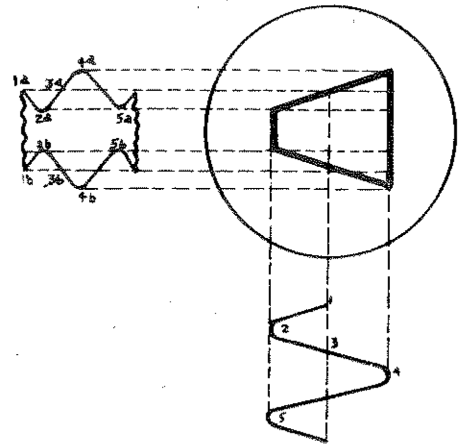


FIGURE 3-20

PROJECTION DRAWING SHOWING TRAPEZOIDAL PATTERN

Step 5. Using a sine wave oscillator for the a-f (modulating) signal, turn on the transmitter, sine wave oscillator and the oscillograph.

Step 6. If the vertical size of the pattern is inconveniently small refer to paragraph b. Step 5 for instructions.

Step 7. Control the size of the pattern on the vertical plane by adjusting the coupling and in the horizontal plane by adjusting the volume control in the monitor circuit (Figure 3-22).

(4) Procedure: Modulated Wave Pattern—

Preliminary Settings

SYNC AMP control — 0
SYNC SELECTOR — EXT
VERTICAL INPUT switch — DIR

Step 1. Follow Steps 1 through 4 of the preceding paragraph.

Step 2. Remove the lead from the HORIZONTAL INPUT and place it on the EXT SYNC terminal.

Step 3. Set the COARSE FREQUENCY switch to include the frequency of the modulating sine wave signal.

Step 4. Set the HORIZONTAL AMP control to result in convenient horizontal deflection.

Step 5. Adjust the FINE FREQUENCY control to obtain 2 or 3 cycles of the modulating frequency on the screen of the cathode-ray tube.

Step 6. Add enough SYNC AMP to "lock-in" the pattern.

Remarks.—The trapezoidal and modulated wave patterns show a picture of the overall performance of the transmitter. By changing the degree of modulation of the carrier wave the shape of the pattern changes. Figures 3-23 through 3-28 show the trapezoidal and modulated wave patterns in various degrees of modulation.

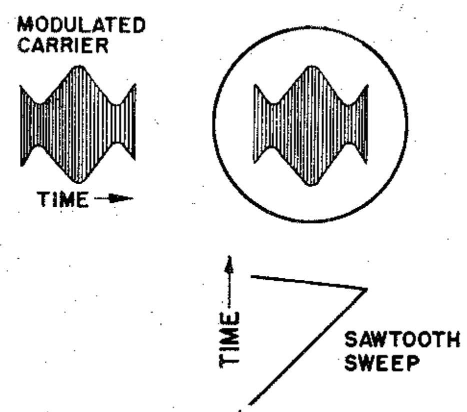


FIGURE 3-21

PROJECTION DRAWING SHOWING MODULATED CARRIER WAVE PATTERN

Modulation percentage may be determined by the following formula:

$$\text{Modulation percentage} = \frac{E_{max} - E_{min}}{E_{max} + E_{min}} \times 100$$

E_{max} and E_{min} are defined in Figures 3-23 and 3-24.

f. TROUBLE SHOOTING.

The trapezoidal and modulated wave patterns can serve as indicators for trouble shooting the transmitter. The method employed is to observe the pattern and note any distortion. Then the shape of the pattern reveals the position of the trouble. This method of trouble shooting requires a certain amount of experience, but proves to be highly satisfactory.

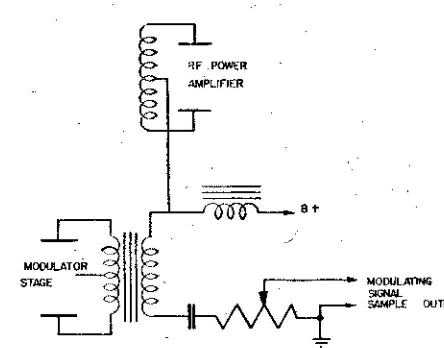


FIGURE 3-22

MONITOR CIRCUIT FOR THE MODULATING SIGNAL

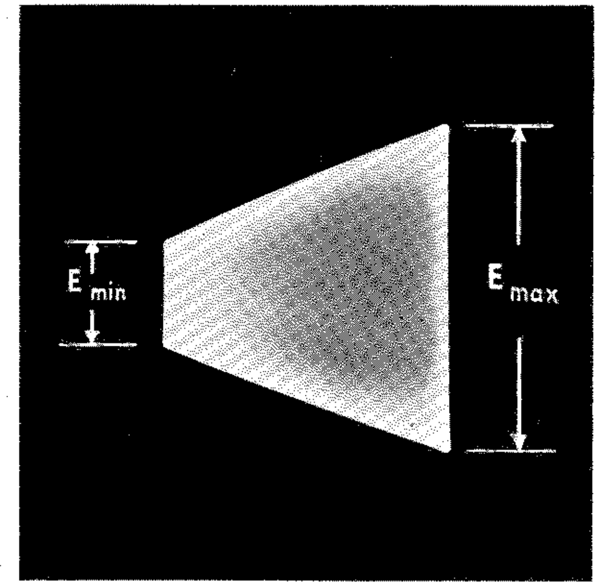


FIGURE 3-23

TRAPEZOIDAL WAVE PATTERN (LESS THAN 100% MODULATION)

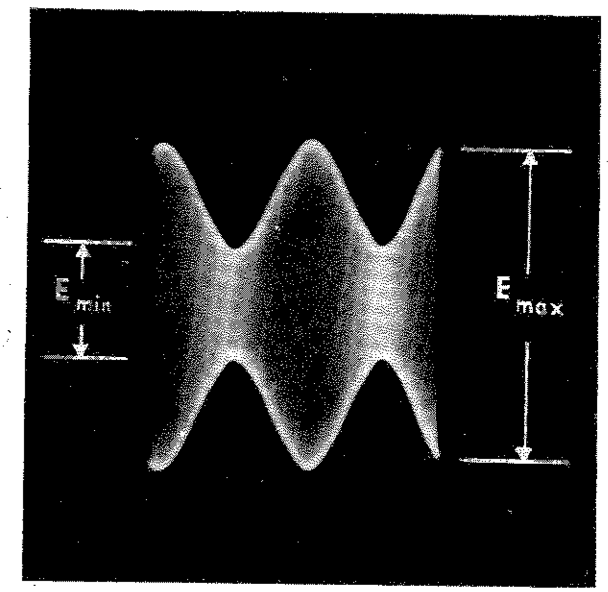


FIGURE 3-24

CARRIER WAVE PATTERN (LESS THAN 100% MODULATION)

7. ALIGNING A-M RADIO RECEIVERS

a. INTRODUCTION.

To complete the discussion of the use of the oscillograph in aligning amplitude modulated radio systems there remains the subject of radio receivers. Included in receiver servicing is the adjustment of the radio frequency (r-f) and intermediate frequency (i-f), in superhetrodyne type radio receivers, and the servicing of audio frequency (a-f) amplifiers.

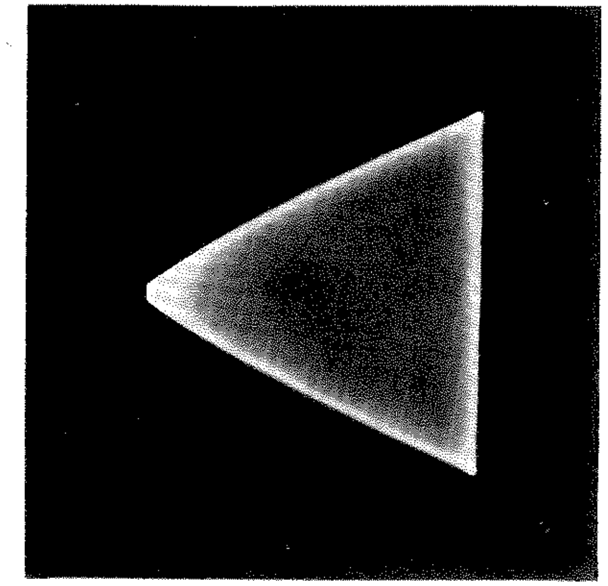


FIGURE 3-25

TRAPEZOIDAL WAVE PATTERN (100% MODULATION)

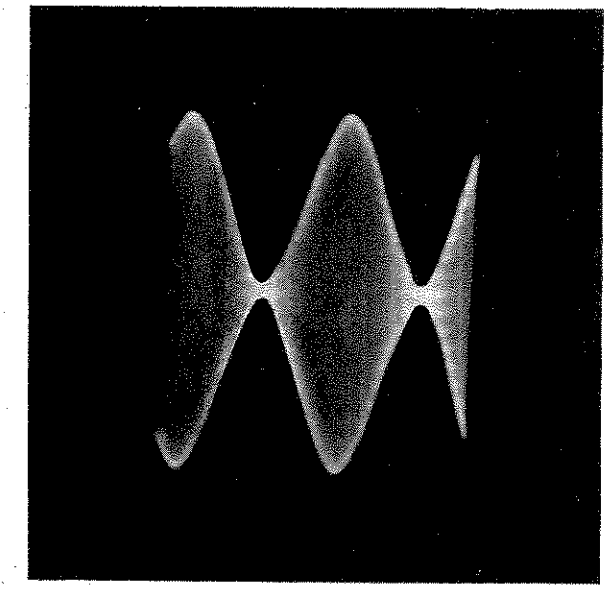


FIGURE 3-26

CARRIER WAVE PATTERN (100% MODULATION)

b. A-F AMPLIFIERS.

The object of the a-f amplifier of a receiver is to provide amplification for the detected signal which has uniform response throughout the desired frequency limits. The equipment necessary for checking audio amplifiers consists of: An audio oscillator of sine wave output in combination with an oscillograph. The procedure for checking an audio amplifier with a sine wave oscillator is identical with that used in checking the audio frequency channel of a transmitter as described earlier in this section.

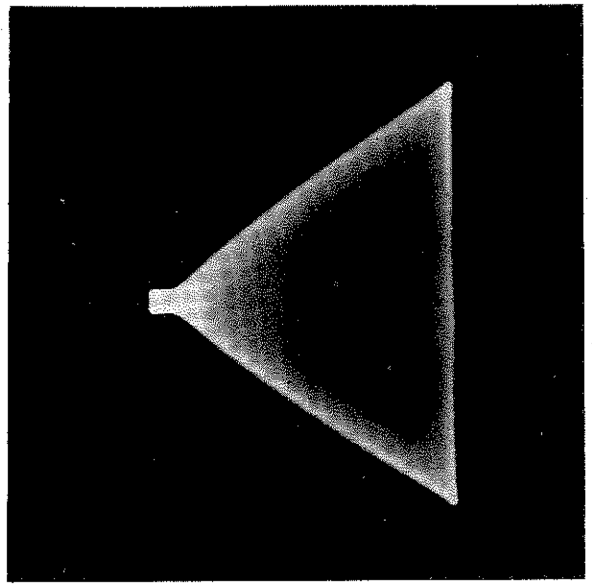


FIGURE 3-27
TRAPEZOIDAL WAVE PATTERN (OVER MODULATION)

c. I-F SYSTEMS.

(1) Introduction.—The alignment of the i-f amplifiers of a receiver consists of adjusting all the tuned circuits to resonance at the intermediate-frequency and at the same time to permit passage of a predetermined number of side bands. The best indication of this adjustment is a resonance curve representing the response of the i-f circuit to its particular range of frequencies.

As a rule medium and low-priced receivers use i-f transformers whose band-width is about 5 kc on each side of the fundamental frequency. The response curve of these i-f transformers is shown in Figure 3-29. High fidelity receivers usually contain i-f transformers which have a broader band-width which is usually 10 kc on each side of the fundamental. The response curve for this type transformer is shown in Figure 3-30.

Resonance curves such as these can be displayed on the screen of an oscillograph. For a complete understanding of the procedure it is important to know how the resonance curve is traced.

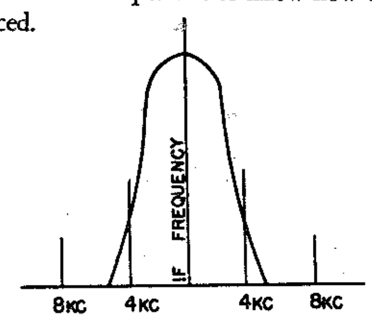


FIGURE 3-29
FREQUENCY RESPONSE CURVE OF THE I-F OF A LOW PRICED RECEIVER

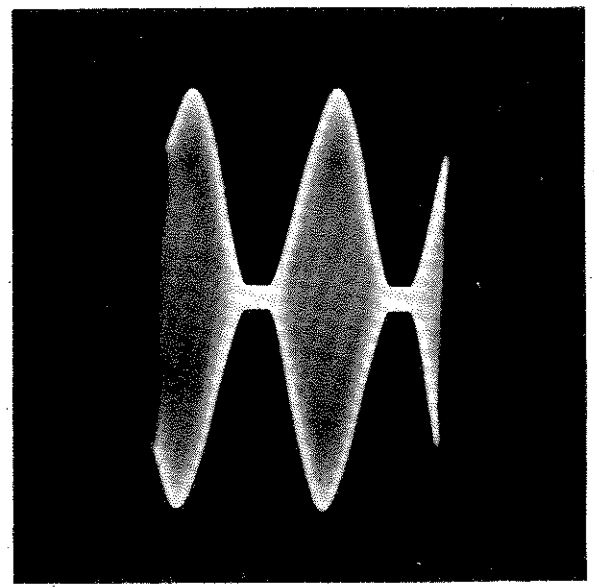


FIGURE 3-28
CARRIER WAVE PATTERN (OVER MODULATION)

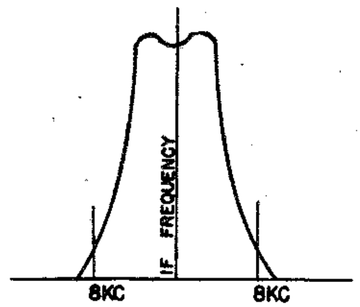


FIGURE 3-30
FREQUENCY RESPONSE CURVE OF HIGH-FIDELITY I-F STAGES

(2) The Resonance Curve on the Screen.—To present a resonance curve on the screen, a frequency-modulated signal source must be available. This signal source is a signal generator whose output is the fundamental i-f frequency which is frequency-modulated 5 to 10 kc each side of the fundamental frequency. A signal generator of this type generally takes the form of an ordinary signal generator with a rotating motor driven tuned circuit capacitor, called a wobulator, or its electronic equivalent, a reactance tube.

The method of presenting a resonance curve on the screen is to connect the vertical channel of the oscillograph across the detector (demodulator) load of the receiver as shown in the detectors of Figure 3-31 (between point A and ground) and the time-base generator output to the horizontal channel. In this way the d-c voltage across the detector load varies with the frequencies which are passed by the i-f system. Thus, if the time-base generator is set

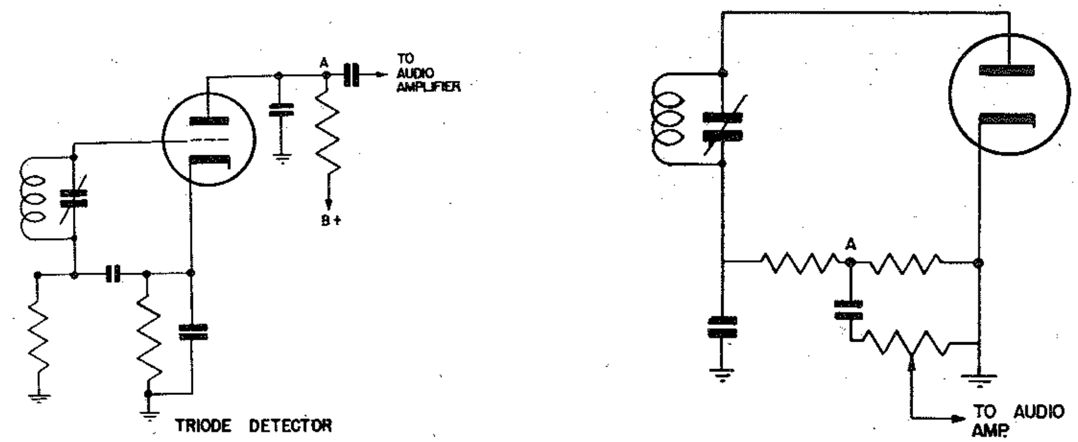


FIGURE 3-31
CONNECTION OF THE OSCILLOGRAPH ACROSS THE DETECTOR LOAD

at the frequency of rotation of the motor driven capacitor, or the reactance tube, a pattern resembling Figure 3-32, a double resonance curve, appears on the screen.

Figure 3-32 is explained by considering Figure 3-33. In half a rotation of the motor driven capacitor the frequency increases from 445 kc to 465 kc, more than covering the range of frequencies passed by the i-f system. Therefore, a full resonance curve is presented on the screen during this half cycle of rotation since only *half* a cycle of the voltage producing horizontal deflection has transpired. In the second half of the rotation the motor driven capacitor takes the frequency of the signal in the reverse order through the range of frequencies passed by the i-f system. In this interval the time-base generator sawtooth waveform completes its cycle, drawing the electron beam further across the screen and then returning it to the starting point. Subsequent cycles of the motor driven capacitor and the sawtooth voltage merely retrace the same pattern. Since the signal being viewed is applied through the vertical amplifier, the sweep can be synchronized internally.

Some signal generators, particularly those employing a reactance tube, provide a sweep output in the form of a sine wave which is synchronized to the frequency with which the reactance tube is swinging the fundamental frequency through its limits, usually 60 cycles per second. If such a signal is used for horizontal deflection, it is already synchronized. Since this signal is a sine wave, the response curve is observed as it sweeps the spot across the screen from left to right; and it is observed again as the sine wave sweeps the spot back again from right to left. Under

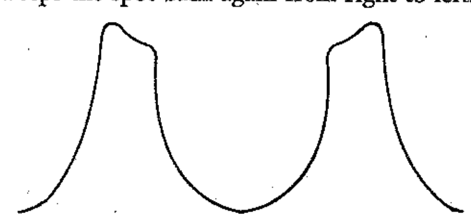


FIGURE 3-32
DOUBLE RESONANCE CURVE

these conditions the two response curves are superimposed on each other and the high frequency responses of both curves are at one end and the low frequency response of both curves is at the other end. The i-f trimmer capacitors are adjusted to produce a response curve which is symmetrical on each side of the fundamental frequency.

When using sawtooth sweep, the two response curves can also be superimposed. If the sawtooth signal is generated at exactly twice the frequency of rotation of the motor driven capacitor, the two resonance curves will be superimposed (Figure 3-34) if the i-f transformers are properly tuned. If the two curves do not coincide the i-f trimmer capacitors should be adjusted. At the point of coincidence the tuning is correct. It should be pointed out that rarely do the two curves agree perfectly. As a result, optimum adjustment is made by making the peaks coincide. This latter procedure is the one generally used in i-f adjustment. When the two curves coincide, it is evident that the i-f system responds equally to signals higher and lower than the fundamental i-f frequency.

Note

Before correcting the setting of the trimmer capacitors, it is necessary to adjust the FINE FREQUENCY control to make the two peaks of the frequency response curves coincide. After these two curves are thus superimposed, the operator should then proceed with the adjustment of the trimmer capacitors to achieve coincidence of the

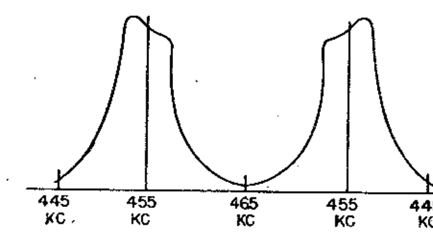


FIGURE 3-33
DOUBLE RESONANCE ACHIEVED BY COMPLETE ROTATION OF THE MOTOR DRIVEN CAPACITOR

two curves as nearly as possible. It will probably be necessary to use a high setting of the SYNC AMP control to maintain this pattern in synchronization.

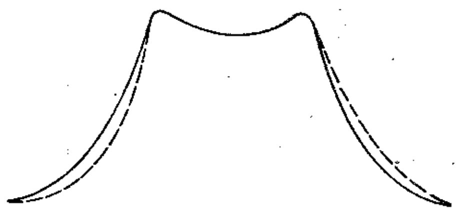


FIGURE 3-34
SUPER-POSITION OF RESONANCE CURVES

(3) Procedure.—Since most i-f systems contain several stages the number of variables must be decreased by starting the alignment at the last i-f circuit and working backward from the detector.

Preliminary Settings

SYNC SELECTOR — INT
VERTICAL INPUT — AMP

Step 1. Join the antenna and ground connections of the receiver together with a 0.001 mfd. capacitor.

Step 2. Short out the tank circuit of the receiver beat frequency oscillator with a wire lead connecting the rotor and stator of its variable capacitor (steps 1 and 2 prevent unwanted signals from entering the i-f system).

Step 3. Connect the output of the frequency-modulated signal generator between grid and ground of the last i-f amplifier tube.

Step 4. Connect VERTICAL INPUT and GROUND across the detector load impedance (Figure 3-31).

Step 5. Set the frequency dial of the frequency-modulated signal generator to the intermediate-frequency to be passed by the i-f system.

Step 6. Turn on the signal generator, oscillograph, and radio receiver.

Step 7. Assuming that the time-base generator of the oscillograph is used, set COARSE FREQUENCY to include twice the frequency of rotation of the motor driven capacitor (or the reactance tube) and adjust the FINE FREQUENCY and SYNC AMP controls to obtain stationary superimposed resonance curves.

Step 8. Adjust HORIZONTAL AMP and VERTICAL AMP CONTROLS for a conveniently sized pattern.

Step 9. Adjust the i-f trimmer capacitors in the plate circuits of this i-f stage until the two response curves are superimposed on each other.

Step 10. Move the input of the signal generator from the grid of this tube to the grid of the preceding i-f amplifier. (On small receivers having only one i-f tube, the signal is placed on the grid of the mixer or the converter tube.)

Step 11. Turn on the receiver and adjust the trimmer capacitors in the i-f transformer for this stage as in Step 9. The receiver output to the oscillograph is still taken at the same point, across the detector load resistor. Because of the gain of this stage, it will probably be necessary to reduce the output of the signal generator.

CAUTION

Once an i-f transformer has been aligned, do not change the setting of its i-f trimmer capacitors, or the alignment will have been changed.

d. R-F SECTION.

Following the alignment of the i-f amplifiers in the superhetrodyne receiver, the next section of the circuit to be adjusted is the r-f section.

(1) Introduction.—The main objects in aligning the r-f systems of a receiver are: (1) to adjust the r-f tank circuits to resonance at the frequency indicated by the receiver dial setting and, (2) to adjust tank circuit of the local oscillator in the receiver to resonance at the frequency indicated by the dial setting *plus* the intermediate frequency of the receiver.

(2) Equipment.—Together with the oscillograph, the necessary equipment is a frequency-modulated signal generator, similar to the one used in aligning i-f systems.

(3) Operation.—As in i-f alignment, the r-f signal is fed into the circuit under examination and the response of that circuit tested by observing the signal voltage across the receiver detector load. The r-f stages are in alignment when the normal i-f response curve is at maximum amplitude.

(4) Aligning the R-F Section.—For r-f alignment the frequency modulated signal is capacitively coupled into the antenna. Both the signal generator and the receiver dial are set for the same fundamental frequency approximately 650 kc. The local oscillator padding capacitor is then tuned to result in the correct i-f frequency. The i-f curve which appears on the screen of the cathode-ray tube varies in amplitude as the local oscillator is tuned. Correct tuning is indicated by maximum amplitude of the i-f response curve.

The signal generator and the receiver dial are both set at the same high fundamental frequency, approximately 1400 kc. The trimmer capacitor, in parallel with the local oscillator tuning capacitor, is then adjusted to result in the maximum amplitude of the i-f frequency response curve.

This procedure of adjusting the dial at approximately 1/4 maximum and 1/4 minimum range insures reasonably good tracking of the oscillator over the entire broadcast band. Of course, the adjustment of the high end after that of the low end requires a resetting of the low end again. These two settings affect each other and they are balanced as closely as possible after two or three settings.

After the oscillator has been aligned, the final step in aligning the r-f section is the trimmer capacitor on the r-f tuning capacitor. This is adjusted to the optimum setting for maximum amplitude of the i-f response curve over the entire band. This capacitor will naturally have more effect on the high frequency than that on the low frequency end of the band. Sets having one or more r-f stages have other trimmers on their tuning capacitors which should be adjusted similarly. The alignment of receivers with the oscillograph permits the serviceman to observe the overall performance of the receiver.

(5) Procedure.

Step 1. Connect the oscillograph across the detector load resistor as explained in the alignment of i-f circuits.

Step 2. Set the receiver tuning dial at approximately 650 kc.

Step 3. Set the fundamental frequency of the f-m signal generator to 650 kc.

Step 4. Connect the output of the signal generator through a capacitor of about 1000 $\mu\mu f$ to the antenna terminal and ground of the signal generator to ground of the receiver. (Naturally the capacitor connected between the antenna and ground and the shorting wire across the receiver oscillator capacitor should be removed. These special connections were made for i-f alignment only.)

Step 5. Turn on the signal generator, the receiver, and the oscillograph.

Step 6. Adjust the local oscillator padder capacitor (in some cases the oscillator inductance) to obtain the maximum amplitude of the i-f response curve which appears on the oscillograph.

Step 7. Set the receiver tuning dial at 1400 kc and the fundamental frequency of the signal generator also at 1400 kc.

Step 8. Adjust the trimmer capacitor in parallel with the oscillator tuning capacitor to result in maximum amplitude of the i-f response curve.

Step 9. Then turn to the settings for aligning the low frequency end of the dial and adjust the oscillator padder capacitor again to result in maximum amplitude.

Step 10. Return to the high frequency position on the dial and adjust the trimmer capacitor again to maximum amplitude.

Note

Probably two or three settings at both of these points will determine the optimum setting for good tracking over the entire band.

Step 11. A final check of tracking is determined by checking the amplitude of the i-f response curve at about 1000 kc. If this amplitude is approximately the same as that at each of the other two settings, good tracking is practically assured.

Step 12. After the oscillator has been aligned for tracking, the trimmer capacitor in parallel with the r-f tuning capacitor should be adjusted to result in optimum amplitude of the i-f response curve throughout the dial range.

Note

In the cheaper models of the a-c—d-c sets it is extremely difficult to align the receiver by this method because 60-cycle pick-up is prevalent throughout the chassis with practically the entire receiver operating above ground potential. Such prevalence of 60-cycle pick-up may make it very awkward to align a receiver by this method. In this case it is possible to capacitively couple the incoming signal to the antenna with a very small capacitor. The output to the oscillograph is taken across the two terminals of the speaker coil. The i-f signal is fed into the antenna with the local oscillator shorted out while the i-f amplifiers are being adjusted. This shunt should then be removed for the alignment of the r-f section.

8. ALIGNING F-M RADIO RECEIVERS

a. INTRODUCTION.

(1) Purpose of F-M.—The narrow channel permitted a-m broadcasting limits the modulating signal to the lower audio frequencies, but with a top audio frequency of 15,000 cycles, f-m broadcasting adds overtones and thus more perfect reproductions to music and speech. Therefore, f-m receivers are designed to offer listeners an output signal of higher fidelity than is possible with a-m receivers. To achieve this high fidelity, f-m is operated with broad channels on a high frequency band.

(2) F-M vs. A-M.—The essential difference between f-m and a-m receivers lies in the method of detection. An a-m detector receives an r-f signal, amplitude modulated at an audio rate, strips off the r-f carrier, and delivers the audio signal to the audio amplifiers. An f-m detector receives a very high frequency, (v.h.f) signal, frequency modulated at an audio rate, removes the v.h.f. carrier, and delivers an audio signal, directly proportional to the amount of frequency modulation, to the audio amplifiers. The f-m circuit comparable to the a-m detector is called the discriminator.

The equipment necessary for f-m receiver alignment is an oscillograph and a frequency modulated signal generator, similar to the equipment required in a-m receiver servicing. Also, in f-m servicing the nature of the system demands that the signal generator frequency be in the f-m range and frequency modulated over a 200 kc band.

Aligning the i-f amplifiers of f-m receivers with an oscillograph is similar to the procedure for a-m except that all

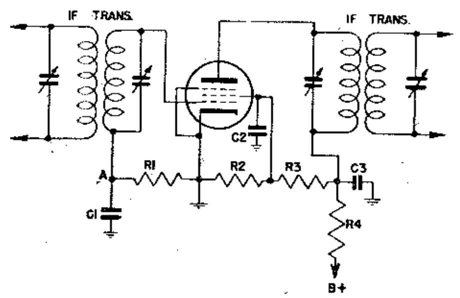


FIGURE 3-35
OSCILLOGRAPH CONNECTION TO OBTAIN I-F CURVE IN F-M RECEIVERS

f-m amplifiers are high fidelity circuits and therefore have broad-band i-f transformers resulting in a broad-band i-f response curve.

b. I-F and R-F ALIGNMENT.

(1) Procedure.—The procedure for aligning the i-f and r-f sections of an f-m receiver is identical with that of aligning the a-m receiver except that the oscillograph is connected to a different section of the circuit and the frequencies are much higher.

(2) Connecting the Oscillograph.—The oscillograph is connected across the grid resistor R1 of the first limiter stage as shown in Figure 3-35. If the load across this resistor is used for a.v.c., however, it is necessary to remove the connections from one of the cathodes of the discriminator as shown in Figure 3-36. This results in the discriminator becoming an a-m detector and the oscillograph is connected across the diode load which is still connected in the circuit. The transformer in the discriminator stage then must be tuned first as a regular i-f transformer.

c. DISCRIMINATOR ALIGNMENT.

(1) General.—There are several f-m discriminator circuits, but they all depend on approximately the same output circuit to the audio stages. This output has opposite polarity for frequencies on either side of resonance of the discriminator tank circuit and becomes greater in amplitude with deviation from the resonant frequency up to a certain point. Diagrammatically, Figure 3-37 shows a characteristic curve of a typical discriminator. Then, on the screen of the oscillograph, with a complete cycle of the output from the frequency modulated signal generator, two curves similar to the one shown in Figure 3-37 result if the time base of the oscillograph is set at the frequency of the rotating capacitor. If, however, the time-base is set to twice the frequency of the output cycle from the signal generator, a pattern resembling Figure 3-38 can be obtained. This latter type pattern is the one generally used in discriminator servicing.

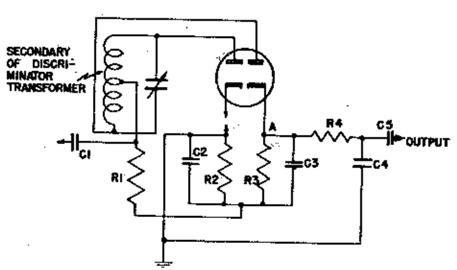


FIGURE 3-36
ALTERNATE METHOD OF OBTAINING I-F CURVE IN F-M RECEIVERS

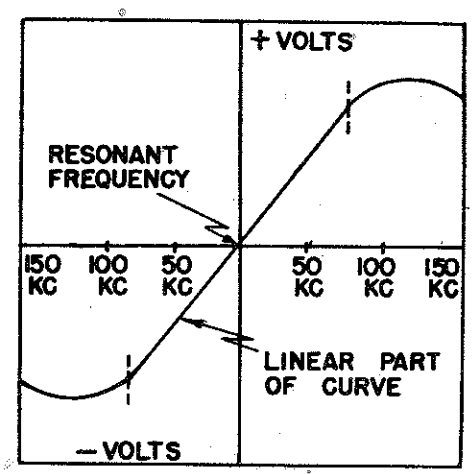


FIGURE 3-37
CHARACTERISTIC DISCRIMINATOR CURVE

(2) Factors Affecting Correct Adjustment.—The primary and secondary of the discriminator transformer generally contain parallel trimmer condensers which can be adjusted. In most cases the primary trimmer affects the symmetry of the pattern and the secondary trimmer the position where the curves cross. It must be remembered that if the cross-over point of the two curves is not at the center of the pattern, the circuit is not tuned to the correct resonant frequency.

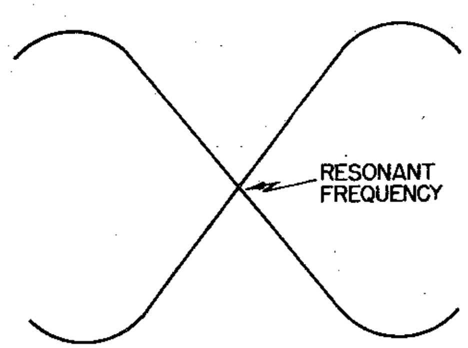


FIGURE 3-38
SUPER-IMPOSED DISCRIMINATOR CURVES

(3) Procedure.

Step 1. Reconnect R2 and C2 into the discriminator circuit if they were removed for i-f alignment.

Step 2. Connect the oscillograph between grid and ground of the first audio stage.

Step 3. If the alignment of the i-f and r-f sections of the circuit has already been performed, the input signal may be fed into the antenna. However, if the preceding circuits have not been aligned, the input signal should be connected between grid and ground of the limiter stage preceding the discriminator.

Step 4. Obtain a pattern which is symmetrical and approaches as closely as possible that shown in Figure 3-37.

SECTION IV

MAINTENANCE

1. GENERAL

The components used in the Type 274-A Cathode-ray Oscillograph have been selected and tested to provide long, trouble-free operating life. It must be recognized, however, that trouble may be expected at some time during the life of the instrument. This section is included to provide useful information for the location and correction of such trouble.

2. DRAWINGS

The schematics of the circuits located just inside of the back cover give the complete information as to how the various components are connected. A list of parts with their descriptions is given on the page accompanying the schematic diagrams.

WARNING

DANGEROUS POTENTIALS AS HIGH AS 1200 VOLTS ARE FOUND IN THIS INSTRUMENT. SINCE THESE POTENTIALS MAY BE DANGEROUS TO HUMAN LIFE, THEY SHOULD BE TREATED WITH PROPER CAUTION.

3. CIRCUIT VOLTAGES

Table 4-1 is included to give the voltages and resistances that are found between the socket connections of the various tubes and ground. The meter used for these measurements has an internal resistance of 20,000 ohms per volt. Naturally voltages or resistance measurements taken with a meter having a lower internal resistance will differ from the values of this table.

It should be remembered that the values given are nominal and considerable variation may be experienced due to various line voltage conditions and component tolerances. Generally, a variation of $\pm 10\%$ is to be expected and 20% may not be uncommon. Judgment is often required to determine if a particular deviation is indicative of trouble.

4. WARRANTY

DU MONT INSTRUMENTS.

All instruments manufactured by Allen B. Du Mont Laboratories, Inc., are guaranteed to equal or exceed all specifications for that particular instrument as published by the company. They are further guaranteed against defective materials, other than the cathode-ray tube, and workmanship for a period of one year from date of sale, and we will promptly repair the instrument or replace it, at our discretion, at any time within the guarantee period should any defect develop from these causes or the instrument be not as represented, upon our inspection of the equipment.

In order that this guarantee be effective, it is necessary that the enclosed guarantee card be properly filled out and mailed to the factory immediately upon receipt of the equipment. Complete information should be given, since a record of every instrument is maintained at our office. This record constitutes our source of information when any correspondence is necessary. Both the *type number and the serial number* of the instrument must be given on this card in order that the information be complete.

DU MONT CATHODE-RAY TUBES.

All industrial cathode-ray tubes manufactured and sold by Allen B. Du Mont Laboratories are guaranteed for a life of 1,000 hours or for six months, depending upon which expires first. The only exceptions to this guarantee are burned-out heaters and broken glass. Cathode-ray tubes will be promptly replaced within the guarantee period if, upon our inspection, the tube has failed within less than its normal expected life.

In order that this guarantee be effective, it is necessary that the enclosed gaurantee card be properly filled out and mailed to the factory immediately upon receipt of the equipment. Complete information should be given in order that the records which we maintain on your particular tube will be accurate. When correspondence is necessary, both *type number and serial number* of the tube should be mentioned. The serial number of Du Mont cathode-ray tubes will be found on the glass stem of the electron gun.

5. SERVICE

Du Mont equipment is designed and manufactured in accordance with the best practices of modern engineering, and it is fully inspected before it leaves our factory. Under normal operation it may be expected to give long, trouble-free service. In order to insure factory service and proper consideration within the guarantee period, the enclosed guarantee card should be properly filled out and mailed to the factory immediately upon receipt of the equipment.

In many cases, equipment has been returned to us, without authorization, and without any need for our examination, resulting in unnecessary shipping costs. In the event that you feel you have not received satisfactory operation from this equipment, you should immediately contact our Instrument Service Department, mentioning the *type number and serial number,* completely outlining all characteristics of the failure, and describing the method in which the equipment has been used.

It is important that such information be given, since much time often can be saved when all operating conditions are known. With such information we often are able to make decisions and suggestions which will avoid returning it to our plant. The foregoing applies also to Du Mont cathode-ray tubes.

All equipment returned to our plant should be shipped, carefully packed, via express prepaid. Cathode-ray tubes larger than five inches screen diameter should be shipped separately and should not be left mounted in their socket within the instrument. In addition, all equipment should be properly identified either by a packing slip or, preferably, by a suitable tag affixed to it. Unidentified equipment which has been returned to us is a serious source of needless errors and delays.

6. REPLACEMENT PARTS

When ordering replacement parts, always give the *type number and serial number* of the instrument and refer to the part by its symbol designation and its description on the schematic.

7. SPECIFICATIONS

The right is reserved to change the specifications of any equipment, without notice, at any time. This right shall not incur any liability to Allen B. Du Mont Laboratories, Inc., to change equipment previously sold, or to supply new equipment in accordance with earlier specifications.

THE DU MONT "OSCILLOGRAPHER"

The Du Mont "Oscillographer," a quarterly publication, is published regularly by the Allen B. Du Mont Laboratories. It is sent free of charge to engineers, research workers, and those engaged in the use and application of cathode-ray equipment. When sending requests for subscriptions and address-change notice, please supply the following: name, company name, company address, type of business, and title of individual.

WARNING

EXERCISE EXTREME CARE WHEN HANDLING THE CATHODE-RAY TUBE. IT MAY BE SCRATCHED AND THEREBY WEAKENED TO THE POINT WHERE IT MAY EASILY BE BROKEN. THE BREAKING OF THIS TUBE MAY CAUSE AN IMPLOSION AND RESULT IN PERSONAL INJURY FROM FLYING GLASS PARTICLES.

TABLE OF VOLTAGE AND RESISTANCE

K=1000 OHMS

Pin No.	*Resistance to Ground in Ohms*	*D-C Voltage to Ground*	*Control Affecting Reading*
	V-1 Type 6AC7—Vertical Amplifier		
1	0	0	
2	0	0	
3	~~1K~~	~~2.4~~	
4	0 to 1 meg.	0	VERTICAL AMP
5	1K	2.4	
6	48K	70	
7	0.6 ohm	6.3 ac	
8	200K	210	
	V-2 Type 6AC7—Horizontal Amplifier		
1	0	0	
2	0	0	
3	~~1K~~	~~2.4~~	
4	0 to 1 meg.	0	HORIZONTAL AMP
5	1K	2.4	
6	48K	70	
7	0.6 ohm	6.3 ac	
8	200K	190-215	COARSE AND FINE FREQUENCY CONTROL
	V-3 Type 884—Sweep Generator		
1	0 to 100K (only SYNC. Amp.)	0-2.5	FINE AND COARSE FREQUENCY AND SYNC AMP
2	0	0	
3	500K to 5 meg.	7.5-45	FINE AND COARSE FREQUENCY
4	NC	NC	
5	10K to 110K (only SYNC. Amp.)	0-0.24	SYNC AMP
6	NC	NC	
7	0.6	6.3 ac	
8	1.3K	5.6-6.2	FINE FREQUENCY CONTROL
	V-4 Type 80—High Voltage Rectifier		
1	3K	1000 ac	
2	2 meg.	—1500	
3	2 meg.	—1500	
4	3K	1000 ac	
	V-5 Type 80—Low Voltage Rectifier		
1	100K	480	
2	540 ohms	380 ac	
3	540 ohms	380 ac	
4	100K	480	
	V-6 Type 5BP-A—Cathode-Ray Tube		
1	1.5 meg.	—1100	
2	NC	NC	
3	5 meg.	+75 to —75	HORIZONTAL POSITIONING
4	700K to 1 meg.	—600 to —900	FOCUS
5	NC	NC	
6	5 meg.	+75 to —75	VERTICAL POSITIONING
7	0	0	
8	0	0	
9	0	0	
10	2 meg.	—1100	
11	1.5 meg.	—1100	INTENSITY CONTROL

PATENT NOTICE

Manufactured under one or more of the following U. S. Patents:

1,844,117	1,960,333	1,999,407	2,000,014	2,014,106
2,067,382	2,082,327	2,085,576	2,087,280	2,098,231
2,153,800	2,157,749	2,162,009	2,163,256	2,164,176
2,185,705	2,186,634	2,186,635	2,190,020	RE. 21,326
2,201,309	2,207,048	2,208,254	2,209,507	2,221,398
2,225,099	2,227,822	2,229,556	2,245,409	2,245,428
2,249,942	2,249,943	2,269,115	2,269,129	2,280,700
2,280,738	2,290,592	2,297,742	2,297,752	2,299,471
2,299,510	2,315,848	2,319,691	2,321,149	2,328,259
2,331,401	2,337,980	2,338,336	2,338,646	2,343,630
2,345,549	2,346,509	2,347,933	2,355,363	2,356,733
2,364,687	2,365,476	2,372,455	2,372,901	2,373,114
2,379,488	2,384,931	2,389,025	2,391,082	2,391,090
2,391,273	DES. 143,796	2,396,014	2,398,535	2,398,959
2,404,185	2,408,193	2,409,419	2,410,920	2,414,319
2,414,634	2,419,118	2,419,177	2,423,362	2,426,419
2,429,824	2,435,564	2,435,680	2,436,265	2,437,173
2,438,668	2,438,706	2,438,717	2,439,186	2,440,597
2,441,334	2,442,138	2,442,264	2,442,545	

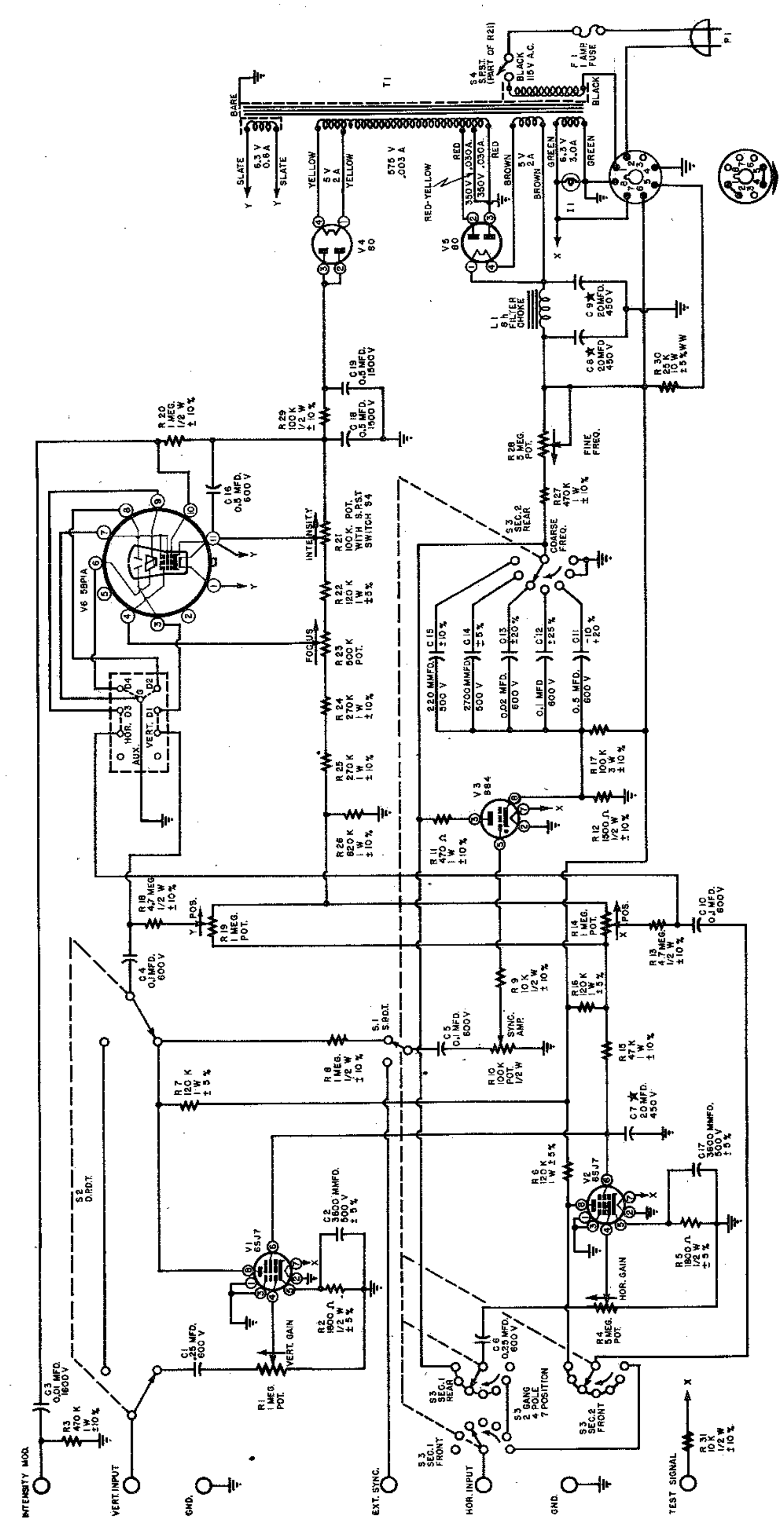
Other Patents Pending

ALLEN B. DU MONT LABORATORIES, INC.

CLIFTON, N. J., U. S. A.

PARTS LIST—TYPE 274

SYMBOL DESIGNATION	REFERENCE DRAWING OR PART NO.	DESCRIPTION
C1	3-152	CAPACITOR, fixed: paper; wax; 0.25 mfd; 600 V; +30–10%
C2	CM35B362J	CAPACITOR, fixed: mica; 3600 mmfd; 500 V; ±5%
C3	3-1140	CAPACITOR, fixed: paper; wax; 0.01 mfd; 1600 V; + 30–10%
C4	3-1195	CAPACITOR, fixed: paper; wax; 0.1 mfd; 600 V; +30–10%
C5		Same as C4
C6		Same as C1
C7	3-1160	CAPACITOR, fixed: electrolytic; 20+20+20 mfd; 450 V
C8		Part of C7
C9		Part of C7
C10		Same as C4
C11	3-1082	CAPACITOR, fixed: paper; wax; 0.5 mfd; 600 V; +20–10%
C12	3-1138	CAPACITOR, fixed: paper; wax; 0.1 mfd; 600 V; ±25%
C13	3-1139	CAPACITOR, fixed: paper; wax; 0.02 mfd; 600 V; ±20%
C14	CM30B272J	CAPACITOR, fixed: mica; 2700 mmfd; 500 V; ±5%
C15	CM20B221K	CAPACITOR, fixed: mica; 220 mmfd; 500 V; ±10%
C16		Same as C11
C17		Same asC2
C18	3-360	CAPACITOR, fixed: paper; 0.5 mfd; 1500 V; +20–10%
C19		Same as C18
F1	11-3	FUSE, cartridge: 1 amp.
I1	39-4	LAMP, incandescent: miniature bayonet base
L1	21-338	INDUCTOR, fixed: filter; 8 hy.
P1	46-108	CABLE, power: copper; 2 #18 ga. stranded conductors; w/2 prong male plug one end
P2	9-294	CONNECTOR, male contact: 8 pin
R1	1-287	RESISTOR, variable: composition; 1 megohm; 1/2 W; ±20%
R2	RC21BF182J	RESISTOR, fixed: composition; 1800 ohm; 1/2 W; ±5%
R3	RC31BF474K	RESISTOR, fixed: composition; 470,000 ohm; 1 W; ±10%
R4	1-421	RESISTOR, variable: coposition; 5 megohm; 2 W; ±20%
R5		Same as R2
R6	RC31BF124J	RESISTOR, fixed: composition; 120,000 ohm; 1 W; ±5%
R7		Same as R6
R8	RC21BF105K	RESISTOR, fixed: composition; 1 megohm; 1/2 W; ±10%
R9	RC21BF103K	RESISTOR, fixed: composition; 10,000 ohm; 1/2 W; ±10%
R10	1-388	RESISTOR, variable: composition; 100,000 ohm; 1/2 W; ±20%
R11	RC31BF471K	RESISTOR, fixed: composition; 470 ohm; 1 W; ±10%
R12	RC21BF152K	RESISTOR, fixed: composition; 1500 ohms; 1/2 W; ±10%
R13	RC21BF475K	RESISTOR, fixed: composition; 4.7 meghom; 1/2 W; ±10%
R14		Same as R1
R15	RC31BF473K	RESISTOR, fixed: composition; 47,000 ohm; 1 W; ±10%
R16		Same as R6
R17	2-257	RESISTOR, fixed: composition; 100,000 ohm; 3 W; ±10%
R18		Same as R13
R19		Same as R1
R20		Same as R8
R21	1-463	RESISTOR, variable: composition; 100,000 ohm; 1/2 W; ±20%; with SPST switch S4
R22		Same as R6
R23	1-288	RESISTOR, variable: composition; 500,000 ohm; 1/2 W; ±20%
R24	RC31BF274K	RESISTOR, fixed: composition; 270,000 ohm; 1 W; ±10%
R25		Same as R24
R26	RC31BF824K	RESISTOR, fixed: composition; 820,000 ohm; 1 W; ±10%
R27		Same as R3
R28		Same as R4
R29	RC21BF104K	RESISTOR, fixed: composition; 100,000 ohm; 1/2 W; ±10%
R30	2-8	RESISTOR, fixed: wire wound; 25,000 ohm; 10 W; ±5%
R31		Same as R9
S1	5-10	SWITCH, toggle: SPDT
S2	5-12	SWITCH, toggle: DPDT
S3	5B-4647	SWITCH, 2 gang 4 pole: 7 pos. (formerly 5-198)
S4		Part of R21
T1	20D-4641	TRANSFORMER, plate and filament: (formerly 20-329)
V1	25-6SJ7	TUBE, electron: Triple-grid detector amplifier
V2		Same as V1
V3	25-884	TUBE, electron: Thyraton
V4	25-80	TUBE, electron: Full wave high-vacuum rectifier
V5		Same as V4
V6	25-5BP1A	TUBE, electron: Cathode-Ray



SCHEMATIC OF CIRCUIT. TYPE 274 CATHODE-RAY OSCILLOGRAPH

Ref. Dwg. DD-4652-C
Issue 5

COMPONENTS PARTS LIST

TYPE 274-A CATHODE-RAY OSCILLOGRAPH

CAPACITORS

Symbol	Part No.	Description
C1	03001520/3–152	.25 μf 600 V paper
C2	03033350/CM35B512J	5100 μμf 500 V ±5% mica
C3	03011400/3–1140	.01 μf 1600 V paper
C4	03011950/3–1195	.1 μf 600 V paper
C5	03011950/3–1195	.1 μf 600 V paper
C6	03001520/3–152	.25 μf 600 V paper
C7	03011600/3–1160	20/20/20 μf 450 V elec.
C8	03033370/CM35B622J	6200 μμf 500 V ±5% mica
C9	03011950/3–1195	.1 μf 600 V paper
C10	03010820/3–1082	.5 μf 600 V paper
C11	03011380/3–1138	.1 μf 600 V paper
C12	03011390/3–1139	.02 μf 600 V paper
C13	03029340/CM30B272J	2700 μμf 500 V ±5% mica
C14	03020470/CM20B221K	220 μμf 500 V ±10% mica
C15	03003600/3–360	.5 μf 1500 V paper
C16	03003600/3–360	.5 μf 1500 V paper
C17	03010820/3–1082	.5 μf 600 V paper
C20	03007790/3–779	1.5/7 μμf 500 V var ceramic

FUSES

F1	11000760/11–3	1 amp

LAMPS

I1	12000840/39–4	.25 amp

INDUCTORS

L1	21003380/21–338	8 hy filter

RESISTORS

R1	01011120/1–287	1 meg ±20% 1/2 W var
R2	02030480/RC20BF102J	1000 ±5% 1/2 W
R3	02035090/RC30BF474K	470,000 ±10% 1 W
R4	01011120/1–287	1 meg ±20% 1/2 W var
R5	02030480/RC20BF102J	1000 ±5% 1/2 W
R6	02034000/RC30BF154J	150,000 ±5% 1 W
R7	02034000/RC30BF154J	150,000 ±5% 1 W
R8	02032130/RC20BF105K	1 meg ±10% 1/2 W
R9	02031890/RC20BF103K	10,000 ±10% 1/2 W
R10	01011080/1–388	100,000 ±20% 1/2 W var
R11	02034730/RC30BF471K	470 ±10% 1 W
R12	02031760/RC20BF821K	1300 ±5% 1/2 W
R13	02032210/RC20BF475K	4.7 meg ±10% 1/2 W
R14	01011120/1–287	1 meg ±20% 1/2 W var
R15	02034970/RC30BF473K	47,000 ±10% 1 W
R16	02033960/RC30BF104J	100,000 ±5% 1 W
R17	02071540/2–257	100,000 ±10% 3 W
R18	02032210/RC20BF475K	4.7 meg ±10% 1/2 W
R19	01011120/1–287	1 meg ±20% 1/2 W var
R20	02032130/RC20BF105K	1 meg ±10% 1/2 W
R21	01014600/1–463	100,000 ±20% 1/2 W var
R22	02035020/RC30BF124K	120,000 ±10% 1 W
R23	01011110/1–288	500,000 ±20% 1/2 W var
R24	02035040/RC30BF184K	180,000 ±10% 1 W
R25	02035040/RC30BF184K	180,000 ±10% 1 W
R26	02035120/RC30BF824K	820,000 ±10% 1 W
R27	02035090/RC30BF474K	470,000 ±10% 1 W
R28	01015340/1–421	5 meg ±20% 2 W var
R29	02032040/RC20BF184K	180,000 ±10% 1/2 W
R30	02034990/RC30BF683K	68,000 ±10% 1 W
R31	02031890/RC20BF103K	10,000 ±10% 1/2 W
R32	02032210/RC20BF475K	4.7 meg ±10% 1/2 W
R33	02032040/RC20BF184K	180,000 ±10% 1/2 W
R34	01023900	1200 ±20% 1.5 W wire wd.

SWITCHES

S1	05000100/5–10	Toggle SPDT
S2	05000120/5–12	Toggle DPDT
S3	5B–13386	Rotary 4P7T

TRANSFORMERS

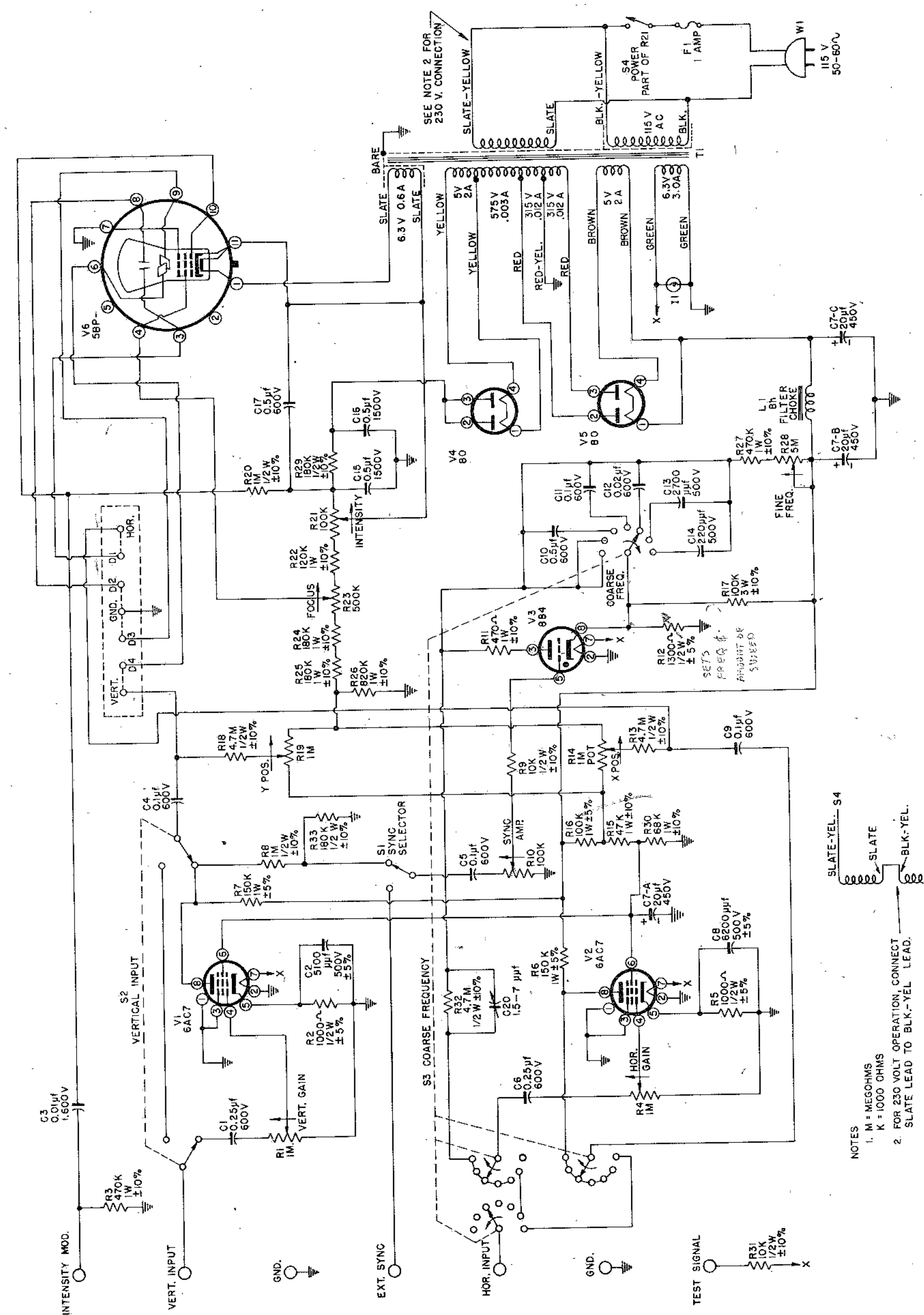
T1	20C–13382	Transformer

TUBES

V1	25000120/25–6AC7	Elec 6AC7
V2	25000120/25–6AC7	Elec 6AC7
V3	25000740/25–884	Elec 884
V4	25000720/25–80	Elec 80
V5	25000720/25–80	Elec 80
V6	25000520/25–5BP	Elec 5BP

CABLE ASSEMBLY

W1	50002980/46–108	Cable Assembly Power



SCHEMATIC OF CIRCUIT. TYPE 274-A CATHODE-RAY OSCILLOGRAPH

Ref. Dwg. D-13381 Issue 8