Section 5

THEORY OF OPERATION

5.1 TAPE TRANSPORT

5.1.1 General

Tape motion in all modes of operation is controlled by the tape transport mechanism. The transport consists basically of a tape supply system, a tape drive system, a tape takeup system, and a control system. These systems act to provide smooth and positive tape motion across the magnetic heads, and to maintain correct tape tension.

A schematic diagram of the tape transport is provided on Fig. 6-20, and a simplified version of this schematic on Fig. 6-21. Components at the front and back of the transport are shown on Figs. 5-1 and 5-2.

A power distribution and fusing diagram is on Fig. 6-19.

5.1.2 Tape Supply and Takeup Systems

Torque motors provide power for the supply and takeup assemblies. These motors are connected so that if power is applied to them when no tape is threaded the turntables will rotate in opposite directions--the supply turntable clockwise and the takeup turntable counterclockwise.

In the play or record modes of operation, the capstan is the sole determinant of tape speed. It pulls tape from the supply reel, whose opposing torque acts to maintain tape tension, and delivers it to the takeup reel, which reels in the tape under proper tension. The torque of the motors, and thus the tape tension, is adjustable at resistors R604 (supply) and R605 (takeup).

During fast forward or rewind operation, the capstan is removed as the tape speed determining element. The torque of one motor is reduced by placing a resistor (R607) in series with it, while the other motor operates with full torque. The turntable under full power then simply pulls the tape from the other turntable, whose opposing torque provides tape tension. The torque at the trailing turntable (from which tape is being pulled), and thus the tape tension, is adjusted at resistor R607.

Additional resistors are switched into the circuit to lower tape tension when reels with small hubs are used. These resistors (R608, supply, and R606, takeup) are shorted by the reel switches for large hub operation. Both are adjustable.

Solenoid-controlled brakes are mounted on each torque motor. In this equipment there are two braking systems. The main brake system is energized (brakes released) whenever tape is placed in motion in any mode. The edit brake system is energized only in the stop-edit mode, when it acts to reduce braking force at each turntable.

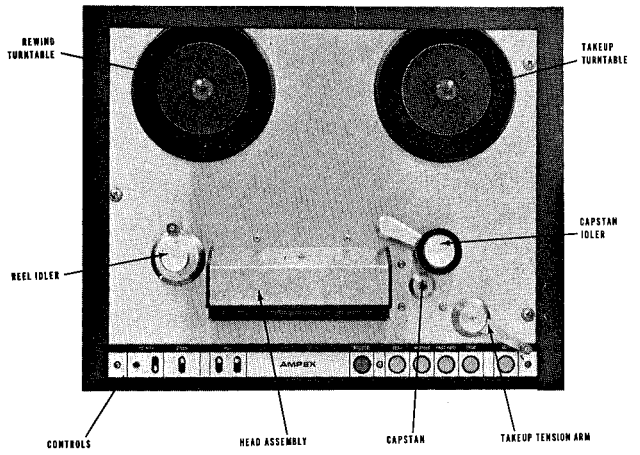

Fig. 5—1. Tape Transport, Front

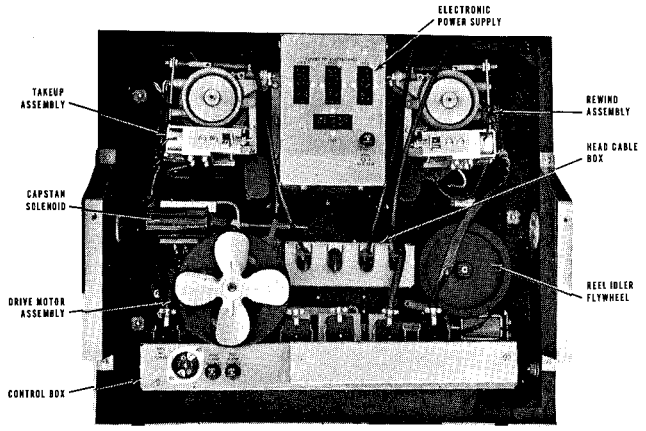

Fig. 5—2. Tape Transport, Rear

There are thus two brake solenoids on each torque motor. When the main brake solenoid is energized, brakes are fully released; when it is de-energized (disregarding action of the edit solenoid) brakes are fully applied. The action of the edit brake solenoid is limited by its mechanical coupling so that when it is energized the brake band still contacts the drum but full braking force is not applied.

A braking differential is required on the main brakes to prevent the formation of tape loops when tape motion is being stopped. The braking force in one direction of rotation (supply counterclockwise, takeup clockwise) is thus adjusted to approximately three times the force in the other direction.

5.1.3 Tape Drive System

A hysteresis-synchronous drive motor is used. One end of the motor shaft is precisely machined and hard chrome plated to act as the capstan. Mounted on the other end of the shaft is a flywheel and fan. A solenoid-controlled capstan idler is employed to clamp the tape to the capstan, thus providing a surface against which the tape can be driven.

The drive motor has two sets of windings to provide two rotational speeds and thus two tape speeds. The speed toggle switch is used to select the winding which will result in the desired speed; this switch also controls the solid-state equalization switching in the electronic assembly. The drive motor operates continuously whenever power is applied to the equipment and tape is properly threaded.

When the equipment is placed in the play (or record) mode, the capstan idler solenoid (K610) is energized, moving the capstan idler so that it clamps the tape in firm, positive contact with the rotating capstan. The main brake solenoids (K605 and K607) are energized, releasing the brakes. The capstan then drives the tape at the selected speed across the head assembly.

5.1.4 Reel Idler

A reel idler assembly, located on the left side of the transport below the supply turntable, is utilized to minimize any transient effects in tape motion which might be imparted by the supply assembly. The reel idler arm absorbs most of the momentary strain applied to the tape when tape motion is started, thus preventing stretching or breaking the tape or the formation of a tape loop on the supply side of the heads. The idler pulley, which has a heavy flywheel, acts to smooth out transients in tape speed caused by torque motor cogging and irregularities caused by an uneven tape wrap on the supply reel.

The tape guide on the idler arm will accommodate either 1/4-inch or 1/2-inch wide tape. The guide is simply lifted and rotated to present the correct face (1/4-inch or 1/2-inch) to the tape.

5.1.5 Takeup Tension Arm

A takeup tension arm is mounted on the takeup side of the transport. This arm has two functions. First, it supplies a small tape storage loop which prevents breaking or stretching the tape during start and stop operations. Second, it actuates the safety switch (S603) and thus stops operation if a large tape loop forms or if tape should break. The second feature also results in auto-

matic stopping when tape is allowed to run completely off either reel. The tape guide is similar to that on the reel idler(refer to paragraph 5.1.4). In addition, a tape hook is provided to prevent tape from falling off the guide if the tape becomes slack or during tape threading.

5.1.6 Tape Lifter Assembly

A solenoid-operated tape lifter assembly raises the tape from contact with the heads during fast forward or rewind operation. When either of these modes are started, tape lifter solenoid K609 is energized thus actuating the tape lifter mechanism. Pressing the edit pushbutton at the tape transport (or at the optional remote control unit) defeats the tape lifter action for the length of time that the pushbutton is held down. Manual override of the tape lifter may be accomplished by opening the head gate and pushing the right hand tape lifter arm back to its retracted position.

5.1.7 Control Circuit

5.1.7.1 Play Mode

When tape is properly threaded and power is applied, the capstan will be rotating at the speed selected at the speed switch. Pressing the PLAY pushbutton then results in the following circuit action.

Play relay K602, in the 24 volt dc circuit, is energized. Contact set 1-9-5 of that relay forms a holding circuit across the play pushbutton. Contact set 2-10-6 applies ac power, through the tension adjusting resistors, to the takeup and rewind (supply) motors. Contact set 3-11-7 completes the 115 volt dc circuit to the capstan idler solenoid, energizing that solenoid. Contact set 4-12-8 completes the 115 volt dc circuit to the supply and takeup main brake solenoids, energizing those solenoids. Thus the brakes are released, the turntable motors are operating, and the tape (pressed against the rotating capstan) is driven at the selected speed.

5.1.7.2 Fast Forward Mode.

Note that the negative return for fast forward, rewind, and edit relays is through transistor Q601, which must be able to conduct for those modes to be actuated (refer to record mode, paragraph 5.1.7.5).

With power applied and tape properly threaded, pressing the FAST FWD pushbutton energizes fast forward relay K604. Contact set 1-9-5 of that relay breaks the 24 volt dc circuit to the play circuit, and makes a holding circuit across the fast forward switch. Contact set 2-10-6 connects full ac power to the takeup motor (reel switch in large hub position) and reduced power through resistor R607 to the rewind motor. Contact set 3-11-7 breaks the 24 vdc circuit to the rewind relay, and makes the 24 vdc circuit to the tape lifter solenoid K609, through edit switch S611. Contact set 4-12-8 connects the 115 vdc to the main brake solenoids K605 and K607, which are energized. The takeup motor therefore operates at full torque, the rewind motor under reduced torque; tape is lifted from contact with the heads, and the brakes are released. Tape is thus pulled from the rewind to the takeup reel.

Note that the negative return for the tape lifter solenoid is through normally closed contacts of the edit switch. If the EDIT pushbutton is pressed, the circuit is opened and the tape lifter action defeated (for as long as the pushbutton is held down).

5.1.7.3 Rewind Mode

The negative return for the rewind, fast forward, and edit relays is through transistor Q601, which must be able to conduct for those modes to be actuated (refer to record mode, paragraph 5.1.7.5).

When power is applied and tape properly threaded, pushing the REWIND pushbutton energizes rewind relay K601. Contact set 1-9-5 forms a holding circuit across the rewind switch. Contact set 2-10-6 connects full ac power to the rewind motor (reel switch in large hub position), and reduced ac power through resistor R607 to the takeup motor. Contact set 3-11-7 breaks the 24 vdc circuit to the play and fast forward circuit and connects 24 vdc to tape lifter solenoid K609. Contact set 4-12-8 connects 115 vdc to the main brake solenoids K605 and K607, which are energized. The rewind motor thus operates at full torque, the takeup motor operates at reduced torque, brakes are released, and tape is lifted from contact with the heads. Tape will be pulled from the takeup reel to the supply reel.

Tape lifter action can be defeated by pressing the EDIT pushbutton, the same as in the fast forward mode.

5.1.7.4 Edit Modes

The negative return for the edit, rewind, and fast forward relays is through transis-

tor Q601, which must be able to conduct for those modes to be actuated (refer to record mode, paragraph 5.1.7.5).

When the edit relay is energized in either the stop/edit or the play/edit mode, contact set 1-9-5 forms a holding circuit across the edit switch. Contact set 2-10-6 breaks the 115 vdc circuit to the takeup main brake solenoid and makes the 115 vdc circuit to the takeup and supply edit brake solenoids. Contact set 3-11-7 breaks the 24 vdc circuit to the record switch, locking out the record mode. Contact set 4-12-8 breaks the ac circuit to the takeup motor and makes a shorting circuit across the safety switch, which is then ineffective.

In the stop/edit mode, therefore, the safety switch is shorted and the low braking force supplied by the edit brake solenoids makes it easy to turn the reels manually. In the play/edit mode, the safety switch is shorted, the record mode is locked out, ac power is removed from the takeup motor, the supply brake is fully released (by the supply main brake solenoid), and the takeup turntable is held by the action of the takeup brake solenoid; the takeup turntable will not rotate, and tape will be spilled off the right side of the transport.

The edit relay is not energized in the fast-winding/edit mode. This mode is simply the defeat of the tape lifting mechanism by pressing and holding the edit pushbotton during fast forward or rewind operation. This opens the negative return lead to the tape lifter solenoid, which will be de-energized as long as the pushbutton is held down. Tape will then contact the heads, and monitoring is possible.

5.1.7.5 Record Mode

Strictly speaking, the record mode is not a tape motion control function. The tape is first placed in motion in the play mode, and the record pushbutton is then pressed to place the electronic assemblies in the record mode by energizing the record relays in those assemblies.

The record mode, however, does have effect on other tape transport control circuits. As shown on Fig. 6-21, when the record relay in any electronic assembly is energized, contact set 4-12-8 of that relay makes a return connection to the transport. As previously described, transistor Q601 must be able to conduct to allow the fast forward, rewind, or edit modes to be entered. Normally, Q601 will conduct whenever any of those modes are initiated. However, if the equipment is operating in the record mode, the connection from the record relay places a bias on transistor Q602 which allows it to conduct. When Q602 is conducting, Q601 is biased to cutoff. Therefore the edit, rewind, and fast forward modes are locked out when the equipment is recording.

5.1.8 Tape Scrape Flutter

Tape scrape flutter can be likened to the effect of drawing a bow across a violin string. The string will vibrate at a resonant frequency. One of the major factors in determining that resonant frequency is the unsupported length of the string.

On a tape transport, the magnetic head acts as the bow and the tape as the violin string. Of course, instead of drawing the bow across the string, the tape is drawn across the head. As it moves across the head the tape will vibrate at its resonant frequency. For a given tape and tension, that frequency will depend upon the unsupported length of tape between the reel idler and the capstan. This frequency is usually in the range to which the human ear is most sensitive, from 1,000 to 6,000 Hz. For example, the scrape flutter frequency on this transport if no tape scrape flutter idler were used would be in the neighborhood of 3,500 Hz.

When a rotating idler (such as the tape scrape flutter idler supplied as standard equipment) is installed in the tape path approximately midway between the reel idler and capstan, the length of unsupported tape is halved. This results in practically doubling the scrape flutter frequency (in the example quoted, that frequency would now be approximately 7,000 Hz). Not only is the flutter frequency moved out of the range of greatest ear sensitivity, but the higher frequency automatically entails a drop in level. The effect of tape scrape flutter is reduced to approximately 25% of its former value.

If the second tape scrape flutter idler (optional accessory) is installed on the transport, the flutter frequency is again raised--to approximately 10,000 Hz. An additional drop in level is also realized, and for all practical purposes tape scrape flutter can be ignored.

5.2 ELECTRONICS

5.2.1 Power Supply

Components for the regulated power

supply in record/reproduce equipment are mounted on the same printed circuit board as those for the bias oscillator (see Fig. 6-22). For reproduce-only equipment the bias oscillator is omitted (see Fig. 6-23). In either case, the printed circuit board plugs into the electronics power supply box mounted at the back of the tape transport. Note that the series regulating transistor (Q705) is mounted on the power supply box chassis.

A-C power is delivered to the power supply from the tape transport. It is fused by fuse F701, rectified by the bridge rectifier formed by diodes CR701 through CR704, and filtered by resistor R706 and capacitor C707. It then is connected to the voltage regulator.

In the regulator, a reference voltage is established by Zener diode VR702. A sampling voltage is taken at variable resistor R712, which is in a voltage divider circuit with resistors R711 and R712 across the output line. Voltage adjustment is made at R712. If the output voltage tends to vary with load, it will affect the conductance of transistor Q706. This will, in turn, change the conductance of transistors Q704 and Q705, which are connected in a Darlington circuit, and the voltage will be maintained at normal level.

Transistor Q703 acts as a constant current source for Q704 and Q706. Overload protection is also provided with this transistor, in conjunction with diode CR707 and resistor R709. If a serious overload occurs, the increased voltage across R709 will also appear across resistor R708, through diode CR707. This will bias transistor Q703 to cutoff. Deprived of their current source, Q704 and Q706 will also be cutoff, removing the bias on Q705. The power supply will thus automatically shut off until the overload is removed.

The regulator is adjusted to provide a +39 vdc (-1/2+1 vdc) to the electronic assemblies. It is also connected back to the speed selector on the tape transport. That selector switches the +39 vdc to one of two lines, which are then returned, through the power supply box, to the solid state equalization switching circuits in the electronics.

A power distribution and fusing diagram is provided on Fig. 6-19.

5.2.2 Bias Oscillator and Amplifier Circuits

These circuits are not provided with reproduce-only equipment.

The master bias oscillator is mounted on the same card as the electronic power supply for record/reproduce equipment (see Fig. 6-22). This is simply a capacitively-coupled push-pull oscillator, operating at a nominal frequency of 150,000 Hz. Operating power of +39 vdc is taken directly from the power supply, so the oscillator operates continuously whenever power is applied to the equipment. Its transformer-coupled output is delivered to the bias amplifiers in each electronic assembly.

Two push-pull bias amplifier stages are mounted on a plug-in printed circuit board for each electronic assembly. Operating power is delivered to these stages through contact set 3-7-11 of record relay K1, when that relay is energized. The circuits, therefore, operate only when the equipment is placed in the record mode.

The push-pull bias input from the oscillator, is connected at pins 1 (shield), 2, and 3 of receptacle 4J11 (see Fig. 6-24). It is connected to the amplifier printed circuit board, and routed to the bases of transistor 3Q18 and 3Q19. Both this circuit and the following (3Q16 and 3Q17) provide normal, push-pull amplification of the bias frequency. They do, however, operate at clipping level to eliminate the need for a bias symmetry adjustment (an unsymmetrical bias waveform causes magnetization of the record heads and high second harmonic distortion). A fully acceptable sine wave is achieved at the output when transformer 3T3 is resonated with the record head, by adjusting the bias adjust control (3C40) to peak the current output to the erase head. The output is also taken through bias adjust resistor 3R80, routed through the bias trap of capacitor 5C35 and inductor 5L2, and then mixed with the record signal before being delivered to the record head. A third output is through bias calibrate resistor 3R44, the output selector switch, and thence to the vu meter; note that a contact set on the output selector switch shorts bias calibrate resistor 3R44 except when that switch is placed in the bias position. This is done to remove the rf from the line and thus reduce the amount of rf being induced into other circuits during the record or reproduce modes.

5.2.3 Record Amplifier Circuit

A schematic diagram of the record amplifier circuit is included on Fig. 6-24. No record amplifier is provided with reproduce-only equipment.

The signal to be recorded is connected to input connector 4J7, and then is routed through the input accessory or dummy plug in re-

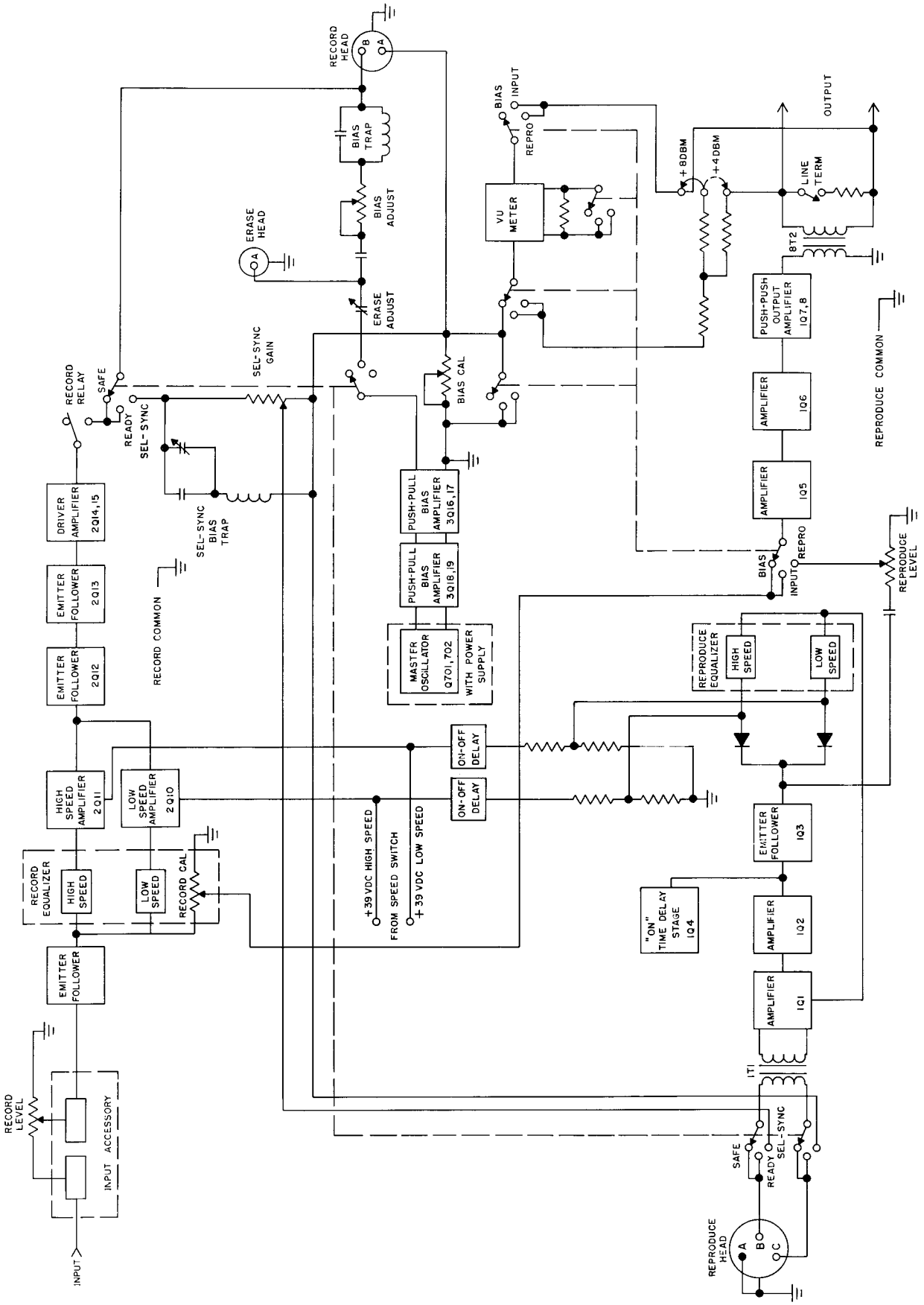

Fig. 5—3. Block Diagram

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ceptacle 4J8. Note that 4J8 is wired so that when the optional microphone preamplifier is employed, the record level control is connected between the two stages in the preamplifier. This effectively makes the preamplifier a variable gain device which will accommodate a wide variety of professional-type microphones.

From the input accessory socket, the signal enters the plug-in printed wiring board circuit, first encountering emitter-follower stage 2Q9. From there it proceeds to the plug-in record equalizer circuit. Note that the record calibrate control, 11R108, is on the equalizer board but is connected before equalization is applied. From that control the signal is wired, through contacts of the output selector switch, to stage 1Q5 in the reproduce amplifier circuit. It proceeds through the reproduce circuit to the output line and the vu meter so that record monitoring is possible and record level can be measured (refer to paragraph 5.2.4).

Both the high speed and low speed equalizers receive the signal from stage 2Q9. Equalization consists of placing a variable capacitor (11C53 for low speed, 11C54 for high speed) in parallel with a fixed resistor (2R51 for low speed, 2R52 for high speed). The capacitor is then adjusted to provide the correct high frequency response.

From the equalizer, the signal is routed through one of the two equalizer amplifiers, 2Q10 or 2Q11. Note that if the low speed is selected at the tape transport, +39 vdc is applied to pin 6 of receptacle 4J11. This voltage is applied, through resistor 2R64, to the emitter circuit of 2Q11, biasing that transistor to cutoff. In the low speed, therefore, transistor 2Q10 passes and amplifies the signal. When high speed is selected, the +39 vdc is applied to pin 7 of 4J11. The voltage is connected to cutoff transistor 2Q10, and stage 2Q11 thus acts as the high speed equalization amplifier. In both 2Q10 and 2Q11 a low frequency boost is realized, by inserting 2R54 and 2C25 (2Q10) and 2R59 and 2C27 (2Q11) in the base circuits.

Time constant circuits in both stages provide a delay in the record on-off function, to minimize popping when the equipment enters or leaves the record mode. The low speed circuit, in the emitter circuit of 2Q10, consists of 2C26 and 2R57 ("on" time delay) and 2C26 and 2R55 ("off" time delay). For high speed the circuit consists of 2C29 and 2R64 ("on" time delay) and 2C29 and 2R60 ("off" time delay). In both cases the time delay in entering record is longer than it is in leaving record.

From the equalizer amplifier the signal is routed through two emitter-follower stages, 2Q12 and 2Q13, to the output driver stage formed by 2Q14 and 2Q15. The output driver stage is a high impedance, constant current, amplifier. Transistor 2Q15 acts as an active load resistance for the collector of 2Q14, thus providing a relatively low d-c resistance and a relatively high a-c resistance. In the audio frequency range, therefore, transistor 2Q14 works into an impedance which is sufficiently high to provide the constant current source for the record head, yet allows full utilization of the d-c operating voltage available.

The signal leaves the printed circuit board at connectors 7 and 8, and proceeds through contact set 1-5-9 of the record relay. It is mixed with the bias frequency following the bias trap (5C35 and 5L2), and proceeds through the record selector switch, in the ready position, to the record head.

Record relay 4K1 is energized by pushing the RECORD pushbutton on the tape transport after the equipment has been started in the play mode. It is held energized (refer to Fig. 6-21) by contacts of the play relay, in the tape transport circuit, through resistor R601. Energizing voltage is connected at pin 4, and the holding voltage at pin 10, of receptacle 4J11. Contact set 1-5-9, when energized, removes ground from the record amplifier output, and routes that output to the record head. Contact set 3-7-11 connects the +39 vdc operating voltage to transistors 2Q12, 2Q13, 2Q14, and 2Q15, which can then conduct (they cannot operate until the equipment is placed in the record mode).

Contact set 4-8-12 acts in conjunction with transistors in the tape transport control circuit (refer to paragraph 5.1.7.5) to lock out the edit, rewind, and fast forward modes whenever the equipment is recording.

Diode 4CR6 in the record relay circuit, isolates the record mode to electronic assemblies which were in the ready condition when the record pushbutton was pressed. For example, if one electronic assembly was in the safe condition when the record mode was started, it will not go into record if its record selector were inadvertently turned from the safe or Sel-Sync to the ready position.

5.2.4 Reproduce Amplifier Circuit

No vu meter is supplied with reproduce-only equipment, otherwise the reproduce circuit for record/reproduce and reproduce-only is essentially the same. Refer to schematic diatrams 6-24 (record/reproduce) and 6-25 (reproduce-only). A monitor jack for reproduce-only equipment is mounted on the back panel of the module.

From the reproduce head, the signal reproduced from the tape is routed through contacts of the record selector switch, then enters the circuitry on the reproduce printed circuit board. It first passes through transformer 1T1. In some special applications it may be necessary to alter the head output at high frequencies, so blank terminals are provided across the secondary winding of the transformer.

After the input transformer, the signal is connected to the base of amplifier stage 1Q1; base bias on this transistor is derived from the current through resistor 1R4, which is filtered by capacitor 1C1. Following 1Q1 is another amplifier stage, 1Q2. D-C feedback is applied through 1R3, bypassed by 1C4 and 1C2, from the collector of Q2 to the collector of Q1. Collector voltage for both 1Q1 and 1Q2 is delivered through transistor 1Q4; those stages cannot operate until 1Q4 conducts. A time constant circuit (1C8 and 1R38) delays conduction of Q4, so that application of power to the equipment does not result in pinning the vu meter indicator, or causing pops at the output.

The signal path from 1Q2 proceeds through emitter follower stage 1Q3. Reproduce equalization is connected from the emitter of that stage back to the emitter of Q1. Either high speed or low speed equalization is selected by turning on diode 1CR2 (low speed) or 1CR1 (high speed) and thus allowing them to pass the signal. At low speed, +39 vdc is delivered to pin 6 of receptacle 4J11. At high speed, the +39 vdc is delivered to pin 7 of that receptacle. A time constant circuit is inserted in both +39 vdc lines, again to protect the vu meter and prevent pops when the speed is switched. Note that when a speed is first selected, the "on" time constant is determined by both a 100 mfd and a 35 mfd capacitor (all contained in capacitor 9C9). When that speed is turned off (other speed selected) the 100 mfd capacitor is not in the circuit, and the delay is determined only by the 35 mfd capacitor. Thus the "on" time when a speed is selected is greater than the "off" time for that speed.

If low speed is selected, the positive voltage from the time delay circuit is connected through 1R15 to diode 1CR2, biasing that diode so that it will conduct and pass the signal from the emitter of 1Q3 to the low frequency equalizer. If high speed is selected, the positive voltage, connected through 1R14 causes diode 1CR1 to conduct and pass the signal to the high speed equalizer. Thus either the low speed or high speed equalizer is connected from the emitter circuit of 1Q3 back to the emitter of 1Q1.

From the emitter of 1Q3 the equalized signal is routed through capacitor 1C7, the reproduce level control, and contacts of the output selector switch, to the base of amplifier stage 1Q5. (Note that this is the stage where the record monitor is connected, refer to paragraph 5.2.3). Capacitor 1C10 in the base circuit of 1Q5, provides an rf bypass, while 1C12 decouples the dc bias to stage 1Q5. Capacitor 1C14, in the collector circuit, is inserted to permit realization of high levels, without clipping.

After 1Q5, the signal is connected to stage 1Q6, which provides drive for the push-push output stage formed by the complementary pair of transistors 1Q7 and 1Q8. The output is taken at the emitter junction of those two transistors, and leaves the printed circuit board.

The output signal is connected to the phones jack, and through transformer 8T2 to the output connector. Line termination switch 4S3 is connected directly across the output line to terminate the equipment during checks and adjustments.

The secondary of the output transformer is connected to the vu meter through a strapping circuit that allows the equipment to be calibrated for either +8 dbm or +4 dbm normal operating level (see Fig. 5-4). When the equipment is strapped for a +8 dbm output, resistors 8R34 and 8R35 are connected as a voltage divider across the transformer, with 8R36 connected to their junction to feed the vu meter. When the strapping is for +4 dbm, resistors 8R34 and 8R35 are connected in parallel with one side of the line, with series resistor 8R36 feeding the vu meter.

5.2.5 Sel-Sync Circuit

The Sel-Sync circuit is shown between the record and reproduce heads on Fig. 6-24. Note that when the record selector switch is placed in the Sel-Sync position, the reproduce head is dis-

connected from the reproduce amplifier. The record head is disconnected from the record amplifier and connected to the input of the reproduce amplifier. The record head will reproduce the signal from the tape and deliver it to the reproduce amplifier, where it is amplified for monitoring purposes.

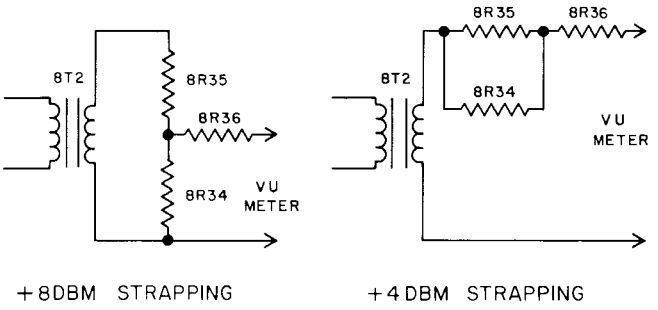

Fig. 5—4. Strapping Circuit, Simplified

A Sel-Sync gain control (4R43) allows the level to be set for monitoring purposes, and a series bias trap (4C18, 4C38, and 4L1) is tuned to prevent bias leakage from a channel operating in the record mode. Note that other contact sets of the record selector open the leads from the bias amplifier to the record head, and the negative return to the record relay.

In the Sel-Sync mode, then, the record head acts as a reproduce head for monitoring purposes. Another record head in the same stack but operating on a different track can be used to record that track synchronously with the first.