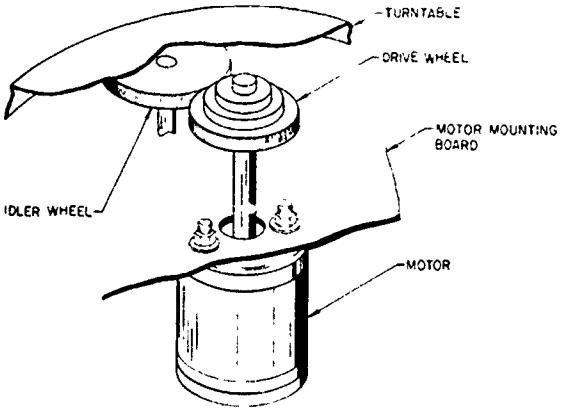

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Figure 11-4. — Turntable drive system.

TURNTABLES

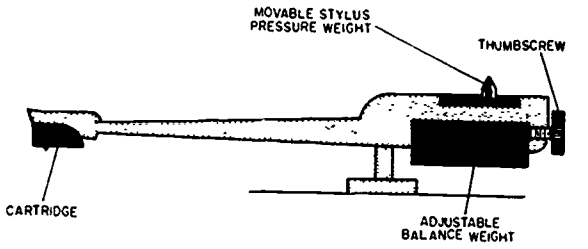
The turntable of a record player is simply a rotating platform, on which one or more records are placed for playback. This platform is driven by a motor or some form of drive system. There are two types of turntables: the single record player that requires manual record changing and the automatic record changer.

Most turntables are driven by a constant speed motor through a drive system consisting of a drive wheel and an idler wheel. The drive wheel is either uniform or stepped. The stepped drive wheel (fig. 11-4) is used in multispeed turntables with each step corresponding to a different speed. The idler wheel is used to reduce rumble or uneven motion of the turntable.

When the largest step of the drive wheel is in contact with the idler wheel, the turntable will turn at its maximum speed; when the smallest step is in contact with the idler wheel, the turntable will turn at its lowest speed. In this way, a 4-step wheel can drive the turntable at its different speeds: 16 2/3, 33 1/3, 45, and 78 rpm. Various methods of shifting from one speed to another exist, but most manufacturers use a spring-loaded cam or similar device.

TONE ARMS

The tone arm of a record player is used to hold the cartridge and carry it into position over the record. When used with an automatic record changer, the tone arm is moved out of the way of the record as it drops into place, then moves to the start position over the record, and drops slowly until the pickup touches the record. In the single-record player, the tone arm is lifted by hand to the start position over the record and then lowered into place. Care must be taken so as not to damage either the cartridge or the record.



140.134

Figure 11-5. — Tone arm.

The tone arm used in a high fidelity or stereo system has several balances or adjustments which are critical to the sound reproduction of the system. These adjustments concern the lateral and vertical movements of the tone arm and also static and dynamic balancing of the arm. Do not try any of these adjustments unless you have a complete list of the manufacturer's specifications for your system. Figure 11-5 shows a typical tone arm that has two movable weights for balancing the arm.

SOUND RECORDER-REPRODUCER SET AN/UNQ-7E

The AN/UNQ-7E is designed as a dual tape transport to record and reproduce audio frequencies on standard 1/4-inch magnetic recording tape. It consists of two major assemblies: the equipment cabinet which houses two recorder-reproducers (tape transports No. 1 and 2) and the remote control unit (RCU). See figures 11-6 and 11-7. The numbers, 1 and 2, associated with the tape transports refer to the upper and lower transports, respectively.

Electrical signals falling within the normal audio frequency spectrum can be recorded at tape speeds of 3.75, 7.5, or 15 inches per second (ips). Only one tape transport at a time can record. Information that was previously recorded on one transport can be played back at the same time other information is being recorded on

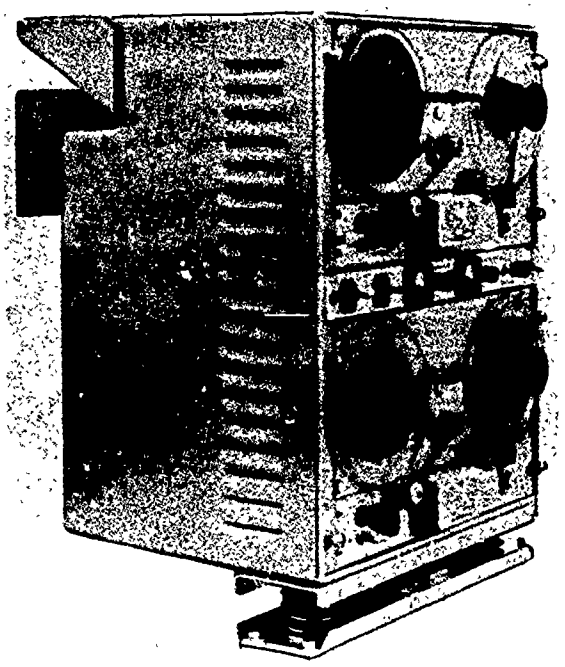


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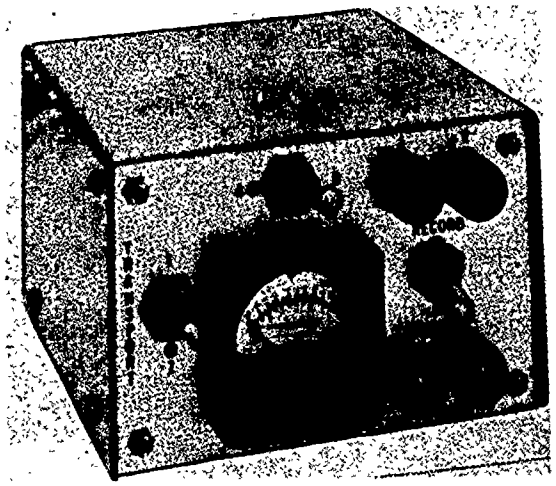
Figure 11-6.—Recorder-reproducer.



7.40(140B)

Figure 11-7.—Remote control unit.

the second transport. There are two channels—one for voice recording (channel A) and the other for data information (channel B). Figure 11-8 is a functional block diagram of this recorder-reproducer.

The tape is first contacted by the erase head which removes any previously recorded signal. It is then contacted by the record head which magnetizes the tape in proportion to the audio signal. When operating in the reproduce mode the tape contacts a reproduce head which senses the fluctuations in magnetic field strength and converts them into electrical signals. These signals are then amplified by the reproduce amplifier. The control section selects the transport, controls movement of the tape, and selects the amplifier section. The remote control unit functions are limited to record and stop. The power supplies provide the proper level and amount of regulation required by each group of circuits.

EQUIPMENT CABINET

The electrical equipment cabinet (fig. 11-9) contains the two tape transports (fig. 11-10) and the following electronic assemblies: a channel A and B record preamplifier, a channel A and B reproduce amplifier, a bias and erase oscillator, and an a-c power supply. With the exception of parts of the power supply and the power amplifiers, these assemblies are self-contained modular components which plug into rack-mounted receptacles within the cabinet.

The record preamplifier incorporates a manually operated automatic gain control (AGC) defeat switch for disabling the channel B AGC circuit during certain recording applications. All functions of the recorder-reproducer set, with the exception of the channel B bias defeat and AGC defeat, can be controlled from the front of the equipment cabinet. A two-position toggle switch is used to turn the power off and on. All other function control switches on the front of the cabinet are three-position, center off, momentary contact toggle switches. One tape transport can record while the other reproduces pre-recorded data, and one can record or reproduce while the other is in either the fast forward on rewind mode of operation. The controls also facilitate any combination of simultaneous fast forward and rewind operation of the two tape transports. A three-position, rotary speed selection switch, a momentary, push-action stop button, and a fast-forward-rewind toggle switch are located just below the supply reel on each transport. Also located on the front of the cabinet are the channel A and B record level VU meters and record level controls, channel A and B output jacks and output level controls, record and

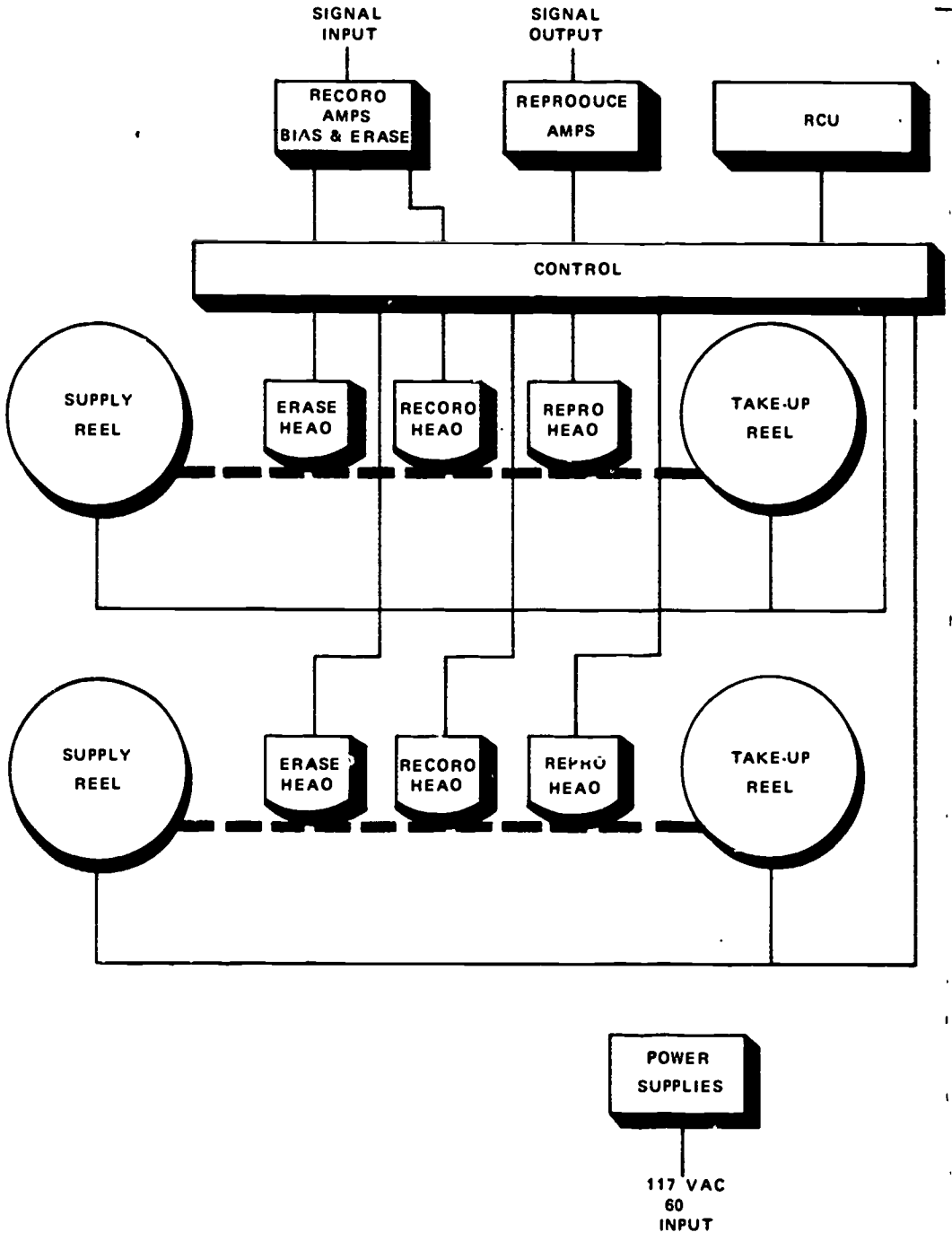


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Figure 11-8.—Recorder-reproducer overall functional block diagram.

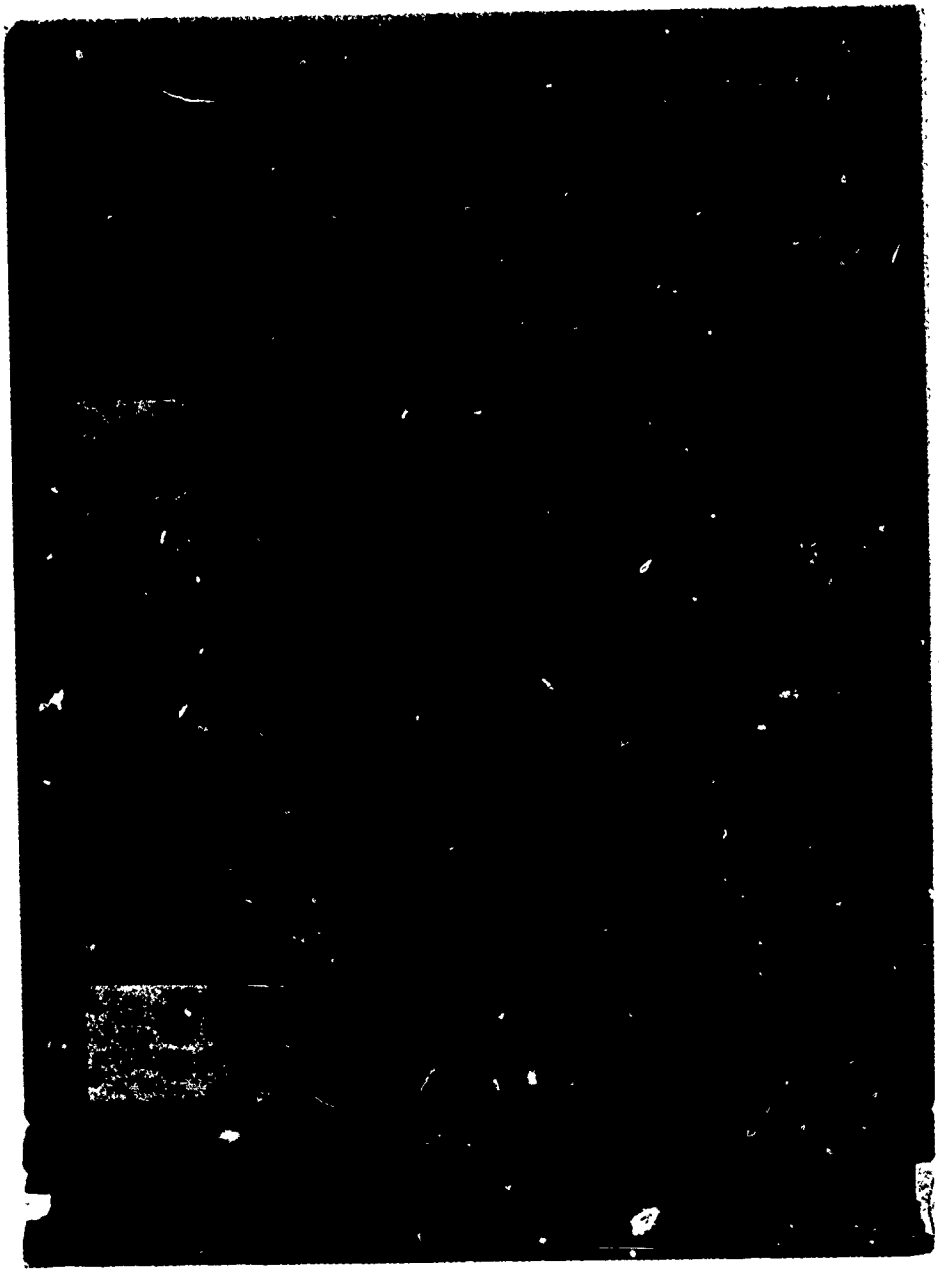

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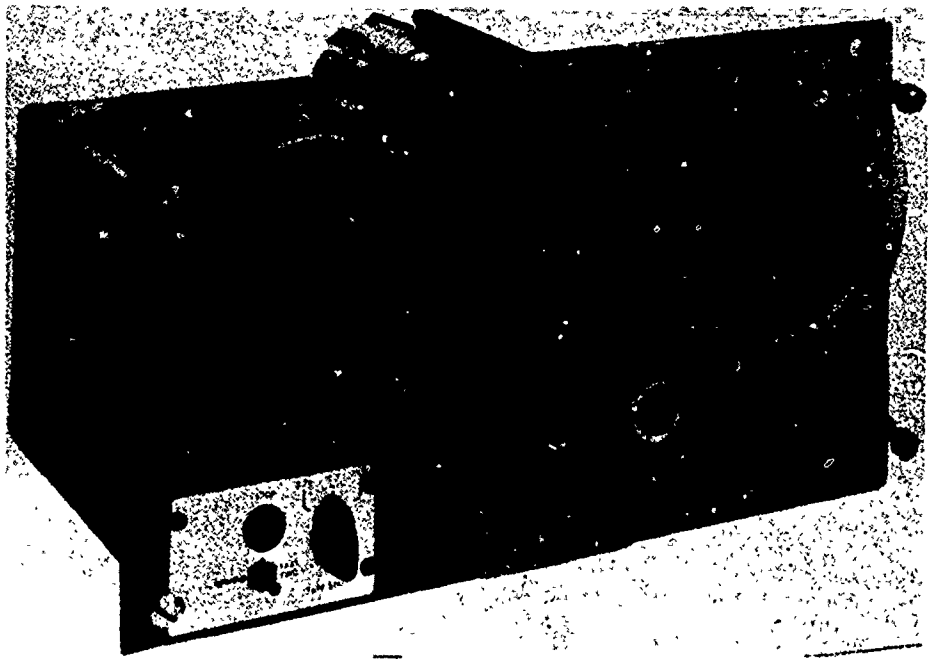
Figure 11-9. — Operating controls, recorder-reproducer.



7.54(140B)C

Figure 11-10.—Recorder-reproducer, magnetic (tape transports).

reproduce indicator lights for tape transports 1 and 2, and a power on indicator light. All indicator lights have mechanical dimmer mechanisms.

REMOTE CONTROL UNIT

The remote control unit (fig. 11-7) permits operation of the record function of either tape transport at locations away from the equipment cabinet. This unit contains the following controls and indicators: one three-position, center off, transport selector switch; one two-position, record-standby switch; two record lamps; two standby lamps; a meter; and a two-position channel selector switch

The standby lamps illuminate continuously when the tape is threaded and transports are in the stop position. The lamps also act as end-of tape indicators by flashing when a transport is within five minutes of end of tape. The five minute warning is based on a tape speed of 7.5 ips. The time to end of tape will vary proportionately for the other tape speeds of 3.75 and 15 ips. When lit, the standby lamps do not indicate that proper tape speed is selected or that record levels have been adjusted.

The meter is used to monitor the record level of channel A or B, depending on the position of the channel selector switch.

TAPE TRANSPORTS

Two identical tape transports, one of which is shown in figure 11-10, are mounted on slides, one above the other in the electrical equipment cabinet, and are used to transport magnetic recording tape past the head assemblies which are mounted on the front of each transport between the supply and take-up reels. Operating speeds are 3.75, 7.5, and 15 ips for record and reproduce. For fast forward and rewind the speed is 300 ips averaged over 1200 feet of tape. Each tape transport has a control assembly made up of electronic parts, relays, etc., that control the operation of the individual tape transports. A bias defeat switch, located on the chassis of the control assembly, permits removal of the bias from channel B. A three-digit counter with reset knob is located on the front of each tape transport and provides an indication of tape usage.

Tape Drive Components

The tape drive components include a synchronous drive motor, a capstan and capstan idler, a reel idler, and a tape guide. The drive motor is a hysteresis synchronous motor with three windings to provide the three tape speeds. The motor shaft is attached to a flywheel pulley which drives the capstan by means of a nylon belt. The drive motor will start and the capstan will rotate as soon as power is applied. The drive belt tension is maintained by a spring-loaded pivot arm on which is mounted the CAP STAND IDLER. The capstan idler consists of a rubber-tired idler wheel mounted on an arm which is attached to the shaft of a rotary solenoid. When the capstan idler solenoid is energized, it moves the idler arm against the capstan, providing a bearing surface for the capstan, which drives the magnetic tape at a constant speed.

A TAPE GUIDE positions the tape vertically with respect to the head assembly. A REEL IDLER smooths out any transient variations in tape speed originating in the tape supply reel.

Rewind and Takeup Components

The rewind and takeup components are identical in construction. Each consists of an induction motor, brake drum, and turntable.

The rewind motor and takeup motor are so connected that when power is applied, one motor operates at full torque and the other at reduced torque. In the record or reproduce mode, a series resistor is placed in each rewind and takeup motor circuit to reduce the normal torque of the motors while optimum tape tension is obtained at each reel.

The reels of tape are isolated from each other by the capstan and capstan idler. The capstan pulls the tape from the supply reel, overcoming the difference in torque of the rewind motor, which provides hold-back tension. A tape loop will be thrown when any malfunction of the equipment allows the feed rate to exceed the takeup rate. If the loop is sufficiently large, or if tape breakage occurs, the safety switch arm will be released to actuate the safety switch, and stop the equipment.

In the FAST FORWARD MODE of operation, the series resistor is removed from the takeup motor circuit, and a resistor is placed in the rewind motor circuit. The takeup and rewind motors operate at full and reduced torques, respectively, and the capstan pulls the tape from the supply reel (on the rewind turntable) to the takeup reel (on the takeup turntable), overcoming the reduced torque of the rewind motor. The tape tension is proportional to the difference in the forces exerted at the periphery of the two reels.

In the REWIND MODE of operation, the foregoing procedure is reversed. The resistor is removed from the rewind motor circuit, and a resistor is placed in the takeup motor circuit. The rewind motor will operate at full torque, the takeup motor at reduced torque, and the tape will be pulled from the takeup reel to the supply reel being held under tension by the reduced torque of the takeup motor.

When the equipment is being operated in any mode of tape travel, the correct tape tension is determined by the power applied to the rewind and takeup motors. However, when power is removed from these motors the forces exerted on the tape are removed, and the tape tension must be maintained by the operation of the brakes.

The brakes consist of brake drums attached to the shafts of the takeup and rewind motors and brake bands equipped with high-tension and low-tension springs, which determine the braking force applied for each direction of rotation. The brake bands are held from contact with the brake drums by the brake solenoid when the equipment is operated under any mode. When power is removed from the equipment the solenoid is de-energized and allows the brake bands to move into contact with the brake drums. To avoid throwing tape loops as the tape comes to a stop, it is necessary that the braking force on the trailing turntable (turntable from which tape is being pulled) always be greater than that which is applied to the leading turntable (turntable which is taking up the tape). However, the braking differential must not be so great that the tape is in danger of being deformed or broken.

Head Assembly

The head assembly consists of erase, record, and reproduce heads. In the record or reproduce modes of operation, a point on the tape will pass over the erase, record, and reproduce heads in that order. The outer tracks of the record and reproduce heads are for channel A, and the inner tracks are for channel B. The erase head is full track, and thus erases the full width of the tape on both channels.

OPERATION

As an IC Electrician you will normally operate the AN/UNQ-7E set only when necessary to

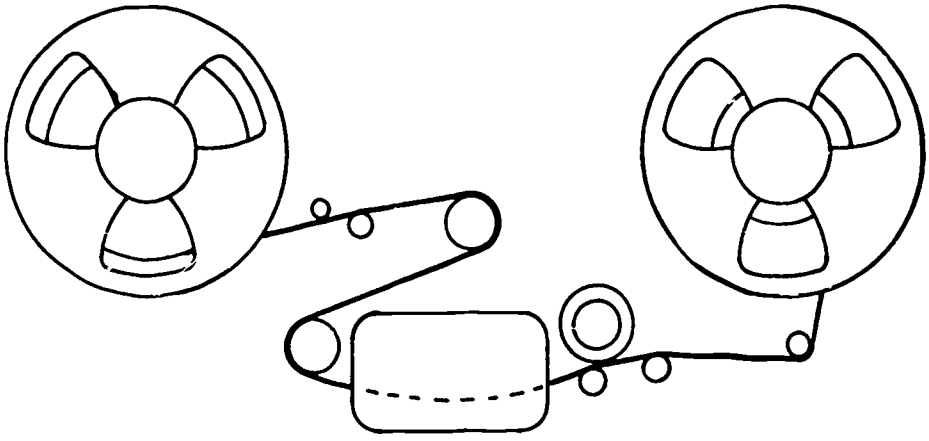


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Figure 11-11.—Tape threading path.

troubleshoot it. All functions of the set can be operated at the front of the equipment cabinet. Only the record and stop functions can be operated at the RCU. Operating the set is similar to operating a basic tape recorder. You should be able to do so by carrying out the instructions that follow.

Pre-operation Procedure

Before operating the equipment, take the following steps. Rotate all dimmer mechanisms on indicator lights counterclockwise to their full open positions. Turn the power switch (on central control panel) to ON. Observe that the white power lamp is lit. Place a full reel of tape on the supply turntable of the selected tape transport, No. 1 or No. 2, and an empty reel on the take-up turntable. Next, thread the tape from the supply reel through the tape head and onto the take-up reel as shown in figure 11-11. Then set the tape counter to the 000 position, and the speed selector on the tape transport to the desired speed. Finally, adjust the input level. The channel A and channel B record levels, as monitored by the meters, are set by the record level controls on the recorder—reproducer control panel. It is not necessary to be in the record mode of operation to obtain record level indications.

Recording

After taking the last pre-operation step, you record by turning both record switches to position 1 or 2, depending on the tape transport selected. Make sure that the tape begins to move forward at the correct speed, and that the red record lamp for this tape transport comes on. To stop the tape transport, simply press its stopbutton. Observe that the tape stops moving and the red record lamp goes out.

Reproducing

After taking the last pre-operation step, you can reproduce by turning the reproduce switch to position 1 or 2, depending on the tape transport selected. Make sure that the tape moves forward at the correct speed and that the green reproduce lamp comes on. As in recording, you stop the tape transport by pressing its stopbutton. Notice that the tape stops and the green reproduce light goes out.

Recording from Remote Control Unit

In operating a tape transport from the RCU, be sure that both standby amber lamps are lit (an indication that power is applied and that the tape is threaded properly). To record from the RCU, move the TRANSPORT selector switch to position 1 or 2, depending on the transport selected. Then position the RECORD-STANDBY switch to record. Check to see that the standby lamp for the selected tape transport goes out and that the red record lamp comes on. To stop recording from the RCU, return the RECORD-STANDBY switch to the standby position, and the

TRANSPORT switch to its OFF position. Observe that the standby lamp comes on and the record lamp goes out.

Rewinding

If the tape is threaded on the recorder-reproducer and is not in motion, you can move it rapidly in either the forward (fast forward) or reverse (rewind) direction by placing the rewind-fast forward switch S1 in the appropriate position. You can stop the moving tape by returning this switch to its OFF position. The tape-motion components will be automatically deactivated at the end of a reel.

COMMERCIAL TAPE RECORDER/REPRODUCERS

This section is concerned only with the operating principles of a typical single-motor tape transport as used in commercial tape recorder-reproducers (tape decks).

MODES OF OPERATION

The operating modes for a tape deck are STOP, RECORD/PLAYBACK, and REWIND/FAST FORWARD. A pushbutton or switch is operated to select the desired mode. Depending on the mode selected, the tape transport mechanism enables the tape to move, or keeps it from moving, from the supply turntable (reel) to the takeup turntable.

Stop Mode

The mechanism shown in figure 11-12 is in the STOP mode. Notice that the brakes are engaged and the drive idler is disengaged from the capstan flywheel. The motor is running, and the idler drive and idler wheels rotate in the directions indicated by the arrows.

Record/Playback Mode

When the mode selector switch is moved to the record or playback setting, the brakes release and a cam engages the drive train between the drive motor and the capstan flywheel. The pressure pads move the tape into contact with the heads, and the rubber pinch roller moves to hold the tape firmly between it and the rotating capstan. The tape is now driven as shown in figure 11-13. The belt connecting the drive motor idler to the takeup turntable drives the turntable

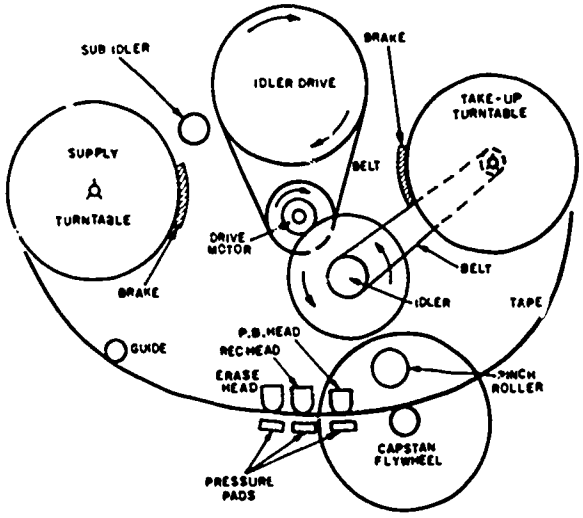

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Figure 11-12.—Tape transport mechanism in stop position.

at a rate slightly faster than necessary to take up the tape. The turntable will, however, turn at a constant rate even as the circle of tape on the takeup reel increases in diameter because the drive belt is designed to slip on the takeup reel spindle. The takeup reel and the pinch

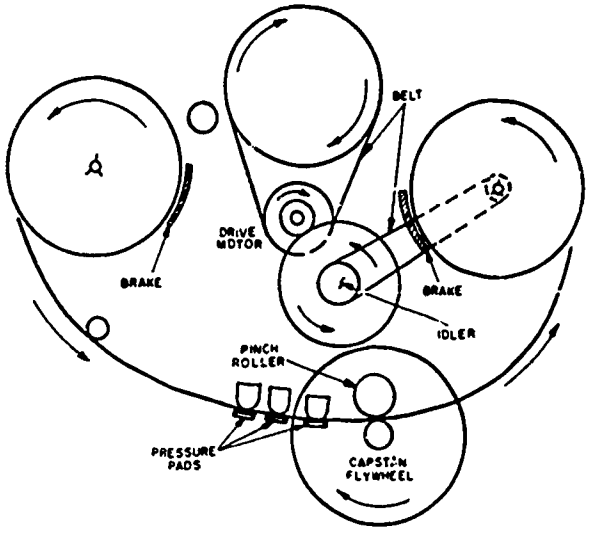

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Figure 11-13.—Tape transport mechanism in record or playback position.

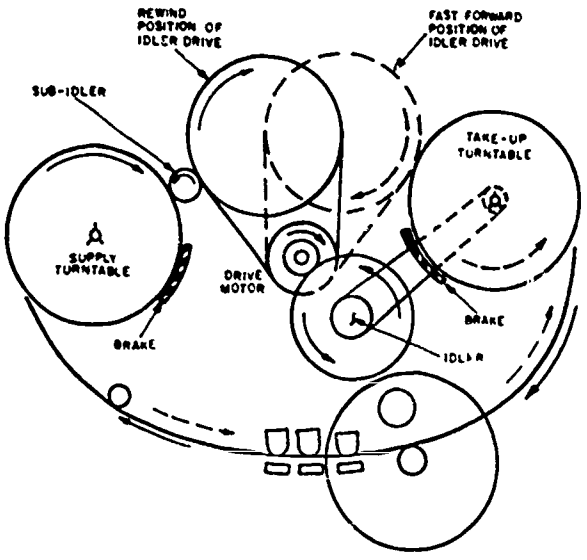

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Figure 11-14. — Tape transport mechanism in rewind or fast forward position.

roller capstan drive combine to move the tape past the heads at a constant speed.

Rewind/Fast Forward Mode

With the mode selector switch in REWIND or FAST FORWARD, the tape transport mechanism is positioned as shown by figure 11-14. The brakes disengage, the pressure pads move away from the heads, and the pinch roller moves away from the capstan. Also, the drive train disengages from the capstan flywheel. Now the tape can pass freely from reel to reel. In the FAST FORWARD mode, the high speed idler drive wheel is shifted into contact with the takeup turntable so that the tape will move quickly onto the takeup reel. In the REWIND mode, the idler drive wheel is shifted in the opposite direction and pushes the sub idler so as to drive the supply wheel at high speeds, thereby rewinding the tape onto the supply turntable.

TAPE RECORDER MAINTENANCE

Tape recorder maintenance includes cleaning, adjusting, demagnetizing tape heads, tape erasing, and tape splicing. Just as in other well-designed electromechanical devices, most troubles in tape recorder/reproducers are usually cleared up by routine cleaning or minor mechanical adjustment.

CLEANING

The largest single reason for tape deck operators complaining about poor quality of reproduction is dirty tape heads. As the tape deck is used, an oxide from the tape surface rubs off and builds up on the face of the heads. The deposit prevents the tape from making good contact with the tape head, causing a reduced output and sometimes magnetically short circuiting the gap between the heads. Clean the heads with the tip of a cotton swab dipped in alcohol or in a commercial tape head cleaner.

Binding or worn drive wheels and pulley belts of the tape transport result in almost as many trouble calls as the heads. A dirty or worn belt can cause the output to flutter or the tape speed to vary. Remove all traces of oil or dirt from belts and rubber-tired drive wheels with alcohol. You should take the pulleys and drive wheels off their shafts and clean them at regular intervals. After reassembly, apply a light coat of machine oil to all bearing surfaces. When a machine is being repaired in the shop, have it cleaned and vacuumed. If cleaning the belts or wheels does not correct the fault, then replace the parts with new ones.

MECHANICAL ADJUSTMENTS

The alignment of the tape heads is important for proper operation of the recorder/reproducer. Usually the tape heads must be aligned in azimuth and height only while playing a test tape. Test tapes are available through electronic supply stores, and contain complete directions for their use.

Most tape recorders use springs to maintain tension on the pinch roller and the brake shoe. Usually you can adjust the tension by turning a nut (fig. 11-15A) or attaching the spring to a different hole (fig. 11-15B). If there is no way to adjust the spring tension, replace the spring with a new one. Adjusting the tension on the pinch roller spring requires the use of a spring scale, such as the one shown in figure 11-16A. Spring scales are available from commercial electronics supply stores. In using a spring scale, follow the instructions furnished by the manufacturer of the tape deck. A handy tool for hooking the springs from hole to hole can be made from a firm piece of wire. See figure 11-16B. This tool reduces the chance of the spring flying off when you are unhooking it.