R 16.

Ampex

-PROFESSIONAL- "77" -TAPE RECORDER-

Maintenance Manual

BYER "77" PROFESSIONAL TAPE RECORDER

MAINTENANCE & FAULT FINDING MANUAL

1. TRIPLE HEAD ASSEMBLY:

(a) Removal of Early Type Tape Contact Guide - This is achieved by removal of circlip fitted to guide mounting stud. The number and position of spacer shim washers and felt pads should be noted. These must be reassembled in original order for correct alignment of tape contact guide.

(b) Removal of Current Type Tape Contact Guide - The complete tape contact guide assembly is removed by loosening a small 8BA screw set at an angle at the lower end of pressure roller lever arm. When replacing ensure screw engages flat on extension of mounting pillar.

(c) Cleaning Heads and Guides - Dust and ferrous powder is best removed by denture brush or similar stiff bristle brush. Caked accumulation on guides or poles are usually caused by particles adhering to smears from cellulose tape, and should be removed by using acetone or similar solvent applied to clean rag or absorbent cotton. This solvent must, however, be used sparingly.

(d) Removal of Triple Head Assembly - The triple head assembly is attached to machined aluminium base by two 4BA x 3/8" screws. Height adjustment (if used) is by aluminium spacer pieces between head bracket and base.

Disconnect six leads connecting heads to recorder. Remove screws holding assembly, taking care that no screw or spacer piece falls behind front panel.

(e) Replacement of Triple Head Assembly - Before fitting make sure tape tracks are clean and in line. Head mounting nuts must be checked to ensure heads are firm on bracket. Spanner size is 3/8" A.F. Mount bracket using original spacer piece fitted with its gapped side clearing cover mounting lug. Bracket must then be tightened in such a position that tape will just clear erase head pole and top lug on tape contact guide. Erase head case and leads must allow free rotation of primary roller.

(e) Replacement of Triple Head Assembly (Contd.)

When making this adjustment tape should be taut between primary and pressure roller; gap between pressure roller and capstan surface being approximately 3/32".

Tape contact guide must then fit evenly in all three heads. Check this by engaging pressure roller on capstan and not by pushing directly on contact guide.

To facilitate easy loading of tape, there must be a straight gap down centre between pressure roller and capstan, heads and contact guide, clearing primary roller on left. This gap should be 1/16" - 3/32" wide and coincide with gap between two front covers.

Reconnect leads to heads at lug panel. The replay head active lead (shielded cable) is soldered to top lug. Metal braid of same lead connects to second lug. Third lug vacant. Two red leads join to fourth and fifth lugs (green leads to head windings).

The last two red wires connect to sixth and ninth (bottom) lugs. Seventh and eighth lugs are for series connection of bias and erase supply.

(f) Shield Cover,Replay Head - This shield is adjusted at factory to minimise hum pickup by replay head. In many cases this must be tilted slightly to provide lowest noise figure for both speeds of tape operation. When adjusted, two small 10BA countersunk screws on inside of shield are tightened and sealed with clear lacquer.

2. PRESSURE ROLLER:

(a) Cleaning - Drive of tape through machine can be, and frequently is, affected by dirty and greasy pressure roller surface.

A brush is useful for removing dust particles, but grease, wax and oil must be removed by solvent. This should be carefully applied with a small cloth moistened with a cleaning fluid.

Correct drive surface is then obtained by coating a fine film of powdered graphite evenly over pressure roller drive surface.

(b) Lubrication - Pressure roller and primary roller are both fitted with double 9 m.m. ball races. These are supplied lubricated and require no further attention.

(c) Adjustment - Pressure roller is adjusted during assembly to provide adequate tape drive without slip through entire 7" reel of tape.

Adjustment, when necessary, is made at hexagon stud at centre of roller. Use 1/4" Whitworth spanner.

Insert .005" shim or feeler gauge in slot at rear of pressure roller solenoid, pressing it between poles and armature.

Next, clamp lightly by passing 3/16" Whit x 1" screw through carrying handle mounting hole over armature (Rear RH hole).

There should now be a gap of .005" between pressure roller and capstan. When loosening or tightening the pressure roller stud, support pressure roller lever arm to avoid strain and damage. Remove 3/16" screw and shim.

(d) Test For Drive - Underdrive: Tape slips or drives irregularly as end of tape is approached. Slight finger pressure on L.H. spool cap will stop tape.

Overdrive: Creepage effects of capstan embedded in pressure roller, plus extra side thrust on motor and pressure roller bearings, will so load motor that it will have difficulty in reaching synchronous speed. This is, of course, more noticeable towards end of tape at 15" per second speed. Slight pressure on L.H. spool cap needed to drop motor speed (lose synchronization). Considerable pressure on same spool cap to cause tape slip.

In some cases the foregoing clearances will need to be modified to bring tape drive within above limits.

Tighten pressure roller stud firmly.

3. CAPSTAN DRIVE MOTOR:

(a) Lubrication - A ball race provides the front or capstan bearing, and is supplied packed with grease, needing no further attention during normal life. Rear bearing is of the self aligning bronze type with integral end thrust adjustment. Lubricate regularly using Shell G.960 or similar lubricant.

(b) End Thrust Adjustment - End thrust should only be adjusted when motor is hot. Loosen lock ring and turn screw till end play is removed. Wind back screw so that minimum end play is felt. Whilst holding screw in this position, secure locking ring.

This is the correct adjustment and prevents unnecessary friction and damage by pre-loading of ball race.

4. SPOOLING UNITS:

(a) Lubrication - This should be carried out regularly with recommended grade of oil applied to front and rear "eyelet" type lubricators, fitted to top of both units.

(b) End Play - Adjustment is made to provide minimum drag in motor, quiet operation, tidy stacking of tape, and smooth tensioning of tape. Minimum end play is used to fulfil all above requirements.

Remove four (4) screws holding protective cover (if fitted) to rear of spooling motor(s).

Whilst holding adjusting screw with screw driver, loosen knurled lock ring. Adjust screw clockwise to reduce play and anti-clockwise to increase end play. Lock screw by holding with screwdriver, as lock ring is tightened. There will be forward movement of shaft caused by compression of neoprene thrust washer fitted internally on front end of shaft.

Test rewind spooling motor for friction by pressing "forward" spool push button. Do not use spools for this check.

(b) End Play (Contd.).

Reduced voltage applied to rewind motor should enable it to start rotating immediately. Similar test is made on take up motor by pressing "rewind" spool button.

Bearings, if slightly tight, may be out of alignment; a light tap on spool shaft and rear end bell of motor will ease the bearings.

(c) Brakes - Cleaning - Faulty brake operation is usually attributed to oil or grease on shoe or brake drum. Remove spooling motor by removing six (6) mounting screws (plus two (2) screws on condenser mounting bracket with early models). Use a clean cloth moistened with acetone, rest on brake drum and rotate shaft several revolutions. This should remove foreign matter from both brake shoe and drum.

(d) Brake Adjustment - The brake actuating arm is secured by two grub screws to armature extension shaft. These two screws should be tightened when armature engages solenoid, and a clearance of .010" exists between brake and drum at extreme end of shoe.

Replace connector plug and start in operation.
Note: Both spooling motor plugs must be fitted in their respective sockets. There must be no hesitancy in the brake leaving drum. Clean or reclean brake drum with an acetone moistened cloth, and re-assemble.

SYMPTOM	FAULT	CAUSE	REMEDY
1) No Take Up.	Mechanical	(a) Motor Seized	This is usually due to prolonged running without lubrication, and can often be corrected by gently tapping rear bearing with a leather or rubber mallet. There is a possibility that the bearings and shaft have picked up metal and this may require a new bearing. The shaft will have to be checked for trueness and also to see that there are no burrs before attempting to re-run with old or new bearing.
	Mechanical	(b) Brake Not Releasing.	This may be due to over-heating in the brake solenoid coil located under a cast cover on the side of motor, or to the grub screws securing the brake arm to the armature shaft having become loose. If found to be due to overheating the solenoid coil may have to be replaced and the cause of overheating located. When repairs have been effected, the solenoid coil should be energised with about 40 volts D.C. and care should be taken that the armature is seating properly on the solenoid core before the cover screws are tightened. The two (2) grub screws on the brake arm should then be tightened (with D.C. Still applied), and with a clearance of approximately 1/32 of an inch between brake shoe and brake drum.
	Electrical	(c) Open Circuit Motor.	Remove plug from socket on side of control box and unscrew top. Check for broken leads. Unscrew condenser bracket from motor frame and check D.C. resistance of windings. Also check motor condenser. If motor windings are open replace motor.

SYMPTOM	FAULT	CAUSE	REMEDY
1) No Take Up (Contd.)	Electrical	(d) Open Resistor	Check 750 ohm 20 watt resistor in resistor cage on outside of control box. Cover may be removed by releasing 1st and 3rd screws.
	Electrical	(e) Faulty Relay Contacts	Check top left hand pair of contacts on large (capstan) relay to ensure that they close when the relay is operated by the "start" button. In some cases the no take up conditions are accompanied by no bias in which case the pivot pin in the relay has worked loose and may be pushed back with a screwdriver.
2) No Holdback	Mechanical	(a) Motor Seized	(Refer Symptom 1(a))
	Mechanical	(b) Brake Not Releasing.	(Refer Symptom 1(B))
	Electrical	(c) Open Circuit Motor.	(Refer Symptom 1(c))
	Electrical	(d) Open Resistor	(Refer Symptom 1(d)), but check instead 2000 ohm 20 watt resistor adjacent to 750 ohm 20 watt resistor.
		(e) Faulty Relay Contacts.	(Refer Symptom 1(e))
3) Pressure Roller Does Not Operate	Mechanical	(a) Faulty Brakes	If brakes are inclined to lock then the tape tension is such that it will not allow pressure roller to operate. The remedy is to bend the offending brake arm to obviate this condition.

SYMPTOM	FAULT	CAUSE	REMEDY
3) Pressure Roller Does Not Operate (Contd)	Mechanical	(b) Slippage of Adjustment.	Check pressure roller to ensure it has not worked loose. Check solenoid cover screws in case solenoid has shifted, and readjust.
	Electrical	(c) Insufficient Mains Voltage	Turn meter switch on amplifier panel to 'A.C.'. If meter reads below 0 VU turn off A.C. switch and adjust mains input selector to 210 volt position. Now turn on A.C. If meter reads higher than 0 VU but proportionately less than the previous reading was below the zero position, the adjustment is correct.
	Electrical	(d) Insufficient D.C. Current	Turn meter switch on amplifier panel and check all readings. This will probably indicate:- (a) Output stage faulty, or (b) Oscillator stage faulty, or (c) Rectifier faulty, or (d) Input filter condenser requires replacing.
	Electrical	(e) Open Circuit Solenoid Coil.	If this condition exists then the capstan (large) relay will not operate either. The remedy is to replace solenoid.
	Electrical	(f) Premature Operation.	Pressure Roller will not operate reliably until amplifier has been switched on for about 30 seconds.

SYMPTOM	FAULT	CAUSE	REMEDY
4) Will Not Start	Electrical	(a) Blown Fuses	Check 1 amp. Fuse on Front Panel and replace if necessary. Check 100 milliamp Fuse in holder on side panel under amplifier.
	Electrical	(b) If, when start button is pressed lights on amplifier go out.	Check action of "stop" microswitch. Check oscillator coil in amplifier for short circuit to ground. Check all relay contacts. Check capstan relay coil. Check pressure roller solenoid coil.
	Electrical	(c) If, when start button is pressed capstan relay, pressure roller, take up and hold back operate but capstan motor does not operate	Check to see that speed change control is not in neutral position. Check contacts in speed change control. Check resistors (in resistor cage) of 1,500 ohm 20 watt variable, and 2,000 ohm 20 watt which are wired in series. Check 3 mfd Motor Condenser mounted on outside of control box. See that capstan rotor is free to rotate and not seized. Check top right hand pair of contacts on capstan relay. Capstan motor stator may be faulty, but a resistance test will not necessarily show it up.
	Electrical	(d) Button Operation.	Check to see that the "start" microswitch operates mechanically, also the "stop" button. If not, they must be replaced.
	Electrical	(e) Speed Change Control Neutral.	Select required tape speed.

SYMPTOM	FAULT	CAUSE	REMEDY
4) Will not Start (Contd.)	Mechanical	(f) Tape Fouling Heads	Feed tape back and forth by hand until centralised on pressure roller and primary roller.
	Mechanical	(g) Pressure Roller Out of Adjustment.	(Refer Section (A) - Paragraph 2(c)).
5) Pressure Roller Does Not Release.	Mechanical	(a) Slippage of Adjustment.	(Refer Symptom 3(b))
	Electrical	(b) Short Circuits To Frame	This usually indicates that the 4 mfd condenser has developed a short circuit, and if so should be replaced by a 600 volt unit if this is not already fitted. Failure of this condenser is usually due to operation of recorder with mains selector switch in wrong position. Short circuits may develop in the capstan relay coil or in the oscillator circuit of the amplifier.
	Electrical	(c) Button Operation	(Refer Symptom 4(d))
6) Loud Mechanical Chattering Noise.	Electrical	(a) Short Circuit Between A.C. & D.C. Circuits.	This fault usually develops in the spooling motor connector plugs and may be cleared easily.
7) Forward Spool Does Not Operate.	Mechanical	(a) Motor Seized	(Refer Symptom 1(a))
	Electrical	(b) Open Circuit Motor.	(Refer Symptom 1(c))
	Electrical	(c) Faulty Relays	Check both small relay contacts and coils to ensure that the relay operates correctly.

SYMPTOM	FAULT	CAUSE	REMEDY
8) Rewind Spool Does Not Operate.	Mechanical	(a) Motor Seized	(Refer Symptom 1(a))
	Electrical	(b) Open Circuit Motor.	(Refer Symptom 1(c))
	Electrical	(c) Faulty Relays	(Refer Symptom 7(c))
9) Capstan Motor Goes At One Speed Only.	Electrical	(a) Faulty Stator	Replace stator.
	Electrical	(b) Faulty Speed Change Control, Condenser or Resistors.	Check speed change control contacts and also 3 mfd condenser mounted on control box. Check series wired 1500 ohm and 2000 ohm 20 watt resistors mounted in resistor cage.
10) Does Not Erase	Mechanical	(a) Tape Contact	Check to see that tape when in motion correctly contacts both gaps on the erase head.
	Electrical	(b) Erase Head Or Record Head	Check continuity of erase head and bias windings which are series connected. Erase head may have shorted turns. This will usually show up as a slightly low bias reading when metering switch on amplifier panel is turned to Bias and slightly high reading on V6 position.
	Electrical	(c) Bias Oscillator	Check operation of bias oscillator (V6) and check continuity of cable to heads. Also check .5 mfd series condenser located on lug strip directly under speaker. Check bias frequency which should be approximately 50 Kc.

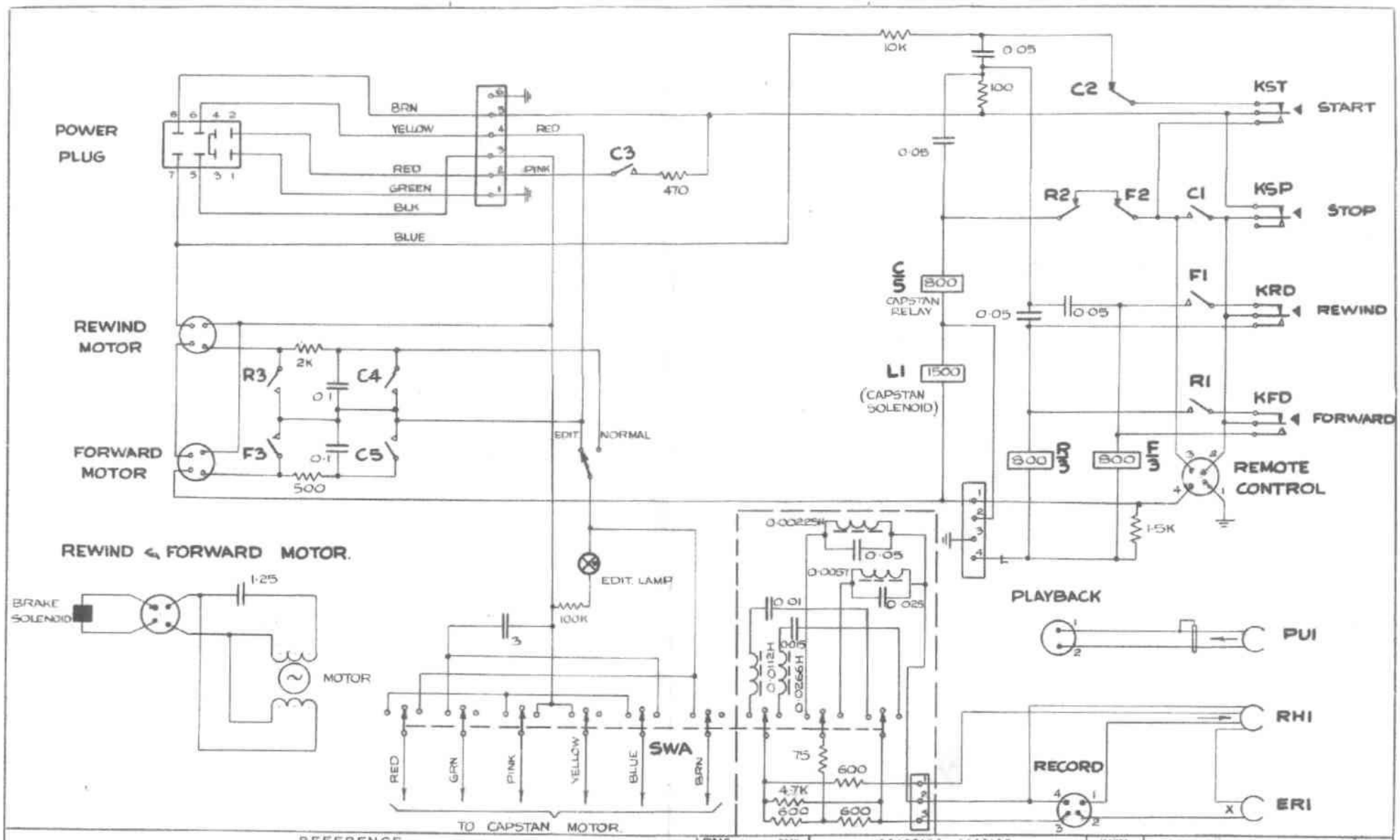
SYMPTOM	FAULT	CAUSE	REMEDY
11) No Bias.	Electrical	(a) Erase Head or Record Head.	(Refer Symptom 10(b).) Bias current should be in the vicinity of .6 amp as measured on a thermocouple ammeter.
		(b) Bias Oscillator	(Refer Symptom 10(c).)
12) Poor Braking	Mechanical	(a) Oiling Up	Remove spooling motor and check for oil on drums and shoes. Excess oil should be removed with Benzol, petrol, etc.
	Mechanical	(b) Worn Brake Shoes.	When this condition occurs remove brake arm by loosening two (2) grub screws and bend extreme end of shoe very slightly until shoe grips on drum. Too much bending will make brakes either lock on or not grip at all, so great care must be taken. When satisfied with seating of shoe, wipe the cork lining and drum with benzol, petrol, etc., and re-assemble as described in Symptom 1(b).
13) When Mains Is Switched On One Relay Closes.	Electrical	(a) Short to Frame In Relay Coil.	This is usually brought about by the lower relay holding screw shorting to a relay coil terminal and may be cleared by removing screws and shortening them. Fault can be picked up with ohm meter check between frame and top left hand contacts of both small relays and between frame and contact carrying a blue wire on the large relay.
14) When Mains Is Switched On Capstan Motor Rotates	Electrical	(a) Short to Frame In Capstan Motor	Replace Faulty Stator.

SYMPTOM	FAULT	CAUSE	REMEDY
14) When Mains Is Switched On Capstan Motor Rotates (Contd)	Electrical	(b) Shorted Condenser	Check anticlick condenser (.1 mfd) on the lug strip mounted on the relay unit. This condenser connects between 2nd from top right hand contact on the large relay, to 2nd from bottom contact on 5-way lug strip alongside relay.
	Electrical	(c) Relay Contacts	Check top right hand pair of contacts on the large (capstan) relay to ensure they are opening correctly when relay is in 'rest' position.
15) When Mains Is Switched On Takeup & Hold-Back Motors Are Energised.	Electrical	(a) Short to Frame Of Mains.	Check wiring with megger to determine whether short from mains to frame exists.
	Electrical	(b) Shorted Condenser.	Check anticlick condenser (.1 mfd) on the lug strip mounted on the relay unit. This condenser connects between 2nd from top left hand contact on the large relay to 2nd from bottom contact on 5-way lug strip alongside relay.
	Electrical	(c) Relay Contacts.	Check top left hand pair of contacts on the large (capstan) relay to ensure they are opening correctly when relay is in 'rest' position.
16) When Switched Off, Mains Indicator Bezel Remains On.	Electrical	(a) Short to Frame Of Mains.	This fault nearly always indicates a short to frame of the mains. This must be cleared and is usually found to be leakage in power transformer, one of the motors, or in the insulation sleeve in the indicator itself. This sleeve must be replaced if faulty.

SYMPTOM	FAULT	CAUSE	REMEDY
17) Keeps Blowing Mains Fuses.	Electrical	(a) Short To Frame Of Mains.	(Refer Symptom 16(a))
18) Keeps Blowing H.T. Fuses.	Electrical	(a) Short To Frame Of H.T.	Check H.T. line of amplifier. Most vulnerable point is the input filter capacitor. Check through control box circuit for shorts.
19) Keeps Blowing Mains Indicator Bezels.	Electrical	(a) Short To Frame Of Bezel Holder Socket.	This requires replacement of bakelite insulating sleeve in bezel holder.
20) Relays Do Not Drop Out When Function Switch Is Turned.	Mechanical	(a) Distorted Contacts On Function Switch.	Check contacts on function switch to see they are not distorted and so do not break properly before next contact makes.
21) When First Switched On Pressure Roller Comes In & Drops Out.	Electrical	(a) 4 mfd Electrolytic Condenser	This normally happens when unit has been out of use for a time and is due to forming currents in the electrolytic. This is quite normal but if it seems excessive it would be advisable to change the condenser.
22) Wow Throughout Tape.	Electrical	(a) Capstan Motor Not In Synch.	Check line voltage on meter.
	Mechanical	(b) Incorrect Pressure Roller Adjustment.	(Refer Section (A) Paragraph 2(c)).
	Mechanical	(c) Incorrect End Thrust Adjustment of Rewind Motor.	(Refer Section (A) Paragraph 4(b)).

SYMPTOM	FAULT	CAUSE	REMEDY
23) Wow at End Of Tape.	Mechanical	(a) Eccentric Spool Core.	Replace spool.
	Mechanical	(b) Tape not spooling concentric with spool hub.	Rethread tape on spool core; obviate forming bump in first turn.
	Mechanical	(c) Incorrect Pressure Roller Adjustment.	(Refer Section (A) Paragraph 2(c).)
	Mechanical	(d) Tightness in Rewind Motor	Tap end of shaft lightly. (Refer Section (A) Para. 4(b).)
24) Noisy Motor(s)	Mechanical	(a) End Thrust(s) Out Of Adjustment.	(Refer Section (A) Paras. 3(b) and 4(b).)
25) High Noise Level On Replay.	Electrical	(a) Shield cap on replay head loose or out of position.	Tighten shield. (Refer Section (A) Para. 1(f).)
	Electrical	(b) Broken Replay Head Lead.	Repair or replace.
	Electrical	(c) Fault in Capstan Motor.	Check for power.

SYMPTOM	FAULT	CAUSE	REMEDY
26) Capstan Motor Not In Synchronous Running (Hunting)	Electrical	(a) Low Supply Voltage.	Check A.C. on meter. Adjust mains input selector switch to "210" position if required.
	Electrical	(b) Fault In Motor Windings.	Replace stator.
	Mechanical	(c) Excessive Pressure Roller Tension.	(Refer Section (A) Paragraph 2(c).)
	Mechanical	(d) Motor Bearings out of alignment.	Strike rear of motor lightly with leather or rubber mallet, (whilst motor is running).
	Mechanical	(e) Lack of Oil	Lubricate with Shell G.960 or similar light oil.



REFERENCE

ENG DATE	APPR.	DRGN. EXAMR.	CHK'D	DRAWN	DRAFTING SECTION AMENDMENTS	ISSUES ORDER No.	ISS.
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28·6·60	JFR	JG	CWB	PRS		1377	2
2/3·61	BEW		CWB	PRS	WAS SB5600/5'3	1910	3
6·6·61	BEW		CWB	PRS		3290	4
22·5·62	BW		DAmcJ	KLM	WAS SB5600/13	4986	5

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N.B.S. STUDIOS
BYER '77'
TAPE RECORDER
TAPE TRANSPORT
(SER. Nos. FROM 1060)

DRAWING NO. SB 5590

SHEET NO. 4/3 OF SHEETS

FORM C.D. 190/2

THIS DRAWING CONSISTS OF SHTS 4/1-4/3 + DL

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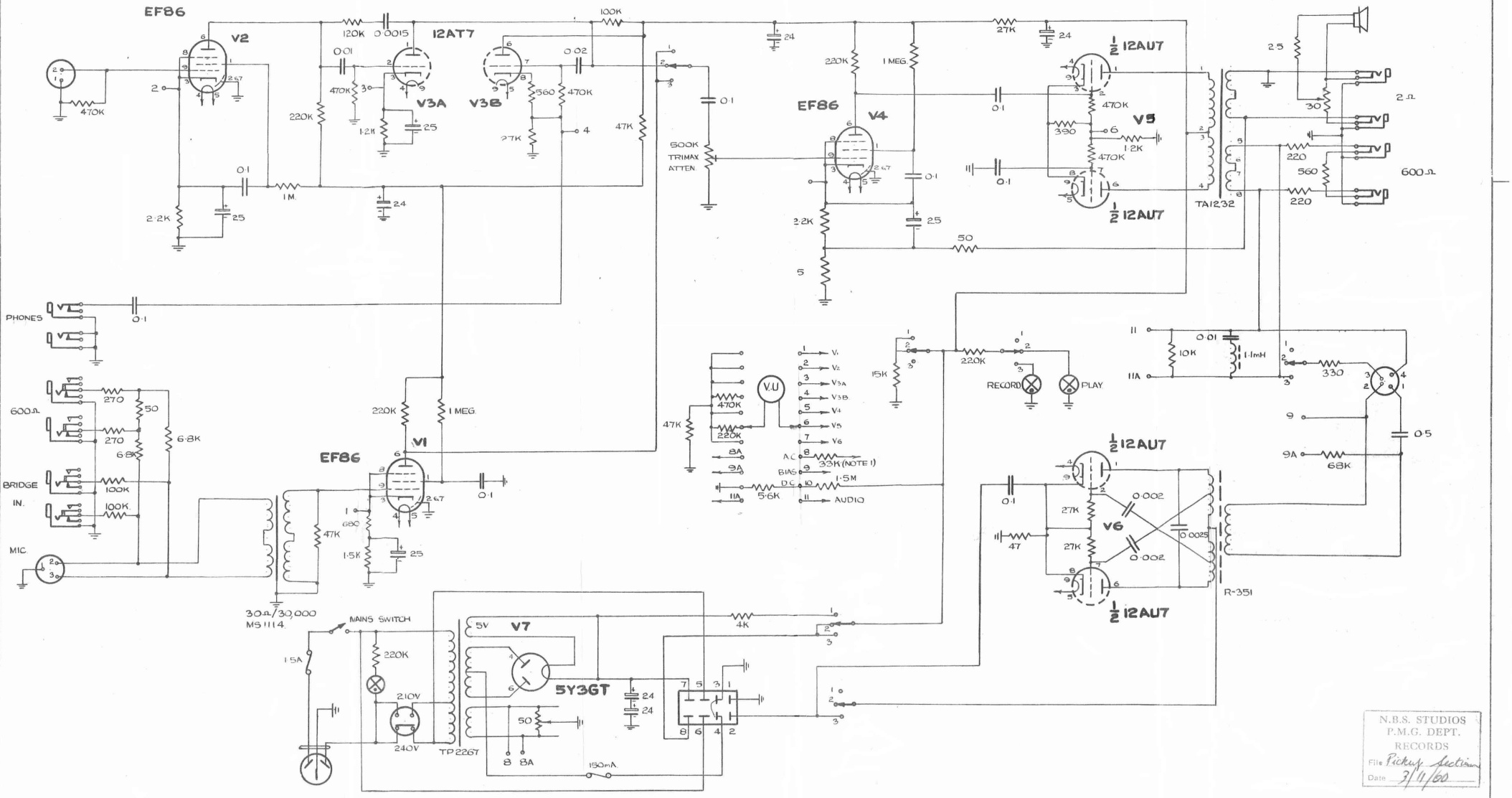

REFERENCE

NOTES

1. ADJUSTED IN FACTORY.

ENG DATE	ENG APPD.	ENG EXAMD.	DRAFTING SECTION CHECKD.	DRAFTING SECTION DRAWN	AMENDMENTS	ISSUES ORDER	ISSUES No.
23.2.60	BRP	J.G.	CWB	PRS		9092	1
19.10.60	BEW		CWB	PRS	VALVE CODING, FUSE CURRENTS	2085	2

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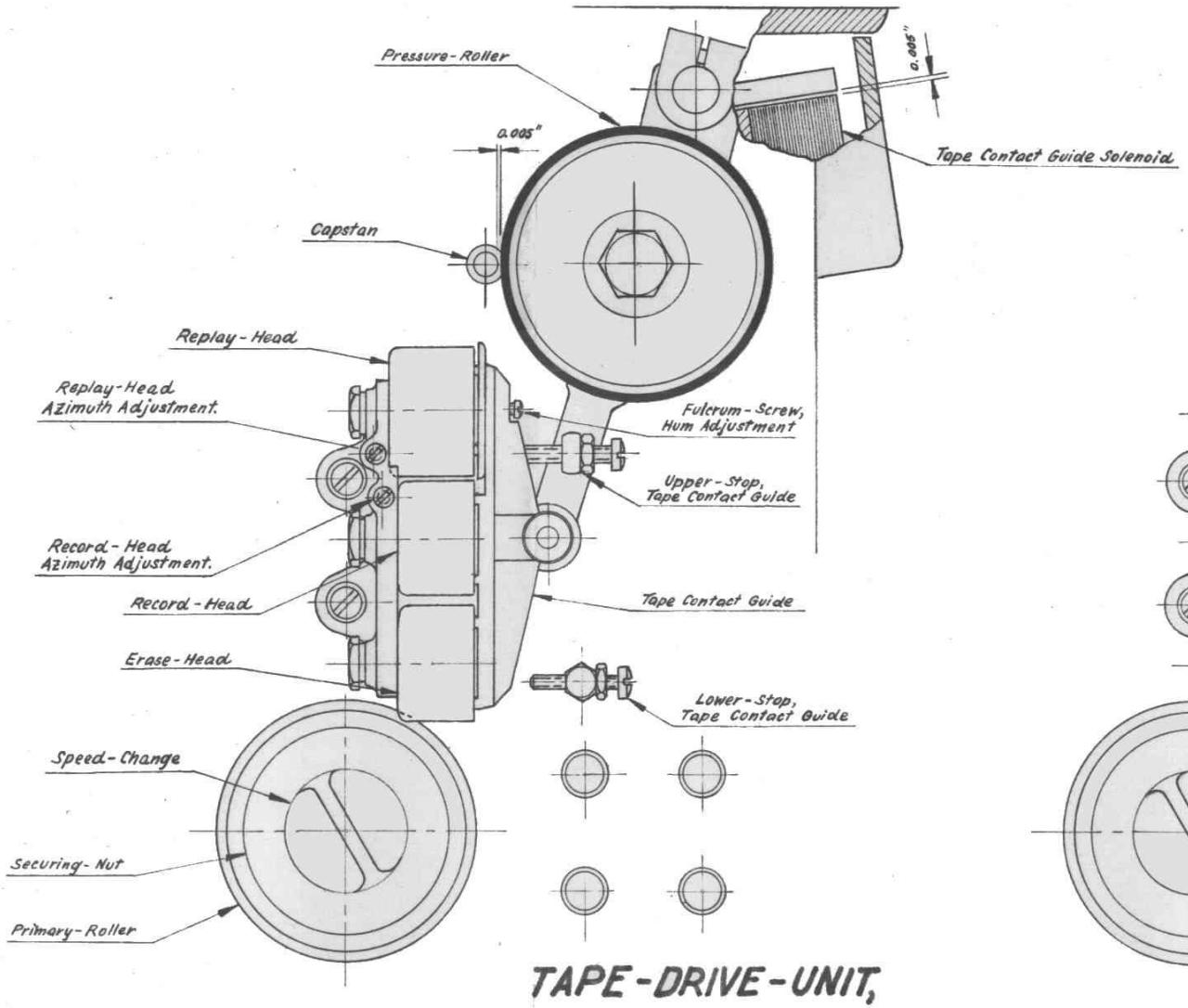
N.B.S STUDIOS
BYER '77'
TAPE RECORDER
AMPLIFIER
SCHEMATIC

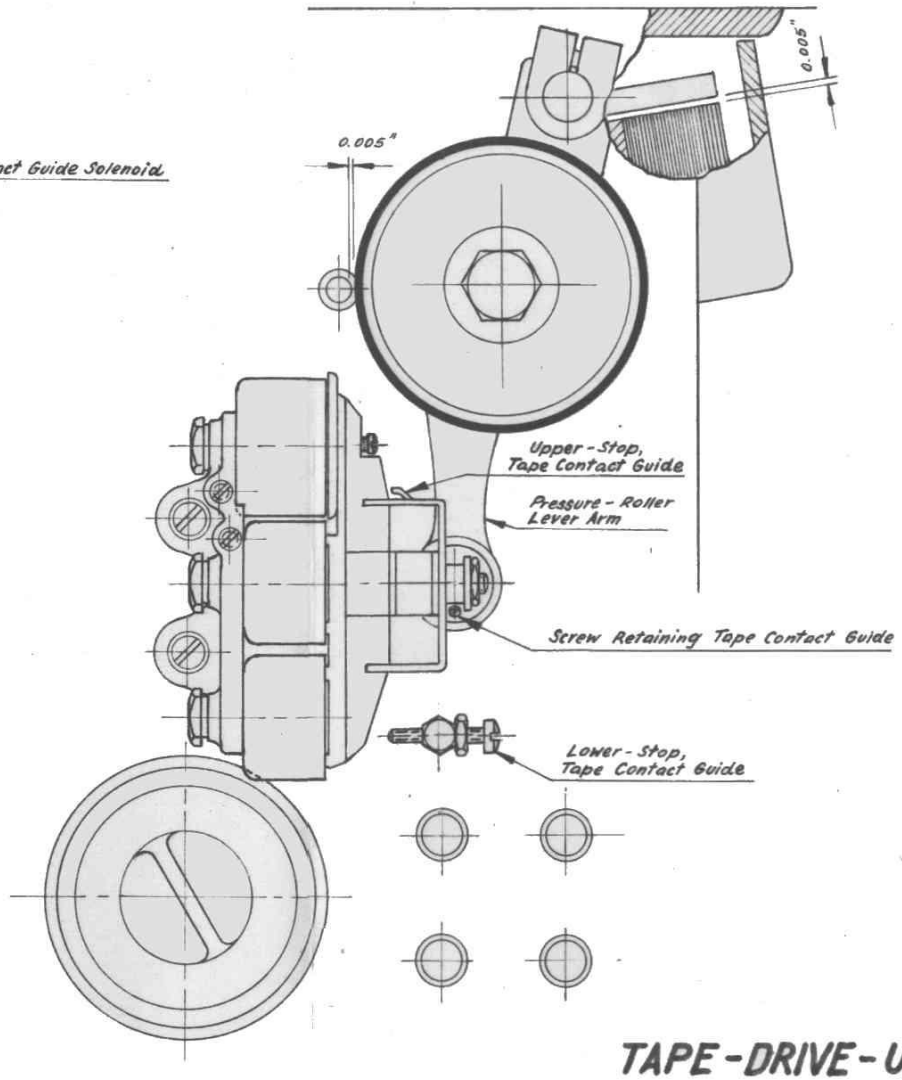
DRAWING NO. SB5600

SHEET NO. 51 OF SHEETS

FORM C.D. 150/3



TAPE-DRIVE-UNIT, EARLY TYPE.



TAPE-DRIVE-UNIT, CURRENT-TYPE.