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In the two previous issues of The C-D Capacitor, we gave you detailed instructions for using your free newspaper mats and postcards in the new "Let Yourself Grow" C-D Sales Promotion Program. If you missed these important issues, write for them.

Now we will show you how to gain the most benefit from three reputation-building display pieces supplied to you free through your local C-D distributor.

"Reliable Radio Service" Shop Displays

Each of these three-color printed items is designed to promote your service as the most dependable in your community. Since prestige is the backbone of all business, you need this valuable display material. Get them from your jobber — FREE.

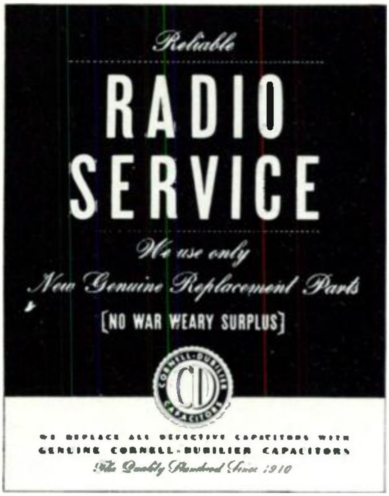
Window Shoppers Open the Door to Profits

The flow of pedestrian traffic past your door can be converted into paying customers if you observe a few simple rules for your window display. People are attracted by pleasing, harmonious displays and are repelled by windows cluttered up like a rummage sale. Your volume of business grows or shrinks depending on the number of prospects that you draw to your window, and into your shop.

Appearance. Your window, and window interior, should sparkle with cleanliness. Dirty backgrounds, faded or torn flooring, and spotty windows injure your sales opportunities. Sloppy window appearance connotes sloppy workmanship, too. Cover dull walls with colorful crepe paper, and floors with inexpensive linoleum.

Trimming. Every city has a window trimming service which, for a nominal sum, will set up a smart window display for you once a month, or as often as desired. Tell your trimmer which merchandise you want emphasized, and he'll build your display around it.

Decal Transfer for your Window, Showcase, or Door



Window Display Cards

Reminder. In all your displays, be sure to give prominence to your "Reliable Radio Service" card. It will remind your prospects constantly that you provide dependable service and use only new and genuine replacement parts.

Night Light. Heaviest traffic often passes by after closing hours. In such cases it pays to leave a small colored light burning to draw display attention, or to spotlight your "Reliable Radio Service" window card.

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Repeat orders and referred customers denote a healthy, "going" service business. C-D decals keep reminding people that they can always depend on you for reliable radio service. Transfer this important decal message on your door or window to identify your shop to all callers again and again. Follow the simple instructions on the back of the transfer sheet.

Cash on the Counter

How many prospects walk out of your shop daily without buying your goods or services? You can convert most of them into cash sales with the convincing "Reliable Radio Service" counter card. It's the sales clincher you need to instill confidence in your ability and integrity. In addition, it backs up your selling effort on re-sale merchandise like midget radios, record players, albums, appliances, etc. . Be sure to order this free counter card from your C-D jobber now.

How Fast Is Your Business Growing?

C-D's new Sales Promotion Program has already helped many servicemen sprout like beanstalks. Ask your jobber to show you the complete 42-point campaign in the C-D "Let Yourself Grow" promotion book.

A Free Market-Place for Buyers, Sellers, and Swappers.

These advertisements are listed FREE of charge to C-D readers so if there is anything you would like to buy or sell, if you wish to obtain a position or if you have a position to offer to C-D readers, just send in your ad.

These columns are open only to those who have a legitimate, WANTED, SELL or SWAP proposition to offer. The Cornell-Dubilier Electric Corp. reserves the right to edit advertisements submitted, and to refuse to run any which may be considered unsuitable. We shall endeavor to restrict the ads to legitimate offers but cannot assume any responsibility for the transaction involved.

Please limit your ad to a maximum of 40 words, including name and address. Advertisements will be run as promptly as space limitations permit.

TRADE — Established radio shop, West Blvd., Los Angeles, equipment, little competition, year lease, $20 month, for good 1941 car or $1,000 cash. Living quarters available. Write P.O.B. 1298, Hollywood 28, Calif.

WANTED—Paint spray outfit, movie camera and projector, transcription turntable and recording equipment. Will swap test equipment, meters, transformers (high fidelity), and transmitting components. Radio Communication Service, 4475 Myrtle St., San Diego 5, Calif.

FOR SALE OR TRADE—RME 510X high frequency converter, 28 mc to 70 mc, $35. All types of power transformer filter chokes and transmitting tubes. Need a good receiver SX28-A or BC-348Q. Frank P. Dane, 4475 Myrtle St., San Diego 5, Calif.

FOR SALE—RCA cathode ray oscillograph, model 151-2, $40. RCA test osc., mod. 167, $38. Superior channel analyzer, $27.50. RCA ribbon mike, $15. Utah auto. changer, mod. 550-C, $15. Portable 5 watt amp. in case with speaker, $28. Need frequency modulator or RCA mod. 159 tele. alignment osc. Cash or swap with above. Cherrill Radio Electric, 4235 Barnett St., Philadelphia 35, Pa.

WANTED—1 or 2 10" PM speakers of 15 or 20 watts. Will trade 16mm movie motor-driven projector, or large size motor-driven jig saw for 1/4 HP motor, less motor. Have 35 to 40 watt amplifier with 6L6's in output, 1 PM speaker cable and lapel mike with cable. Will trade for test equipment or what have you. John Arnold, P.O.B. 84, Bluffs, Ill.

FOR SALE— Complete equipment of radio shop. Some items as complete set of manuals, test equipment, etc. Will send itemized list if interested. Mrs. S. A. Frank, 317 S. Walnut, Freeport, Ill.

FOR SALE—Radio shop. Large stock and good equipment. For further details call 361 or write T. A. Milam, 215 E. Grant St., Decatur, Ala.

WANTED — Linguiphone Spanish records and lessons complete. H. J. Brown, 420 Robin Rd., Allentown, Pa.

WANTED—Electric Radio Service Sign. Have HT-4 Xmitter for $930 and good supply critical tubes. E. Howell, Rt. 2, Dillon, S. C.

FOR SALE—Tubes in sealed cartons at list price. Send in your needs. Also No. 85 Supreme tube tester, $25. 1941 Ford Zenith built auto radio, 6 tubes, $32.50. 110 volt ac-dc code machine, requiring a 1117Z6 tube, $10. Snyder's Radio Service, Pitman, Pa.

WANTED—Riders' volume 5 needed badly. Mike Kubala, 11044 Republic, Vandyke, Michigan.

FOR SALE—High Fidelity 14 tube amplifier, with TRF tuner, dual audio channels, 2 speakers, record changer, mike, etc. Write for description and price. J. W. Massecar, 2737 Broadway, Huntington Park, Calif.

WANTED—Transmission for 1935 Chevrolet Master passenger car. Will pay good price. Guy Young, Ponca, Ark.

(Continued on page 13)

AVC CIRCUITS*

Basic Types and Their Characteristics

The development of AVC circuits has presented many interesting problems to the radio technician. In attempting to develop a troubleshooting procedure for AVC circuits, it soon becomes evident that it is impossible to approach the problem by composing a list of symptoms, defects, and tests. Such a list might serve to guide the serviceman in troubleshooting a defective power supply, for example; but a procedure of this type is of little aid in locating AVC faults. To begin with, modern AVC circuits, in addition to being rather complicated, appear to be subject to a limitless number of circuit variations. Furthermore, defects in the AVC system are accompanied by somewhat elusive symptoms. Whereas a defective filter condenser in the power supply will manifest itself in a definite and unmistakable manner, a defective filter condenser in an AVC circuit may produce effects that are apparently unrelated to the AVC system as such.

In view of these considerations, it has been decided to approach the problem by investigating, in detail, some features of basic types of AVC circuits and pointing out possible sources of trouble. In this manner a service procedure flexible enough to meet the needs of any particular system may be developed.

Before attempting to analyze the AVC circuit, it may be of assistance to digress into an inquiry of some of the factors that led to its development. Most radio technicians are not too young to remember the days of pre-AVC receivers with their annoying tendency to fade or blast during reception as the intensity of the received signal underwent sudden variations. Fading and blasting were so troublesome that the necessity of eliminating them was obvious.

Since the engineer was confronted with variables over which he could exercise little or no control, there was little that could be done at the transmitter end of the broadcasting system. Accordingly, the solution was sought in the receiver. Since the trouble was occasioned by changes in the intensity of the received signal, the obvious remedy was to develop some device that would act to counterbalance these changes in signal level. The operation of this device was to depend upon the principle of controlling the sensitivity of the receiver in such a manner that an input would be accompanied by a proportionate decrease in receiver sensitivity — conversely, a decrease in signal level would be accompanied by a proportionate increase in receiver sensitivity. This has come to be the operating principle of all AVC systems.

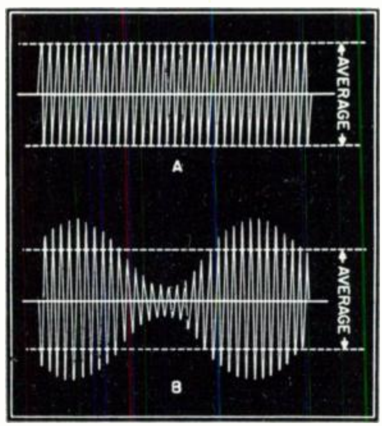

Fig. 1 A represents an unmodulated carrier of a given amplitude. B represents a modulated carrier of the same average amplitude as A.

* *By Peter Markantes in "Radio Maintenance" magazine.*

Incidentally, it is of interest to note that, from the start, the term "automatic volume control" was a misnomer. Actually, it is not the "volume" that is being controlled, but rather receiver sensitivity. A little thought will show that any attempt to keep the volume constant would result in extreme distortion.

From the foregoing, it can be seen that the signal intensity must be automatically controlled before it reaches the audio section. This leads, then, to a more rigid description of the purpose of the AVC circuit; viz., to maintain the amplitude of the voltage at the input of the second detector at a constant value. More specifically, the average amplitude must be kept constant.

A glance at Fig. 1 will show why the distinction is made between amplitude and average amplitude. Fig. 1a shows an unmodulated RF wave of some average value. Fig. 1b shows the same RF wave modulated by a sine wave. Note that the average amplitude is the same in both instances. Obviously the control must not act to change the modulation envelope.

How is this control of gain accomplished? From elementary tube theory, we know the amount of amplification of a tube is at every instance dependent upon the value of grid bias. The more negative the grid voltage, the lower the gain of the tube; the less negative the grid voltage, the higher the gain of the tube. If a DC voltage, varying in size with the variations in signal intensity, could be obtained and applied to the grid of a tube, the gain of this tube would vary in accordance with signal variations.

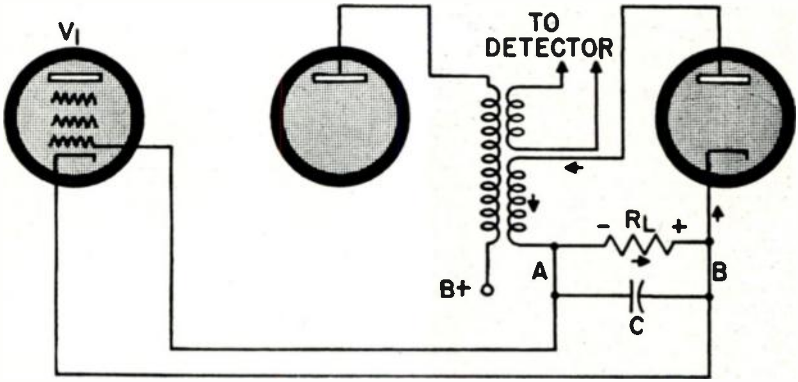

Fig. 2 Simplified AVC circuit.

One way of accomplishing the desired result is shown in Fig. 2. Here a diode rectifier receives a portion of the signal from a third winding on the IF transformer. Since the diode conducts only when its plate is positive, there is set up a current flow as indicated by the arrows. This current flow produces a voltage drop across R-1 with polarities as shown. By connecting the grid of V-1, the controlled tube, to point "A" and the cathode to point "B," V-1 receives a negative bias. For strong signals, the voltage drop across R-1 will be large, thus making the grid of V-1 more

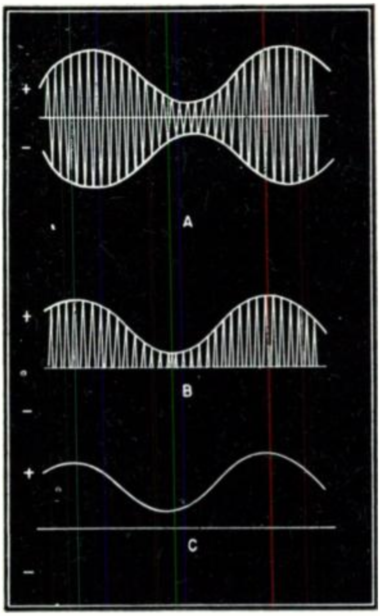

Fig. 3 A represents the voltage in the primary of the IF transformer. B represents the voltage in the diode circuit. C represents the voltage across R-1.

negative and decreasing the gain. For weak signals, the drop across R-1 decreases, making the grid less negative and thus increasing the gain.

Although this serves as an explanation of the fundamental action of AVC, several important factors have been overlooked. One assumption that has been made is that the voltage across R-1 is steady DC. Actually, such is not the case. The voltage across R-1 is as shown in Fig. 3c. Obviously, the voltage across R-1 in the form shown at 3c is unsuitable for bias since it contains audio variations. Therefore, a filter must be inserted to remove this audio component. The circuit with filter added is shown in Fig. 4. Here R-1 C-1 acts as a filter to remove the audio component.

Filters

Although there are a number of ways of analyzing the action of this filter, perhaps the easiest approach is to consider the DC and AC components of the voltage separately. First, the DC voltage present from "C" to "B" is the same as the voltage from "A" to "B." There is no voltage

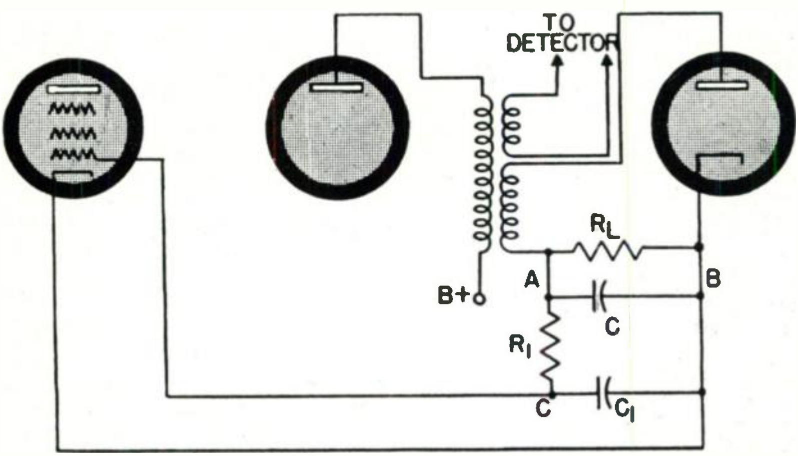

Fig. 4 AVC circuit similar to that shown in Fig. 2. A filter has been added to remove the audio signal component.

drop across R-1. This is one reason, incidentally, that R-1 can take the place of the choke in a conventional power supply filter.

The AC component will act to charge C-1 to the peak voltage as

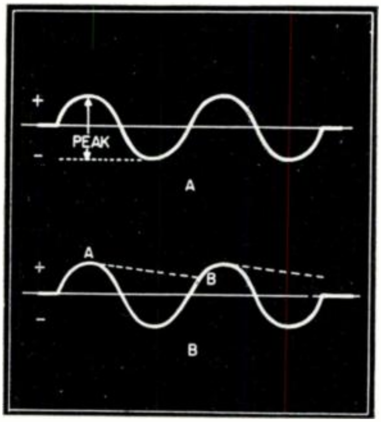

Fig. 5 An illustration of the filtering effect of R-1 and C-1. The upper illustration represents the AC component across condenser C. The lower shows how the charge on condenser C-1 removes the AC component by holding the potential near the peak value.

shown in Fig. 5. The portion A-B of Fig. 5b shows how the voltage across C-1 tends to drop as the AC starts on its negative swing. It is apparent that the efficiency of the filter depends upon the steepness of the portion from A to B. The steepness will in turn depend upon a very important factor: The time constant of the R-1 C-1 filter. An explanation of time constant could fill volumes, but for our purposes it will suffice to define time constant as:

1. The amount of time it will take a condenser to charge up to approximately 67 per cent of the peak of the applied voltage when the voltage is applied through a series resistor.

2. The amount of time it will take a condenser to discharge through a series resistor to approximately 37 per cent of its initial voltage after the applied voltage has been removed.

It can be shown that this time constant is equal to the product of the resistance and the capacitance:

$$t=RC$$

t=time in seconds
R=resistance in megohms
C=capacity in microfarads

To consider a practical example, assume R-1=1 meg. and C-1=0.5 ufd in Fig. 4. At a given instant, there is present a voltage of —5 volts on the grid of V-1 as a consequence of the flow of rectified current through R-1, the diode load resistor. A certain instant later, the intensity of the received signal changes so that the flow of rectified current through R-1 produces a drop of 15 volts.

Will this —15 bias be applied to the grid of V-1 instantaneously? From what has been said, it is apparent that an appreciable interval will pass before this voltage will appear at the grid of V-1. As a matter of fact, 1/20 of a second after the increase of voltage occurs—

$$(R_1C_1=1 \text{ meg.} \times .05 \text{ ufd}) \\ =.05 \text{ seconds}$$

The voltage across C-1 has risen to 11.7 volts (5 volts + 67% of 10 volts). The significance of time constant lies in the fact that it must be smaller than the time taken to tune the receiver from one station to another. If the time constant is large, it is possible, when tuning from a strong station to a weak one, to pass over the weak station since the receiver has been in an insensitive position.

However, if the time constant is compared to the time required for one cycle of the audio component to take place, it is seen that the time constant should be as large as possible in order that the efficiency of the filter will not fall off at the lower audio frequencies.

Therefore, a compromise is made between filtering efficiency and speed of action of the AVC. Commercial design calls for an average value of

0.1 second. From the servicing angle this means that changes in the value of filter resistance or capacity will upset this time constant and result in the aforementioned effects.

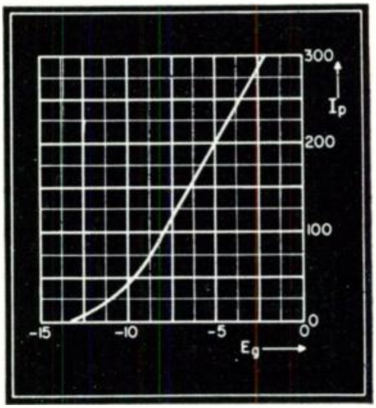

Fig. 6 The grid voltage plate current curve of an ordinary vacuum tube.

Before going on to examine a typical AVC circuit, it would be well to mention another factor that must be considered. This concerns the type of tube that can receive this control voltage. Fig. 6 shows an Eg-Ip characteristic of a tube used in some applications. Here, a negative bias greater than 10 volts will drive the plate current to cut-off. If the amplification of this tube is controlled by an AVC voltage, it is obvious that a strong signal that produces an AVC voltage of say —30 volts will drive the tube beyond cut-off. This will result in severe distortion. Tubes with characteristics of this type are known as sharp cut-off types and are unsuited for use with AVC.

By using a remote cut-off type whose characteristic is as shown in Fig. 7, there is little danger of plate current cut-off. Although this is primarily a design consideration, one fact makes it necessary for the service man to know about it. This concerns the tendency of remote cut-off tubes to change their characteristic with age. As these tubes age, their characteristic tends to change as shown by the dotted lines in Fig. 7. Since this is one type of tube failure that is not revealed by tube testers, it is apt to be overlooked as a possible source of trouble.

So far, the bias for the controlled tube has been shown as being derived from the diode load resistor. In practice, however, the controlled tube usually receives a small initial bias independently of the AVC voltage. This is shown in Fig. 8. Here, R-2 supplies a small bias to the controlled tube. Since R-2 is connected to ground, as is R-1, the total bias on the tube is equal to the sum of the drops across R-2 and R-1 as shown by the indicated polarities on the diagram.

The audio variations which are present across R-1 have been mentioned only in connection with their adverse effect upon the control voltage. Actually, there is no reason why they cannot be applied to the input of the audio amplifier. In other words, the same tube can be used for both AVC rectifier and second detector. Going one step further, the diode load resistor may be replaced by a potentiometer which will serve simultaneously as audio volume control and diode load resistor.

This leads to the circuit of the typical AVC system as shown in Fig. 9. Here the function of the components is as previously described. R-1 serves as the audio volume control and diode load resistor. The filters R-1 C-1, R-2 C-2, and R-3 R-4, in addition to providing filtering, also serve to isolate the stages from each other. It is obvious that the grids of the controlled tubes cannot be returned to the same point if regeneration is to be avoided.

Common Faults

Some of the troubles possible in the AVC circuit may now be investigated.

R-1—Open. The set will be inoperative since no audio voltage is being applied to the audio amplifier. In addition, of course, no bias is available for the controlled tubes.

In checking R-1, some difficulties immediately present themselves. R-1 is 500 kilowatts or higher in value. This means that a high range ohmmeter is needed in order to check continuity.

If a voltmeter is used to check R-1 (by measuring bias on the controlled tubes) it must be remembered that an ordinary voltmeter presents too low a resistance for reliable readings. Therefore, a VTVM is recommended.

R-1—Value Changed. An increase in the value of R-1 will result in excessive AVC voltage and thus distortion on strong signals.

C—Open. This results in severe attenuation of signal present in diode circuit. That this will be so is clear when it is realized that C (usually about 100 uufd) will offer about 4 ohms impedance to an IF signal of 456 kc. If C opens, the impedance rises to the value of R-1 shunted by the impedances of the filters.

An open at C would be difficult to find. The usual troubleshooting procedure would probably consist of isolating the second detector as the defective stage by means of signal tracing. In the course of checking components in this stage, an open C would be revealed by substitution of a good condenser.

C-Shorted. This would result in a dead receiver since the audio input would be shorted to ground.

R-1—Open. This results in complete lack of bias on the controlled tubes since the grids of these tubes are returned to ground through R-1. All the results of floating grids are, of course, present. Again, a VTVM or ohmmeter capable of reading resistances in the order of megohms is required.

R-1—Change in Value. An appreciable increase in the value of R-1 will increase the time constant and may result in distinct "plops" when tuning the receiver.

Occasionally the value of R-1 will vary intermittently, resulting in fading. Trouble of this nature is hard to locate. The most direct method is to replace the resistor if it is suspected.

C-1—Open. This is accompanied by unstable operation ("motor-boat-

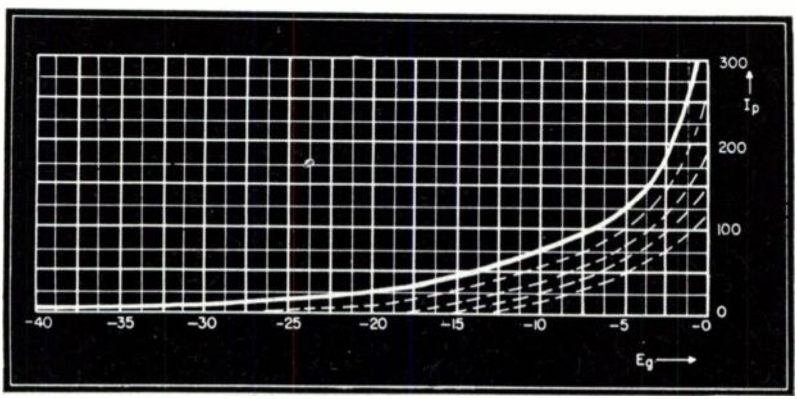

Fig. 7 The grid voltage plate circuit current curve of the remote cut-off type tube used in AVC circuits. The dotted lines show how the tube's characteristics change as it ages.

ing," etc.) since the filtering action is considerably reduced. Again, the direct method of testing is to substitute a good condenser.

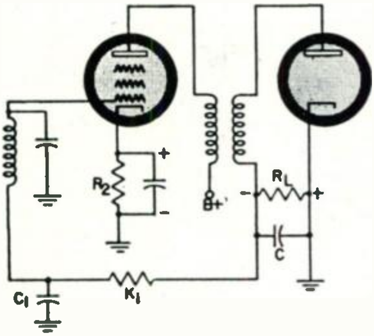

Fig. 8 An AVC circuit with cathode bias provided for the controlled tube.

C-1—Leaky. This will result in reduced AVC voltage on the controlled tubes. If C-1 is leaky, it is in effect a resistance connected from the junction of R-1 and R-2 to ground. As such, R-1 and R-C-1 (leakage resistance of C-1) form a voltage divider across R-1. The voltage available at the grids of the tubes would then be $\frac{R_c}{R_c+R_1}$ of the total AVC voltage.

Although no ill effects might be apparent when tuned to weak stations, a leak in C-1 would result in distortion on strong signals when the AVC voltage would be insufficient to prevent the grids from going positive during a portion of the input cycle.

Inasmuch as no current flows through R-2 and R-1, a VTVM will read the same voltage at "C," "B," or "A" (with respect to ground) if C-1 is intact. A leak in C-1, will then result in a readable voltage drop across R-1.

C-1—Short. This will result in complete lack of AVC voltage on the controlled tubes. The symptoms and tests are much the same as they are when C-1 is leaky.

R-2—R-3—R-4—Open. The grid of the affected tube will be free, resulting in unstable operation. The VTVM or the high range ohmmeter will quickly reveal this defect.

C-2—C-3—C-4—Open. As previously explained, these condensers act as filters for the AVC, and in conjunction with R-2—R-3—R-4, as decoupling filters between the individual stages. For instance, the voltage coupled into T-2 will normally appear between grid and ground of the mixer since C-3 is a virtual short for RF if C-3 opens the grid of the mixer and is coupled to the grid of the IF tube.

C-2—C-3—C-4—Short or Leaky. A short in any of these condensers will result in lack of AVC in the particular stage affected. In addition, the

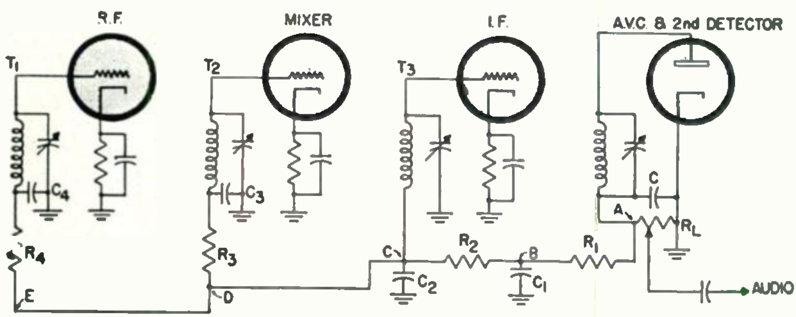

Fig. 9 A complete AVC circuit with filter and isolating resistors.

AVC voltage on the other stages will be considerably reduced as a result of the voltage divider action previously discussed.

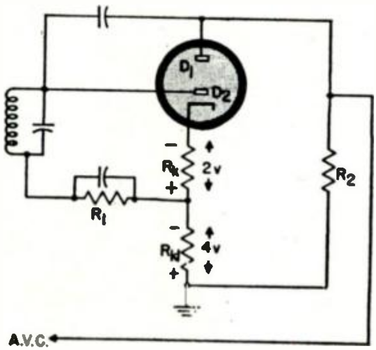

Fig. 10 Circuit used to obtain delayed AVC action.

Leakage in any of these condensers will again result in flow of current through the filter resistors with the same voltage divider action reducing the AVC voltage.

At the risk of redundancy, one word of caution about resistor and condenser replacements. Exact values must be used in order to preserve the original time constant.

Delayed AVC

The AVC system under consideration up to now is a very elementary type. One obvious shortcoming of this circuit is that AVC action takes place on all signals. This means that the receiver sensitivity will be reduced, not only on strong signals, but also on weak signals, when the maximum sensitivity is desired. In order to have the maximum sensitivity available for weak signals, a modification known as delayed automatic volume control (DAVC) has been introduced. This type of circuit functions in such a manner that no AVC action takes place until the intensity of the received signal reaches a predetermined level.

Although there are a number of methods of delaying the AVC action, Fig. 10 shows the basic system. Here two separate diodes are necessary: one for AVC and one for second detector action. The IF signal is fed to each of the diodes, although not always in the manner shown here. D-2 functions as the second detector. Note that its circuit is substantially the same as the basic circuit of the elementary AVC rectifier, with the exception that its load resistor R-1 is returned to the cathode, not to ground. D-1 is the AVC diode and its load resistor R-1 is returned to ground.

As a result of plate current flow through the triode, resistor R-K develops a voltage with polarity as indicated. Now, with no signal applied, there is no current flowing in the D-1 circuit; and since there is no voltage drop across K-1, D-1 is at ground potential. However, due to the drop across R-K, D-1 is negative with respect to its cathode by the amount of voltage drop across R-K. As the signal is applied, D-1 assumes a potential equal to the peak IF voltage. As long as this peak IF is smaller than the drop across R-K, no current can flow through D-1 circuit. However, as soon as the signal increases in intensity and makes D-1 positive with respect to its cathode, current will flow and produce a voltage across

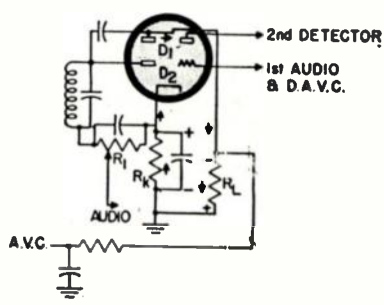

Fig. 11 Circuit of combined delayed AVC, second detector and first audio.

K-1 in the manner shown. Thus the AVC action is delayed until the signal reaches a predetermined level.

Still another modification is that known as QAVC or quiet automatic volume control. The function of this circuit is to prevent the receiver from working at all until the signal strength is high enough to produce satisfactory reception.

For the sake of simplicity, imagine resistor R-1 of Fig. 10 returned to ground rather than to the cathode. Now D-2, the detector diode, will also have a delay voltage to overcome before detection can take place, and weak signals are not heard. This again brings up the objection that AVC action starts with the weakest signal heard. Therefore, in order to delay AVC action until sufficiently strong signals are received, R-K is split in two parts as shown in Fig. 11.

Assuming arbitrary values of voltage as shown in Fig. 11, it can be seen that no signals will be produced until the peak value of the IF exceeds the 2 volts delay on D-2. When the signal intensity is such that the peak of the IF is between 2 and 6 volts, the full sensitivity of the receiver is available. As soon as the peak exceeds 6 volts, AVC action takes place.

These are but a few of the many circuits possible for AVC, but they should point the way toward an understanding of the circuit and the development of a successful service technique.

THE RADIO TRADING POST

(Continued from page 4)

FOR SALE — Complete converted Army BC-412-A 5" **oscilloscope chassis** with power supply, sweep, hor. and vert. amplifiers, and all tubes. Ready to use. Bargain at $100. FOB Chicago. Will trade for high fidelity audio equipment, FM, speakers, etc. Paul H. Prokes, 9216 S. Menard Ave., Oak Lawn, Ill.

FOR SALE—Basic parts for 2" scope; all new; 2AP1; 5R4; 6x5 tubes; sockets; high and low voltage transformer; 15H; .070 amp. choke; 3 15 mfd 450v. cond. in can with tube base; socket; 6SN7W tubes, resistors, etc., diagram; all for $25. J. J. Bobrow, 1045 Woodycrest, Bronx 52, New York.

FOR SALE—Model OM frequency modulated oscillator, frequency range 100 kc to 30 megacycles, in five bands. Less audio output leads, and instruction manual. Will sell for $35 cash. Joseph A. Wozniak, 1336 5th Ave., Pittsburgh 19, Pa.

FOR SALE OR TRADE—New tubes, 832A, 2C26, 9000 series, others. Also co-axial cable plugs and connectors, silver-plated. Headsets, ham parts, and Echophone receiver, like new. Send your swap list and tell me what you want. Sgt. Bill Sheetz, Police Dept., Bradenton, Florida.

FOR SALE—Model 920P precision tube and set tester in perfect condition. Used 8 months in part time servicing, $55. Have just received a 954 model precision and do not need two. J. C. Phillips, c/o P.O., Johnson City, Tenn.

FOR SALE—Triumph model 840 oscillograph 3", excellent condition, $65. Also LaSalle Extension University Higher Accountancy course complete, $15. A-1 Radio, 1748 East 177th St., New York 60, New York.

FOR SALE—Hickock model OS-8 signal generator, $22.50. Triplett model 1212 tube tester, $12.50. Have tubes, ham parts, transformers, and many other parts and equipment. Write for list. Walter Keith Radio Service, South Side Square, Newton, Iowa.

FOR SALE—Rider chanalyst, model 11A, RCA station allocator, No. 171, Thordarson home built oscilloscope 2", Clough-Brengle frequency modulator, model 111, modulation sets, new Motorola FM82, one used GE, all in good condition. Make an offer. Mrs. J. V. Shepard, 214 N. Diamond St., Greenville, Pa.

FOR SALE—Brand new in original cartons Mallory vibrators No.'s 222, 245 and 273C. Radiart No.'s 3315 and 5400. Prepaid, $20. Value list, $36.75. Johnson Radio Service, 302 Oakwood St., Austin, Minnesota.

WANTED—A set of Lingaphone code records, and Rider's manuals 7 through 10. Leonard Poole, Herndon, Va.

FOR SALE—Tube testers, analyzers, oscillators, and other radio needs. For complete list write to Van's Studio and Radio Service, Bridgeville, Del.

TRADE OR SELL—Knocked down 35 watt xmitter with power supply, tubes, 80 meter crystal, 2 Readrite 0-150 mo, Triplett 0-300 ma. Want Class Bov C model gas engine, modeling supplies, gas model kit, 12A8 and 1V tubes. All letters answered. Don Anderson, 917 East Kemp Ave., Watertown, S. D.

FOR SALE—Radio and electrical appliance business in one of the South's fastest growing cities. Franchises for well known appliances. Owner has other interest. Fortune for right party. Write P. W. White, Kingsport, Tenn.

WANTED—U. S. or foreign stamp collection and pair of opera or field glasses. Will trade transmitting and receiving parts, tubes, meters, microphones, cathode ray tubes, etc. B. Bernbaum, 5746 North Park Ave., Philadelphia 41, Pa.

FOR SALE OR TRADE—Luger pistol with holster and 3 extra clips, 90 rounds of Luger ammunition; 6 German knives and bayonets. Best offer gets them. Harman P. Hercules, 1920 Myrtle St., Kansas City 2, Mo.

FOR SALE—RCA 167 signal generator in A1 shape for $35. Hamilton Radio Clinic, What Cheer, Iowa.

FOR SALE—Model CE Solar capacity analyzer in excellent condition, $35. C. D. Ferguson, Gen. Del. Burlington, N. C.

FOR SALE—Brand new 115 volt ac rim drive phono motors, $3.75 each. Have about 40 of them. Also some 3 tube ac-dc phono amplifiers, $3.85, less tubes, some record player portable cases, new, $6.50. Joseph Haas, 23-54 31st Ave., Astoria, L. I., New York.

WANTED—25D8GT and 1D8GT tubes in sealed boxes, about 6 of each. Will pay $2 for each or trade. What do you need? Write before sending tubes. State amount you have and what you want. F. U. Dillion, 1200 N. Olive Dr., Hollywood 46, Calif.

WANTED TO BUY—Audio transformers, Ferranti, Sangamo C171, D171, C210, G210 and H171, Amertran 152, 271, 442, Interstage, and W-E 144A; Neobeam oscilloscope; Hickok 510X and 202; power chokes, G-R 565S, Acme 377 and others (state price, brand and model number, henries and D.C. ohms); V-T voltmeter. Address: Apt. 13B, 675 West End Ave., New York 25, N. Y.

WANTED—Wireless record player. Give description, condition and price. Jens C. Jensen, 528 Seneca St., Storm Lake, Iowa.

SELLING OUT—VFO converter, frequency meter, power supply meters, miscellaneous parts and tubes. Write for detailed list to W. Kemper, Box 1971, Georgia Tech, Atlanta, Ga.

POSITION WANTED—as radio serviceman or helper in established radio shop, vicinity of Maspeth, L. I., N. Y. Am 19 and in second year of college studying electrical engineering. Have had 3 years experience servicing radios and am familiar with all types of test equipment. Andrew Valentino, 57-13 69th St., Maspeth, L. I., N. Y.

FOR SALE OR TRADE—DeForest's correspondence course, Radio Sound and Television. Have many radio books, brand new. Send for list. Paul Schapka, 601 W. Summit Ave., Muskegon Hts., Michigan.

WANTED—25B8 tube. Please state what you would want, cash or exchange. Ed's Radio, 3843 E. Tremont Ave., Bronx, New York.

FOR SALE—Rich and Bundy, Ltd., transformer, 500 primary volts, input 160-200 volts, output 4000 and 8000 volts. Want 35mm Arriflex camera. Write full description and price. Robert Eininger, 130 W. 12th St., New York, N. Y.

FOR SALE OR TRADE—Supreme 400B diagnometer; uses 3 Weston meters. One Confidence "Special" tube tester, English reading scale, tests to 7 prong tubes only. Can be easily modernized. $20 each or what have you. Fred Wittich, Middle Village, N. Y.

FOR SALE—Western Electric hearing aid, like new; RCA 160 oscilloscope in new condition; 208B Dumont oscilloscope; 3½" ac-dc meters of all types; Philco 030 signal tracer. Best offer. Ed Vockeroth, 1746 N. Campbell, Chicago 47, Ill.

FOR SALE—Radio City tube checker in portable case, in A-1 condition. Tests all tubes including miniature tubes. Price, $25. James Domino, 58-81 Maspeth Ave., Maspeth, L. I., N. Y.

SWAP OR SELL—Book on watch repairing, "Modern Methods in Horology" by Grant Hood. Also instructions for repairing alarm clocks. Want radio text book or service manual. J. M. Kilroy, 9 Christopher St., Dorchester 22, Mass.

FOR SALE—Four 814 and two 826 high voltage transmitting capacitors, meters, and resistors. All new. Also other parts. Write for list. Selling out. W. Ussler, Jr., 7112 Cresheim Rd., Philadelphia 19, Pennsylvania.

FOR SALE—Stancor 60N transmitter, complete with deluxe cabinet. Crystal and coils furnished for one band. Price, $75. Paul E. Trued, Box 311, Sanford, Fla.

ATTENTION—Need any of those hard-to-get parts? Write for list, or what do you need? Reasonable prices. All letters answered. Jim Berry, Box 86, Summerville, Ga.

WANTED—Rider's Service Manuals numbers 3, 4, and 5, revised Navy Blue edition. Send full particulars. Paschal G. Riddle, 6100 W. Park Ave., St. Louis 10, Mo.

WANTED—0-25 volt Million tube tester chart. E. Reeser, Logan, Kan.

FOR SALE—Supreme tube tester, model 503, $35. Superior signal generator, model 1230, $35. Superior channel analyzer, $65. Triplett free point tester, $15. All in perfect working condition. Advance Electric, 418 E. 10th St., Mt. Carmel, Ill.

FOR SALE OR TRADE—Gold plated Holton comet and case. Cost $180 new. Good condition. Trade for good late model tube tester or signal generator. Bob Lien, Burlington, Wash.

WANTED—Supreme analyzer; any good Jackson test equipment; a good communications receiver. In writing, give model, condition and price. Blackfoot Radio Shop, 18 W. Pacific St., Blackfoot, Idaho.

FOR SALE—Collection of "Service" magazine, August 1931 through 1942 with only 7 copies missing. What is your offer? R. Butchart, 12019 Hamilton, Detroit 3, Mich.

FOR SALE—One model 551 Supreme set analyzer complete with adapters and test prods. Also one model 430 Triumph tube checker, both in good condition. Roy Ault, Box 102, Glencoe, Ohio.

FOR SALE—Tube tester, suitcase style, removable front cover, 6½"X14"X9½" closed. Automatic ballast control, model ABC. Made by L. & L. Electronic Co., Memphis Tenn. Practically new. The first money order for $30 takes it. Shipped parcel post prepaid. Emanuel F. Cox, Box 177, Caraway, Ark.

FOR SALE—New A100 signal generator, 100 kc, 52 mc, 5 bands, 100% interior-exterior model, $42. New Triplett model 3212 tube tester, $49. Very latest model. Leo Raboy, 604 W. 114th St., New York 25, New York.

FOR SALE—2 new TZ-40's in cartons, $7; 2 new VT-127 (100-TL) in cartons, $5.50; 1 Meissner new audio filter, without fones, $10. Robert L. Smith, 1727 W. Jefferson St., Kokomo, Ind.

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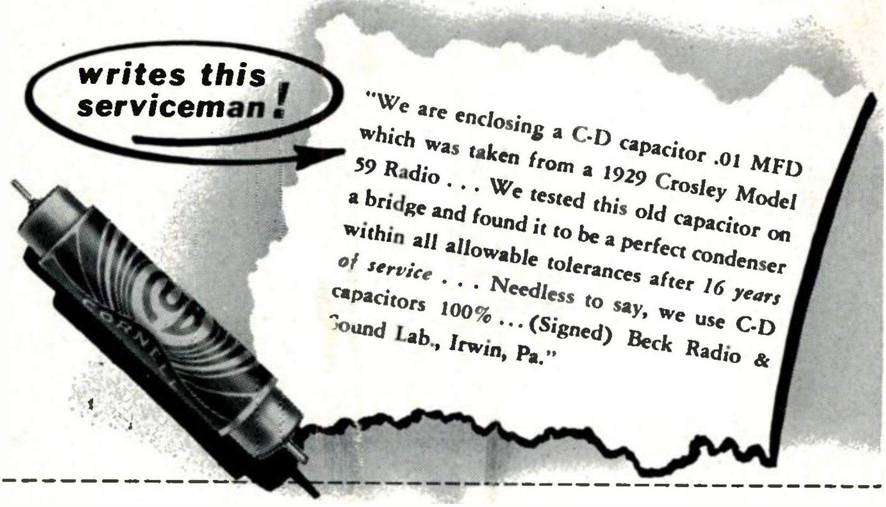

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