

# HOW TO

## Troubleshoot and Repair Portable Cassette Recorders

HOMER L. DAVIDSON

PORTABLE CASSETTE PLAYERS AND RECORDERS (the ones that use standard Philips cassettes, not to be confused with mini- or micro-cassette devices) can be repaired as easily as any other tape units. Don't be afraid of their small size—the components may be a little closer together and you may have to work in a tighter space, but that's all. Servicing them can be easy when you follow the tips and information here.

If you have a well-equipped workbench you shouldn't need much in the way of additional equipment. If you don't have one, a take-up torque gauge may be needed for mechanical components. A VTVM (Vacuum Tube Volt-Meter) will do nicely for making head-azimuth adjustments, and for troubleshooting the amplifier section, you can use your signal generator, signal tracer, and scope.

### Cleaning and lubrication

Most sound and speed problems can be solved by a good clean-up and "lube job." A dirty record/playback head may be responsible for weak and distorted sound, and under- (or over-) lubrication can cause tape-speed to vary erratically.

When a recorder develops speed or sound problems, it's time for a cleanup and lubrication. Start at the erase and record/playback heads and clean them with alcohol and a soft-tipped cleaning stick. Critical points for cleaning are shown in Fig. 1. *Do not* use rubbing alcohol—it contains an additive that may leave a gummy deposit. Use pure isopropyl alcohol (available at your drugstore's prescription counter). If some oxide is packed into the gap area of the record/playback head, gently use the round end of the cleaning stick to remove it. You can get at the heads easily by putting the recorder in the RECORD mode; that moves them out into the open.

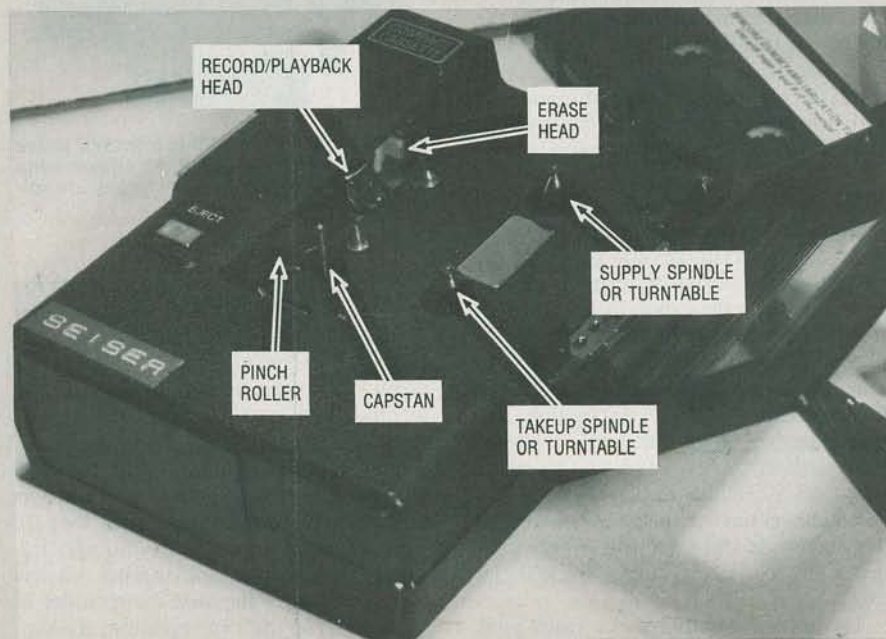
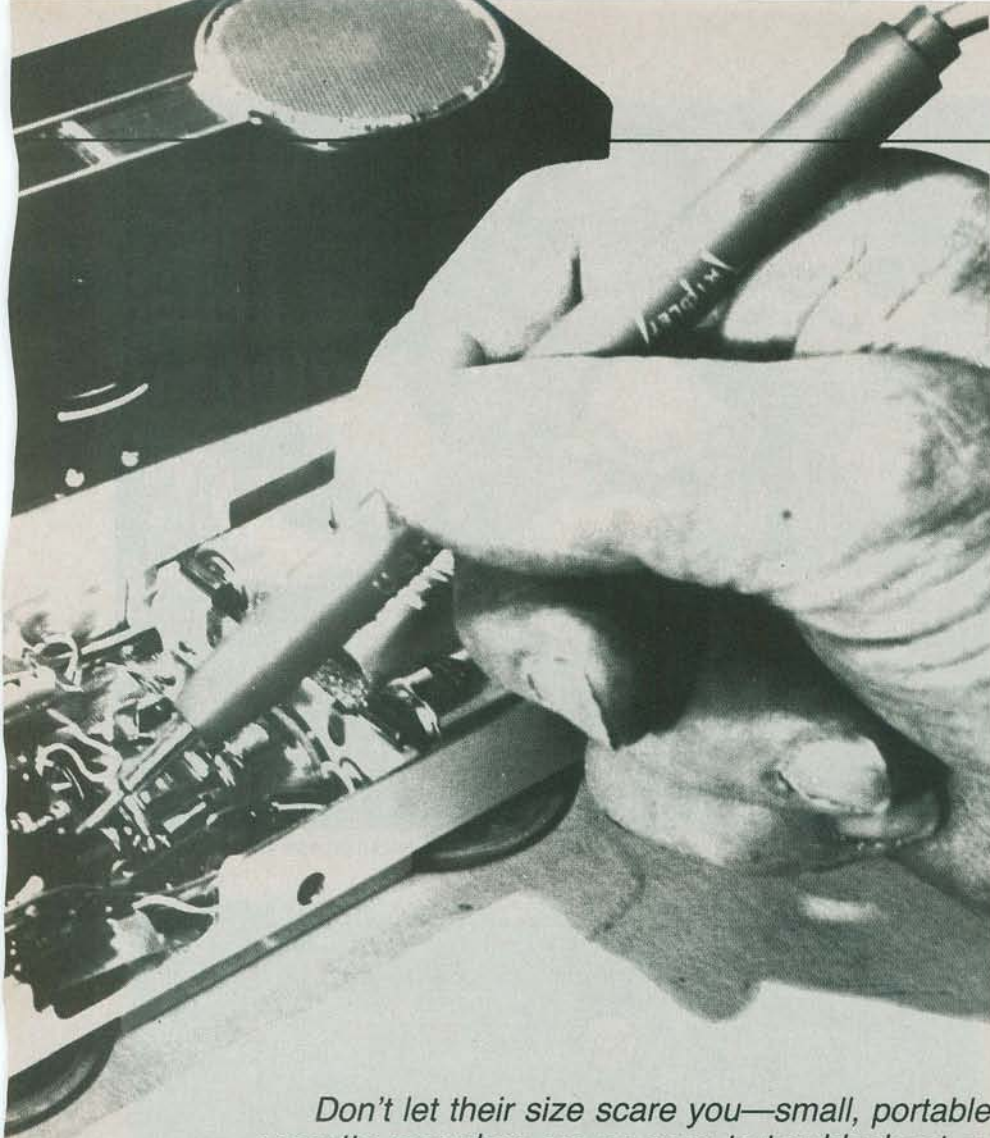


FIG. 1—CRITICAL POINTS FOR CLEANING are indicated above. A good cleaning can be all that's needed to solve many problems.



*Don't let their size scare you—small, portable cassette recorders are as easy to troubleshoot as their larger brothers. Here are a number of hints and kinks to help you out.*

You may find more oxide on the pinch roller and capstan than on the tape heads. Remove it with alcohol. Apply a drop of light oil to the pinch-roller bearing and wipe off any excess. Also, always dry off parts that have been cleaned with alcohol since it can damage many rubber and plastic components if it remains on them too long.

If the capstan flywheel appears sluggish, remove it and clean it with alcohol. Also clean around the flywheel-bearing area using a cleaning stick dipped in alcohol. Place a drop of oil upon the capstan bearing and replace the capstan. Wipe off any excess oil with a paper towel or cloth. Clean the capstan-drive area well to remove any remaining oil.

A dry capstan-bearing may be responsible for erratic or slow tape motion, and noisy and squeaky sounds may be caused by dry motor or pulley bearings. Excess oxide on the pinch roller can also be the cause of slow speed or tape pulling. Oil on any drive surface may produce slow—or no—motion in the parts it contacts.

Erratic bunching of tape from the cassette may be caused by a drop of oil on the drive surface of the take-up turntable.

All rubber or plastic drive-pulley surfaces should be cleaned with a cleaning stick, and a drop of light oil placed on the pulley bearings. Any excess oil should be wiped off. All sliding parts should receive a thin coat of light grease. Finally, most motors have sealed bearings and never needed lubricating.

After cleanup and lubrication, it's always a good idea to demagnetize the record/playback head to insure best frequency-response, and then to check the unit out to see how it performs.

Now we'll discuss some commonly encountered problems, and their causes and remedies.

#### **No play or fast-forward**

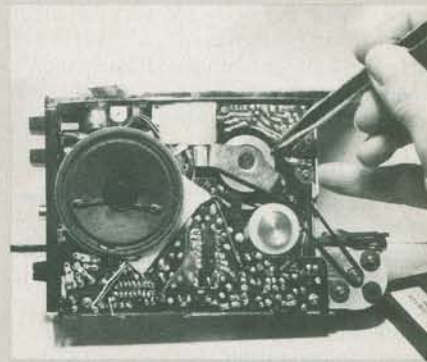
When the recorder's in the PLAY or RECORD mode, the capstan and pinch roller pull the tape across the record/playback head, with the takeup turntable causing the tape to be wound on the cas-

sette's takeup hub. In FAST FORWARD, the tape moves in the same direction, but the takeup turntable runs at a faster rate of speed; the capstan and pinch roller are disengaged. It's possible for one defective component to affect *all* of those functions.

If the capstan or tape will not move with the PLAY switch engaged, check for a defective ON/OFF switch. Hold the unit close to your ear and see if you can hear the motor running. If the motor is dead, check the power switch and see whether the voltage is being applied to the motor. If the motor is operating, check for a loose or broken drive belt. If the unit works on AC, but not from its batteries, make sure that batteries are not weak or dead.

Erratic fast-forward action can be caused by a dirty, worn, or binding turntable. Check for oil on the idler wheel or drive pulley (see Fig. 2).

Sometimes the fast-forward lever may bend and not permit the drive pulley to



**FIG. 2—FAST-FORWARD** problems may be caused by oil on the idler pulley or capstan/flywheel.

engage the capstan. Check for a weak spring or an out-of-position lever mechanism. A good cleanup of the take-up turntable and a drop of oil on the drive pulley bearing may cure erratic fast-forward motion.

#### **No rewind**

If a recorder/player operates normally in the PLAY and FAST FORWARD modes, but not in REWIND, suspect that the idler or drive pulley is not engaging the supply turntable. In some units the idler pulley gets shifted to the left and rotates the supply spindle in the opposite direction. A dry or worn supply turntable may be the cause of erratic rewind, as well as of slow speeds.

To remedy erratic rewind, remove the supply turntable and clean it with a cloth dampened with alcohol. Don't forget to dry it off afterwards. Place a drop of light oil on the turntable bearing, and then replace the turntable. Clean the rubber or plastic drive area with alcohol and use a

cleaning stick to clean off the idler or drive-pulley surface area. Also check for a worn or binding idler-pulley.

If a loud chattering noise is heard when the cassette is almost rewound, suspect dry hub areas in the cassette itself. A tiny drop of oil in the plastic hub area may help, but be careful; you don't want to ruin the tape.

### Slow speed and wow

Slow-speed problems may be caused by a dry-capstan-bearing or by oil on the drive surface. A dry or worn pinch roller can also be responsible for slow speeds or wow. Replace the pinch roller if you find it's out of round after cleanup. (A defective pinch roller can also cause the tape to ride high or to pull from the cassette.)

Check for a loose drive belt, or oil on it, when wow or slow-speed symptoms are noted. You may find that the motor belt slips right at the drive-motor pulley. Some of the important points to check are shown in Fig. 3.

Also, look for a black area or small particle of rubber on the motor pulley; those signs indicate that the belt is slipping. Since the belts are very small in diameter and stretch easily, it's best to use an exact belt replacement. Finally, don't overlook the possibility of a defective cassette being responsible for wow.

### Check the motor

A defective motor can cause slow speed and wow conditions. Generally, a defective motor will start at normal speed, and then slow down. Sometimes if you tap the motor housing, it will speed up again. In most units you will find a motor-speed potentiometer that can be used to adjust the speed over a certain range. If the speed adjustment has no effect, check the speed-control circuit and motor. (A typical circuit is shown in Fig. 4.)

In some cases you may find that the motor is running too fast. Adjust the speed control, using a piano or music selection as a reference. You can also use a frequency counter to determine the correct speed.

If the motor is still running too fast, see whether the belt is riding too high on the motor pulley. If none of the above adjustments help, install a new motor, using an exact replacement.

### Pulling and bunching tape

Bunching and unraveling of tape in a cassette player may be caused by an erratic or inoperative take-up turntable. The take-up turntable or spindle winds the tape coming from the capstan into the cassette. When the take-up spindle becomes dirty or starts to bind, the excess tape will bunch up and pull out of the cassette. Remove the take-up turntable and clean it with alcohol. Apply a drop of oil to the bearing area. Also, clean the turntable-drive area. Check the idler and

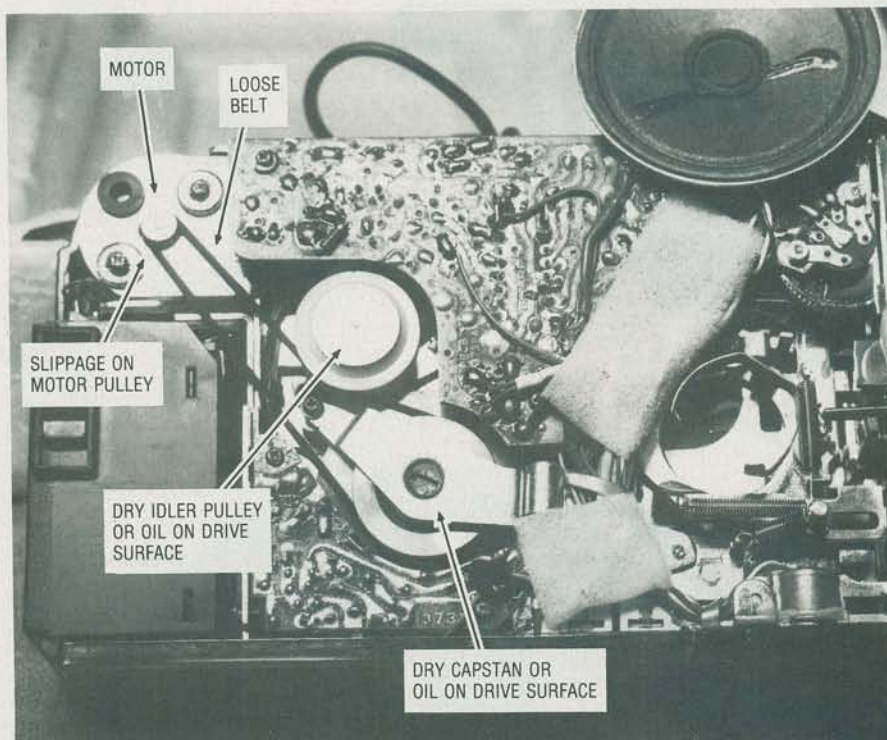


FIG. 3—CHECK THESE AREAS if you are experiencing slow-speed or wow problems.

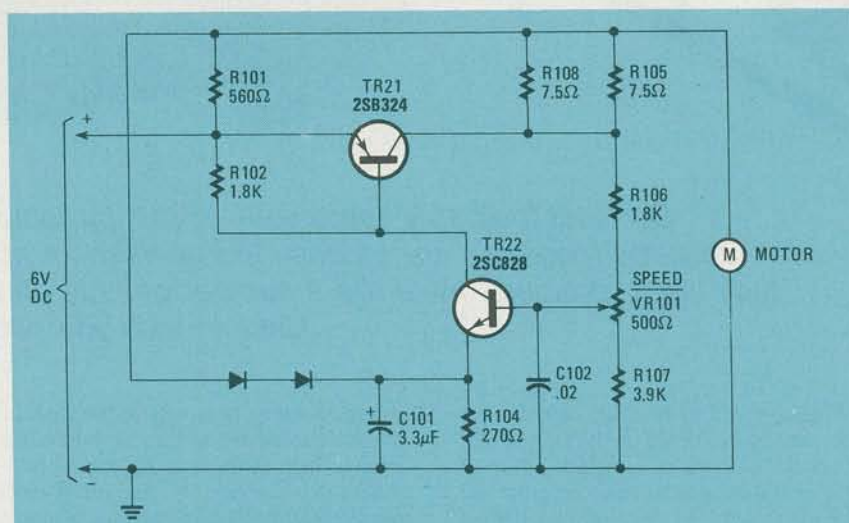


FIG. 4—MOTOR-SPEED CONTROL circuit used by J.C. Penny model 6541. Circuits in other recorders should be similar.

drive pulleys for oil or dirty drive-surfaces.

Sometimes the pressure roller may become worn or out of round, and cause the tape to ride high and pull out of its proper path. In that case, try cleaning the pinch roller and capstan with alcohol. A bent capstan may also cause tape pulling.

If the take-up turntable, pinch roller, and capstan appear to be normal and the player is still pulling tape, check the take-up torque with a torque gauge. Finally, remember that a defective cassette can cause tape to unravel or bunch up.

### No sound

If the tape is moving but there's no

sound, suspect the record/playback head or the amplifier section. Quickly rotate the volume control up and down and listen for a scratchy sound from the speaker. If you can hear some noise, it's an indication that the amplifier is working, so suspect the record/playback head. If you hear a loud hum with the volume wide open, check for a broken wire at the record/playback head. Since the head assembly moves forward every time the PLAY or RECORD buttons are pushed, the wires leading to it have a tendency to break with time.

To determine whether the record/playback head is defective, pass a small screwdriver-blade rapidly across the head

area. You should hear a flutter from the speaker. If you don't, dismantle the player by removing both the top and bottom covers. Check the head connections for broken wires. Touch the screwdriver blade to the ungrounded side of the tape head. With volume wide open you should hear a loud hum; a loud noise would indicate that the tape head may be defective. Remove the cable-leads and measure the resistance of the head. Normally, that resistance will be between 50 and 800 ohms.

Defective components in the audio stages can be located with an audio-generator/signal tracer and through voltage measurements. Start at the first AF transistor and inject a 1-kHz signal to the base of each transistor. Step by step, check each stage. When the signal appears, you have located the defective stage. Check each transistor in the problem area for out-of-line voltages. (A schematic is a must when servicing cassette-recorder amplifier circuits.)

In some earlier units you may find five or more small transistors in the amplifier stages, while in present-day ones only one or two transistors may precede a power-IC output circuit. Such a circuit is shown in Fig. 5. To signal-trace the IC circuits, inject an audio signal at the IC's input pin and use the speaker as the indicator. To make sure the IC really is defective, measure the voltages at each pin. With correct voltages, but no signal from the IC, you can safely assume that the IC is defective. If the IC is leaky, even the supply voltage may be affected.

### Weak and distorted sound

Weak and distorted sound may be caused by a dirty record/playback head. Clean the head with alcohol and a cleaning stick, as described earlier, before tearing into the amplifier. A weak battery or insufficient operating voltage can also affect the quality of the sound.

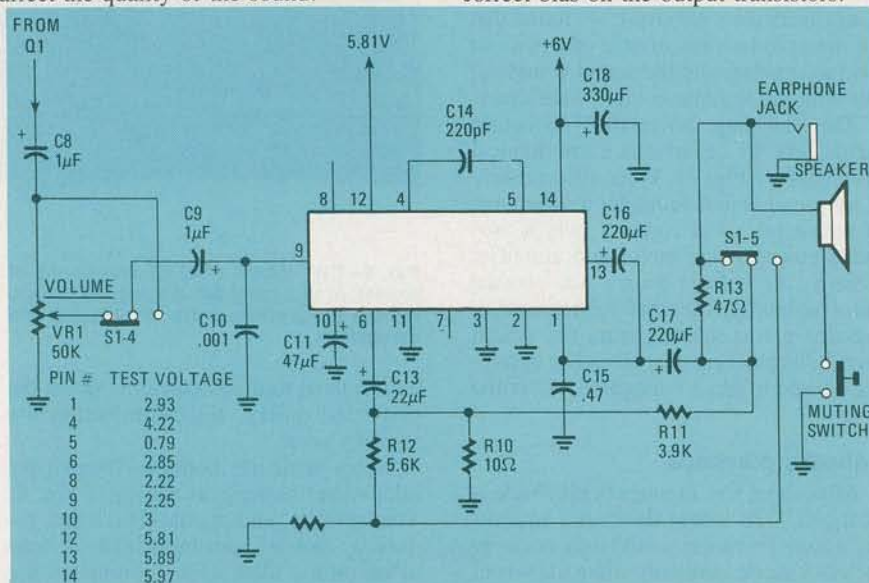


FIG. 5—IC OUTPUT CIRCUIT used in Sanyo model M1000. Voltages shown are typical for this unit but may be different in others.

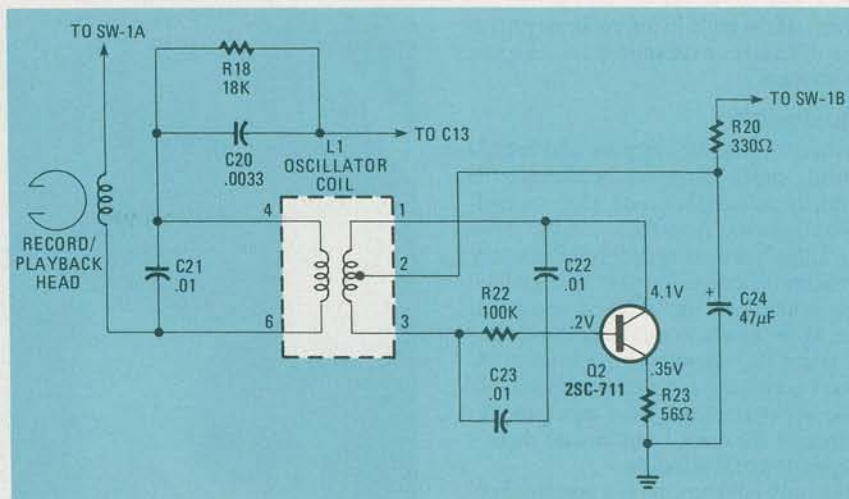


FIG. 6—RECORD OSCILLATOR CIRCUIT used by Sharp model RD-428UA. Use a scope on L1 to determine whether the oscillator is working.

The best method for locating a weak audio-stage is to inject an audio signal, with a scope connected to the output of the recorder/player so that you can observe the audio waveform. Start at the record/play-head connections. The signal should be the same on both sides of the electrolytic coupling-capacitor. (Most weak-sound problems are caused by small coupling-capacitors and transistors in the amplifier section.) If it is not, shunt a new capacitor across the suspected one and see whether the sound returns. Each transistor in the amplifier section should have a large gain from its base to collector terminals.

Excessive distortion may accompany a weak-signal condition. Most distortion in small amplifiers takes place in the output stages. In push-pull transistor output-circuits, an open or leaky transistor can produce weak and distorted sound. Since most circuits of that type are DC-coupled, check the driver or AF transistor for incorrect bias on the output transistors.

Remove both transistors when distortion is located in a push-pull output circuit—it's best to check each transistor for leakage out-of-circuit. Before replacing the output transistors, check the emitter and bias resistors for correct values. Generally, a burnt emitter-resistor will be found along with a shorted or leaky output-transistor.

A leaky IC can also produce weak and distorted audio. Replace the suspected IC when no signal will pass through it or if incorrect voltages are measured at its pins. Use a wick-type solder absorber (like *Solder-Wik*) to remove the excessive solder from the IC pins to make removing the part easy. Then use a low-wattage pencil iron to install the new IC.

### No record function

If the unit will play but not record, suspect a dirty PLAY/RECORD switch or defective record circuits. First, make sure the record/playback head is clean. Then spray the PLAY/RECORD switch with contact-cleaner. Work the switch back and forth to clean the contacts and then try to record once again.

Although most portable recorders do not have an oscillator stage to excite the record tape-head, you may run across one that does. A representative circuit is shown in Fig. 6. To determine whether the oscillator is operating, use the scope and check the waveforms at the primary and secondary windings of L1. Transistor testing of Q2 and voltage measurements can indicate whether the transistor is functioning properly.

Check for poor connections to the built-in microphone. Most built-in mikes are electret-capacitor types and require a DC-voltage to work, so test for that voltage at one of the microphone terminals. A defective microphone may be responsible for weak or erratic recordings. Substitute a dynamic microphone across the shielded wires to the built-in mike terminals (but do not connect it to the DC

source). If the built-in microphone proves to be defective, exchange it for an exact replacement.

### Adjustments

When "crosstalk" or poor playback is noticed, check the erase head, and the azimuth adjustment of the record/playback head. A defective erase head may allow previously-recorded material to remain on a tape, producing a garbled mess when new material is recorded. Most erase heads found in portable recorders are DC-operated. Check for a DC voltage across the erase head with the unit in the RECORD mode. Also check the resistance of the erase head in case there's an open internal winding.

The only adjustment on a portable recorder's record/playback head is for azimuth (elevation). The azimuth-adjustment screw is usually located on one side of the head, with a coiled spring underneath it. Connect a VTVM with an eight-ohm dummy load to the earphone jack. Insert a 3-kHz or 6.3-kHz test tape and start it playing. Adjust the azimuth screw for the highest reading on the VTVM. After that has been done, you may want to dab the adjustment screw with paint or glue to secure it in place.

The only other mechanical adjustments are for take-up torque and adjustment of the pressure roller. (You may find that either one or both adjustments are fixed in some models.) The pressure-roller adjustment can be made using a spring scale and changing the position of the pressure-roller spring to vary the tension it puts on the mechanism.

Take-up torque should be measured on the take-up turntable with a torque gauge while in PLAYBACK mode. Most take-up torque readings should be between 35-60 gr-cm. For greater tension, bend the tension spring and, if necessary, replace the take-up pulley. It's best to follow the manufacturer's service literature for correct tension adjustment.

Now let's take a look at some typical case histories.

### Weak and distorted output

A GE NBR-35311C had weak and distorted sound. Although the symptoms indicated possible output-transistor problems, the tape head, pinch roller, and capstan were cleaned with alcohol as a matter of routine. The weak condition still remained, as expected.

When the back cover was removed we noticed that new batteries had been installed. Only 2.7-volts was measured at the adjustment transistors. Either the transistors were defective or something in the circuit was loading down the voltage source. A bench supply was connected to the player for servicing and everything worked normally. It turns out that one of the new batteries was practically dead, and the battery terminals were corroded. A good cleanup of the battery terminals

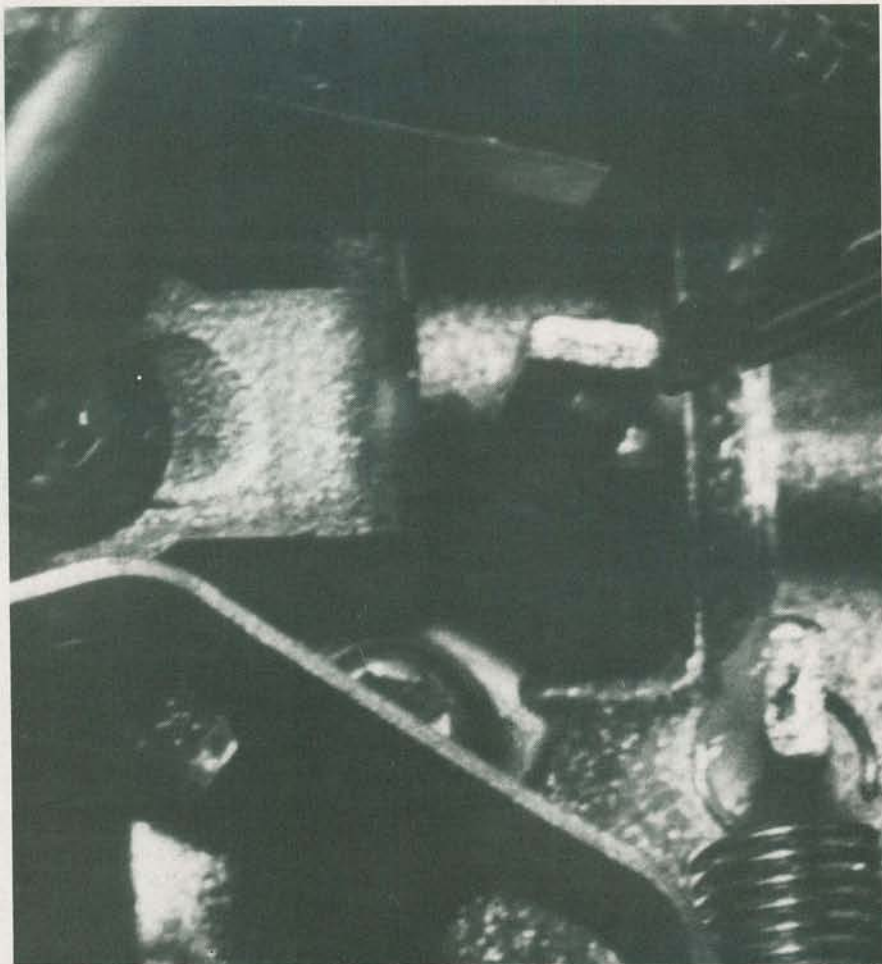


FIG. 7—THE UNINSULATED switch lever shorted out the power-supply voltage in this Sharp model RD-428UA.

and a set of fresh batteries solved the weak-audio/distortion condition.

### No play, no record

In a Sharp RD-428UA, we found that the motor was turning, but we couldn't play or record. Both REWIND and FAST FORWARD modes were normal. When both covers were removed, we found that the motor did not run in either the PLAY or RECORD modes, and the sound would cut out with the volume control wide open.

The "no play, no record" symptom turned out to be an electromechanical problem (see Fig. 7). When the RECORD/PLAY switch's metal plunger touched one of the switch's leaf contacts, which provided power to the motor and amplifier circuits, the voltage source was shorted out. It seems that the small rubber insulating sleeve was missing from the switch lever. The problem was solved by epoxying a piece of large "spaghetti" over the lever.

### Squeaky playback

After about five minutes of playback, a Sharp RD-428 would develop a squeaking noise. The noise would only occur in the PLAY mode, and only when the wheel or pulley came around to a certain position. Sometimes by probing around with

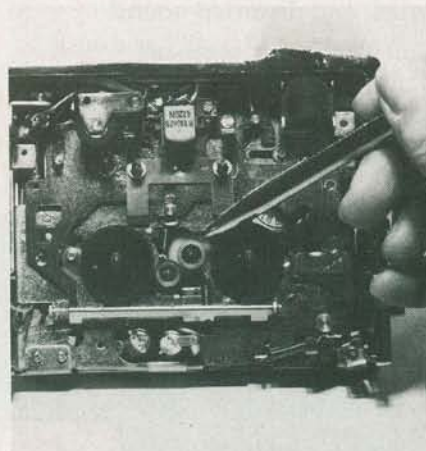


FIG. 8—DRY IDLER PULLEY was cause of squeak in this recorder. It's a good idea to remove the problem parts for cleaning and lubrication.

an insulated tool you can slow down the suspected pulley, thus eliminating the squeaky noise.

In this particular model we found a dry idler-wheel bearing, as shown in Fig. 8. The spindle and turntables were removed, cleaned, and lubricated. A drop of oil on the idler wheel eliminated the squeaking noise.

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## CASSETTE RECORDERS

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### **Normal tape movement, no audio**

A Sanyo *M1000* cassette recorder ran nicely, but had no audio output. Rotating the volume control back and forth did not generate any sound from the speaker. A 1-kHz signal was injected at the volume control, but there was still no sound. Even when the signal was injected at pin 9 of the audio-amplifier IC nothing happened. An electrolytic coupling-capacitor was soldered to pin 13 of the IC and connected to an external speaker, but there was *still* no output.

Although the voltages at the IC were near normal, the IC was determined to be defective. Another LA4100 power-IC was installed and that solved the no-sound problem.

In summary, troubleshooting portable cassette-recorder/players is no different from working on other cassette players. You may find the components a little more compact and closer together but—then again—you may find fewer components to worry about. In fact, working with portable units can prove to be a pleasant diversion.

**R-E**