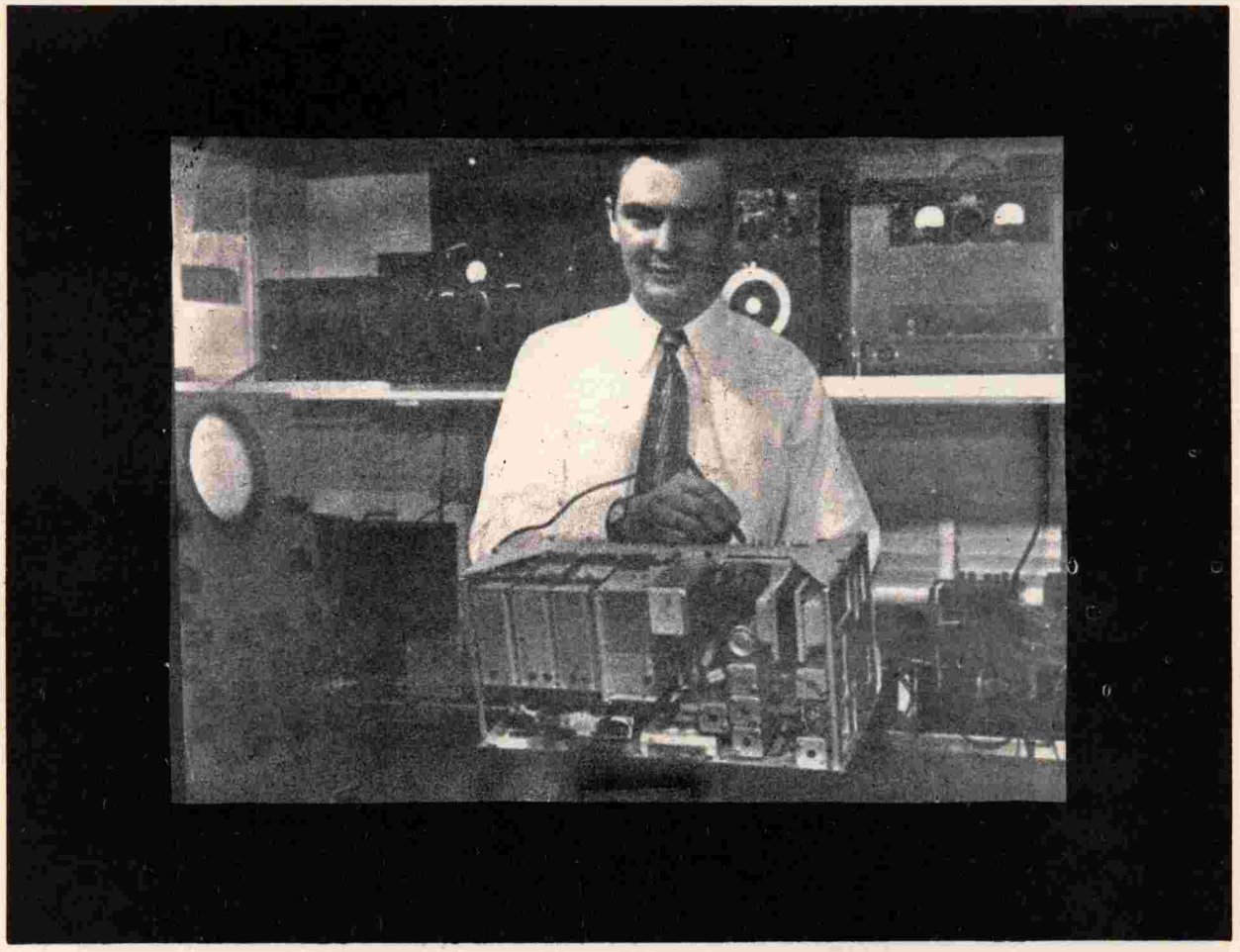

LESSON
50 RA-1

FADING AND INTERMITTANT RE-CEPTION, AND RMA COLOR CODE

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FADING AND INTERMITTENT RECEPTION, AND RMA COLOR CODE

Fading and intermittent reception are probably the two most perplexing disorders in radio receivers that are encountered by the service technician. The reasons are that nearly every component part of a receiver has at some time been found to be the source of such a disturbance, and in the majority of cases the faults occur in some apparently minor circuit element that ordinarily is not suspected. Locating the cause of these disorders often requires many hours of painstaking search and labor, that may tax to the limit the ingenuity and resources of a whole service department.

Much time and effort can be saved by following some systematic analysis method, but sometimes such jobs turn out to be purely a hit and miss proposition of trying this and trying that. Valuable information can often be obtained by questioning the customer about the frequency of the occurrence and the conditions under which the change in volume appears, whether it occurs while volume or tuning adjustments are being made, or when some one walks heavily across a section of the floor, or when certain lights in the house are turned on or off, etc. The owner will always be glad to give such information and often unknowingly suggest the cause.

Consulting the Manufacturer's service department may help in difficult cases, for frequently when such a disorder is due to some defective part, it has appeared in numerous other sets of the same type or series, and the service department will have the information on record and be glad to pass it on. Or, having a file of "case records" will often help in saving time, for when a job comes in on a particular make of receiver afflicted with fading, reference to the file may at once disclose the cause. The "Tricks of the Trade"

articles in different service magazines should be watched and records kept, for this data and information are generally very valuable and often contain the exact solution for the particular problem on hand.

Fading may be due either to a defective part within the receiver itself or to a faulty condition in the power supply lines or antenna-ground equipment. The antenna-ground system can quickly be eliminated by disconnecting the leads and observing if the intermittent action stops. If so, the antenna should be inspected. It may be that the antenna or lead-in touches another wire or some grounded part of the building, etc. When swaying in the wind the antenna may touch some object that absorbs some of the energy or even increases the pick-up action. The electrical contact between the antenna and lead-in may be poor, or ther may be a break in the lead-in wire itself. No wrap-around connections should be tolerated, only soldered joints. There may be a floating contact somewhere in the ground lead. All doubtful joints should be resoldered. If a window lead-in strip is used, that should not be overlooked.

It frequently occurs that when an electric light or other appliance is turned on or off, the volume of the radio set changes, this being more pronounced if the light and radio are on the same branch circuit. The cause of this undesirable effect is usually a poor ground on the radio. As one or more lights are turned on, they form additional shunts across the line, with the result that the radio-to-ground impedance is reduced and the volume comes up. The condition can often be corrected by establishing a good separate ground, or by connecting two .01-mfd paper condensers (400 or 600-volt) in series across the primary or A.C. line side of the power transformer and tying the middle connection to the set chassis. In some cases it may be that the effect is especially prominent at one certain switch, and shunting this switch with a 0.1-mfd condenser may cure the condition.

First the chassis should be thoroughly cleaned, all dust and dirt removed between the tuning condenser plates, and clean wiping contacts established between the rotor and frame. Also good contact should be assured between the condenser frame and chassis. Then the chassis should be examined for surface defects such as loose shielding elements, tubes loose in their sockets, screen grid caps loose, mounting rivets or set screws not drawn tight, etc. Defects of such a mechanical nature will usually manifest themselves if the chassis is given several good taps or jars. If the speaker and its connections appear good, the tubes should next be eliminated as a possible cause by operating the receiver with an entire set of new tubes. If a poor tube is the cause, it may be cheaper to replace all of them rather than spend several hours time trying them out one by one. Finally, if all these attempts fail to reveal the trouble, a thorough electrical inspection must be made of the inner circuit system, and this is generally a tedious job.

For such an electrical inspection the chassis should be turned upside down and a station tuned in with good volume. With a little bakelite or fiber rod all connections and soldered joints should be tested, and where the least doubt exists the joint should be resoldered with a good hot iron. The volume control should be inspected; and if it is of the wire wound type and appears corroded, it should be cleaned with carbon tetrachloride and a thin coating of pure white vaseline applied. If it persists in being coarse or noisy, it should be replaced. For the remainder of the analysis the following observations will serve as an excellent guide.

An analysis of a large number of service jobs that involved nearly every well known make of receiver and a tabulation of the causes found for fading and intermittent reception, showed that about 50% of the cases were due to defective bypass or coupling condensers and about 20% to defective resistors.

The condenser most frequently at fault is the detector-plate to audio-grid coupling condenser. Even a slight leak here will upset the circuit stability. Next are the detector plate to ground bypass and the screen grid bypass condensers. Following these are the various cathode bypass condensers, the R.F. secondary return condensers, the oscillator to 1st detector coupling condenser, the oscillator plate to ground bypass, the R. F. coupling condensers, and the A.V.C bypass condensers. All these condenser tests should be made after the radio set has been turned on for at least thirty minutes so that everything has been properly warmed up.

The various resistors should also be checked while that are hot, for otherwise the faults may not show up. The resistor most frequently the source of trouble is the screen grid series resistor. Often it is advisable to replace small quarter-watt resistors with others having a half or one-watt rating. The chief fault with carbon resistors is that they change their value and develop a bad contact at the terminal wires. Wire wound resistors do not change in value so readily, but often develops poor contacts where the terminal wires are welded to the resistance elements.

A. Source of trouble may lie in:

1. Antenna and lead-in system.
2. Electric wiring installation
3. Receiver chassis: (a) Mechanical surface defect. (b) Circuit component defect.

B. Antenna and lead-in system - see if:

1. Antenna or lead-in touches some grounded part of building or another wire.
2. Antenna sways in wind, or touches some other object.
3. Lead-in wire is broken, or has a floating ground.
4. Contact between antenna and lead-in is poor or corroded.

5. Window lead-in strip is defective.

C. Electric wiring installation - see if:

1. Receiver line fuse is loose or clips are corroded.

2. Cord has a broken wire, or cord wires are loose on plug.

3. Plug is loose in socket.

4. Line wires in outlet box are loose.

5. Mounting screws and lock nuts are not drawn tight in box.

D. Lights turned on or off affect volume - may be due to:

1. High resistance ground to receiver.

2. Antenna system poor or insufficient.

E. Mechanical surface defects on chassis - check for:

1. Tube loose in socket, or loose control grid cap.

2. Loose shielding element.

3. Mounting rivets or set screws not drawn tight.

4. Dirt in tuning condenser, or poor contact between rotor and frame.

F. Defective tube or tubes - checked by operating receiver with set of new tubes.

1. If tubes are at fault, replace entire set - time and money saved.

G. Defective circuit components.

1. Check volume control and replace if necessary.

(a) Clean with carbon tetrachloride and apply vaseline.

2. Bypass condenser defective - fading abrupt. Check in this order:

(a) Detector plate to audio grid coupling condenser.

(b) Detector plate bypass to ground or chassis.

(c) Screen grid bypass to ground.

(d) R.F. secondary return.

(e) Oscillator to 1st det. coupling condenser.

(f) Oscillator plate bypass to ground.

(g) A.V.C. bypass condensers.

3. Defective resistors - fading generally gradual. Check:

(a) Screen grid resistors and bleeder resistors, and replace with higher wattage rating.

(b) Detector bias resistor.

(c) Vol. Control bias limiting resistor.

(d) A.V.C. filter resistors, etc.

4. Other defective units, such as:

(a) Open antenna choke.

(b) Poor local-distance switch.

(c) Open R.F. choke.

(d) Broken R.F. transformer.

(e) Leaky filter condenser.

(f) Poor frequency range switch.

(g) Defective speaker voice coil.

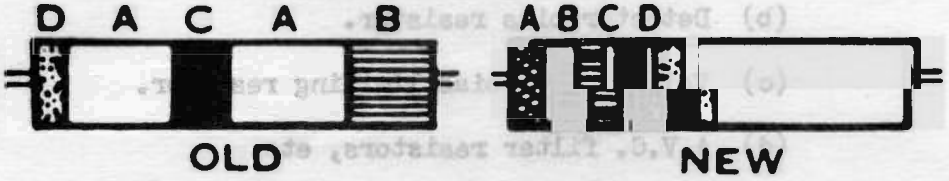
RMA RESISTOR COLOR CODE

Color codes have been adopted by radio parts and set manufacturers to designate by color the value of resistors and fixed condensers, so that one can tell by inspection what the actual value of such a unit is without having to resort to the use of some suitable measuring device. Without such a color code it would be impossible to tell the correct value of a defective resistor in a radio set.

The resistor color code includes ten colors, one color for each numerical digit, and the resistor is colored in four places. The first or end color shows the lst significant figure. The second color the 2nd significant figure. The third color indicates the number of ciphers to be added or the multiplier. The fourth color indicates the tolerance and when applied the tolerance is indicated by gold or silver.

RMA STANDARD RESISTOR COLOR CODE

Adopted November 14, 1939



A—Color for 1st significant figure.

B—Color for 2nd significant figure.

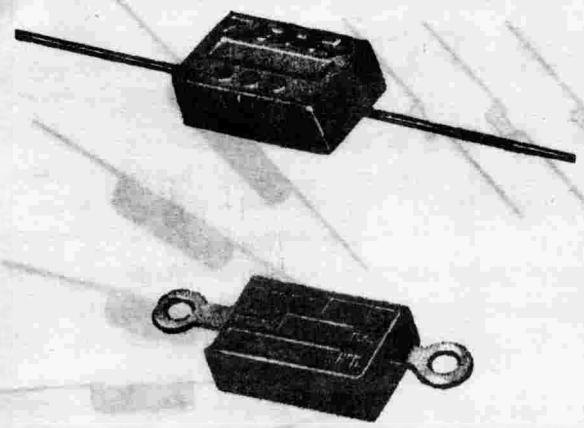
C—Color for No. of Ciphers or Multiplier.

D—Gold or Silver Indicates Tolerance, when applied.

Color	Significant Figure	Multiplying Value
Black	0	1
Brown	1	10
Red	2	100
Orange	3	1,000
Yellow	4	10,000
Green	5	100,000
Blue	6	1,000,000
Violet	7	10,000,000
Gray	8	100,000,000
White	9	1,000,000,000
Gold	± 5% Tolerance	0.1
Silver	±10% "	0.01
No Color	±20% "	

EXAMPLES

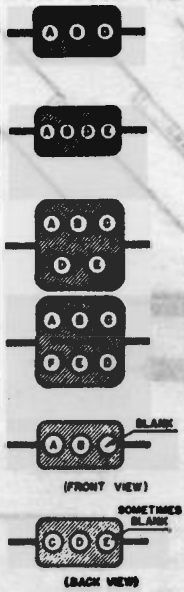
43,000 ohms	Yellow (4)	Orange (3)	Orange (X1000)
3,000 "	Orange (3)	Black (0)	Red (X100)
3.3 "	Orange (3)	Orange (3)	Gold (0.1)



MICA CAPACITORS

Above are shown two different types of mica capacitors both of which are of the postage stamp size and moulded in bakelite. The one at the top has two inch leads while the one below has lugs for renew connections. Mica capacitors of this type give capacity values between 10 and 10,000 mmfd.

MICA CAPACITOR COLOR CODE



The capacity of capacitors having a mica dielectric is conveniently specified by using a color code. The colored dots; A, B, C, D, E, and F; as shown at the left are used to indicate the capacitance in micro-microfareds of mica capacitors. The capacitance tolerance, as well as the DC test voltage; that is, the maximum voltage that the capacitor must withstand are also given as can be seen below.

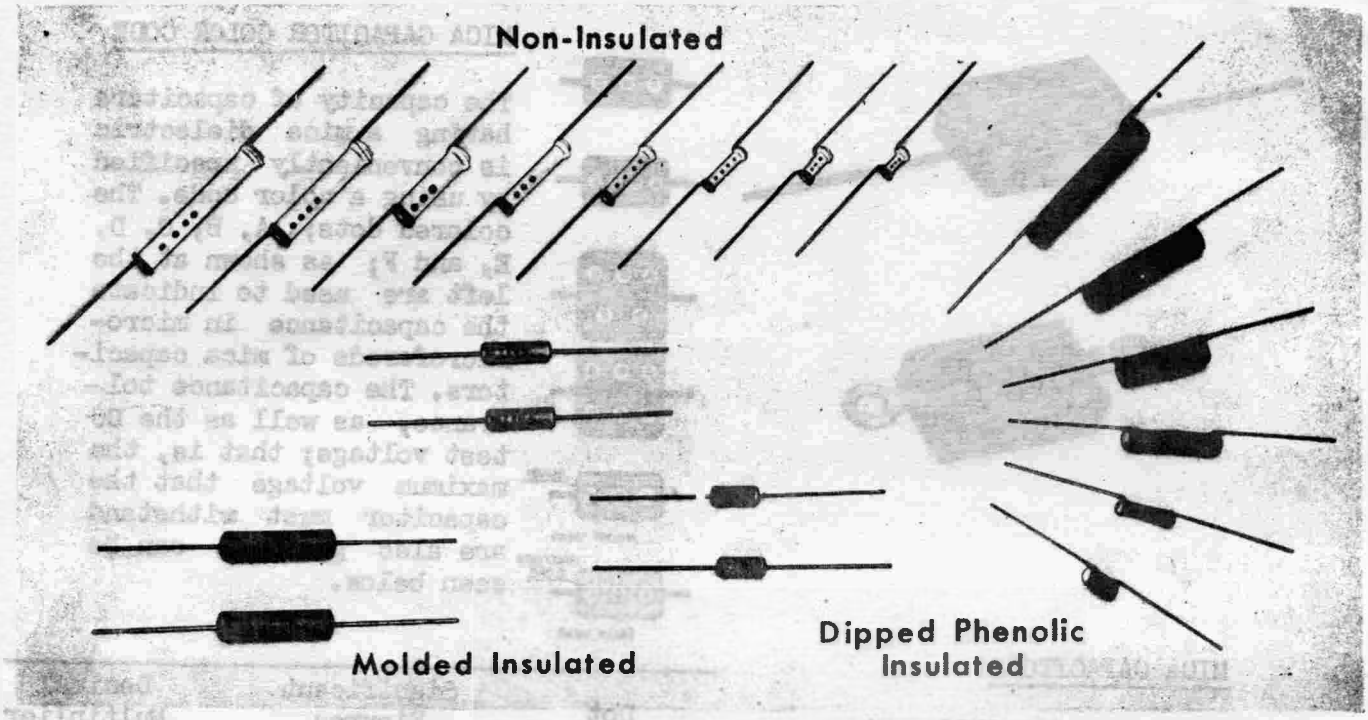
Dot Color	Significant Figures (A)	(B)	(C)	Decimal Multiplier (D)
Black	0	0	0	-
Brown	1	1	1	10
Red	2	2	2	100
Orange	3	3	3	1,000
Yellow	4	4	4	10,000
Green	5	5	5	100,000
Blue	6	6	6	1,000,000
Violet	7	7	7	10,000,000
Gray	8	8	8	100,000,000
White	9	9	9	1,000,000,000
Gold	-	-	-	0.1
Silver	-	-	-	0.01
No color	-	-	-	-

Dot Color	Capacitive Tolerance (E)	dc Text Voltage (F)
Black	—	—
Brown	1%	100
Red	2%	200
Orange	3%	300
Yellow	4%	400
Green	5%	500
Blue	6%	600
Violet	7%	700
Gray	8%	800
White	9%	900
Gold	5%	1,000
Silver	10%	2,000
No color	20%	500

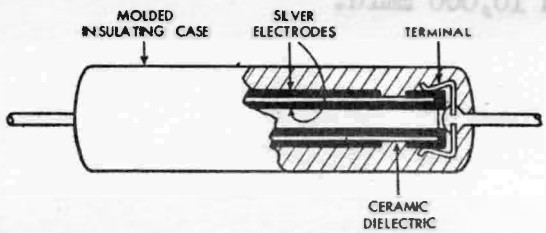
— Examples —

100 mmfd. A — Brown 1; B — Black 0; C — Black 0; D — Black X0; E — No color 20%; and F — Green 500 volts.

250 mmfd. A — Red 2; B — Green 5; C — Black 0; D — Black X0; E — No color 20%; and F — Green 500 volts.



Three different types of small fixed capacitors consisting essentially of a ceramic dielectric with silver electrodes fired at a very high temperature are shown above. By varying the composition of ceramic dielectric, various temperature characteristics may be obtained. These capacitors are known as temperature compensating ceramicons made by the Erie Resistor Corporation located at Erie, Penn. U.S.A. They manufacture the non-insulated, the moulded insulated and the dipped in phenolic insulated type capacitors. At the right is shown the cross sectional area of a moulded case insulated capacitor. Capacity values between 10 mmfd and 10,000 mmfd.



Cross Section Drawing of Molded Case Insulated Ceramicon

RMA TRANSFORMER COLOR CODE

The following color codes are recommended for identifying the terminal leads on the various transformers used in a radio receiver. Observing these colors will often save much time in tracing the wires in a set that is on hand for service and repairs. Of course, if the transformer makers did not observe this color code, then it is of no value as an aid in locating leads.

Primary (untapped): both leads - black

Primary (tapped):	start - black, tap - black and yellow finish - black and red
Rectifier filament:	both leads - yellow. If center-tapped tap is yellow and blue
Rectifier Plate: (Hi-voltage)	Plate leads - red center-tap lead - red and yellow
Amplifier Filament: (Winding No. 1)	both leads - green center-tap lead - green and yellow
Amplifier Filament: (Winding No. 2)	both leads - brown center-tap lead - brown and yellow
Amplifier Filament: (Winding No. 3)	both leads - slate center-tap lead - slate and yellow

Audio Transformers

Straight Audio:	plate - blue, pos. B - red, grid - green grid return - black
Push-Pull Input:	plate - blue, pos. B - red, both grids - green sec. center-tap - black
P. P. Interstage:	plate (start) - blue or brown, plate - brown pri. center-tap - red grid (start) - green or yellow, grid - green sec. center-tap - black

I. F. Transformers

I. F. Transformers:	primary plate - blue, pos. B - red secondary grid or diode - green, grid or diode return - black, center-tap - green and black

Practical Service Pointers

1. When replacing dial lights be sure that they are not only of the proper voltage rating, but also have the correct current rating as determined by the color of the bead, especially if the pilot lights are in series with the filament circuit.
2. When a receiver works on manual tuning but not on push-button tuning, this has often been found to be due to an open circuit in the push-button section of the antenna transformer.
3. When making a soldered connection to the chassis, if no bolts or rivets can be used, use a heavy duty soldering iron, for this will produce a higher tem-

perature and give a firmer joint. Use rosin for solder.

4. To remove sticky knobs of the "pull-off" type, place a string or strip of cloth back of the knobs and give a quick jerk. Using a screw driver or prying tool may scratch the surface of the panel.

5. Frying noises in a receiver are often caused by corroded contacts in the pilot lights. Clean the contact surfaces of the bulbs and sockets with fine sandpaper and carbon tetrachloride.

6. High noise level in an A.V.C. receiver can frequently be corrected by increasing the initial bias on the A.V.C. system through increasing the value of the bias resistor.

7. Intermittent reception and distortion are frequently caused by a defective coupling condenser between the 2nd detector plate and grid of the audio amplifier. This condenser is a common source of trouble.

8. No reception over the high-frequency range of a receiver of the superheterodyne type can frequently be corrected by reducing the value of the oscillator cathode bias resistor.

9. Generally when replacing an R.F. (or I.F.) shorted plate or screen bypass condenser, it is also advisable to replace the series resistor, for the condenser breakdown often damages the resistor also.

10. Weak and distorted reception with all tubes lighting, is usually caused by leaky or shorted bypass condensers, especially if the condensers are of the block type form.

11. Excessive noise between stations in wide-range A.V.C. receivers can often be reduced through cutting down the gain in the I.F. stage by increasing the value of the cathode bias resistor.

12. No reception over portions of the tuning range, especially the low frequency end, is frequently caused by defective resistors or bypass condensers in the

cathode circuit of the mixer tube.

13. Frequent rectifier tube burn-outs in A.C.-D.C. sets are usually caused by intermittent filter condenser shorts, and can be prevented by connecting a 50 or 100-ohm current limiting resistor into each plate lead of the rectifier tube.

14. In battery operated portable receivers it is very important to have the correct polarity of the A-battery leads, for a reverse connection may greatly increase the B-battery drain and hence shorten the life of the B-battery.

15. Poor tuning eye action is often caused by a defective series resistor that has changed in value. Replacing the resistor will generally correct such action.

16. Intermittent oscillator action is often caused by poor contacts in the band selector switch. This can be corrected by cleaning the contacts with carbon tetrachloride and tightening the contacts with a hammer and punch.

17. When a receiver of the superheterodyne type does not track properly over the entire tuning range, this trouble can often be corrected by changing the I.F. to a value above or below the recorded peak frequency.

18. Lack of out-put power (volume) in a receiver employing a single output tube can generally be corrected by connecting a larger bypass condenser (about 25 mfd) across the cathode bias resistor.

19. Noisy tuning in motor-driven automatic tuning systems can usually be quited by connecting a .1-mfd. condenser from the hot side of the motor to ground or chassis.

20. Low volume and poor tone are sometimes caused by one section of the primary of the output transformer being open or partially short-circuited.

21. A bad hiss can be caused by a defective mixer tube or by low filament voltage on the mixer tube. The filament winding may be partially shorted, requiring a new power transformer.

22. Intermittent low-frequency motor boating is often caused by loose shielding elements, especially I.F. transformer cans. Make complete mechanical inspection and reset any loose rivets.

23. The tone quality of many receivers with a single output tube can often be improved by connecting a larger bypass condenser (up to 20 mfds) across the cathode bias resistor of the output tube.

24. Noise in carbon type volume controls can in many cases be eliminated by cleaning the carbon element with a soft rubber eraser.

25. Intermittent and noisy operation are often caused by a weak end spring on the gang condenser. This results in poor contact between the rotor and frame. Sandpaper all contact surfaces.

26. Tone quality of many receivers employing a push-pull output can be improved by connecting a 10,000-ohm resistor across the primary of the push-pull input transformer.

27. To prevent slipping in friction drive dials, sprinkle Rosin Powder on the friction surfaces, and proper action will be restored.

28. The tone quality and gain in many midget receivers can be improved by installing new coupling condensers (try different sizes) in the 2nd detector-to-audio resistance coupler. Sometimes using resistors of different values will also help greatly.

29. Rattles and noises in midget sets can often be eliminated by slipping small felt washers over the control shafts and using different knobs. Also, the escutcheons may be loose and need tightening.

30. Whistling and squealing in A.C.-D.C. midgets is usually caused by the electrolytic filter condensers having lost their capacity due to drying out from the excess heat.

31. Stray pickup of static or unwanted signals can often be eliminated by covering the under side of the chassis with a metal shielding plate well bonded

to the chassis.

32. Rattling of the paper diaphragm of a cone speaker can usually be remedied by applying a thin coat of rubber cement to both sides of the diaphragm.

33. A power transformer designed for a Class A audio amplifier cannot be used in a Class B system on account of the heavy plate current drawn intermittently by the Class B amplifier.

34. A low ratio audio transformer with a large iron core and high impedance primary of many turns will give more volume than a smaller and more cheaply built high ratio transformer.

35. In midget sets in which the ground return of the power circuit is made to the slider terminal on the volume control, noisy control action often sets in. This can be corrected by shunting a wire from the slider terminal directly to chassis.

36. When replacing coupling condensers, try larger capacities, for if the speaker can handle the lower notes, this will improve the tone quality greatly. The same applies to audio cathode bypass condensers.

37. An excellent anti-slip dial compound can be made by dissolving rosin in alcohol. This solution is very effective and is also easily applied.

38. Powdered graphite mixed with vaseline and applied sparingly, makes a dandy lubricant for tuning condensers and volume control shafts.

39. To remove the sealing compound from enclosed units, freeze the unit in a refrigerator. The compound will then chip away easily and leave a clean job.

40. Distortion in AC-DC sets using 25L6G tubes is often due to a defective tube, even though the tube tests good. Install a new 25L6G and the distortion will disappear.

41. In some locations it may be desirable to reduce the R.F. gain of high sensitivity receivers in order to reduce noise pick-up between stations. This can be effected by adding a 500 to 3000-ohm resistor, depending upon the

reduction in gain desired, and a .05 bypass condenser, in series with the I.F. cathode lead. If the circuit already has a minimum bias resistor of 100 ohms or so in the cathode lead, this additional resistance can be connected in series with it, until the desired operating conditions are established.

EXAMINATION QUESTIONS ON FOLLOWING PAGES.