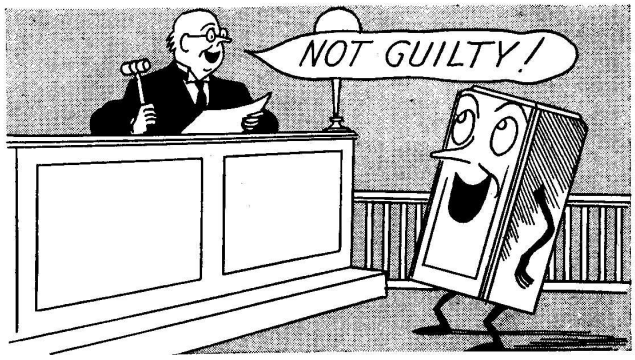
FIXING RADIOS

No. 33 Recognizing Complaints Not Caused by Receiver Defects

RADIO SERVICING METHODS

FM10M348 1948 Edition Printed in U.S.A.

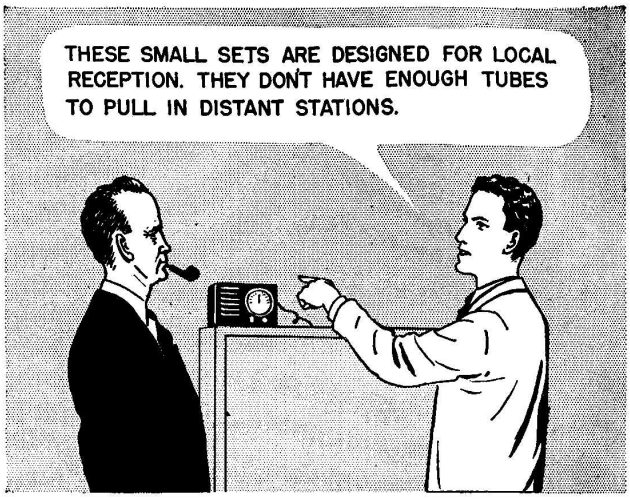


Recognizing Complaints Not Caused by Receiver Defects

PERHAPS, now that you have had more technical radio training, you find it a little hard to realize that most people are completely ignorant of how and why a radio works. Yet it is a fact. Generally speaking, it is a fortunate fact for you—after all, if everyone were thoroughly familiar with the workings of a set, servicemen would find it hard to make a living. But there will be times in your servicing career when you will wish a customer knew a little more about his set—times when you will make a long trip to his home only to find that he is complaining about something that is perfectly natural and simply can't be helped.

Such fruitless calls come to every serviceman. They are irritating and profitless—since you are not usually justified in charging more than your minimum service charge—but you must learn to expect them. In fact, very often you can get some benefit from them in the way of customer good will, just by taking a few minutes to explain carefully and courteously what the trouble is and why it cannot be remedied.

The complaints to which we refer are those that are not caused by a *defect* in the receiver. An example is the complaint, fairly common in the summer, that "my set doesn't pick up the stations I used to get last winter." As you know, this is not the fault of the set; reception



When you find that a customer's complaint is that his little a.c.-d.c. set doesn't have the performance of a large console receiver, remember to be diplomatic. Don't insult his set—he bought it, and he may resent your remarks as a slur on his judgment. Point out the limitations of his set in such a way that he will not take offense. For example, you might use the words of the serviceman in the illustration above when your customer complains that he can't get a distant station. DON'T say, "You can't expect a cheap set like this one to be any good."

is naturally poorer in the summer, and there is nothing you can do to change that fact. But many customers, lacking your technical knowledge, are not aware of the differences in reception at various times of the year; consequently, you will get service calls to fix "weak" receivers that are actually in perfectly good condition.

Others of these complaints will be caused by the customer's misunderstandings of the capabilities of his set. For example, you know that the selectivity and tone quality of a five-tube midget set are far inferior to those of a ten-tube console receiver, if both are properly designed. The average set owner realizes this only vaguely, if at all. To him, both sets are simply radios; therefore, both should bring in both local and distant stations with ample volume and clarity, and with a minimum of interference from other stations.

This Booklet discusses the common complaints of these kinds that you are apt to meet. They are treated under the usual headings of dead set, weak reception, and so forth. However, this Booklet differs from most of the preceding ones in one respect: very often there is no service information on the complaints, since there is no way of servicing them. Instead, in such cases, we have pointed out what the causes of the condition are, so that you can, in turn, explain them to your customers. Although this is not service data, it is none the less valuable information; you are going to have to make such explanations fairly often.

DEAD RECEIVER

When you are called upon to service a dead receiver, find out first just how dead it is. Determine whether the set is absolutely and completely dead—no sign of life whatsoever, no sounds from the loudspeaker, and no lights in any of the tubes or the pilot lamp.

If so, you will do well to check up on the installation. It is rather rare for a set defect to make the set absolutely lifeless. Rather, some defect in the installation that has interrupted the supply of power to the set is most often to blame—such things as the power cord's being out of the wall outlet, the wall outlet's being dead because of a blown house fuse, etc. (You can check the wall outlet by plugging a lamp into it.)

If you live in a district that has both a.c. and d.c. power lines, make sure the receiver is connected to the kind of power for which it is designed. You may find that an a.c. receiver has been plugged into a d.c. outlet. Naturally, the set won't work; in fact, you will probably find that the primary of the power transformer has been burned out.

Set Shows Some Life. On the other hand, if the set has some degree of liveness—some slight operating noise and hum from the speaker, lights visible in tube filaments or pilot lamps, or some bands alive while the others are dead—it is probable that some defect exists in the receiver. However, there is a possibility that one of the following outside conditions is to blame.

Occasionally a complete loss of reception occurs on

one or more short-wave bands because of natural phenomena, such as ionospheric disturbances caused by sun spots. When these spots occur, the ionic layers that reflect radio waves often shift up and down and thus change the reflection pattern. Also, at certain times, magnetic storms of sufficient intensity to block all reception on certain short-wave bands may occur.

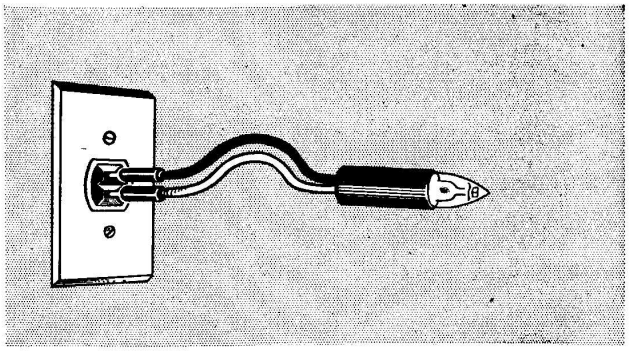
When a customer complains that one or more short-wave bands are dead, check carefully to see whether other bands are alive. If they are, and the noise level and the fading on these bands appear unusually intense, it is quite probable that ionospheric disturbances are to blame. In this case, just wait for an hour or so. Usually the bands will start to come back to life in that length of time, thus indicating that the trouble is not in the preselector or oscillator stages of the set. Also, noise on the supposedly dead bands is a further indication that the set is probably all right.

Sometimes a customer believes his set has gone dead because he cannot get some local station, when actually the trouble is that the station has gone off the air temporarily. Always suspect this if a set plays on most stations, but does not pick up a local. It is possible for a set to go dead on just a part of its tuning range, but the chances are that the station is off the air instead. To make a quick check, try to pick up the station on another receiver. If you can't tune it in on either set, you can safely assume that the station has had a breakdown.

When a receiver is located in a well shielded place, such as within a steel-framework building, an outside antenna may be necessary for reception. If something should happen to the antenna, the receiver owner may believe his set has gone dead. Usually, careful tuning over all wave bands will disclose some slight pickup on some bands, which should lead you to think that the antenna system may be defective.

WEAK RECEPTION

A defective antenna system can cause weak reception rather than a dead set, and, of course, there are a number of set defects that must be considered. However, sometimes a set owner complains that reception is weak when



When a set is completely dead, always check the wall outlet to make sure it is "hot." A neon test light like this one is a handy device for testing the outlet. If you prefer, you can plug in a lamp or use your voltmeter to make the check. If you find no voltage at the outlet, most likely a fuse is blown in the power line.

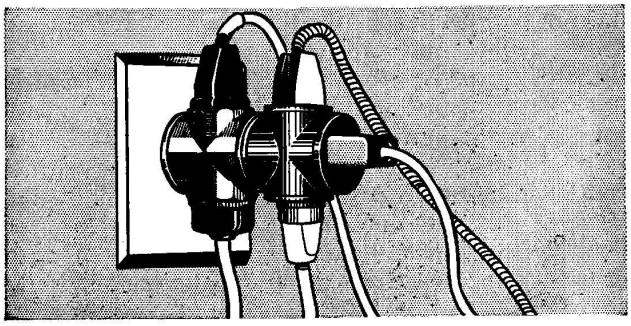
he tries to pick up distant stations under adverse conditions, or with a radio not designed for this reception. In these cases, the customer's complaint of weak reception is not really justified; true, reception is not good, but it is as good as can be reasonably expected. When you get a complaint of this sort, your task will be to explain why the reception is poor rather than to try to correct it.

When the owner tells you that he once picked up a distant station satisfactorily, but no longer does so, you should of course make sure the set is up to normal in sensitivity. However, before you go to any great trouble to check sensitivity, consider carefully the conditions under which the change in reception occurred. Reception of distant stations is always better at night than in the daytime. Therefore, if the owner's complaint is that he receives a station at night and not in the daytime, or that he heard it well last winter and does not hear it so well in the summer time, then the normal limitations of reception are probably responsible for the change. (Once in a great while, he may be unable to get a station any more because the station has made some change in the directivity of its antenna system or in its power.)

In this connection, remember that reception on different short-wave bands varies not only with the season of the year but also with the hour of the day. For instance, the 19-meter band (16 megacycles) works best during the daytime, and even then stations that are less than about 1500 miles away may be difficult to pick up. On the other hand, the 24- and 31-meter bands will give fairly good reception for stations over 2000 miles away both day and night. For good daylight reception over comparatively short distances, the 49-meter band is more reliable. Most short-wave stations broadcast simultaneously in several bands, so the set owner can try tuning for the desired station in the band that is most favorable at the listening time.

Furthermore, if the receiver owner is a short-wave enthusiast, he must realize that many of the short-wave programs are beamed in specific directions. If a station is broadcasting a program intended for a country or a location in a direction far removed from that of the receiver, then he should not expect to pick up that station very well, if at all, during those hours. On the other hand, when the station shifts to an antenna system beaming the program in his direction, he may find the same station coming in with practically the same strength as a local.

Sometimes you will find a radio plugged into not just one, but a combination of cube taps. This is almost sure to cause trouble—eventually, if not at the moment. Plug the set directly into the wall outlet and advise your customer to connect the other devices elsewhere.



► Fairly often, you will find that the trouble is that the receiver owner expects too much. He may suddenly have decided to listen to some distant station that his receiver is incapable of getting satisfactorily. There may be many reasons why his set can't bring in the particular station he wants. The power of the station to which he wants to listen may be inadequate for the distance, even with the best of receivers and antennas. There may be something about his location that prevents good reception from that particular station. The receiver antenna system may be entirely inadequate for long-distance reception. Finally, the set itself may be too insensitive because of its design limitations. Naturally, a small receiver that has been manufactured to sell for a low price does not have the number of stages required for high sensitivity.

► When you are attempting to judge how much sensitivity a set can reasonably be expected to have, remember that the number of tubes in a receiver is not as important as is the way that these tubes are used. Such tubes as tuning-eye indicators, phase inverters, a.v.c. tubes, noise-squelch tubes, and tone-control tubes, do not amplify the signals; neither do rectifiers and diode detectors. In determining what a receiver should be capable of doing, you must consider only those tubes that *amplify* the signal. Even this is not a perfect guide, because manufacturers follow different design practices. One manufacturer may make his sets highly sensitive, another may sacrifice sensitivity for better tone quality, still another may reduce the gain in his set to prevent oscillation—yet all may use the same number of amplifying tubes. These design factors are hard to explain to a customer, and you must be familiar with the receiver before you can be absolutely sure about them.

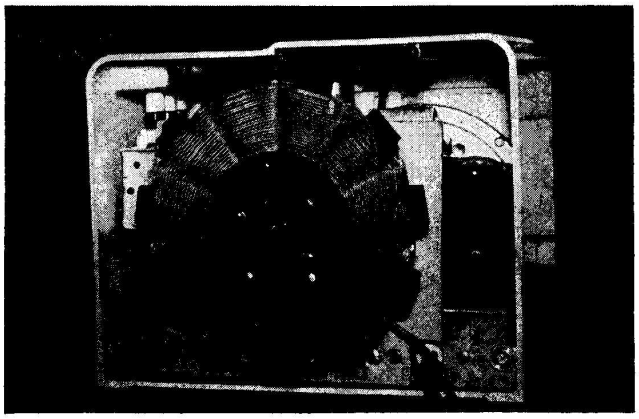
Naturally, if you find every receiver of a particular make and model operates at about the same level, then they must be designed to work that way. But don't make snap judgments after hearing only one or two sets. Remember that radio receivers are production devices—they are allowed rather wide variations in their response characteristics. You may find one that has unusually high sensitivity, far more than others of this same

model. Therefore, don't jump to the conclusion that, because one was extra peppy, all should be that way. That one set could have been the model in which all the tolerances added in the proper direction to give extra pep.

► Another design factor that can affect the sensitivity of a set is the kind of antenna intended to be used with it. Quite a number of modern receivers use loop antennas, some of which are rather directional in their characteristics. For this reason, many of the larger console sets are arranged so that the loop antenna may be rotated for best reception from a particular direction. Perhaps the receiver owner is unaware of this, or someone may have changed the loop position. When you meet a set of this sort, always try rotating the loop to see if you can improve the response from the desired station.

In midget receivers, the loop antenna is generally fastened to the cabinet in such a manner that the cabinet itself must be rotated to turn the loop. Try this anyway. If you find a particular position that gives much better results, demonstrate this fact to the owner, and then let him see if he can find a better location in the room for the radio. Incidentally, the directional characteristic of the loop may be the reason for the complaint of weak reception, because the receiver may have been moved to a position in which reception is poor.

A loop antenna receives poorest when it is turned at right angles to the direction from which the signal is coming.



FADING SIGNALS

Since practically all sets now have a.v.c. circuits, receiver owners have become accustomed to hearing local stations come in without fading. A customer who happens to turn on a distant station may believe that something has gone wrong with his set if the station fades in and out. This is a natural condition, however, not a set defect. The a.v.c. circuit cannot do anything about a signal that fades below the threshold level. Therefore, it is entirely natural for signals from distant stations to fade in and out as reception conditions vary. Interference between the ground waves and the sky waves is a common reason for fading in the broadcast band, and shifting of the Heaviside layer accounts for much of the short-wave fading.

Interference between ground and sky waves is more pronounced with stations from 50 to 150 miles away than it is from more distant stations. This is because this is the point where the ground wave (radiation that travels close to the earth's surface) and the sky wave (radiation that travels outward from the earth, then is reflected back) happen to be at about the same strength, but out of phase with each other. Therefore, it is quite possible that some semi-distant station of this kind will be subject to severe fading, while a more distant station can be received reliably.

Two kinds of fading exist. One is relatively slow: the station is received for varying periods of time, then gradually fades out, and a few minutes later fades back in. The other kind of fading is very rapid: the station fades in and out in an extremely short period of time. This very rapid fading may completely destroy the intelligibility of the signal, leaving nothing but a hash or "monkey chatter."

Insofar as auto receivers are concerned, you can expect the signal to fade in and out as the car passes over a bridge, travels along a street car line having an overhead trolley, or moves to a position where a tall steel-frame building comes between the car and the transmitter of the station being received. These are all normal effects; don't waste time trying to eliminate them.

INTERMITTENT RECEPTION

Intermittent reception is seldom caused by anything but a receiver defect. If you are sure that intermittency is the complaint, you can proceed to check the receiver at once without bothering to consider the possibility that some outside influence is really to blame.

However, sometimes it is hard to tell whether a set is actually intermittent. The prime example is a set that changes radically in its volume when light switches are snapped on or off. This may mean that the set has an intermittent defect, and that the line voltage surges caused by snapping the switches are shocking the receiver into and out of normal operation. On the other hand, it may mean that the antenna-ground installation is poor, and that the receiver is depending on signals picked up by the power line. If so, as you change the resistance across the power line by adding or taking away the lights and other appliances, the signal strength will naturally vary. You may have to try the receiver in another location to determine which condition exists.

INTERFERENCE

The amount of interference between signals will depend greatly upon the selectivity of the receiver and the listening habits of the receiver owner.

Signal interference may be divided into three classes: *1*, interference from stations on the *same* frequency as the one tuned in; *2*, interference from stations on frequencies *adjacent* to the one tuned in; and *3*, interference from stations on frequencies widely *different* from the one tuned in.

Stations on Same Frequency. Interference from signals originating on the same frequency is practically a hopeless case. This occurs mostly when you try to listen to a low-power station at the high-frequency end of the broadcast band, where there are frequently as many as fifty or more stations broadcasting on the same frequency. In the daytime, only the nearest station is likely to be received. However, at night, particularly in winter, more distant stations on this same frequency may easily be picked up.

Most console receivers have open backs to permit the escape of the sound waves that result from the movement of the back surface of the speaker cone. If the receiver is placed too close to a wall, these sound waves will be trapped within the cabinet, usually causing rattles and hollow booming noises. To prevent this effect, the best position for a receiver is across the corner of a room, as shown above. If the customer prefers the receiver parallel to a wall, make sure that it is at least two or three inches out from the wall.

Once in a while a radical change in the antenna will prove helpful. Strangely, you will have to experiment to determine whether you need a *better* antenna or a *poorer* one! Sometimes a better antenna will provide sufficient signal from the desired station to allow the a.v.c. system of the radio to reduce the sensitivity enough to minimize reception from the more distant station. On the other hand, you may, by reducing the amount of pickup by the antenna system, sometimes eliminate pickup from the more distant interfering station. Repositioning even the same antenna may help in some cases. Antennas of the inverted L type are somewhat directional, so sometimes rotation of the antenna may tend to favor the desired signal. However, if the undesired signal originates from a station of sufficient power, or from one sufficiently close by, there is little you can do about this condition.

Adjacent Channel Interference. Interference from stations on adjacent channels is another condition about which little can be done in most cases.

You are not apt to run into this difficulty with sets that are highly selective, except when the customer at-

tempts to pick up a weak, distant station that is on a band adjacent to a powerful local. Naturally, in such a case, the more powerful station is almost certain to cause interference no matter how selective the set is.

Adjacent-channel interference is most apt to occur, as you would expect, in sets that have a broad response. A t.r.f. set, for example, always tunes broadly, and is frequently the victim of such interference. High-fidelity a.m. receivers are another kind that tune broadly and are therefore subject to interference; in fact, they are designed only for reception of local stations and for use under conditions where the desired signal is many times stronger than any undesired signal that is likely to interfere.

The sensitivity of the set has a bearing on whether it is likely to have trouble with adjacent-channel interference. Naturally, the more sensitive the set, the more likely it is to pick up undesired signals in addition to the one you want.

Once in a while, if only one station is causing the trouble, you can cut down the amount of signal from this interfering station by using a wave trap in the antenna circuit of the receiver. To do so, tune the wave trap to the interfering signal, and adjust it until the undesired signal comes through with minimum volume. Whether or not this method works depends mostly on how close together the desired and undesired signals are. If they are only 10 or 20 kc. apart, the wave trap may reduce the strength of the desired signal almost as much as it does that of the undesired; in that case, of course, the wave trap is of little use.

Other Interferences. Interference from stations on the same or adjacent frequencies can occur in both t.r.f. and superheterodyne receivers. In addition, the superheterodyne (but not the t.r.f.) is subject to a number of kinds of interference from stations on frequencies far removed from the desired one.

Usually something can be done to clear up interferences of this last kind. Let's briefly review what they are (you studied them in your Fundamental Course), and see what can be done about them.

► Perhaps the most common of these interferences is

caused by a nearby code station or long-wave weather station that happens to be on a frequency equal to the i.f. frequency of a superheterodyne. If the signal from this station is strong enough to get through the preselector of the set, it will travel directly through the i.f. amplifier and cause interference at all points on the dial. Interference of this kind can also be created by a station with a frequency equal to one-half the i.f. frequency of the superheterodyne; in this case, the second harmonic of the station frequency (produced in the receiver) causes the trouble.

The best cure for this difficulty is to shift the i.f. frequency 10 or 15 kilocycles, if this can be done without seriously upsetting the dial calibration. Another possible cure is to use a wave trap in the antenna circuit, tuning the trap to the i.f. frequency of the set and adjusting it for minimum response at this frequency. Fig. *1* shows two ways of connecting wave traps for this purpose. After installing the trap by either method, feed a strong i.f. signal from a signal generator into the antenna-ground terminal of the set, then adjust the trap until the output of the set is at a minimum.

► Another common trouble is

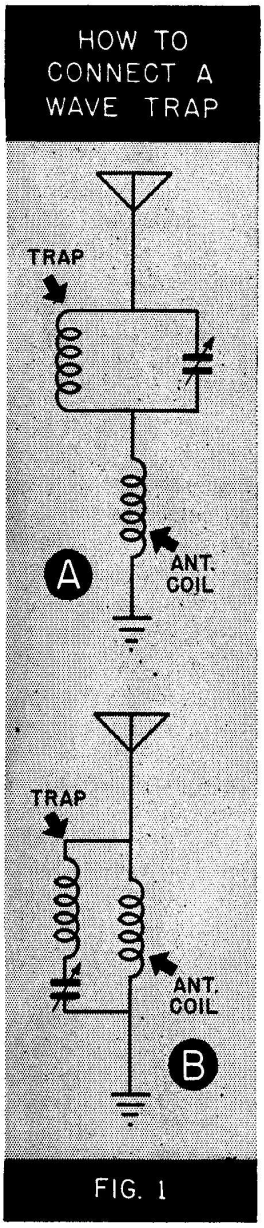


FIG. 1

image interference. As you know, in the superheterodyne the desired incoming signal frequency is normally *below* the oscillator frequency by the amount of the i.f. frequency. However, if there is a strong station at a frequency *above* the oscillator frequency by the amount of the i.f., it may be able to get through the preselector with sufficient strength to mix with the oscillator and produce the i.f. signal. (This interfering signal is equal to a frequency twice the i.f. frequency above the desired signal.)

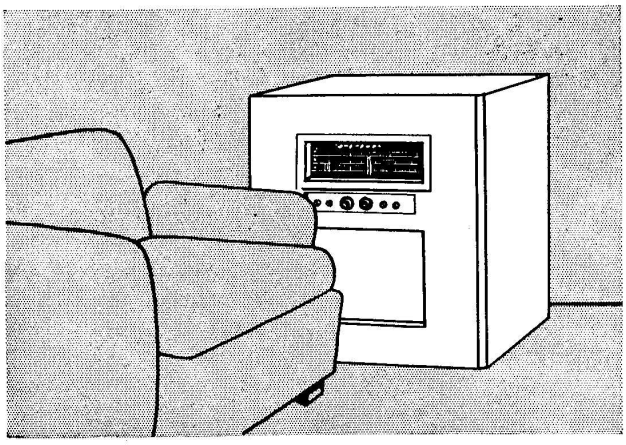
Image interference normally occurs only when you are very close to a powerful local station, or when the preselector of the receiver is not of the best quality. Sometimes it is caused by too long an antenna, because the loading reflected into the resonant circuit broadens the preselector response.

When you find image interference, try re-aligning the entire receiver, particularly the preselector.

If only one desired station is interfered with, it is possible to use a wave trap in the antenna circuit, tuned to the interfering signal and adjusted for minimum response. Another possible solution is to shift the i.f. value about 10 kc. This moves the interfering signal to another point on the dial, and thus lets the desired signal come through clearly.

► A complaint somewhat similar to image interference may be caused if the set oscillator generates strong harmonics. One of these harmonics may combine with some high-frequency signal to produce the i.f. frequency of the set. Interference from this source is rather unusual: for one thing, most oscillators are limited in harmonic output. For another, the frequency of the undesired signal would have to be, at the very least, over twice the frequency of the desired signal for this interference to occur; if the radio is of reasonably good quality, it should be able to keep out even a very strong signal that is so far removed from the desired one. However, if you should encounter a case of this kind, you can again use a wave trap tuned to the interfering signal. There is very little likelihood of there being more than one station in any one location powerful enough to cause this kind of trouble.

► In a few rare locations, two stations may be picked



If the customer complains that the tone of his receiver is not clear, make sure the set is not placed so that a large chair or other piece of overstuffed furniture is close to it and directly in the path of the sound waves produced by the loudspeaker. The chair will tend to absorb high frequencies, creating a muffled sound.

up whose frequencies differ by exactly the i.f. value of a radio. In this case, these two station signals can beat together, without using the oscillator signal in the superheterodyne, to produce an i.f. frequency capable of being amplified by the i.f. stages of the receiver. If the combining occurs outside the set, the only cure is to shift the i.f. about 10 kc. However, if the first detector stage does the combining, a wave trap may be used, tuned to either of the two station frequencies.

► Some customers may call to your attention the fact that a strong local station is received at two points on the dial. Usually, some high-frequency broadcast station is picked up at the low-frequency end of the dial. This is repeat-point reception. It occurs because, at this dial setting, the oscillator frequency is below the local station frequency by the amount of the i.f., and the local station produces a signal strong enough to get through the preselector. The low-frequency point on the dial where the high-frequency station is heard a second time is called the "repeat point."

As you just learned, this condition is what causes

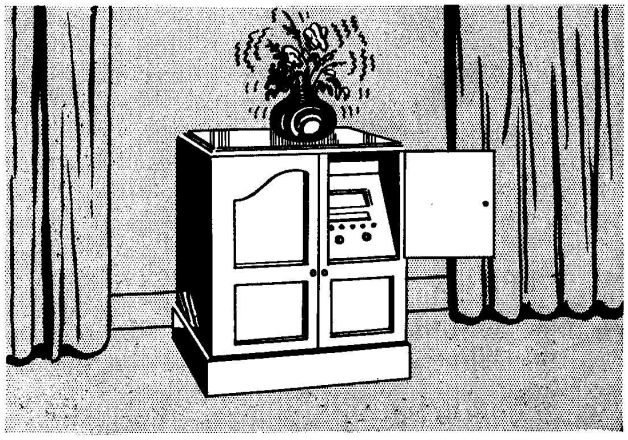
image interference if some desired station is at the same point on the dial as the repeat point of the high-frequency station. If no station comes in at the repeat points, just explain to the customer why this is so, but do nothing about it.

DISTORTION

Ordinarily, distortion is caused by a receiver defect. In broadcast-band reception, the only exception that is not the fault of the customer occurs when a local station is so powerful that it overloads the receiver. On the short-wave bands, a form of distortion may occur from time to time because of rapid fading of the signal. In these cases, it is even possible for different frequencies to fade at different time intervals; this form of selective fading may wipe out a portion of the side band of some signal being received, thus distorting the signal.

Sometimes the distortion that a customer complains about is caused by his mistuning of his radio. Some people seem to be unable to tune a receiver properly,

A complaint that the receiver makes a rattling or buzzing sound usually means that the speaker cone is unglued. However, sometimes such a noise occurs because a vase or some other object that has been placed on top of the radio is set into vibration by the speaker. Loose hardware on the set, such as an escutcheon plate or a door handle, may also buzz or rattle for the same reason.



even with the aid of a tuning eye or a tuning meter. If the customer complains of distortion, and none is apparent when you tune in the radio, have him tune in several stations. If you find that he is not tuning the radio exactly, point this out to him and show him how to do it properly.

NOISE

Noise is a complaint that may well be caused by something outside the receiver and its installation. Atmospheric disturbances cause plenty of interference on a.m. receivers, and man-made interference, such as that arising from motors, switch contacts, etc., may be heard to some extent even on f.m. receivers.

Whenever you have a complaint of noise, follow the suggestions given in another RSM Booklet to localize the difficulty. Obviously, if the noise can be cut out by disconnecting the antenna or ground, or by using a power-line filter, then it is arising outside the radio and is caused by either atmospheric trouble or man-made interference.

There are a few facts about noise, however, that you may have to explain at some time. A receiver owner may notice that the amount of noise heard between stations is much higher than that heard when a station is tuned in. He may want to know why, or may think that something is the matter with the receiver. As you know, this condition is natural: when no signal is tuned in, the a.v.c. circuit has the receiver operating at maximum sensitivity, so plenty of noise is picked up. When a signal is tuned in, the sensitivity of the set is reduced, so the amount of noise picked up is less. Furthermore, to a listener, the presence of the signal tends to mask some of the noise. Therefore, it is entirely natural to get higher noise levels between stations. (This problem of noise between stations has led to the development of inter-station noise suppression systems for many services—such as police radio—where it is necessary to listen in constantly but where there may not be a signal at all times.)

Of course, you are familiar with the noises caused by atmospheric disturbances that are heard on a.m. receiv-

The local oscillators of some receivers, portables in particular, will stop working if the line voltage drops even a few volts below normal. Suspect this when you get a complaint like that made by the customer in the sketch above. Turning on an electric iron, or any other high-wattage appliance, may cause a considerable drop in the line voltage at all outlets connected to the same circuit. This is especially apt to happen in older houses, where the wiring is often too small to carry heavy currents.

ers, particularly in the summer time. F.M. receivers are not troubled by atmospheric conditions, because limiter circuits, or discriminator circuits having limiter functions, cut out the noise before it reaches the speaker. This is an inherent design feature that cannot be built into a.m. receivers.

Sometimes a customer who has just purchased a receiver having short-wave bands does not realize that various forms of noise are heard on these bands that are not noticeable on the broadcast band. For instance, ignition interference from passing cars may be quite severe on certain short-wave bands. This is, of course, a random interference, since it will occur only when cars of certain types are passing.

About the only thing that you can do to minimize interference caused by car ignitions is to erect a noise-reducing antenna system as far away from the street as possible. Even this is not a cure-all, for some of this interference is very severe.

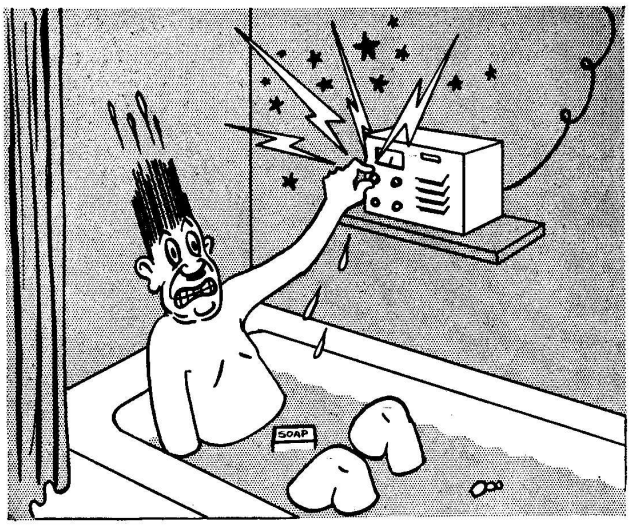
MISCELLANEOUS COMPLAINTS

There are a few other fairly common complaints that you should be prepared to meet. Since they do not fit into any of the previous categories, we have collected them into this final section.

A receiver owner may become alarmed because he notices that a spark is seen when the antenna lead is connected or disconnected from the receiver. Once in a while this is the result of a collection of static on the antenna, but more often it is caused by the design of the receiver. Many sets have a by-pass condenser connected from one side of the power line to the set chassis. If no ground is used on the receiver, and the antenna itself happens to be grounded, it is quite possible that the condenser will discharge, producing a visible spark, when the connection between the antenna and the set is made or broken. This sparking is not harmful; however, if you want to eliminate it, you can do so by grounding the chassis or by clearing up the ground on the antenna system. If you ground the chassis, the ground lead will always show a spark when it is connected or disconnected. (Of course, you cannot use a ground on an a.c.-d.c. receiver.)

► As we have explained elsewhere, it is easily possible to get a shock from an a.c.-d.c. set if it is one of the types in which the chassis is connected directly to one side of the power line. Most sets of this kind are well protected by a cardboard or wooden back on the receiver cabinet, but sometimes these are left off or are taken off by the customer. Should any ask you about this shock, explain why it occurs, and warn them to keep their hands away from the rear of the receiver.

► Watch out for a.c.-d.c. receivers in kitchens and bathrooms. Sometimes you will find that one has been set upon a refrigerator or a stove, and that some exposed mounting bolt touches these grounded objects. Once in a while, a house fuse may be blown by such a short circuit. When one of these receivers is used in a bathroom, make sure it is mounted well away from any possible ground. For the sake of safety, be particularly careful to see that the set is in such a position that it cannot be tuned or touched by anyone in the bathtub.



It is DANGEROUS to touch ANY electrical appliance when you are wet. If you find a radio in a bathroom, warn the owner not to tune it while he is in the tub. Better still, persuade him to move it to a location where a person in the tub cannot reach it.

► When an owner finds that a power cord of the Cordohm type, or a transformer, or the speaker field of his set becomes hot, he is apt to get excited about it—particularly if he makes the discovery when the receiver happens to be in need of repair. Of course, you can assure him that it is normal for these parts to get hot. However, make sure they are not hotter than they should be. Estimating what a safe degree of heat is requires some judgment, because some receivers run hotter than others. However, you can be pretty sure that something is wrong if the set becomes so hot that smoke appears.