

HOBBY CORNER

Cassette-speed modifications

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A SHORT WHILE BACK, A VERY THOUGHT-provoking letter came from Larry White of Texas. He has a certain brand and model of audio cassette player and would like advice on making a couple of modifications to it. Sorry, Larry, that I don't have that particular machine here for experimentation, but here are some ideas that you or any of our other readers can check out with any recorder/player.

Before discussing ways to vary tape speed, however, I feel it necessary to point out that we are very fortunate that tape-machine manufacturers have decided upon standard speeds for tape travel. The typical speeds for audio tapes for various applications are 15, 7.5 (15/2), 3.75 (15/4), 1.875 (15/8), and 0.9375 (15/16) inches-per-second (ips). All other things being equal, the faster the tape moves, the higher will be the fidelity of the recording. "Normal" audio cassettes run at 1.875 ips, more commonly referred to as 1 7/8 ips.

Since all standard cassettes and machines operate at the same speed, it is evident that cassettes made on one machine will play properly on another machine (at least as far as speed is concerned). Without such standardization, you would not want to buy a pre-recorded tape; you could not send a tape to your buddy; and if you had to replace an old

machine, your old tapes could not be played on the new one. The cassette world would be in chaos. And now, that obvious caveat: if you change the speed of a recorder/player, the only cassettes you will be able to play on it will be those recorded on it. Those tapes will not play on another machine. (Of course, that is not true if the accuracy of sound reproduction is unimportant!)

With that said, let's see how to do some speed changing. Some of the methods give better results than others on a given machine. No one way is better or easier on every make or model. Proceed with caution. Some of the changes are irreversible—if they don't work properly, your recorder/player can be ruined for normal use. I would not recommend your applying these procedures to a good (expensive) machine.

The first method—mechanical

The most obvious way to change tape speed is to change the size of the capstan. That's the little spinning shaft that sticks up and squeezes the tape against a rubber roller, called the pinch roller or capstan roller (see Fig. 1). In most machines, you can see those parts easily by pushing the PLAY button with no cassette in place. If you aren't familiar with the capstan and pinch roller, stop now and check them out—we'll be discussing them at some length.

Mechanically, there are two basic types of cassette players. The first type may be called direct-drive machines, and includes those in which the capstan is actually the shaft of the drive motor. The second type includes machines in which the capstan is driven by a belt-and-pulley arrangement—usually, the capstan is the shaft of a large and relatively heavy flywheel. You can determine which type your machine is by going into the case and taking a look.

With both types, one of the factors determining the tape speed is the diameter or circumference of the capstan. At any given capstan rotational speed, the tape speed varies proportionally with the size of the shaft. The smaller the diameter, the slower the tape. The larger the diameter, the faster the tape.

Direct-drive machines

The mechanical method of modifying the first type (direct drive) machine in-

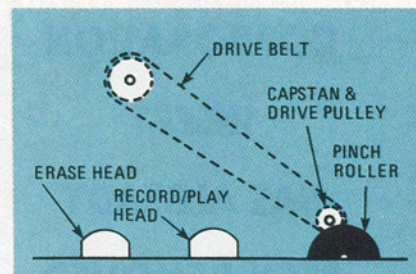


FIG. 1

volves actually changing the size of the capstan. If you fit a "cap" of some kind on the shaft to increase its diameter, it will pull the tape faster. Great care must be taken to make the cap of a material that will not have a tendency to cause the tape to adhere to it—you can imagine, and may have experienced, the problems resulting from tape wrapping itself around the capstan! Further, the cap must be perfectly round. Metal and very hard plastic have been used with success.

Larry's need, however, is to *slow* the tape speed. That is what most folks want to do, and it involves decreasing the capstan diameter—a task which is easier said than done. If you really want to try that, remove the motor (and thus the capstan) from the machine and *gently* hold a file against the capstan while the motor runs. (If you don't remove the motor, everything may be ruined by falling filings.) Work very carefully so the capstan remains of equal diameter throughout the length that presses against the roller. The sides must be exactly straight—neither bowed in nor out, and not slanting up or down in a cone shape. If the shape isn't right, the tape will be pulled sideways as well as forward and that will cause obvious problems.

Do not change the size of the capstan much without stopping to test the results of your labors. The best way to do that is to reassemble the machine and play a previously recorded tape, listening for a change in tones of speech or musical pitch. In addition, record and play a tape at the new speed to see how things are working. If you are satisfied with the results but want greater change, continue with the operation.

I do not advise attempting to make large speed-changes in that manner. The main reason is that there is a definite relationship between speed and the power required from the motor. Depending up-

AN INVITATION

To better meet your needs, "Hobby Corner" will undergo a change in direction. It will be changed to a question-and-answer form in the near future. You are invited to send us questions about general electronics and its applications. We'll do what we can to come up with an answer or, at least, suggest where you might find one.

If you need a basic circuit for some purpose, or want to know how or why one works, let us know. We'll print those of greatest interest here in "Hobby Corner." Please keep in mind that we cannot become a circuit-design service for esoteric applications; circuits must be as general and as simple as possible. Please address your correspondence to:

Hobby Corner
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200 Park Ave. South
New York, NY 10003

on how far you go and the motor in your particular machine, you could reach the point that the motor would not be able to pull the tape at all!

It is very difficult, it not impossible, to back out after going too far. That is an additional reason for not attempting to modify an expensive machine—at least, not until you have some experience.

Pulley-driven machines

The mechanical method of modifying a pulley-driven-capstan machine is not fraught with quite as many pitfalls as is modifying direct-drive machines. Nevertheless, considerable care must be taken. In this case, your task is to change the size of one or more of the belt-driven pulleys. The general rules for this method are:

1—Tape speed changes directly with the size of the *driving* pulley. In other words, decrease the diameter of the pulley on the motor shaft and you decrease the speed of the tape, and vice versa.

2—Tape speed changes inversely with the size of the *driven* pulley. In other words, increase the diameter of the pulley on the capstan and you decrease the speed of the tape, and vice versa.

So, all you have to do is locate and fit a pulley of the correct size on the shaft and then install a belt of the right length. It isn't easy, but it can be done on some machines without tearing them up. (You can even change both pulleys.)

Of course, you may be lucky enough to find a motor that runs at an acceptable new speed and that can simply be installed where the old one was.

The second method—electronic

Do not overlook the possibility of decreasing the speed of the motor in the machine *without* making mechanical changes. If you can do that and still have enough power to pull the tape steadily, you have it made. Whether or not it can be done depends on the motor in your cassette player. The speed of some motors is determined by the precisely set voltage applied to them—change the voltage and you change the speed. If fidelity is important, that may require the installation of a voltage-regulator circuit. If all that's required is to be "in the ballpark," a simple power resistor may do the trick. You might even get fancy and install a variable-speed control. Then, you could have available a range of speeds for various purposes.

There are, of course, other methods of controlling the speed of a motor. For example, you might run into a machine that uses the frequency of the supply voltage to determine the speed. In that case, you could modify the frequency-determining circuit. In general, to successfully change motor speed in a given machine, you will have to study the circuit used. Except for the method that requires filing the capstan, you can experiment with a method and, if you are unsuccessful, put everything back exactly as it was.

If you do attempt to change the speed of a cassette machine, choose an old/inexpensive one on which to experiment. Study your cassette recorder/player to see which methods are possible, and which of them is most practical. Don't overlook the possibility of using a combination of methods to cause a greater change than you could get with just one. Watch out for the power available versus the power required from the motor as the speed is changed. Also, when the speed is changed significantly, it may be desirable or necessary to change the frequency compensation in the record/playback circuit(s).

The success of your efforts to slow the tape speed will depend upon two factors. One, of course, is the care with which you work. The other is the minimum quality of sound reproduction acceptable in your particular application. The less stringent your requirements, the more likely you are to be satisfied with the results. Good luck!

Reminder

Your questions are welcomed, of course. We'll try to answer those of greatest general interest to all readers. Don't forget that we'll be glad, also, to get word of any unusual circuits and applications that you work out.

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