Pictorial Guide to VHS Threading

Even though electronics tells them what to do, mechanical devices do these jobs.

FOREST BELT

A VHS CASSETTE RECORDER THREADS tape into the transport only for the PLAY and RECORD modes. Pressing the STOP button causes the mechanism to unthread the tape and then return it to the cassette.

That's something you need to know. In Beta machines, if you remember, inserting the cassette and pressing the carrier down until it latches makes the tape thread immediately. Beta tape remains wrapped around the video head drum and through the transport path during the record, play, fast forward, and rewind modes. It stays that way in the stop mode, too. Only when the EJECT button is depressed does the tape unwrap and return to the Beta cassette.

Not so in a VHS unit. Several things happen to make the machine ready to operate when you insert the cassette and press down the cassette carrier, but threading is *not* one of them.

Genuine familiarity with a video cassette recorder comes through experience. If you have access to a VHS machine, you can follow these explanations directly. Lacking a machine, study the photos. They should prepare you for the reality of opening up a VHS recorder to troubleshoot the mechanical portions of a threading or unthreading fault.

As you see each mechanical device pointed out in a photograph, the caption tells you what it does and how it works. In some instances, fault symptoms may not be obvious; however, the captions tell how to recognize the malfunctions. (**Note:** The VHS machine used for those photos is an RCA *model VCT400*. Other brands and models contain similar threading mechanics.)

WITH SIDE, TOP AND BACK COVERS OFF cassette carrier—chamber that holds cassette—becomes accessible. Removing four screws frees carrier cover. Pawl trips latch at end of cassette gate, a door in the cassette itself that protects tape inside, and, as carrier is pressed down, metal post near corner lifts gate to uncover tape at front of cassette.

Most common defect: warped cassette carrier assembly or bent metal post. Either is often caused by owner inserting cassette backward or upside down and then trying to FORCE carrier down to latching position. Only practical cure is replacement of entire carrier assembly. But metal parts can hardly ever be straightened to the tight tolerances necessary for operation.

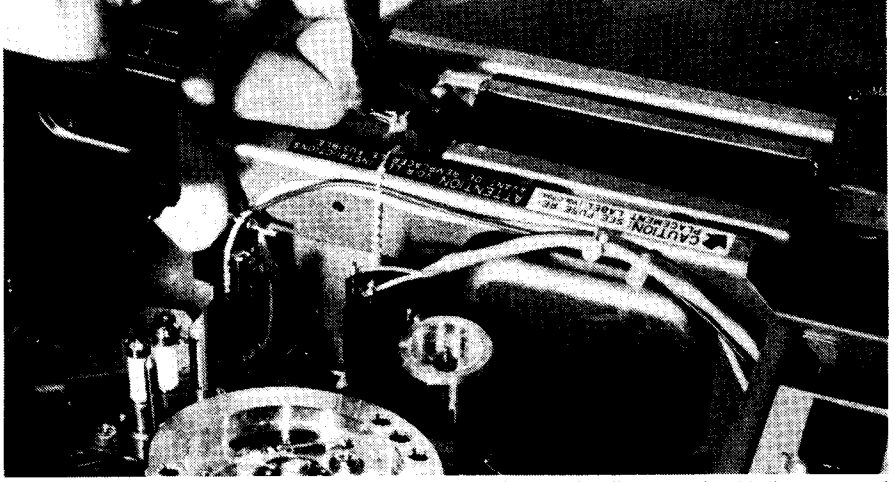
To inspect threading this way, press down on cassette and depress the PLAY button. **Note:** Continue pressure on cassette during operation; slight looseness with carrier cover off lets tape misalign and either tangle, break, or shut machine off. As long as you hold cassette down tight, machine should function in Play mode, sending picture and sound to TV monitor. If tape does not thread with PLAY button depressed, perform tests the way the following photos describe.

OPERATION WITHOUT CASSETTE can be accomplished by pushing the cassette carrier down until it latches. Then stick black tape over phototransistors at each side of mechanism. Otherwise, automatic shutoff lamp illuminates them and prevents PLAY button from latching. Even bench or room light can trip the auto-shutoff system, which instantly unlatches any operating button you might push.

Mechanical or electronic? With both phototransistors covered, press PLAY. If the button does not latch, listen for clicking of auto-shutoff solenoid each time you try to press the button down. Solenoid is just behind row of operating buttons, and hidden by them. A click indicates that the solenoid is unlatching the button. Trouble probably is electronic, in auto-shutoff system, or caused by some error or malfunction that activates auto-shutoff.

If there's no clicking, but you still cannot get the PLAY button to latch down, look for mechanical trouble. Solenoid might be stuck.

Two spring-loaded roller arms keep cassette carrier down. Pull them away and press EJECT to release cassette carrier. From up position, push carrier down slowly keeping downward pressure on PLAY button at the same time. At bottom of carrier travel, roller arms should slip over top of carrier-tray ends. If that does not release block on PLAY button, mechanical interlock is not working right.



THREADING MECHANISM in the stop mode leaves tape unthreaded (photo at left). Path of tape before threading leads across front of cassette, with gate up and exposing tape. Mechanism moves to threaded positions in play mode (photo at right). Drawing illustrates tape path in unloaded mode, and labels key parts of threading mechanism.

With PLAY button latched down, switch closes to apply 12 volts to six-transistor stage that drives loading motor. Motor pulley drives worm gear. Two leading gears engage teeth around perimeter of two loading rings. Teeth cover only about one-third of circumference of each loading ring.

Loading or threading posts are part of loading rings. When motor drives rings, those posts move in arc, in slots on guide plate. If cassette were in place, both posts would protrude inside cassette, between tape and reel. Also "inside" tape path is *threading guide post*, right next to left-side loading-ring post. At right corner of cassette, also "inside" tape path, is capstan.

Loading motor turns rings, and ring posts move outward, each moving partway around one side of video-head cylinder. If a cassette were there, tape would be pulled outward from the cassette by each of these loading-ring posts.

Threading-guide post moves outward, too; but it is pivoted on arm and swings leftward, guiding tape in that direction. Threading-guide post establishes path that holds tape against full-erase head.

As that post approaches leftmost travel, its pivot arm levers another pivoted arm. *Tension post* on the second arm swings rightward and encounters tape. Attached to base of that tension arm is brake band that encircles base of supply reel turntable. If tape were to slacken a bit, brake band would tighten. Drag on supply reel would keep slack out.

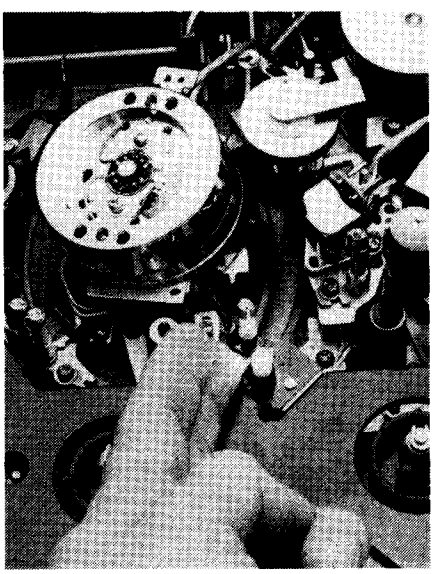
As loading-ring posts pull tape outward along each side of cylinder, tab on left-side ring pushes impedance roller back slightly, to allow tape past. Then impedance roller returns into contact with tape. Impedance roller contacts tape firmly just before 90-degree direction change around left loading-ring post.

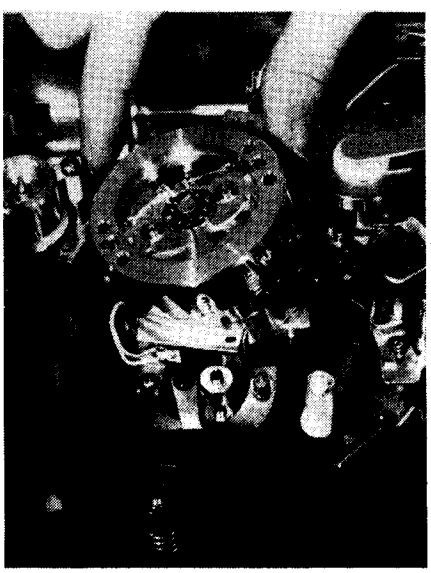
An *angle-post* right beside loading post changes tape direction another 90 degrees. At the same time, angle post orients tape to lie flat against canted cylinder.

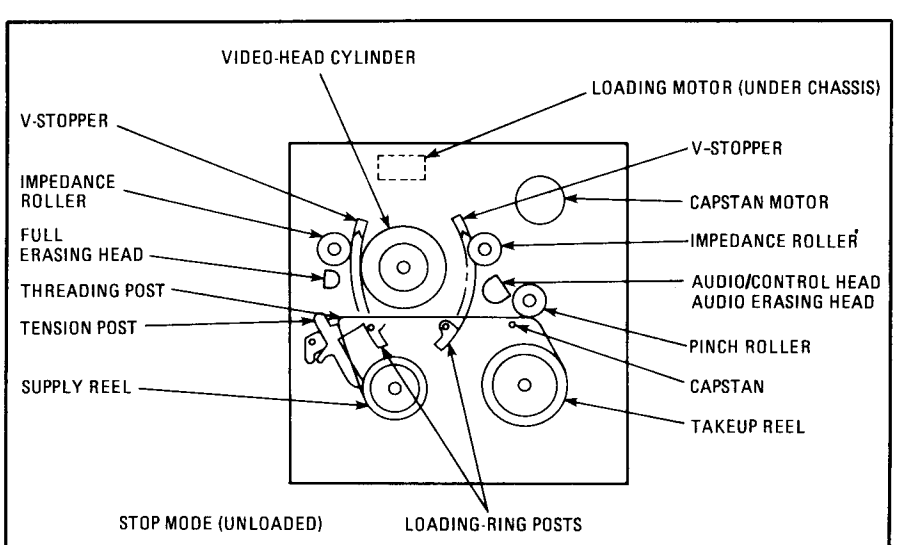
As all that occurs on left side, right-side loading-ring post pulls tape from that side of cassette. But there are no threading-guide and tension posts on right side; another impedance roller positions tape close against right-side loading post. Angle-post there straightens up angle as tape comes from around cylinder. Tape path from impedance roller to capstan goes past audio and control head and holds tape in contact with that head.

When both loading rings have moved their posts through complete arcs (about 110 degrees), both posts encounter V-shaped stop blocks. A loading-end switch signals loading-motor drive stage to stop motor. Similar signal activates pressure-roller solenoid, which draws roller against capstan.

That completes loading. Capstan motor has turned on, as has cylinder drive circuitry. (Video-head cylinder operates from servo-controlled three-phase internal drive motor. In some machines it operates continuously, even in stop or unthreaded mode.)







LEAF SWITCHES signal when threading or unthreading has finished. Tab on left-side loading ring pivots arm that pushes loading-end switch closed.

In earlier VHS models, loading-end switch applies 12 volts DC (logic high) to logic circuits that turn off threading motor stages, activate pressure-roller solenoids, and switch electronics to playback. Unloading-end switch, activated by projection on right-side loading ring, grounds logic input when it closes. This applies logic low to stop reversed threading motor.

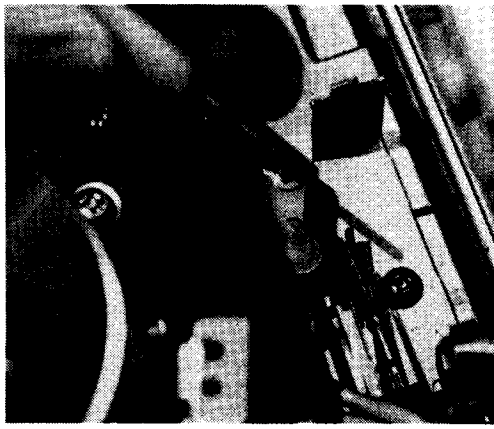
Some later VHS models have been altered to take logic low from both switches—that is, each switch grounds its respective circuit connection when it closes at end of action.

Microswitches often become misadjusted, but leaf switches seldom do. It's easy to tell by inspection whether a leaf switch closes as it should. However, leaf-switch contacts are susceptible to oxidation. Occasional burnishing is an important part of preventive maintenance.

Most noticeable symptoms of faulty end-switches: Slight swishing sound of loading motor as its pulley slips in belt, motor having failed to shut off after loading. In unloading or stop mode, capstan may keep running after unthreading has supposedly finished.

Observe those switches. Normal operation calls for whichever switch is closed to open as threading or unthreading *begins*. Thus both stay open during actual load/unload activity. Failure of either switch to open thwarts this operation. Machine may refuse to load; may load and then kick out PLAY button but not unload; or may fail to unload when returned to stop mode either by auto-shutoff or manually.

Replacement is best, of course, Inept adjustment of a leaf switch often aggravates problems just described.

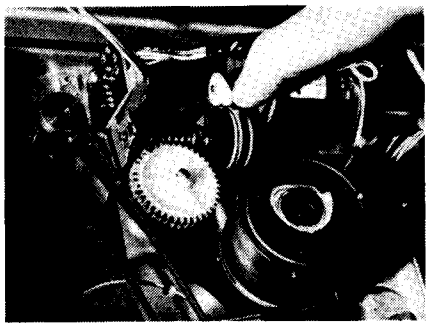


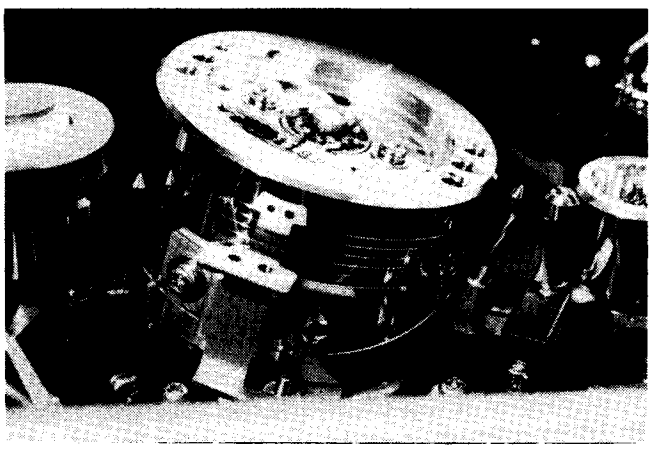
SIMPLE FAILURE of machine to load tape after PLAY button has latched down can point to broken or slipped drive belt. Characteristic of this symptom: slight whine of loading motor running but no hint of movement in threading mechanism. After several seconds without loading activity, automatic shutoff takes over and pops PLAY button back up.

Occasionally, jammed threading mechanism prevents loading. That situation generally is accompanied by some noticeable effort of loading rings to turn. Again, though, auto-shutoff takes over presently. A stray object jamming the machinery can often be dislodged by turning loading-drive worm gear backward by hand. Bent parts would require replacement. Do not try bending them back yourself; bending might work for a while, but will result in callbacks and wasted time.

Slipping drive belt takes the same cure as in a high-grade record changer or audio tape recorder. Clean pulleys and belt thoroughly with alcohol. Best to replace belt. Do not touch either pulleys or inside surface of replacement belt. Be sure you have right belt; wrong size can create intermittent.

If loading motor fails to run, do not blame motor until you have checked out motor-drive stages. Transistor fault there, as often as not, lets motor run in one direction but not in other.





TAPE POSITIONING in transport can be critical. Guides and posts along path take care of that positioning. However, probably the most crucial are guide posts on loading rings (photo above). They align tape with respect to head wheel and thus with spinning video heads. Even slight misadjustment of just one guide post delivers band of snow (photo above, right). In some cases, you see multiple bands across picture. This symptom may not be too bad with tapes recorded on same machine.

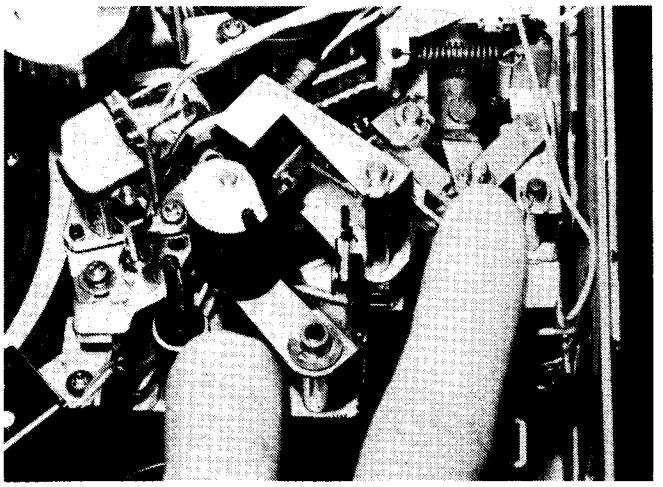
Examine tape itself. If tape shows crinkling along one edge, cause is likely in guide posts on loading rings.

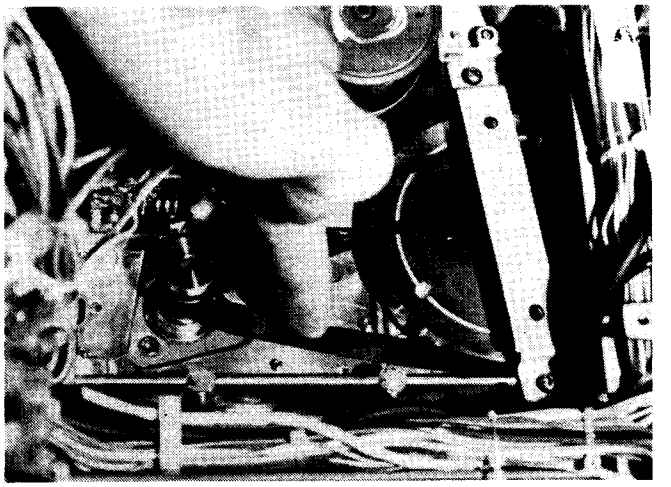
Heights of post guides are independently adjustable in most machines. It's easiest if you remove cassette-carrier cover. However, you can manage preliminary trial adjustment with only machine cover off.

Insert cassette (*not* your alignment cassette). Press PLAY. When the machine has threaded, turn off main power switch. That leaves posts out beside head wheel and accessible. To reach right-side post, you may have to push the impedance roller aside, as shown in photo at bottom right). Use only special tool for adjustment (RCA No. 144389; Magnavox No. VFK0137/171455-13). (When you turn machine back on, it automatically unthreads and cycles out to stop mode, since power was interrupted.)

Make your trial adjustments only slight—never more than one-half turn of alignment screw each time. After one attempt, play properly recorded tape and observe snow band. If it has become wider, you have gone in the wrong direction or have adjusted a post that was not out of line.

P.S. Misalignment of head wheel assembly *could* cause the snow bands; but that is not likely unless head wheel has been replaced and its supports improperly seated.



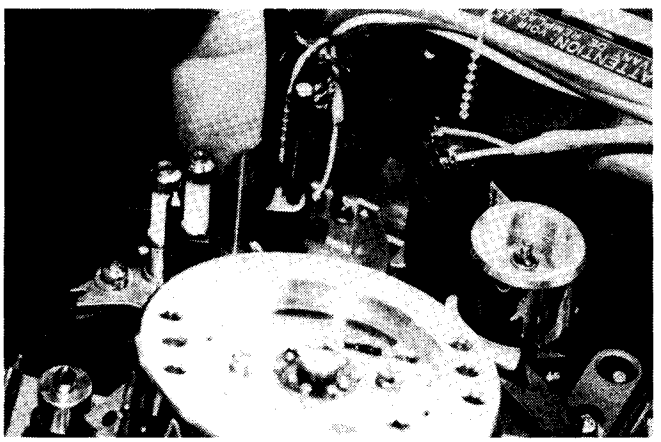


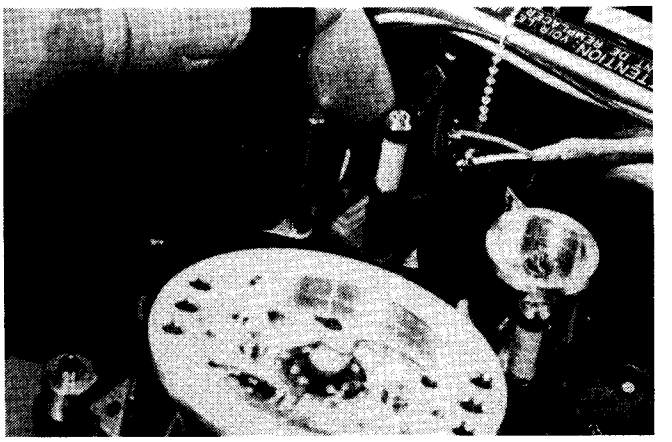
STEADY MOVEMENT OF TAPE through transport depends largely on capstan and pressure (pinch) roller. Minor speed variations are noticeable first in audio track. As "wow" grows worse, picture begins breaking up—and sometimes mutes completely, blanking off both video and sound. Control servos try to smooth out minor speed errors, but severe changes reach beyond their range. Indeed, too much slippage trips machine's automatic shutoff.

Transport or tape-movement faults fit into at least four categories. (1) Inadequate pinch-roller pressure, or flatted or aged roller. (2) Capstan-drive slippage. (3) Excessive drag at supply-reel turntable. (4) Faulty cassette. A faulty cassette, which seldom happens, can be handled easily by simply substituting a known good cassette.

Pinch-roller trouble can develop from fault in solenoid (see photo above, left) or its linkages. Hardening rubber on pinch roller can allow slippage, and calls for new roller. Thorough cleaning of capstan shaft with alcohol should help, and should be done with any replacement roller. Keep finger-marks from both capstan and roller.

Capstan shaft has flywheel underneath deck, driven by flat rubber belt from pulley on capstan drive motor (see photo above, right). Aging belt or accumulation of oil or dirt on pulleys can induce slippage. Any video recorder should have new set of drive belts installed every year or so, or after 1000 hours of operation, as preventive maintenance. Suggest that to machine owner, when an older machine comes in. But you'd better not replace them without explaining first, unless they're actually defective; someone might accuse you of installing unneeded parts.





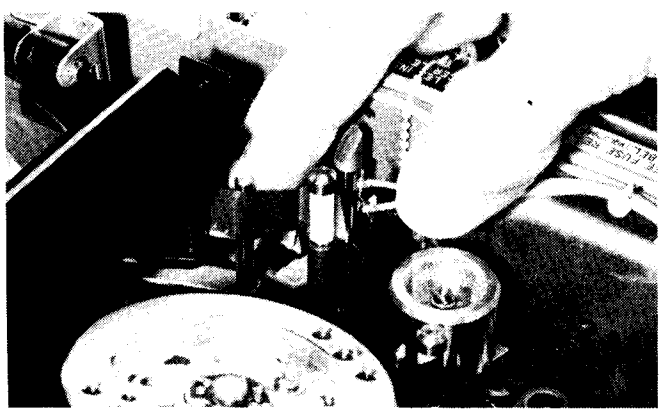
DURING PLAY OR RECORD operation, only motion applied to supply-reel turntable comes from tape being drawn out of cassette. Yet, turntable cannot be left free to "coast." Tape tension must be maintained so that tape stays in close contact with heads throughout transport.

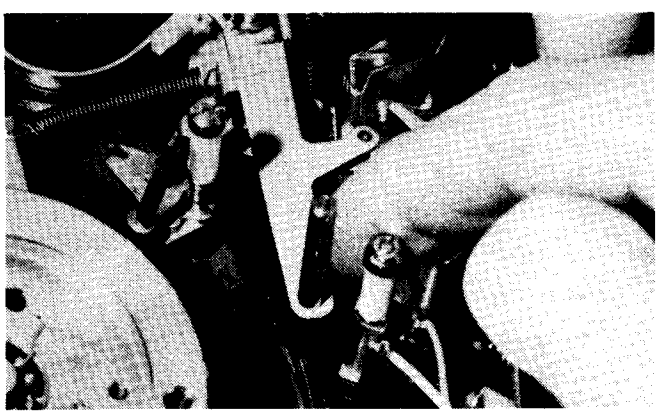
When loading posts move outward, drawing tape with them, threading-guide post moves leftward. Its motion operates another *tension arm* on which is *tension post* that moves rightward, encountering tape. You can gauge motion of those two posts in photos above; thread positions are in photo at above right. Also, to help you visualize those actions, photo at bottom left shows tape route between these two posts.

Other end of tension-post arm attaches to brake band at base of supply-reel turn-table (see photo at bottom right. If tape tries to slacken, slack allows tension post to move rightward, which tightens brake band around supply turntable.

That brake is thus self-regulating under most circumstances. Too much braking overtightens tape and forces tension post slightly leftward, loosening brake band. However, misadjustment might leave the brake band entirely too tight and present too much drag on supply reel.

Foreign material, such as debris from broken tape, might work its way down alongside either turntable. That could impede rotation of turntable. Stuck takeup turntable causes tape to spill. After several seconds, in some machines, this condition activates the auto-shutoff circuitry.





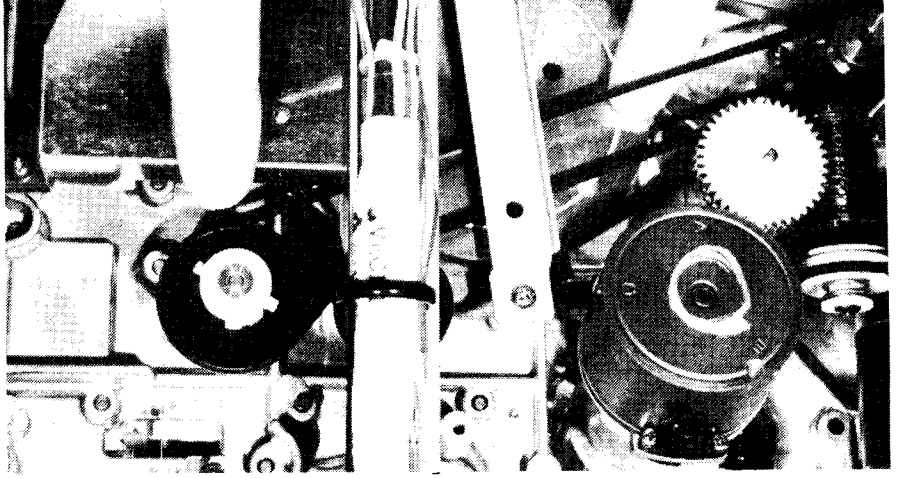
FAST FORWARD AND REWIND both operate only with tape unthreaded. Tape path carries it across front of cassette, with gate open, of course. Either operating button closes switch contacts that turn on capstan drive-motor. (Video-head cylinder, which has its own drive, remains off, in some machines.)

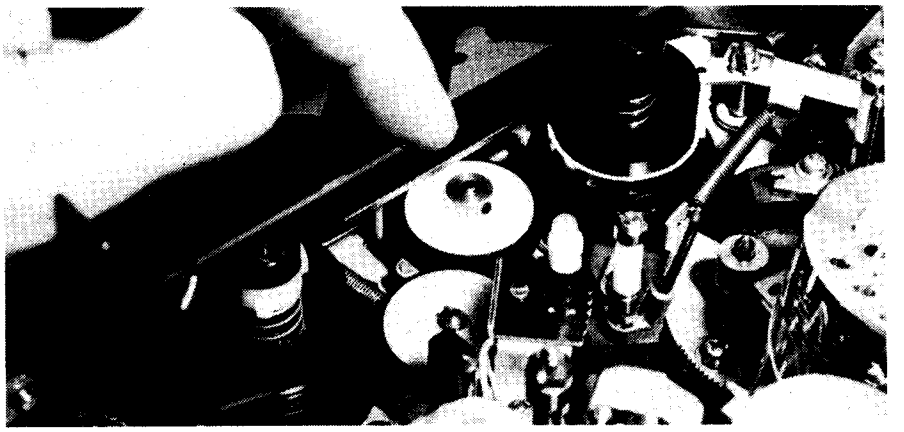
Rubber belt from pulley on capstan motor (see photo at top) spins fast-speed drive wheel (where finger points in photo at bottom). Mechanical coupling from REWIND button pulls fast-speed wheel into contact with rim of supply turntable. Result: turntable spins "backward" at high rpm, winding tape back onto supply reel very rapidly.

Pressing FAST FORWARD button pulls fast-forward idler wheel into contact with both fast-speed wheel and rim of takeup turntable. That pulls tape rapidly from supply reel and winds it up on takeup reel.

Defects are generally mechanical. (1) Button linkage may fail to pull correct wheel or idler into contact with proper turntable rim. (2) Turntable in question might be stuck, but that would also affect Play or Record modes. (3) Turntable may have lubricant on its rim. (4) One of idler wheels with rubber tires may be afflicted by defects common to such parts: aged and cracked or hardened rubber tire; dirt or lubricant accumulation; or chafed bearing at wheel center. (5) Drive belt may have broken, slipped off, or stretched. (6) Pulleys beneath deck (photo at top) may have accumulated grit or oil, or set screw might have come loose.

Cleaning takes care of dirt and oil. Replacement cures bad drive belt. Replacement is surest corrective for bad idlers. In every case, however, even after replacements, clean entire drive system with alcohol before you call any job complete.





SOME PRECAUTIONS are appropriate once you have found and cleared threading/unthreading problems.

Before you start reassembly of covers—even before you put cover back on cassette carrier—remove two strips of black tape covering end-sensor phototransistors. Otherwise, machine could damage video tape.

Inexperienced technicians reaching that phase of VCR repair often can't find or identify correct screws for replacing covers. To avoid such confusion, buy compartmented trays at hardware store and label each compartment. Less expensive: commandeer styrofoam egg carton from kitchen (see photo below).

With all covers in place, insert blank cassette tape and test all functions: Record from camera and tuner, at both speeds, using monitor; playback into monitor; pause; fast forward; rewind; and, of course, stop. Be sure machine goes automatically to Stop mode and unloads at both ends of tape travel, and whenever you slow down capstan or head wheel by hand. **R-E**