid simultaneously stretches the power spring and returns the core bar and clutch to the low end of the dial.

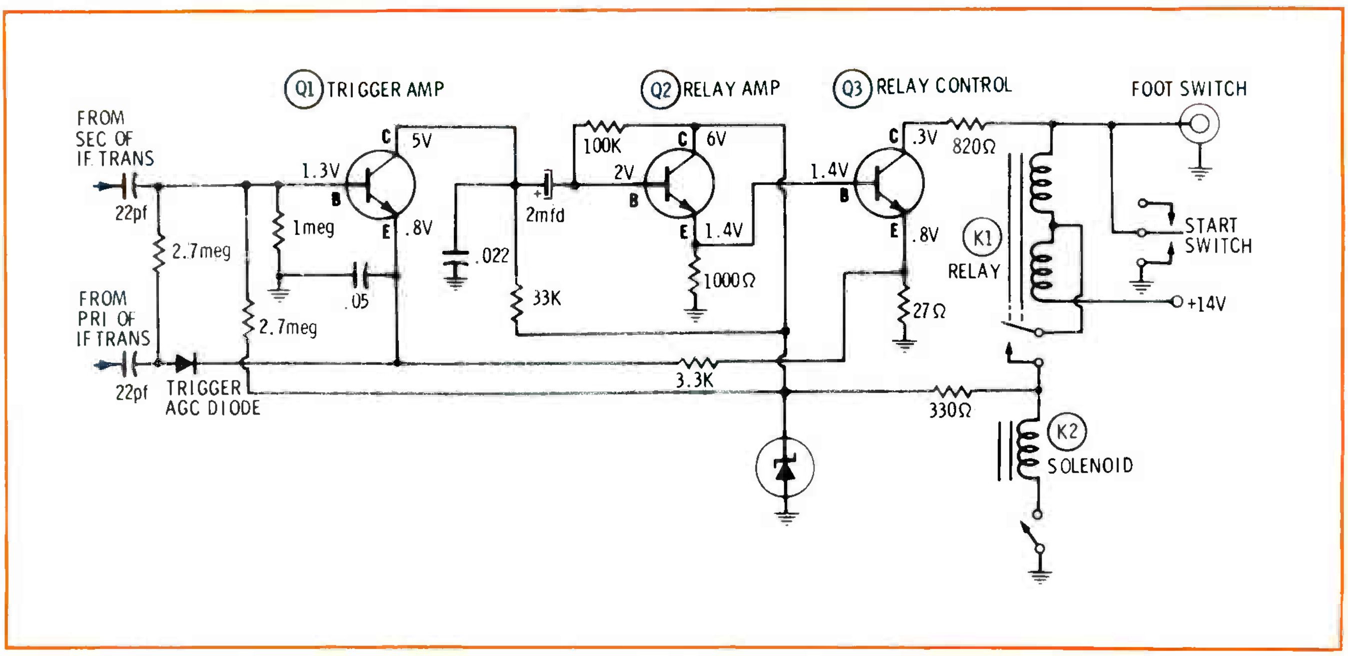
The stopping circuit has three transistors, and it is activated by signals from the IF stages. Any station signal cuts off conduction of the relay transistor, which de-energizes the relay. When a stop at a station is required, a paddle on the relay locks the gears of the governor to stop movement of the tuner.

Of the basic signal-seeker systems that we will cover, the Delco system by General Motors is the most widely used. Therefore, we will start with that system.

Delco "Wonder Bar"

The circuit diagram for the trigger stages in the Delco Wonder

Fig. 1 This is the schematic of the trigger and relay circuits of the Delco "Wonder Bar" signal-seeking radios. The voltages listed are of those obtained when the radio is seeking.



Bar radios is shown in Fig. 1.

When the "search" switch (operated by a bar on the front of the radio) is pressed, the negative end of the winding of the control relay K1 is grounded. (See Fig. 2 for location of the relay.) Current flows through the coil of the relay, holding the armature down, pulling the paddle away from the governor, and closing a contact which supplies voltage to the trigger stages. When the bar is released, control of the relay is taken over by current flowing through Q3, the relay-control transistor, because the radio is now off station. The relay should remain energized until an incoming station signal cuts off Q3.

When the relay is energized, its paddle no longer projects through the slot cut into the side of the governor. A closeup of the governor is shown in Fig. 3. Without the paddle to block the governor, the gear train runs, and the tuner seeks.

When a station is received, a signal from the IF amplifier activates the trigger amplifiers (Q1 and Q2). This cuts off Q3 and deenergizes the relay.

To prevent the tuner from stopping too soon when the first faint sideband of the station appears in the passband of the IF's, Delco takes a sample of the signal from the primary of the last IF transformer and rectifies it by a diode to supply AGC to the base of Q1.

When the tuner approaches the stop at the high end of the dial, a solenoid-energizing switch is closed by the forward motion of the tuner core-bar assembly. Movement of the plunger in the solenoid restretches the power spring, recocks the worm gear, returns the core bar assembly to the low end of the band, and turns off the tang-operated actuating swtich.

Because this system for recocking the tuner mechanism draws so much current, be sure that any battery eliminator used to power the radio can handle the extra load. Both the Delco model P-612 and the Eico model 1040 eliminators have a 20-ampere rating which is necessary for this type of operation. The supply should deliver 14 to 16 volts at the "A" lead of the radio.

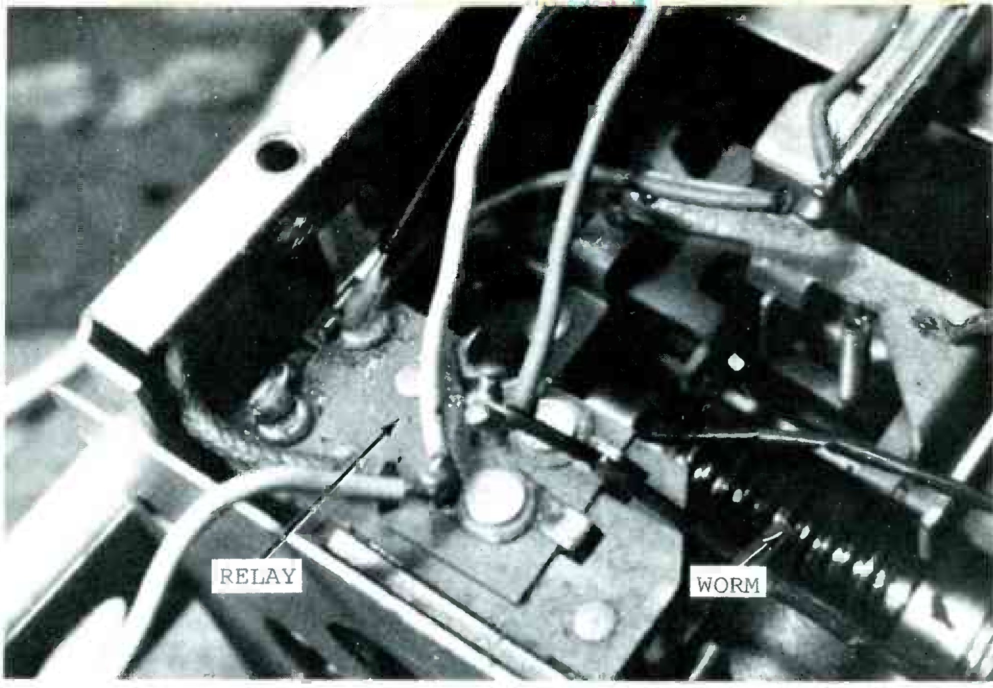


Fig. 2 The relay and the worm in the Delco radio can be seen easily when the cover is removed. Other components are located more deeply inside.

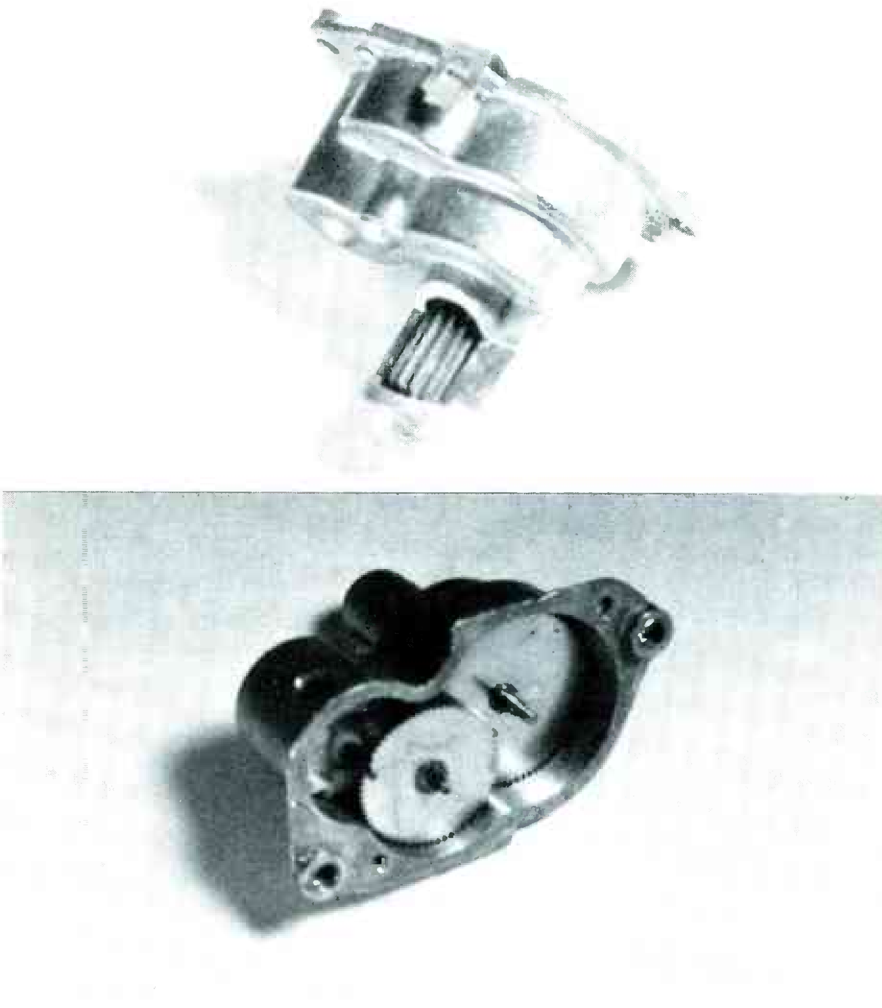


Fig. 3 Two views of the governor assembly used in Delco radios. The gear train slows the speed of seeking. Seeking is ended by locking these gears.

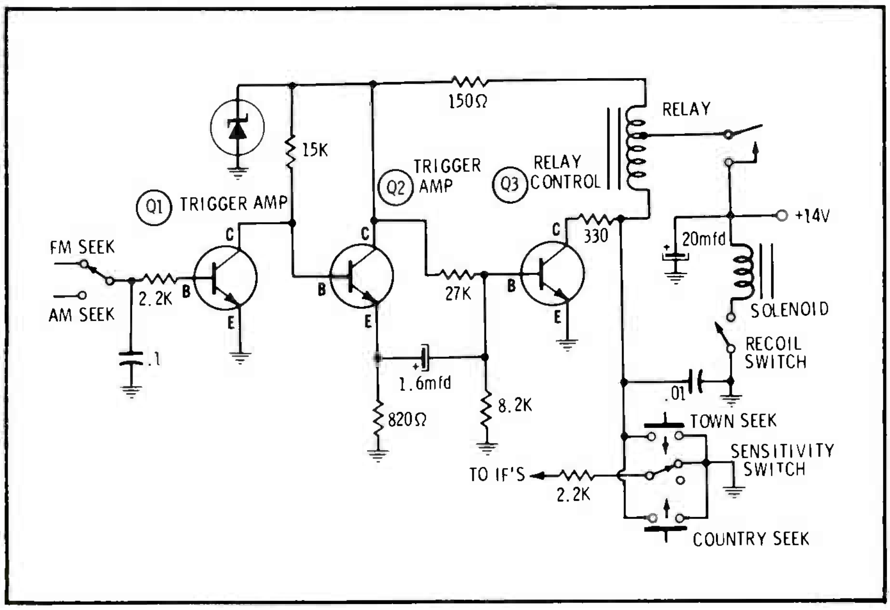


Fig. 4 The schematic of the trigger and relay circuits of the Bendix signal-seeking radios manufactured for Lincoln autos. None of the transistors shown have voltage unless the radio is seeking.

However, a lighter-duty supply can be used if it is paralleled with a 12-volt automobile battery.

Failure to use a power source having adequate peak current, or a high enough "A" lead voltage can cause the solenoid to bind and stop half way through its recocking cycle. This is before the point where the turnoff switch is tripped, therefore, such binding often results in overheating and subsequent failure of the coil in the solenoid.

Bendix Signal Seekers

Bendix signal-seeker radios made for the Lincoln Continental division of the Ford Motor Company are similar enough to the Delco radios to invite description by comparison. The major differences are in the respective trigger amplifiers and the trigger-sensitivity switches (see Fig. 4 for the Bendix circuit). Two search switches are used in Bendix radios, as shown in Fig. 5. These also double as sensitivity switches; one is marked "town" and the other "country". Delco radios, on the other hand, have a multi-position sensitivity switch separate from the search switch.

Troubleshooting Signal-Seeking Radios

Troubleshooting signal-seeker radios should begin with observation of the seeking operation. During seeking in the most sensitive mode, the tuner should glide smoothly across the band and stop at nearly any station that is more than barely audible. When the bar holding the tuning cores comes to the high end of the band, it should instantly recoil to the low end.

When the antenna plug is removed from its socket on the radio (to eliminate all signals), the tuner should continue indefinitely the seek-recock cycle. At all times during such operation the motion of the dial pointer and core bar should be smooth.

Typical Troubles

Typical troubles of the signal-seeking radios generally fall into only a few categories:

- failure to run,
- failure to recock,
- running erratically, or
- failure to stop on a station.

Failure to seek

If the signal seeker fails to run, you must determine whether:

- the tuner is jammed,
- the relay is stuck,
- the clutch is misadjusted, or
- the search switch is malfunctioning.

If the relay energizes and the armature pulls all the way in whenever the search switch (see Fig. 6) is pressed, it is a safe bet the relay and switch are okay. However, if the relay does not pull in, the trouble either could be in the relay itself, or in the search switch. Mechanical operation of the search switch can be checked usually by an "eyeball" examination. Make sure that, when depressed, the leaves of the switch are making good contact. Because a large amount of current passes through these contacts, any oxide, dirt or tarnish on the points will stop the operation.

To check the operation of the switches, ground the lugs of the switch using a screwdriver or similar tool. If the relay still fails to energize, and the proper voltage is applied to the hot lug of the coil, the relay probably is bad. An ohmmeter check of the coil usually will indicate the fault.

In case the relay functions in the normal manner, yet the tuner fails to start seeking, there is probably a mechanical jam somewhere. One possibility is a misadjusted clutch. This is the best bet, if the manual and pushbutton tunings are also affected. A jam can happen if the clutch plate is pressing too tightly against the pressure plate.

But if the clutch is not at fault, it becomes necessary to determine whether the trouble is in the signal-seeker part of the tuner or in the regular pushbutton portion. To accomplish this, we must disengage the manual tuning by depressing one of the pushbuttons (not enough, however, to move the dial pointer). With one pushbutton slightly depressed, by hand move the dial pointer back and forth across the scale a few times. Any binding or jamming of the pushbuttons, treadle, or core bar should become evident.

If the trouble is in the signal-seeker portion of the tuner, it could be caused by a defective governor gear train, a broken power spring, or a jammed worm-gear-and-rack assembly. Of course, there is always a possibility that a loose screw, a piece of solder, or other foreign material might be lodged inside the

(Continued on page 59)

(Continued from page 56)
tuner. In most cases, the power spring can be checked visually. If it is defective, it will either be broken or torn loose from one of the moorings at the end.

Assuming that the power spring is in good shape, the mounting screws of the governor should be loosened so it is disengaged from the worm gear. The worm gear and rack should fly forward and strike the high-end stop. If it does, the gear train in the governor is frozen, and the governor should be replaced.

Caution: Make this last test with the power supply disconnected from the radio. If power is applied when the governor is removed, the tuner will "machine gun". Without the governor to slow the speed during the search scan, the tuner will repeat very rapidly the travel-recoil cycle until something breaks, burns out or flies apart! So remember to disconnect the power.

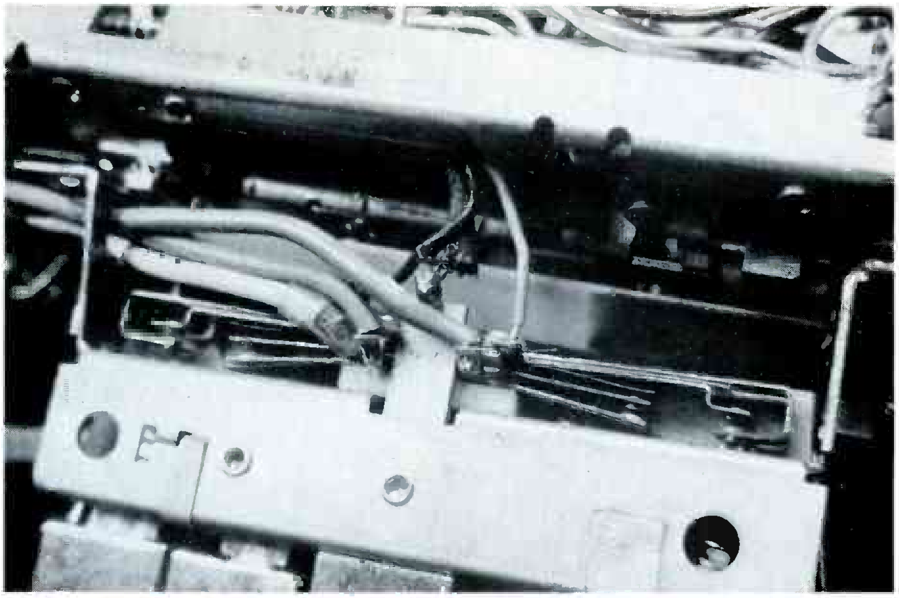


Fig. 5 Two search switches are used in the Bendix radio. One is for "town" and the other for "country" signal conditions.

Erratic movement

A tuner that runs erratically probably needs a new governor or a good clean-and-lube job. The same checks used to locate the cause of a jammed tuner often will locate the cause of erratic or jerky operation.

Failure to recoil

If the tuner travels all the way down to the high-end stop but fails to recoil back to the low end, the trouble will be one of the following:

- a bad solenoid,
- a bad recocking switch,
- no tripping of the recocking switch, or
- an inadequate power supply.

One lug of the solenoid coil is connected permanently to the +14-volt battery line. The other lug is grounded through the recocking switch. Check the solenoid by using a screw driver to ground the terminals of the recocking switch. Caution: Be sure that nothing in the tuner can strike the screwdriver when the solenoid "fires". This recocking action is so violent that it could injure you or cause other serious damage. If this test proves the solenoid to be okay, check to see if the switch is being tripped properly. A visual test is satisfactory with most modern Delco radios. However, those by Bendix require a little ESP, a dash of occult power, and a lot of luck; the switch is buried beneath the volume and tone control assembly. If the switch is being thrown, yet the solenoid does not receive voltage, the switch is probably open, and should be replaced. In cases where the switch is not thrown properly, often the reason is an operating tang that is bent slightly. A strong pair of long-nose pliers can be used to correct such a defect.

Failure to stop on a station

A common trouble encountered in servicing signal-seeker radios is when the tuner seeks, but never seems to find a station. If the radio fails to stop when it tunes across a station, the cause of the problem is likely to be one of the following:

- the relay, or the adjustment of the relay,
- the trigger circuit, or
- a problem of weak sensitivity of the radio.

In localities where signals are strong, a lack of sensitivity might not immediately be apparent. Be sure to test on a weak signal or with a generator that has a calibrated attenuator any radios that have this symptom.

You should also determine whether the relay paddle properly is fitting the gears in the governor. If the paddle is adjusted too high, it will fail to engage the stopping gear inside the governor, and the tuner will continue to seek. In that case, loosen the mounting screws of the relay and reposition the relay so the operation becomes normal.

Also, the relay might be defective. In that event, replace the relay. Unfortunately, this relay is a special part that cannot be replaced by a universal type. Order an original-equipment type for replacement.

The trigger circuit might fail to cut off the conduction of Q3 because of a defect in the trigger circuit itself, or because of an inadequate driving signal (radio is insensitive). DC tests with a VTVM, FET meter, or a high-ohms-per-volt VOM combined with the normal troubleshooting techniques for transistorized circuits usually will locate any problems in these circuits.

Tuner stops at the edge of each station

If the signal seeker stops short of the exact center of the station carrier, check for an unbalanced input to the trigger amplifiers. In Delco radios, the defect might be one of the 22-pf capacitors at the base of Q1. In both Bendix and Delco radios, the problem might be a defective output IF transformer, or one that is misaligned.

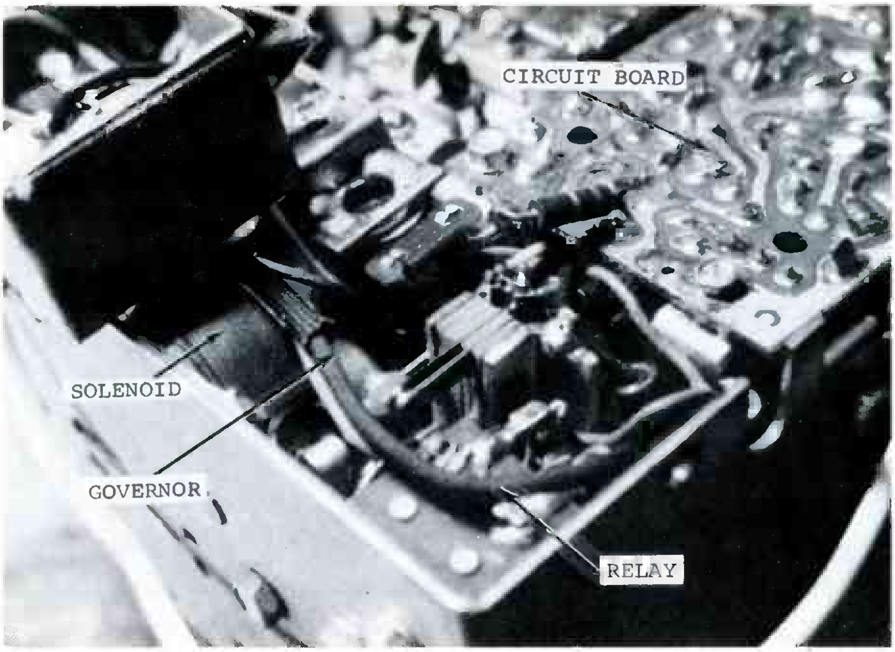


Fig. 6 These are the locations of some of the most visible components in the Bendix signal-seeking radios.

"Machine gun" action

Occasionally the problem in a seeker radio will be a rapid repetition of the travel/recoil cycle each time the search switch is pressed. The nickname for this trouble originates from two similarities to the operation of a machine gun: the sound it makes, and motion of the worm/rack assembly which resembles the breech action of a machine gun.

A broken gear train in the governor or a misadjusted governor assembly might be the cause of the symptom in either the Bendix or Delco models. Loose meshing of the threads of the worm gear with those of the governor can cause machine gunning. On the other hand, an excessively tight fit can cause a jam. Use moderation in making this adjustment.

After a radio has been machine gunning, carefully check the dial pointer and core/bar mechanisms; the machine gunning is so violent that many of these parts can become bent or broken.

Tuner starts to seek, but stops when the search bar is released

Either a malfunctioning trigger circuit or a defective relay will cause this symptom. When you test the trigger circuit, remember that the transistors have normal DC voltages only when the radio is searching. If these voltages indicate that the trigger/relay circuit should be operating, the relay should be the next suspect.

Slightly more current flows through the coil of the relay when the search switch is operated than when Q3 is conducting. Therefore, a sluggish or sticky relay might release when the search bar is not operated. Measure the voltage across the coil under both conditions to determine if Q3 is conducting sufficiently.

Without a command, the tuner starts to seek

This "mind of its own" symptom is found most often with radios that have a floor-mounted search switch. The leads to the switch can short together intermittently. In other radios, the contacts of the search switch might be too closely spaced and produce an intermittent contact. Other radios might have been improperly fitted during the installation.

The writer remembers one humorous case in which movement of the customers' left foot occasionally activated the signal seeker. The foot switch had not been mounted, but was only covered by the rug so the customer was unaware of its existence. He owned the car for six years, suffering all the time from a ghostly signal seeker.

Tuner stops at random points off station

A spurious signal which deceives the signal seeker is usually the cause of this symptom. Spark noise from the engine in the customer's car (or a passing car) can cause wrong stopping, as can electrical noise from signs and traffic signals.

Other than to lower the sensitivity, there is little that can be done to the radio to correct the problem.

Tuner remains at the low end of the dial

There are three main possible causes of this symptom. They are:

- poor voltage regulation of the power supply,
- binding of the tuner at the low end, or
- location of a station near the stop at the low end of the dial.

Poor voltage regulation is caused by a deficiency of the test equipment in the shop.

Binding problems usually involve either the clutch or the core/bar assembly. Trace for the source as you would for any type of binding. However, inaccessibility of the components makes the analysis more difficult.

Stopping at the low end of the band because of a station located there can occur in any part of the country. However, it is most common in the coastal regions. Many radios will tune all the way to 500K Hz where maritime stations sending code sometimes can be received. Also, radio stations on the broadcast band whose frequency is one of the first few channels will cause the same complaint. In my location, we must contend with both conditions. The oscillator frequency can be readjusted so the radio will not tune low enough to receive the ship stations. Unless the radio owner has you desensitize his receiver by adding a resistor of a few hundred ohms in series with the antenna choke, nothing can be done about the low-frequency broadcasting stations. □

productreport

Features and/or specifications listed are obtained from manufacturers' reports. For more information about any product listed, circle the associated number on the reader service card in this issue.

Solid-State Inverter

Product: Model 12U-S2A inverter
Manufacturer: ATR Electronics, Inc.
Function and/or Application: Operation of 117 volt 60 cycle AC equipment from 12-volt DC storage battery power in transportation vehicles.
Features: The inverter is recommended for the operation of tape recorders, TV receivers, VTR equipment, public address systems, ham gear, test instruments, phonos, radio sets, small synchronous motors, scientific laboratory and hospital equipment, small AC-DC universal type motors, fluorescent or incandescent lights, and similar equipment. The inverter is filtered and comes complete with battery cables.

Specifications: The 12U-S2A has an output capacity of 275 watts continuous and 300 watts intermittent while maintaining a frequency of 60 cycles with varying load or input voltage.
Price: Model 12U-S2A sells for $139.50.
Circle 80 on literature card

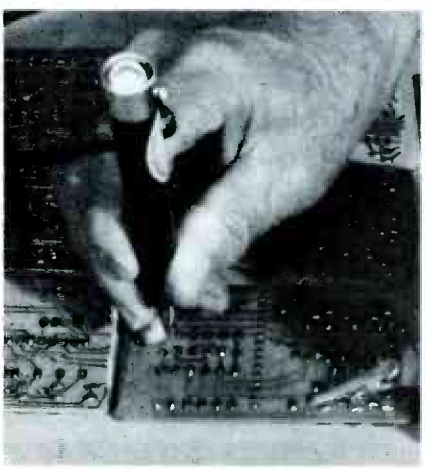
Screwdriver Line

Product: Color-coded-for-size screwdrivers
Manufacturer: Vaco Products Co.
Function and/or Application: Self evident.
Features: Handles are break proof, shock proof and have Comfordome grips with no-slip action.

Specifications: Red, white and blue handles designate size: red, 3/16 inch blade; white, 1/4 inch size; blue, 5/16 inch size. Blades are made of chrome vandium steel, hand ground to closest tolerances, and chrome plated for durability.
Price: Not available.
Circle 81 on literature card

Electrical Tester

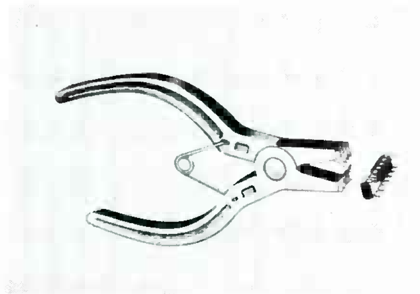
Product: No current electrical tester
Manufacturer: Burnworth Tester Co.
Function and/or Application: Tester for electrical breaks and power failures.
Features: Can be used for electrical wiring equipment, radio and TV circuits, motors, diodes, appliances, etc. Self-powered with two penlight batteries and a 4-foot cord. Bright flash indicates cable is functioning properly. If dim or no flash results, trouble can be located with point-to-point check for continuity.



Specifications: Not available.
Price: The electrical tester sells for $2.98.
Circle 82 on literature card

IC Flat-Pack Puller

Product: S4916 flat-pack plier puller
Manufacturer: Starnetics Co.
Function and/or Application: Installation and removal of 10- and 14-lead IC flat-pack units.
Features: The plier jaws are insulated to be freely used in a live circuit environment. IC's can be removed in the desoldering phase because of the fulcrum jaw design, which prevents bent leads and short circuits.



Specifications: Not available.
Price: The S4916 sells for $18.95.
Circle 83 on literature card

Solderless Terminal Kit

Product: Kit No. 6175-63 packing kit of solderless terminals
Manufacturer: Vaco Products Co.
Function and/or Application: Individual packing kit.
Features: Each zip-top plastic bag slips into separate terminal compartments assuring fresh, exact count terminals that will not spill, rattle or get lost. Kit

(Continued on page 62)

contains ten of the more popular insulated, single-grip terminals for electronics, electrical, and general purpose use, including ring tongue, spade, and flanged spade types, plus No. 1963 crimping tool with bolt slicer.
Specifications: N/A
Price: The kit sells for $11.25.

Circle 84 on literature card

Autotransformer

Product: TVSD-1 step-down autotransformer
Manufacturer: Essex International, Inc.
Function and/or Application: Reduces excessive line voltage supplied to homes.
Features: Plug into wall and plug TV power cord into the TVSD-1. The unit may be mounted in any position on the back of the cabinet or any convenient location. A line cord and plug are provided for input and a receptacle for output.
Specifications: The TVSD-1 reduces line voltage by 10 per cent

with a 350 VA rating which will handle all size TV sets. The unit measures 2-5/8 inches x 2-1/4 inches x 2-5/16 inches.
Price: The TVSD-1 sells for $10.29.

Circle 85 on literature card

Circle 25 on literature card

Retaining-Ring Plier Set

Product: Model 444-K snap-ring plier set.
Manufacturer: Jensen Tools and Alloys
Function and/or Application: Interchangeable plier tips, both internal and external for shafts from 3/8 inch to 1 1/4 inch.
Features: Two plier handles are furnished, one opens when the handle is squeezed (for external rings), the other closes when the handle is squeezed (for internal

rings). The pliers are manufactured from heat treated steel. Clamping screws hold the replaceable tips in place.
Specifications: Eight pairs of interchangeable tips are provided for use on the plier handles. The tips are furnished in straight, 45 degree, and 90 degree configurations, and in diameters of .035, .045, and .060 inches.
Price: Model 444-K sells for $7.95.

Circle 86 on literature card

Blue Lateral and Purity Assembly

Product: Model 7605 single-unit

blue lateral and purity assembly.
Manufacturer: J.W. Miller Co.
Function and/or Application: Replacement for similar assemblies on any size rectangular dot pattern.
Features: The 7605 assembly registers blue, red and green beams. An outer wheel moves

opposing magnets to provide adjustment up to 1/2 inch minimum for blue lateral convergence. Purity correction is accomplished by individual adjustment of the two purity rings.
Specifications: Not available.
Price: Not available.
Circle 87 on literature card

Epoweld® Adhesive

Product: "Double/Bubble" fast-setting, two-part adhesive.
Manufacturer: Hardman, Inc.
Function and/or Application: Repairs broken castings, fills cracks, seals joints, repairs fiberglass parts, etc.
Features: Parts A and B are packaged in proportioned foil twin-packs to assure proper mixing ratios. Epoweld® adhesive

sets in 3 to 4 minutes and has a resistance to weather, hot or cold water, gasoline, oil, etc., and produces a bond that will resist stresses up to 1 1/2 tons per square inch.
Specifications: One packet contains a measured amount of resin and the other, the required amount of hardener. Mixed Epoweld®, in a thin film, is essentially colorless.
Price: Not available.
Circle 88 on literature card

Sound-Operated Switch

Product: Remote-control Signal Commander
Manufacturer: Signal Science, Inc.
Function and/or Application: Turns on or off the power to lamps or appliances by handclaps, or other loud signals.
Features: A red indicator lights when the remote control unit has power. The first handclap, or loud noise, lights the yellow indicator, and the next handclap turns on the power to the appliance. Noises which occur after the yellow indicator goes out do not activate the switch.
Specifications: Not available.
Price: The remote-control Signal Commander sells for $29.95. □
Circle 89 on literature card

Circle 27 on literature card

Circle 29 on literature card

The MARKETPLACE

This classified section is available to electronic technicians and owners or managers of service shops who have for sale surplus supplies and equipment or who are seeking employment or recruiting employees.

Advertising Rates in the Classified Section are:

- 25 cents per word (minimum $3.00)
- "Blind" ads $2.00 additional
- All letters capitalized—35 cents per word

Each ad insertion must be accompanied by a check for the full cost of the ad.

Deadline for acceptance is 30 days prior to the date of the issue in which the ad is to be published.

This classified section is not open to the regular paid product advertising of manufacturers.

Use your Scope (any model, no rewiring) to Test Transistors Incircuit. Simple instructions $1.00. Schek Technical Services, 8101 Schrider St. Silver Spring, Maryland 20910. 6-72-6t

FOR SALE

FOR SALE—B&K 1450 Oscillo/Vectorscope 1 yr. Perfect. $199 CO-OP TV RD 2, Rhinebeck, N.Y. 12572. 7-72-1t

NEEDED

NEEDED—One number 1B5 tube and four number UX201A tubes. Write Van Etten Elect., 1215 W. 7th St., Texarkana, Tex. 75501. 7-72-1t

Circle 30 on literature card

advertisers' index

catalogs literature

Circle appropriate number on Reader Service Card.

ANTENNAS

100. *Antenna Specialists Co.*—announces a new amateur radio catalog with an expanded line of two meter, six meter, and three-quarter meter amateur base and mobile antennas.
101. *Blonder-Tongue, Inc.*—announces a booklet presenting the basic facts necessary to understand MATV systems. A Glossary of Terms is included for further understanding.
102. *Jerrold Electronics Corp.*—Catalog S, titled "Systems and Products for TV Distribution," lists specifications of this manufacturer's complete line of antenna distribution products, including antennas and accessories, head-end equipment, distribution equipment and components, and installation aids.
103. *Union Metal Manufacturing Co.*—announces a new 8-page catalog that illustrates self-supporting antenna poles up to 250 feet in height, design information for 25 foot through 200 foot poles, pole accessories, foundation specifications and erection information.

AUDIO

104. *Arista Enterprises, Inc.*—announces their 58-page needle and cartridge catalog. The needle cross reference reportedly has up-to-date cross references of all major needle manufacturers, in addition to cross reference sections of phonograph manufacturers' needle and cartridge numbers.
105. *GC Electronics*—an updated line of exact replacement rubber drives and belts is detailed in the new Walsco cross-reference catalog. Included are a variety of phono and recorder drive wheels and pulleys, pinch rollers, round rubber belts, square cross-section rubber belts, spring belts and fabric drive belts, felt pressure pads, phono mounting "E" and "C" clips in an assortment kit, motor mounting grommets, changer switches, and a kit of assorted phono drives and belts.
106. *Jensen Manufacturing Div.*—has issued an 8-page catalog, No. 1090-E, which describes applications of 167 individual speaker models. Special automotive, communications, intercom and weathermaster speakers, plus a complete line of electronic musical instrument loudspeakers are featured.
107. *Mellotone, Inc.*—introduces a new catalog featuring CHANGE-A-GRILLE self-stick acoustic fabric for speaker grilles. Swatches of six basic patterns are attached to the catalog showing fabric styles and colors.
108. *Nortronics*—a new publication, "Recording Equipment Maintenance Manual" describes factors that make regular maintenance important. Also, product-by-product catalog section on QM-SERIES accessories.
109. *Shure Brothers*—has published a new catalog describing their line of microphone and circuitry products for broadcasting, recording, motion pictures, and professional sound reinforcement. Included are illustrations and technical specifications.
110. *Switchcraft, Inc.*—introduces a 28-page catalog listing its line of phone jacks and plugs, switches, connectors, adapters, and molded cable assemblies. Each part is listed by number and the page on which it is found.

AUTO ELECTRONICS

111. *Littelfuse, Inc.*—has released a new 32-page, 1971 automotive replacement fuse guide for passenger autos, sports cars, trucks, and taxi cabs. Fuse descriptions and circuits they protect are included.
112. *Nortronics Co., Inc.*—announces a revised brochure describing the Model 5800 replacement head for a reported 90 per cent of all 8-track auto and home stereo players. A listing of players is offered by more than 70 different manufacturers in terms of model number or head part number.

BUSINESS MATERIALS

113. *Laurel Office Aids, Inc.*—introduces an 80-page, 1972-1973 catalog which includes office equipment, general office forms, sales and receiving forms, office supplies, business books and gift items for the office and home.
114. *Watts Business Forms, Inc.*—announces a 1972 Stock Business & Tax Forms catalog. The index covers over 60 categories of standard stock forms and tax forms for general business use.

CCTV

115. *GBC Closed Circuit TV Corp.*—announces a new 20-page catalog, which illustrates and describes all of the components necessary to a complete video communications system. The catalog illustrates monitors ranging from 5-inch units to a 20-inch solid-state unit.

CAPACITORS

116. *Cornell-Dubilier Electronics*—has issued an 80-page cross-reference, 1972 catalog for location of single, dual, triple, and quadruple section replacement electrolytics.
117. *Loral Distributor Products*—has made available a 24-page electrolytic capacitor replacement guide. The catalog features replacement products by the original manufacturers part number.

118. *Sprague Products Co.*—has announced a 40-page manual which lists original part numbers for each manufacturer, followed by ratings, recommended Sprague capacitor replacements, and list prices. More than 2,500 electrolytic capacitors are included.

COMPONENTS

119. *Bulow Internationl*—announces a new parts list for spare-parts and replacement parts for several major European radio and electronics manufacturers. Components, transistors, diodes and mechanical parts are included.
120. *Essex International, Inc.*—the new 64-page Color and Monochrome Television Parts Replacement Guide lists over 500 Stancor transformer and deflection components for 200 television manufacturers. A reported 14,000 replacements for original parts are available.
121. *P. R. Mallory & Co., Inc.*—introduces a 64-page general catalog containing approximately 10,000 items. Included in the catalog are batteries, capacitors, controls, resistors, semiconductors, switchers, and timers plus security systems, cassette recorders and cassette recording tapes.
122. *Precision Tuner Service*—announces a new tuner parts catalog, including a cross reference list of antenna coils and shafts for all makes of tuners.
123. *Workman Electronic Products, Inc.*—has released a 68-page 1972 catalog of replacement components for radio and television. Included are resistors, fusing devices, circuit breakers, sockets, convergence controls, electronic chemicals, audio cables, adapters for hi-fi and cassette type recorders battery holders and prototype kit components.

CONTROLS & SWITCHES

124. *Centralab Dist. Products*—introduces a chart which covers all Fastatch II rotary and push-pull action line switches. Diagrams are illustrated for each switch plus photographs for quick reference guide to replacement push-pull line switches.

KITS

125. *Heath Co.*—announces their 1972 Heathkit catalog, reportedly featuring over 350 kit projects. Projects for the home, the car, and workshop are included.

MARINE ELECTRONICS

126. *Raytheon Co.*—introduces the Webster antennas and seven new antennas designed for use with standard and single sideband marine radio-telephone and citizens band radios. The Webster antennas for VHF/FM radio are offered in 3 dB, 6 dB, and 9 dB models.

SECURITY ELECTRONICS

127. *Mountain West Alarm Supply Co.*—a 64-page catalog describes and offers over 350 intrusion and fire alarm products. Six-pages of Application Notes for alarm equipment also is included.

SEMICONDUCTORS

128. *Electronic Devices, Inc.*—announces a 4-page catalog on solid-state replacement and renewal parts for color TV receivers including solid-tubes, cartridges and multipliers. Solid-state solid-tube high-voltage rectifiers, focus rectifiers and damper diodes, silicon and selenium focus cartridges, diagrams showing dimensional drawings and socket connections for solid-tube solid-state replacements of vacuum tubes with maximum ratings for pulse rectifier service is also included.
129. *International Rectifier Corp.*—announces the new 64-page "Semiconductor Cross Reference and Transistor Data Book," with over 35,000 listings, including 10,000 types not previously shown. Types included are transistors, diodes, zeners, capacitors, rectifiers, and SCRs. A removable wall chart and new products bulletin are also included.
130. *Motorola, Inc.*—announces the 1972 Motorola HEP Semiconductor Cross-Reference Guide and Catalog, featuring approximately 38,000 semiconductor devices to HEP replacements. Included are 1N, 2N, 3N, JEDEC, manufacturers' regular and special "house" numbers and many international devices, with particular emphasis on Japanese types.
131. *RCA Distributor Products*—introduces a 96-page "SK Series Top-Of-The-Line Replacement Guide" (SPG-202M) which cross-references over 46,000 semiconductor device numbers. In addition a Solid-State Quick Selection Replacement Chart (1L1367A) listing entertainment SK-Series devices is included.
132. *Semitronics Corp.*—has a new, revised "Transistor Rectifier, and Diode Interchangeability Guide" containing a list of over 100 basic types of semiconductors that can be used as substitutes for over 12,000 types.

SERVICE AIDS

133. *Chemtronics*—announces a new 12-page, 1971-1972 catalog of products, including: tuner sprays, circuit coolers, insulating sprays, contact and control sprays, lubricants, tape head cleaners and conditioners, electronic glues and cements, solder, and spray paints.
134. *Kester Solder*—has released an 8-page brochure presenting the company's full line of soldering products. Presented are: "44" resin core solder, acid-core solder, solid-wire, bar solder, TV-radio solder and Metal Mender.

SHOP EQUIPMENT

135. *Kole Enterprises, Inc.*—

announces a 36-page color catalog which includes 31 sizes of corrugated stock/parts bins, flat and vertical storage bins, transfer and magazine files and shipping cartons.

SOLID-STATE

136. *Electronic Devices, Inc.*—offers a replacement guide on tubes and parts replaced by the EDI solid-state replacement components for color TV.
137. *International Rectifier*—64-page volume, JD-451, has been revised and lists information on diodes, zeners, capacitors, rectifiers and SCR's. There are a reported 4000 new transistor listings. Specifications, characteristics, tables and wall charts are also included.

TECHNICAL PUBLICATIONS

138. *Howard W. Sams & Co., Inc.*—announces publication of a new 96-page 1972 Technical and Scientific Book Catalog. Described are over 800 hardbound and softbound books which cover "do-it-yourself" titles from the Audel Division, amateur radio publications, audio visual materials, instructor's guides and student workbooks. Titles range from "ABC's of Air Conditioning" to Writer's and Editor's Technical Stylebook".
139. *Sencore, Inc.*—Speed Aligner Workshop Manual, Form No. 576P, provides 20 pages of detailed, step-by-step procedures for operation and application for Sencore Model SM 158 Speed Aligner sweep-marker generator.
140. *Sylvania Electric Products, Inc., Sylvania Electronic Components Div.*—has published the 14th edition of their technical manual, which includes mechanical and electrical ratings for receiving tubes, television picture tubes and solid-state devices.
141. *Tab Books*—has released their Spring 1972 catalog describing over 170 current and forthcoming books. The 20-page catalog covers: schematic/servicing manuals, broadcasting; basic technology; CATV; electric motors; electronic engineering; computer technology; reference; television, radio and electronics servicing; audio and hi-fi stereo; hobby and experiment; amateur radio; test instruments; appliance repair, and transistor technology.

TEST EQUIPMENT

142. *Dynascan Corp.*–announces a new 24-page 2-color catalog of B&K Precision Test Equipment. A total of 21 instruments are reportedly presented; from a Mutual Conductance Tube Tester to a new DC to 10 MHz Triggered Sweep Oscilloscope.
143. *Eico*—has released a 32-page, 1972 catalog which features 12 new products in their test equipment line, plus a 7-page listing of authorized Eico dealers.
144. *Hickok*—has published a 4-page brochure, "Hickok Oscilloscopes," which contains descriptions, specifications and prices for Models 5000A and 5002A oscilloscopes.
145. *Information Terminals*—has introduced a new brochure featuring the M-100 Tension Monitor, the M-200 Torque Tester and the M-300 Head and Guide Gage.
146. *Leader Instruments Corp.*—announces the 1972 Catalog of Leader Test Equipment. Test equipment included is the LBO-301 portable triggered-sweep oscilloscope, LSW-300 new solid-state post injection sweep/marker generator, and the LCG-384 miniportable, solid-state battery operated color-bar generator.
147. *Lectrotech, Inc.*—announces the 1972 catalog. "Precision Test Instruments for the Professional Technician". It contains specifications and prices on sweep marker generator, oscilloscopes, vectorscopes, color bar generators and other test equipment.
148. *Mercury Electronics Corp.*—14-page catalog provides technical specifications and prices of this manufacturers' line of Mercury and Jackson test equipment, self-service tube testers, testers, test equipment kits and indoor TV antennas.
149. *Pomona Electronics*—announces their new 60-page 1972 general catalog of electronic test accessories. The catalog provides illustrations and complete engineering information on all products, including dimension drawings, schematics, specifications, features, and operating ranges.
150. *Signal Analysis Ind. Corp.*—announces a 4-page bulletin describing their Model SAI-42 real time digital correlation and probability analyzer. Computional and averaging flexibility, increased dynamic range, increased time resolution, and dial-in capability are among features described with illustrations of the instrument controls.
151. *Tektronix, Inc.*—introduces a 76-page "New Products" catalog. Products listed are: automated test systems, computer display terminals, machine control products, and TV test instruments and monitors.
152. *Testline Instruments*—has issued a brochure for their new Model 101 Curve Tracer for checking transistors in- and out-of-circuit. All features, specifications, applications and warranty information are included.
153. *Triplett Corp.*—a 4-page, illustrated, 2-color brochure featuring a new battery-operated, portable Model 603 FET VOM has been introduced. Application data and specifications are included.
154. *Triplett Corp.*—announces a 2-page, 2-color data sheet for Model 6028, a 2¾ digit VOM. Data sheet gives DC volts, AC volts, ohms AC

and DC current ranges plus construction information, price and accessories.

155. *Speco Components Specialists, Inc.*—announces their 43-page, 1972 catalog of VOM multitesters and meters for TV technicians. Individual features and specifications for each instrument are included.

TOOLS

156. *Brookstone Co.*—announces a new 48-page, 1972 catalog which includes 185 new, unusual and useful hard-to-find tools, plus hundreds of other versatile hand tools and small power tools.

157. *Chapman Manufacturing Co.*—offers a pamphlet containing their line of tools and tool kits. Kit No. 6320, the Midget Ratchet is featured along with other available tool kits.

158. *Ideal Industries*—introduces a 2-page, 4-color brochure announcing their new Heat Gun. Performance characteristics applications, operating features, specifications and ordering information reportedly are included.

159. *Jensen Tools and Alloys*—has announced a new catalog No. 470, "Tools for Electronic Assembly and Precision Mechanics." The 72-page handbook-size catalog contains over 1,700 individually available items.

160. *Plato Products, Inc.*—introduces a 28-page, 2-color soldering tip catalog, No. 0372. Illustrated with dimensioned drawings to facilitate accurate selection, the new catalog features tips to fit leading brands and models of soldering irons.

161. *Upson Tools, Inc.*—Catalog No. 72 contains many new service kits and metric tools. The complete line of 4-in-1 tools offers 16 combinations of double-ended screwdrivers and a variety of nutdrivers.

162. *Vaco Products Co.*—has issued a 12-page price schedule for all Vaco tools. Stock number, description, and list price on each item is given.

163. *Xcelite, Inc.*—Bulletin N770 describes this company's three new socket wrench and ratchet screwdriver sets.

TRANSFORMERS/COILS

164. *Essex Controls Division*—new Stancor Transformer Catalog No. 207 lists over 1,900 standard transformers for design engineers. Full technical data, mounting dimensions, photographs and other specifications on the line of audio transformers, power transformers, chokes and inductors are included. A complete listing of all Stancor sales offices and stocking warehouses is included.

165. *J.W. Miller Co.*—announces a new 92-page radio and TV replacement coil cross reference guide for known domestic and foreign color and black and white TV sets, home and car radios. Over 22,000 replacement coils for 327 manufacturers names reportedly are listed.

166. *Stancor Products*—pocket-size, 108-page "Stancor Color and Monochrome Television Parts Replacement Guide" provides the TV technician with transformer and deflection component part-to-part cross reference replacement data for over 14,000 original parts.

TUNER REPAIR

167. *PTS Electronics, Inc.*—62-page catalog with over 600 exact-replacement tuners listed under their original manufacturer number for ease of exchange. A replacement guide for antenna coils and shafts is also provided.

TV ACCESSORIES

168. *Telematic*—introduces a 14-page catalog featuring CRT brighteners and reference charts, a complete line of test jig accessories and a cross reference of color set manufacturers to Telematic Adapters and convergence loads.

TV PICTURE TUBES

169. *GTE Sylvania*—50-page brochure which describes characteristics of over 900 television picture tubes, plus data on interchangeability information and tips on installation and handling of TV picture tubes.

170. *GTE Sylvania, Inc.*—has published an interchangeability guide listing 191 commonly used color TV picture tubes which can be replaced with 19 GTE Sylvania Color Bright 85® types. □

SAMS PHOTOFACT

Supplement to 1972 ANNUAL INDEX

Covers PHOTOFACT Set Numbers 1218 thru 1253 and Specialized Volumes AR-109 thru AR-123, CB-37 thru CB-39, MHF-21 thru MHF-26, TR-90 thru TR-101, TSM-129 thru TSM-134 Released.

JANUARY thru JUNE 1972

This Supplement is your Index to new models covered by PHOTOFACT since December 1971. For model coverage prior to this date see the 1972 PHOTOFACT Annual Index. Use this Supplement with the Annual Index—together they are your complete Index to PHOTOFACT coverage of over 89,000 models.

Set No. — Folder No.

A

ADMIRAL
(Also See Recorder Listing)
Admiral Corp.-National Service Div.
P.O. Box 845
Bloomington, Illinois 61701
★Chassis K18-1A/-2A 1218–POM
★Chassis K1663-33 (Similar to Chassis) .... 1204—1
●Chassis NA10-1A 1236–POM
★Chassis T11K10-1A 1242–POM
★Chassis T12K10-1B 1242–POM
●Chassis TR2-1A (Run 10) 1245—1
●Chassis TR2-2A (Run 10) 1245—1
●Chassis TR3-1A (Run 10) 1245—1
★Chassis 1K10-8 (Runs thru 16) .... (PCB1211-4) 1083—1
★Chassis 1K18-1A,-2A 1218–POM
★Chassis 1K1697-9,-10 (Similar to Chassis) .... 1204—1
Chassis 10J2 .... MHF-26
★Chassis 12K2084-6 .... 1218–POM
★Chassis 12K2086-2 .... 1218–POM
★Chassis 12K2088-1, -2 1218–POM
★Chassis 13K2089-1 .... 1218–POM
★Chassis 15K1673-33 .... 1218–POM
★Chassis 15K1680-1 .... 1218–POM
★Chassis 15K1686-1,-5 .... 1218–POM
★Chassis 15K1687-1, -2 .... 1218–POM
Chassis 50A1 .... MHF-25
●C1897PM (Similar to Chassis) .... 1068—1
KS411-8 (Similar to Chassis) .... 1083—3
KS643 (Similar to Chassis) .... 1083—3
PS561 (Similar to Chassis) .... 1201—3
PS571C (Similar to Chassis) .... 1111—4
PSF541M (Similar to Chassis) .... 1083—3
●SK9P248,M .... 1245—1
●SK9P290,M .... 1245—1
★SK5241 .... 1218–POM
★SK5245 .... 1218–POM
★SK5248 .... 1218–POM
STC711 .... MHF-26
STC761 .... MHF-25
★3L1381 .... 1218–POM
★3L1385 .... 1218–POM
★3L1388 .... 1218–POM
★5AL5145 .... 1218–POM
★5AL5148 .... 1218–POM
★5L5151 .... 1218–POM
★5L5155 .... 1218–POM
★5L5158 .... 1218–POM
★5L5161 .... 1218–POM
★5L5171 .... 1218–POM
★5L5178 .... 1218–POM
★5L5181 .... 1218–POM
★5L5185 .... 1218–POM
★5L5188 .... 1218–POM
★5L5191/93/95 .... 1218–POM
★5L5201/03/05 .... 1218–POM
★5L5253 .... 1218–POM
★5LS5231/33/35 .... 1218–POM
★5ST5213 .... 1218–POM
★5ST5223 .... 1218–POM
●7P280 .... 1236–POM
★8T791C (Similar to Chassis) .... 1204—1
★8T911C (Similar to Chassis) .... 1204—1
★8T941C 1218–POM
★8T950 .... 1218–POM
★8TS911C (Similar to Chassis) .... 1204—1
●9P239 .... 1245—1
●9P245 .... 1245—1
●9P250 .... 1245—1
●9P257 .... 1245—1
●12P261 .... 1245—1
●12P275 .... 1245—1
●12P280 .... 1245—1
●12P287 .... 1245—1
●16P267, M (Similar to Chassis) .... 1068—1
●18P28FS (Similar to Chassis) .... 1068—1
●19H419M (Similar to Chassis) .... 1068—1
●19P27CFS (Similar to Chassis) .... 1068—1
●19P428 (Similar to Chassis) .... 1068—1
●19P437C (Similar to Chassis) .... 1068—1
★19T100C 1218–POM
★19T111C 1218–POM

ADMIRAL—Cont.
★19T118C/119C 1218–POM
★19T201C 1218–POM
★19T208 .... 1218–POM
★21T701C 1218–POM
★21TS711C 1218–POM
●22C91/95 .... (Similar to PCB1013-3) 975—1
●22T81C .... (Similar to PCB1013-3) 975—1
★2080P,PF 1242–POM
★2097P 1242–POM
★6047PC-M .... (PCB1211-4) 1083—1
★6080P,PC 1242–POM
★6097P,PC 1242–POM

AIRCASTLE
Spiegel, Inc.
1061 West 35th Street
Chicago, Illinois 60609
TRS-25, TRS-27 .... TSM-129
23-02 .... CB-38
162-F1 .... TSM-133

ALLIANCE
The Alliance Mfg. Co., Inc.
22790 Lake Park Blvd.
Alliance, Ohio 44601
C-225 (Antenna Rotator) 1211–SED

ALLIED
Allied Radio Shack
2617 West Seventh Street
Fort Worth, Texas 76107
14A50502 .... MHF-22
1450 (14A50502) MHF-22
2436 .... TSM-93

ALLIS CHALMERS
(See Auto Radio Listing)

AMBASSADOR
(Also See Recorder Listing)
Allied Purchasing Corp.
401 Fifth Avenue
New York, N. Y. 10016
★AM7000WD .... 1242—1
●AM7112WD (Late Prod.) .... 1225—1
★AM7116WD .... 1229—1
★AM7118WD .... 1242—1
★1912 (Similar to .... PCB 956-4) 859—2
★2920/21/22 (Similar to Chassis) .... 1063—1
★2955 (Similar to Chassis) .... 871—3
★2960/62/63 (Similar to Chassis) .... 871—3
●6716/18/19 (Similar to Chassis) .... 838—2
●6918 (Similar to Chassis) .... 838—2
●6976/6978 (Similar to Chassis) .... 838—2
●6982 (Similar to Chassis) .... 858—1
●7015 (Similar to Chassis) .... 1056—2
●7018 (Similar to Chassis) .... 838—2

AMC-AMCREST
Amcrest Corporation
1440 Broadway
New York, New York 10018
750 .... TSM-132

AMERICAN MOTORS
(See Auto Radio and Recorder Listings)

AMPEX
(Also See Auto Radio and Recorder Listings)
Ampex Consumer Equipment Division
2201 Lunt Avenue
Elk Grove Village, Illinois 60007
ASR-100 .... MHF-25

ARVIN
(Also See Changer and Recorder Listings)
Arvin Industries Inc.
1531 Thirteenth Street
Columbus, Indiana 47201
30R56-12 (Ch. 1.00711) .... 1212—4
40R56-12 (Ch. 1.00721) .... 1212—4
55R47 (Ch. 1.83101) TSM-48
55R58 (Ch. 1.83201) TSM-48
80M25-28 (Ch. 1.01121) .... 1233—4
80M35-11 (Ch. 1.00791) .... 1230—4
80M35-16 (Ch. 1.00791) .... 1230—4
80P25-19 (Ch. 1.01041) MHF-26
Ch. 1.00711 .... 1212—4
Ch. 1.00721 .... 1212—4
Ch. 1.00791 .... 1230—4
Ch. 1.01041 .... MHF-26

ARVIN—Cont.
Ch. 1.01121 .... 1233—4
Ch. 1.20101 .... TSM-79
Ch. 1.90801 .... TSM-66

ASTRO LINE
(See Auto Radio Listing)

AUDI
(See Auto Radio Listing)

AUDIOVOX
(See Auto Radio and Recorder Listings)

AUTOMATIC
(Also See Auto Radio and Recorder Listings)
Automatic Radio Mfg. Co., Inc.
2 Main Street
Melrose, Massachusetts 02176
PED-2512 .... TSM-134
PEL-2501 .... TSM-134

B

BENNETT
Bennett Laboratories, Inc.
5800 Christie Avenue
Emeryville, California 94608
(Address Change)

BLONDER-TONGUE
Blonder-Tongue Laboratories
9 Alling Street
Newark 2, New Jersey
American-300 (VHF/UHF TV Amp) 1238–SED
DA-4U/V-75 (VHF/UHF Amp) 1242–SED
DA-4V (1435) (TV Distribution Amp) 1232–SED
Homer 75V 1240–SED
Homer 300V 1240–SED
Horizon 464D (TV Distribution Amp) 1234–SED
Spanner (VHF/UHF TV Amp) 1238–SED
Suburban 4542 (UHF/VHF Amp) 1232–SED
Vamp-Tic (VHF TV Distribution Amp) 1238–SED
Voyager 4553 (VHF/UHF Amp) 1242–SED

BOMAN ASTROSONIX
(See Auto Radio and Recorder Listings)

BRADFORD
(Also See Recorder Listing)
W. T. Grant Company
1515 Broadway, Times Square
New York, New York 10036
★WTG-53413 .... 1237—1
★WTG-53421 .... 1249—1
★WTG-54346 .... 1228—1
★WTG-54353 .... 1228—1
★WTG-54395 .... 1220—1
★WTG-54403 .... 1220—1
★WTG-54411 .... 1220—1
WTG-55202 (Similar to Chassis) .... 1098—5
★WTG-59204A,B .... 1210—1
★WTG-59212A .... 1210—1
WTG-60434 (Similar to Chassis) .... 1125—5
WTG-60939 .... TSM-132
●WTG-61093 .... 1243—1
WTG-61457 (Similar to Chassis) .... 1049—3
WTG-61499 (Similar to Chassis) .... 1130—5
WTG-89425 (Similar to Chassis) .... 1104—5
●WTG-91959 .... 1250—1
●WTG-91967 .... 1250—1
WTG-95745 (Similar to Chassis) .... 1130—5
WTG-95766 (Similar to Chassis) .... 1130—5
●1004C22/D22 .... 1250—1
●1005A32/B22 .... 1246—1
●1042B40 .... 1243—1
★1104K31 .... 1228—1
★1104L41 .... 1228—1
★1142A21/B21/C21 .... 1220—1
★1171A22 .... 1237—1
★1171B22 .... 1249—1
★1205A42/B42 .... 1210—1
1306A29 .... 1049—3
1306A39 (Similar to Chassis) .... 1098—5
1306B10 (Similar to Chassis) .... 1130—5

BRADFORD—Cont.
1306B20 (Similar to Chassis) .... 1130—5
1306B39 (Similar to Chassis) .... 1049—3
1306F20 (Similar to Chassis) .... 1130—5
1405M31 .... MHF-26
1506A40 (Similar to Chassis) .... 1104—6
2053D30 .... TSM-132
53702 .... MHF-25
60434 (Similar to Chassis) 1125—5
60830 (Similar to Chassis) 1159—5
89193 (Similar to Chassis) 1074—6

BRITISH LEYLAND
(See Auto Radio Listing)

BROWNING
Browning Laboratories, Inc.
1269 Union Street
Laconia, N. Hampshire 03246
Mark II Series B CB-39
SSB-15 .... CB-39
SST CB-37

BUICK
(See Auto Radio and Recorder Listings)

C

CADILLAC
(See Auto Radio and Recorder Listings)

CARTAPE
(Also See Auto Radio and Recorder Listings)
Car Tapes, Inc.
9180 Kelvin Avenue
Chatsworth, California 91311
PT-8 .... TSM-133

CATALINA
White Stores, Inc.
Wichita Falls, Texas 60639
●122-180 (Similar to Contents) .987
●122-752F .... 1229—2
122-1305 (Similar to Contents) 869
★122-2121A 1236–POM
●122-2147A .... 1229—2
★122-2815A .... 1234—1
★122-2820A .... 1234—1
★122-2845A .... 1234—1
★122-2850A .... 1234—1
★122-2855A .... 1234—1
★122-2865A .... 1234—1
★122-2880A (TV Ch. Only) 1234—1
★122-2885A .... 1234—1
★122-2890A .... 1234—1
★123-2607A (TV Ch. Only) 1234—1
★123-2610A (TV Ch. Only) 1234—1

CHANNEL MASTER
(Also See Auto Radio and Recorder Listings)
Channel Master Corp.
Ellenville, N. Y. 12428
★6106A, 6107A .... 1223—1
★6111A .... 1223—1
★6119A .... 1223—1
★6121A/22A/23A/24A .... 1223—1
★6143A 1236–POM
6201 .... TSM-129
6202 .... TSM-131
6205 .... TSM-130
6208 .... TSM-130
6232 .... TSM-132
6237 .... TSM-134
6238 .... TSM-132

CHEVROLET
(See Auto Radio and Recorder Listings)

CHRYSLER
(See Auto Radio Listing)

CONCORD
Concord Electronics Corp.
1935 Armacost Avenue
Los Angeles, California 90025
STA-12 .... MHF-25

CORNELL-DUBILIER
Cornell-Dubilier Electronics
118 East Jones Street
Fuquay-Varina, N. C.
AR-20 (Antenna Rotator) 1223–SED
TR-15/-16 (Antenna Rotator) 1213–SED

CORONADO
Gamble-Skogmo, Inc.
P.O. Box 458
Minneapolis, Minn. 55440
●TV2-1408A .... 1231—1
●TV2-1420A .... 1231—1
★TV2-2021A .... 1227—1
★TV2-2031A .... 1227—1
★TV2-2041A .... 1227—1
★TV2-2051A .... 1227—1
★TV2-2061A .... 1227—1
★TV2-2071A .... 1227—1
★TV2-2081A .... 1227—1
★TV2-2081B (Similar to Chassis) .... 1227—1

COURIER
(Also See E.C.I.)
Fanon/Courier Corporation
990 South Fair Oaks Avenue
Pasadena, California 91105
Caravelle CB-38
CCT-3 .... CB-37
Conqueror CB-38

CRAIG
(See Auto Radio and Recorder Listings)

CROWN RADIO
(See Recorder Listing)

CURTIS MATHES
Curtis Mathes Mfg. Co.
P.O. Box 5610
Dallas, Texas 75222
★Ch. C/CMC37 .... 1244—1
Ch. 47-2 .... 1230—5
Ch. 47-3 .... 1238—4

D

DELCO
(See Auto Radio and Recorder Listings)

DODGE
(See Auto Radio Listing)

DUMONT
DuMont Radio & Television
14th & Coles Streets
Jersey City, N. J. 07302
★19DP01 (Ch. 30K18-1B) 1224–POM
★19DP02W (Ch. 31K18-1B) 1224–POM
★25DC04W/06S/07M (Ch. 32K16) .... 1253—1
★59T01WN (Ch. 120976A) .... (PCB1211-4) 1102—1
★59T02WN (Ch. 120984A) .... (PCB1211-4) 1102—1
★Ch. 30K18-1B 1224–POM
★Ch. 31K18-1B 1224–POM
★Ch. 32K16 (Runs 13 thru 17) .... 1253—1
★Ch. 120976A .... (PCB1211-4) 1102—1
★Ch. 120984A .... (PCB1211-4) 1102—1

E

E.C.I.
(Also See Courier)
Fanon /Courier Corporation
990 South Fair Oaks Avenue
Pasadena, California 91105
Address Change

EIA
Production Code Source 1248

ELECTROHOME
Electrohome Limited
809 Wellington Street North
Kitchner, Ontario, Canada
●Apollo M11-206 (Ch. M11-A) .... 1236—1
●Bradford M11-212 (Ch. M11-A) .... 1236—1
●Brandon M04-210 (Ch. M4-Z) (Similar to Chassis) .... 1176—1
●Breton M11-211 (Ch. M11-A) .... 1236—1
●Comet M04-215 (Ch. M4-Z) (Similar to Chassis) .... 1176—1
★Corsair C07-144 (Ch. C7-E) .... 1198—1
●Croydon M11-201 (Ch. M11-A) .... 1236—1
★Crusader C07-151 (Ch. C7H-E) (Similar to Chassis) .... 1198—1

ELECTROHOME—Cont.
★Dundurn C07-147 (Ch. C7H-E) (Similar to Chassis) .... 1198—1
●Gemini M11-205 (Ch. M11-A) .... 1236—1
●Glendale M04-202 (Ch. M4-Z) (Similar to Chassis) .... 1176—1
★Hampton C07-145 (Ch. C7A-E) (Similar to Chassis) .... 1198—1
●Jupiter M04-205 (Ch. M4-Z) (Similar to Chassis) .... 1176—1
●Meteor M04-204 (Ch. M4-Z) (Similar to Chassis) .... 1176—1
★Parkdale C09-110 (Ch. C9-B) .... 1213—1
●Polaris M04-203 (Ch. M4-Z) (Similar to Chassis) .... 1176—1
●Verdun M04-201 (Ch. M4-Z) (Similar to Chassis) .... 1176—1
★Versailles C09-109 (Ch. C9-B) .... 1213—1
★Ch. C9-B .... 1213—1
●Ch. M4-Z (Similar to Chassis) .... 1176—1
●Ch. M11-A .... 1236—1

ELECTROPHONIC
(Also See Recorder Listing)
Electrophonic Corp. of America
101-10 Foster Avenue
Brooklyn, New York 11236
T-9 .... TSM-131
T-16 .... TSM-130
T-17 .... TSM-131
T-107 .... MHF-22
T-108 .... MHF-23
T-109 .... MHF-23
T-500A MHF-26
T-700 .... MHF-26
T-4100 .... MHF-21
Ch. 24M .... 1217—4
Ch. 26C (Similar to Chassis) .... 1207—3
Ch. 31H .... 1222—4
Ch. 32M .... 1236—5
Ch. 41, 43 .... 1224—4
Ch. 64M .... 1217—4
Ch. 76K .... 1214—4
Ch. 77K .... 1221—5

ELGIN
(See Recorder Listing)

EMERSON
Emerson Television Sales Corp.
14th & Coles Streets
Jersey City, New Jersey
●9FP02/03/04W (Ch. T2R2-1A, -2A) .... 1230—1
10ES01W/02M/03S (Ch. 121007) .... 1151—5
●12FP01/02/03W (Ch. T2R3-1A, -2A) .... 1230—1
●18BP01 (Ch. T25H4-1A) (Similar to Chassis) .... 1211—1
★18EP04 (Ch. 30K17-1A) .... 1252—1
●19BP08/09W (Ch. T25H4-1A) .... 1211—1
★19CP04W (Ch. 33K18-1A) 1252—1
★19EP01 (Ch. 30K18-1A) .... 1252—1
★19EP02W (Ch. 31K18-1A) .... 1252—1
★19EP03R (Ch. 32K18-1A) .... 1252—1
●19FP04/05W (Ch. 11H5) 1222—1
●19FP10 (Ch. T12K3-1A) 1218–POM
●19FP11W (Ch. T12K3-1B) 1218–POM
●19FP12W (Ch. T13K3-1B) 1218–POM
●20FP01/02W (Ch. 16H5) 1222—1
★21ET01 (Ch. 11K1663-40) (Similar to Chassis) .... 1207—1
★21ET02W (Ch. 32K1687-2) .... 1244—2
●22BC01W/02M/03S (Ch. 12H5) .... 1222—1
●22BS02W (Ch. 14H5) (Similar to Chassis) .... 1222—1
●22BT05W (Ch. 12H5) .... 1222—1
●22FC01W/02M/03S (Ch. 12H5) .... 1222—1
●22FC06W/07M/08S (Ch. 12H5) .... 1222—1
●22FS01W (Ch. 14H5) .... 1222—1
●22FT01W (Ch. 12H5) .... 1222—1
●22FT04W (Ch. 12H5) .... 1222—1
★23EC10W/12S (Ch. 5K1675-4) (Similar to Chasis) .... 1207—1
★23EC13W (Ch. 11K1670-2) (Similar to Chassis) .... 1207—1

NOTE: ● Denotes Television Receiver. ★ Denotes Color Television Receiver. **AOR** Denotes Available On Request. **AR** Denotes Auto Radio Series Volume. **CB** Denotes CB Radio Series Volume. **HTP** Denotes Home Tape Player Series Volume. **MHF** Denotes Modular Hi-Fi Series Volume. **PCB** Denotes Production Change Bulletin. **POM** Denotes Bonus Schematic in Photofact-of-the-Month Package—Unavailable After Month Of Issue. **SED** Denotes Special Equipment Data. **TR** Denotes Tape Recorder Series Volume. **TSM** Denotes Transistor Radio Series Volume.

Set No. Folder No.

EMERSON—Cont.

★25EC11W (Ch. 11K1663-41) (Similar to Chassis) ... 1207—1
★25EC14M/15W/16S (Ch. 32K1673-32) ... 1244—2
★25EC17W/19S (Ch. 32K1686-4) ... 1244—2
31M15 ... MHF—26
31M17, A ... MHF—24
●Ch. T2R2-1A, -2A ... 1230—1
●Ch. T2R3-1A, -2A ... 1230—1
●Ch. T12K3-1A, -1B ... 1218-POM
●Ch. T13K3-1B ... 1218-POM
★Ch. 5K1675-4 (Similar to Chassis) ... 1207—1
●Ch. 11H5 (Run 24) ... 1222—1
★Ch. 11K1663-40, -41 (Similar to Chassis) ... 1207—1
★Ch. 11K1670-2 (Similar to Chassis) ... 1207—1
●Ch. 12H5 (Run 24) ... 1222—1
●Ch. 14H5 (Run 24) ... 1222—1
●Ch. 16H5 (Run 24) ... 1222—1
★Ch. 30K17-1A ... 1252—1
★Ch. 30K18-1A ... 1252—1
★Ch. 31K18-1A ... 1252—1
★Ch. 32K18-1A ... 1252—1
★Ch. 32K1673-32 (Runs 13 thru 17) ... 1244—2
★Ch. 32K1686-4 ... 1244—2
★Ch. 32K1687-2 ... 1244—2
★Ch. 33K18-1A,-1B ... 1252—1

F

FANON-MASCO
(Also See Recorder Listing)
Fanon/Courier Corporation
990 South Fair Oaks Avenue
Pasadena, California 91105
SFT-900 (Guardsman) ... CB—37
T-808 ... CB—38
CHB-4 ... CB—37

FISHER
Fisher Radio Corp.
11-40 45th Road
Long Island City, N.Y. 11101
250-T ... MHF—24
400-T ... MHF—24

FORD
(See Auto Radio and Recorder Listings)

G

GENERAL ELECTRIC
(Also See Recorder Listing)
For TV Models
General Electric Company
College Blvd.
Portsmouth, Virginia 23705
For Radio and Phonograph Models
General Electric Company
1101 Broad Street
Utica, New York 13501
A211g (Ch. PK160) (Similar to Chassis) ... 1209—4
A242g (Ch. PK160) (Similar to Chassis) ... 1209—4
A401h (Ch. TU540, CP1,PA40) ... 1219—5
A401g (Ch. TU540, PA40, CP1) ... 1219—5
A482g (Ch. PK160) (Similar to Chassis) ... 1209—4
A534h (Ch. TU540-1, PA40, CP1) ... 1219—5
A536g (Ch. TU540, CP1,PA40) ... 1219—5
A634h (Ch. TU540-1, PA40, CP1) ... 1219—5
A818h (Ch. TU540-1, CP1,PA135) ... 1248—4
C151k (Ch. PK160) ... 1209—4
C241g (Ch. PK160) (Similar to Chassis) ... 1209—4
C351k (Ch. TU540-11, PA40, CP1) ... 1219—5
C445g (Ch. TU540-1, PA40, CP1) ... 1219—5
C481g (Ch. PK160) (Similar to Chassis) ... 1209—4
C524k (Ch. TU540-1, PA40, CP1) ... 1219—5
C524m (Ch. TU540, CP1,PA40) ... 1219—5
C550g (Ch. TU540, PA40, CP1) ... 1219—5
C557g,h,i (Ch. TU540-14, PA40-5,-6) (Similar to Chassis) ... 1219—5
C614g (Ch. TU540-1, PA40, CP1) ... 1219—5
C651g (Ch. TU540, PA40, CP1) ... 1219—5
C657g, h (Ch. TU540-15, PA40-3) (Similar to Chassis) ... 1219—5
C771g (Ch. TU540,CP1,PA40) (Similar to Chassis) ... 1219—5
C817g,h (Ch. TU540-10, CP1,PA135) ... 1248—4
C819h (Ch. TU540-1, CP1,PA135) ... 1248—4
C961g (Ch. PK160) (Similar to Chassis) ... 1209—4
C4350A,B ... 1236—4
C4540A,B,C ... 1245—5
C4570A ... 1239—4
★CBM250NWD-2 (Ch. N-2) ... 1219—1
★CBM261CMD-1 (Ch. C-1) (Similar to Chassis) ... 1100—2
★CBM261CWD-2 (Ch. C-2) ... 1231—2
★CBM264CWD-2 (Ch. C-2) ... 1231—2
G210g (Ch. PK160) (Similar to Chassis) ... 1209—4
G240g (Ch. PK160) (Similar to Chassis) ... 1209—4
G402g (Ch. TU240, PA40, CP1) ... 1221—4
G402h (Ch. TU540, PA40, CP1) ... 1219—5
G480g (Ch. PK160) (Similar to Chassis) ... 1209—4
G514g (Ch. TU540-1, PA40, CP1) ... 1219—5
G542g (Ch. TU540, PA40, CP1) ... 1219—5
G543h,k (Ch. TU540-1, PA40, CP1) ... 1219—5

GENERAL ELECTRIC—Cont.

G618g (Ch. TU540-1, PA40, CP1) ... 1219—5
G960g (Ch. PK160) (Similar to Chassis) ... 1209—4
H530g (Ch. TU540-1, PA40, CP1) ... 1219—5
★JA5301WD (Ch. JA) ... 1242-POM
★JA6212WD (Ch. JA) ... 1242-POM
★M234GWD-1 (Ch. G-1) (Similar to PCB 1057-3) 973—2
★M810CWD-2 (Ch. C-2) ... 1231—2
★M910LWD-2 (Ch. L-2) ... 1231—2
★M911LMP-2 (Ch. L-2) ... 1231—2
★M913LPN-2 (Ch. L-2) ... 1231—2
★M916LPN-1 (Ch. L-1) (Similar to PCB 1175-3) 1100—2
★M916LPN-2 (Ch. L-2) ... 1231—2
★M922LWD-2 (Ch. L-2) ... 1231—2
★M930LWD-1 (Ch. L-1) (Similar to PCB 1175-3) 1100—2
★M930LWD-2 (Ch. L-2) ... 1231—2
★M931LMP-1 (Ch. L-1) (Similar to PCB 1175-3) 1100—2
★M931LMP-2 (Ch. L-2) ... 1231—2
★M933LCT-2/934LEA-2 /935LMD-2 (Ch. L-2) ... 1231—2
M8614A ... TSM—133
M8615A ... TSM—132
P464g,h (Ch. T7N-J) (Similar to Chassis) ... 979—5
P794g (Ch. TU540-14, PA40-5) (Similar to Chassis) ... 1219—5
P2835A ... TSM—130
P2950B ... TSM—132
P4830A ... TSM—130
P4920A ... TSM—134
T361p,n (Ch. T2P) ... 1192—4
T440p (Ch. T2P) ... 1192—4
T541j,k (Ch. T7N-J) (Similar to Chassis) ... 979—5
T4840A ... TSM—133
●TR105TVY (Ch. T-6) ... 1242—2
●TR110TEB (Ch. T-6) ... 1242—2
●TR115RTX-2 (Ch. R-2) 1242-POM
●TR120RVY-1 (Ch. R-1) ... 1220—2
V972g,h (Ch. PK6) ... 1237—4
V982g ... 1237—4
●WM020WEB-1/WVY-1 (Ch. W-1) ... 1221—1
●WM153SCH-3 (Ch. S-3) ... 1217—1
●WM194SWD-3 (Ch. S-3) ... 1217—1
★WM201HGR-4/202HVY-4 (Ch. H-4) ... 1223—2
★WM203HWD-4 (Ch. H-4) 1223—2
★WM205HWD-4/206HWD-4 (Ch. H-4) ... 1223—2
★WM212HWD-4 (Ch. H-4) 1223—2
★WM218HWD-4/219HWD-4 (Ch. H-4) ... 1223—2
★WM225HWD-4 (Ch. H-4) 1223—2
★WM257NWD-2 (Ch. N-2) 1219—1
★WM260CBG-2, CWD-2 (Ch. C-2) ... 1231—2
★WM264CWD-2 (Ch. C-2) ... 1231—2
★WM266CWD-2 (Ch. C-2) ... 1231—2
★WM270CBW-2 (Ch. C-2) ... 1231—2
★WM274CWD-2 (Ch. C-2) ... 1231—2
★WM277CWD-2 (Ch. C-2) ... 1231—2
★WM279CCT-2/279CEA-2 (Ch. C-2) ... 1231—2
★WM351NBW-2/353NWD-2 (Ch. N-2) (Similar to Chassis) ... 1219—1
★WM355NWD-2 (Ch. N-2) (Similar to Chassis) ... 1219—1
★WM381CWD-2/382CWD-2/383CWD-2 (Ch. C-2) ... 1231—2
★WM385CCT-2,CEA-2, CMD-2 (Ch. C-2) ... 1231—2
838h (Ch. TU540-1, CP1, PA135) ... 1248—4
8630A ... MHF—25
★Ch. C-2 ... 1231—2
Ch. CP1 ... 1219—5, 1221—4, 1248—4
Ch. CP1-1,-6,-7,-8, -11,-12,-13 ... 1219—5, 1221—4
★Ch. H-4 ... 1223—2
★Ch. JA ... 1242-POM
★Ch. L-2 ... 1231—2
★Ch. N-2 ... 1219—1
Ch. PA40,-1,-2,-3,-4 ... 1219—5, 1221—4
Ch. PA135 ... 1248—4
Ch. PK6 ... 1237—4
●Ch. R-1 ... 1220—2
●Ch. R-2 ... 1242-POM
●Ch. T-6 ... 1242—2
Ch. TU240,-8,-9,-10, -11,-12,-13 ... 1221—4
Ch. TU540 ... 1219—5
Ch. TU540-1 ... 1219—5, 1248—4
Ch. TU540-10 ... 1248—4
Ch. TU540-11 ... 1219—5
●Ch. W-1 ... 1221—1

GENERAL MOTORS CORP.
(GMC) (See Auto Radio and Recorder Listings)

GRANTLINE
W. T. Grant Company
1515 Broadway, Times Square
New York, New York 10036
Address Change

H

HEATHKIT
Heath Company
Benton Harbor, Michigan 49023
★GR-481 ... 1234-SED

HITACHI
(Also See Auto Radio and Recorder Listings)
Hitachi Sales Corporation of America
48-50 34th Street
Long Island City, N. Y. 11101
Address Change
★CFA-440 ... 1241—1
★CFA-461 ... 1231—3
★CNU-871 ... 1241—1
★CNU-881 ... 1231—3
★CNU-891 ... 1231—3
★CSU-691 ... 1241—1
★CSU-790 ... 1231—3

HITACHI—Cont.

★CTU-970 ... 1231—3
★CWU-220 ... 1230—2
DPK-321(U) ... MHF—24
●IU-54 ... 1223—3
KC-770E,H ... 1225—4
KC-775H ... 1242—4
KS-2210 ... MHF—24
●P-22G,R (Similar to Chassis) ... 1233—1
●S-87/88 (Similar to Chassis) ... 1233—1
●SU-86 (Ch. SV-A) ... 1233—1
●TU-76 (Ch. SV-A) ... 1233—1
●TWU-68/69 (Ch. SV-A) ... 1233—1
●TWU-73 (Ch. SV-A) ... 1233—1
●Ch. SV-A ... 1233—1

I

INLAND-DYNATRONICS
(See Auto Radio and Recorder Listings)

INTERNATIONAL
(See Auto Radio Listing)

J

JEEP
(See Auto Radio Listing)

JERROLD
Jerrold Electronics Corp.
The Jerrold Building
15th & Lehigh
Philadelphia, Pa. 19132
AMA-50 (AM RF Rebroadcast Amp.) ... 1226-SED
AT-* (Audio-Trol) ... 1229-SED
SPM-2 (VHF/UHF Amp) 1225-SED
SPM-106 (VHF/UHF Amp) ... 1225-SED
U5V ... 1232-SED
106 (VHF/UHF Amp) ... 1225-SED
454T (UHF Converter Amp) ... 1232-SED
465SS (Oscillator/Power Supply) ... 1232-SED
3550 (VHF-FM Amp) ... 1224-SED

JOHN DEERE
(See Auto Radio Listing)

JOHNSON
E. F. Johnson Company
11 32nd Avenue, S.W.
Waseca, Minnesota 56093
Messenger 124-M ... CB—39
242-0134 ... CB—39
242-0152 ... CB—12
242-0156 ... CB—12

JULIETTE
(See Recorder Listing)

JVC
JVC America, Inc.
50-35 56th Road
Maspeth, N.Y. 11378
●3230 ... 1252—2

K

KARMANN GHIA
(See Auto Radio Listing)

KAY-TOWNES
Kay-Townes Antenna Company
Turner Chapel Road
Rome, Georgia 30161
AB-4000/4100 (VHF/FM Amp) ... 1225-SED
AB-4200 (VHF-UHF-FM Distribution Amp) ... 1224-SED
AB-4400 ... 1224-SED
AB-4500 (VHF/UHF/FM Distribution Amp) ... 1238-SED
AB-4600 (VHF/UHF Distribution Amp) ... 1223-SED
AB-4700 (VHF/UHF/FM Distribution Amp) ... 1223-SED
AB-4800 (VHF/FM Distribution Amp.) ... 1223-SED
AB-4900 (VHF/FM Amp) ... 1225-SED
AB-5000 (VHF/UHF/FM Amp) ... 1225-SED
AB-5100 (Antenna-Mounted Amp) ... 1224-SED
AB-5200 (VHF/UHF/FM Amp) ... 1225-SED
AB-5300 (VHF/UHF/FM Amp) ... 1229-SED
AB-5400 (VHF/UHF/FM Distribution Amp) ... 1229-SED
AB-5800 (VHF/UHF/FM Distribution Amp) ... 1229-SED
AB-6000 (VHF/FM Mast-Mounted Amp) ... 1223-SED
AB-6100/6200/6300 (VHF/FM Amp) ... 1229-SED
AB-7000 (UHF Amp) ... 1249-SED
AB-7100 (VHF Amp) ... 1225-SED
AB-7200 (UHF Amp) ... 1228-SED
AB-7400 (VHF Amp) ... 1238-SED
AB-7500 (VHF Amp) ... 1238-SED
AB-7600 ... 1240-SED
AB-7700 (VHF/UHF/FM Amp) ... 1249-SED
AB-7800 (VHF/UHF/FM Amp) ... 1228-SED
AB-8000 (VHF/FM Antenna Mounted Amp) ... 1232-SED
AB-8200 (VHF/UHF/FM Antenna Mounted Amp) ... 1232-SED
AB-8700 (VHF/FM Amp) 1228-SED
AB-8800 (VHF/FM Amp) 1228-SED
AB-9000 (VHF Distribution Amp) ... 1238-SED
AB-9100 (VHF Distribution Amp) ... 1226-SED
AB-9400 (VHF/UHF/FM Distribution Amp) ... 1226-SED
AB-9500 (VHF/UHF/FM Distribution Amp) ... 1238-SED
AB-9900 ... 1240-SED

KENWORTH
(See Auto Radio Listing)

L

LAFAYETTE
Lafayette Radio Electronics
111 Jericho Turnpike
Syosset, L. I., New York 11791
Dyna-Com 3A (99-31940L) ... CB—37
Dyna-Com 12a (99-32484) ... CB—38
HB-23A (99-32351WX) ... CB—38
LR-100 (99-02214WX) ... MHF—23
Telsat SSB-25 (99-32377W) ... CB—37
99-02214WX ... MHF—23
99-31940L ... CB—37
99-32351WX ... CB—38
99-32377W ... CB—37
99-32484 ... CB—38

LINCOLN
(See Auto Radio and Recorder Listings)

LLOYD'S
(See Recorder Listing)

M

MACK TRUCK
(See Auto Radio Listing)

MAGNAVOX
(Also See Recorder Listing)
The Magnavox Company
Bueter Road
Fort Wayne, Indiana 46803
1P9282 ... MHF—21
1R1707 ... 1212—5
1R1729 ... 1229—5
1R1736 ... 1216—5
2K8886 ... MHF—24
Chassis A510-02-AA,-BA (Similar to Chassis) ... 923—5
Chassis A511-01-BA (Similar to Page 57) ... MHF—16
Chassis A512-01-AA ... MHF—21
Chassis A512-02-AA (Similar to Page 5) ... MHF—21
●Chassis CU362/363 (Similar to Chassis) ... 205—6
●Chassis CU372/373 (Similar to Chassis) ... 205—6
Chassis R214-08-00 (Similar to Chassis) ... 875—6
Chassis R214-09-00 (Similar to Chassis) ... 878—6
Chassis R214-10-00 (Similar to Chassis) ... 877—7
Chassis R214-11-00 (Similar to Chassis) ... 878—6
Chassis R224 ... 1234-SED
Chassis R231-01-AA,R231-02-AA, R231-03-AA ... 1235—4
Chassis R240-01-AA ... MHF—24
Chassis R264-09-AA (Similar to Chassis) ... 975—6
Chassis R264-10-AA,R264-11-AA (Similar to Chassis) ... 1037—5
Chassis R264-79-AA (Similar to Chassis) ... 975—6
★Chassis T952-01-AA ... 1237—2
★Chassis T952-02-EB ... 1237—2
★Chassis T952-06 Series ... 1218-POM
★Chassis T952-08 Series ... 1218-POM
★Chassis T952-10 Series ... 1218-POM
★Chassis T952-11 Series ... 1218-POM
★Chassis T952-12 Series ... 1218-POM
★Chassis T952-13 Series ... 1218-POM
★Chassis T957-01-AA, -BA,-CA,-DA,-EA,-FA 1218-POM
★Chassis T957-02-AA, -BA,-CA,-DA,-EA,-FA 1218-POM
●Chassis T959-01-AA ... 1249—2
★Chassis T960 Series ... 1230-POM
★Chassis T962-01-AA,-AB,-BA, -BB,-CA,-CB,-DA,-DB ... 1253—2
★Chassis T962-02-AA,-AB, -BA,-BB ... 1253—2
★Chassis T962-05-AA,-AB, -BA,-BB ... 1253—2
★Chassis T962-06-AA,-AB,-BA, -BB,-CA,-CB,-DA,-DB ... 1253—2
★Chassis T962-07-AA,-AB, -BA,-BB ... 1253—2
★Chassis T962-71-AA,-AB,-BA, -BB,-CA,-CB,-DA,-DB ... 1253—2
★Chassis T962-72-AA,-AB, -BA,-BB ... 1253—2
★Chassis T962-75-AA,-AB, -BA,-BB ... 1253—2
★Chassis T962-76-AA,-AB,-BA, -BB,-CA,-CB,-DA,-DB ... 1253—2
★Chassis T962-77-AA,-AB, -BA,-BB ... 1253—2
★Chassis 704061-1 (TV Remote Control Unit) 1253—2A
★Chassis 704064-1 (TV Remote Control Unit) ... 1253—2A

MALLORY
(See Recorder Listing)

MASSEY FERGUSON
(See Auto Radio Listing)

MASTERWORK
Masterwork Audio Products
1080 Goffle Road
Hawthorne, New Jersey 07506
M500 ... MHF—25

MEDALLION
(See Auto Radio and Recorder Listings)

MERCURY
(See Auto Radio and Recorder Listings)

MGA
(Also See Auto Radio Listing)
Mitsubishi International Corp.
7045 North Ridgway Ave.
Lincolnwood, Illinois 60645
●BB-092 ... 1218-POM
●BS-130 ... 1222—2
●BS-131 ... 1238—1
★CH-121 ... 1218-POM
★CH-141 ... 1218-POM

MGA—Cont.

★CH-160 ... 1218-POM
★CH-190/191 ... 1218-POM
★CM-253A/-254A/-255A/-256A ... 1239—1
★CS-165 ... 1218-POM
★CS-195 ... 1218-POM

MIDLAND
(Also See Recorder Listing)
Midland International Corp.
For CB Models
Midland Communications Co.
P.O. Box 19032
Kansas City, Mo. 64141
For All Other Models
P.O. Box 1903
Kansas City, Mo. 64141
11-432 ... 1248—5
13-868 ... CB—37
13-874 ... CB—38
13-880B ... CB—39
●15-109B ... 1253—3
●15-112B ... 1232—1

MORSE ELECTRO PRODUCTS
(Also See Recorder Listing)
Morse Electro Products Corp.
101-10 Foster Avenue
Brooklyn, New York 11236
T-9 ... TSM—131
T-16 ... TSM—130
T-17 ... TSM—131
T-107 ... MHF—22
T-108 ... MHF—23
T-109 ... MHF—23
T-500A ... MHF—26
T-700 ... MHF—26
T-4100 ... MHF—21
Ch. 24M ... 1217—4
Ch. 26C (Similar to Chassis) ... 1207—3
Ch. 31H ... 1222—4
Ch. 32M ... 1236—5
Ch. 41, 43 ... 1224—4
Ch. 64M ... 1217—4
Ch. 76K ... 1214—4
Ch. 77K ... 1221—5

MOTOROLA
(Also See Auto Radio and Recorder Listings)
Motorola, Inc.
9401 West Grand Avenue
Franklin Park, Ill. 60131
●BP309HH (Ch. C12TS-465,T) (Similar to PCB1185-3) 1091—2
●BP318HW (Ch. E12TS-465,T) (Similar to PCB1185-3) 1091—2
●BP403HW (Ch. C12TS-465) (Similar to PCB1185-3) 1091—2
●BP461HW (Ch. 16TS-597,T) (Similar to Chassis) ... 1087—2
●BP523HN (Ch. Q19TS-597) (Similar to Chassis) ... 1087—2
●BP529HW (Ch. K19TS-597) (Similar to Chassis) ... 1087—2
●BP530HW (Ch. Q19TS-597) (Similar to Chassis) ... 1087—2
SK102GW ... MHF—24
SK104GW ... MHF—22
SK106GW ... MHF—26
SK107GM ... MHF—24
SK550GS-1/552GC-1 (Ch. GHS-2500/2600) (Similar to Chassis) ... 1080—5
SK559HW (Ch. GHS-2500/2600) (Similar to Chassis) ... 1080—5
SK564HK (Ch. GHS-2500/2600) (Similar to Chassis) ... 1080—5
SK570HP/572HS/573HW (Ch. EHS-62351) (Similar to Chassis) ... 1089—4
★TT687HW (Ch. ATS-938) ... 1212-POM
★TT934HW (Ch. ATS-938) ... 1212-POM
★TU905HW (Ch. ATS-938) ... 1212-POM
★TU934HW/945HS/946HK (Ch. ATS-938) ... 1212-POM
★WP477HW (Ch. E16TS-929) ... 1240—1
★WP483HW (Ch. E16TS-929) ... 1240—1
★WP563GWC (Ch. F18TS-929) ... 1240—1
★WP572HW,HWC (Ch. F18TS-929) ... 1240—1
★WP572HWG (Ch. F18TS-929) ... 1240—1
★WP573HW (Ch. F18TS-929) ... 1240—1
★WP580HW (Ch. F18TS-929) ... 1240—1
★WP581HW (Ch. 19TS-931) ... 1230-POM
★WT680GWAC (Ch. STS-934) (Similar to Chassis) ... 1205—2
★WT685HW, HWC (Ch. TS-938) ... 1212-POM
★WT688HW (Ch. TS-938) ... 1212-POM
★WT809HN (Ch. TS-934) (Similar to Chassis) ... 1205—2
★WT933HW, HWC (Ch. TS-938) ... 1212-POM
★WU834GWAC/835GSAC/836GPAC (Ch. STS-934) (Similar to Chassis) ... 1205—2
★WU855HW (Ch. STS-934) (Similar to Chassis) ... 1205—2
★WU904HW, HWC/906HW, HWC/907HS/908HP,HPC (Ch. TS-938) ... 1212-POM
★WU911GWAC/912GWAC/914GPAC (Ch. STS-934) 1205—2
★WU937GUAC (Ch. STS-934) (Similar to Chassis) ... 1205—2
XC1HHA (Ch. FHT12) ... 1085—6
●YBP403HW (Ch. YC12TS-465) (Similar to PCB1185-3) . 1091—2
●YBP523HN (Ch. YQ19TS-597) (Similar to Chassis) ... 1087—2
●ZD402HU (Ch. ZDCTS-465) (Similar to PCB1185-3) 1091—2
●ZD523HN (Ch. ZDQ19TS-597) (Similar to Chassis) ... 1087—2
ZP232HN (Ch. CHS-3504) . 1074—5
●ZW402HU (Ch. ZWC12TS-465) (Similar to PCB1185-3) ... 1091—2
●ZW523HN (Ch. ZWQ19TS-597) (Similar to Chassis) 1087—2
★Ch. ATS-938 ... 1212-POM
●Ch. E12TS-465, T (Similar to PCB1185-3) ... 1091—2

MOTOROLA—Cont.

★Ch. E16TS-929 (Codes B-31 thru B-43,845 thru C-00,C-09) ... 1240—1
Ch. EHS-62351 (Similar to Chassis) ... 1089—4
★Ch. F18TS-929 (Codes B-31 thru B-43,845 thru C-00,C-09) ... 1240—1
Ch. GHS-2500/2600 Chassis) ... 1080—5
●Ch. K19TS-597 (Similar to Chassis) ... 1087—2
●Ch. Q19TS-597 (Similar to Chassis) ... 1087—2
★Ch. TS-938 ... 1212-POM
●Ch. YQ19TS-597 (Similar to Chassis) ... 1087—2
●Ch. ZDQ19TS-597 (Similar to Chassis) ... 1087—2
●Ch. ZWQ19TS-597 (Similar to Chassis) ... 1087—2
★CH. 19TS-931 ... 1230-POM

N

NORELCO
(Also See Changer and Recorder Listings)
Norelco Service, Inc.
30-30 Review Avenue
Long Island City, New York 11101
Address Change

O

OLDSMOBILE
(See Auto Radio and Recorder Listings)

OLYMPIC
Olympic Int'l. Ltd.
Service Dept.
89-89 Union Turnpike
Glendale, N.Y. 11227
CS821 ... MHF—25
CT822 ... MHF—25
●3P70 ... 1237—3
●6P71 ... 1221—2
●9P94 ... 1219—2

OPEL
(See Auto Radio Listing)

P

PACE
Pathcom, Inc.
24049 S. Frampton Ave.
Harbor City, Calif. 90710
Address Change

PACKARD BELL
(Also See Recorder Listing)
Teledyne Packard Bell Electronics
12333 West Olympic Blvd.
Los Angeles, Calif. 90064
RPC-234 (Ch. 18HF6) ... 1215—4
RPC-238 (Ch. 18HF6) ... 1215—4
RPC-252 (Ch. 18HF7) ... 1215—4
RPC-311/312/314 (Ch. 36HF2) (Similar to Chassis) ... 1204—4
RPC-344/346/348 (Ch. 18HF6) ... 1215—4
RPC-352 (Ch. 18HF7) ... 1215—4
RPCT-344/346 (Ch. 18HF6, TPAK-25) For Radio Ch. ... 1215—4
For Tape Player (Similar to Page 80) ... HTP—1
RPS-09 (Ch. 18HF7) ... 1215—4
RPS-105/107 (Ch. 36HF2) (Similar to Chassis) ... 1204—4
RTS-24 ... MHF—25
RTS-115 (Ch. 36HF2, TRA-14) For Radio Chassis ... 1204—4
For Recorder Chassis (See Page 107) ... TR—66
★1C524WL ... 1236-POM
★1C624 ... 1164—2
●1M123/125 ... 1172—1
●1M323/325 ... 1172—1
●1M523/525 ... 1174—1
●1M623/625 ... 1175—2
★2C842/844 (Ch. 98C32 or 98C34) ... 1124—2
★2C852/854 (Ch. 98C32 or 98C34) ... 1124—2
★2C934 (Ch. 98C32 or 98C34) ... 1124—2
★2C954 (Ch. 98C32 or 98C34) ... 1124—2
Ch. 18HF6,18HF7 ... 1215—4
Ch. 36HF2 (Similar to Chassis) ... 1204—4
★Ch. 98C34 (Similar to Chassis) ... 1124—2

PANASONIC
(Also See Auto Radio and Recorder Listings)
Motsushita Electric Corp. of America
Panasonic Service & Parts Div.
10-16 44th Drive
Long Island City, N.Y. 11101
●AN-96 (Similar to Chassis) 1146—1
●AN-132,C ... 1240—2
●AN-142,C ... 1240—2
●AN-152D,DC ... 1240—2
●AN-162 (Similar to Chassis) ... 1240—2
★CT-392, C ... 1218-POM
★CT-394, C ... 1218-POM
★CT-395VR ... 1230-POM
★CT-396 ... 1236-POM
★CT-771 ... 1242-POM
★CT-991P (Late Prod.) ... 1228—2
RE-6451, C ... 1211—5
RE-7430,C ... MHF—24
RE-7800, C ... MHF—22
RS-820S ... MHF—23
SC-555 (Similar to page 49) ... MHF—19
SE-2070 ... MHF—26
SG-635 ... 1228—5
●TR-003, C ... 1224-POM
●TR-005, C ... 1224-POM
●TR-425R, RC ... 1235—1
●TR-445T ... 1243—3
●TR-465R ... 1230-POM

NOTE: ● Denotes Television Receiver. ★ Denotes Color Television Receiver. **AOR** Denotes Available On Request. **AR** Denotes Auto Radio Series Volume. **CB** Denotes CB Radio Series Volume. **HTP** Denotes Home Tape Player Series Volume. **MHF** Denotes Modular Hi-Fi Series Volume. **PCB** Denotes Production Change Bulletin. **POM** Denotes Bonus Schematic in Photofact-of-the-Month Package—Unavailable After Month Of Issue. **SED** Denotes Special Equipment Data. **TR** Denotes Tape Recorder Series Volume. **TSM** Denotes Transistor Radio Series Volume.

Set No. / Folder No.

PANASONIC—Cont.
●TR-489R 1236-POM
●TR-499 .... 1242-POM
●TR-522 .... 1230-POM
●TR-539 .... 1224-POM
●TR-542 .... 1242-POM

PEARCE-SIMPSON
Pearce-Simpson, Inc.
4701 N.W. 77th Ave.
Miami, Florida 33152
Cougar 23 .... CB-38

PENNEYS-PENNCREST
(Also See Auto Radio and Recorder Listings)
J. C. Penney Co., Inc.
1301 Avenue of the Americas
New York, N.Y. 10019
★CR201 (TV Remote Control Unit) 1225-2A
★CT202 (TV Remote Control Unit) 1225-2A
★685-4827A/4828 1233-2
1310 .... MHF-26
●1317 .... 1242-POM
●1412 .... 1242-POM
●2321,2322 1239-2
●2341 .... 1230-POM
●2365 (Similar to Chassis) 1089-3
★2852 .... 1230-POM
★2853 1225-2
★2855, A 1221-3
★2856 .... 1218-POM
★2857 .... 1230-POM
★2861/62/63 1221-3
★2871, A 1218-1
★2872 .... 1230-POM
★2885A 1236-2
★2886 1224-2
★2887, A 1218-1
★2889 .... 1242-POM
3810 .... TSM-132
3840 .... TSM-129
3850 .... TSM-130
●4356A/57A/58A 1226-1
●4392A 1226-1
4801 1241-4
★4834B/35B 1247-1
★4848B 1247-1
★4854B/55B 1247-1
★4896B 1247-1
5138 1237-5
5906 1224-5
6681 .... MHF-24
6825, A MHF-21
★6892A/93A 1247-1

PHILCO-FORD
Philco-Ford Corporation
Tioga & "C" Streets
Philadelphia, Pa. 19134
●B413BBE/414BAV/415BWA (Ch. 3BL23) 1236-POM
●B522AWH (Ch. 20P24) .... (PCB-1211-4) 1148-1
●B532AWA (Ch. 20P24) .... (PCB-1211-4) 1148-1
●B661AWA (Ch. 20ST30AV) 1241-2
●B709BWH (Ch. 20ST30B) (Similar to Chassis) 1241-2
●B712AWH,AWH-1/713AAV (Ch. 20ST30AV) 1241-2
●B717AWA,AWA-1/718AWA (Ch. 20ST30AV) 1241-2
●B733AWA,AWA-1 (Ch. 21ST31V) 1241-2
●B855AWA (Ch. 21ST31V) 1241-2
●B872BPC (Ch. 21ST31V) 1241-2
●B913BWA (Ch. 3BL23) 1236-POM
★C3751AWA-1 (Ch. 2CP30) 1236-POM
★C7200AWA (Ch. 22QT79) 1239-3
★C7210AWA (Ch. 22QT80) 1239-3
★C7229AWA (Ch. 22QT80) 1239-3
★C7250AWA/51AMA/52APC (Ch. 22QT80) 1239-3
★C7272ALP (Ch. 22QT80) 1239-3
★C7310AWA (Ch. 22ST80) 1235-2
★C7310AWAB-1 (Ch. 2CY80) 1236-POM
★C7320AWA (Ch. 22ST80) 1235-2
★C7320AWAB-1 (Ch. 2CY80) 1236-POM
★C7337BPC (Ch. 2CY80) 1236-POM
★C7340AWA (Ch. 22ST80) 1235-2
★C7345AWA (Ch. 22ST80) 1235-2
★C7360AFW/61AMA (Ch. 22ST80) 1235-2
★C7362APC, AMD (Ch. 22ST80) 1235-2
★C7370AWA/72ALP (Ch. 22ST80) 1235-2
★C7382ALK (Ch. 21ST91P) 1235-2
★C8180AWA/82ALK (TV Ch. Only 22ST81) 1235-2
★C9350AWA/52APC (Ch. 22QT80) 1239-3
★C9440AWA (Ch. 22ST80) 1235-2
★C9450AWA/52APC (Ch. 22ST80) 1235-2
H350UWA/351UMA/352UDK (Ch. 10PR705,U70STDK) 1241-5
H353AWA/354AMA/355ALK (Ch. 10PR705) 1241-5
H450UWA/451UMA (Ch. 10PR705,U70STDKA) 1241-5
H460UWA (Ch. 10PR705,U70STDKA) 1241-5
H461AWA/462AMD (Ch. 10PR705,A) 1241-5
H462UDK (Ch. 10PR705,U70STDKA) 1241-5
H510AWA (Ch. 10PR705A) 1241-5
H540UWA (Ch. U150ST) 1232-5
H572UDK (Ch. U150ST) 1232-5
Ch. RT105B 1241-5
Ch. U70STDK,STDKA 1241-5
Ch. U150ST 1232-5
★Ch. 2CP30 .... 1236-POM
★Ch. 2CY80 .... 1236-POM
●Ch. 3BL23 .... 1236-POM
Ch. 9PS70 1241-5
Ch. 10PR705,A 1241-5
●Ch. 20P24 (Run 7) .... (PCB 1211-4) 1148-1
●Ch. 20ST30AV (Run 5) 1241-2
●Ch. 20ST30B (Similar to Chassis) 1241-2
●Ch. 21ST31V (Run 5) 1241-2
★Ch. 21ST90T 1174-2
★Ch. 21ST91P 1235-2
★Ch. 22QT79 1239-3
★Ch. 22QT80 1239-3
★Ch. 22ST80/81 1235-2

PIONEER
U.S. Pioneer Electronics Corporation
178 Commerce Road
Carlstadt, New Jersey 07072
SX-440 .... MHF-22
SX-770 .... MHF-24
SX-990 .... MHF-21

PLYMOUTH
(See Auto Radio Listing)

PONTIAC
(See Auto Radio and Recorder Listings)

PORSCHE
(See Auto Radio Listing)

R

RCA
RCA Sales Corporation
600 North Sherman Drive
Indianapolis, Indiana 46201
●AP191W (Ch. KCS171E) .... (PCB 1216-4) 1061-1
●AP301W (Ch. KCS174H) .... (PCB 1232-4) 1115-2
●AQ098E (Ch. KCS176XB, RC-3006) 1224-1
●AQ122W (Ch. KCS188A) 1227-2
●AQ127B (Ch. KCS188A) 1227-2
●AQ158WR (Ch. KCS168XB,KRT5A) 1251-1
●AQ186F, WEN (Ch. KCS171F,R,AB) .... (PCB 1216-4) 1061-1
●AQ191W (Ch. KCS171E,P,AA) .... (PCB 1216-4) 1061-1
●AQ194W (Ch. KCS171E,P,AA) .... (PCB 1216-4) 1061-1
●AQ198WEN/200W (Ch. KCS172D,E) (Similar to Chassis) 1198-3
●AQ201WEN (Ch. KCS174H,L,M) .... (PCB 1232-4) 1115-2
●AR-122W (Ch. KCS188B) 1242-POM
●AR-123W (Ch. KCS188A) 1242-POM
●AR-127B (Ch. KCS188A) 1242-POM
●AR128E (Ch. KCS187A) 1242-POM
●AR191W (Ch. KCS171AE) 1242-POM
●AR-192W (Ch. KCS172L) 1242-POM
●AR194F/195WEN (Ch. KCS171AE) 1242-POM
●AR-200W (Ch. KCS172M) 1242-POM
★CQ222W/223L/224W/226L 227W/228S (Ch. KCS183D,E) 1236-3
★EQ325E,H (Ch. CTC51B) (Similar to Chassis) 1209-3
★EQ-391W (Ch. CTC52XAB) 1242-POM
★EQ425W (Ch. CTC55XAB) 1242-POM
★EQ446EEN (Ch. CTC52A) (Similar to Chassis) 1211-3
★EQ449WR (Ch. CTC55XT) (Similar to Chassis) 1203-2
★EQ-469W (Ch. CTC63XA) 1242-POM
★EQ475W (Ch. CTC59XA) 1212-POM
★EQ475WR (Ch. CTC59XB) 1212-POM
★ER-334W (Ch. CTC51E) 1242-POM
★ER-338W (Ch. CTC51XU) 1242-POM
★ER-390W (Ch. CTC52XAE) 1242-POM
★ER-395W (Ch. CTC52XAE) 1242-POM
★ER-430W (Ch. CTC63XC) 1242-POM
★FQ485W (Ch. CTC50XR) 1226-2
★FQ505W (Ch. CTC46A) 1243-2
★FQ505WR (Ch. CTC46B) 1243-2
★FQ517W (Ch. CTC39XAR) 1246-2
★FQ519W (Ch. CTC39XAT) 1246-2
★FQ535W (Ch. CTC39XAK) 1246-2
★FQ545W (Ch. CTC46H) 1243-2
★FR-505WX (Ch. CTC46A) 1242-POM
★FR-510WENX (Ch. CTC46A) 1242-POM
★GQ561W/563L (Ch. CTC50XR) 1226-2
★GQ575A,W (Ch. CTC46A) 1243-2
★GQ579L (Ch. CTC46A) 1243-2
★GQ583S (Ch. CTC46A) 1243-2
★GQ599W (Ch. CTC39XAJ) 1246-2
★GQ619W (Ch. CTC39XAJ) 1246-2
★GQ621W/6231/625D,S (Ch. CTC39XAJ) 1246-2
★GQ627L (Ch. CTC39XAJ) 1246-2
★GQ634L (Ch. CTC39XF) 1246-2
★GQ636D,S (Ch. CTC39XF) 1246-2
★GQ637D,S (Ch. CTC39XAJ) 1246-2
★GQ653W (Ch. CTC39XAJ) 1246-2
★GQ657L (Ch. CTC39XAJ) 1246-2
★GQ661D,S/662W/663L/665D,S (Ch. CTC39XAJ) 1246-2
★GQ669W (Ch. CTC46H) (Similar to Chassis) 1243-2
★GQ673L (Ch. CTC46H) (Similar to Chassis) 1243-2
★GQ677D,S (Ch. CTC46H) (Similar to Chassis) 1243-2
★GQ679W (Ch. CTC46H) 1243-2
★GQ709L (Ch. CTC46H) 1243-2
★GQ715D,F (Ch. CTC46H) 1243-2
★GQ719D,S (Ch. CTC46H) 1243-2
★GQ723W (Ch. CTC46H) 1243-2
★GQ725W (Ch. CTC46H) 1243-2
★GQ729W (Ch. CTC46H) 1243-2
★GQ737L/739D,S,Q,Y (Ch. CTC46H) 1243-2
★GQ745W (Ch. CTC46H) 1243-2
★GQ749W (Ch. CTC46H) 1243-2
★GQ759L (Ch. CTC46H) 1243-2
★GQ769D,S (Ch. CTC46H) 1243-2
★GQ819W (Ch. CTC46H) 1243-2
★GQ829F (Ch. CTC46H) 1243-2
★GQ839L (Ch. CTC46H) 1243-2
★GQ849F (Ch. CTC46H) 1243-2
★GQ859D,S (Ch. CTC46H) 1243-2
★GQ879W (Ch. CTC46H) 1243-2
★GQ881W (Ch. CTC46H) 1243-2
★GQ887L (Ch. CTC46H) 1243-2
★GQ893D,S (Ch. CTC46H) 1243-2

RCA—Cont.
★GR-530WX (Ch. CTC46A) 1242-POM
★GR-534LX (Ch. CTC46A) 1242-POM
★GR-538DX,SX (Ch. CTC46A) 1242-POM
★GR-544AX,LX (Ch. CTC46A) 1242-POM
★GR-548DX,GX,SX (Ch. CTC46A) 1242-POM
★GX726W (Ch. CTC46H) (Similar to Chassis) 1243-2
★HP908L/910D,S (Ch. CTC39XP, RC-1239D, RS-253F) For TV Chassis .... 1126-3 For Radio/Amp. Chassis (Similar to) 1169-6
★HQ901A,W (TV Ch. Only CTC46A) 1243-2
★HQ907W (TV Ch. Only CTC46P) 1243-2
★HQ919W (TV Ch. Only CTC46P) 1243-2
★HQ923L (TV Ch. Only CTC46P) 1243-2
★HQ927D,S (TV Ch. Only CTC46P) 1243-2
●JP192W (Ch. KCS171J,T,AC) .... (PCB 1216-4) 1061-1
RVM685E TSM-134
RVM694E TSM-130
RVS856R 1238-5
RVS881W 1238-5
RVS884L 1238-5
RVS888D 1238-5
RZC941W-K MHF-24
RZS454T 1238-5
RZS476W 1217-5
VPP50E (Ch. RC-3003A, RS-243A) 1242-5
VPT26W (Ch. RC-3005) 1250-4
VQT10W/11L/12S (Ch. RC-3005B) 1250-4
VQT18W/19L (Ch. RC-3005B) 1250-4
VQT20W/21L (Ch. RC-3005A,B) 1250-4
VQT22S (Ch. RC-3005A) 1250-4
VRE08W/09L (Amp Ch. Only—RS-265D) 1207-4
VRP48S (Ch. RS-271B) 1208-4
VRP56W (Ch. RS-265D) 1207-4
VRT20W/21L/22S (Radio Ch. Only RC3005B) 1250-4
VS1001W (Ch. RS-265D) 1207-4
VS1200W (See Page 75) MHF-20
VS4000 .... MHF-26
VZP30G (Ch. RS-270B) 1208-4
VZP33B,J (Ch. RS-270B) 1208-4
VZP38B (Ch. RS-270B) 1208-4
★Ch. CRK13A (TV Remote Control Unit) 1243-2
★Ch. CTC39XA,XAK,XAR, XAT,XF 1246-2
★Ch. CTC46A (1972 Prod.) 1243-2
★Ch. CTC46A (1973 Prod.) 1242-POM
★Ch. CTC46B,H,P 1243-2
★Ch. CTC50XR 1226-2
★Ch. CTC51B (Similar to Chassis) 1209-3
★Ch. CTC51E,XU 1242-POM
★Ch. CTC52XAB,XAE 1242-POM
★Ch. CTC55XT (Similar to Chassis) 1203-2
★Ch. CTC59XA,XB 1212-POM
★Ch. CTC63XA,XC 1242-POM
●Ch. KCS168XB 1251-1
●Ch. KCS171AA,AB,AC,E,F, J,P,R,T .... (PCB 1216-4) 1061-1
●Ch. KCS172L,M 1242-POM
●Ch. KCS173K,L,N,P 1061-1
●Ch. KCS174H,L,M .... (PCB 1232-4) 1115-2
●Ch. KCS176XB 1224-1
●Ch. KCS183D,E 1236-3
●Ch. KCS187A 1242-POM
●Ch. KCS188A 1227-2
●Ch. KCS188A,B 1973 Prod.) 1242-POM
●Ch. KRT5A (TV Remote Control Unit) 1251-1A
Ch. RC-3003A 1242-5
Ch. RC-3005,A,B 1250-4
Ch. RC-3006 .... 1224-1A
Ch. RS-243A 1242-5

RANGER
(See Auto Radio and Recorder Listings)

RAYMER
Trutone Electronics, Inc.
14660 Raymer Street
Van Nuys, California 91405
LTS-1 (Speaker Line Tester) 1217-SED
795 (10 Watt Amplifier) 1217-SED

RAYTHEON (Also see Belmont) For CB
Raytheon Co.
213 E. Grand Avenue
So. San Francisco, Calif. 94080
RAY-1015 (See Photofact Servicer) 625

REALISTIC
(Also See Recorder Listing)
Allied Radio Shack Corporation
2727 West 7th Street
Fort Worth, Texas 76107
TRC-100B (21-134) CB-38
12-1474 1236-6
21-134 .... CB-38

REGENCY
Regency Electronics, Inc.
7900 Pendleton Pike
Indianapolis, Indiana 46226
CB-291 .... CB-37
Sprint/23 (CB-291) CB-37

RENAULT
(See Auto Radio Listing)

ROBERTS
(See Recorder Listing)

ROBYN
Robyn International, Inc.
P.O. Box 478
Rockford, Michigan 49341
BB-123 .... CB-39
TR-123C CB-38

ROSS
(Also See Recorder Listing)
Ross Electronics Corporation
2834 South Lock Street
Chicago, Illinois 60608
8450 .... TSM-133
8875 .... TSM-134

S

SAAB
(See Auto Radio Listing)

SANYO
(Also See Radio and Recorder Listings)
Sanyo Electric, Inc.
1200 West Walnut Street
Compton, California 90220
●21T41 1232-2
●21T42 .... 1224-POM
●21V71, 21V72 1219-3
★51C11 .... 1224-POM
★91C16/17 .... 1224-POM
★91C18 .... 1230-POM
●91V17 .... 1224-POM
●91V71 1238-2

SBE
Linear Systems, Inc.
220 Airport Boulevard
Watsonville, California 95076
SBE-7CB (Sierra) CB-39
Sierra CB-39

SEARS-SILVERTONE
(Also See Recorder Listing)
Sears, Roebuck & Company
303 East Ohio Street
Chicago, Illinois 60611
132.20890000 1222-5
132.20920000 1214-5
132.22800001 .... TSM-131
132.31003000/3001 1227-4
499.74060000/60001 .... MHF-23
528.31214100-101 (Similar to Chassis) 1175-6
528.31216100/101 (Similar to Chassis) 1175-6
528.31303006/007 (Similar to Chassis) 1175-6
528.31304006/007 (Similar to Chassis) 1175-6
528.31305006/007 (Similar to Chassis) 1175-6
528.31314101 (Similar to Chassis) 1175-6
528.31516102 (Similar to Chassis) 1175-6
528.32880100 .... MHF-25
★528.41880100 .... 1212-POM
★528.43050001 thru 43050021 .... (PCB 1219-4) 1127-3
★528.43260001 (Similar to Chassis) 1208-3
★528.43266000 thru .43266004 (Similar to Chassis) 1208-3
★528.43341100 thru .43341126 1250-2
★528.43351100 thru .43351126 1250-2
★528.43361100 thru .43361126 1250-2
★528.44100000 thru .44100024 1249-3
●528.50070006 thru .50070010 .... (PCB 1245-4) 1190-3
●528.50400004 thru .50400023 .... (PCB 1245-4) 1190-3
●528.51030000 thru .51030021 1248-1
●528.51030103 1248-1
●528.51031200 1248-1
●528.51130100 thru .51130118 1248-1
●528.51140007/0008/0009/0010 .... (PCB 1220-4) 1134-3
●528.51150007 thru .51150015 .... (PCB 1220-4) 1134-3
●528.51150016 thru .51150025 .... (PCB 1244-4) 1134-3
●528.51710906 thru .51710915 .... (PCB 1220-4) 1130-3
●528.51710916/917 (Similar to PCB 1220-4) 1130-3
●528.51720906 thru .51720915 .... (PCB 1220-4) 1130-3
●528.51720916/917 (Similar to PCB 1220-4) 1130-3
548.74200100 1240-4
★562.40801000/1001 .... (PCB 1216-4) 1154-3
●562.50230100 1247-2
●562.50270100 1247-2
●562.50310100 1247-2
564.22790100 .... TSM-129
★564.40050100 .... 1224-POM
★564.40570000/0001 1229-3
★564.41220001 .... (PCB 1247-4) 1169-2
★564.41221100 .... 1242-POM
★564.41230100 .... 1242-POM
●564.49980100 1184-1
●564.50080100 1228-3
★4033 (Ch. 562.10512) .... (PCB 1229-4) 1123-3
★41101 (Ch. 564.80161/162) .... (PCB 1228-4) 1147-1
★Ch. 11G9NB (TV Remote Control Unit) 1208-3A
★Ch. 528.72730/31/32/33/34/35 (Similar to Chassis) 1091-3
★Ch. 562.10512 .... (PCB 1229-4) 1123-3
★Ch. 564.80161/162 .... (PCB 1228-4) 1147-1

SETCHELL-CARLSON
Setchell-Carlson, Inc.
New Brighton
St. Paul, Minnesota 55112
602C,CR,CU (Ch. X162) 608-3

SHARP
(Also See Recorder Listing)
Sharp Electronics Corp.
10 Keystone Place
Paramus, N.J. 07652
★C-2011 .... 1218-POM
★C-2031 .... 1218-POM
★C-9311 .... 1218-POM
FXH-47 1218-4
●TF-90P 1218-2
★TF-90PA 1218-POM
●TU-95PA 1218-POM

SHARP—Cont.
●TW-93P/94P 1218-2
●2U-121S 1218-POM
●2W-141D 1250-3
●3S-111 .... 1218-POM

SIMCA
(See Auto Radio Listing)

SINGER
Singer Consumer Prod. Div.
30 Rockefeller Plaza
Room 6228
New York, New York
●HE-7010 1251-2
●HE-7020 1251-2
●HE-7030 1248-2

SONY
(Also See Recorder Listing)
Sony Corp. of America
47-47 Van Dam St.
Long Island City, N.Y. 11101
★KV-1210U (Late Prod. Ch. SCC-06-E) 1232-3
★KV-1220U (Ch. SCC-10-A, SCC-A04-AA,-CA) 1218-3
★KV-1224 (Ch. SCC-19A-A) 1224-POM
★KV-1720 .... 1212-POM
★KV-9000U (Ch. SCC-B-01-AA,-BA,-DA) 1222-3
●TV-112 1242-3
●TV-730 (Ch. SMC-155A) 1235-3
●TV-740 1245-2
●TV-900UA (Ch. SMC-160) 1234-2
●TV-940 (Ch. SMC-157) 1234-2
★Ch. SCC-A01-AA,-BA,-DA 1216-2
★Ch. SCC-A04-AA,-CA 1218-3
★Ch. SCC-B-01-AA,-BA,-DA 1222-3
★Ch. SCC-06-E (Late Prod.) 1232-3
★Ch. SCC-08-A,-B 1216-2
★Ch. SCC-10-A 1218-3
★Ch. SCC-19A-A 1224-POM
●Ch. SMC-155A 1235-3
●Ch. SMC-157 1234-2
●Ch. SMC-160 1234-2

SOUNDESIGN
(Also See Recorder Listing)
Realtone Electronics Corp.
34 Exchange Place
Jersey City, N.J. 07302
4962 .... TSM-133
4965 .... TSM-134

SYLVANIA
(Also See Recorder Listing)
GTE Sylvania, Inc.
700 Ellicott Street
Batavia, N.Y. 14021
BK370WH, YL (Ch. 375-2) 1226-4
BK375WH (Ch. 375-2) 1226-4
BK380W (Ch. 375-2) 1226-4
BT320GN, WH (Ch. 375-1) 1226-4
BT330WH (Ch. 375-1) 1226-4
BT335W (Ch. 375-1) 1226-4
BT350W (Ch. 375-3) 1226-4
BT355P (Ch. 375-3) 1226-4
★CD70-1 (Ch. D14-8) 1245-3
★CD72-1/74-1 (Ch. D14-10) 1245-3
★CD82WR-2 (Ch. D14-11) 1245-3
★CL479P-3/P-7 (TV Ch. Only E01-13) 1251-3
★CL594CR-3 (Ch. E01-14) 1251-3
★CL860W-1 (Ch. E01-7) 1251-3
★CL860W-2 (Ch. E01-17) 1251-3
★CL862P-1 (Ch. E01-7) 1251-3
★CL862P-2 (Ch. E01-17) 1251-3
★CL875P-1 (Ch. E01-7) 1251-3
★CL875P-2 (Ch. E01-17) 1251-3
★CL882P-1 (Ch. E01-7) 1251-3
★CL882P-2 (Ch. E01-17) 1251-3
★CL883BT-1 (Ch. E01-7) 1251-3
★CL883BT-2 (Ch. E01-17) 1251-3
★CL960WR-1 (Ch. E01-8) 1251-3
★CL960WR-2 (Ch. E01-18) 1251-3
★CL962PR-1 (Ch. E01-8) 1251-3
★CL962PR-2 (Ch. E01-18) 1251-3
★CL975PR-1 (Ch. E01-8) 1251-3
★CL975PR-2 (Ch. E01-18) 1251-3
★CL982PR-1 (Ch. E01-8) 1251-3
★CL982PR-2 (Ch. E01-18) 1251-3
★CL983BTR-1 (Ch. E01-8) 1251-3
★CL983BTR-2 (Ch. E01-18) 1251-3
CR280 (Ch. R49-3) MHF-25
★CX78/79 (Ch. D14-6) 1245-3
★CX87WR (Ch. D14-7) 1245-3
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●MW22BK (Ch. A09-1) 1230-3
●MW1041AV/1042GD (Ch. B14-1) 1202-3
●MW1044/45 (Ch. A09-1) 1230-3
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●MZ200 (Ch. B12-2) .... (PCB 1211-4) 1094-2
●MZ1091BG/1092W/1093K/1094W-2/1095W-2/1096K-2/1097P-2 (Ch. B10-6) 1244-3
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SC432 (Ch. R45-1) 1250-5
SC433,-1,-2/434,-1,-2 (Ch. R45-1) 1250-5
SC441-1 (Ch. R45-1) 1250-5
SC442,-1/445,-1 (Ch. R45-1) 1250-5
SCT447 (Ch. R45-7) 1250-5
SCT447-2 (Ch. R45-7, TC4) 1250-5
SCT447X/448 (Radio Ch. Only R45-7) 1250-5
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★Ch. D12-11 (Code 06) .... (PCB 1234-4) 1143-1
★Ch. D12-15 (Code 07) .... (PCB 1234-4) 1143-1
★Ch. D14-6 (Codes 01, 02, 50, 51) 1245-3
★Ch. D14-7 (Codes 01,02) 1245-3
★Ch. D14-8,-10 (Codes 00,50,51) 1245-3
★Ch. D14-11 (Code 00) 1245-3

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★Ch. E01-13,-14 1251-3
★Ch. E01-17,-18 1251-3
Ch. P61-1,-2 1213-4
Ch. R15-1,-2 1065-6
Ch. R15-4 1065-6
Ch. R45-1,-7 1250-5
Ch. R49-3 .... MHF-25
Ch. TC4 1250-5
Ch. 373-1 .... TSM-129
Ch. 375-1,-2,-3 1226-4

SYMPHONIC
(Also See Recorder Listing)
Symphonic Radio & Elec. Corp.
Foot of John Street
Lowell, Massachusetts 01852
P2711A (Ch. A-886) (Similar to Chassis) 1139-6
●TPS-300 1226-3
1143 (Ch. R-835) MHF-23
1932 1244-5
Ch. R-835 .... MHF-23

T

TENNA
(See Auto Radio and Recorder Listings)

TOSHIBA
Toshiba America, Inc.
41-06 DeLong Street
Flushing, N.Y. 11355
★C501S (Ch. TAC-6410) 1230-POM
★C811S (Ch. TAC-6350) 1230-POM
★C812D (Ch. TAC-6350) 1230-POM
550C MHF-26
★Ch. TAC-6330 .... 1230-POM
★Ch. TAC-6350 .... 1230-POM
★Ch. TAC-6410 .... 1230-POM

TOYOTA
(See Auto Radio and Recorder Listings)

TRIUMPH
(See Auto Radio Listing)

TRUETONE
(Also See Auto Radio and Recorder Listings)
Western Auto Supply Co.
2107 Grand Avenue
Kansas City, Mo. 64108
★ADM2255A-27 .... 1212-POM
IST5929A-17 1215-5
MIC3014C-27 (See page 97) TSM-111
●MIC3220A-27 .... 1236-POM
●MIC3909B-17 (Similar to Chassis) 1109-3
●MIC3912B-17 1240-3
●MIC3912C-17 .... 1212-POM
●MIC3916B-17/3918C-27/3919B-17 1224-3
★MIC4218A-27 1246-3
TEW6270A-17 1243-4
TEW6275A-17 1249-4
TEW6295A-17 (Similar to Chassis) 1001-5
★2DC2255 .... 1212-POM
●2DC3220 .... 1236-POM
●2DC3912B 1240-3
●2DC3912C 1212-POM
●2DC3916B/18C/19B 1224-3
★2DC4218 1246-3
4DC5929 1215-5
4DC6270 1243-4
4DC6275 1249-4
4DC6295 (Similar to Chassis) 1001-5

V

V-M
V-M Corporation
375 West Main Street
Benton Harbor, Mich. 49023
323BL-1, BR-1, RG-1, YE-1 (Ch. 20116) 1033-7
339BK-1 (Ch. 20117) 1045-9

VOLKSWAGEN
(See Auto Radio Listing)

VOLKSWAGEN TRANSPORTER
(See Auto Radio Listing)

VOLVO
(See Auto Radio Listing)

W

WARDS AIRLINE
(Also See Auto Radio and Recorder Listings)
Montgomery Ward & Co.
619 Chicago Avenue
Chicago, Illinois 60607
GCI-2090A 1231-4
GCI-2095A 1231-4
GCI-2422A (Radio Ch. Only) 1163-8
GCI-2432A (Radio Ch. Only) 1163-8
GCI-2452A (Radio Ch. Only) 1163-8
GCI-2521A 1219-6
GCI-2531A 1219-6
GCI-2541A 1219-6
GCI-2551A 1219-6
GCI-2621A 1220-5
GCI-2641A 1220-5
GCI-2651A 1220-5
●GCI-11102A, B, C, D 1241-3
●GCI-11132A, B, C, D 1241-3
●GCI-11262A,B 1241-3
★GCI-12102A 1248-3
●GCI-13162A 1230-POM
●GCI-14821A 1227-3
●GCI-14841A 1227-3
●GCI-14851A 1227-3
★GCI-15921A For Similar TV Ch. .... 1217-3 For Similar Radio Ch. 1219-6
★GCI-15951A For Similar TV Ch. .... 1217-3 For Similar Radio Ch. 1219-6
★GCI-16322A 1224-POM
★GCI-16342A 1224-POM
★GCI-16522A 1224-POM

NOTE: ● Denotes Television Receiver. ★ Denotes Color Television Receiver. AOR Denotes Available On Request. AR Denotes Auto Radio Series Volume. CB Denotes CB Radio Series Volume. HTP Denotes Home Tape Player Series Volume. MHF Denotes Modular Hi-Fi Series Volume. PCB Denotes Production Change Bulletin. POM Denotes Bonus Schematic in Photofact-of-the-Month Package—Unavailable After Month Of Issue. SED Denotes Special Equipment Data. TR Denotes Tape Recorder Series Volume. TSM Denotes Transistor Radio Series Volume.

Set No.	Folder No.
WARDS AIRLINE—Cont.	
★GCI-16542A	1224-POM
★GCI-16552A	1224-POM
★GCI-17321A,B	1220-3
★GCI-17341A,B	1220-3
★GCI-17351A,B	1220-3
★GCI-17421A	1220-3
★GCI-17441A	1220-3
★GCI-17451A	1220-3
GEN-1352A (See Page 89)	TSM-99
GEN-1382A	TSM-132
GEN-1392A	TSM-133
GEN-1481A	TSM-133
GEN-1745A	MHF—25
GEN-1971A	1223-4
GEN-1981A	1247-5
GEN-6011A	MHF-23
GEN-6031A	MHF-24
GEN-6111A	MHF-25
GEN-6211A	TSM-129
GEN-6411A	1243-5
●GEN-11442A	1247-3
●GEN-11482A	1247-3
●GEN-11492A	1247-3
●GEN-11562A	1230-POM
●GEN-11741B	1218-POM
●GEN-11961B	1230-POM
●GEN-13442A	1234-3
JWR-2814A,B	MHF-21
62-1352 (See Page 89)	TSM-99
62-1382	TSM-132
62-1392	TSM-133
62-1481	TSM-133
62-1971	1223-4
62-1981	1247-5
62-6211	TSM-129
62-6411	1243-5
●63-13442	1234-3
WEBCOR (See Recorder Listing)	
WELTRON (Also See Auto Radio and Recorder Listings) Weltron Company, Inc. 514 East Peabody Street Durham, North Carolina 27702	
WFMX-104	TSM-129
2001	TSM-131
WESTINGHOUSE Westinghouse Electric Corp. Consumer Electronics Div. Route 27 Vineard Road Edison, N.J. 08817	
PAS7150A (Ch. V4003C03)	MHF-25
RCF9100A (Ch. V3012C01)	MHF-26
RCF9120A (Ch. V3014C01)	MHF-24
Ch. V3012C01	MHF-26
Ch. V3014C01	MHF-24
Ch. V4003C03	MHF-25
WHEEL HORSE (See Auto Radio Listing)	
WHITE MOTOR CO. (See Auto Radio Listing)	
WINEGARD Winegard Company 3009-1 Kirkwood Burlington, Iowa 52601	
AC-223B(OB) (VHF/UHF Amp)	1242-SED
AC-295B(OB) (VHF/UHF Amp)	1242-SED
AC-695B (TV Amp)	1242-SED
DA-425 (UHF Amp)	1245-SED
DA-815 (TV Amp)	1249-SED
DA-825A (VHF-UHF Amp)	1245-SED
WOLLENSAK (See Recorder Listing)	

Y

Set No.	Folder No.
YORK (See Recorder Listing)	

Z

Set No.	Folder No.
ZENITH Zenith Sales Corporation 1900 N. Austin Ave. Chicago, Illinois 60639	
B471R	1246-4
C587W (Ch. 29CT20)	MHF-24
●C1335C,F,L,P (Ch. 12CB12X)	1252-3
●C1335C1,F1,L1,P1 (Ch. 12CB12X)	1252-3
●C1335C2,F2,L2,P2 (Ch. 12CB12X)	1252-3
●C1335C3,F3,L3,P3 (Ch. 12CB12X)	1252-3
●C1340W,W1,W2,W3 (Ch. 12CB12X)	1252—3
●1835C,C1,C2,C3,G,G1,G2,G3 (Ch. 16DB12X)	1242-POM
●C1840W,W1,W2,W3 (Ch. 16DB12X)	1242-POM
★C2915W (Ch. 20CC50Z)	1238-3
★C2915W1 (Ch. 20CC50)	1238-3
★C2915W2 (Ch. 20CC50Z)	1238-3
★C2915W3 (Ch. 20CC50)	1238-3
★C2950W (Ch. 18CC29) (Similar to Chassis)	1225-3
★C2965W7 (Ch. 18CC30) (Similar to Chassis)	1225-3
★C2983W11 (Ch. 20CC50Z)	1238-3
★C2983W12 (Ch. 20CC50)	1238-3
★C2983W13 (Ch. 20CC50Z)	1238-3
★C2983W14 (Ch. 20CC50)	1238-3
★C2984W,W2 (Ch. 20CC50Z) (Similar to Chassis)	1238-3
★C2997W (Ch. 20CC50Z)	1238-3
★C2997W1 (Ch. 20CC50)	1238-3
★C3510C1,C3,C6 (Ch. 14CC14)	1233-3
★C3510C7 (Ch. 14CC14Z)	1233-3
★C3510C8 (Ch. 14CC142) (Similar to Chassis)	1233-3
★C3520W1,W3 (Ch. 14CC14)	1233-3
ZENITH—Cont.	
★C3520W7,W8 (Ch. 14CC14Z)	1233-3
★C3710C1,C3,L1,L3 (Ch. 14CC15)	1233-3
★C3710C7,L7 (Ch. 14CC15Z)	1233—3
★C3710C8,L8 (Ch. 14CC15Z) (Similar to Chassis)	1233-3
★C3710C9,L9 (Ch. 14C15Z)	1233-3
★C3722W3 (Ch. 14CC16)	1233-3
★C3722W8 (Ch. 14CC16Z)	1233-3
★C3722W18 (Ch. 14CC16Z) (Similar to Chassis)	1233-3
★C3910W7 (Ch. 18CC29) (Similar to Chassis)	1225-3
★C3910W8 (Ch. 18CC29)	1225-3
★C3914W7,W9 (Ch. 18CC30) (Similar to Chassis)	1225-3
★C3914W8 (Ch. 18CC30)	1225-3
★C4020W,W2 (Ch. 19DC20)	1230-POM
★C4024W2 (Ch. 19DC20)	1230-POM
★C4025W5 (Ch. 19CC19) (Similar to Chassis)	1215-3
★C4028W2 (Ch. 19DC20)	1230-POM
★C4030W5 (Ch. 19CC19) (Similar to Chassis)	1215-3
★C4030W11,W13 (Ch. 19CC19Z) (Similar to Chassis)	1215-3
★C4208W1 (Ch. 20CC50)	1238-3
★C4208W6,W11 (Ch. 20CC50Z)	1238-3
★C4509W11,W12 (Ch. 20CC50)	1238-3
★C4509W16,W17 (Ch. 20CC50Z)	1238-3
★C4512W1,W3 (Ch. 20CC50)	1238-3
★C4512W6,W7 (Ch. 20CC50Z)	1238-3
★C4512W31,W32 (Ch. 20CC50Z) (Similar to Chassis)	1238-3
★C4516W,W2 (Ch. 20CC50)	1238-3
★C4516W5 (Ch. 20BC50) (Similar to Chassis)	1197-2
★C4516W31,W32 (Ch. 20CC50Z) (Similar to Chassis)	1238-3
★C4517M,M2 (Ch. 20CC50)	1238-3
★C4517M31,M32 (Ch. 20CC50Z) (Similar to Chassis)	1238-3
★C4518DE2,P,P2 (Ch. 20CC50)	1238-3
★C4518DE6,P6,P7 (Ch. 20CC50Z)	1238-3
★C4518DE31,DE32,P31,P32 (Ch. 20CC50Z) (Similar to Chassis)	1238-3
★C4730X (Ch. 25CC25)	1212-POM
★C4787P/88DE/89P (Ch. 25CC55)	1212-POM
★C5722W1 (Ch. 14CC16)	1233-3
★C5722W7 (Ch. 14CC16Z)	1233-3
★C5722W17 (Ch. 14CC16Z) (Similar to Chassis)	1233-3
★C6030W4 (Ch. 19CC19, S-86335) (Similar to Chassis)	1215-3
★C6030W13 (Ch. 19CC19Z) (Similar to Chassis)	1215-3
★C6509W16 (Ch. 20CC50Z)	1238-3
★C6730X,X11 (Ch. 25CC25)	1212-POM
★C6787P/88DE (Ch. 25CC55)	1212-POM
★C8775P (TV Ch. Only 25CC55)	1212-POM
Royal 73J2 (Ch. 23-1, 24-1)	TSM-131
R73J2 (Ch. 23-1,24-1)	TSM-131
★S2929W13 (Ch. 14CC16Z) (Similar to Chassis)	1233-3
★S-83596 (TV Remote Control Unit)	1238-3
★S-86436 (TV Remote Control Unit)	1238-3
★S-87861 (TV Remote Control Unit)	1233-3A
★S-87941 (TV Remote Control Unit)	1233-3A
●T2616W,W1,W2,W3 (Ch. 12CB12X)	1252—3
●T2628W,W1,W2,W3 (Ch. 16DB12X)	1242-POM
★T2824W1,W3 (Ch. 14CC14)	1233-3
★T2824W7 (Ch. 14CC14Z)	1233—3
★T2824W8 (Ch. 14CC14Z) (Similar to Chassis)	1233-3
★T2824W9 (Ch. 14CC14Z)	1233-3
★T2828W1,W3 (Ch. 14CC16)	1233-3
★T2828W8 (Ch. 14CC16Z)	1233-3
★T2828W18 (Ch. 14CC16Z) (Similar to Chassis)	1233-3
★T2833W8 (Ch. 18CC30)	1225-3
★T2836W5 (Ch. 19CC19) (Similar to Chassis)	1215-3
★T2837W2 (Ch. 19DC20)	1230-POM
★T2851W2 (Ch. 20CC50)	1238-3
★T2851W7 (Ch. 20CC50Z)	1238-3
★T2851W31,W32 (Ch. 20CC50Z) (Similar to Chassis)	1238-3
★T2853DE2,P2 (Ch. 20CC50)	1238-3
★T2853DE7,P7 (Ch. 20CC50Z)	1238-3
★T2853DE31,DE32,P31,P32 (Ch. 20CC50Z) (Similar to Chassis)	1238-3
●Ch. 12CB12X	1252—3
Ch. 12KT40Z8	TSM-74
★Ch. 14CC14,Z/15,Z/16,Z	1233-3
●Ch. 16DB12X	1242-POM
★Ch. 18CC29/30	1225-3
★Ch. 19CC19Z (Similar to Chassis)	1215-3
★Ch. 19DC20	1230-POM
★Ch. 20CC50,Z	1238-3
Ch. 23-1	TSM-131
Ch. 24-1	TSM-131
★Ch. 25CC25	1212-POM
★Ch. 25CC55	1212-POM
Ch. 29CT20	MHF-24

AUTO RADIOS AND TAPE PLAYERS

A

Set No.	Folder No.
ALLIS-CHALMERS	
1BTAC	AR-112
AMERICAN MOTORS American Motors Corp. 14250 Plymouth Road Detroit, Michigan	
1JA4105 (3632704)	AR-122
3632704	AR-122
AMPEX Ampex Consumer Equipment Division 2201 Lunt Avenue Elk Grove Village, Illinois 60007	
Micro 40	AR-111
Micro 44	AR-110
ASTRO-LINE (See Boman Astrosonix)	
AUDI Motorola, Inc. 9401 West Grand Ave. Franklin Park, Illinois 60131	
1AU1121	AR-118
AUDIOVOX CORPORATION Audiovox Corporation 150 Marcus Blvd. Hauppauge, New York 11787 Address Change	
AUTOMATIC Automatic Radio Mfg. Co., Inc. 2 Main Street Melrose, Massachusetts 02176	
APX-2334	AR-120
CFE-6745A	AR-119
EMS-2121	AR-119
EXP-8012	AR-121
MES-1454	AR-119
MIN-9945	AR-121
MNE-6725A	AR-123
MNI-1410	AR-123

B

Set No.	Folder No.
BOMAN ASTROSONIX Boman Astrosonix-Div. of California Auto Radio, Inc. 9426 Stewart & Gray Road Downey, California 90241	
BM-907	AR-116
BM-909	AR-119
BM-910	AR-111
BM-926	AR-119
BM-960	AR-121
BM-1000	AR-117
BM-2900	AR-120
CR-500	AR-109
CR-520	AR-122
CR-800	AR-109
SP-90	AR-116
100-M	AR-115
300-PB	AR-118
400-FM	AR-112
600-MPX	AR-113
BRITISH LEYLAND (Also See Triumph) British Leyland Motors, Inc. 600 Willow Tree Road Leonia, N. J. 07605	
F8SMXR (R100)	AR-122
F9SMB (HAC725)	AR-122
HAC725	AR-122
R100	AR-122
BUICK United Delco Distributors	
14BFMT2	AR-120
14BPBT2	AR-114
24AFP1	AR-118
24APB1	AR-115
24AT411	AR-112
24BFM1	AR-113
24BFMT1	AR-120
24BFP1	AR-110
24BPB1	AR-117
24BPBT1	AR-114
24BT411	AR-112
7307554	AR-112
7313514	AR-118
7313604	AR-115
7930134	AR-114
7930144	AR-120
7930224	AR-117
7930234	AR-110
7930244	AR-113
7935374	AR-112

C

Set No.	Folder No.
CADILLAC United Delco Distributors	
15CFMT3	AR-114
25CFMT1,2	AR-114
25CFP1	AR-112
25CMW1,2	AR-110
25CT411	AR-112
7930015	AR-112
7930025	AR-110
7930495	AR-112
7937005	AR-114
CARTAPE Car Tapes, Inc. 9180 Kelvin Ave. Chatsworth, California 91311	
CT-4800	AR-119
CT-8000	AR-123
CT-8200	AR-121
CT-8800	AR-123
CT-8900	AR-116
CT-8999	AR-123
X-8100	AR-119
CHANNEL MASTER Channel Master Corp. Ellenville, N.Y. 12428	
6203	AR-116
6204	AR-113
6282	AR-122
6291	AR-121
6292	AR-119
CHEVROLET United Delco Distributors	
11BFMT2	AR-118
11BPBT2	AR-115
21AFM1	AR-109
21AFP1	AR-117
21AFPK1	AR-117
21APB1	AR-110
21APBK1	AR-110
21AT411	AR-112
21BFM1	AR-114
21BFM3 (Similar to Page 41)	AR-114
21BFMT1	AR-118
21BFP1	AR-113
21BFP2 (See Page 61)	AR-113
21BFPK1	AR-113
21BFPK2 (See Page 61)	AR-113
21BPB1	AR-112
21BPB2	AR-120
21BPBK1	AR-112
21BPBK2	AR-120
21BPBT1	AR-115
21HPB1	AR-112
21HPB2	AR-120
21HPBK1	AR-112
21HPBK2	AR-120
21TFP1	AR-117
21TPB1	AR-110
21TT411	AR-112
21VFP1	AR-117
21XFMT1	AR-118
21XPBT1	AR-115
7305841	AR-110
7313971	AR-112
7314201 (1972 Prod.)	AR-112
7314201 (1972 1/2 Prod.)	AR-120
7314211	AR-114
7930061	AR-115
7930121	AR-118
7930161	AR-115
7933241	AR-110
7933251	AR-117
7933261	AR-109
7933291 (1972 Prod.)	AR-112
7933291 (1972 1/2 Prod.)	AR-120
7933301	AR-113
7933501	AR-110
7933511	AR-117
7933641 (1972 Prod.)	AR-112
7933641 (1972 1/2 Prod.)	AR-120
7935021 (1972 Prod.)	AR-112
7935021 (1972 1/2 Prod.)	AR-120
7936011	AR-113
7936181	AR-115
7936191	AR-118
7936271	AR-117
7936601	AR-112
7937571	AR-117
CHRYSLER Chrysler Corp. P.O. Box 1118 Detroit Michigan 48231	
28BFW1	AR-109
2884759 (0BBJ, 1BBJ)	AR-89
3501164 (28BFW1) (1972 Prod.)	AR-109
CRAIG Craig Corp. 2302 East 15th Street Los Angeles, California 90021	
1901	AR-118
3122	AR-122
3126	AR-121
3127	AR-117

D

Set No.	Folder No.
DELCO United Delco Distributors	
20BCT11	AR-115
7937400	AR-115
DODGE (Also See MoPar) Chrysler Corp. P.O. Box 1118 Detroit, Mich. 48231	
AR-615SG-BL,-L	AR-117
ARA-10L, W	AR-117
1DP2010	AR-109
3420889 (1DP2010)	AR-109
3501156	AR-122
3501157	AR-109

F

Set No.	Folder No.
FO-MO-CO (See Ford, Lincoln, Mercury)	
FORD Ford Motor Co. Dearborn, Mich.	
C9AA-19A241	AR-73
C80A-19A049E	AR-87
DOZA-19A242	AR-86
D1AA-19A242AD	AR-104
D1ZA-19A242AD	AR-104
D2BA-18810 (Similar to Page 51)	AR-59
D2HA-18810 (Similar to Page 51)	AR-51
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1/2 FD4103 (D1AA-19A242AD)	AR-104
1BTF	AR-115
1FBF (D1AA-19A241)	AR-94
1FBO (D1OA-19A241)	AR-94
1FBTP (D1TA-19A241)	AR-94
1FBZ (D1ZA-19A241)	AR-94
1FD4103 (D1AA-19A242AD)	AR-104
2BTB/BTT/BTW (Similar to Page 51)	AR-59
2FD4103 (D1AA-19A242AD)	AR-104
2MZ4101 (D1ZA-19A242AD)	AR-104

Set No. — Folder No.

G

GENERAL MOTORS CORP. (GMC)
United Delco Distributors
26TFP1 AR–117
26TRMP1 AR–110
26TT411 AR–112
26TTCP1 AR–110
7305516 AR–110
7308166 AR–112
7931466 AR–117
7931766 AR–110

H

HITACHI
Hitachi Sales Corporation of America
48-50 34th Street
Long Island City, N.Y. 11101
CS-1000IC AR–111
CS-1050IC AR–123
CS-1150IC AR–123
CS-1700IC AR–123
TRQ-206 AR–116

I

INLAND-DYNATRONICS
Inland Dynatronics, Inc.
10 Horizon Blvd.
South Hackensack, N. J. 07606
S-75 AR–121
S-85 AR–119
S-900 AR–119
WV-509 AR–122
X-304 AR–122

INTERNATIONAL
International Harvester Co.
180 N. Michigan Avenue
Chicago, Illinois 60601
1BT1H AR–110
1HA1914 (244793-R91) AR–120
244793-R91 AR–120

J

JEEP
Kaiser-Jeep Corp.
200 Industrial Drive
Plymouth, Michigan
1KJ1024 (981030) AR–118
1KJ1025 (981026) AR–118
1KJ1048 (984336) AR–118
981026 (1KJ1025) AR–118
981030 (1KJ1024) AR–118
984336 (1KJ1048) AR–118

JOHN DEERE
1AR4231 AR–110
1BTJD AR–113
7SMJD AR–110

K

KARMANN GHIA
Volkswagen of America
Englewood Cliffs, New Jersey
Sapphire XV AR–118
1VW1116 AR–118
2VW1116 AR–118

KENWORTH
K345393 AR–122
1KW1904 (K345393) AR–122

L

LINCOLN
Ford Motor Co.
Dearborn, Mich.
D20A-18806 AR–122
1FBL (D1VA-19A241) AR–97
2MT4108 (D1LA-19A242AA) AR–104

M

MACK TRUCK
U7MMT AR–112
204SX28 AR–108

MASSEY FERGUSON
1BTMF AR–117

MEDALLION
Medallion Automotive Products Company
P.O. Box 1903
Kansas City, Missouri 64141
65-203 AR–120
65-486 AR–123
65-500 AR–116
65-501A AR–121
65-502 AR–123
65-505 AR–119
65-506 AR–123

MERCURY
Ford Motor Co.
Dearborn, Mich.
DOMA-19A242C AR–85
D0RJ-19A241A AR–109
DOWA-19A242A AR–86
D20A-18806 AR–122
1/2 MY4106 (D1MA-19A242AD) AR–105
1CP2033 (D0RJ-19A241A) AR–109
1FBA (D1YA-19A241) AR–98
1FBG (D1GA-19A241) AR–98
1FBM (D1MA-19A241) AR–98
1FBW (D1WA-19A241) AR–98

MGA
Mitsubishi International Corp.
7045 North Ridgeway Ave.
Lincolnwood, Illinois 60645
AR-615SG-BL,-L AR–117
ARA-10L,W AR–117

MOTOROLA
Motorola, Inc.
9401 West Grand Ave.
Franklin Park, Ill. 60131
P718S AR–116
TM200S AR–111
TM718S AR–116
7SMFT AR–109
10P3598 AR–109
Ch. TD138J AR–116

O

OLDSMOBILE
United Delco Distributors
13BFMT2 AR–117
13BPBT2 AR–118
23AFM1 AR–112
23AFP1 AR–115
23APB1 AR–120
23AT411 AR–112
23BFM1 AR–110
23BFM3 (Similar to page 91) AR–110
23BFMT1 AR–117
23BFP1 AR–114
23BPB1 AR–115
23BPBT1 AR–118
7930053 AR–118
7930063 AR–117
7930093 AR–117
7935003 AR–120
7935013 AR–112
7935023 AR–115
7935033 AR–110
7935063 AR–118
7937413 AR–112
7938303 AR–115
7938313 AR–114

OPEL
United Delco Distributors
24LPB1 AR–114
24PPB1 AR–112
7312234 AR–112
7930254 AR–114

P

PANASONIC
Matsushita Elec. Corp. of America
Panasonic Service & Parts Div.
10-16 44th Drive
Long Island City, N.Y. 11101
CX-351EU AR–111
CX-830EU AR–111

PENNEYS—PENNCREST
J. C. Penney Co., Inc.
1301 Avenue of the Americas
New York, N.Y. 10019
981-0101 AR–119
981-0105 AR–121

PLYMOUTH
(Also See MoPar)
Chrysler Corp.
P.O. Box 1118
Detroit, Mich. 48231
3501156 AR–122
3501157 AR–109

PONTIAC
United Delco Distributors
12AFP1, 12AFPK1 AR–120
12BFMT2 AR–115
12BPBT2 AR–117
12FFP1, 12FFPK1 AR–120
12GFP1, 12GFPK1 AR–120
21AFM1 AR–113
21AFP1, 21AFPK1 AR–120
21APB1 AR–114
21APBK1 AR–114
21XFMT1 AR–115
21XPBT1 AR–117
22AFM1 AR–113
22AFP1, P2 AR–120
22AFPK1, K2, K3 AR–120
22APB1 AR–114
22APBK1 AR–114
22AT411 AR–112
22BFM1,2 AR–112
22BFMT1 AR–115
22BFP1 AR–109
22BFP2 (See Page 99) AR–109
22BFPK1 AR–109
22BFPK2 (See Page 99) AR–109
22BPB1 AR–118
22BPB2 AR–122
22BPB3 (Similar to page 93) AR–115
22BPBK1 AR–118
22BPBK2 AR–115
22BPBK3 AR–122
22BPBT1 AR–117
22BT411 AR–112
22FBPK1 AR–114
22FFM1 AR–113
22FFP1, P2 AR–120
22FFPK1, K2, K3 AR–120
22FPB1 AR–114
22FT411 AR–112
22GFM1 AR–113
22GFP1, P2 AR–120
22GFPK1, K2, K3 AR–120
22GPB1 AR–114
22GPBK1 AR–114
22XT411 AR–112
7307302 AR–114
7307332 AR–114
7307402 (1971 1/2 and 1972 Prod.) AR–120
7307432 (1971 1/2 and 1972 Prod.) AR–120
7307702 AR–112
7312332 AR–113
7312892 AR–114
7312912 AR–114
7312922 (1971 1/2 and 1972 Prod.) AR–120
7312942 (1971 1/2 and 1972 Prod.) AR–120
7313522 AR–114
7313532 (1971 1/2 and 1972 Prod.) AR–120
7313542 AR–113
7313552 AR–114
7313562 (1971 1/2 and 1972 Prod.) AR–120
7930012 (1972 Prod.) AR–118
7930012 (1972 1/2 Prod.) AR–122

PONTIAC—Cont.
7930022 AR–109
7930032 AR–112
7930202 AR–115
7930202 (1972 Prod.) AR–118
7930202 (1972 1/2 Prod.) AR–122
7930212 AR–109
7930242 AR–117
7930252 AR–115
7930492 AR–112
7930542 AR–113
7933241 AR–114
7933251 AR–120
7933261 AR–113
7933501 AR–114
7933511 AR–120
7934782 AR–112
7936181 AR–117
7936191 AR–115
7936232 AR–112

PORSCHE
Motorola, Inc.
9401 West Grand Ave.
Franklin Park, Illinois 60131
1PE1123 AR–118

R

RANGER
Ranger Auto Radio
19201 Cranwood Parkway
Warrensville Heights, Ohio 44128
R-71-T AR–111

RENAULT
Renault, Inc.
750 Third Ave.
New York, New York 10017
1RE1926 (55569-00) AR–118
1RE1927 (55569-01) AR–118
1RE1928 (55569-04) AR–118
55569-00/-01/-04 AR–118

S

SAAB
Saab, Inc.
100 Waterfront
New Haven, Conn.
0BSA,0BSAA,0BSAB AR–113
0BSA99 AR–113
1BSA AR–113
1BSA99 AR–113
9FBSA,9FBSAB AR–110
9FBSA99 AR–110

SANYO
Sanyo Electric, Inc.
1200 West Walnut Street
Compton, California 90220
FT-883 AR–121

SIMCA
Chrysler Corporation
P.O. Box 1118
Detroit, Michigan 48231
1BS1,1BS1B AR–114

T

TENNA
Tenna Corporation
19201 Cranwood Parkway
Warrensville Heights, Ohio 44128
TC-80-T AR–116
TC-82-T AR–111

TOYOTA
Toyota Motor Sales U.S.A., Inc.
2055 West 190th Street
Torrence, Calif. 90501
CR-122FT AR–114
CR-127FT AR–114
CR-523FT AR–117
CR-528FT AR–117
CX-161FTB AR–114
CX-165FTB AR–114
RT-60DFT AR–122
RT-60LFT AR–115
86120-20090 (CR-122FT/127FT) AR–114
86120-20110 (CR-523FT/528FT) AR–117
86120-22010 (RT-60DFT) AR–122
86120-22040 (RT-60LFT) AR–115
86260-14010 (CX-165FTB) AR–114
86260-20011 (CX-161FTB) AR–114

TRIUMPH
British Leyland Motors, Inc.
600 Willow Tree Road
Leonia N.J. 07605
0BTR,0BTRA,B AR–110
1BTR AR–110
9FBTR AR–113

TRUETONE
Western Auto Supply Co.
2107 Grand Avenue
Kansas City, Missouri 64108
ITC7004A-07 AR–111
MIC7003A-17 AR–116
4DC7003 AR–116
4DC7004 AR–111

V

VOLKSWAGEN
Volkswagen of America
Englewood Cliffs, New Jersey
Sapphire XV AR–118
1VW1116 AR–118
1VW1118 AR–118
2VW1116 AR–118
3VW1116 AR–118

VOLKSWAGEN TRANSPORTER
Volkswagen of America
Englewood Cliffs, New Jersey
Sapphire XV AR–118
1VW1116 AR–118
2VW1116 AR–118

VOLVO
Volvo Distributors, Inc.
Volvo Drive
Rockleigh, New Jersey
0BV0,0BV0C,D AR–109
1BV0,1BV0C,D AR–109
1VV2032 (279971) AR–120
1VV2908 (279971) AR–120
2VV2016 (279959-1972 Prod.) AR–120
9FBV0,9FBV0C,D AR–112

W

WARDS—RIVERSIDE
Montgomery Ward & Co.
619 Chicago Avenue
Chicago, Illinois 60607
ZCX-16753A,B,C,D AR–116
61-16753 AR–116

WELTRON
Welton Company, Inc.
514 East Peabody Street
Durham, North Carolina 27702
717,718 AR–111

WHEEL HORSE
Wheel Horse
515 West Ireland Road
South Bend, Indiana 46614
1BTWH AR–114

WHITE MOTOR CO.
White Motor Co.
842 E. 79th St.
Cleveland, Ohio 44101
1WM2134 (02-7074020) AR–118
02-7074020 AR–118

RECORD CHANGERS

A

ARVIN
Arvin Industries, Inc.
1531 Thirteenth Street
Columbus, Indiana 47201
2006703-2 (Similar to Changer) 1109–4

N

NORELCO
Norelco Service, Inc.
30-30 Review Avenue
Long Island City, N.Y. 11101
Address Change

RECORDERS AND TAPE PLAYERS

A

ADMIRAL
Admiral Corp.—National Service Div.
P.O. Box 845
Bloomington, Illinois 61701
Chassis 6V2 TR–100
Chassis 8A5 TR–99
CTR571 TR–99
CTR591 TR–100
IC9000 TR–100

AMBASSADOR
Allied Purchasing Corp.
401 Fifth Avenue
New York, N.Y. 10016
2V960 TR–95

AMERICAN MOTORS
American Motors Corp.
14250 Plymouth Road
Detroit, Michigan
1JA4105 (3632704) AR–122
3632704 AR–122

AMPEX
Ampex Consumer Equipment Division
2201 Lunt Avenue
Elk Grove Village, Illinois 60007
Micro 9A (Similar to Page 5) TR–81
Micro 32 TR–101
Micro 40 AR–111
Micro 44 AR–109
Micro 54 TR–97
Micro 70 TR–99
761 TR–95
767 TR–95
1461 TR–95
1467 TR–95

ARVIN
Arvin Industries, Inc.
1531 Thirteenth Street
Columbus, Indiana 47201
40L31-19 (Ch. 1.48701, 1.48702) TR–92
Ch. 1.48701/702 TR–92

AUDIOVOX CORPORATION
Audiovox Corporation
150 Marcus Blvd.
Hauppauge, New York 11787
Address Change

AUTOMATIC
Automatic Radio Mfg. Co., Inc.
2 Main Street
Melrose, Mass. 02176
CFE-6745A AR–119
EMS-2121 AR–119
EXP-8012 AR–121
MES-1454 AR–119
MIN-9945 AR–121
MNE-6725A AR–123
MNI-1410 AR–123
PED-2512 TSM–134
PEL-2501 TSM–134

Set No. — Folder No.

B

BOMAN ASTROSONIX
Boman Astrosonix-Div. of Califonia Auto Radio, Inc.
9426 Stewart & Gray Road
Downey, California 90241
BM-907 .... AR-116
BM-909 .... AR-119
BM-910 .... AR-111
BM-926 .... AR-119
BM-960 .... AR-121
BM-1000 .... AR-117
BM-2900 .... AR-120
SP-90 .... AR-116

BRADFORD
W. T. Grant Company
1515 Broadway, Times Square
New York, New York 10036
WTG-60939 .... TSM-132
2053D30 .... TSM-132

BUICK
United Delco Distributors
14BFMT2 .... AR-120
14BPBT2 .... AR-114
24AT411 .... AR-112
24BFMT1 .... AR-120
24BPBT1 .... AR-114
24BT411 .... AR-112
7307554 .... AR-112
7930134 .... AR-114
7930144 .... AR-120
7935374 .... AR-112

C

CADILLAC
United Delco Distributors
15CFMT3 .... AR-114
25CFMT1,2 .... AR-114
25CT411 .... AR-112
7930495 .... AR-112
7937005 .... AR-114

CARTAPE
Car Tapes, Inc.
9180 Kelvin Ave.
Chatsworth, California 91311
CT-4800 .... AR-119
CT-8000 .... AR-123
CT-8200 .... AR-121
CT-8800 .... AR-123
CT-8900 .... AR-116
CT-8999 .... AR-123
PT-8 .... TSM-133
X-8100 .... AR-119

CHANNEL MASTER
Channel Master Corp.
Ellenville, N.Y. 12428
6201 .... TSM-129
6202 .... TSM-131
6203 .... AR-116
6204 .... AR-113
6205 .... TSM-130
6208 .... TSM-130
6291 .... AR-121
6292 .... AR-119
6304 .... TR-100
6306 .... TR-101
6327 .... TR-98

CHEVROLET
United Delco Distributors
11BFMT2 .... AR-118
11BPBT2 .... AR-115
21AT411 .... AR-112
21BFMT1 .... AR-118
21BPBT1 .... AR-115
21TT411 .... AR-112
21XFMT1 .... AR-118
21XPBT1 .... AR-115
7313971 .... AR-112
7930061 .... AR-115
7930121 .... AR-118
7930161 .... AR-115
7936181 .... AR-115
7936191 .... AR-118
7936601 .... AR-112

CRAIG
Craig Corp.
2302 East 15th Street
Los Angeles, California 90021
2606 .... TR-90
2609 .... TR-96
3122 .... AR-122
3126 .... AR-121
3127 .... AR-117

CROWN RADIO
Crown Radio Corp.
228 E. Harris Ave.
South San Francisco, Calif. 94080
CRC-410FW TR-101
CRC-7550F TR-98
CTR-320W TR-93
CTR-8750 .... TR-94

D

DELCO
United Delco Distributors
20BCT11 .... AR-115
7937400 .... AR-115

E

ELECTROPHONIC
Electrophonic Corp. of America
101-10 Foster Avenue
Brooklyn, New York 11236
T-9 .... TSM-131
T-16 .... TSM-130
T-17 .... TSM-131

ELGIN
Elgin National Industries, Inc.
50-35 56th Road
Maspeth, New York 11378
R5600 .... TR-97

F

FANON-MASCO
Fanon/Courier Corporation
990 South Fair Oaks Avenue
Pasadena, California 91105
Address Change

FORD
Ford Motor Company
Dearborn, Michigan
D1AA-19A242AD AR-104
D1SA-19A242AB AR-102
D1ZA-19A242AD AR-104
1/2 FD4103 (D1AA-19A242AD) AR-104
1FD4103 (D1AA-19A242AD) AR-104
2FD4103 (D1AA-19A242AD) AR-104
2MZ4101 (D1ZA-19A242AD) AR-104

G

GENERAL ELECTRIC
General Electric Company
1001 Broad Street
Utica, New York 13501
M8614A TSM-133
M8615A TSM-132

GENERAL MOTORS CORP. (GMC)
United Delco Distributors
26TT411 .... AR-112
7308166 .... AR-112

H

HITACHI
Hitachi Sales Corporation of America
48-50 34th Street
Long Island City, N.Y. 11101
CS-1000IC AR-111
CS-1050IC AR-123
CS-1150IC AR-123
CS-1700IC AR-123
TRQ-206 .... AR-116
TRQ-232S TR-95
TRQ-250,E,R,W TR-91
TRQ-253 (A), (E) TR-96
TRQ-260 (A),(W) TR-92
TRQ-280 (A),(E),(W) TR-93

I

INLAND DYNATRONICS
Inland Dynatronics, Inc.
10 Horizon Blvd.
South Hackensack, N.J. 07606
S-75 .... AR-121
S-85 .... AR-119
S-900 .... AR-119

J

JULIETTE
Topp Electronics, Inc.
4201 N. W. 77th Ave.
Miami, Florida 33166
CTP-2032 .... TR-91

L

LINCOLN
Ford Motor Company
Dearborn, Michigan
D1LA-19A242AA AR-104
2MT4108 (D1LA-19A242AA) AR-104

LLOYD'S
Lloyd's Electronics of California, Inc.
18601 South Susana Road
Compton, California 90221
1V20-114A TR-92
9V72A-114A TR-96

M

MAGNAVOX
The Magnavox Company
Bueter Road
Fort Wayne, Indiana 46803
1V9002 .... TR-90

MALLORY
P. R. Mallory & Co., Inc.
3029 E. Washington Street
Indianapolis, Indiana 46206
MCR1211 (Similar to page 47) TR-97

MEDALLION
Medallion Automotive Products Company
P.O. Box 1903
Kansas City, Missouri 64141
65-486 .... AR-123
65-500 .... AR-116
65-501A AR-121
65-502 .... AR-123
65-505 .... AR-119
65-506 .... AR-123

MERCURY
Ford Motor Company
Dearborn, Michigan
1/2 MY4106 (D1MA-19A242AD) AR-105
2MR4111 (2MR1) AR-105

MERCURY (PAX LTD.)
Pax, Ltd.
5125 Church Street
Skokie, Ill. 60076
20-1025 .... TR-90
20-1035 .... TR-92

MIDLAND
Midland International Corp.
P.O. Box 1903
Kansas City, Missouri 64141
12-140 .... TR-94
12-157 .... TR-91
12-440 .... TR-92

MORSE ELECTRO PRODUCTS
Morse Electro Products Corp.
101-10 Foster Avenue
Brooklyn, New York 11236
T-9 .... TSM-131
T-16 .... TSM-130
T-17 .... TSM-131

MOTOROLA
Motorola, Inc.
9401 West Grand Ave.
Franklin Park, Illinois 60131
CP500EN-1 (Ch. CHS-3600) (See Page 91) HTP-7
GP40GW TR-91

MOTOROLA—Cont.
LP200HE (Ch. DHS-3600) (Similar to Page 91) HTP-7
P718S AR-116
TM200S AR-111
TM718S AR-116
Ch. DHS-3600 (Similar to Page 91) HTP-9
Ch. TD138J AR-116

N

NORELCO
Norelco Service, Inc.
30-30 Review Avenue
Long Island City, New York 11101
RR25 .... TR-101
1320 .... TR-96
1440 .... TR-90
1530 .... TR-94
2400,P TR-92

O

OLDSMOBILE
United Delco Distributors
13BFMT2 .... AR-117
13BPBT2 .... AR-118
23AT411 .... AR-112
23BFMT1 .... AR-117
23BPBT1 .... AR-118
7930053 .... AR-118
7930063 .... AR-117
7930093 .... AR-117
7935063 .... AR-118
7937413 .... AR-112

P

PACKARD BELL
Teledyne Packard Bell Electronics
12333 West Olympic Blvd.
Los Angeles, Calif. 90064
TRD-120 (Similar to Page 34) TR-73

PANASONIC
Matsushita Electric Corp. of America
Panasonic Service & Parts Div.
10-16 44th Drive
Long Island City, N.Y. 11101
CX-351EU AR-111
CX-830EU AR-111
RQ-209AS TR-97
RQ-209DAS TR-90
RQ-222AS TR-95
RQ-224AS/224S TR-98
RQ-226S TR-94
RQ-236S TR-93
RQ-243S TR-99
RS-256UAS TR-96

PENNEY'S—PENNCREST
J. C. Penney Co., Inc.
1301 Avenue of the Americas
New York, N.Y. 10019
981-0101 .... AR-119
981-0105 .... AR-121
3300 .... TR-100
3810 .... TSM-132
3840 .... TSM-129
3850 .... TSM-130
6232,6233 (Similar to Page 136) TR-18
6569 .... TR-98

PONTIAC
United Delco Distributors
12BFMT2 .... AR-115
12BPBT2 .... AR-117
21XFMT1 .... AR-115
21XPBT1 .... AR-117
22AT411 .... AR-112
22BFMT1 .... AR-115
22BPBT1 .... AR-117
22BT411 .... AR-112
22FT411 .... AR-112
22XT411 .... AR-112
7307702 .... AR-112
7930242 .... AR-117
7930252 .... AR-115
7930492 .... AR-112
7934782 .... AR-112
7936181 .... AR-117
7936191 .... AR-115
7936232 .... AR-112

R

RANGER
Ranger Radio
19201 Cranwood Parkway
Warrensville Heights, Ohio 44128
R-71-T AR-111

REALISTIC
Allied Radio Shack Corporation
2727 West 7th Street
Fort Worth, Texas 76107
TR-8 (14-912) TR-91
TR-8A (14-912A) TR-91
14-912,A TR-91

ROBERTS
Rheem Manufacturing Co.
Califone-Roberts Div.
6050 West Jefferson Blvd.
Los Angeles, Calif. 90016
80 (Similar to page 95) TR-73
525 .... TR-93
526 (Similar to Page 75) TR-100
530 .... TR-93
808, D TR-99

ROSS
Ross Electronics Corporation
2834 South Lock Street
Chicago, Illinois 60608
8450 .... TSM-133
8875 .... TSM-134

S

SANYO
Sanyo Electric, Inc.
1200 West Walnut Street
Compton, California 90220
FT-883 .... AR-121

SEARS-SILVERTONE
Sears, Roebuck & Company
303 East Ohio Street
Chicago, Illinois 60611
174.34940000 .... TR-97
400.34171100 (Similar to page 97) TR-89
564.21180200 (Similar to page 83) TR-72
564.34300000 .... TR-100
564.34401700 (Similar to page 93) TR-62

SHARP
Sharp Electronics Corp.
10 Keystone Place
Paramus, N. J. 07652
RD-416U TR-100
RD-425U TR-99
RD-426U TR-92

SONY
Superscope, Inc.
8150 Vineland Ave.
Sun Valley, Calif. 91353
TC-8W TR-96
TC-60 .... TR-98
TC-100 (Serial #258,171 and Later (USA) #309,101 and Later (Canada) TR-90
TC-125 .... TR-100
TC-160 .... TR-93
TC-180/AV TR-99
TC-330 .... TR-101
TC-352D TR-97
TC-650 .... TR-94
TC-651 (Similar to Page 65) TR-94
TC-707C (Similar to Page 65) TR-94
TC-1180 .... TR-99
TC-2120 .... TR-100
TC-2200 .... TR-93
TC-6350 .... TR-97

SOUNDESIGN
Realtone Electronics Corp.
34 Exchange Place
Jersey City, N.J. 07302
4962 .... TSM-133
4965 .... TSM-134

SYLVANIA
GTE Sylvania, Inc.
700 Ellicott Street
Batavia, New York 14021
CT150 (Ch. TC4) TR-94
Ch. TC4 .... TR-94

SYMPHONIC
Symphonic Radio & Electronic Corp.
Foot of John Street
Lowell, Massachusetts 01852
AT-115 .... TR-90
CR-142 .... TR-90

T

TENNA
Tenna Corporation
19201 Cranwood Parkway
Warrensville Heights, Ohio 44128
TC-80-T AR-116
TC-82-T AR-111

TOYOTA
Toyota Motor Sales U.S.A., Inc.
2055 West 190th Street
Torrence, Calif. 90501
CX-161FTB AR-114
CX-165FTB AR-114
86260-14010 (CX-165FTB) AR-114
86260-20011 (CX-161FTB) AR-114

TRUETONE
Western Auto Supply Co.
2107 Grand Avenue
Kansas City, Mo. 64108
ITC7004A-07 .... AR-111
MIC7003A-17 .... AR-116
4DC7003 .... AR-116
4DC7004 .... AR-111

W

WARDS (AIRLINE-RIVERSIDE)
Montgomery Ward & Co.
619 Chicago Avenue
Chicago, Illinois 60607
GEN-3930A TR-95
GEN-6211A TSM-129
ZCX-16753A,B,C,D AR-116
61-16753 .... AR-116
62-6211 .... TSM-129
62-3930 .... TR-95

WEBCOR
United Sound & TV Co.
5036 Venice Blvd.
Los Angeles, Calif. 90019
EP-2203-1 (Similar to Chassis) 608-14

WELTRON
Weltron Company, Inc.
514 East Peabody Street
Durham, North Carolina 27702
WFMX-104 .... TSM-129
717,718 .... AR-111
2001 .... TSM-131

WOLLENSAK
3M Company
Revere-Mincom Div.
2501 Hudson Rd.
St. Paul, Minnesota 55119
4400 .... TR-98
4410 .... TR-98
4500 .... TR-97
4510 .... TR-97
6150 (Lots A,B) TR-93
6154 (Lots A,B) TR-93
6250 .... TR-91
6350 .... TR-91
6360 .... TR-91
6364 .... TR-91

Y

YORK
York Radio Corp.
15 Empire Blvd.
So. Hackensack, N. J. 07606
CTR-12 .... TR-95

NOTE: ● Denotes Television Receiver. ★ Denotes Color Television Receiver. **AOR** Denotes Available On Request. **AR** Denotes Auto Radio Series Volume. **CB** Denotes **CB** Radio Series Volume. **HTP** Denotes Home Tape Player Series Volume. **MHF** Denotes Modular Hi-Fi Series Volume. **PCB** Denotes Production Change Bulletin. **POM** Denotes Bonus Schematic in Photofact-of-the-Month Package—Unavailable After Month Of Issue. **SED** Denotes Special Equipment Data. **TR** Denotes Tape Recorder Series Volume. **TSM** Denotes Transistor Radio Series Volume.

Printed in U.S.A.

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- Now 120 SKs replace more than 46,000 devices

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- 15 heat sinks from TO-18 to TO-3 package styles

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- New SK Replacement Guide
- New SK Wall Chart
- Transistor Tape/Slide Educational Shows
- Manuals

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