

STEREO  
SONIC  
RESONANCE



**DOKORDER**  
model **1140**

---

## TABLE OF CONTENTS

<b>ABOUT THIS MANUAL .....</b>	<b>1</b>
<b>THE 1140 WARRANTY .....</b>	<b>1</b>
<b>UNPACKING .....</b>	<b>1</b>
<b>DISASSEMBLY .....</b>	<b>1</b>
<b>1140 TRANSPORT CONTROLS .....</b>	<b>2~4</b>
<b>THE 1140 ELECTRONICS .....</b>	<b>5~6</b>
<b>BIAS .....</b>	<b>7</b>
<b>CARE AND MAINTENANCE .....</b>	<b>8</b>
Cleaning the Tape Guidepath	
Demagnetizing Heads and Guidepath	
Lubrication	
Other Maintenance	
<b>NOTES ON MULTI-CHANNEL RECORDING WITH THE 1140 .....</b>	<b>9~11</b>
Stereo Recording	
Punch In	
Ping-Pong	
Editing	
<b>ACCESSORIES .....</b>	<b>12</b>
Standard	
Optional	
<b>SCHEMATIC DIAGRAM .....</b>	<b>13~17</b>

Note: Some of the indications and details in the photographs in this Owner's Reference Book may be different from the actual appearance of your deck. This is due to last-minute design modifications for improvements.

## ABOUT THIS MANUAL

Nobody likes to read these manuals (nobody likes to write them either) but they're important. First, because every complex machine has its own personality, and if you're going to work well together you've got to get to know each other. Secondly, the more bells and whistles something has the easier it is to make a mistake when you're preoccupied with other things. Like your music.

This manual then, is like the one you get when you buy a car. We presume you know where you want to go, but we want you to be familiar with the controls so you won't get the windshield wipers when you want the lights.. And you should know how to keep this particular machine up and running so it doesn't break down on you some dark night and leave you stranded.

One last thing before we begin. It has to do with who we think you are.

Multi-channel tape recorders are pretty new as these things go. That is, tape recorders themselves haven't been around as long as, say, turntables, but the state of the art has changed considerably over the last few years.

Functions and features that used to be found exclusively in professional machines costing thousands of dollars are becoming more and more available to everyone.

The point is that while it is relatively easy to define a professional, it is difficult to define "everyone." This manual has to speak to those of you who are intimately familiar with the multi-channel recording art, those who are just getting into it, and those interested only in quad and stereo entertainment.

We've taken a lot of time to reach a balance here but we know some of you will feel you are getting too much information and some not enough. Like all compromises, nobody will be completely satisfied. Including us.

## THE 1140 WARRANTY

The warranty you get with your 1140 is as important as this manual. Maybe more so. For our mutual benefit please read it and do what it says to do.

## UNPACKING

1. Make sure you got everything you paid for. There is an accessory list on page 12.
2. If you see any damage when you unpack call your Dokorder dealer immediately.
3. Save the 1140 carton in case you move or ship the 1140 later.
4. The flywheel on the 1140 is locked to protect it from vibration during shipment (Fig. 1). Remove this screw before use.

## DISASSEMBLY

You may someday want to knock down the 1140. It's easy to do, but there are some things to be careful about. (Fig. 2)

1. There are three elements to the 1140: the transport, amplifier, and amplifier support. The support is connected to the transport and amplifier by wing nuts but there are two cables running through the support terminated by 20-pin connectors. Since the support is very heavy, be sure to unseat the amplifier connectors before you remove the wing nuts.
2. Again, because the support is so heavy, take off the electronics before you take off the support.
3. When the 1140 is disassembled, take care when you move the transport; you don't want to hit something and bend the long bolts in the rear.

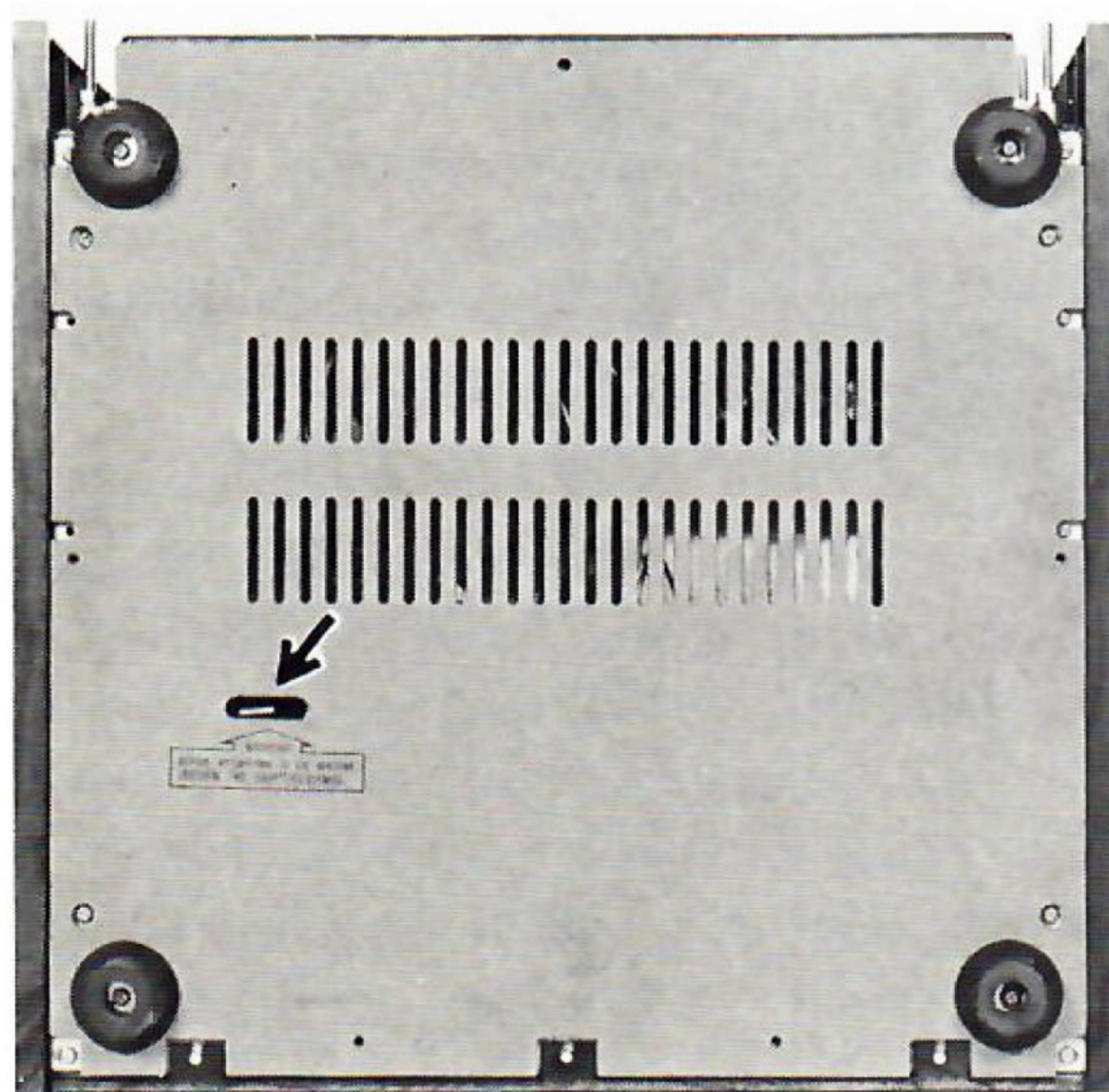


Fig. 1

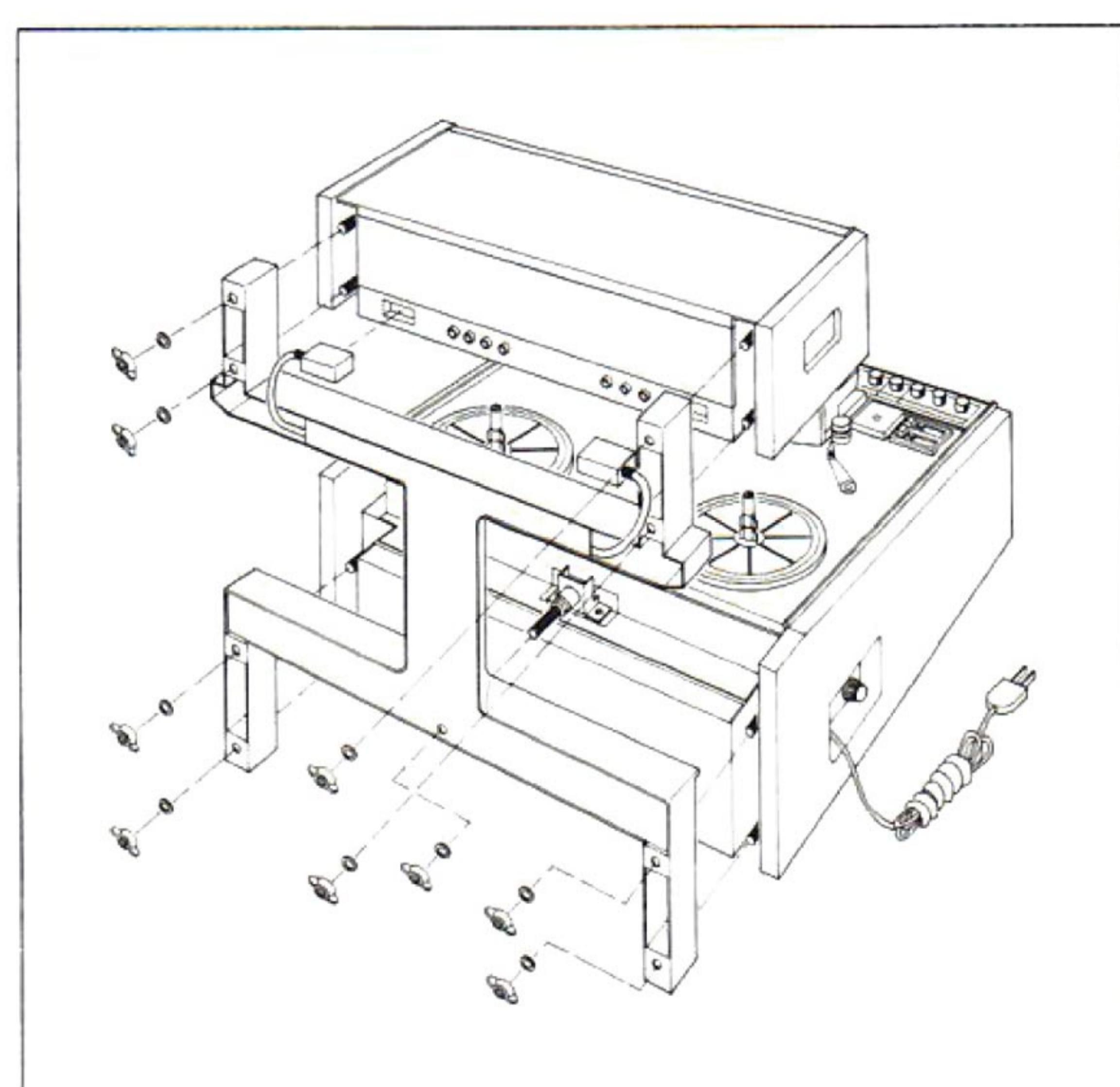


Fig. 2

## LOCATION OF CONTROLS (TRANSPORT)

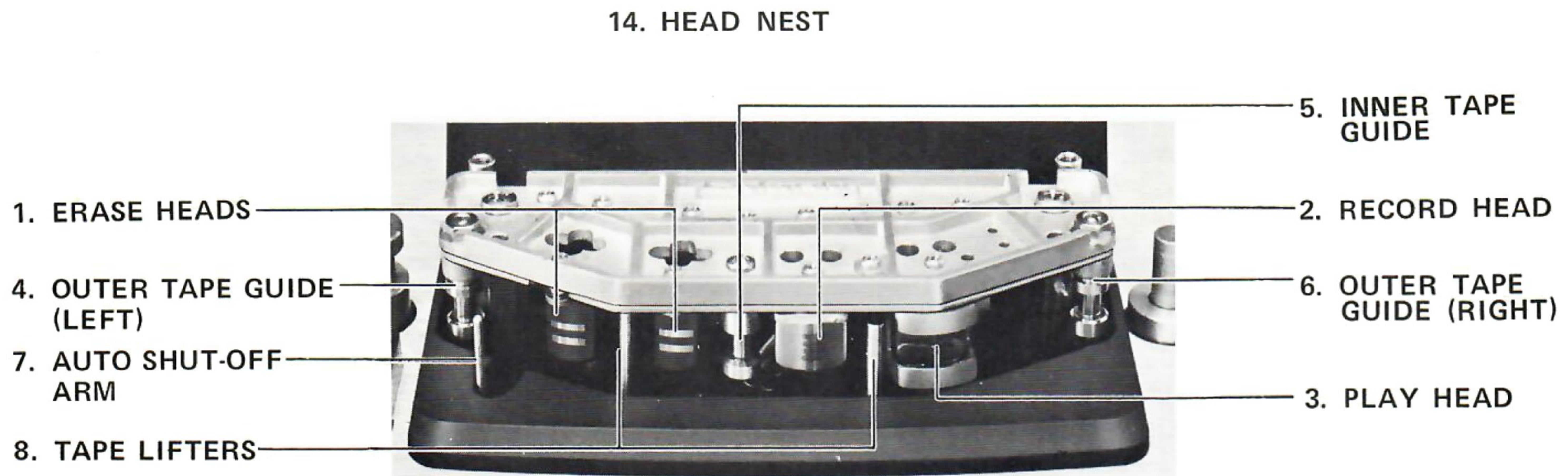
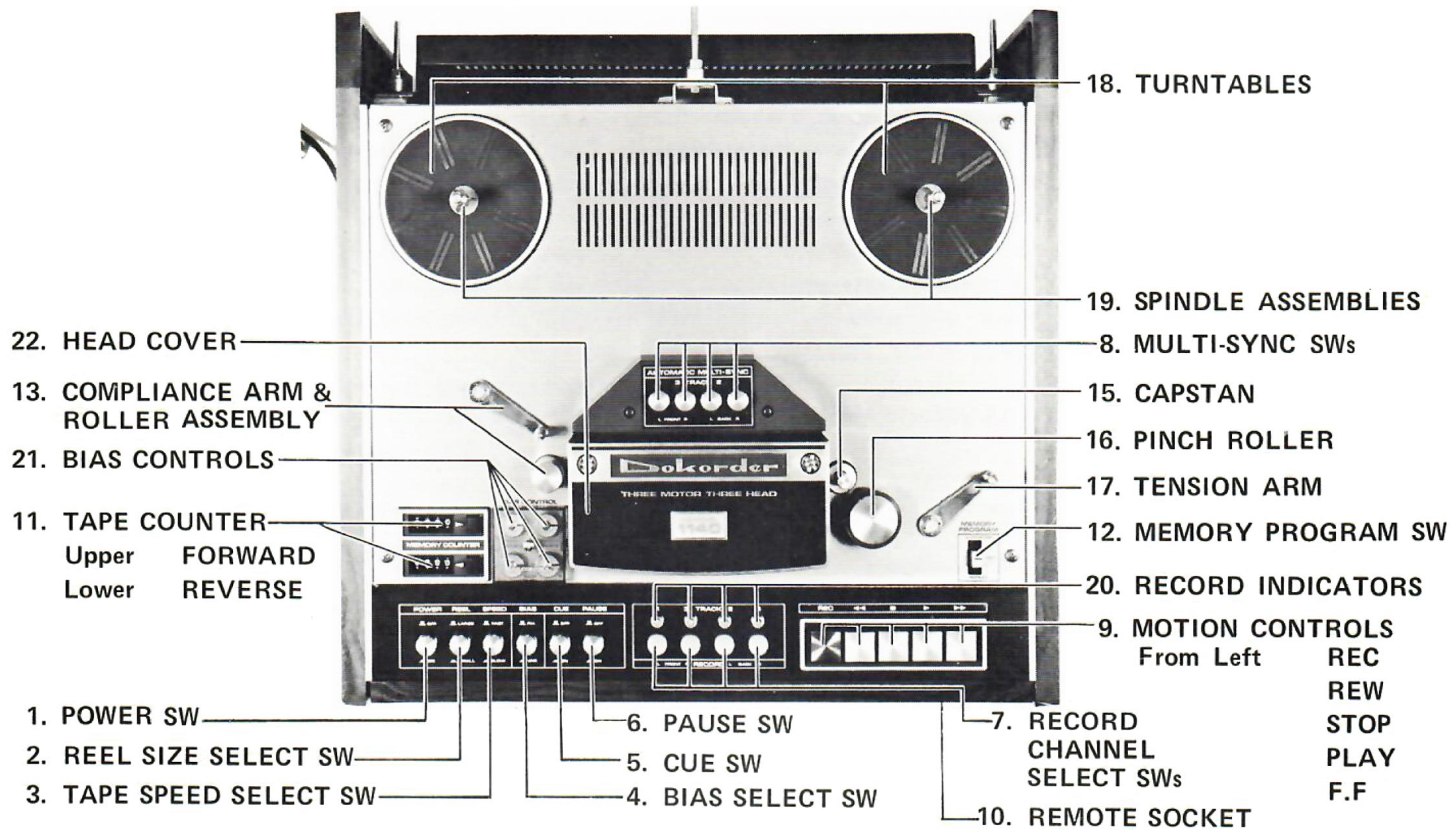


Fig. 3

## 1140 TRANSPORT CONTROLS

### 1. POWER

Push for on.

### 2. REEL

Push for 7-inch reels, release for 10-1/2. You can use smaller reels occasionally but we don't recommend it as a steady diet.

NOTE: the 1140 has motion-sensing circuitry for anti-spill tape handling. But you risk spilling tape and breakage if you use a 10-1/2 inch reel for takeup from a 7-inch reel (and if you go from a 10-1/2 inch to a 7-inch reel you risk a lot more). We know tape is expensive and there will be times when you don't have enough program material to fill a 10-1/2 inch reel and you'll want to spin it off onto something smaller. Just remember when you do not to get into a screaming fast forward or rewind because you'll end up with tape all over your shoes.

### 3. SPEED

Push for 7-1/2 ips, release for 15 ips.

### 4. BIAS

Release to set Bias to the (internally) Fixed position. That's for Scotch 212, Maxell UD-35, and its equivalents. Push for Variable position so you can change the bias current to match your tape.

NOTE: For more information, see the section on BIAS AND EQUALIZATION, pages 6 and 7.

### 5. CUE

Push to activate. The basic function of the Cue mode is to defeat the tape lifter. In Stop mode, with Cue engaged, you can manually rotate the reels to locate the exact point for splicing or cue-up. In fast forward or rewind, the Cue function will help you find the beginning or end of program material. Always be sure however, to enter Record mode with the Cue button released.

NOTE: To avoid tape and head wear, be sure to release the Cue function when you're through.

### 6. PAUSE

Push to engage. Stops tape movement instantly in Play or Record without canceling that mode. One way to use the function is when you're in Record and something goes wrong just after you've slated a take. You can hit the pause button, fix what's wrong and go without getting out of Record. Another way to use it is when you're taping off the air. You can cut out commercials, station ID's and so on.

### 7. RECORD CHANNEL SELECT

Push to select. Think of these buttons as a Record-Ready function. They pre-program the 1140 for the track or tracks you want to record. The indicator lamps above each button will identify the recording channel, after final record mode has been initiated. For extra safety, the 1140 is not yet in Record Mode and won't be until you push the Record and Play touchbuttons. This way you can select your tracks and forget about them while you rehearse, set levels and so on. When you're ready to record, you just push Record, hold it, and press play.

### 8. MULTI-SYNC

Push to select. For monitoring in an overdub situation. Temporarily assigns the recorded signal on the track you select to be played by the record head instead of the reproduce head. Requires selection of one or more Record Select buttons before Sync mode is activated.

NOTE: See the section on Multi-Channel Recording, page 9, for important information on how the multi-sync function works on this particular machine.

### 9. MOTION CONTROLS

Left to right as your face the transport the logic-operated touchbutton controls are Record, Rewind, Stop, Play and Fast Forward. To record, select the appropriate channel by depressing the proper pushbutton (see 7, above). Record can be entered from Stop or Play by holding Record and pushing Play.

NOTE: Since these buttons are logic controlled instead of mechanical, they do not lock in. You can go from one mode to another directly except when you're in Record. Then you have to enter Stop first. Also, the 1140 has a motion sensing system instead of a fixed time delay. Time delay systems usually operate on a worst-case philosophy which always assumes the reels are at their highest speed. To get from one mode to another you have to suffer through the machine's assumption that the reels were going flat out, whether they were or not. The 1140 immediately senses when the reels have stopped.

## 10. REMOTE

For Dokorder Model RC-11 Remote Control Unit. Remotes all tape transport functions.

NOTE: With the Dokorder RC-11, all local buttons will remain operative.

## 11 & 12. PROGRAM MEMORY

Had the famous Murphy been a recording engineer, one of his laws would state: "The greater the need to find the beginning, the less you will remember to log it."

The 1140's Program Memory function provides automatic cue-up and is dedicated to everyone who's ever overdubbed a perfect track on the wrong take or suffered through a back-and-forth hunt for the elusive start of something good.

Here is how to use the counter memory mechanism:

1. Before you record or play something, set the Memory Program Switch to Off.
2. Zero the Forward Counter reset button, then record or play your program material.
3. When you're finished, zero the Reverse Counter reset button.
4. Set the Memory Program switch to Auto-Stop or Repeat, depending on whether you want to stop at the beginning or play it again.
5. Then all you have to do is stop and enter Rewind. You can override the function by holding down the button of whatever mode you're in (Play, Fast Forward, etc.) or, of course by setting the Program Memory switch to Off.

NOTE: 1. The Program Memory circuits are automatically disabled in the Record mode to avoid inadvertant operation which might interrupt a "take".

2. Getting back to the beginning is not a perfect process and couldn't be without costing you a lot of money. The tape won't always stop at the exact spot, although it will stop very near. So set the Program Memory enough in advance of the program material to take that into account. You'll still be a lot closer to home than you ever were without it. Also, realize that if the point at which you wish to cue up at is close to the beginning of the tape, the automatic rewind may overshoot to the extent of running the tape completely off the take-up reel. When this is the case, it will be necessary for you to slow the rewind speed by shuttling between Fast Forward and Rewind modes.

## 13. COMPLIANCE ARM and ROLLER ASSEMBLY

## 14. HEAD NEST with erase, record and reproduce heads.

The head cover is easy to take off to help when you're editing (in fact, to show you what a penny's worth these days, it's ideal for removing the head cover screws).

NOTE: The automatic shutoff arm is located in the head nest (Fig. 3). When disengaged, power for mechanical functions of the transport is shut off but power to the electronics is not affected. The reason the shut-off arm is here instead of part of the output side Tension Arm is so you can use the 1140 in "wastebasket" mode (see the section on editing, page 11).

## 15. Centerless ground CAPSTAN SHAFT with massive flywheel, hysteresis synchronous motor, indirect drive.

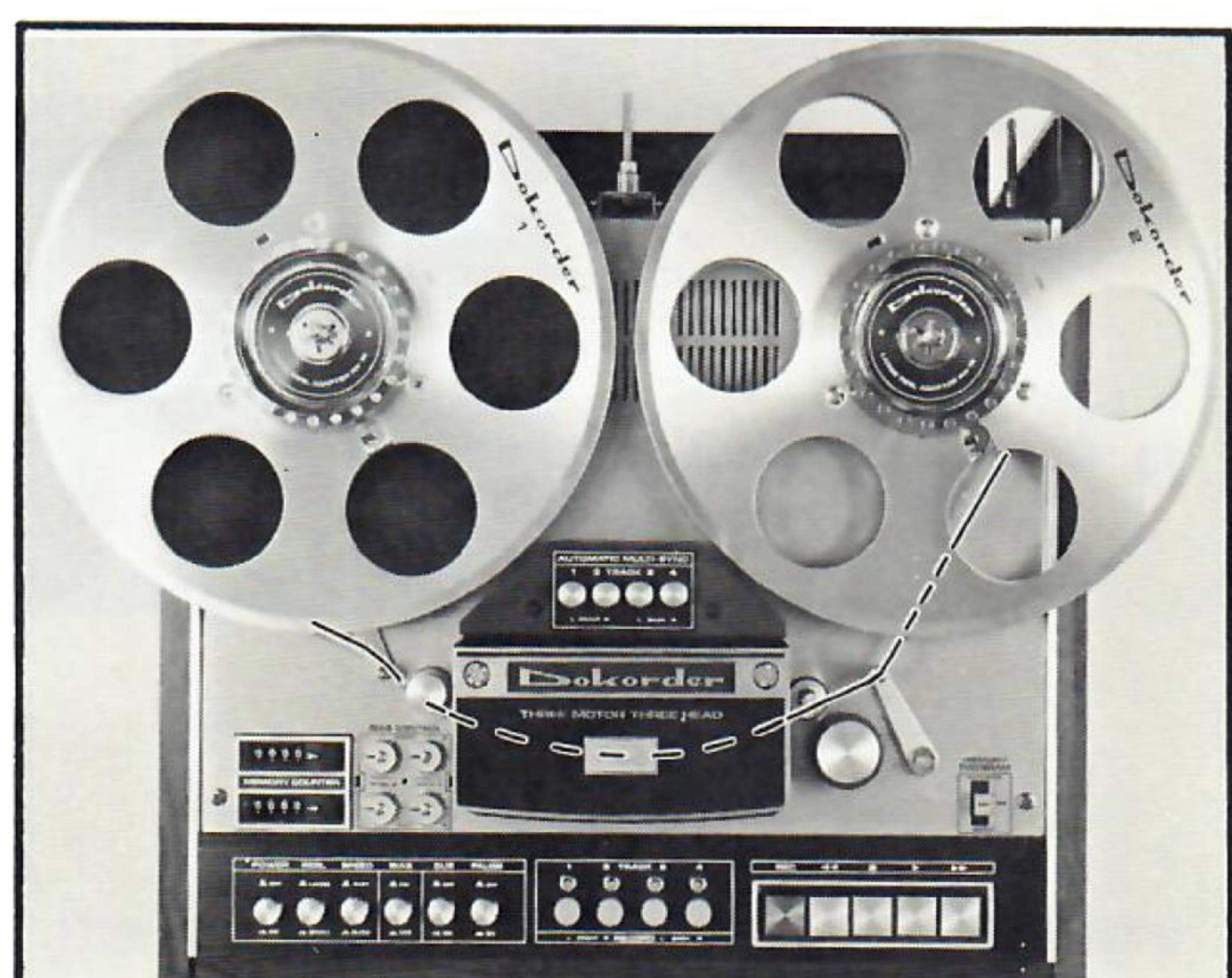
## 16. PINCH ROLLER

## 17. TENSION ARM, output side.

## 18 & 19. TURNTABLES and SPINDLE ASSEMBLIES

independently driven by two heavy-duty 6-pole constant torque motors. Loading 7-inch reels is a pretty straightforward procedure. You don't need reel clamps because they're already there (and for that matter you don't have to use them because the 1140 has a horizontal transport, although you probably should to avoid reel chatter at high speeds). All you have to do is line up the fins on the reel clamp with the reel shaft, mount the reel, then pull up the fin and give it a slight twist.

10-1/2 inch reels can be tricky on any machine. On the 1140 the best way is to seat the hub adapter in the reel first. Then, with your thumbs holding the adapter in place and your fingers on the outer circumference of the reel, locate it on the reel shaft, pull up the fin and turn it to lock the reel. And you said it couldn't be done.



TAPE THREADING PATH

Fig. 4

## LOCATION OF CONTROLS (ELECTRONICS)

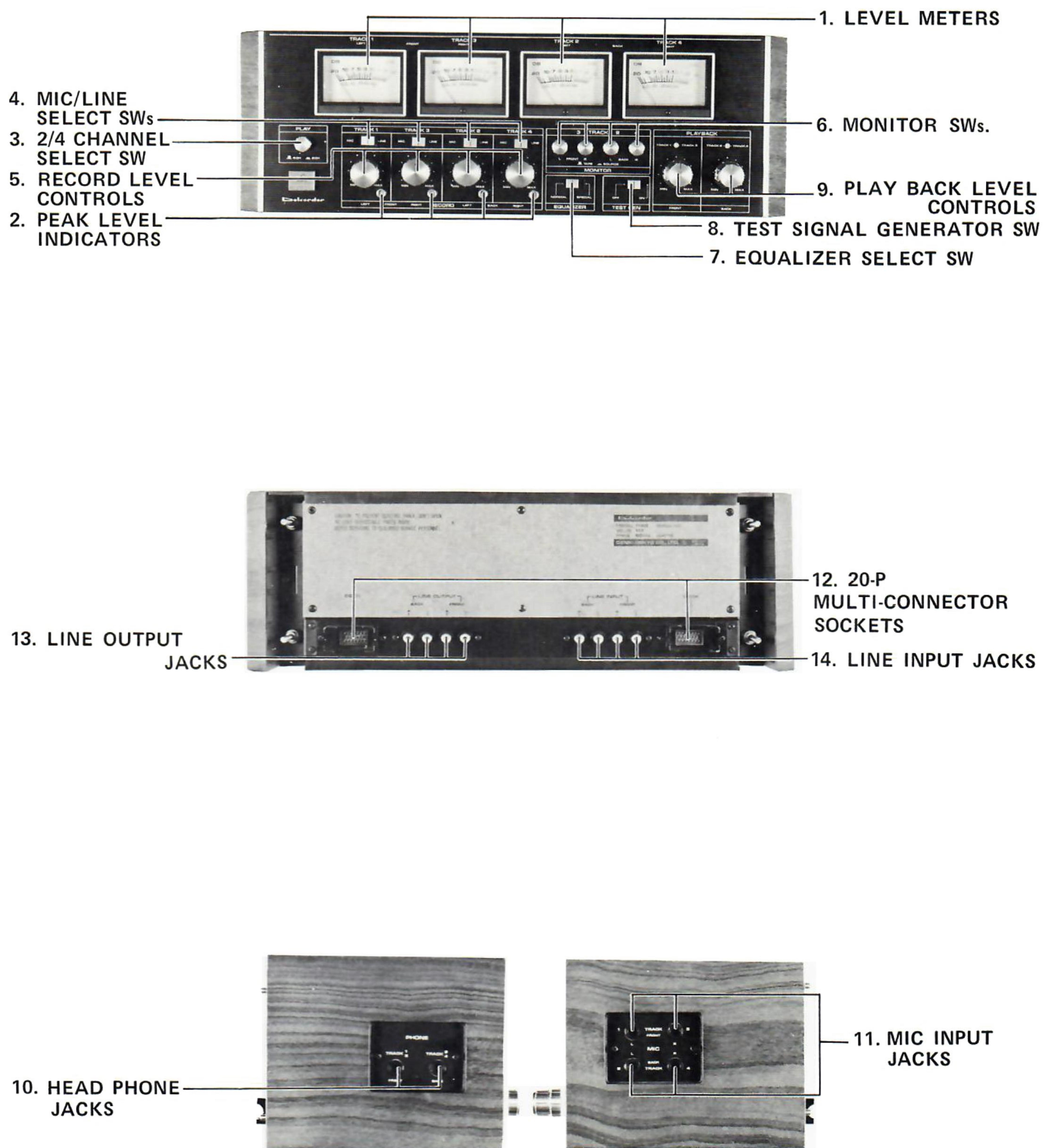


Fig. 5

---

## THE 1140 ELECTRONICS

---

### 1. METERS

For nominal reference, 0 indicates optimum record level and in reproduce mode corresponds to 0dB = .775V out.

### 2. PEAK LEVEL INDICATORS

Since the meters are intended to show average levels, the peak indicators on the 1140 are designed to trigger when signals are over-level by 8 dB or more on short duration peaks.

### 3. 2/4 CHANNEL SELECT

With the button depressed, power to tracks two and four is off. Meter illumination for these channels is also off to make it easier to locate the two working channels.

### 4. MIC/LINE SELECT

Selects between line input and mic input jacks.

NOTE: The line/mic mixing function you generally find on decks was eliminated in favor of lower noise record circuitry.

If you want mixing at all you will probably want Mic/Mic mixing and obviously that is not the function of a tape recorder but a mixer.

### 5. RECORD LEVEL CONTROL

Controls record gain of selected input, mic or line.

### 6. MONITOR SWITCHES

Independent selection of signals which will appear at the Output jacks.

Released; signal from tape.

Depressed; incoming signal to be recorded.

### 7. EQUALIZER

Changes the equalization curve of the record amplifier during recording. Use in combination with the bias switch and bias controls. The switch in NORMAL is for Scotch 212 or equivalent, SPECIAL is for Maxell UD-35 and equivalents.

### 8. TEST GENERATOR

A built-in pink noise generator which supplies a test signal to each channel for the purpose of adjusting front panel bias controls. This admittedly unusual device gives you a simplified, but much more accurate, way to get the optimum bias for the tape you use. To learn how it works, see the section on Biasing the 1140, page 7.

### 9. PLAYBACK LEVEL CONTROL

Varies the level of the playback signal to the output jacks.

### 10. PHONES

For headphone monitoring. Use headphones with an impedance of 8 Ohms.

NOTE: There is a new EIA standard for jack spacing and the 1140 conforms to that standard.

### 11. MIC IN.

Accepts 50 to 600 Ohm unbalanced microphones.

## BIAS

---

With the 1140's pink noise generator, adjusting bias becomes a simpler but much more accurate process. Since pink noise includes a predetermine spectrum of frequencies, once you adjust for a peak output you will then be properly biased for high frequencies, which is not necessarily so when a single tone is used. But since pink noise is of a very random nature, the meters will jump slightly around their average. However, when the test generator is on, the meters will deflect more slowly to help you get the proper adjustment.

NOTE: Remember to turn the test generator off when you're through biasing. If you don't and you're in Record, you'll be recording Pink noise. In Playback the meters will be over damped.

Here is the procedure for bias:

1. Switch Test Generator on.
2. Set all Monitor switches to Tape.
3. Set the Bias Switch down to Variable.
4. Depress all four Record Select Buttons.
5. Load your tape and enter Record.
6. Advance all Playback Level controls for some nominal indication on the meters (somewhere near 0 is best).
7. Starting with the Track 1 Bias Control, adjust it slowly and carefully until you get a maximum reading on the Track 1 meter.

If the needle goes off scale at this point, reduce the playback level.

NOTE: It doesn't matter what the absolute level indication is on the meter so long as it is the maximum you can get for a given setting of the playback level control.

8. Go back through procedure 7 until you're satisfied the meter has shown the highest reading you can get.
9. Repeat procedure 7 for the remaining three tracks.

Incidentally, if you're hooked up to a monitoring system you can learn to hear your way through this process as well as see it. For example, if you overpeak you may not see the change on the meter as readily as you hear a reduction in the high end hiss content of the pink noise.

NOTE: When you're finished with the bias procedure, make sure you replace the bias control cover to avoid accidentally disturbing the controls.

## CARE AND MAINTENANCE

Cleaning and demagnetizing heads, guides and so on should be done routinely. The heads play the most important role in recording and playback and the smallest piece of dust or dirt can affect performance.

One of the things most responsible for collecting junk on the heads is caused by adhesive residue from the little piece of tape manufacturers put at the beginning of the reel. You should throw that away and a complete turn of the leader or tape it was stuck to.

Dokorder makes a very good head cleaner, or you can use denatured or isopropyl alcohol. When you use this stuff, make sure the heads are dry before you run tape over them.

### Cleaning the Tape Guidepath

Dust, oil and other debris in the tension arms, guides, capstan, pinch roller and other parts of the tape path can give you problems with wow and flutter. Clean them using a piece of lintless cloth moistened with head cleaner. The capstan and pinch roller can be cleaned by putting a light coat of cleaner on the surface and letting them revolve together. To do this, push the auto shut-off arm upward and push Play.

Don't use an excess of solution when you clean these parts because runoff can get into the inside of the deck. In fact, any cleaning process on the 1140 is more a matter of elbow grease than cleaning solution.

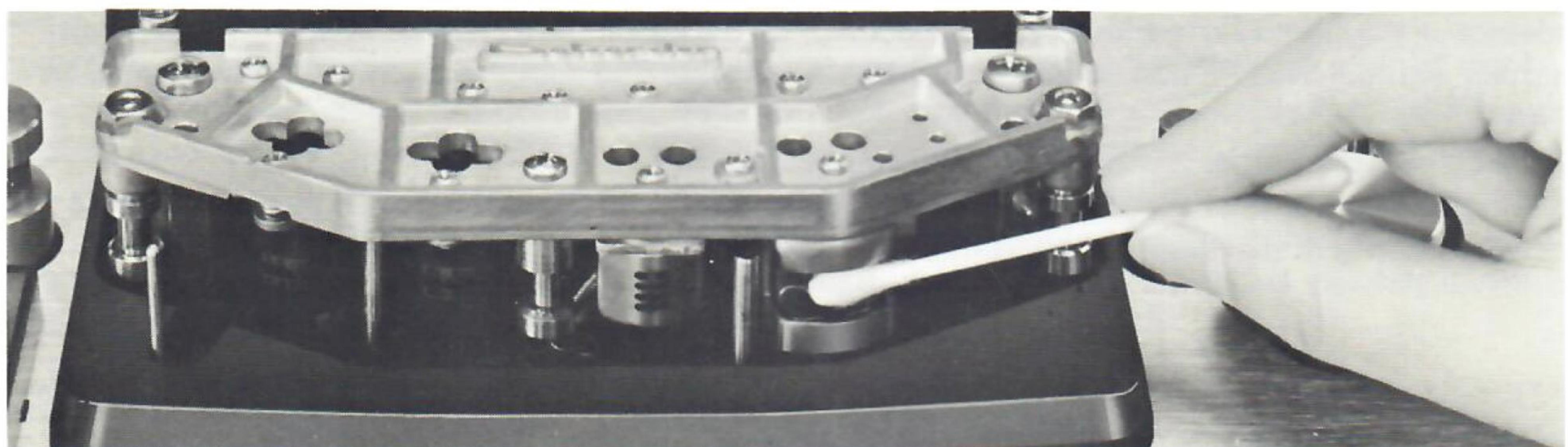


Fig. 6

### Demagnetizing Heads and Guidepath

Over a period of time the heads of any tape recorder slowly become magnetized. If the heads are not demagnetized occasionally there will be an increase in noise and high frequency response will be affected.

Before you begin, make sure the power switch on the 1140 is off and the plug is removed from the AC outlet. Using any commercially available demagnetizer, plug it into the AC outlet and turn it on. Place the demagnetizer tip as close to the head surface as possible, move it up and down several times, then gently pull it away from the surface of the heads.

Be especially careful not to nick or scratch the heads.

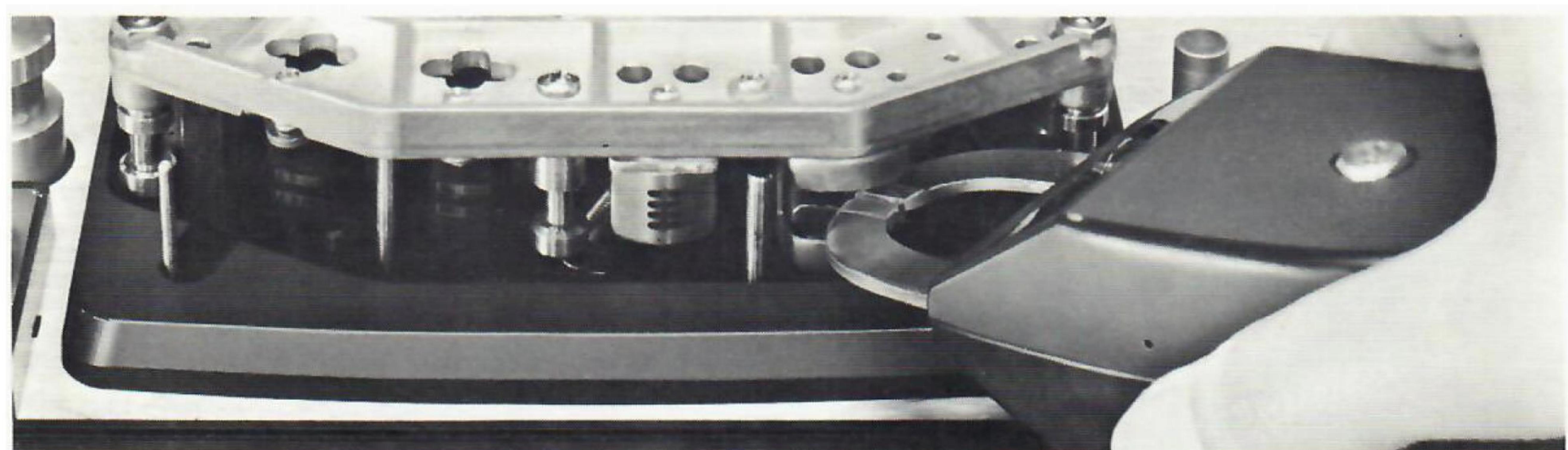


Fig. 7

### Lubrication

We can't advise a schedule of lubrication because we don't know your environment or frequency of use. But any sudden onset of mechanical noises or flutter and wow problems may be a cry for oil. Then contact a Dokorder service station.

### Other Maintenance

Most electronic adjustments on the 1140 are identified and grouped together and can be easily reached through the top of the electronics. They are there, however, only for qualified people. If you don't know what adjustments we're talking about, don't even take the lid off to look.

## NOTES ON MULTI-CHANNEL RECORDING WITH THE 1140

The trouble with most multi-channel tape recorders is simply knowing where you are. There is a sync system and a record system; on any given track when you're in one system you don't want to be in the other, and when you're playing something back you don't want to be in either. Multiply that by four tracks and you can find yourself spending a lot of time concentrating on your music as signal when you want to be thinking about music as art.

The 1140 takes a lot of that frustration off your back. Start an overdub session with all sync buttons down. Just set 'em and forget 'em. Once the sync buttons are depressed it's only a matter of pre-selecting the track you want using the Record Select buttons, because the logic circuitry on the 1140 automatically gets you in and out of Sync and in and out of Source. All you have to do is concentrate on the Record Select buttons. Depress them when you want to record those tracks and you're automatically in Sync. Release them and you're automatically out of Sync.

For example:

You want to record Track 1. You enter Record-Ready by depressing the Record Select button for Track 1. Even though the sync button for Track 1 is also down, when you enter record mode by pressing Record and Play you will automatically be switched to Source.

After you've recorded that track and you want to play it back, release the Record Select button for Track 1 and leave the sync buttons down. Now you'll automatically be switched to the playback head and you'll hear what you've done in full fidelity.

It's as easy as that.

By the time you're up to Track 4 where it used to get really hairy (you had to be out of Record-Ready and into Sync on Track 1, 2 and 3, and out of Sync and into Record-Ready on Track 4), you're still just repeating the same simple steps you used for Track 1.

You only have to work with the 1140 for two minutes to see what a pushover the process is. In fact, it takes a lot less time to do it than to write about it.

Another nice thing about the sync function on the 1140 is that the level from the record head in sync is the same as the playback head so you won't have to worry about gain.

Finally, the Program Memory function earns its keep in overdub recording so get into the habit of using it.

### Stereo Recording

If you're going to do a two-track stereo recording just follow the front-panel sequence of the meters to get the right track geometry. As you face the panel from left to right the meters are for Tracks 1, 3, 2 and 4. Use the 2/4 Channel button here to cut off power to the two channels you're not using and to darken those meters.

### Punch In.

When you punch in you're selectively re-recording a portion of a track and keeping everything else. Here's a typical situation: You've recorded a track in which you've expressed yourself particularly well artistically, but part of the performance has a flaw. Or maybe you've got a keeper but you want to add a tag line.

By entering Record mode at the point of the flaw or where you want the tag, the track can be salvaged.

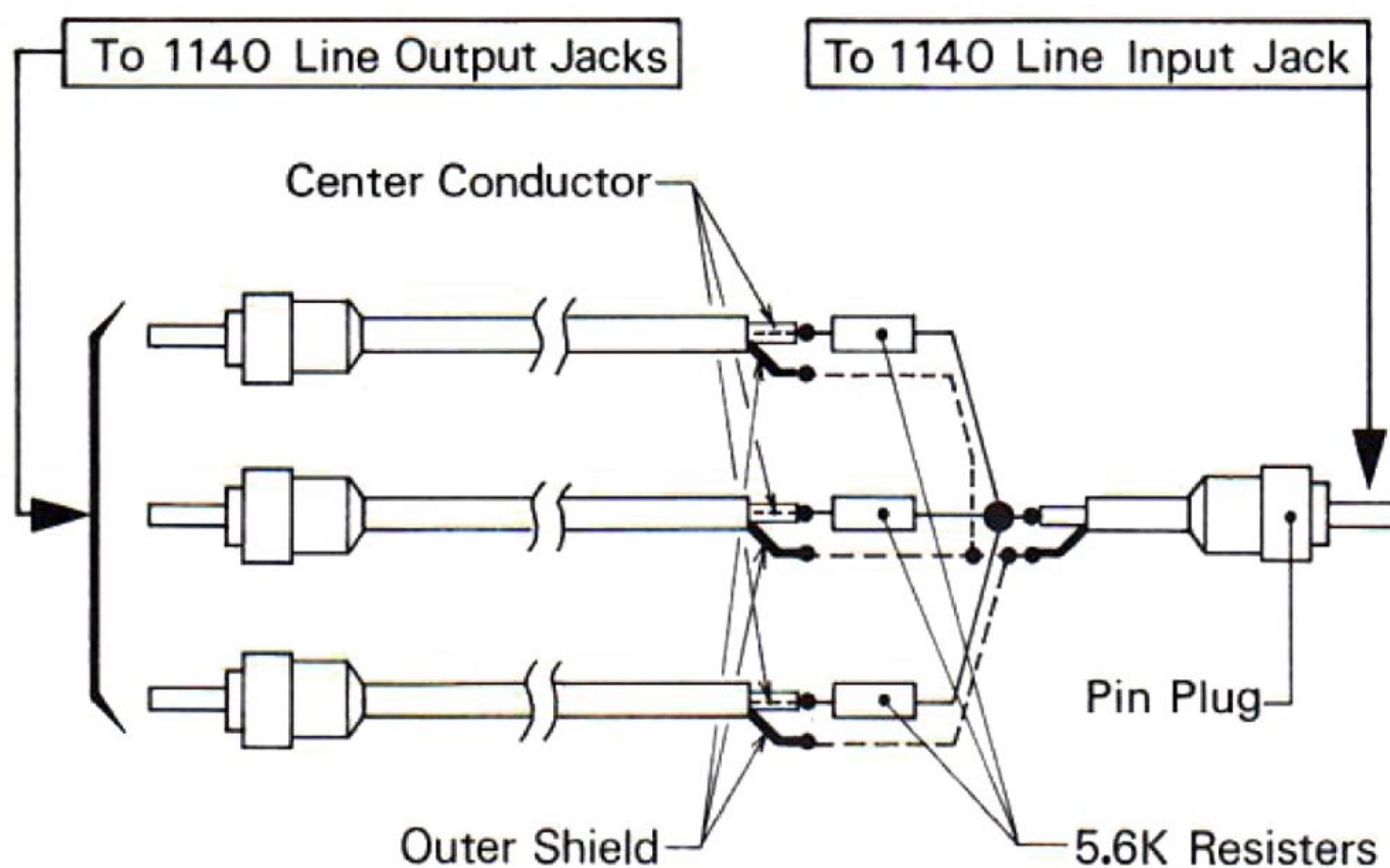
Punch-in is great for those **that was perfect except for that one clunker and if we have to do the whole thing over we'll be here all night** nights. But there are some negatives. For one thing punch-in is not easy and you have to rehearse it perfectly. If you don't do it right you're going to lose the whole thing.

Furthermore, any tape recorder will put an impulse noise on the tape when you enter Record. Sometimes it's low enough to be completely undetectable (like on \$20,000 professional equipment), sometimes it sounds like the Shot Heard Around the World. In keeping with the price you paid for the 1140 the impulse noise is extremely quiet and will probably be masked by your program material. But it isn't non-existent.

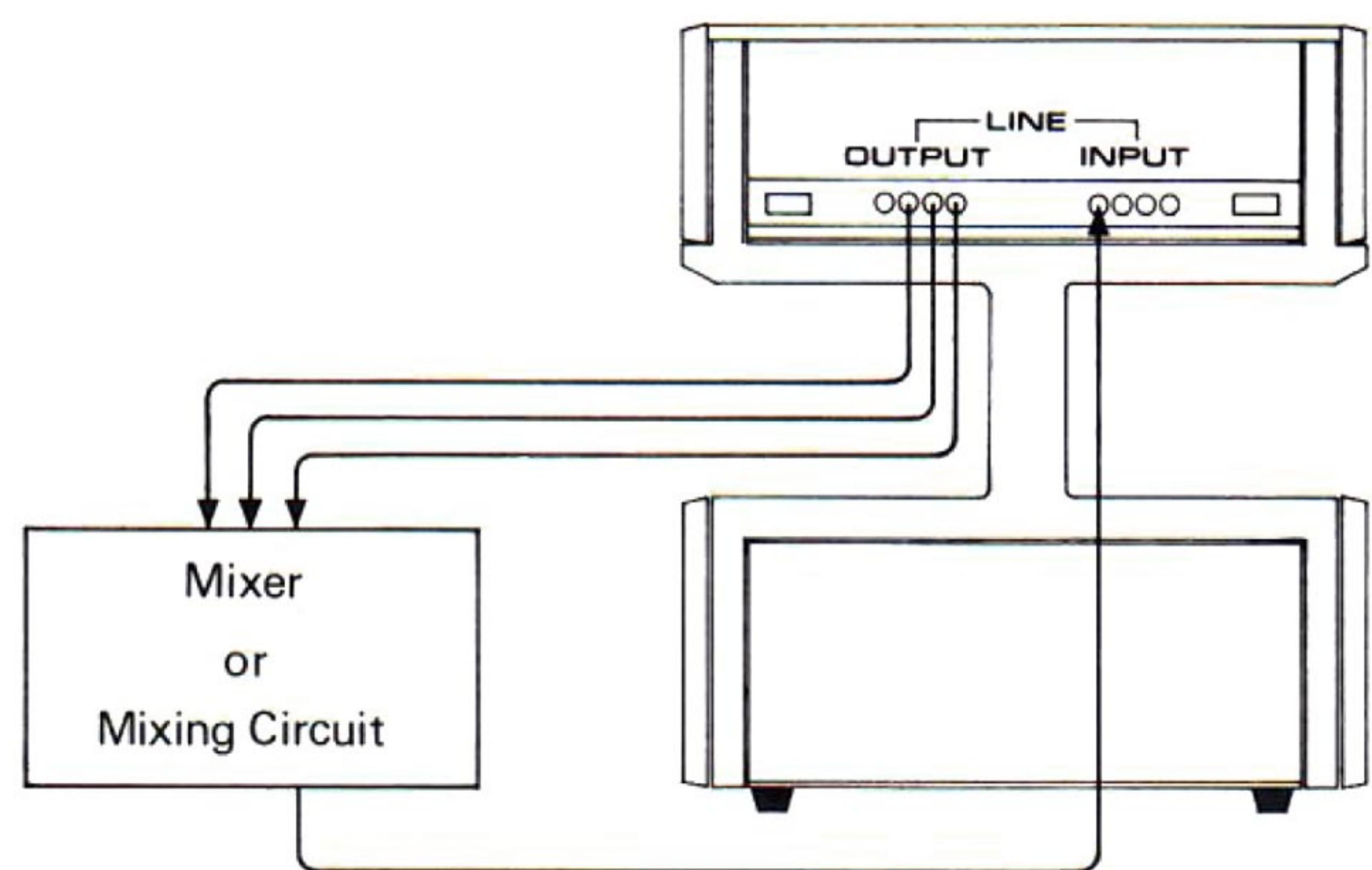
Here is the way to punch in with the 1140:

1. Practice, practice, practice. Don't pre-select that track for Record until you're as ready as you'll ever be. While you're practicing you'll be listening in sync. When you enter Record, you'll automatically be switched to Source.
2. When you're ready, pre-select the track for Record and enter Play.
3. As you get up to the punch-in point, press the Record button and hold it.
4. At the exact point you want to punch in, touch the Play button and go (notice it only took one hand to punch in).

(A) SUGGESTED 3 TO 1 MIXING CIRCUIT



(B) BASIC "PING-PONG" CONNECTION EXAMPLE



(C) SCHEMATIC, "PING-PONG" FUNCTION.

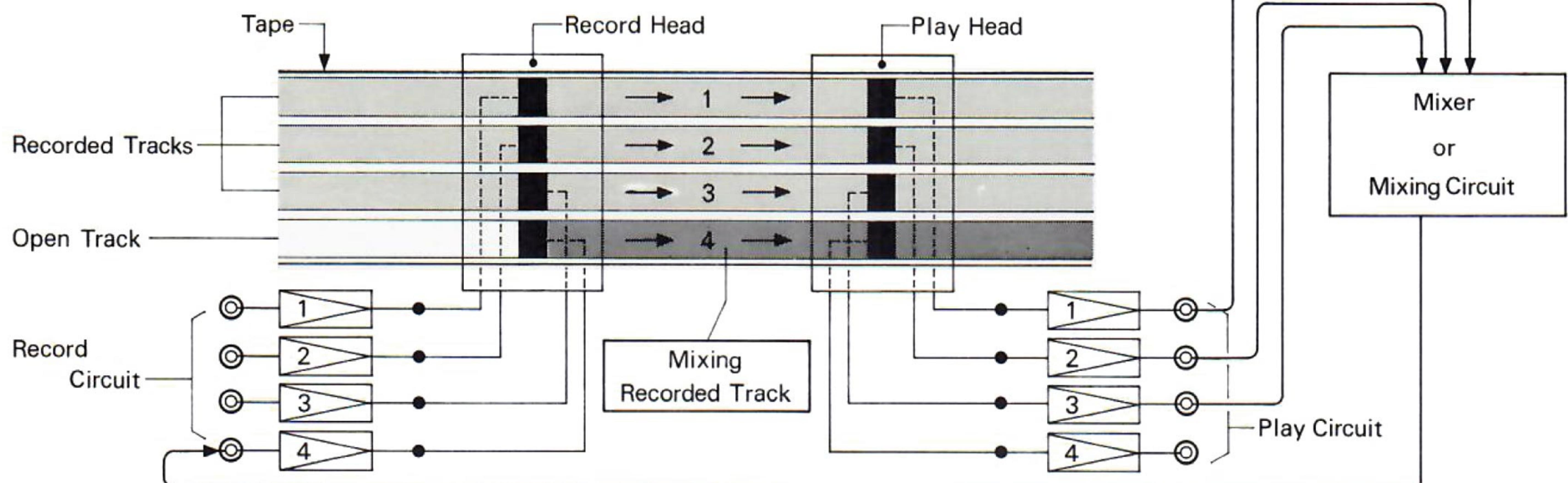


Fig. 8

"WASTEBASKET" MODE



Fig. 9

## Ping-Pong

There is a trick of combining completed tracks and transferring the composite onto a remaining track to free the first tracks for reuse. It's called ping-ponging and it effectively expands the number of available tracks on a four channel tape-recorder.

Here's the way it works:

1. You have three tracks of program material which you mix down to one track. Now you have one track of program material and three tracks to use.
2. You record on two of those tracks.
3. Taking those two tracks, plus the track you made when you combined the three tracks above, you mix them down to the empty track. At this point five tracks have been combined onto one, and you still have three to go.
4. You record two more tracks and mix them down to one. At this point, you must mix down from sync mode.
5. Now you have two remaining tracks, which you record separately.
6. Refer to our diagram, Fig. 8, for an example of ping-ponging three recorded tracks onto a fourth.

What you got was nine tracks of material onto four but, as with punching in, it's not all peaches and cream. First of all you need some kind of mixer. It can be elaborate or as simple as putting together a few resistors and patch cords according to the schematic we've included.

Secondly, as in any duplication process, there is going to be a generation loss when you mix the master tracks down. Here is where the performance characteristics of the 1140 become very important.

Before you mix your master tracks down, make sure the mix is satisfactory. The process inherently discards master takes; once you record over those tracks you've freed, they're gone for good.

Also remember that the mix you're making is monophonic. Don't ping pong something you'll wish had separation later. You want to ping pong off the normal playback head so make sure you're out of sync. Now you have to release the Sync buttons.

But if you've got three tracks and you only want to mix down two of them, you have to be in sync or the track you've mixed down to will play back ahead of the one you kept. Furthermore, you'll be playing back with a head that was made to record with and the fidelity won't be what it was with the normal playback head. It won't be bad if it's material that will later be masked by lead material or if it doesn't have a lot of brilliance or important high frequency content. Just be aware of the potential problem.

## Editing

Do yourself a favor and get a good edit block. That simple, machined piece of metal may be expensive but it's worth it. Edit tabs are expensive, too, but they save time and you'll get a cleaner splice.

If you handle a lot of tape you might want to check with a good photo supply store and see if you can get some linen gloves like film editors use so you can keep the natural oils from your fingers off your tape.

In addition to the Cue and Pause functions, the 1140 has another feature to help you edit. Because the automatic shut-off arm is in the head nest, you can use the 1140 in so-called "wastebasket" mode.

Wastebasket mode refers to a process where you thread tape as you normally would, but instead of putting it on the takeup reel you let it spill into a container next to the tape recorder.

Wastebasket mode is especially useful when you're editing out large chunks of material, like takes you don't need to save.

**NOTE:** If you don't disturb the tape in the container you can put it on a reel by taking an end piece and threading it as normal onto a takeup reel. Do that in Play mode, not Fast Forward, or you'll get a Class A example of a bad wind. You can also listen to a small piece of tape without having to put it on reels. Just thread it and hold both ends. Then push Play. The pinch roller will take care of tape tension on the right side but you have to hold the left to maintain contact with the heads.

## ACCESSORIES

### STANDARD

1. Owner's Reference Book .....	1
2. Warranty Card .....	1
3. Service Depot .....	1
4. 10-½ inch Empty Metal Reel (R-10).....	1
5. 10-½ inch Reel Adaptors (RA-12).....	2
6. 10-½ inch Reel Adjusting Discs .....	2
7. Pin-to-Pin Plug Cables .....	4

### RC-11

#### Remote Control Unit

This unit couples to model 1140 and remotes all tape transport functions.



Cleaning Set

### R-10

10-½" Metal Reel



### RA-12

10-½" Reel Adapter with Reel Adjusting Disc

### HS303D

Super-sensitive 2-way Stereo Headphone Set

Sensitivity: 100 dB at 1 KHz, 1 mW

Frequency response: 15~23000 Hz

Impedance: Switchable 8~16 ohms and  
20 Kohms

Level control: 40 ohms, 1 W in each phone



### OPTIONAL

#### C40-KD

Rack Console



### RX-19

19" Rack Adapter with Patch Cords and External Jacks, for model 1140.



### D-9X

Acryl Dustcover, reddish brown smoke



## SPECIFICATIONS (1140)

Recording system:	4-track, 4-channel recording & playback, stereo compatible.		
Tape speeds:	38 cm/sec. (15 ips) and 19 cm/sec. (7-1/2 ips)		
Reel capacity:	10-1/2" or 7"		
Frequency response:	$\pm 3$ dB 30 ~ 23K at 15 ips $\pm 3$ dB 30 ~ 20K at 7-1/2 ips		
Signal to noise ratio:	Better than 60 dB (WRMS), 56 dB (RMS)		
Crosstalk:	Better than 58 dB at 1 KHz (WRMS), 50 dB (RMS)		
Wow and flutter:	Less than 0.04% at 15 ips (WRMS), 0.07% (RMS) Less than 0.06% at 7-1/2 ips (WRMS), 0.1% (RMS)		
Equalization:	NAB		
Bias frequency:	200 KHz $\pm 10\%$		
Input per channel:	MIC	Sensitivity	0.25 mV (-69.8 dB)
		Impedance	600 ohms
	LINE	Sensitivity	77.5 mV (-20 dB)
		Impedance	100K ohms
Output per channel:	LINE	Output level	0.775 V
		Load Impedance	10K ohms or higher
	HEAD- PHONES	Output level	2 mW
		Impedance	8 ohms
Fast forward/rewind time: (2500 foot tape, 10-1/2" reels)	Within 85 seconds		
Heads:	Three Head system		
Motors:	Three (1-4/8 pole hysteresis synchronous for capstan 2 6-pole induction for reels)		
Circuit complement:	3 LSI, 10 IC, 105 Transistors, 102 Diodes		
Power requirement:	117 V, 60 Hz		
Weight:	66 lbs		
Dimension:	17" W, 20 " H, 16-1/2" D		