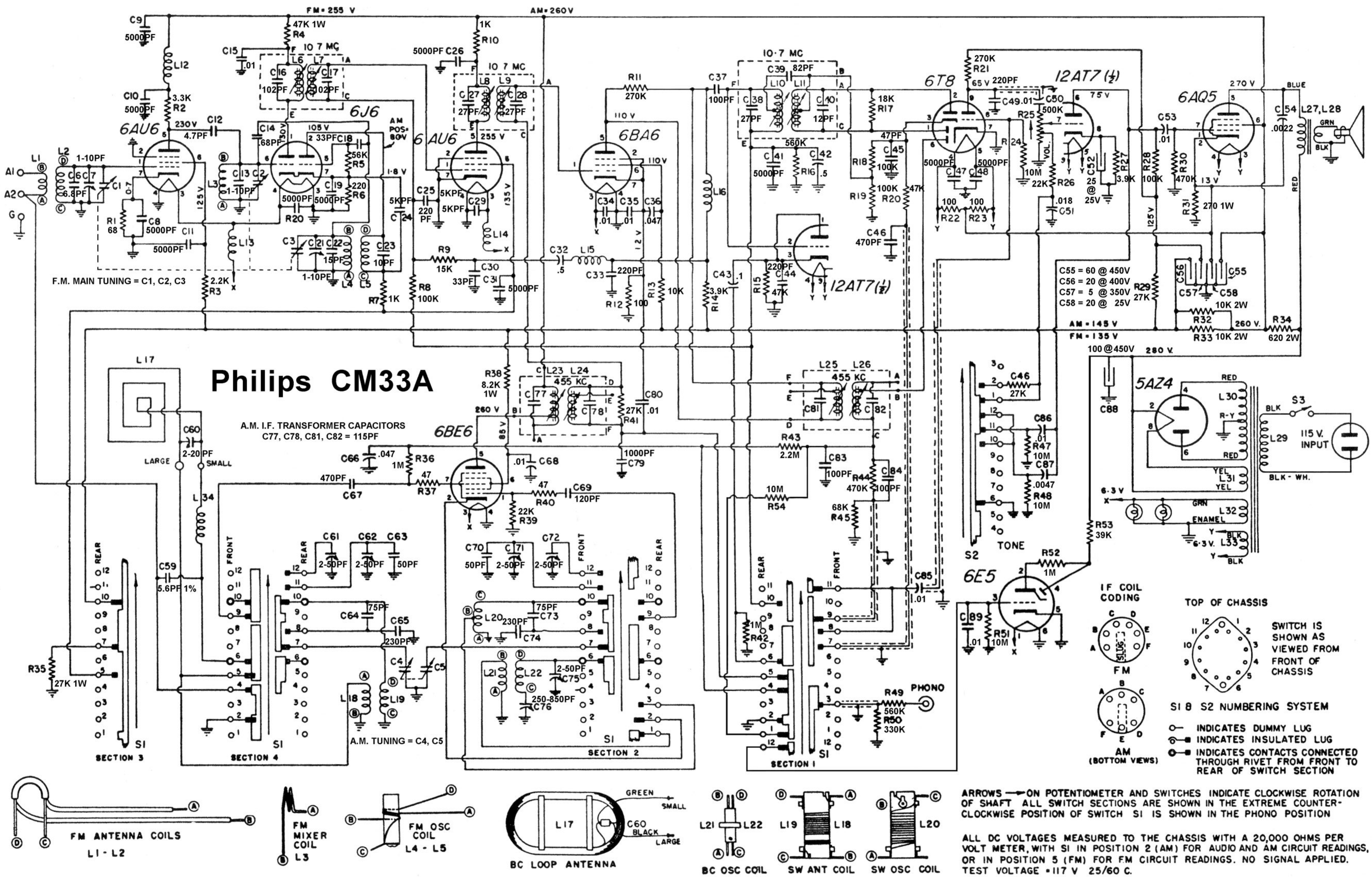
L	1 2 17 34 12 3 13 6 7 4 5 18 19 14,8,9, 20 21 22 15 16 10 11 25 26 29 30 31 32 33 27 28
C	6 7 1 8 9 10 11 12 13 14 15 2 16 3 20 21 22 17 19 18 23 24 25 26 27 29,30,31,28 32 34 35 33 36 37 43 38,41,42,39,40 45 46 47 48 49 50 51 52 53 56 57 58 55 54
C	59 60 61 62 63 64,65,66,67,4,5, 70,71,68,72,73,74,75,76,77,78 79 80 81 83 82 84 85 89 86 87 88
R	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 22 23 21 24 25 26 27 28 29 30 31 32 33 34
R	35 36 37 38 39 40 41 42 43 54 44 45 49 50 51 46 47 48 52 53



ARROWS ——► ON POTENTIOMETER AND SWITCHES INDICATE CLOCKWISE ROTATION OF SHAFT. ALL SWITCH SECTIONS ARE SHOWN IN THE EXTREME COUNTER-CLOCKWISE POSITION OF SWITCH S1 IS SHOWN IN THE PHONO POSITION

ALL DC VOLTAGES MEASURED TO THE CHASSIS WITH A 20,000 OHMS PER VOLT METER, WITH S1 IN POSITION 2 (AM) FOR AUDIO AND AM CIRCUIT READINGS, OR IN POSITION 5 (FM) FOR FM CIRCUIT READINGS. NO SIGNAL APPLIED. TEST VOLTAGE = 117 V 25/60 C.

SPECIFICATIONS

Model CM33A is a 10-tube FM-AM superheterodyne receiver, including tuning indicator, and covers the standard AM band, the 31 and 25 meter short wave bands and the FM band.

PHILIPS TUBES:

6AU6	R.F. Amplifier (FM)
6J6	Mixer and Oscillator (FM)
6AU6	I.F. Amplifier (FM)
6BE6	Pentagrid Converter (AM)
6BA6	I.F. Amplifier (FM-AM)
12AT7	Diode AM Reduction Detector, FM AVC and AF Amplifier
6T8	Demodulators and A.F. Amplifier
6AQ5	Audio Output
5AZ4	Rectifier

RANGE SWITCH POSITIONS:

Position 1: Phonograph Position.
Position 2: Standard Broadcast Band 540 to 1600 kc.
Position 3: Shortwave Range from 9.5 to 9.8 Mc.
Position 4: Shortwave Range from 11.5 to 12.1 Mc.
Position 5: FM Band, 88 to 108.5 Mc.

INTERMEDIATE FREQUENCY: AM = 455 kc.
FM = 10.7 Mc.

AUDIO OUTPUT: 2.5 watts undistorted.
5 watts maximum.

ANTENNA and GROUND:

A built-in loop antenna provides standard broadcast reception from local stations. The loop acts as a plate antenna on the short wave bands. The use of an outside FM antenna of the folded di-pole type is necessary for FM reception. Connect a 300 ohm line between the FM antenna and terminals A1 and A2 on the receiver. The external FM antenna will provide improved standard broadcast and shortwave reception. A secure ground should be made to a ground rod or cold water pipe.

CONTROLS: Left to right (looking at front)

1. Tone Switch.
2. On-Off Switch and Volume Control.
3. Tuning Control.
4. Wave Range and Phonograph Switch.

PHONOGRAPH CONNECTIONS:

A connector is supplied to connect a pickup to the receiver. The circuit is designed to operate with a crystal or other high impedance pickup.

LINE VOLTAGE: 115 volts, 25 to 60 cycles.

CURRENT DRAIN: 0.8 ampere maximum.

CABINET DIMENSIONS: Width—19¾"
Height—13¼"
Depth—11¼"

SERVICE DATA

Explanation of Switch Diagrams: The schematic diagram shows each section of switches in a straight line form. The short stator contacts are represented as solid squares; the long contacts as solid rectangles; and the rotor contacts as bars. All sections are shown in the extreme counterclockwise (No. 1) position of the switch knob. As the switch rotates clockwise the rotor contacts move upwards through the remaining positions. The exact location of each stator contact on its wafer is shown on a front view drawing of a switch wafer on the schematic diagram.

CIRCUIT FEATURES

FM OPERATION

As this receiver incorporates entirely new design features in the FM section, the service technician must be thoroughly familiar with the functions of the various circuit components to understand clearly the receiver operation and thereby be able to diagnose troubles effectively.

Most conventional FM receivers employ one or more grid limiter stages ahead of the discriminator, which limiters tend to limit or reduce any amplitude modulation which may appear. For a given design of a limiter stage, the degree of limiting action or AM reduction is directly proportional to the signal strength at the limiter grid — greater limiting occurring for higher signal strengths.

This receiver employs a new technique of AM reduction known as Amplitude-Modulation-Feed-Back (AMFB), which title is an indication of the method of achieving AM Reduction.

The incoming FM signal is acted upon in conventional manner by the 6AU6 RF Amplifier, the 6J6 Oscillator/Mixer and the 1st (6AU6) and 2nd (6BA6) IF Tubes.

In the plate circuit of the 2nd IF tube (6BA6) the 10.7 Mc FM IF signal is developed across the choke L16 and is capacitor coupled by C37 to the primary L10 of the discriminator transformer and to one half of the 12AT7 tube connected as a diode detector.

The diode load is split between the anode (R16) and the cathode (R15) circuits. The anode resistor (R16) is bypassed for both RF and AF voltages but a D.C. voltage appears across it proportional to the signal strength. This D.C. voltage is the AVC voltage when operating on the FM range, and is applied to the grid of the 1st IF tube (6AU6) for normal AVC action.

The cathode resistor (R15) is bypassed for RF only, so that the detected signal appearing across R15 will be of the same wave form as any Amplitude Modulation present on the signal at this point in the circuit.

This detected AM voltage is fed through C43 (and the range switch) to the grid of the 2nd IF tube 6BA6 (which also acts as an AF amplifier for this purpose) for amplification and appears across R14. This voltage is then fed through L15, C32 and R9 to the grid of the 1st IF tube 6AU6 in the proper phase to perform the AM reduction (or limiting) action.

CHECKING DISCRIMINATOR

The discriminator may be checked by several methods. Either of the following two should be satisfactory and the first is usually sufficient.

Method 1:

Connect a standard FM signal generator to the antenna terminals according to the Alignment Procedure. Set generator to approximately 100 Mc. and tune the receiver to resonance, using the AVC voltage at R16 and C42 as an indicator. Adjust the output of the generator until the AVC is about 3 to 3.5 volts. With the speaker connected to the secondary of the output transformer, adjust the volume control to a low listening level. The signal generator is to be modulated by 400 cycles and deviation is to be 22.5 kc. (30%). Gradually increase percentage modulation. The output should not "Distort" or "Break-up" until over 100% modulation is applied (over 75 kc. deviation).

Method 2:

Check the discriminator during IF Alignment. Adjust the generator output at 10.7 Mc. until 3 volts AVC is developed at R16-C42 and note the value of generator output. Turn off generator output. The VTVM is then connected to the junction of the de-emphasis resistor and condenser R20-C46 and then it is adjusted to zero reading. (This latter adjustment is necessary, due to the slight difference in contact current of the discriminator diodes. Also because the change in output voltage will be small when the signal generator's frequency is varied.)

Turn on the signal generator and adjust it to the same value as noted above. Varying the frequency of the signal will produce positive and negative voltages on the VTVM. Both will reach a peak if the generator frequency is varied enough. Both peaks should be approximately equal and should occur at approximately 100 kc. above and below 10.7 Mc.

CHECKING AM REDUCTION

AM Reduction should be checked after IF Alignment or at any time when it is not operating properly.

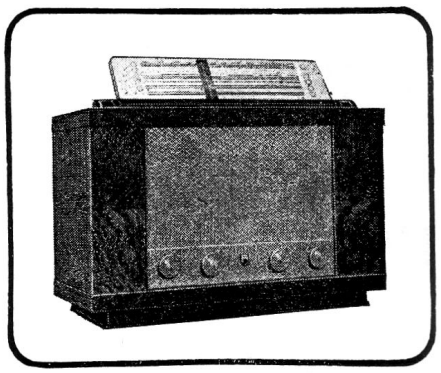
The IF generator is to be 400 c, 10% Amplitude Modulation and connected according to Alignment Procedure.

Adjust the signal generator until the AVC is about 3 volts. Complete operation step No. 4 of the alignment chart.

While listening to speaker, temporarily connect and disconnect a 1.0 mf. 400 V. capacitor from the junction of C32 and L15 to the chassis. When the capacitor is connected there should be a considerable rise (15 db minimum) in the 400 cycle output. If the increase is not present, check R9, C32, L15 and C43 for defective parts.

TO REMOVE CHASSIS

1. Disconnect plug from line socket.
2. Remove antenna and ground connections.
3. Remove back cover and control knobs.
4. Loosen thumb screw securing the pointer to the clamp on the dial cord.
5. Remove the two slotted head screws securing the band indicator roller in its housing.
6. Remove the tuning indicator from the bracket.
7. Pull out the speaker connectors.
8. Remove chassis support bracket at rear of chassis.
9. The chassis will now slide out of the cabinet, providing the shipping screws in the bottom of the cabinet have been removed.



ALIGNMENT NOTES

A. After step 2 has been completed, do not readjust L26 and L25.

B. The speaker should be connected to the receiver for the FM alignment so that the signal may be heard. The AVC voltage is to be maintained between 2.5 and 3 volts by regulating the signal generator.

C. L11 must be aligned for absolute minimum audio output from speaker. After obtaining minimum signal, realign L10 for maximum AVC voltage and then realign L11 for minimum audio signal.

D. If the wiring associated with L4 has been altered since the factory installation, it will be necessary to align L4 at 90 Mc. by unsoldering the grounded lead of L4 and sliding it up or down in the hole in the chassis.

E. A balanced output frequency modulated signal generator is recommended for RF alignment. If a suitable FM signal generator is not available the RF or "front end" alignment can be done quite well with an AM signal generator capable of supplying frequencies from 87 to 109 Mc. Adjust for maximum AVC voltage.

F. The use of a signal generator for steps 5, 6, 7 and 8 is recommended only if the available generator is sufficiently accurate to insure correct frequency settings. Otherwise, an alternative procedure employing FM station signals in place of a signal generator is recommended. For adjustments at the high frequency end of the band, use the station nearest 105 Mc. For adjustments at the low frequency end of the band, use the station nearest 90 Mc. Make certain of the frequency of the FM stations used in alignment, in order that the receiver may be logged correctly. If only one FM station is available in your community, it will have to suffice for RF alignment.

G. Check the coil adjustments with a tuning wand. If inserting the brass end in or near the coil increases the AVC reading, spread the coil turns. If the powdered iron end increases the AVC reading, compress the coil turns. If both ends of the tuning wand cause a decrease in the VTVM reading, the coil is correctly adjusted. Do not change the coils excessively, as only a small adjustment is required at these frequencies.

H. After aligning C13, repeat operation 6, then recheck C13.

I. After aligning C7, check the alignment of L2, if the wiring associated with L2 has been altered. If alignment of L2 is necessary, apply a 90 Mc. signal and slide the coil up or down at the solder connections then realign C7.

J. After completing operation 10, repeat operation 9 and then operation 10.

K. Align oscillator trimmer for first peak from minimum setting of trimmer.

L. After the preceeding alignment has been completed, replace the receiver in the cabinet and connect the loop antenna to the chassis.

ALIGNMENT OF RECEIVER

EQUIPMENT REQUIRED

Signal Generator: A signal generator or generators capable of supplying AM Signals from 450 kc. to 12.5 Mc., also FM signals from 87 to 109 Mc. If the FM signal generator is not available, the antenna, oscillator and RF interstage circuits can be aligned with an AM signal generator having output frequencies of from 87 to 109 Mc.

Output Meter: A power output meter or a high resistance AC voltmeter.

Vacuum Tube Voltmeter: A vacuum tube voltmeter capable of reading ± 3 volts.

Alignment Tools: Align all IF transformers with a non-metallic screw driver.

ALIGNMENT PROCEDURE AND EQUIPMENT CONNECTIONS

SIGNAL GENERATOR (OR GENERATORS)

Allow a sufficient length of time for the signal generator and receiver to become thermally stable before making any tests. Connect the common lead of the signal generator to the chassis base as close as possible to the input signal connection for all operations except the FM-RF alignment. Always be sure to use the specified capacitance or resistance in series with the output lead of the generator as indicated in the alignment chart. Series components are to be connected as close as possible to the receiver.

OUTPUT METER (FOR AM OUTPUT INDICATION)

If a power meter is used, adjust it for 4 ohms impedance and connect it in place of the speaker voice coil. Do not exceed a 500 Milliwatt reading. If an AC voltmeter is used it should be connected across the voice coil, and the output kept below 1.4 volts during alignment. Regulate the signal generator attenuator to keep the output below the above limit.

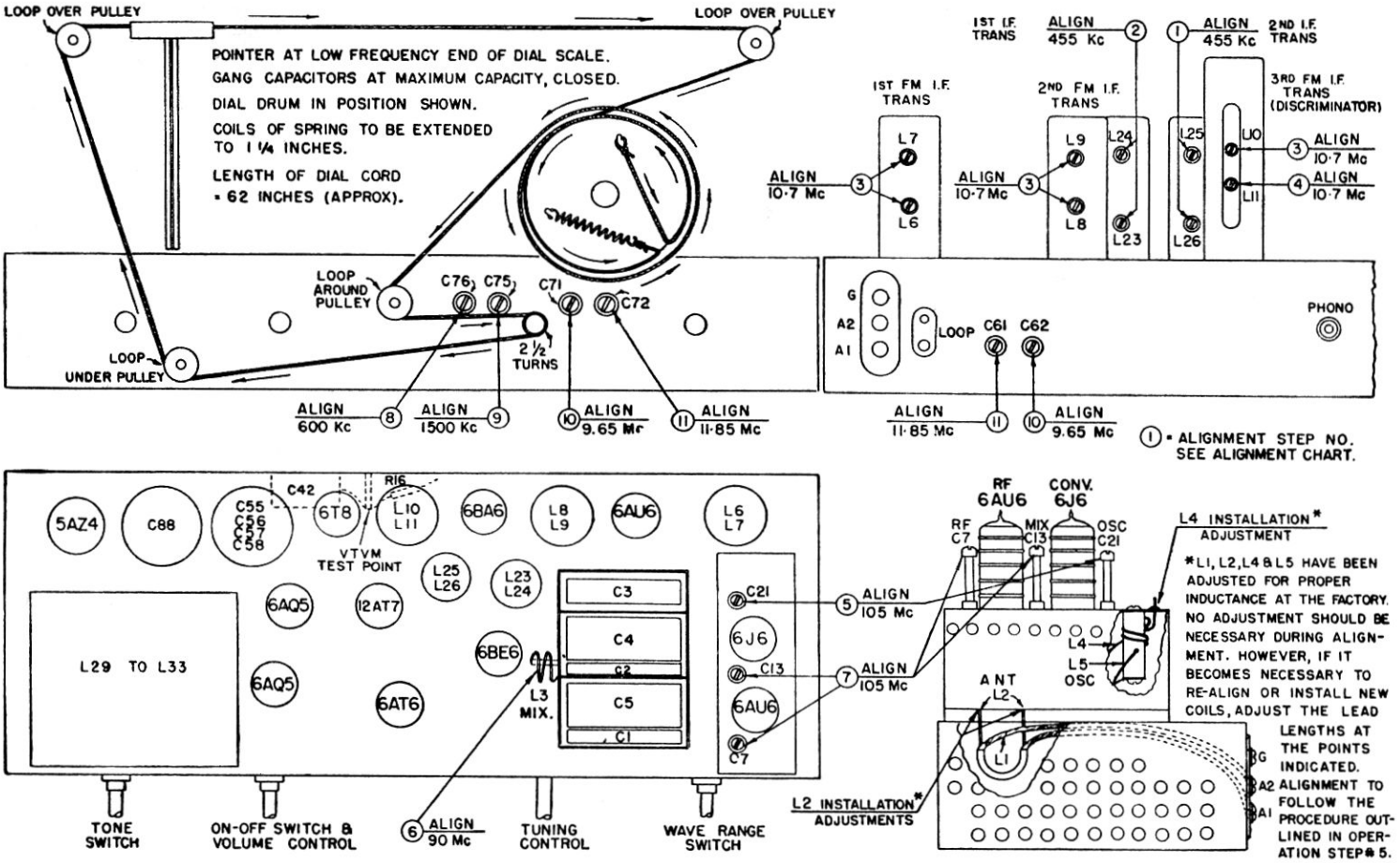
VACUUM TUBE VOLTMETER

Connect the common lead of the VTVM to the receiver chassis. The zero adjustment of the VTVM must be checked regularly. A.V.C. voltage is to be maintained between 2.5 and 3 volts during RF and IF alignment. This is to be controlled by regulating the signal generators output.

RECEIVER

Set the tone switch to the third position (flat response position). Adjust the dial pointer to correspond to the alignment mark on the dial, when the gang tuning capacitor is fully meshed. The alignment mark is the end of the horizontal lines on the 550 kc. end of the dial scale. Set the volume control to the maximum adjustment for AM alignment. On FM alignment the volume control is normally set so that the alignment signal may be heard, when using an FM signal generator. Disconnect the loop antenna for all alignment other than operation Step 13. Throughout all bands the oscillator operates 455 kc. or 10.7 Mc. HIGHER in frequency than the station carrier frequency.

Philips Model CM33A Alignment Data



ALIGNMENT PROCEDURE CHART

Operation Steps	SIGNAL GENERATOR				METER			RECEIVER				
	Series Component	Connection To Receiver	Frequency	Modulation	Type	Connection To Receiver	Scale	Range Switch	Tuning Capacitor	See Note	Adjust in Stated Order	Adjust For
1	.05 mf.	6BA6 Pin No. 6	455 kc.	400c AM at 30%	Output	In place of voice coil	4 ohms	AM	Max. Cap.		L26-L25	Max. Output
2	.05 mf.	Stator of C4	455 kc.	400c AM at 30%	Output	In place of voice coil	4 ohms	AM	Max. Cap.	A	L24-L23	Max. Output
3	.05 mf.	Stator of C13	10.7 Mc.	400c AM at 10%	VTVM	Junction of R16 and C42	3 volts	FM	Max. Cap.	B	L6, L7, L8, L9, L10	Max. A.V.C. Voltage
4	.05 mf.	Stator of C13	10.7 Mc.	400c AM at 10%	VTVM	Junction of R16 and C42	3 volts	FM	Max. Cap.	C	L11	Min. Audio Output
5	150 ohm resistor in each lead	Antenna Terminals A1 and A2	105 Mc.	400c FM at 30% 22.5 kc. swing	VTVM	Junction of R16 and C42	3 volts	FM	105 Mc.	D-E-F	C21	Max. A.V.C. Voltage
6	150 ohm resistor in each lead	Antenna Terminals A1 and A2	90 Mc.	400c FM at 30% 22.5 kc. swing	VTVM	Junction of R16 and C42	3 volts	FM	90 Mc.	G	L3	Max. A.V.C. Voltage
7	150 ohm resistor in each lead	Antenna Terminals A1 and A2	105 Mc.	400c FM at 30% 22.5 kc. swing	VTVM	Junction of R16 and C42	3 volts	FM	105 Mc.	H	C13	Max. A.V.C. Voltage
8	150 ohm resistor in each lead	Antenna Terminals A1 and A2	105 Mc.	400c FM at 30% 22.5 kc. swing	VTVM	Junction of R16 and C42	3 volts	FM	105 Mc.	I	C7	Max. A.V.C. Voltage
9	100 mmf.*	Antenna Terminal A1	600 kc.	400c AM at 30%	Output	In place of voice coil	4 ohms	AM	600 kc.		C76	Max. Output
10	100 mmf.*	Antenna Terminal A1	1500 kc.	400c AM at 30%	Output	In place of voice coil	4 ohms	AM	1500 kc.	J	C75	Max. Output
11	100 mmf.*	Antenna Terminal A1	9.65 Mc.	400c AM at 30%	Output	In place of voice coil	4 ohms	31M	9.65 Mc.	K	C71, C62	Max. Output
12	100 mmf.*	Antenna Terminal A1	11.85 Mc.	400c AM at 30%	Output	In place of voice coil	4 ohms	25M	11.85 Mc.	K	C72, C61	Max. Output
13	None	Placed near Loop	1500 kc.	400c AM at 30%	Output	In place of voice coil	4 ohms	AM	1500 kc.	L	C60	Max. Output

* Or a Standard Dummy Antenna with a 200 mmf. Capacitor in Series.