

VCR ROUTINE MAINTENANCE

COURSE # NEB736001

Object: To show how to clean heads, change belts and to do other routine non-electronic maintenance. Also, to determine if professional service is needed. No electronic troubleshooting will be taught.

Motivation: To save money. This course will save the student the \$39.95 fee that most servicers charge to clean a VCR.

Suggested Text: TROUBLE SHOOTING and REPAIRING VCRs by Gordon McComb. Tab Books catalog #2960. Available at dealers such as Active Components at 125 SE Marine Drive in Vancouver. About \$25.00

INTRODUCTION

The VCR is one of the most complex devices ever offered to the public. It requires levels of precision of manufacture and operation undreamed of in the 1960s for a consumer product. Since its introduction as a consumer product in the mid 70s, the growth of this product has been phenomenal. Also, in spite of a constant inflation since then, the price of VCRs has steadily dropped.

A VCR in 1978 cost over 1 month's gross wages for the average worker. Now, a VCR can be bought for as little as two days pay. Even the most deluxe models cost far less than the most basic 1978 model in terms of the number of hours one has to work to buy one. The VCR that cost \$1400 in 1978 (in 1978 dollars) is available in a much better model now, with more features for \$229.00 today (in present day dollars).

BASIC THEORY

An audio tape recorder records a frequency range from 50 Hz (cycles per second) to about 15,000 Hz. This can be obtained with a tape speed of 1 7/8 inches per second on a good cassette deck. The upper frequency limit is mainly determined by the speed the tape moves past the tape head. To get better high frequency response, the tape has to move past the head at a higher speed.

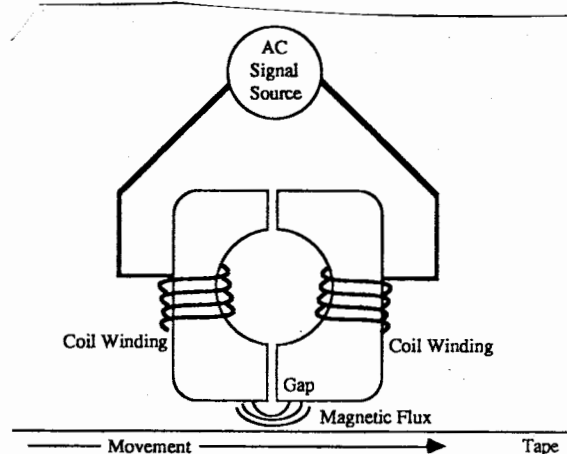


Figure 1 Tape Head Cross-section

Format and Speed	Writing Speed	Linear Tape Speed
Beta		
B-I	274.6 ips (6975mm/s)	1.57 ips (40mm/s)
B-II	275.4 ips (6995mm/s)	0.78 ips (20mm/s)
B-III	275.6 ips (7002mm/s)	0.52 ips (13.3mm/s)
VHS		
SP	228.5 ips (5804mm/s)	1.31 ips (33.35mm/s)
LP	229.1 ips (5820mm/s)	0.66 ips (16.7mm/s)
EP	229.3 ips (5826mm/s)	0.44 ips (11.12mm/s)
8mm		
SP	147.7 ips (3751mm/s)	0.56 ips (14.3mm/s)
LP	148 ips (3758mm/s)	0.28 ips (7.2mm/s)

Note: Writing speed increased slightly at slower linear tape travelling speeds

Figure 2 Tape speed chart

In video recording, the range of frequencies that we wish to record range from 50 Hz to 6,000,000 Hz. This is abbreviated as 6MHz. This requires much faster tape speeds. In Figure 2 we have a chart showing the writing speed for various tape formats. In the VHS system, to record the frequencies required, we have to have the head moving past the tape at a speed of about 229 inches per second.

This is very fast. This would result in extremely fast tape movement and we would need huge reels of tape to record even 1 hour of video. The trick developed by the Ampex Corporation in the 1950s for professional video recording was to spin the heads at an angle to a wide tape. This is possible as video can be recorded a frame at a time on a very narrow track.

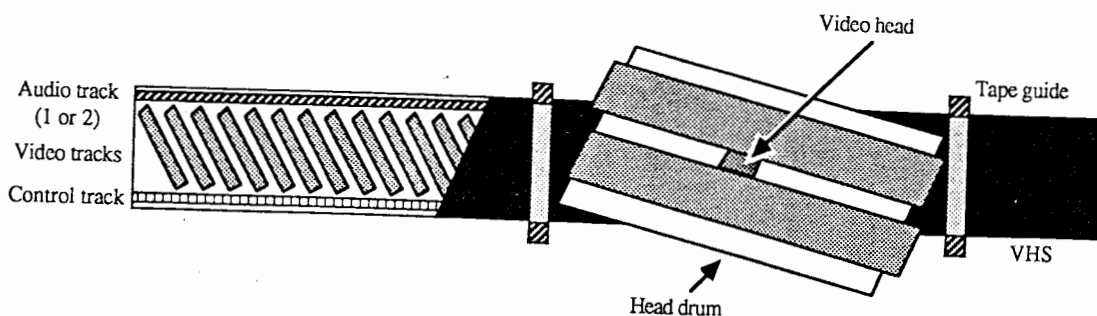


Figure 3 VHS Video Recording

By spinning the head and by putting two heads on the head drum we can record tracks on the tape at high speed while at the same time moving the tape very slowly. The tape movement speed in a VHS

VCR ranges from 1.31 inches per second in SP mode down to 0.44 inches per second in SLP or EP mode. By this means we can make a reasonably sized tape cassette that can play for many hours.

The tape head consists of a stationary part called the "lower cylinder" and a spinning part called the "upper cylinder". The heads are mounted on the upper cylinder.

The tape, when loaded is wrapped around slightly over 180° of the cylinder's circumference.

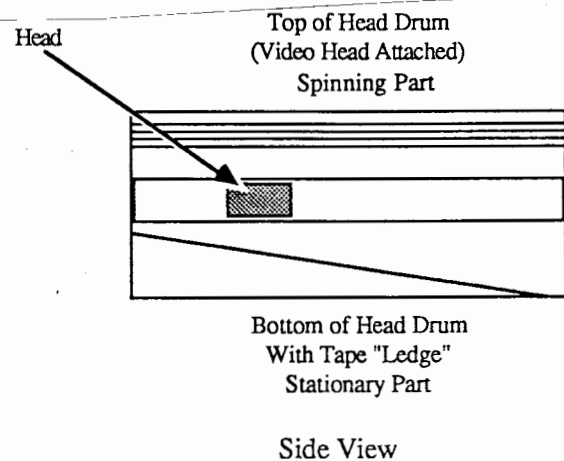


Figure 4 Video Head

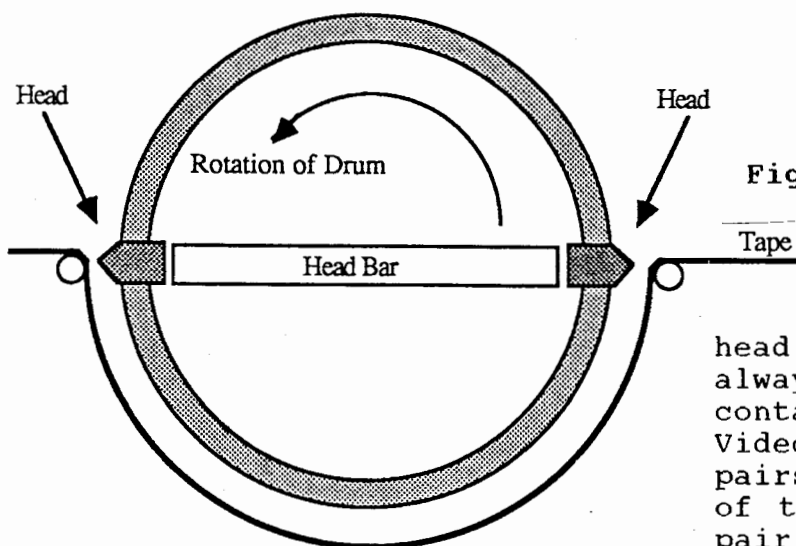


Figure 5 Top view of upper cylinder

As you can see, to maintain head to tape contact there must always be at least 1 head in contact with the tape at all times. Video tape heads always work in pairs and there must be a minimum of two. A 4 head machine has one pair optimized for SP speed and a second pair optimized for SLP speed.

A Hi-Fi machine has two additional heads for the Hi-Fi sound track. Some machines have one extra head for "trick play". This head is only to give a clear image when the VCR is in Pause mode. It has no effect of normal playback. Better camcorders and some top end VCRs also have an erase head mounted on the upper cylinder for noise free video editing. This is often called a flying erase head.

The number of heads does affect performance but makes little difference in maintenance procedures. There are two additional, stationary head that must be maintained. If you refer to Figure 3 you can see an audio track at the top of the tape and a control track at the bottom. The audio track is for standard, non Hi-Fi sound and the control track is required for the VCR's servo circuits to properly align the video heads with the tracks recorded on the tape. The other head is the erase head.

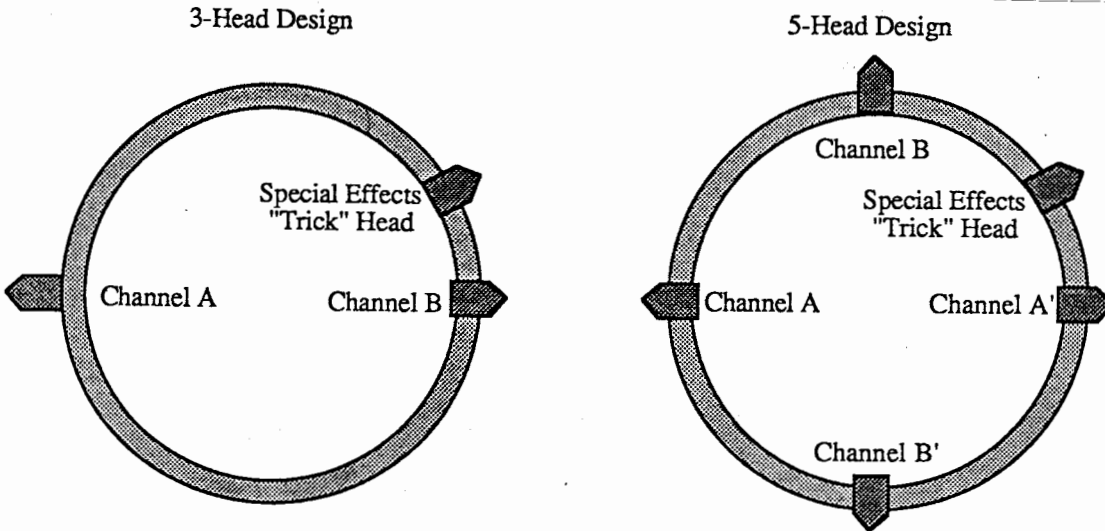


Figure 6 Special 3 & 5 head designs used in some VHS decks

The tape, when loaded in the VCR has a complex path that takes it around the head drum and various other places. The loading of the tape is fully automatic when you press the play button.

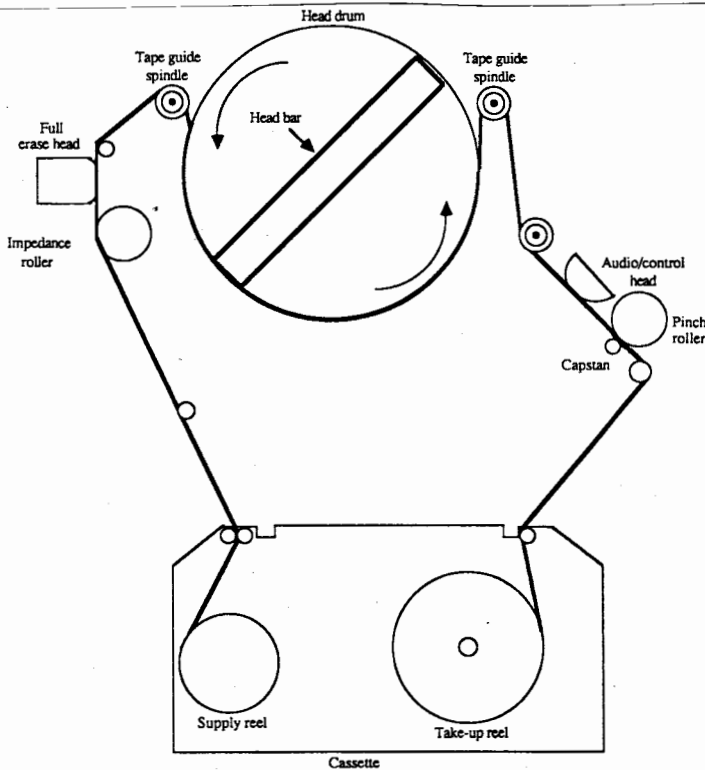


Figure 7 A simplified view of VHS tape threading

has to turn at a variable speed as the amount of tape on it is

The tape comes off of the supply reel in the cassette. It goes past the impedance roller, full erase head, first tape guide spindle, head drum, second tape guide spindle, audio/control head and capstan/pinch roller before re-entering the cassette being rolled up on the take-up reel.

The tape is moved along the path by the capstan which rotates at a constant speed depending on what speed the tape was recorded at. The pinch roller pinches the tape against the capstan so that it can move at a steady speed. The take-up reel takes up the slack at the tape is pulled along by the capstan. The take-up reel

constantly changing. There is a slip mechanism to allow the take-up reel to maintain constant tension on the tape.

The supply reel has a tension band around it to provide a constant amount of drag. This keeps the tape pressed against the video head and prevents any slack from occurring.

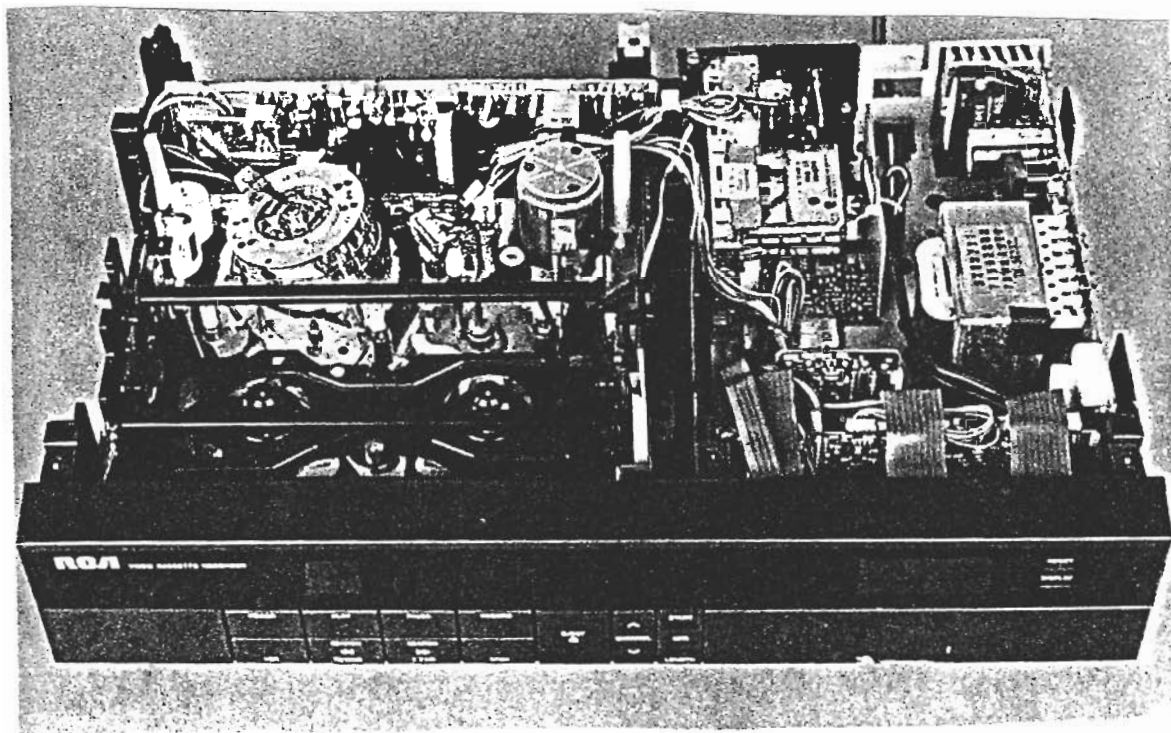


Figure 8 Typical VCR with the top cover removed

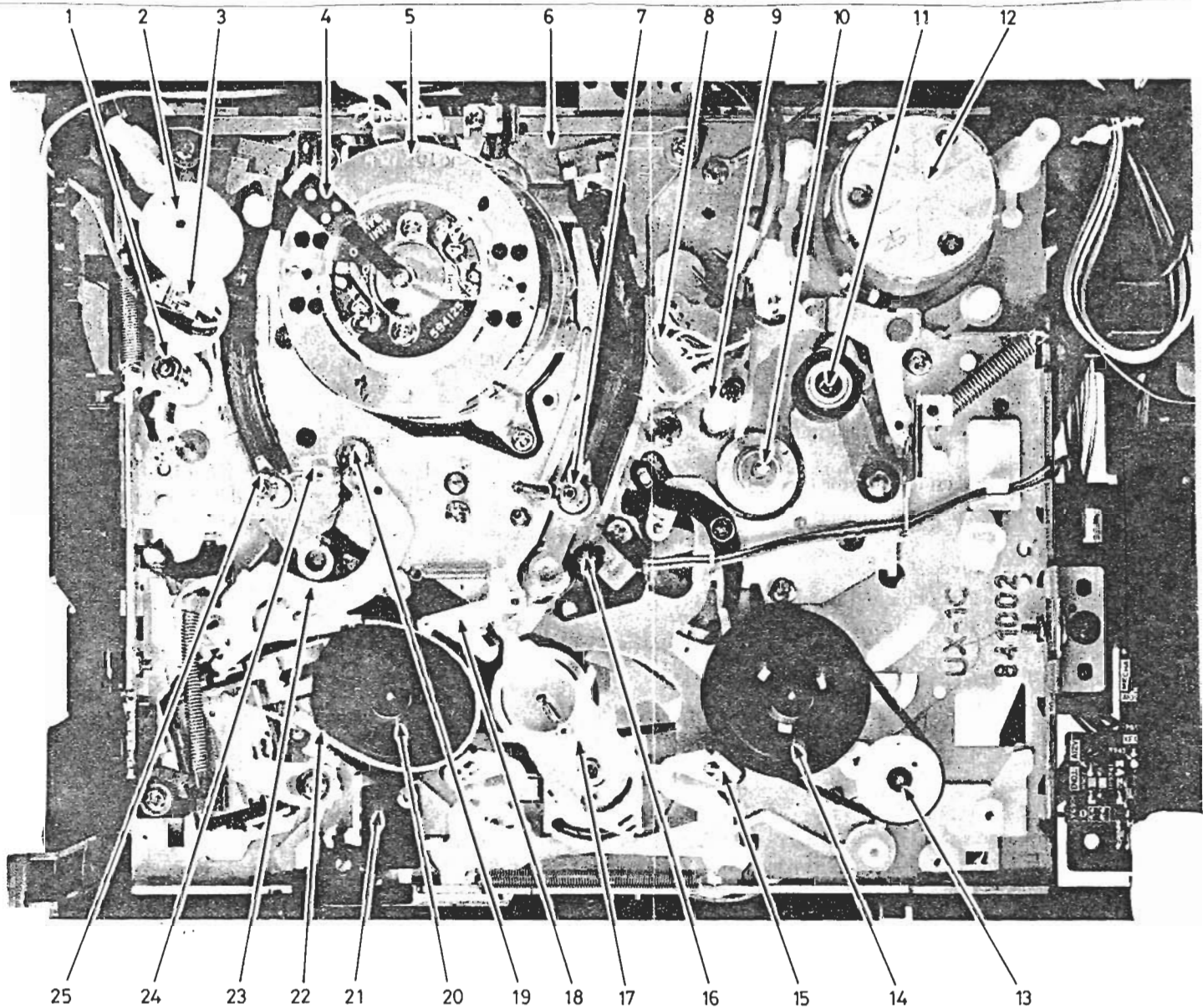
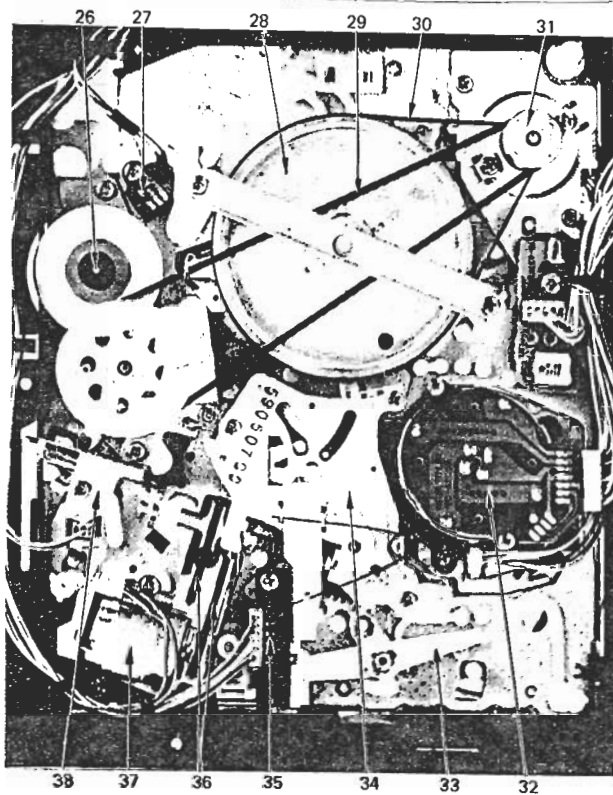


Figure 9 Top view of a typical VHS tape transport

- | | |
|--------------------------|-------------------------|
| 1. SUPPLY GUIDE POLE | 14. TAKE-UP REEL DISK |
| 2. IMPEDANCE ROLLER | 15. MAIN BRAKES |
| 3. FULL ERASE HEAD | 16. END LAMP |
| 4. CYLINDER MOTOR BRUSH | 17. REEL DRIVE IDLER |
| 5. UPPER CYLINDER | 18. SUB BRAKE |
| 6. CATCHER/CYLINDER BASE | 19. TENSION POLE |
| 7. TAKE-UP GUIDE ROLLER | 20. SUPPLY REEL DISK |
| 8. AUDIO/CONTROL HEAD | 21. SAFETY TAB SWITCH |
| 9. TAKE-UP GUIDE POLE | 22. TENSION BAND |
| 10. CAPSTAN SHAFT | 23. TENSION ARM |
| 11. PRESSURE ROLLER | 24. ANGLE POSTS |
| 12. CAPSTAN MOTOR | 25. SUPPLY GUIDE ROLLER |
| 13. LOAD PULLEY | |

To get to the tape transport you have to remove the top cover of the VCR. Before doing this, you **MUST** unplug the AC power. In late model VCRs, the top cover is usually held on with two to four Phillips head screws. A #2 Phillips is usually the correct size.



- 26. CLUTCH PLATE
- 27. REEL SENSOR
- 28. CAPSTAN FLYWHEEL
- 29. REEL BELT
- 30. CAPSTAN BELT
- 31. CAPSTAN MOTOR PULLEY
- 32. LOWER CYLINDER
- 33. TENSION RELEASE ARM
- 34. LOADING GEAR ASSEMBLY
- 35. MECHANISM STATE SWITCH
- 36. LOADING BELTS
- 37. LOADING MOTOR
- 38. BRAKE SLIDER

In the bottom view you can see the belts used to drive the tape. The long belt drives the take-up reel while the shorter belt around the large flywheel drives the capstan.

Figure 11 Bottom view of transport mechanism

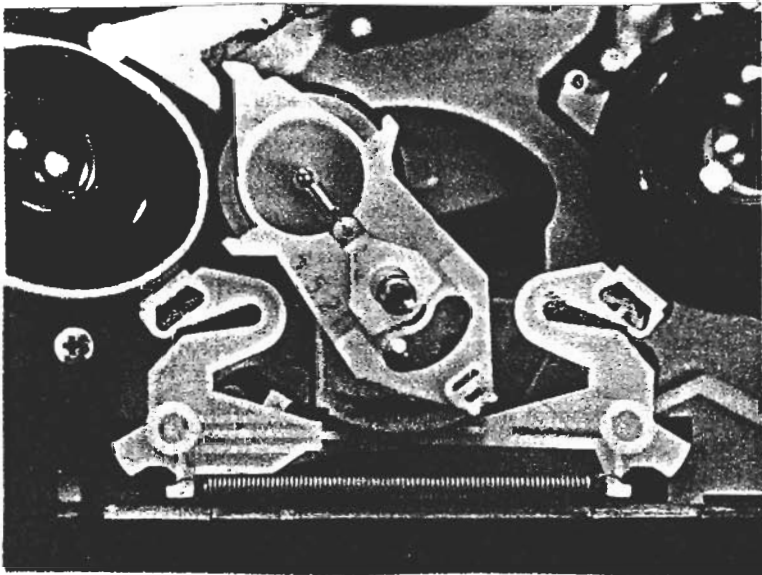


Figure 13 Idler tire

The reel drive idler illustrated here is a very critical part that has caused a lot of problems on Hitachi built VCRs in the mid-80s. This includes most RCA models. This part will fail on every machine eventually causing intermittent tape handling problems. Replacements are available for about \$12.00 at Main Electronics in Vancouver or Able Electronics in Burnaby.

CLEANING

The main thing you will learn in this course is how to clean and lubricate the VCR's mechanism. Cleanliness of the video head is

extremely critical. The least amount of dirt can prevent the video heads from recording or playing back properly.

The drum unit illustrated is a typical two head assembly. The actual video heads are tiny black rectangles on the side of the upper cylinder directly below the large holes on the top of the upper cylinder. They are easily damaged and cleaning them must be done with the proper tools.

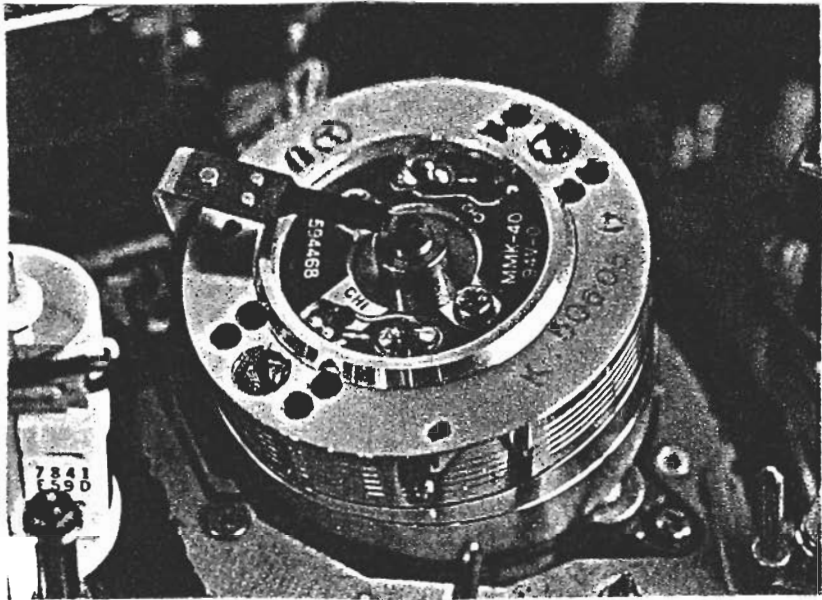


Figure 14 The video head drum or cylinder assembly

The easiest way to clean video heads is to use a wet type video head cleaning tape. These are available almost anywhere. A typical example would be the Radio Shack 44-8055 which sells for \$19.54. These are alright for surface dirt and occasional maintenance. They may not keep the machine as clean as it should be, especially if there is a smoker or a pet in the household.

To clean the video heads properly requires a more direct approach. Panasonic suggest the following procedure. The video head cleaning swab is first sprayed with a cleaner such as Radio Shack Contact and Head Cleaner, part # 44-1011 (\$3.83) or dipped into a head cleaning solution.

Then, the cleaning stick or swab is pressed against the head and rubbed in the direction of tape travel, clockwise around the head.

Both sides of a double faced swab may be used. Make sure that you clean all the heads on the drum.

A complete cleaning kit including the cleaning sticks and a bottle of cleaning solution is available from Radio Shack. (Part #44-1172 \$15.59). The swabs, along with any required parts or chemicals, are also available from Main Electronics at 4554 Main St. in Vancouver. The swabs are about \$5.50 for a package of 10.

Whatever you do, do not use Q-Tips, a cloth, your finger or any other thing to clean the video heads other than a swab or stick meant for cleaning video heads. You will, not might, damage the heads. The heads are the most expensive part in the VCR. Don't take a chance.

The cleaner used is usually Freon TF (yes, the ozone killer) mixed with alcohol. Isopropyl alcohol may also be used provided it

PROCEDURE FOR CLEANING OF UPPER CYLINDER UNIT

1. Position the video head to permit access for cleaning and hold the upper cylinder to keep it from turning while cleaning.
2. Gently rub the video head in direction of tape travel with Head Cleaning Stick.
3. Repeat for the other video head.

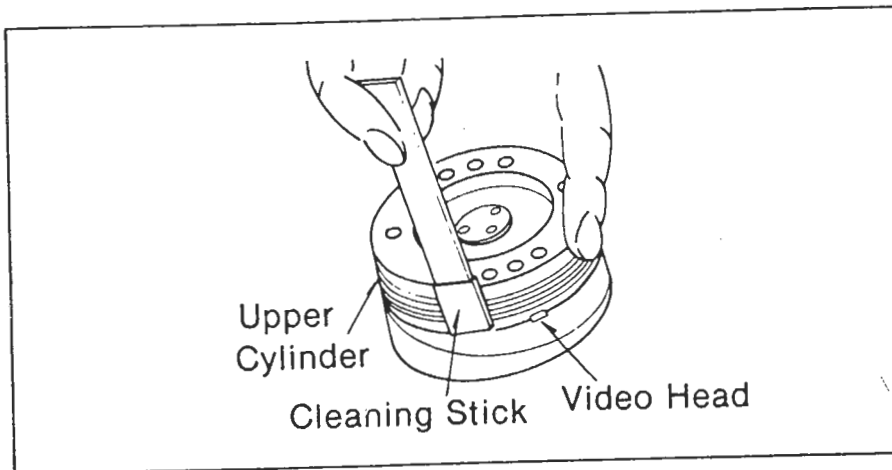


Figure 15 Head Cleaning

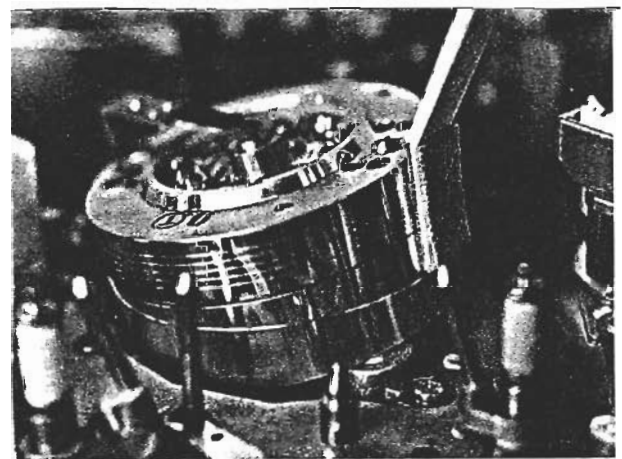
video heads.

It is not considered prudent to spray cleaners directly onto the video heads. The cleaning agent is Freon which, when it evaporates, drops in temperature by up to 90°C. The sudden thermal shock can crack the tiny ferrite chip that is used for the video head, rendering it useless.

After cleaning, wait at least 5 minutes before inserting a tape into the VCR and playing it. This is to allow the cleaner to fully evaporate. If the heads are still wet when you play the tape, the heads will get dirty again and will be much harder to clean again. Also, the VCR may also "eat" the tape.

is "technical" or "medical" grade. That is, 97% alcohol or more. The higher the percentage of alcohol, the less water is in the mix. The water takes longer to evaporate and can prevent adequate removal of the dirt.

Do not use a cleaning solution meant for audio heads. They sometimes have lubricants that are not needed nor desired for



Cleaning the video heads with a charmois-tipped applicator. Remember to fully wet the charmois with the cleaner.

Figure 16 Head Cleaning

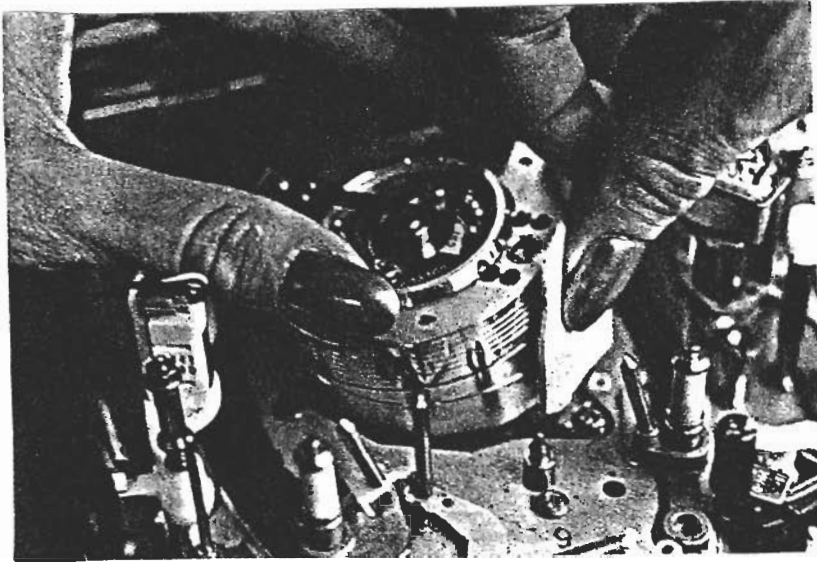


Figure 17 Using a chamois square

After cleaning the video head, the full erase and audio/control heads must be cleaned. These may be cleaned with a Q-Tip or the used video head cleaning swab as they are nowhere as critical. Use the same cleaning solution as used for the video heads.

Other parts that need cleaning include:

- Idler tire
- Capstan shaft
- Pinch roller
- Take-up and supply reel rims
- Tape guides
- Threading/loading pulleys
- Rubber rollers
- Capstan motor pulley (on the bottom)
- Capstan shaft flywheel (on the bottom)

These too may be done with Q-Tips using the video head cleaning solution. Caked on rubber on these parts can be removed with an orange stick borrowed from a manicure set.

Make sure that none of the rubber rollers are cracked or have caked on dirt that the cleaning could not remove. These will have to be replaced. If you are not absolutely sure of how to do this, leave it to a professional.

Do not try to clean the tension band that is wrapped around the supply reel. However, if the felt lining appears worn, you may have to replace it. If you are unsure how to do this, leave it to a professional.

After being used for cleaning, the swab should not be reused. The dirt on it may be transferred back onto the video head the next time. However, the instructor has successfully reused the swabs a number of times.

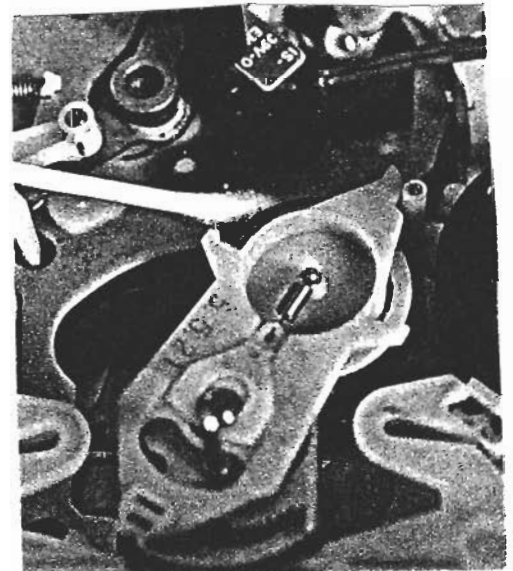


Figure 18 Cleaning the idler tire

To oil the deck, look for parts that move. The video head requires no lubrication under any circumstances. If in the least bit of doubt do not oil anything. Never use more than one of the smallest drops you can make anywhere in a VCR. Use a very light oil such as 3-IN-1 sewing machine oil. Radio Shack have a needle tip oiler, part number 64-2301 for \$2.94. Do **NOT** get oil or grease onto any part that touches the tape or any belts under any circumstances. If you do, immediately clean the affected area at once.

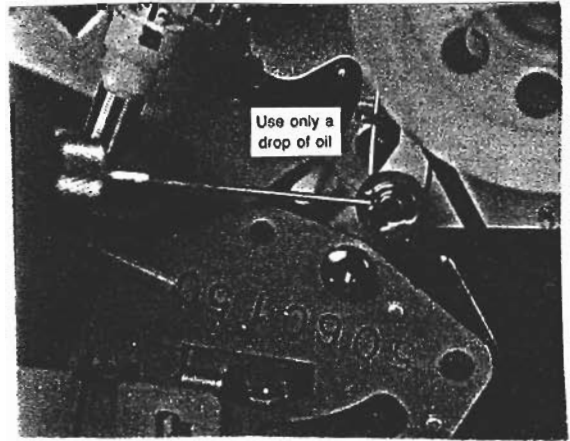


Figure 19 Oiling

One part that should be oiled is the capstan shaft bearing. To oil it, see Figure 19. Note that there is usually a small plastic washer on the capstan. This must be moved upwards before oiling the shaft. Use only a tiny, tiny drop and then move the washer back down.

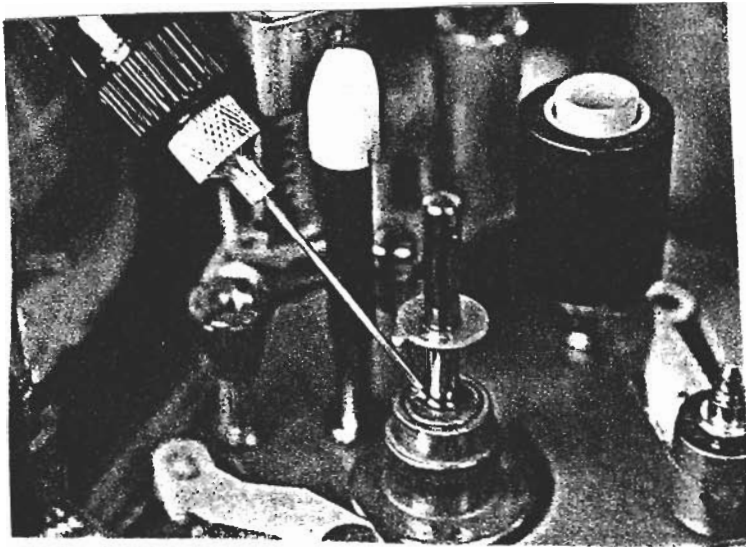


Figure 20 Oiling the capstan shaft

If any oil gets on the shaft above the washer, this must be cleaned off before the VCR is used.

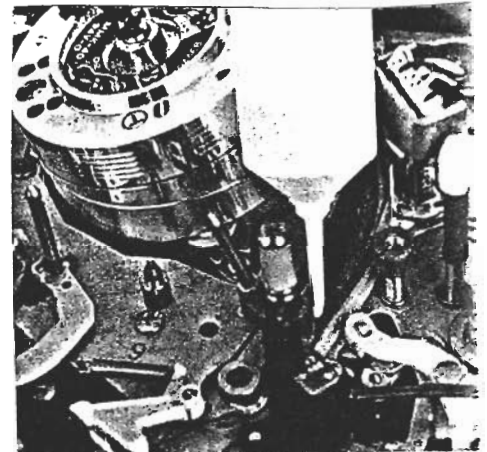


Figure 21 Greasing

The only areas that usually require greasing are the tracks that the tape guides follow when loading or unloading the tape. Use a white grease such as "Lubriplate" in very sparing amounts. If you have any doubts, too little is better than too much.

At this point, play the machine with the cover off of it. Do not touch anything inside of it with the cover off while it is plugged in except for the front panel controls.

Note that some VCRs will not play if a light is directly above the machine. A light will trip the end of tape sensor making the VCR think it is at the end of the tape, putting it into the stop mode.

REMOTE CONTROL

The remote control is a spot where trouble often occurs with TV sets and VCRs. Usually remote problems are cured by buying a new remote control for about \$50.00 to \$100.00. The most common remote control problem is deal batteries. After testing or replacing the batteries, dirty battery contacts are a very common fault.

To clean them, remove the batteries and by using the special battery contact cleaning tool shown in Figure 22, rub the contacts until they are clean. A file or sandpaper should not be used unless the contacts are rusty as this will remove the plating on the contacts.

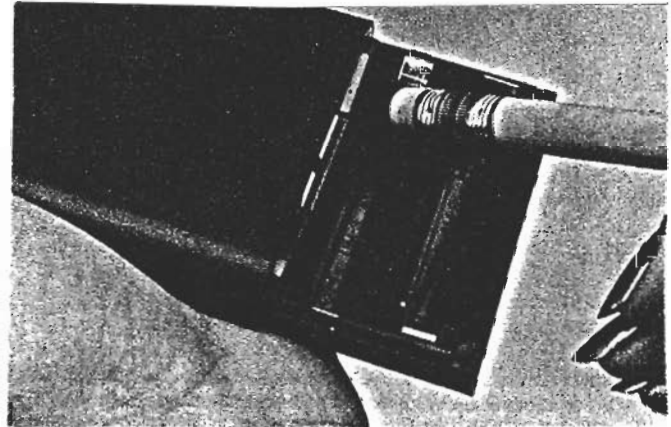


Figure 22 Cleaning battery contacts

Unless a special battery is needed, use only alkaline batteries such as Duracells or Energizers in your remote as these last longer and are less likely to leak. Do not use rechargeable batteries as they have a lower voltage and you will get greatly reduced range. Also, they will need charging monthly while alkaline cells should last for several years.

The special cleaning tool for battery contacts is a available at any stationary store.

If The problem is that only some buttons do not work, cleaning the hand unit may be necessary. Open it up and clean it. See Figure 23 for an illustration of a typical remote hand unit. Simply blowing out the crud and spraying cleaner often restores operation of non working buttons.

Some hand units use a rubber membrane keyboard. If your remote has the membrane that is not glued directly to the circuit board, separate the rubber membrane from the printed circuit board. Take a strip of blank white bond paper about 1" wide and moisten it with your head cleaner.

Rub this piece of paper over the rubber contacts on the rubber membrane as if it were sand paper. Repeat with another piece to the printed circuit board. Paper is just abrasive enough to cut through

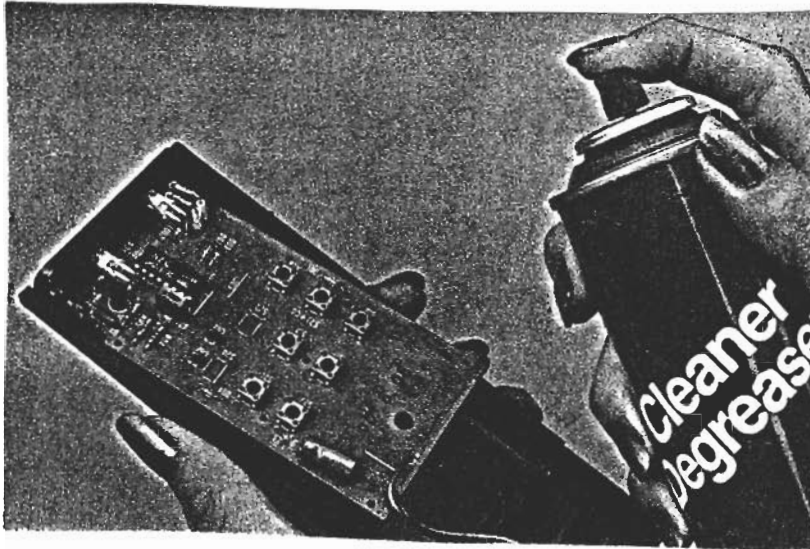


Figure 23 Cleaning the remote control

the dirt without damaging the plating on the circuit board. Reassemble the hand unit and test it.

PARTS DEALERS

The primary source for parts for a product is, of course, the people who made or imported it. Most manufacturer's have a local representative. However, for supplies

for the sort of maintenance we have discussed here, your local Radio Shack has most everything you need.

Another excellent source that has everything you need and can get any part you need is Main Electronics at 4554 Main St. in Vancouver. They are open on Saturday but not Sunday. This is where the professionals buy their supplies. In Burnaby, you can also buy supplies from Ridd Electronics at Second and McDonald, 3-4 blocks east of Boundary.

Now that RCA has closed their Vancouver parts operation, RCA parts are distributed by Able Electronics on Douglas Road in Burnaby.