

WHAT IS OBLONG, BLACK, INSCRUTABLE AND EATS CASSETTES?

by Thomas M. Myers

The title of this article is only half in jest. Actual cassette-eating is much more frequently the fault of the cassette than of the cassette player, and many of the lower-priced portable cassette players on the market are incredibly tough and troublefree. Players nevertheless do need service sooner or later. You may have a resident technician for your lab or a good audio-visual service department, or you may be content to have all your work done outside by a commercial service organization. But if none of this fits your situation and if you are in a budget squeeze, be assured that you can perform much of the needed service right on the premises. It is the purpose of this article to give you a guide to doing your own service in as efficient and logical a way as possible.

Why get involved in doing your own maintenance (aside from cost considerations, that is)? For one reason, you are on the spot in the lab and are constantly in touch with the equipment. You may thus be better able to diagnose and correct a problem—sometimes while it is developing—than is a serviceman on the outside who may see the machine only after it has broken down and who may not really understand how it is used. He may thus have to spend more time in diagnosis than is necessary, and this will in turn raise the cost. Another reason is that the trouble one has with these machines are due in good measure to the fact that they are not really meant to be used as heavily and in the same way as they are in a school situation. (Machines in a lab, for instance, are cycled much more frequently than they are in home use.) This means that even the manufacturer's service literature may not cover the troubles that occur, since they are atypical. You may in effect, then, find yourself being forced into writing your own service manual.

The information in the following pages has developed out of experience over the last two and a half years with machines that have been in moderate to heavy use every day in the carrels of our lab. (For a report on the planning, installation and operation of our library-type cassette lab, see my article: "A Budget Cassette Lab" in *NALLDJ* (May, 1971), Vol. 5, No. 4, pp. 47-52. Our machines are Sony TC 110's, but we also have often had occasion to work on or at least look at numerous other makes.) It will apply particularly to

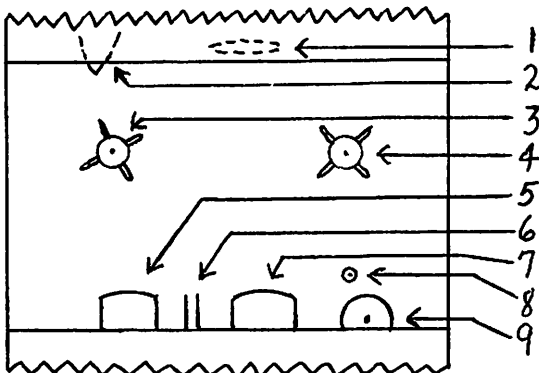
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players that retail for about \$50-\$125, but very possibly not to the pocket-size machines that are appearing now. From brand to brand these players differ from each other in various ways, but they also resemble each other in enough important aspects that one can generalize about them. The basic approach to service that I offer should, moreover, be useful with a much wider range of tape recorders than just the ones considered in this article.

The simplest and easiest job, and the one that needs to be done most frequently, is performed without even taking anything apart. It involves cleaning the parts touched by the tape as it is being played: the capstan, pinch roller, heads and guides. (For efficiency of reference in the following discussion, I have included a diagram of this area of a representative cassette player with identification of the essential parts. See Figure 1.) The accumulation of oxide from the surface of the tape and dust from the air is a natural and unavoidable process and in time will seriously affect the quality of the sound produced by the machine if it is not removed. The tool to use is a cotton swab (Q-Tip, Softees, etc.; get the cheapest kind). The cleaning agent is denatured alcohol or a commercial head cleaner such as that marketed by GC Electronics (Audiotex) or by Robins, available usually at electronics parts stores, record shops and the like. The cleaning process itself consists in moistening a swab very lightly with cleaner, rubbing it up and down on the faces of the heads and the capstan and across the pinch roller, then drying these parts with the other end.

There are several handy tricks that you can use to ease and improve the cleaning process. First, with the power on put the machine in the "playback" mode without having a cassette in it. This moves the parts forward, where they are more easily reached. It also allows you to clean the capstan and pinch roller by just holding the swab against them as they turn. Cleaning the capstan while it is turning will sometimes result in its picking up a bit of cotton from the swab and wrapping it around itself. Don't worry about this, but do be sure to run a fingernail up the capstan afterward to see that no cotton is left on it. Only a tiny shred on the capstan will distort the sound. Some machines cannot be put into playback mode without having a cassette in place. With those, you reach in with the swab the best way you can. A slender little finger is of great assistance here in getting the pinch roller turned all the way around.

Another trick—one that may help lengthen the life of the machine—is to use only a barely moistened swab. Dip just the tip of the swab into the liquid and remove it as soon as you see it begin to suck the liquid up. Touching a soaked swab to the capstan may release a drop



1. Pressure plate to hold cassette.
2. Sensing device that tells machine if plastic ear has been removed from the cassette. If you bend the tip of it up, the machine will think the ear is gone even though it is not, and will not allow you to record. You can thus protect cassettes from accidental erasure without having to remove the ears (which makes later re-recording of them clumsy).
3. Tape feed spindle.
4. Tape take-up spindle.
5. Erase head.
6. End-of-tape sensor; works only when end of tape is marked with metal foil.
7. Record-playback head.
8. Capstan.
9. Pinch roller. When the machine plays, the capstan turns; the pinch roller pushes the tape against the turning capstan and the tape is thus pulled off 3, past the heads and on to be rewound on 4.

FIGURE 1

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or so of liquid that will run down the capstan and seep into the bearing. (The bearing is the metal guide that the capstan turns in. You can see the top of it at the base of the capstan. See Figure 1, #8.) There are several indications now that this can damage the type of bearing used in cassette players.

Finally, supplement the use of alcohol by periodically cleaning the pinch rollers with ammonia. Use a fairly strong aqueous solution from the drugstore, not the sudsy household kind. It may be a bit hard on your nose, but it removes an amazing amount of stuff that alcohol will not. This prevents the surface of the pinch roller from getting so caked up and hardened that it no longer helps pull the tape through smoothly.

"Periodically" brings up the question of how often this sort of cleaning should be done. I feel that one gets the best results by establishing a routine of head and capstan cleaning after six to sixteen hours of use. The treatment with ammonia should be done every second or third time. There is, of course, no hard and fast rule to apply here. Different makes of machines are different in their sensitivity to dirt, and different makes of cassettes differ in their readiness to slough off oxide. Using Audio-Magnetics cassettes with our Viking duplicator, for instance, we have found it necessary to clean the cassette slaves after only three to four hours of operation. A friend has told me that the same duplicator with Ampex cassettes does not have to be cleaned nearly as often. The word, then, clearly is "Get to know your own equipment." One thing can be said in general: if you can see a deposit on the heads of any tape recorder, it is high time to clean.

In addition to this sort of cleaning, there is a certain amount of lubrication which can also be done without taking the machine apart, but it is done much less frequently, at about 6 to 8 month intervals. The only material you need here is oil, but it must be of excellent quality, neither so light that it does not stand up nor so heavy that it will not soak into the bearings. A good oil is that developed by Newcomb Audio Products Co. for use with their machines. Chemlube #650. This oil comes packaged with a long applicator tube which lets one put the oil exactly where it is needed, a very important feature.

The process is to put *one drop* of oil at the point where the capstan enters the bearing, one more where it can get into the pinch roller bearing and another at the point where the pinch roller assembly is pivoted. It speeds the process sometimes to have the machine running. Be sure not to use much oil—over-lubricating a tape recorder can cause a real mess. Be sure to pick up any excess afterward with a dry swab.

While the cleaning you do outside the machine is done frequently—at 6 to 16 hour intervals—and the lubrication there is done at the much longer intervals of 6 to 8 months, the rest of the cleaning and lubrication need be done only at about 12 to 18 month intervals. It requires, however, that you climb down into the machine's innards. With caution, common sense, a good light and long, slender fingers this need not be difficult.

Provide yourself with a clean, comfortable, well-lighted place to work. You will need a #0 Phillips screwdriver and probably another ordinary screwdriver with a narrow ($\frac{1}{8}$ inch) tip. A fairly long and narrow pair of tweezers will also be handy. (A tip: buy good tools and take care of them. They will pay for themselves in a short time. Regard the 99-cent bargain table as a form of one-armed bandit.) You may find it helpful to file a little metal off the point of the screwdriver so that it will fit down snugly into the slots in the screws (which seem to be often a bit shallower in Japanese products). Get several hypodermic syringes of the throw-away type made for diabetics. They are very handy for getting lubricants and cleaners into tight places. A quantity of clean, absorbent, lint-free rags is also necessary.

For lubrication use the same oil that you used outside the machine. In addition you will need a light grease, such as Lubriplate All-Purpose 23-02 of GC Electronics, Newcomb spindle grease #L-14, or even Vaseline. You will continue to need the ammonia, and should also get some electronic contact cleaner and a point burnishing tool (which is really just a very fine, thin, flat file). GC Electronics makes a good cleaner that can be purchased with a burnishing tool. You are better off here with the liquid rather than the spray can.

With the necessary equipment and supplies at hand, you are ready to begin work. There are two key rules to consider before you begin the process of opening the machine. First, look carefully before you do anything for the first time. Look to see whether one end or one side of a case cover must be lifted up first in order to get the other end or side clear of some push buttons or such. Look to see whether knobs have to be removed before anything else. If there is any doubt about how parts should go back together, draw yourself a sketch of them before you disassemble them. If you do not know anything to the contrary, assume that there may be a coiled spring or loose part under that part you are removing, so keep light pressure down on it and try to look under it before you lift it completely off. Look again when you replace the cover to see that you are not pinching some of those pesky little wires.

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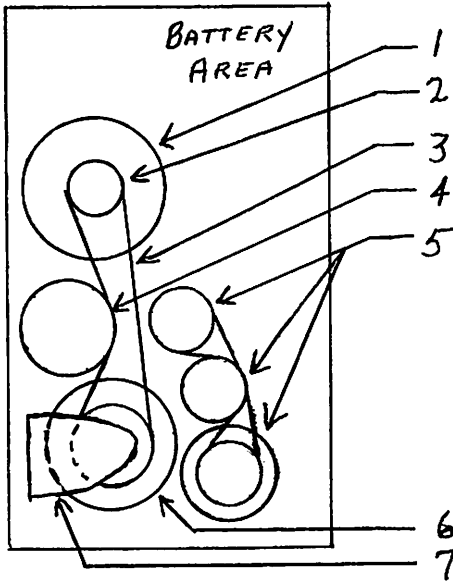
The second key rule is to use only as much force as is necessary, whatever you are doing. Under no circumstances should you use all your strength on any of these maintenance operations. Neither should you normally resort to prying or hammering to remove or replace anything. When you go to work on a cassette player, think of it as being basically small and weak.

With these two rules in mind, begin opening the machine by disconnecting the power cord, if the machine has one, removing the battery case or the cover to the battery compartment, then the batteries. Look for any movable parts—perhaps the cover to the cassette compartment—that might fall off when the machine is turned over. Look for the screws that are obviously holding the case together. There are probably three to five of them in the bottom of the case (one or two may be in the battery compartment) and they are probably of the Phillips type (the ones with the cross-shaped slot in the head). (See Figure 2, note 2.)

In removing the screws the trick is to avoid letting the blades of the screwdriver slip out of the slots in the screw, because this so mutilates the slots that the screw eventually can not be turned. Keep the shaft of the screwdriver perpendicular to the head of the screw and apply firm pressure downward while turning the screwdriver slowly. Do the same in reverse when reassembling the machine. Tighten the screws just until they are snug. Once the case screws are out, the halves of the case should come apart with more or less the amount of pull it takes to peel a stubborn Valencia orange. In fact, you might just try imagining that you are holding an oblong, black Valencia orange in your hands and are concerned with not squirting juice all over yourself.

With the machine open, you are looking down into the mechanical and electronic works of the cassette player. (Again, see Figure 2 for a simplified diagram of a typical player interior.) It is possible that you will have to remove a circuit board in order to get at any of the mechanical workings, but avoid this if you can. Should it become necessary, first remove the screws holding it, then try gingerly raising it up and back out of the way. With luck you won't have to unsolder any of the wires attached to it, and thus won't have to learn how to solder (which isn't hard, either, for that matter). In all likelihood you will be able to get at the mechanical parts without removing anything more.

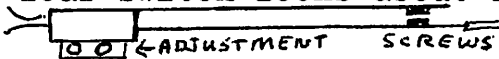
Once you have access to the works, begin the maintenance by unhooking the drive belt from the motor pulley and laying it to one side. Do oiling first so the oil will have time to seep in. Apply one or two



1. Motor.
2. Motor pulley.
3. Main drive belt.
4. Idler wheel that drives take-up spindle.
5. Fast-forward-rewind idler wheel assembly; may be mounted on a single nylon frame.
6. Flywheel attached to end of capstan.
7. Flywheel retaining bracket.

Note:

- 1) A leaf switch looks about like this:



- 2) A Phillips screw head looks like this:



- 3) An E-clip looks about like this:



FIGURE 2

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drops of oil to the point at which the motor shaft enters the motor housing, i.e., where it enters the bearing. You will need to reach in under the motor pulley in order to do this. If it is possible to reach the other wheels and pulleys, put one drop of oil where it can get into their bearings. Pick up any excess oil with a swab. If you can conveniently do so, apply some light grease to the bearing point beneath the flywheel. A hypodermic syringe may work well for this.

The next step is to clean all the rubber and the surfaces it touches. Use ammonia and plenty of it. Unhook any belts that you can reach (noting first which way they go on their pulleys) and pull them through an ammonia-wet rag. With a swab or rag on the tip of a screwdriver clean the grooves they ride in. Clean the rubber faces of any drive wheels and the surfaces they ride against. The simplest way to do this is to turn the wheels with a finger while holding a swab against them. It is profitable, albeit more difficult, to clean the rubber faces of the supply and take-up spindles. Sufficient access to them can frequently be gained by removing the rewind-fast forward idler assembly. The latter can easily be removed if it is secured to its pivot shaft by an E-clip (See Figure 2, note 3) that snaps into a groove on the shaft. The E-clip is removed by slipping a very thin, narrow-bladed screwdriver between it and the shaft and prying gently against the E-clip. Station a finger in back of it to keep it from flying away when it snaps off.

It remains only to clean any leaf switches (See Figure 2, note 1) that you can get at. Apply some electronic contact cleaner to the contacts with a pipe cleaner or brush then burnish the point surfaces by pushing the points together with the burnishing tool between them and sliding the tool back and forth several times. This same contact cleaner can, incidentally, also be used to clean the volume and tone controls. You do not clean them routinely, however, but rather only when they need it. They are normally either attached to the board or mounted on one side of the machine. The actual control is attached to the center of the wheel that protrudes through the case of the player. Put one or two drops of cleaner where the control attaches to the wheel and let it seep in.

If a machine is given this kind of preventive maintenance from the time it is new, it is possible that it will run for a long time without developing any problems. But problems *do* have a way of occurring, even in the best-managed "labholds." Here are the ones we have encountered so far, along with their remedies. Some may seem trivial or frivolous, but at the time they were real and embarrassingly troublesome. The causes and remedies are arranged in accordance with an-

other key rule in service work: always attempt the simplest and quickest solution possible before going on to a more complicated, time-consuming one.

1. Fuzzy, blurry, distorted sound, lowering of volume, but no noticeable change of pitch.

- a. Suspect dirty heads and capstan, possibly a shred of cotton wound on the capstan.
- b. Suspect a defective cassette and try substituting one that you know is good.
- c. If it persists it is likely a head out of alignment or a circuitry problem, either of which you may well relegate to a serviceman.

2. Noticeable lowering or fluctuating of pitch, perhaps not occurring until the cassette has been played half-way through or more.

- a. Suspect a faulty cassette and try one known to be good.
- b. Suspect dry bearings and dirty or oily rubber parts; clean and lubricate.
- c. Suspect that one or more leaf switches may be dirty and/or out of adjustment. Adjust them so that the points are pushed together very firmly.
- d. If it persists it may be a sign that the motor is beginning to fail, which calls for replacement.

3. A sharp rise in the pitch when the machine is first turned on—the “Mickey Mouse” sound.

- a. I am not yet sure what the whole explanation is. Our machines just do it very occasionally, and the remedy seems to be to stop and re-start the machine or to take the cassette out and put it in again. This is no great problem, but out of curiosity I would like to know what causes it.

4. Machine operates but no sound comes from the speaker.

- a. Suspect deviltry and check to see whether something—e.g., a roll of paper—has been jammed into the monitor (ear) jack. Remove the foreign object and this should automatically restore the sound.
- b. Suspect a very dirty volume control and run the control very rapidly through its whole range several times. If this restores the sound even partially, clean the control.
- c. If it persists suspect that the head has failed (but look first to see whether a wire is just disconnected from the head) or that there is some serious circuit trouble, corrective work for the serviceman.

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5. There is a crackle of static when the volume or tone control is moved.

a. Suspect it is dirty and clean it.

6. You hear a pop as the machine runs, either irregularly or in time with the revolutions of the wheels in the cassette.

a. Suspect that one or more of the leaf switches is dirty and clean it.

b. Suspect a poor connection, especially in some wire that attaches to the frame of the machine. Prospect around gently and tighten any loose connections that you find.

c. If it persists, call a serviceman.

7. You hear a squeak when the machine is turned on or off, and/or when it is in rewind and fast-forward modes.

a. Suspect dry bearings and lubricate, paying special attention to the fast-forward-rewind idler assembly. It can be difficult to get lubrication down into the latter. Injecting Lubriplate into the bearing areas with a hypodermic syringe seems to work fairly well.

b. (This doesn't occur very frequently.) Suspect that an idler wheel or a rubber belt might be rubbing on something and check to see if the noise stop when the machine is turned into a different position or when the circuit board is raised slightly. Is it possible that the plate supporting the flywheel has loosened and allowed the flywheel to drop down too far?

c. If you can't locate the squeak and the machine is otherwise running all right, try ignoring it. This symptom has rather frequently not been tied to any very important problem.

8. Machine will not function at all.

a. Check to see that it is getting power: power cord plugged in firmly at both ends; batteries good and properly installed, if you are using battery power.

b. Remove the cassette and try the machine. The cassette may have jammed or have been completely wound over onto the right-hand side, which would stop the machine.

c. If a microphone with remote control switch is plugged in, check to see if the switch is on.

d. Check to see that nothing has been jammed into the remote control jack, thus breaking the main power circuit.

e. Check the leaf switches for the usual and keep an eye out for loose wires, especially back around the motor area.

f. If all these fail, admit your limitations and send the machine to the serviceman.

9. Machine stops playing by itself, although the connections to the power source are all right, and may or may not start again when the controls are jiggled, pushed harder, etc.

- a. Suspect dirty leaf switches, perhaps also out of adjustment.
- b. It's a serviceman problem.

10. Another one that I do not yet fully understand is really a form of cassette-eating. As the machine is playing, the tape slips out of its proper track through the middle of the capstan-pinch roller combination and moves too far up or down. This action results in the tape's getting wrinkled longitudinally, which usually means that that piece of tape is no longer useful. What I have found so far is that this *can* be caused by insufficient pressure of the pinch roller against the capstan, by incorrect alignment of the pinch roller with regard to the capstan, and/or *perhaps* by dry bearings. That is all pretty inconclusive and I would appreciate having a complete answer. At any rate, the correcting of it is difficult enough that you may well not want to tackle it. The more common form of cassette-eating, by the way, where the tape gets wrapped around and around the pinch roller, capstan and such, is usually the fault of the cassette. The take-up spool jams and the tape has no proper place to go after it has left the capstan area. It may, of course, also be caused by maladjustment of the take-up spindle clutch. Adjusting it is probably something to leave to a serviceman.

Three more comments, and then I'm done.

One. "What they always say" about cassettes is true. Buying cheapies is usually false economy. Stick with major brands that are guaranteed. Investigate the chance of getting a price break through your bookstore or audio-visual department (they sometimes can get set up as a type of dealership). Avoid the longer-play cassettes (C-90's and-120's); they seem generally to be harder for machines to handle.

Two. Grit your teeth and take a new machine apart. Install batteries and turn it on while you have the case off. Watch it run. You can learn a lot this way and can have in mind a picture of how the machine looks when it is all right. It may help you when you go to work on one that is malfunctioning.

Three. "Why not just buy cheap machines, use them a year or two and then throw them away? We've got the budget for that." That may be an unanswerable question, but here is what I feel about it. The really cheap machines are just not good enough for language use. Too much motor noise, for one thing. More important to me, however, is the obligation not to further the trash-pollution of the

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world by throwing away an appliance that is quite repairable and usable. Not throwing away may also in a small way discourage the manufacturer from over-producing.

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SPANISH

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