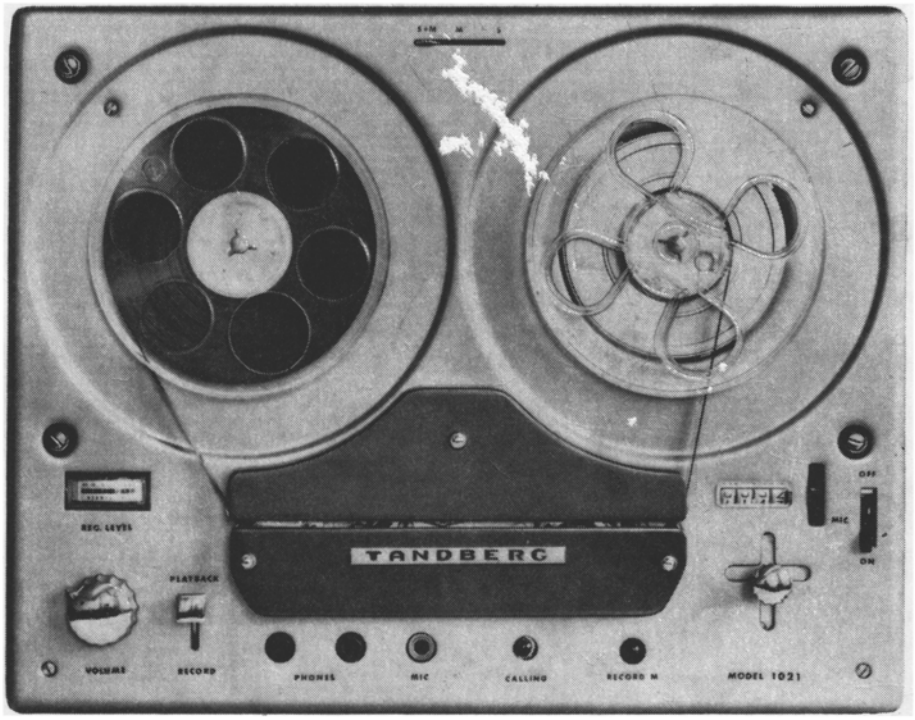
TANDBERG TAPE-RECORDER

Model 10–21

above Ser. No. 780601

Service Manual



Tandberg RADIO

TANDBERGS RADIOFABRIKK A/S - OSLO - NORWAY

Preface

This service manual covers the Tandberg tape recorder Model 10-21. The Model 10-21 is a complete halftrack, one speed (3¾ i.p.s.) fully transistorized tape recorder specially designed for language laboratory use.
We hope that everyone concerned with our products will find this service manual useful.

Contents

1.0 Technical specification, Tandberg tape recorder model 10—21

Power requirements:	220 Volts, 50 c/s or 115 Volts, 60 c/s. 20 Volts D.C., stabilized and 28 Volts D.C., unstabilized.
Power consumption:	20 Watts A.C. and 10 Watts D.C.
Motor:	Shaded pole.
Tape speed:	3.3/4 i. p. s.
Speed accuracy:	Relative accuracy, repeated playback: ± 2 % or 3,6 seconds in 30 minutes. Absolute speed tolerance: ± 1 %.
Playing time:	Two-track recording on 1800 ft. of tape is 96 minutes.
Fast wind or rewind:	Fast wind or rewind time for 1800 feet of tape is approx. 4½ min.
Tape path:	The tape moves from left to right. The heads are mounted with the airgaps pointing towards the front.
Recording tape:	Maximum reel diameter is 7". Good quality recording tape is recommended.
Remote start/stop:	The tape recorder can be started and stopped instantly from the master desk.
Heads:	Half-track stereo erase head. Half-track stereo record head, air gap: 13 μ. Half-track stereo playback head, air gap: 3 μ.
Frequency response:	80—10 000 c/s ± 2 dB.
Harmonic distortion:	The amplifiers are equalized to conform with the N. A. B. standards. The distortion from the record amplifiers at maximum recording level is less than .5 %. The distortion from the tape recorded with a 400 c/s signal at maximum recording level is less than 6 %, when played back. The distortion from the tape recorded with a 400 c/s signal at 10 dB below maximum recording level is less than .5 %, when played back.

Signal to noise ratio:	The signal to noise ratio is better than 52 dB with the tape recorded to 6 % distortion.
Crosstalk:	The crosstalk rejection is better than 60 dB at 400 c/s.
Wow and flutter:	Better than .2 % RMS.
Erase and bias frequency:	The erase and bias frequency is 85 kc/s. ± 2 kc/s. The even harmonic distortion in the bias current is less than .5 %.
Recording level indicator:	The VU meter is connected to the student track (lower track). The indicator range is 20 dB plus overload.
Input impedance:	**MICROPHONE INPUT, STUDENT TRACK:** Input impedance 200 ohms, maximum input voltage: 1,5 mV. Normal input signal for maximum recording level at 1000 c/s: .25 mV.
Output:	Output impedance: 30 ohms. Maximum output voltage: 2,5 V.
Counter:	4 digit counter shows the number of revolutions of the take-up turntable.
Power supply:	All power except 220 V A.C. (115 V A.C.) for the motor is furnished from the master desk.
Dimensions:	Teak cabinet 38,7 cm (15¼") long, 30,2 cm ($11^{7}/_{8}$") wide and 17,2 cm (6¾") high.
Weight:	8,2 kg (18.2 lbs.).

2.0 The function of the controls:

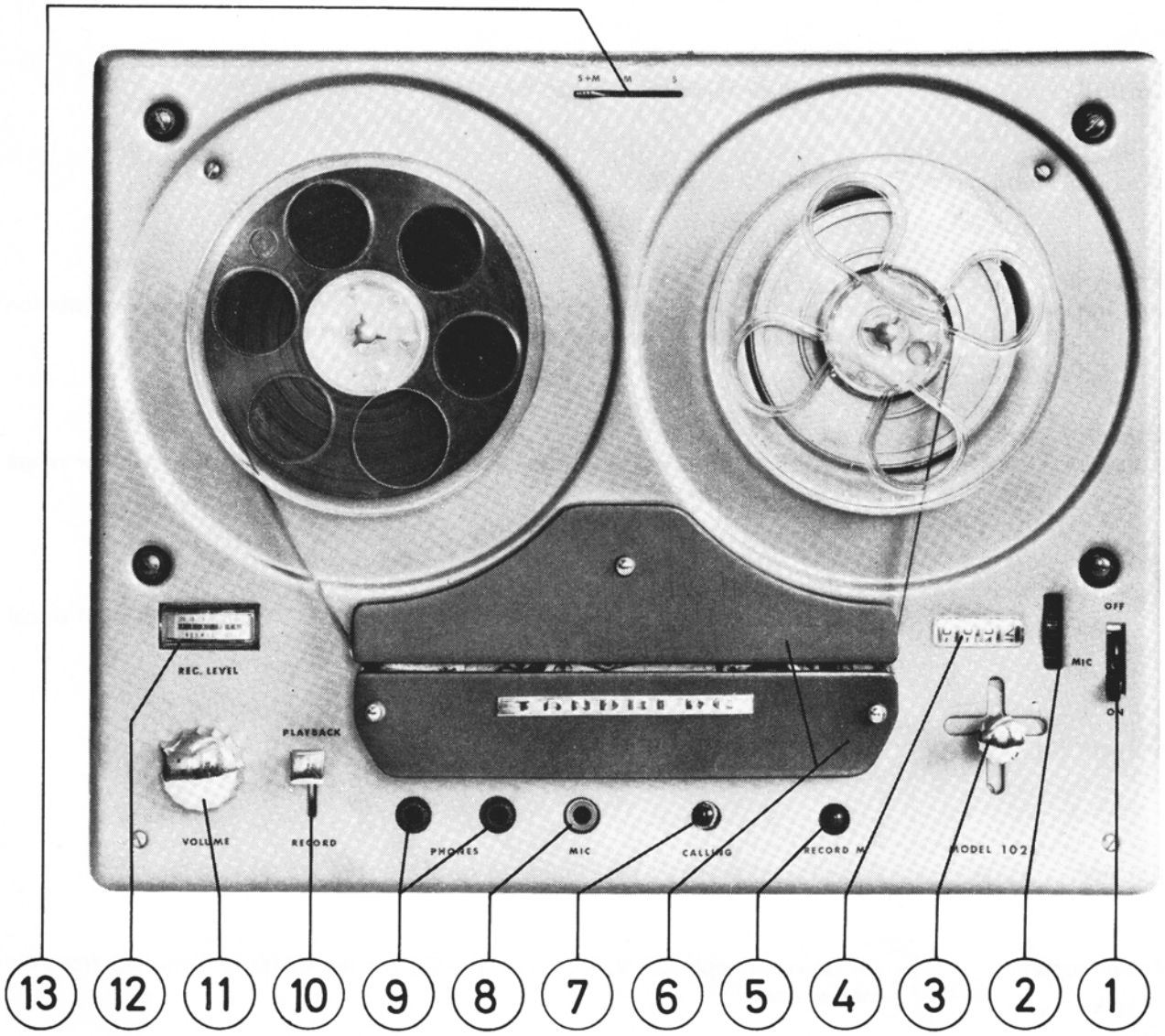


Fig. 1. The operating controls.

1. Microphone switch: Turns the microphone on or off.

2. Re-set wheel: Re-sets the tape counter to zero.

3. Operating lever: Activates the mechanism in the tape recorder for the different modes of operation.

4. Tape counter: Indicates the position of the tape.

5. Recording M lamp: Lights up when the recorder is set up for recording on master track.

6. Front and rear trim covers: Remove the trim covers to clean or demagnitized the heads. The mic. level pot. meter R3 is located under the front trim cover.

7. The calling push-button: Is depressed when the student wishes to draw the attention of the instructor. A white lamp at the master desk will light up when the push-button is depressed.

8. The microphone input: Microphone input with 200 ohms impedance.

9. The phone outputs: 2 parallel phone outputs with 30 ohms impedance.

10. The record/playback lever: Activates the electronic units (student track) for record or playback modes.

11. The volume control: Adjusts the volume of the student's headphones.

12. The recording indicator: Indicates the recording level of the student track.

13. The output selector:
pos. S : playback from student track.
pos. M : Playback from master track.
pos. S + M: playback from student and master tracks simultaneously.

3.0 The connections

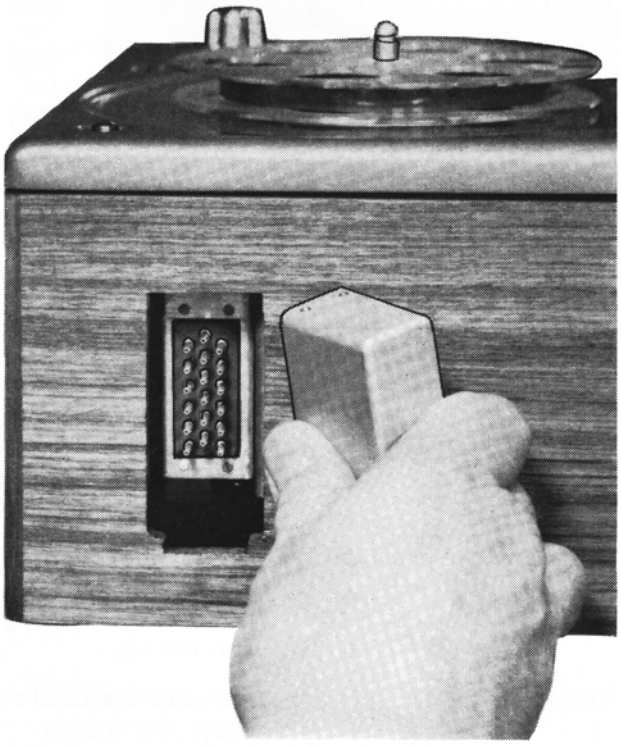


Fig. 2. Connection for the 18 pin plug.

The DC power, the programme lines and the signal lines are connected to the tape recorder via the 18 pin socket shown in fig. 2.
The microphone jack and the two phone jacks are located in front of the trim covers ref. fig. 3. The two phone jacks are connected in parallel.

Black jack plug: phones.
Chrome jack plug: mic.

Three phono jacks (green, black and red) are provided at the rear of the tape recorder for connection to the test rig during adjustments.
Ref. fig. 46 and 55.

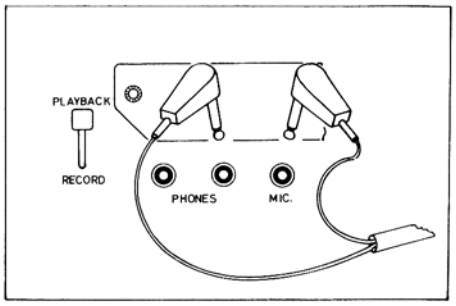


Fig. 3. Connections for the headset.

4.0 The mechanism, detailed description and adjustment instruction

The main function of the mechanical system is to drive the turntables and the capstan in the different modes of tape motion. The mechanical function is activated by the operating lever.

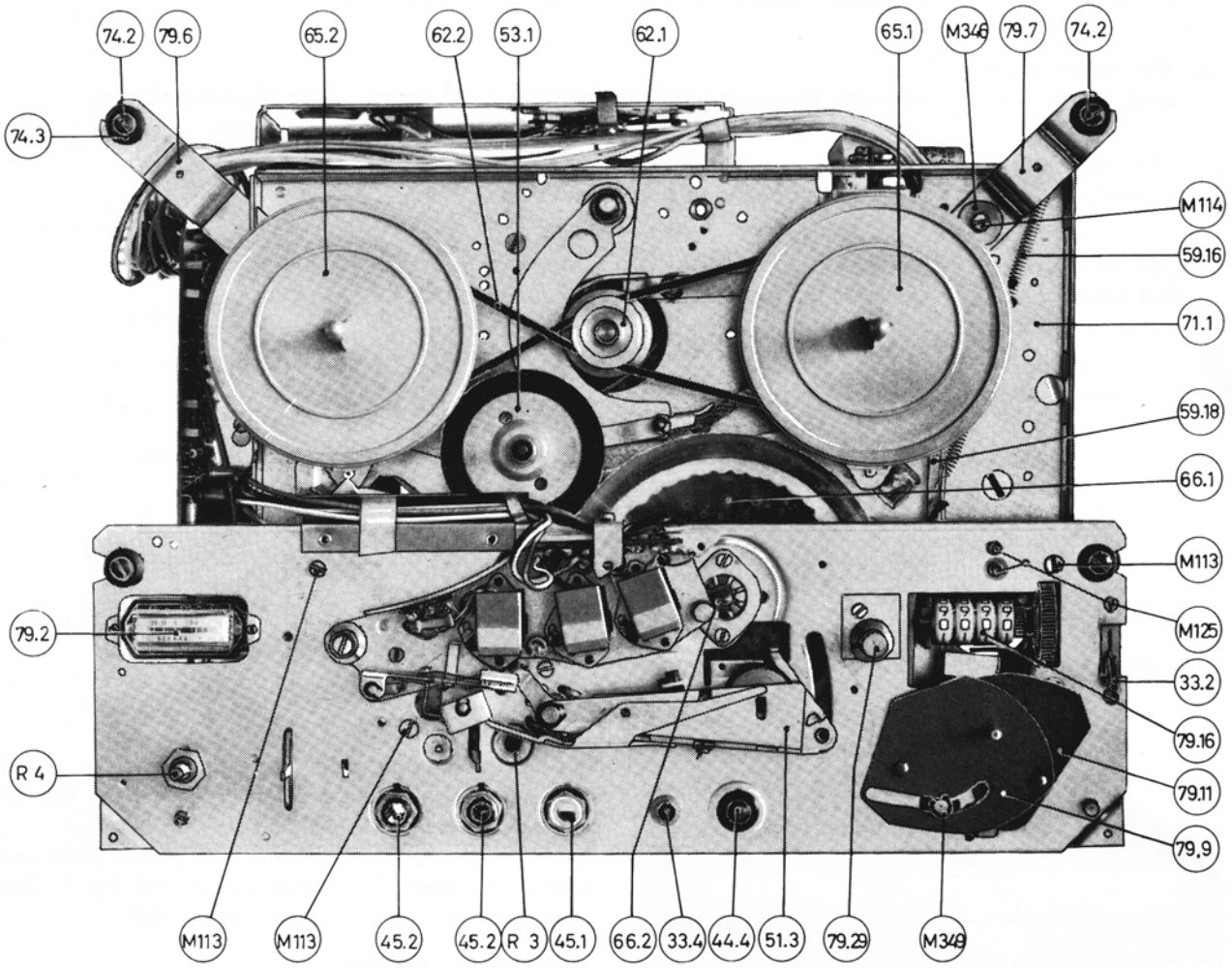


Fig. 4. Top view, with top cover removed.

4.1 THE OPERATING LEVER

The operating lever (54.1) is located at the right front corner of the tape recorder. It has five positions: Normal forward drive, fast forward drive, fast rewind, neutral and free.
Ref. fig 1 and 5.
The operating lever activates the following parts:

The motor switch (33.3): Connects the power to the motor (14.1) in normal forward drive, fast wind or fast rewind.

The eccentric segment (59.17): Guides the pressure wheel assembly (51.3) and the lifting arm (59.18).

The trip bar (52.1): Activates the clutches under the friction discs (61.1 and 61.2).

4.1.1 The motor switch.

The microswitch (33.3) is located on the bracket for the operating lever (54.11) ref. fig. 5. The switch is connected in series with the motor current and is activated by the operating lever (54.1) to shut off the motor in neutral or free position.

Adjustments:

The operating point of the microswitch (33.3) should be set according to fig. 6. The motor should start when the operating lever (54.7) is moved from neutral to either normal forward, fast wind or fast rewind position. Unscrew the three screws A, B and C ref. fig. 5. Adjust the horizontal position of the delrin bracket (33.9) and the vertical position of the micro-switch (33.3) obtaning proper positions for correct operating points.

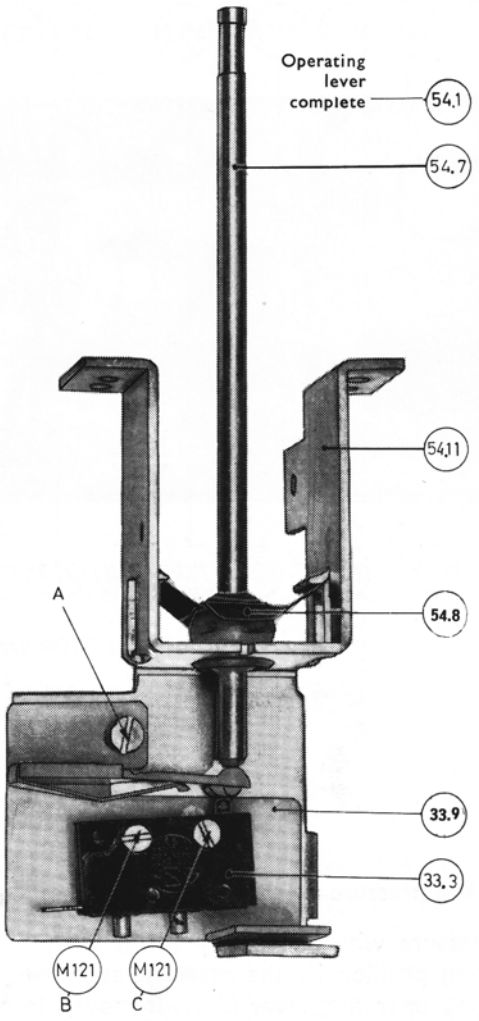


Fig. 5. The operating lever.

4.1.2 The eccentric segment.

The eccentric segment (59.17) is located underneath the upper mounting plate (71.2) and is linked to the operating lever (54.1). Ref. fig. 7.
The eccentric segment (59.17) moves the pressure wheel (51.1) against the capstan (66.2) when the operating lever (54.1) is being set to normal forward drive.
The lifting arm (59.18) is linked to the eccentric segment (59.17) and releases the speed transfer wheel (53.1) from contacting the motor pulley (62.1) in all operating modes, except in normal forward drive position.

Adjustment:

Adjust the return motion of the pressure wheel assembly (51.3) by bending the lug A, ref. fig. 7, to ascertain easy threading of the tape in the slot between the two trim covers (73.1, 73.2). The tape should not stick against the pressure wheel (51.1) during the threading.

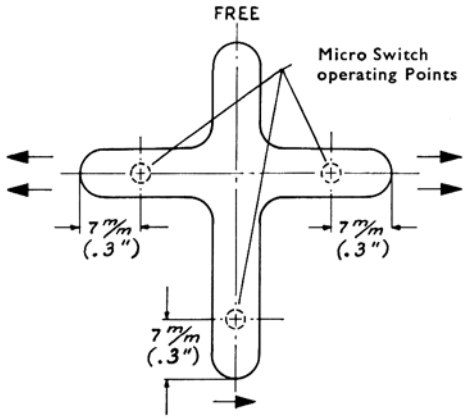


Fig. 6. Adjustment of the operating points for the microswitch.

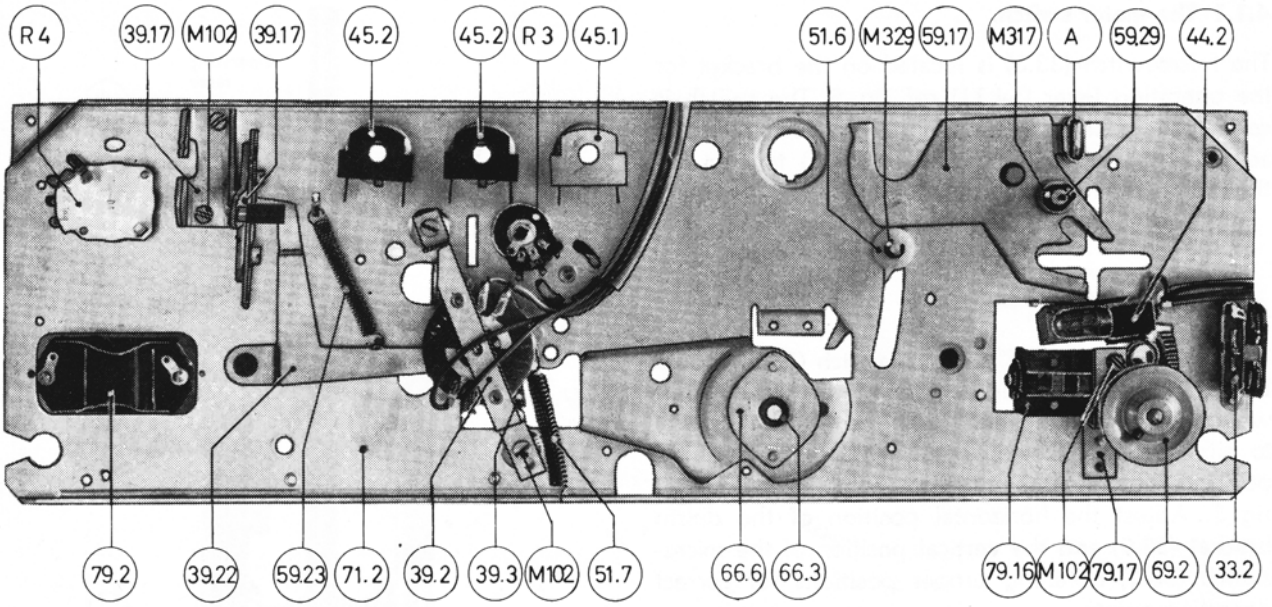


Fig. 7. The upper mounting plate, bottom view.

4.1.3 The pressure wheel assembly.

The pressure wheel assembly (51.3) is guided into operating position by the eccentric segment (59.17) when the operating lever (54.1) is moved to normal forward drive.
The pressure wheel (51.1) is mounted under balanced spring tension with the pressure wheel shaft (51.2) running through two oblong slots in the pressure wheel bracket (51.14). The mounting will allow the pressure wheel (51.1) a horizontal springloaded play of approx. 6 mm (¼") on a line perpendicular to the front of the upper mounting plate (71.2). Ref. fig. 8.

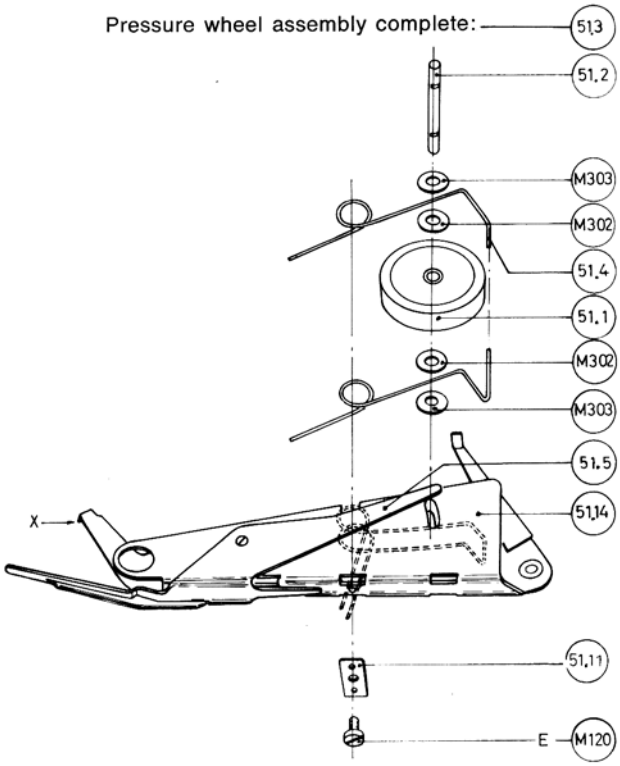


Fig. 8. The pressure wheel assembly, exploded view.

Adjustments:

The balanced spring tension of the pressure wheel (51.1) is adjusted to obtain uniform pressure of the pressure wheel (51.1) against the capstan. Loosen screw E, and turn the spring equalization latch (51.11) clockwise or counter clockwise until the tape runs smoothly by the pressure wheel (51.1) in normal forward drive. Make sure that no airpockets are formed between the tape and the pressure wheel (51.1) and that the tape is completely covered by the rubber surface of the pressure wheel. Ref. fig. 8 and 9.

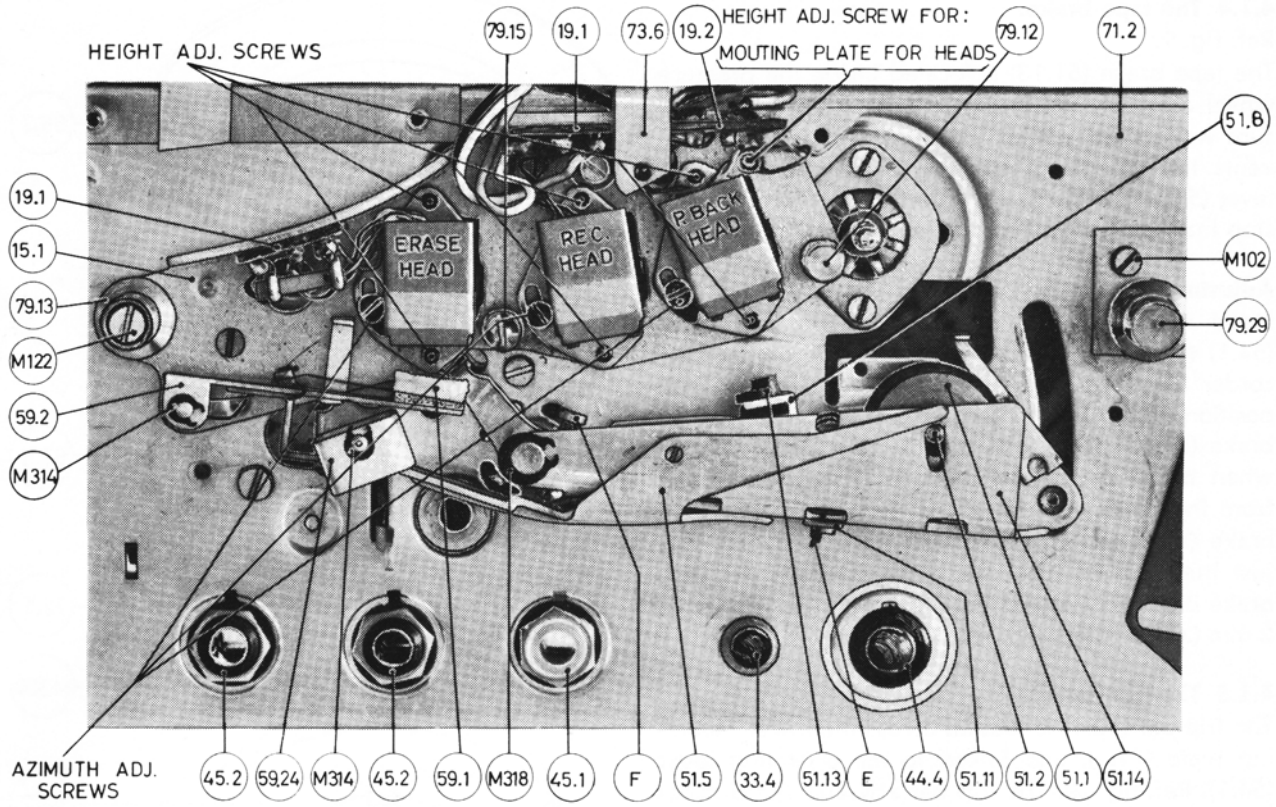


Fig. 9. The heads and the pressure wheel assembly.

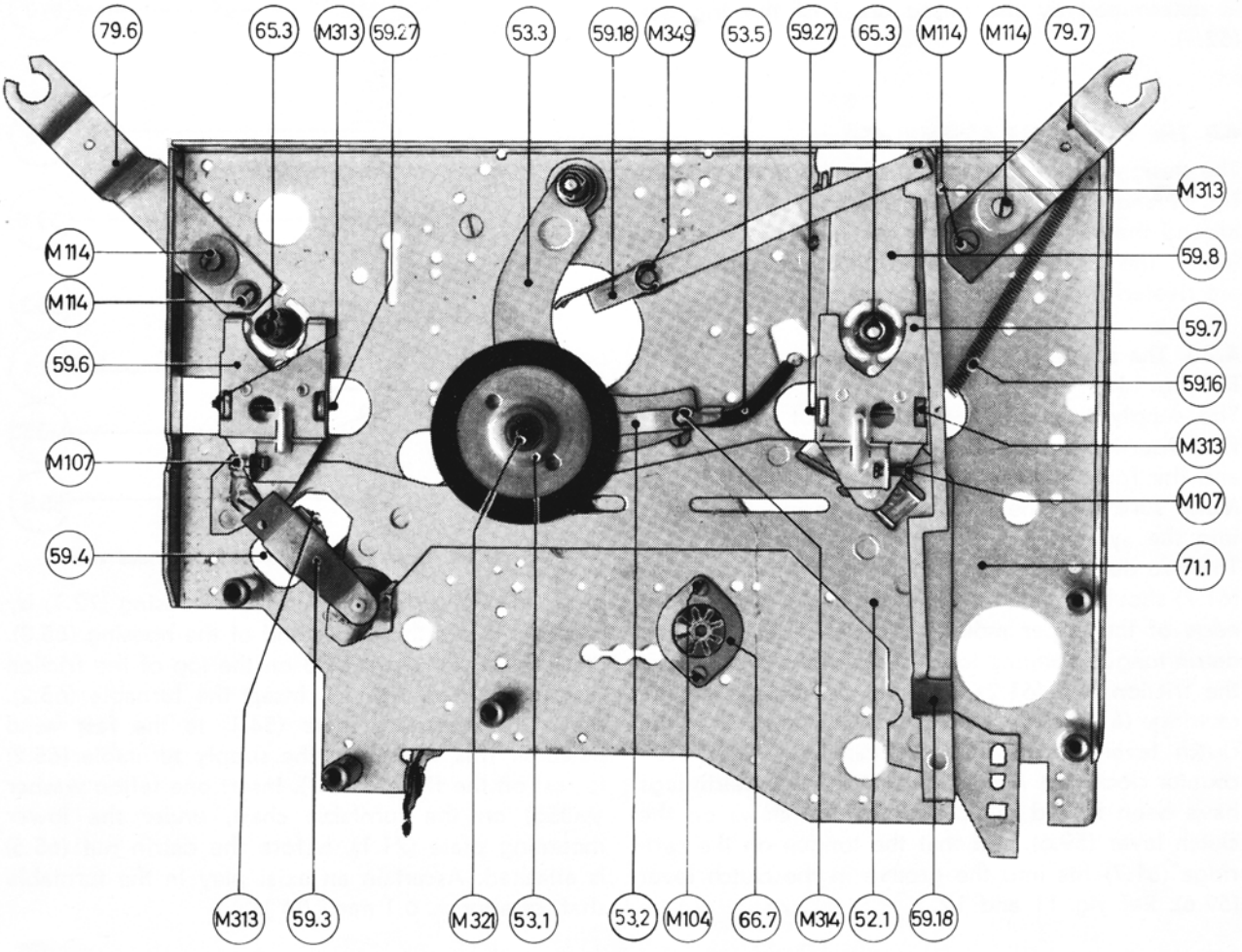


Fig. 10. The lower mounting plate, with the turntables removed.

4.1.4 The tape brake.

Ref. fig. 9.

The tape brake (51.13) is located inside the pressure wheel assembly (51.3) and is activated by the pressure wheel lever (51.5). The tape brake (51.13) prevents the tape from creeping when the operating lever (54.1) is in normal forward drive, with the start-stop magnet in stop position (energized).

Adjustments:

Insert the recording tape, set the operating lever (54.1) to normal forward drive and the Student Recorder Start-Stop Switch at the master panel to stop position. (The start-stop magnet is energized.) The tape brake (51.8) should prevent the tape from creeping when the pressure pad arm (59.2) is pulled away from the erase head. Start the mechanism. The tape brake (51.8) should be completely disengaged. Adjust the screw F until the space between the tape brake block (51.13) and the playback head is approx. 2 mm (.08").

4.1.5 The trip bar.

The trip bar (52.1) is located across the lower mounting plate (71.1), and linked to the operating lever (54.1). Ref. fig. 10. The trip bar activates the clutches underneath both friction discs (61.1, 61.2) by a sliding motion. The vertical position of the two clutches is determined by the raised areas of the trip bar (52.1).

4.2 THE TURNTABLE ASSEMBLIES

The design of the turntable assemblies are shown in fig. 11 and 14. The turntable assemblies are built up around the two housings for the turntable bearings (65.3). The housings for the turntable bearings (65.3) are riveted to the lower mounting plate (71.1).

4.2.1 The supply turntable assembly.

Ref. fig. 11.

The supply turntable assembly is put together by first inserting the helical compression spring (61.5) and the friction disc (61.2) over the housing (65.3). Make sure that the compression spring (61.5) fits into the sylindrical groove in the cartridge (61.7). The two delrin lugs and the tongue on the cartridge (61.7) should lie on a line perpendicular to the front edge of the upper mounting plate (71.2), with the delrin tongue pointing towards the front. Press down the friction disc (61.2) until the delrin lugs on the cartridge (61.7) have passed through the notch in the clutch lever (59.6). Turn the cartridge (61.7) 90° counter clockwise. Make sure that the two delrin lugs have been locked in position by the claws on the clutch lever (59.6), and that the tongue on the cartridge (61.7) fits into the groove in the clutch lever (59.6). Ref. fig. 11 and 12.

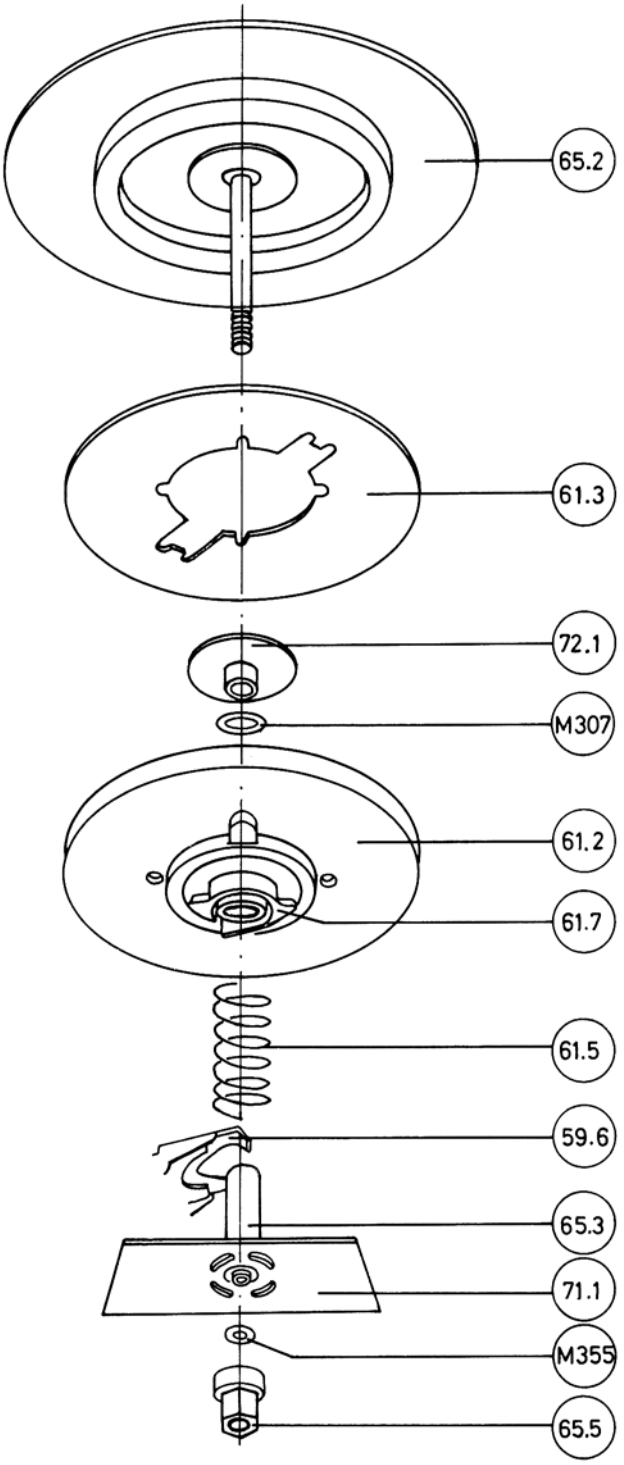


Fig. 11. The supply turntable assembly, exploded view.

Insert the flange for the turntable housing (72.1) by pressing it into the upper end of the housing (65.3). Place the mylar sheet 61.3 on the top of the friction disc (61.2). Ref. fig. 13. Insert the turnable (65.2). Move the operating lever (54.1) to the fast wind position. This will allow the supply turntable (65.2) to rest on the flange (72.1). Insert one teflon washer (M355) on the turntable shaft, under the lower mounting plate (71.1), before the delrin nut (65.5) is attached. Ascertain an axial play in the turntable shaft of approx. 0.1 mm (.04").

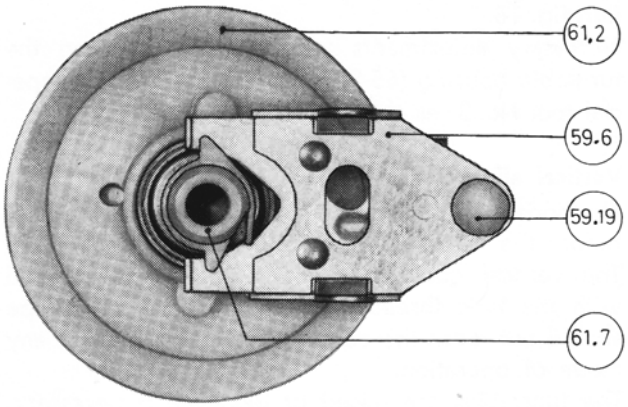


Fig. 12. The supply friction disc, with the clutch lever.

4.2.2 The take-up turntable assembly.

Ref. fig. 14.

The take-up turntable is put together by first inserting the helical compression spring (61.6) and the friction disc (61.1) over the housing (65.3). Make sure the compression spring (61.6) fits into the sylindrical groove in the cartridge (61.7). The two delrin lugs and the tongue on the cartridge (61.7), should lie on a line perpendicular to the fron edge of the upper mounting plate (71.2), with the delrin tongue pointing at the rear edge of the lower mounting plate (71.1). Press down the friction disc (61.1) until the delrin lugs on the cartridge (61.7) have passed through the notch in the upper clutch lever (59.7). Press the lower clutch lever (59.8) all the way down by using a screw driver. The space between the two clutch levers (59.7, 59.8) will now be approx. 6 mm (¼"). Turn the cartridge (61.7) 90° clockwise, and make sure that the two delrin lugs have been locked in position by the claws on the lower clutch lever (59.8). Ref. fig. 14 and 15.

Insert the flange for the turntable housing (72.1) by pressing it into the upper end of the housing (65.3). Place the mylar sheet (61.3) on top of the friction disc (61.1) and insert the turntable (65.1). Move the operating lever (54.1) to the fast rewind position.

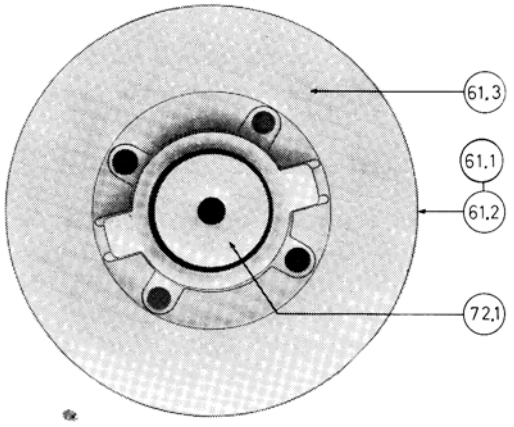


Fig. 13. The supply friction disc, with the mylar sheet.

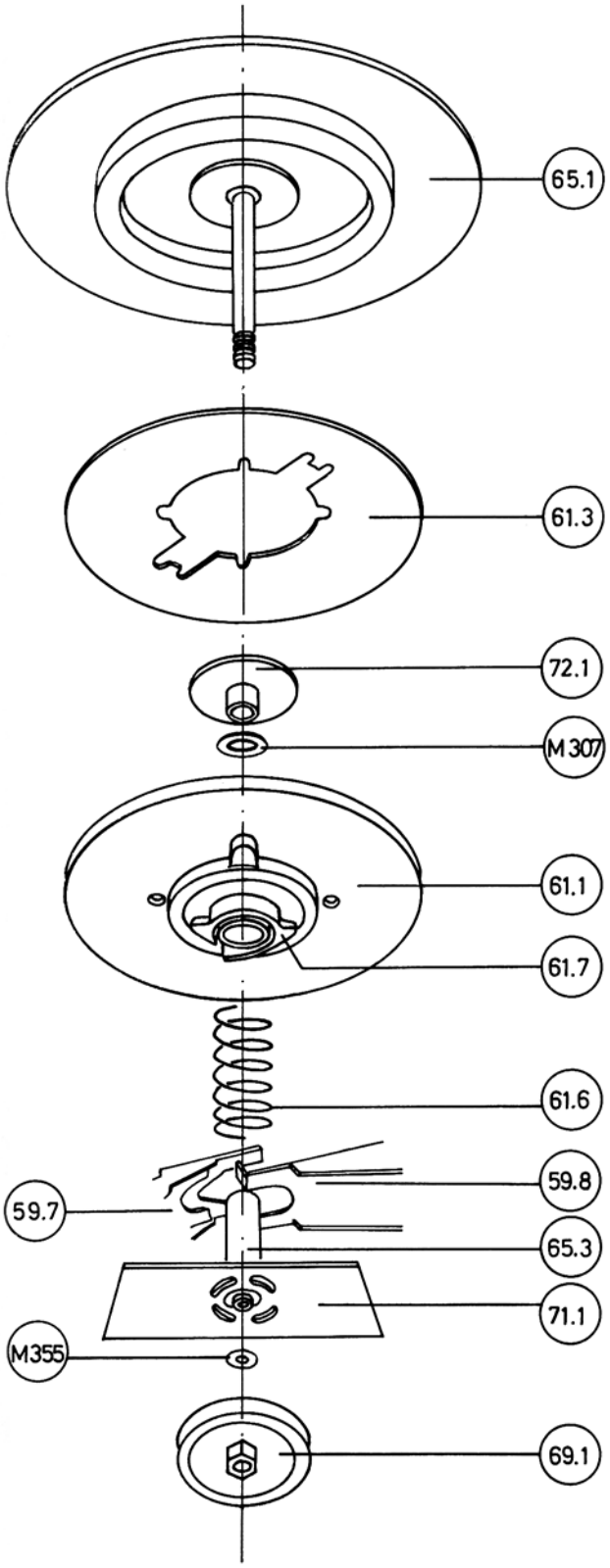


Fig. 14. The take-up turntable assembly, exploded view.

This will allow the take-up turntable (65.1) to rest on the flange (72.1). Insert one teflon washer (M355) on the turntable shaft, under the lower mounting plate (71.1) before the pulley (69.1) is attached. Ascertain an axial play of the turntable shaft of approx. 0.1 mm (.04").

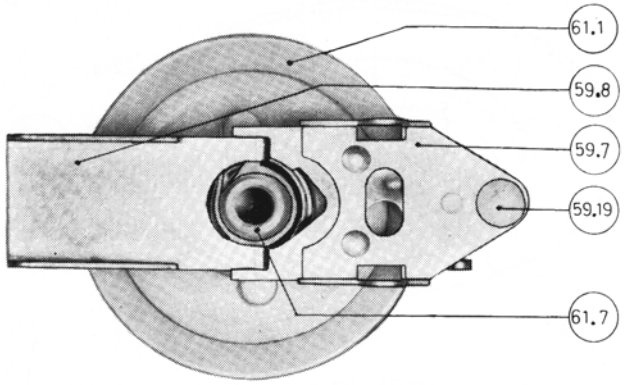


Fig. 15. The take-up friction disc, with the clutch levers.

4.2.3 Horizontal and vertical alignments of the turntables.

Use the special tools 1, 2, and 3 for these alignments. Ref. fig. 54.

Horizontal alignments.

The horizontal position of the two turntables (65.1, 65.2) parrallel to the lower mounting plate (71.1) is checked by placing the special tool No. 1 across both turntables as shown in fig. 16. There should be no spacing between the ruler (tool No. 1) and the turntables.

Necessary adjustments are made by beding the turntable housing in correct position. Use the special tool No. 3, as shown in fig. 17.

The horizontal position of both turntables (65.1, 65.2), parrallel to a line perpendicular to the front edge of the upper mounting plate (71.2) is checked by using the special tool No. 2.

The edge of the special tool No. 2 should run exactly into the tape groove in the guide (79.13, 79.14), when the operating lever (54.1) is in the neutral position.

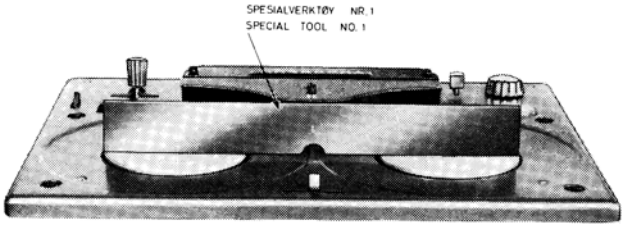


Fig. 16. Control of the horizontal position of the turntables with tool No. 1.

Ref. fig. 18.

Necessary adjustments are made by bending the turntable housing (65.3) in correct position. Use special tool No. 3, as shown in fig. 17.

Vertical alignments.

The horizontal position of the turntables must be set before the vertical alignment is made.

The vertical position of the turntables is checked with the tape threaded on the recorder. The tape should not touch the edge of the plastic reels in any mode of operation.

The tunrtables are raised or lowered, if necessary, by adding or subtracting turbax washers (M306-7) between the flange for the turntables housing (72.1, 72.2) and the turntable housing (65.3). Ref. fig. 11 and 14. A final check of the horizontal position of the turntables should be made.

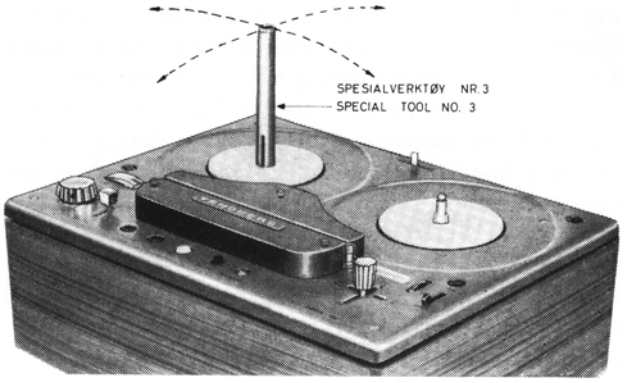


Fig. 17. Alignment of the horizontal position of the turntables with tool No. 3.

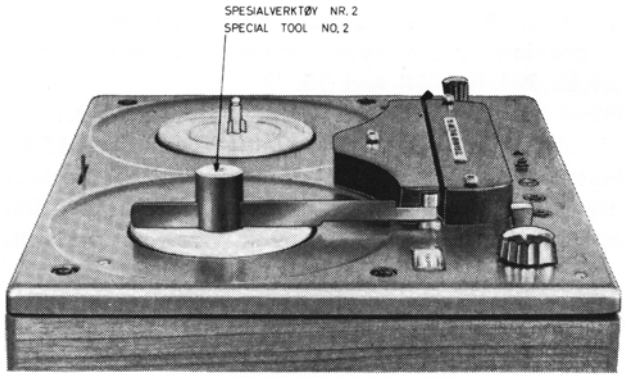


Fig. 18. Control of the horizontal position of the turntables with tool No. 2.

4.3 CLUTCH ALIGNMENTS

4.3.1 General.

The motor will always run and drive both friction discs (61.1, 61.2) when the operating lever (54.1) is set to either normal forward drive, fast wind, or fast rewind position. The two friction discs will run in the opposite directions caused by the treading of the rubber drive belt (62.2). Ref. fig. 4.

The torque of the turntables (65.1, 65.2) is obtained by the friction between the friction discs (61.1, 61.2) and the feltrings glued to the turntables (65.1, 65.2). The friction between the discs and the turntables is determined by the position of the clutches mounted under each friction disc. The clutches are operated by the trip bar (52.1), which is connected to the operating lever (54.1).

4.3.2 Fast rewind.

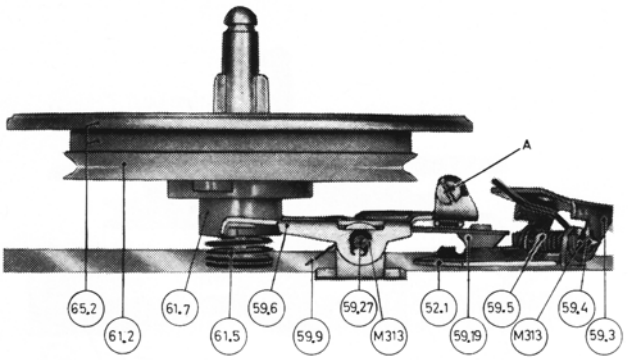


Fig. 19.

The supply turntable.

The supply turntable (65.2) has maximum obtanable friction with the friction disc (61.2) in this position. The friction disc (61.2) is pressed against the turntable (65.2) by the entire tension of the compression spring (61.5).

The trip bar (52.1) has moved, and the delrin button (59.19) on the clutch lever (59.6) is at the lowest position. The two delrin lugs on the cartridge (61.7) and the clutch lever (59.6) are disengaged.

Adjustments.

Adjust the height of the clutch lever (59.6) by the screw (A) until the clearance between the clutch lever (59.6) and the delrin lugs on the cartrigde (61.7) is approx. 0.5-1 mm (.02" — .04").

The torque of the supply turntable (65.2) should be min 75 g (2¾ oz) acting on an arm of 8 cm (3½"). Recheck all other positions of the operating lever and finally seal the adjustment screw A.

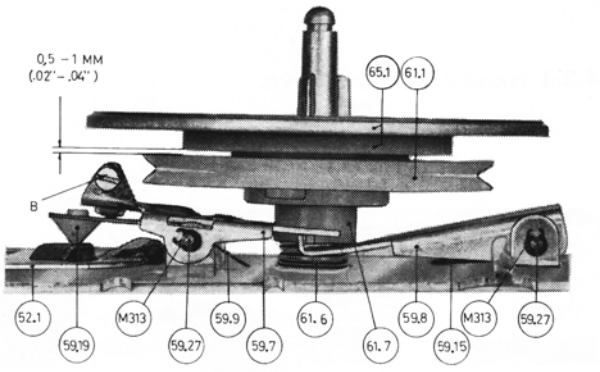


Fig. 20.

The take-up turntable.

The take-up turntable (65.1) is completely disengaged from the friction disc (61.1) and free-running in this position.

The trip bar (52.1) has moved, and the delrin button (59.19) on the upper clutch lever (59.7) is at the highest position, pressing down both the lower clutch lever (59.8) and the two delrin lugs on the cartridge. (61.7).

Adjustments.

Adjust the height of the upper clutch lever (59.7) by the screw (B) until the clearance between the friction disc (61.1) and the feltring on the turntable (65.1) is approx. 0.5-1 mm (.02" — .04"). Recheck all other positions of the operating lever and finally seal the adjustment screw B.

4.3.3 Fast wind.

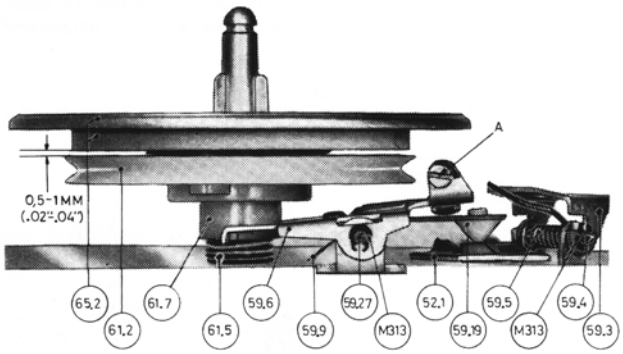


Fig. 21.

The supply turntable.

The supply turntable (65.2) is completely disengaged from the friction disc (61.2) and free-running in this position.

The trip bar (52.1) has moved, and the delrin button (59.19) on the clutch lever (59.6) is at the highest position, pressing down the two delrin lugs on the cartridge (61.7).

Adjustments.

Adjust the height of the clutch lever (59.6) by the screw (A) until the clearance between the friction disc (61.2) and the feltring on the turntable (65.2) is approx. 0.5 — 1 mm (.02" — .04"). Recheck all other positions of the operating lever and finally seal the adjustment screw A.

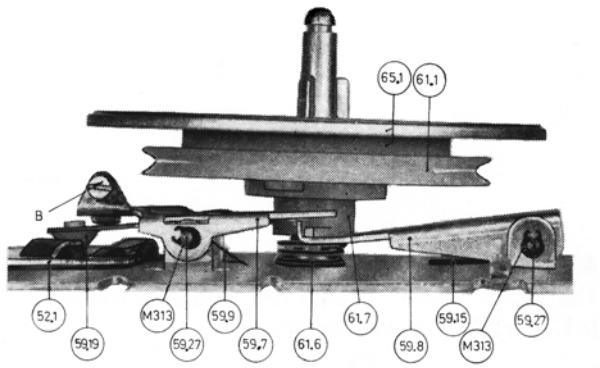


Fig. 22.

The take-up turntable.

The take-up turntable (65.1) has maximum obtainable friction with the friction disc (61.1) in this position. The springloaded lower clutch lever (59.8) is pressing the delrin lugs on the cartridge (61.7) upwards in addition to the entire tension of the compression spring (61.6).

The trip bar (52.1) has moved, and the delrin button (59.19) on the upper clutch lever (59.7) is at the lowest position, disengaging the lever (59.8) and the two delrin lugs on the cartridge (61.7).

Adjustments.

Adjust the height of the upper clutch lever (59.7) by the screw (B) until the clearance between the upper and the lower clutch levers (59.7, 59.8) is approx. 0.5 mm (.02").

The torque of the take-up turntable (65.1) should be min. 65 g (2¼ oz) acting on an arm of 8 cm (3½"). Recheck all other positions of the operating lever and finally seal the adjustment screw B.

4.3.4 Normal forward drive.

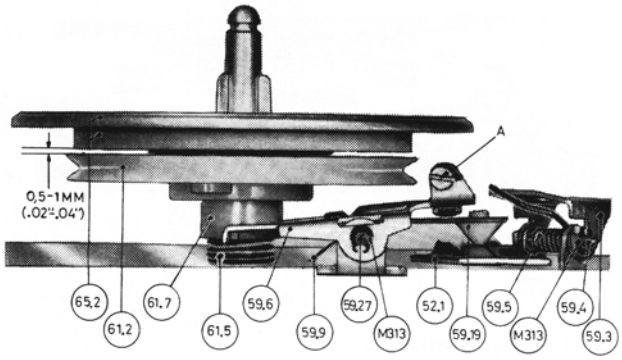


Fig. 23.

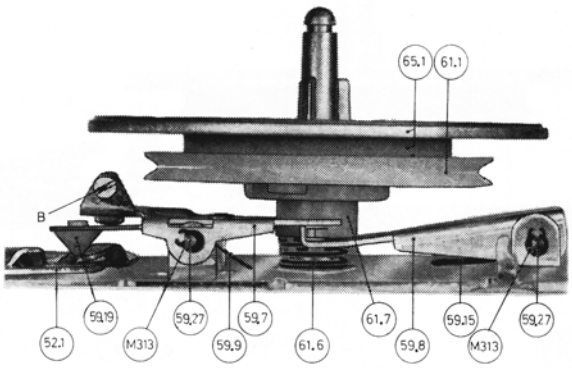


Fig. 24.

The supply turntable.
The supply turntable (65.2) is completely disengaged from the friction disc (61.2) and free-running in this position.
The trip bar (52.1) has moved, and the delrin button (59.19) on the clutch lever (59.6) is at the highest position, pressing down the two delrin lugs on the cartridge (61.7).

Adjustments.
Adjust the height of the clutch lever (59.6) by the screw (A) until the clearance between the friction disc (61.2) and the feltring on the turntable (65.2) is approx. 0.5 — 1 mm (.02" — .04"). Recheck all other positions of the operating lever and finally seal the adjustment screw A.

The take-up turntable.
The take-up truntable (65.1) has a reduced friction with the friction disc (61.1) in this position. The torque of the take-up truntabel (65.1) should be sufficient to take-up the tape in record or playback modes. The trip bar (52.1) har moved, and the delrin button (59.19) on the upper clutch lever (59.7) is in the middle position, pressing down the spring loaded lower clutch lever (59.8). The delrin lugs on the cartridge (61.7) are released from any tension, and the friction disc (61.1) is pressing against the turntable (65.1) only by the tension of the compression spring (61.6).

Adjustments.
Adjust the height of the upper clutch lever (59.7) by the screw (B) until the delrin lugs on the cartridge (61.7) are in the center position between upper and lower clutch levers (59.7, 59.8). The torque of the take-up turntable (65.1) should be 12—25 g (½ — 1 oz) acting on an arm of 8 cm (3½"). Recheck all other positions of the operating lever and finally seal the adjustment screw B.

4.3.5 Neutral.
The motor power is shut off, and the friction discs (61.1, 61.2) are not running.

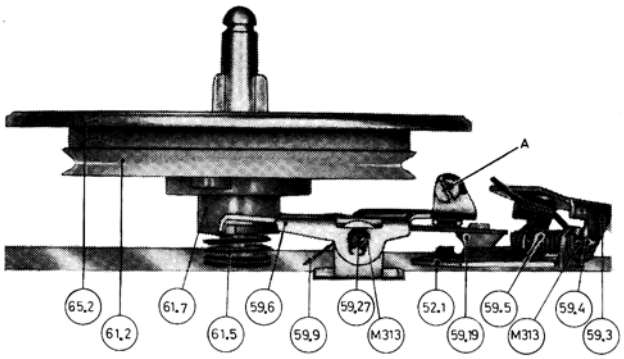


Fig. 25.

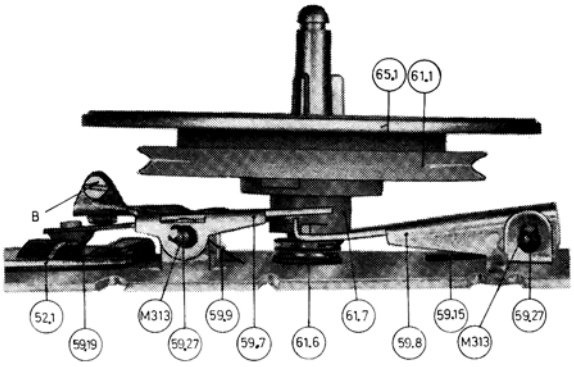


Fig. 26.

The supply turntable.
The supply turntabel (65.2) has maximum obtainable friction with the friction disc (61.1) in this position. Ref. chapter 4.3.2, fast rewind.

The take-up turntable.
The take-up turntable (65.1) has maximum obtainable friction with the friction disc (61.1) in this position. Ref. chapter 4.3.3, fast wind.

4.3.6 Free.
The motor power is shut off and the friction discs (61.1, 61.2) are not running.

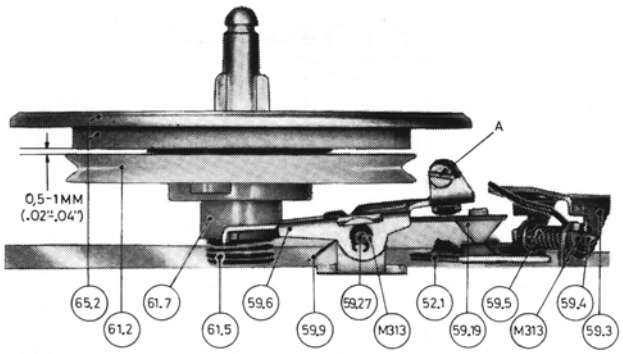


Fig. 27.

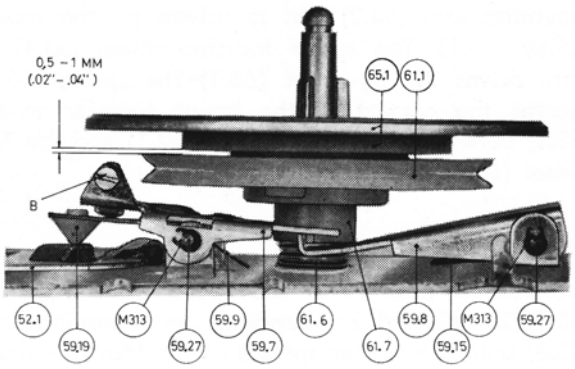


Fig. 28.

The supply turntable.
The supply turntable (65.2) is completely disengaged from the friction disc (61.2) and free-running in this position. Ref. chapter 4.3.3, fast wind.

The take-up turntable.
The take-up turntable (65.1) is completely disengaged from the friction disc (61.1) and free-running in this position. Ref. chapter 4.3.2, fast rewind.

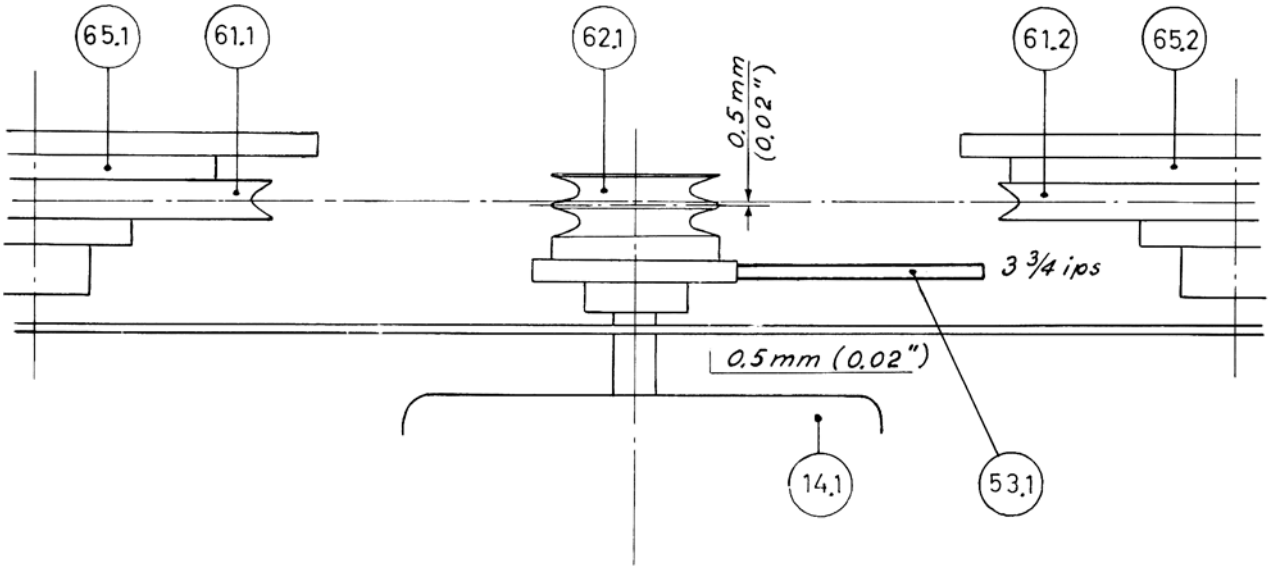


Fig. 29. Alignment of the motor pulley.

4.4 THE MOTOR PULLEY
The drive mechanism with the speed transfer wheel (53.1) is shown in fig. 29.

Adjustments.
The vertical position of the motor pulley (62.1) is adjusted with the operating lever (54.1) in neutral position. The dividing rib of the motor pulley (62.1) should be set 0.5 mm (.02") below an imaginary line drawn between the bottoms of the V-shaped grooves in the friction discs (61.1, 61.2).

4.4.1 Threading of the rubber drive belt.
The rubber drive belt (62.2) is chossthreaded as shown in fig. 4. The belt is running in the upper groove in front of the pulley (62.1), and in the lower groove at the rear of the pulley. The crossing should lie between the supply turntable (65.2) and the motor pulley 62.1).

4.5 THE SPEED TRANSFER WHEEL

The speed transfer wheel (53.1) is attached to the mounting arm (53.3) and is driven by the motor pulley (62.1). The speed transfer wheel (53.1) in turn, drives the fly-wheel (66.1) The spring (53.5) secures the contact of the speed transfer wheel (53.1) between the motor pulley (62.1) and the fly-wheel (66.1). Ref. fig. 4 and 32.

Adjustments.

The vertical position of the speed transfer wheel (53.1) is adjusted by bending the mounting arm (53.3) until the rubber surface of the transfer wheel (53.1) runs in center of the pulley track.
The horizontal alignment of the speed transfer wheel (53.1) is adjusted by bending the transfer wheel holder (53.2) (tool No. 6, fig. 54) until the speed transfer wheel runs parallel to the flywheel (66.1).

4.6 THE LIFTING ARM

The lifting arm (59.18) is located between the upper and the lower mounting plates (71.2, 71.1) and linked to the eccentric segment (59.17), ref. fig. 10. The lifting arm (59.18) releases the speed transfer wheel (53.1) from contact with the motor pulley (62.1) in all positions of the operating lever (54.1) except in normal forward drive.

Adjustments:

The lifting is adjusted by bending the lug Z on the lifting arm (59.18). Ref. fig. 32.
The lifting shall take place by a relatively small movement of the operating lever (54.1) from normal forward drive to neutral position. The lifting should be completed before the motor current is shut off by the microswitch 33.3).

4.7 THE FLYWHEEL WITH THE CAPSTAN

The flywheel shaft acts as the capstan (66.2), and is mounted in two selflubricating and selfadjusting bearings (66.3). Ref. fig. 30.

Adjustments.

The vertical position of the capstan (66.2) is aligned with the special tool No. 5 inserted on top of the capstan as shown in fig. 31.
The two screws (M 125) are loosened, and correct position of the capstan (66.2) is obtained when all three legs of the tool No. 5 touches the upper mounting plate (71.2).

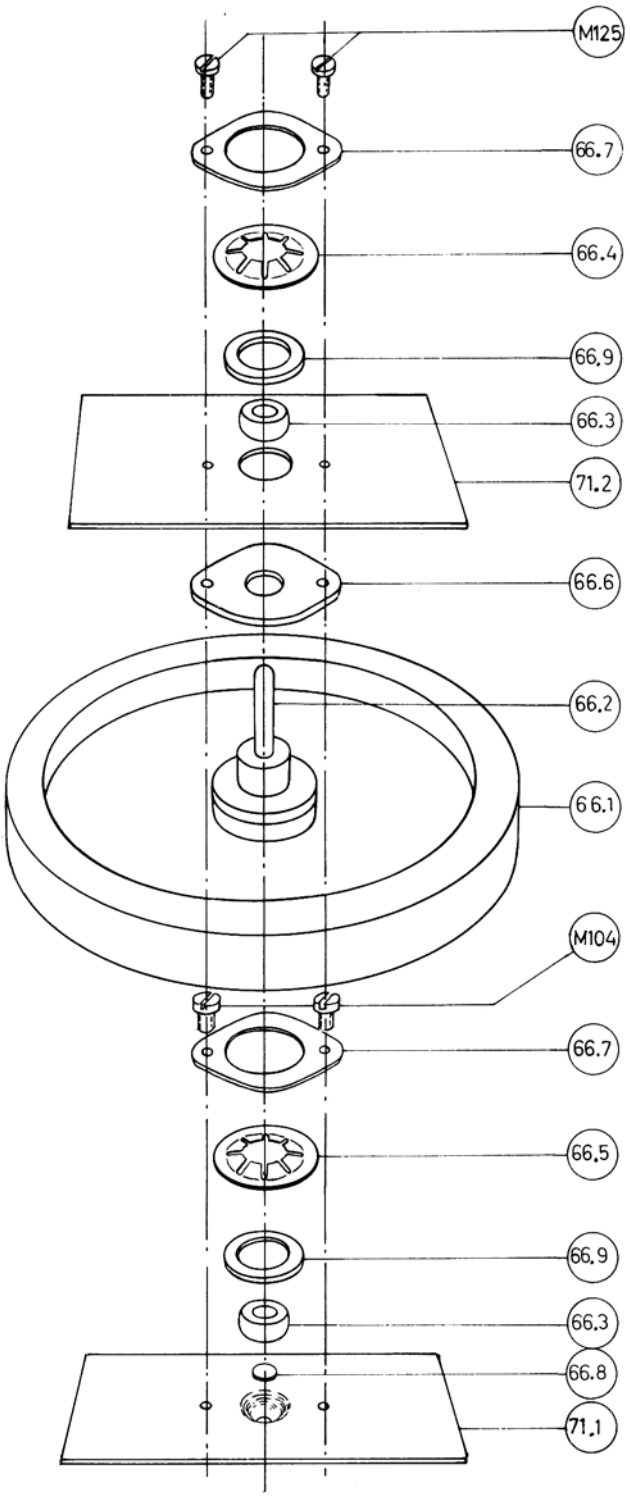


Fig. 30. The flywheel with the bearings, exploded view.

4.8 THE REMOTE START-STOP MECHANISM

The remote start-stop mechanism is designed as shown in fig. 33.
The start-stop magnet (33.5) has a push-type armature which activates the start-stop lever (59.22) at point A, when the start-stop switch at the master desk is set to stop position. The start-stop lever, will in turn, press against the pressure lever (51.5) in

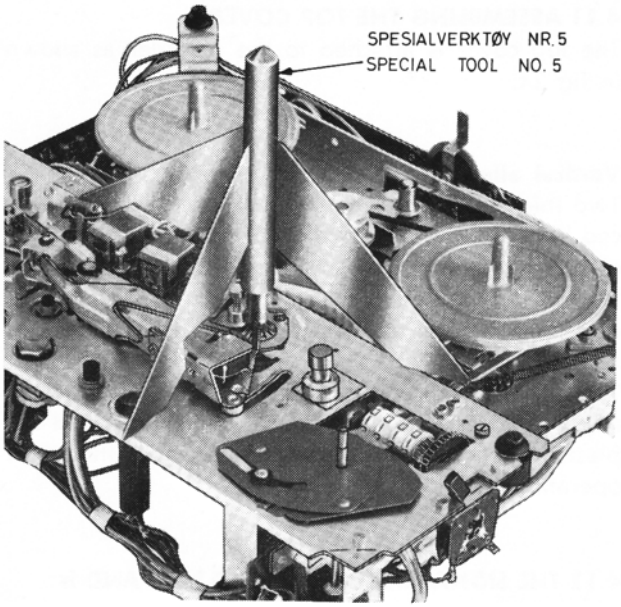


Fig. 31. Alignment of the capstan with tool No. 5.

point B. The pressure wheel lever moves the pressure wheel shaft (51.2) with the pressure wheel (51.1) away from the capstan (66.2) and activates the tape brake block (51.13) which prevents the tape from creeping.

Adjustments:

The start-stop magnet (33.5) is energized, and the armature fully attracted, when the operating lever (54.1) is in normal forward drive and the start-stop switch (at the master desk) in stop position. Adjust the pressure wheel lever (51.5) by bending the flat part B to obtain a spacing of approx. 0.5 mm (.02") between the pressure wheel (51.1) and the capstan (66.2).

Start the mecanism by switching the start-stop switch (at the master desk) to start position. The start-stop magnet (33.5) is now disconnected. Adjust the pressure wheel lever (51.5) by bending the tonque C to obtain a spacing of approx. 1 mm (.04") between the pressure wheel shaft (51.2) and the pressure wheel lever (51.5) at point D.

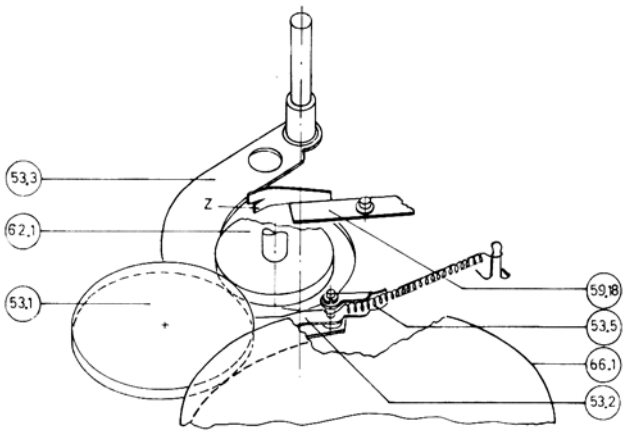


Fig. 32. The speed transfer wheel engaged with the motor pulley and the flywheel.

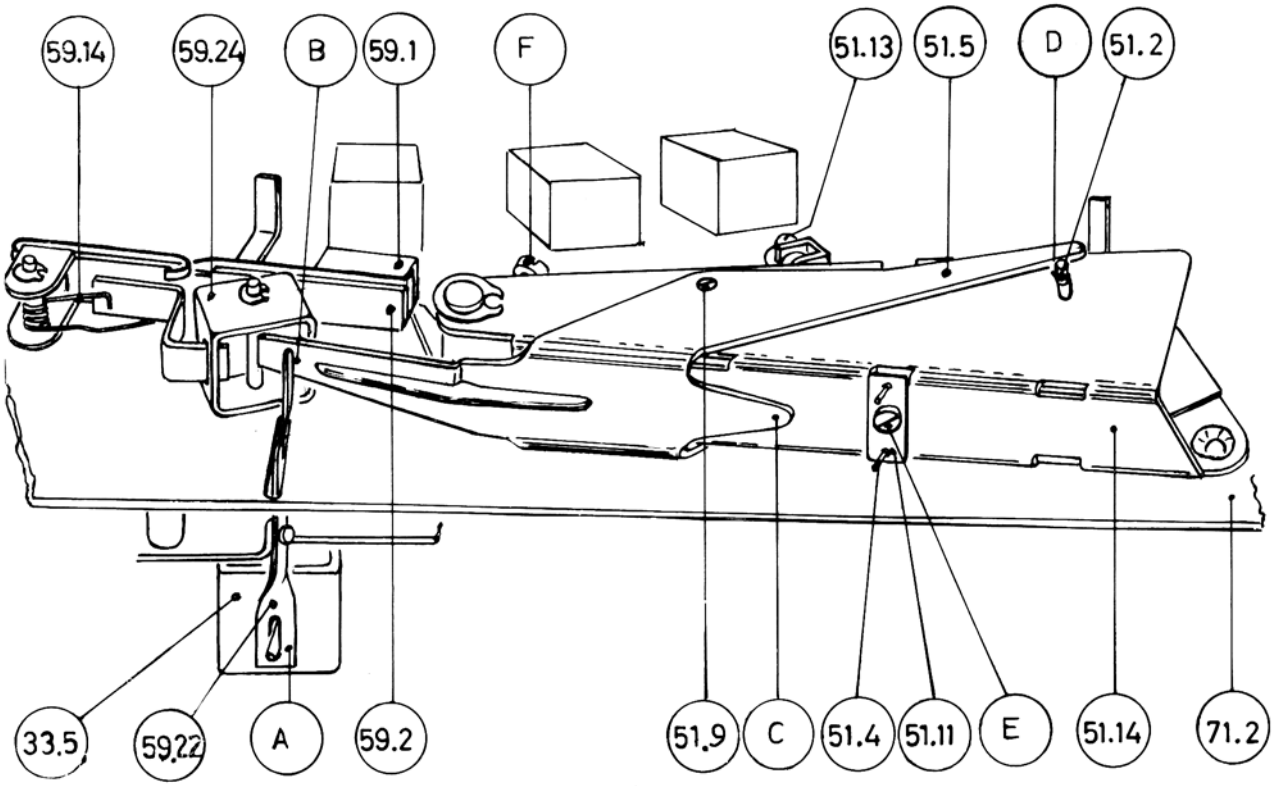


Fig. 33. The remote start/stop mechanism.

4.9 THE PRESSURE PAD

The pressure pad (59.1) is located in front of the erase head and is introduced to secure maximum erasure, and to ensure constant friction for the tape, when the recorder is operating in normal forward drive. Ref. fig. 9 and 33. The pressure pad arm (59.2) is activated by the pressure wheel lever (51.5) and the transfer bracket (59.24). The pressure pad (59.1) is pressing against the tape and the erase head in normal forward drive, and is completely disengaged in all other positions of the operating lever (54.1).

Adjustments:

The pressure pad (59.1) should be cleaned occasionally, as accumulation of dust and iron oxide particles might seriously affect the erasure and the tape movement.

Note: Do not soak the felt pad with any liquid.

The pressure pad (59.1) is designed as a snap-on type, and can easily be pulled out by bending the two tags on the hard brass spring away from the slots in the pressure pad arm (59.2).

The tension of the pressure pad (59.1) against the erase head, in normal forward drive position, should be 75—100 g ($2^5/_8$ — $3^1/_2$ oz). This tension is corrected by adjusting the tension of the spring (59.14) for the pressure pad.

4.10 THE REVOLUTION COUNTER

The revolution counter (79.16) is located between the upper and the lower mounting plates (71.2, 71.1), behind the operating lever (54.1). The counter (79.16) is driven by a rubber belt (69.3) and a pulley disc (69.1) attached to the shaft of the take-up turntable (65.1). Ref. fig. 7.

4.11 ASSEMBLING THE TOP COVER

The top cover is attached to the recorder as shown in fig 34.

Vertical alignment of the top cover.

Two thick rubber washers (74.5) have been introduced between the top cover and the mounting brackets. By tightening the two rear screws (M 130) slightly, the rubber will be compressed and allow the necessary vertical adjustment of the top cover. Ref. fig. 34.

The vertical position of the top cover should be adjusted to ascertain sufficient spacing between the plastic tape reels and the top cover in all modes of operation.

4.12 THE SIGNAL MICROSWITCHES V3 a AND b

Ref. fig. 55.

The microswitches V3 a and b are located on an adjustable bracket which is mounted on the start-stop magnet (33.5).

Adjustments:

The start-stop magnet (33.5) is energized and the armature fully attracted, when the operating lever (54.1) is in normal forward drive and the start-stop switch (at the master console) is in stop position.

Loosen the two screws for the bracket, and move the bracket in horizontal position away from the magnet until a clearance is obtained between the brass spring and the microswitches.

Move the bracket slowly in the opposite direction (towards the magnet) until the red and yellow lamps on the student strip are shut off. Fasten the bracket screws. Check the operation of the microswitches by starting and stopping the tape recorder using the student start-stop switch.

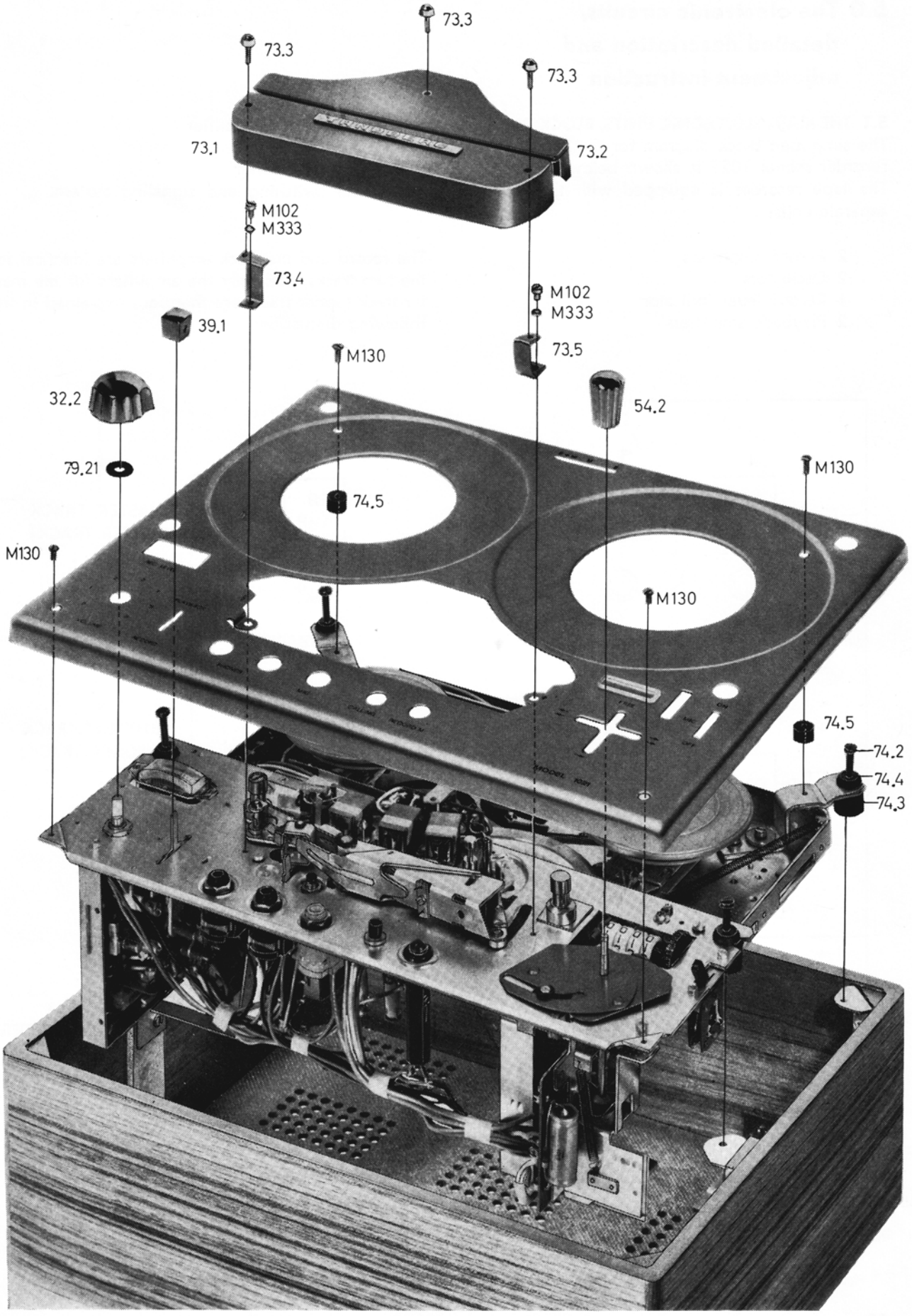

73.3
73.3
73.3
73.1
73.2
M102
M333
73.4
M102
M333
39.1
73.5
M130
32.2
54.2
79.21
74.5
M130
M130
M130
74.5
74.2
74.4
74.3

Fig. 34.

5.0 The electronic circuits, detailed description and adjustment instruction

5.1 THE MAIN ELECTRONIC UNITS, BLOCK DIAGRAM

The simplified block diagram for the Tandberg tape recorder model 1021 is shown below. Ref. fig. 35. The tape recorder is equipped with the following separate units:

2 Record amplifiers
2 Oscillators
1 Record level indicator
2 Playback amplifiers
1 Microphone amplifier
1 Mixer
1 Phone amplifier
The switching and signaling system.

The record and playback amplifiers are identical for the two tracks, and only the amplifiers for the master track (upper track) are therefore explained in the following discussions.

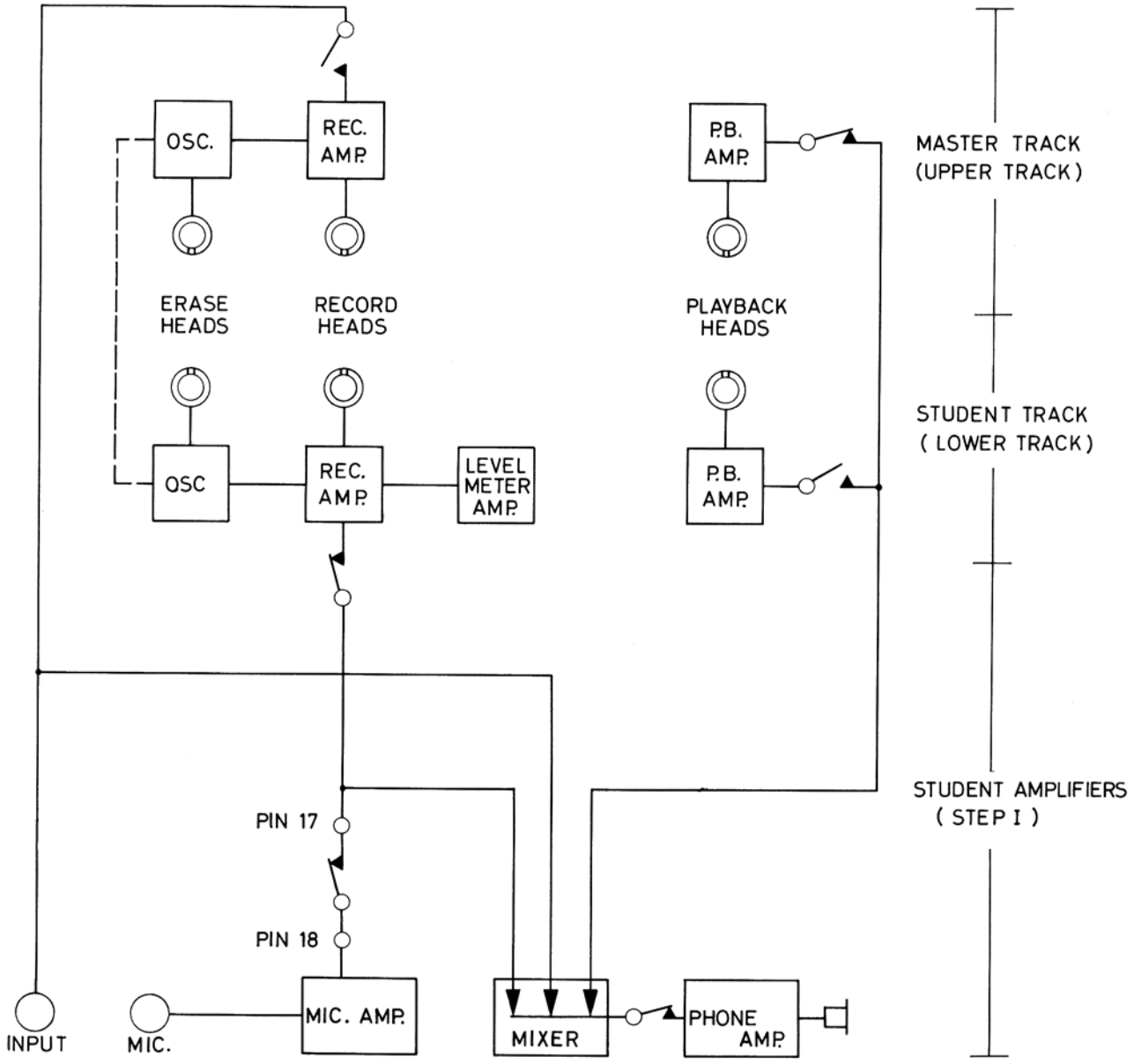


Fig. 35. Block diagram, Model 1021, in position playback from master track — record on student track (listen — respond — record).

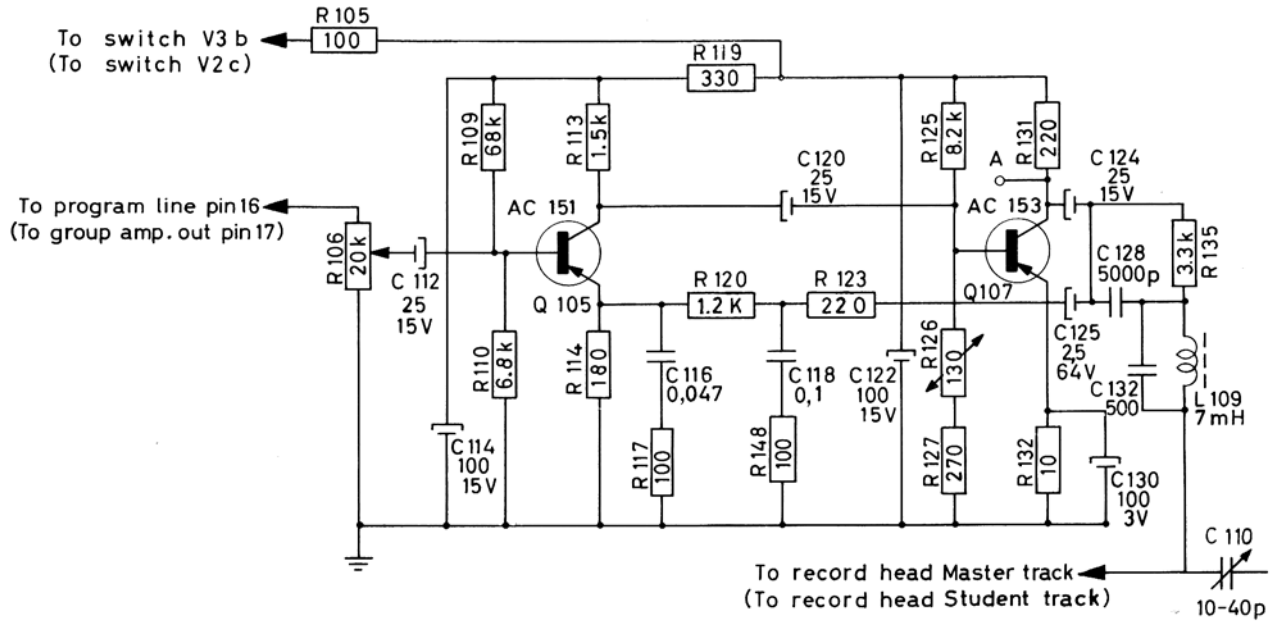


Fig. 36. The record amplifier, schematic.

5.1.1 The record amplifier.

The schematic for the record amplifier is shown in fig. 36.
The record amplifier is a two stage amplifier using the transistors AC 151 and AC 153. The signal is fed to the top of the potentiometer R 106.
The record equalization is obtained by the negative feed-back circuit (R 123 — C 118 — R 120 — C 116) from the collector of Q 107 to the emitter of Q 105.
Mainly the high frequencies are compensated in the record amplifier. Ref. fig. 37.
The record current is fed to the record head in series with the parallel circuit C 128 and R 135 which will slightly increase the high frequency record current.
The resonant circuit L 109 and C 132 is tuned to the oscillator frequency and rejects the bias from the output of the record amplifier.
The bias voltage is fed to the record head across the capacitor C 110. (Ref. fig. 55.)

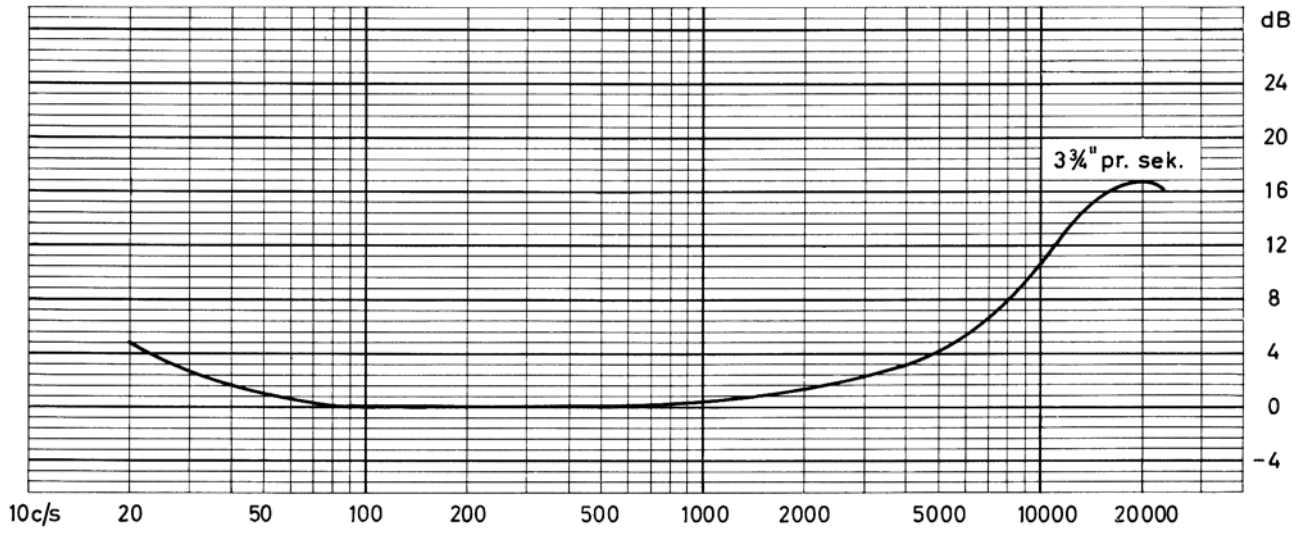


Fig. 37. The response curve for the record amplifier.

5.1.2 The oscillators.

The schematic for the oscillators is shown in fig. 38. There are two oscillators, one for each track.

Monaural operation, student's track only:

The oscillator for lower track is controlled by the record/playback lever: The oscillator starts when the programme selector is set to either of the positions: SM — GR 1 or GR 2 and with the operating lever to normal forward drive and the remote start-stop to start position.

The diodes D 101 and 102 are reverse biased.
The oscillator for upper track (master oscillator) can not be started from the student's tape recorder.

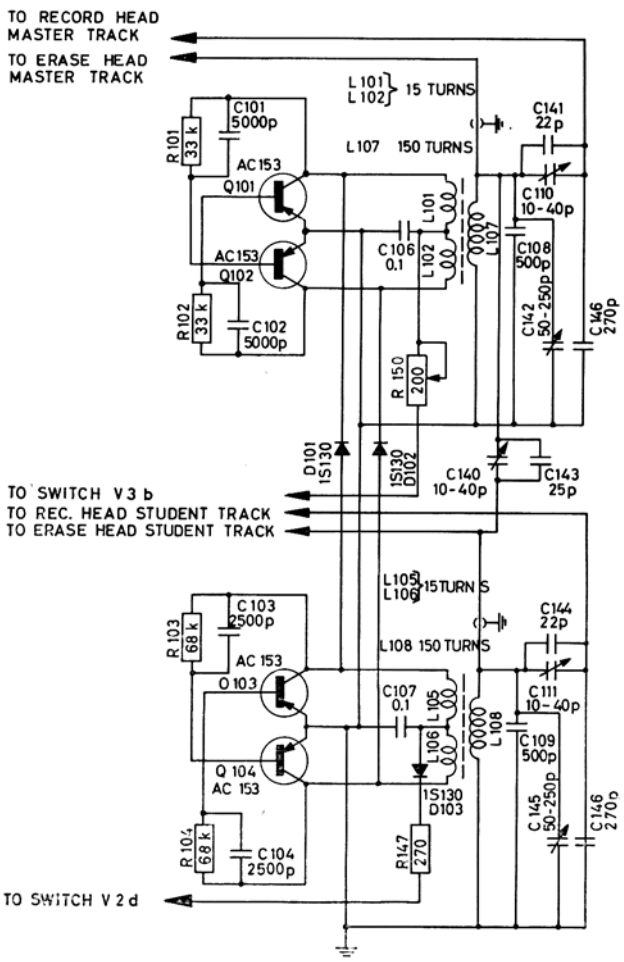


Fig. 38. The oscillator, schematic.

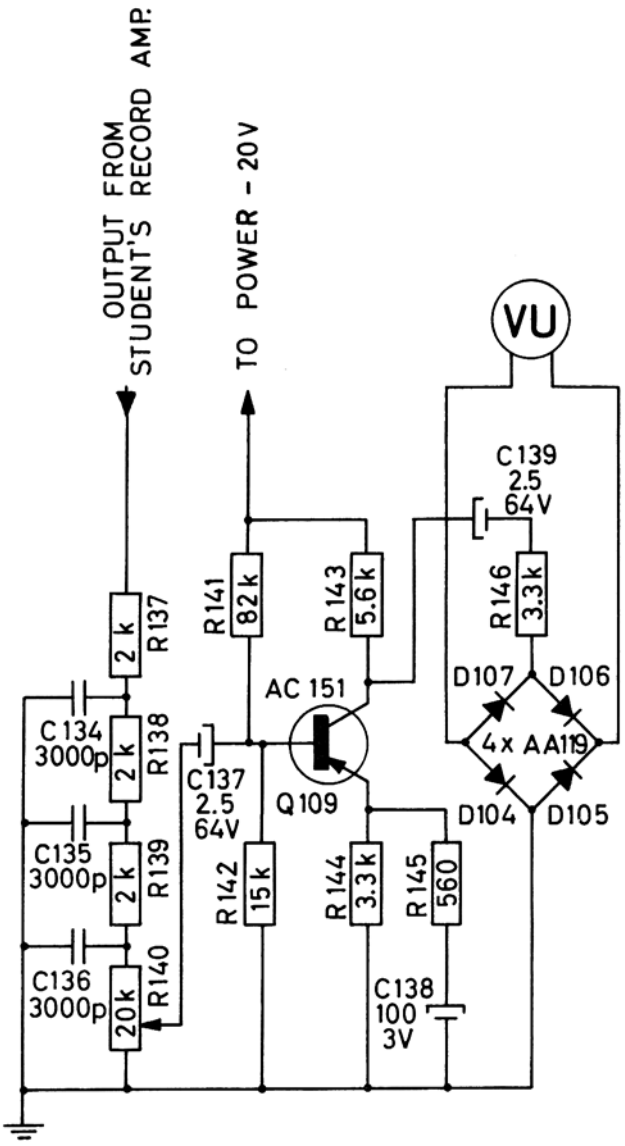


Fig. 39. The level meter amplifier, schematic.

Stereo operating, synchronus run of both oscillators:

The oscillator for the student track (lower track) is controlled by the oscillator for the master track (upper track). The DC and AC voltages are fed from the master oscillator through the diodes D 101 and D 102 to the oscillator for the student's track.
Both oscillators will run synchronus when the programme selector is set to either of the positions 1—6 and the operating lever to normal forward drive. (The remote start-stop switch is set to start position.)
The resistor R 150 is adjusted until the bias on the lower track (student track) is equal in stereo and mono operation. The bias is measured across a 100 ohm resistor in series with the lower head-half to ground.
The oscillator frequency is tuned to 85k c/s by C 142 and C 145. Ref. para. 6.4 and 6.5.

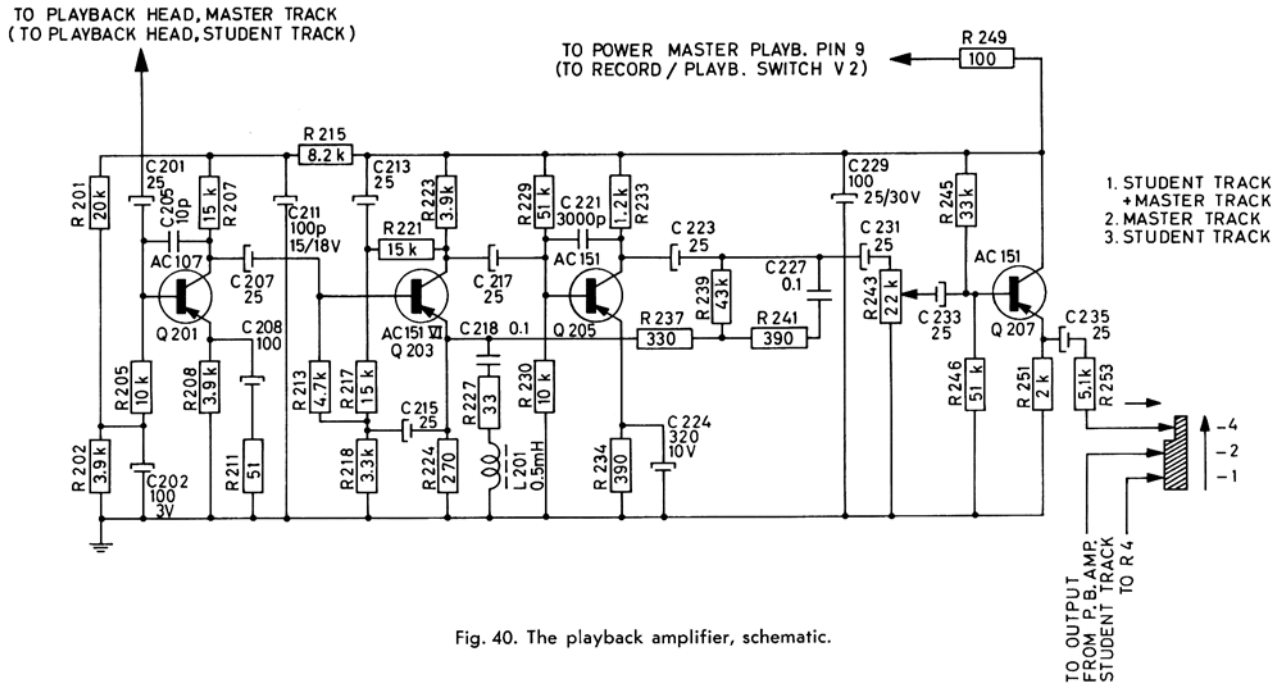


Fig. 40. The playback amplifier, schematic.

5.1.3 The level meter amplifier.

The schematic for the level meter amplifier is shown in fig. 39.

The level meter amplifier is a one stage amplifier using the transistor AC 151 or AC 162.

The resistors R 137 — R 138 — R 139 and the capacitors C 134 — C 135 — C 136 form a bias filter.

The output signal from the amplifier is rectified by the bridge rectifier D 104 — D 105 — D 106 and D 107 and fed to the VU meter.

5.1.4 The playback amplifier

The schematic for the playback amplifier is shown in fig. 40.

The playback amplifier is a four stage amplifier using one transistor AC 107 and three transistors AC 151. The playback equalization is obtained by the negative feedback circuit from the collector of Q 205 to the emitter of Q 203.. The amplification of the low frequencies is increased to conform with the N.A.B. standards. Ref. fig. 41. The inductance L 201 will give an increase of the high frequency amplification. The capacitors C 205 and C 221 form feedback circuits for the oscillator voltage.

The output stage is connected as emitter follower with an output impedance of 5 kohms. The output voltage is opprox. 350 m V.

R 243 is the output level adjustment potentiometer. Ref. para 6.2 for adjustment of the playback amplifier.

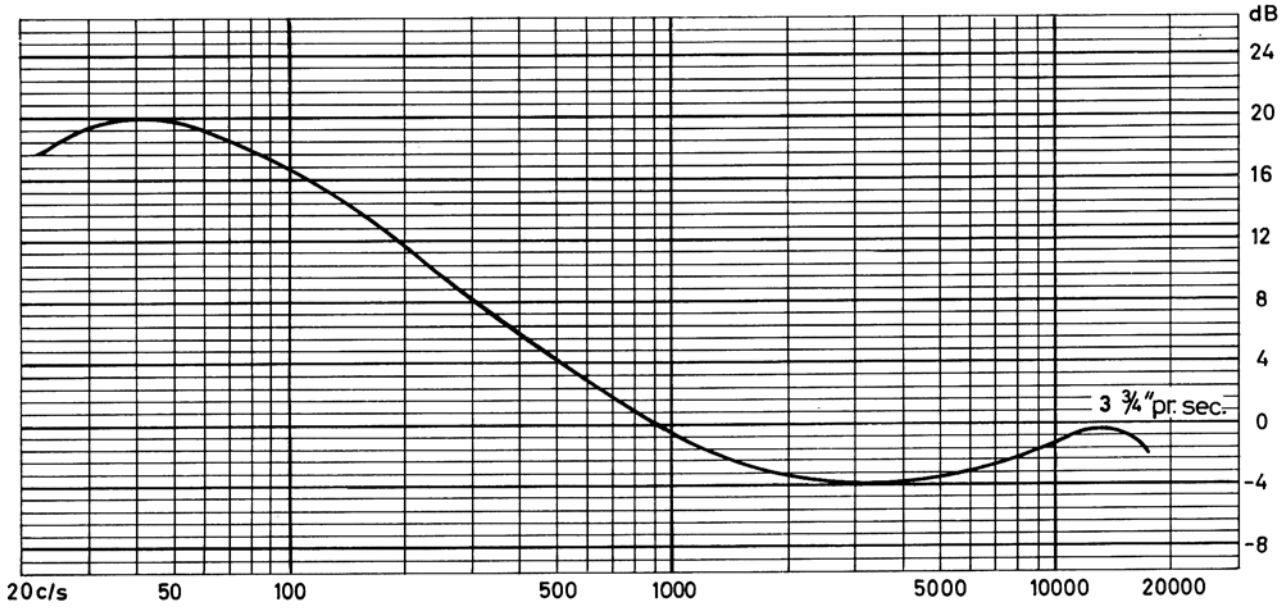


Fig. 41. The response curve for the playback amplifier.

5.1.5 The microphone amplifier

The schematic for the microphone amplifier is shown in fig. 42.
The microphone amplifier is a four stage amplifier using the transistors AC 151. The input impedance of the amplifier is approx. 200 ohms and is obtained by the feedback circuit R 304 C 302 from the collector to the base of Q 301.
The resistor R 314 forms a stabilizing feedback circuit. The resistors R 307 — R 315 and R 320 are stabilizing the amplification of each stage.
The microphone switch V5 shortcircuits the microphone to ground in «OFF» position.
The potentiometer R 3 is mounted under the front trim cover and controls the microphone amplifier gain.
The output stage Q 304 is connected as an emitter follower with low output impedance. The output signal is fed to pin 18 on the student strip.
The frequency response of the microphone amplifier is straight over the entire audio range.
The pins 18 and 17 are shortcircuited by the switch V 201—I.

5.1.6 The mixer.

The schematic for the mixer is shown in fig. 43.
The mixer circuit is composed of three equal emitter followers with high input impedance and low output impedance. The frequency response for each emitter follower is straight within the entire audio range.

Emitter follower I:

The input of the emitter follower I is connected to the output from the microphone amplifier, pin 17. (The pins 17 and 18 are shortcircuited by the switch V 201—I in all positions of the programme selector except GR 1 and GR 2).
The output from the emitter follower I is connected to the input of the phone amplifier (control mix, pin 7).

Emitter follower II:

The input of the emitter follower II is connected to the programme line (pin 16). The output from the emitter follower II is connected to the input of the phone amp (control-mix, pin 7).

Emitter follower III:

The input of the emitter follower III is connected to the output from the masters microphone amplifier when the student key is in position intercomm.
The output from the emitter follower III is connected to the base of transistor Q 309.

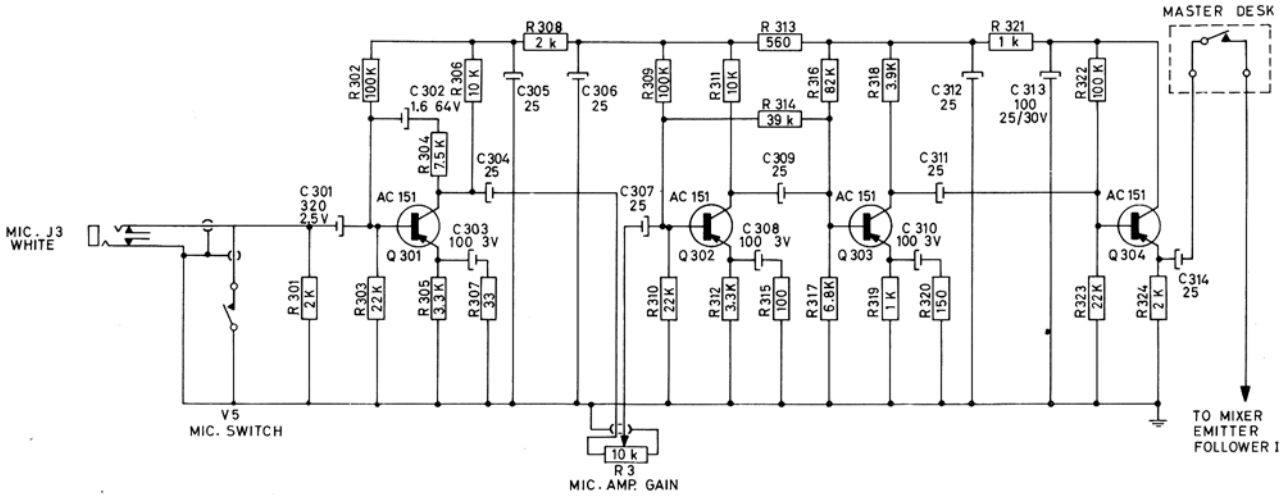


Fig. 42. The microphone amplifier, schematic.

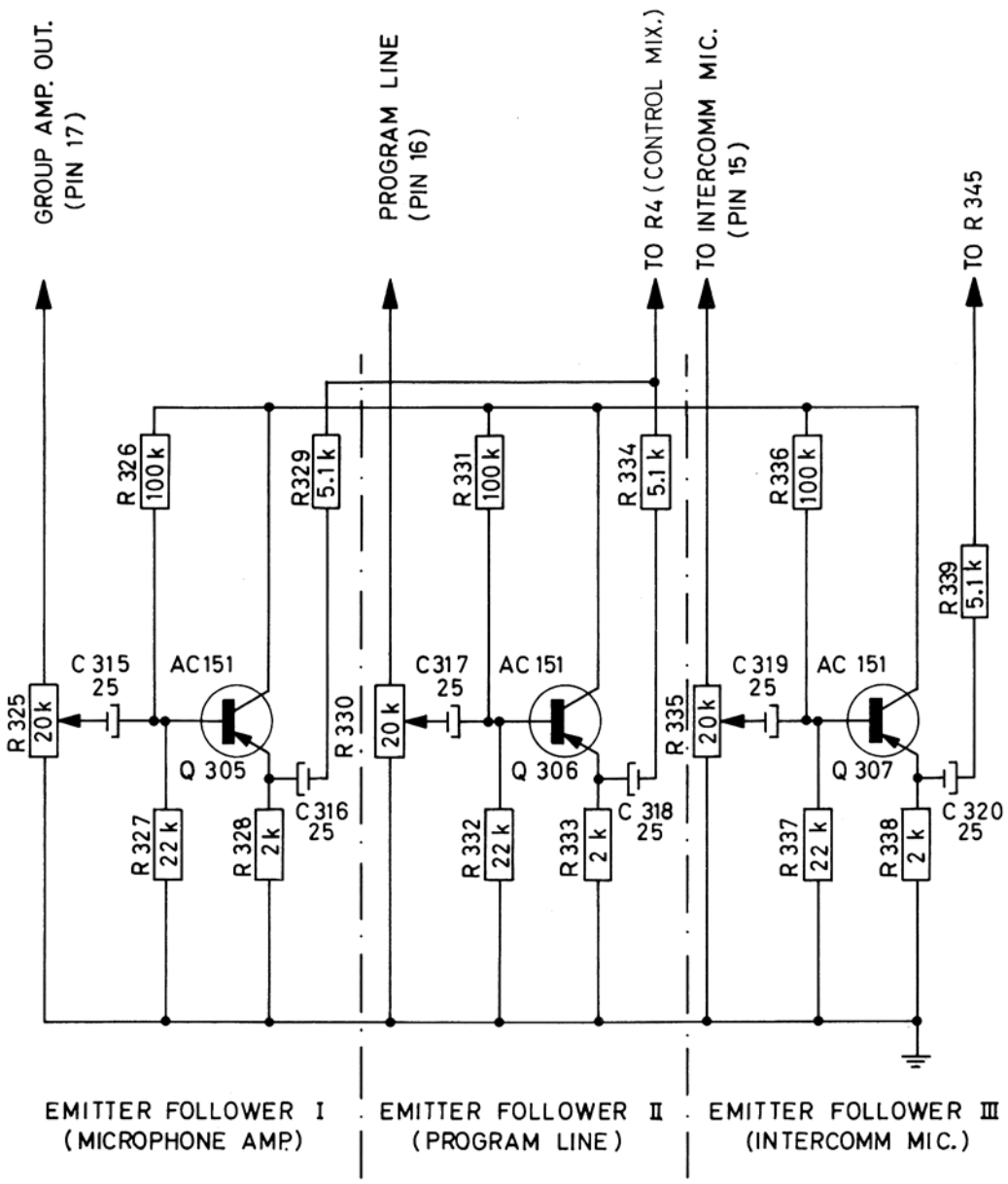


Fig. 43. The mixer, schematic.

5.1.7 The phone amplifier.

The schematic for the phone amplifier is shown in fig. 44.

The phone amplifier is a three stage amplifier using two transistors AC 151 and one transistor AC 153.

The input of the phone amplifier is connected to the volume control potentiometer R 4.

The frequency respone of the amplifier is straight over the entire audio range.

The capacitor C 326 forms a bias filter, while the capacitor C 328 forms a negative feedback circuit for the bias.

The all-call diode OA 81 is normaly forward biased. In all-call position the diode is grounded (reverse biased) thus braking down all inputs to the transistor Q 309 except the master's microphone.

The output impedance of the phone amplifier is approx. 30 ohms.

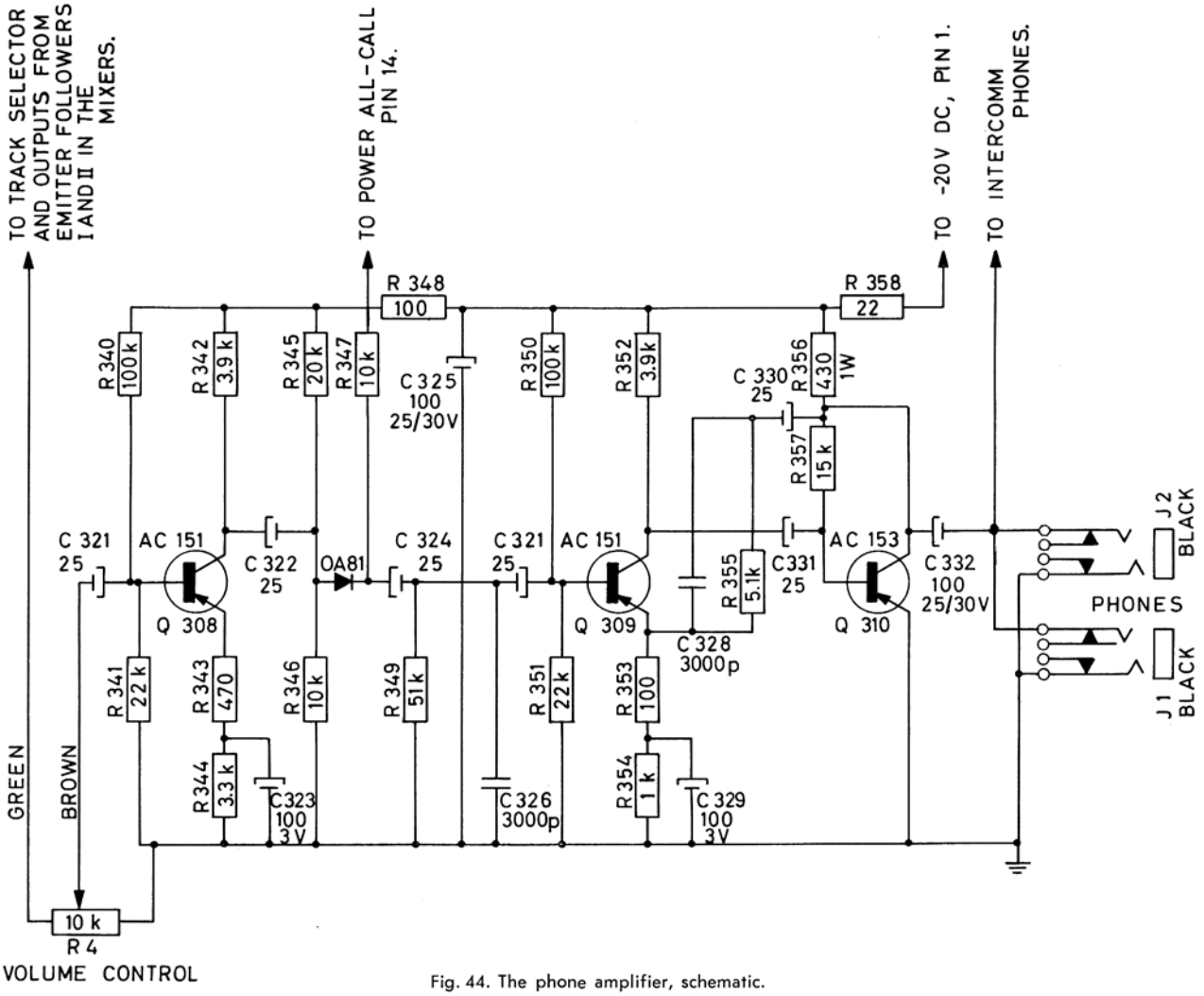


Fig. 44. The phone amplifier, schematic.

5.2 THE SWITCHING AND SIGNALLING SYSTEM

The block diagram for the model 1021 is shown in fig. 35.

5.2.1 The record/playback selector.

Ref. fig. 1.
The record/playback selector has two positions:
«Record»: Recording on student track (lower track).
«Playback»: Playback. Ref. chapter 5.2.2.

5.2.2 The output selector.

Ref. fig. 1.
The output selector has three positions:

«S»: Only the student track (lower track) is reproduced through the headphones.

«M»: Only the master track (upper track) is reproduced through the headphones.

«S + M:» Both the master track (upper track) and the student track (lower track) are reproduced simultanously through the headphones.

5.2.3 The calling push-button.

Ref. fig. 1.
The tape recorder is furnished with a push-button for calling the attention of the instructor.
A white lamp will light up at the master's desk when the push-button is depressed.

5.2.4 Recording on master track (upper track):

Recording on master track (upper track) is entirely controlled from the master's desk.
The student's programme selector at master's desk is set to either of the positions 1 — 6 and the student's tape recorder is started or stopped by the student start-stop switch.
(The student's tape recorder must be pre-set with tape inserted and the operating lever to normal forward drive).
The red record M lamp on the student's recorder will light up when the programme selector is set to either of the positions 1 — 6. This indicates that the recor-

ding will take place on the master track when the tape recorder is started.
Both oscillators are running synchronus.
The student can not interrupt, brake into or start a recording on the master (upper track) from his tape recorder.

5.2.5 Recording on master track (upper track) and student track (lower track) simultaneously:

This is the operation where the master programme is recorded on the upper track while student is repeating the master's voice and recording it on the lower track.
The master controls are set as outlined under para 5.3.4. The playback-record lever at the student's recorder is set to record. The operating lever is set to normal forward drive with tape inserted.
The red record M lamp lights up and indicates that the recording is taking place on the master track (upper track).
Both oscillators are running synchronous.

5.2.6 listening to the master track (upper track) and recording on the student track (lower track) simultaneously.

This is the operation where the master programme is played back from the upper track while the student is repeating the master's voice and recording it on the lower track.
The programme selector at the master desk is set to pos. S.M. The oscillator and the record amplifier for the upper track together with the record M lamp are shut off.
The playback amplifier for upper track is activated. The oscillator, the record amplifier and the level meter amplifier for lower track are activated when the playback-record lever is set to record pos.
The playback volume is set by the volume control.

5.2.7 Playing back master track (upper track) and student track (lower track) simultaneously.

This is the operation where the student compares his exercise to the master's lesson.
The controls at the master desk are set according to para 5.2.6.
The playback-record lever at the student's tape recorder is set to playback position.
Both playback amplifiers are activated and the student can listen to

1 The student track
2 The master track
3 The student track + the master track

according to the position of the output selector.

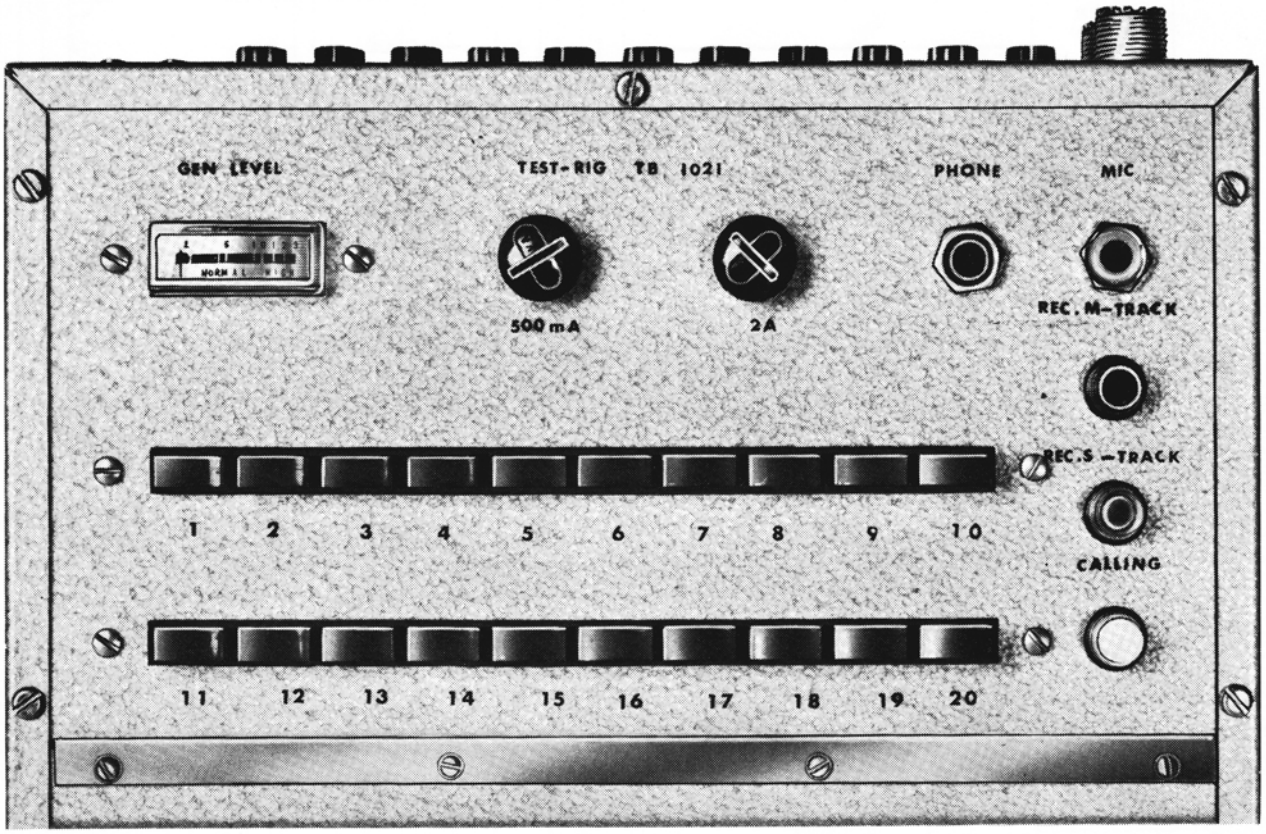


Fig. 45. The test rig.

6.0 Control and adjustment procedure

To perform a complete adjustment of the model 1021 tape recorder it will be necessary to use the test rig No. 4084. Ref. fig. 45.

6.0.1 Connecting the test rig to the tape recorder and the external equipment.

Ref. fig. 46 for connecting the test rig 4084 to the tape recorder and the external equipment.

6.1 PROCEDURE

Depress push-button No. 1.

Before the tape is threaded the following preliminaries must be attended to:

a) Demagnetize the heads and adjacent parts.
Note: The demagnetizer must not be shut off before it is moved away from the heads.

b) Turn the potentiometers R 325 and R 330 anticlockwise to zero.

c) Depress the calling push-button on the tape recorder and check that the white bulb lights up.

d) Plug in the mains.

6.1.1 Check of the tape path.

a) The height of the mounting plate for the heads (15.1) is aligned by the adjustment screw at the rear of the playback head. Move the operating lever slowly to normal forward drive with at tight

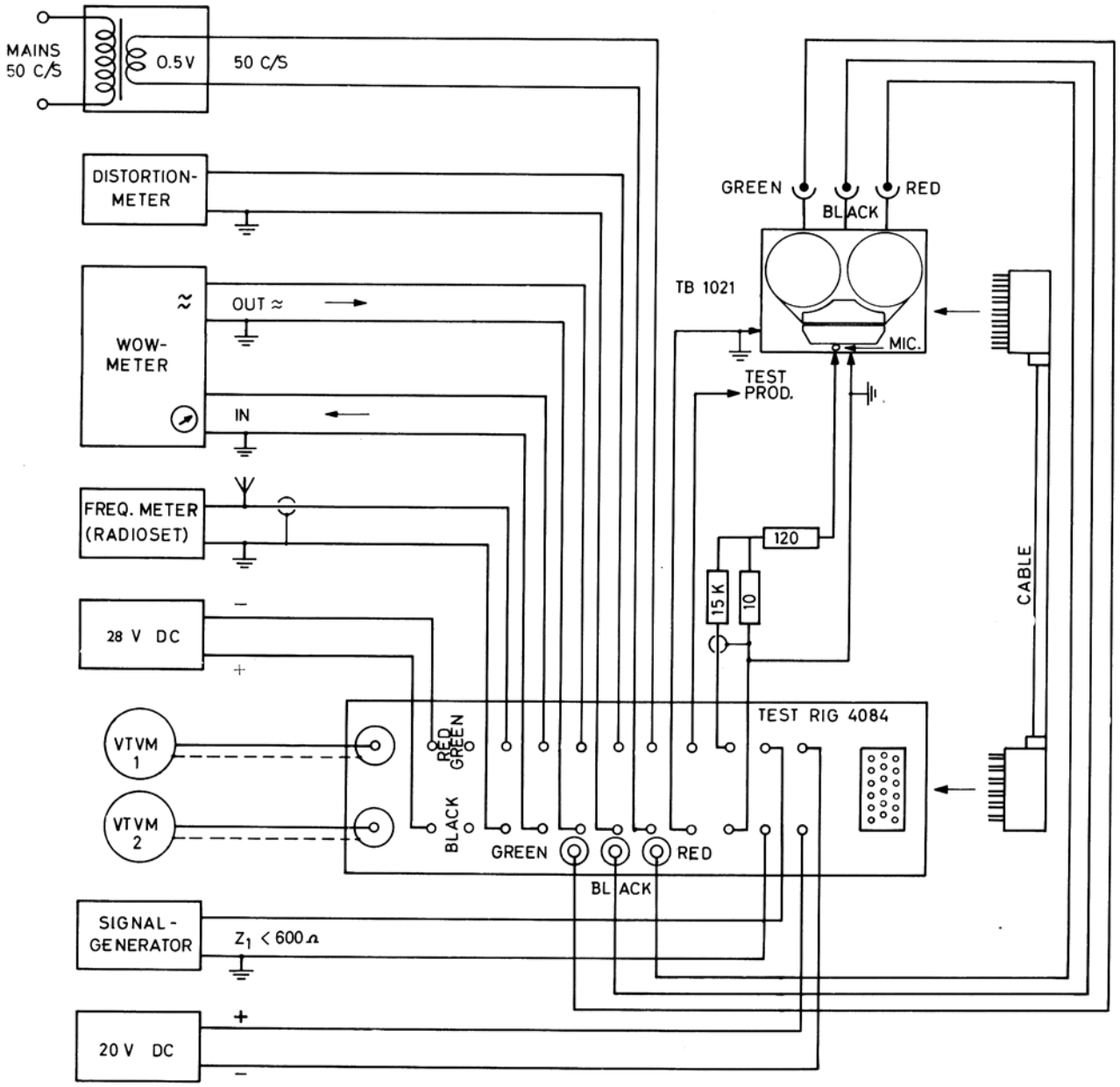


Fig. 46. Connection of the external equipment to the test rig 4084.

tape inserted. Align the height of the mounting plate for the heads until the tape runs equidistant from the flanges of the tape guide (79.12). Ref. fig. 9.

b) Set the operating lever in normal forward drive with tape inserted. Align the adjustable tape guide (79.15) until the tape runs equidistant from the flanges of the tape guide. Ref. fig. 9.

c) Check that the pressure roller runs parallel with the capstan and that the rubber covers the entire tape. No air pockets must be formed between the pressure roller and the tape. Adjust the equalization latch (51.11) if necessary.

d) The height position of the heads is aligned by the height adjustment screws. Ref. fig. 9.
The tape should run flush with upper part of the airgap for ch. 1 on the record and playback heads. The height of the erase head is adjusted so that the tape runs equidistant from the upper and the lower edge of the ferrite core.

Note: The heads are furnished with two height adjustment screws each. Both screws must be turned equally to ensure correct horizontal position of the heads.

6.1.3 Lateral adjustment.
Pull the pressure pad (59.1) away from the erase head when the standard azimuth alignment tape (Tandberg test tape No. 2) is being played back. The output level should not decrease more than 3dB. Adjust the lateral position of the playback head, if necessary, by turning the head mounting plate.

6.2 ADJUSTMENT OF THE PLAYBACK LEVEL
Depress push-button No. 2.
Insert the Tandberg test tape No. 4. This is a full track prerecorded tape with 400 c/s at 7½ i. p. s. tape speed. Set the output selector to S + M and start the tape recorder in playback.
Shortcircuit the upper playback head at the soldering strip for the heads. Adjust R 244 until the left V. T. V. M. reads 70 mV. Remove the shortcircuit. Shortcircuit the lower playback head at the soldering strip for the heads. Adjust R 243 until the V. T. V. M. No. 1 reads 70 mV. Ref. fig. 48.

6.3 Speed check.
Depress push-button No. 3.
Insert the Tandberg test tape No. 10 b. This is a prerevorded tape with 50 c/s on track 1 and 4 recorded at 3¾ i. p. s. tape speed. Set the output selector to S + M and start the tape recorder.

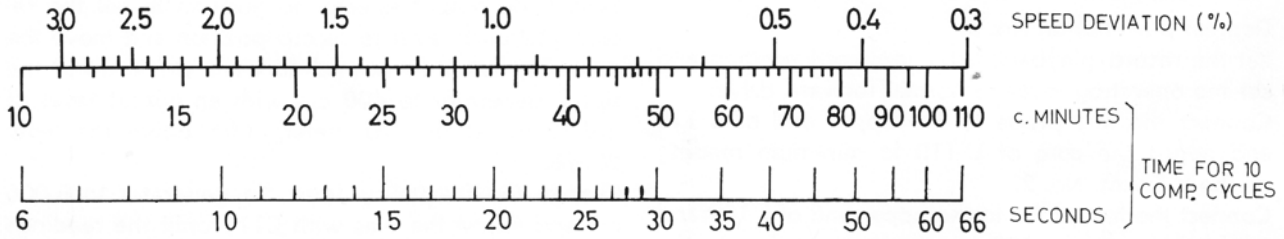


Fig. 47.

6.1.2 Azimuth adjustment.

Insert the Tandberg test tape No. 2 (full track prerecorded 10.000 c/s at 7½ i. p. s. tape speed) and set the output selector to S. The test prod from the test rig is connected to the yellow wire on the output selector and the tape recorder is started. Align the azimuth position of the playback head by means of the azimuth adjustment screw, ref. fig. 9 until max. reading is obtained on both V. T. V. M.
The V. T. V. M. No. 2 should indicate approx. 8 dB higher output than V. T. V. M. No. 1. If the maximum is not obtained simultaneously on both tracks one must try to divide the devation equally on both heads.

The right V. T. V. M. will show a variable reading, and the time in c minutes for 10 cycles should be taken, using a stop watch. The time is compared to the graph and the speed deviation is found.
By one cycle is ment the indication from minimum to maximum and back to minimum again.
Brake the left reel carefully, if the indication on the V. T. V. M. speeds up, the tape recorder runs too slow. If the indication slows down, the tape recorder runs too fast.

The speed tolerance is ± 2 %.
Remove the test tape.

6.4 ADJUSTMENT OF THE STUDENT OSCILLATOR

Depress push-button No. 4.
Set the record/playback lever to record position and move the operating lever to normal forward drive.
Turn the output selector to S + M. The yellow lamp will light up.
Check the oscillator voltage with a V.T.V.M. and a high impedance test probe conncted to the lower end of C. 143.
Connect a frequency meter to the white plastic insulation of the wire for the lower erase head. (A capacitive connection is necessary to prevent the frequency meter from loading the oscillator.)
Adjust the frequency by C 145 to be 85 k c/s and check the voltage on the V.T.V.M. Move the V.T.V.M. to the upper end of C 143 and adjust C 140 for min. reading. Ref. fig. 48 and 55.

6.5 ADJUSTMENT OF THE MASTER OSCILLATOR

Depress push-button No. 5.
Set the record/playback lever to record position and move the operating lever to normal forward drive.
Connect a high impedance test probe to the upper end of C 143 and a frequency meter to the white plastic insultation of the wire for the lower erase head as outlined under para. 6.4. Adjust the frequency by C 142 to be 85 k c/s and adjust R 150 until the V.T.V.M. reads the same as under para. 6.4. Ref. fig. 48, 49 and 55.

6.6 ADJUSTMENT OF THE SUPPRESSOR CIRCUITS

Depress push-button No. 6.
Set the record/playback lever to record position and set the operating lever to normal forward drive.
Connect the test probe to the upper end of L 110 and adjust the core of L 110 to minimum reading on the V.T.V.M. No. 2.
Connect the test probe to the upper end of L 109 and adjust the core of L 109 to minimum reading on the V.T.V.M. No. 2.
Ref. fig. 48 and 55.

6.7 ADJUSTMENT OF THE MICROPHONE AMPLIFIER LEVEL

Depress push-button No. 7.
Feed a 400 c/s signal 0.5 V (O dB at the VU meter) to the jig.
Adjust R 3 until the V. T. V. M. No. 2 reads .5 V.
Ref. fig. 4.

6.8 ADJUSTMENT OF THE RECORDING HEAD

Depress push-button No. 8.
Thread the recorder with instrumentation tape 499 from Scotch and set the output selector to position S. Tune the generator to 8.000 c/s with an output level of .5V. (O dB at the VU meter). Turn down the output level 20 dB from the generator. Connect the signal prod to the yellow wire on the output selector. Set the record/playback lever to record position, and move the operating lever to normal forward drive.
Align the azimuth and the lateral position of the record head as outlined for the playback head under para 6.1.2 and 6.1.3.

6.9 TRACK CONTROL

Depress push-button No. 9.
Insert the Tandberg test tape No. 9 (full track prerecorded 1.000 c/s at 7½ i.p.s. tape speed).
Tune the signal generator to 800 c/s with at output level of .5V (0 dB at the VU meter).
Move the record/playback lever to record position and set the operating lever to normal forward drive.
Run through about 30 cm. of the tape and stop the recorder. Dip the tape in Magna-See solution to make it visible. Check that the two recorded tracks are distributed symmetrical across the tape, and that the pre-recorded zone remains in center of the erased zone. Readjust the height of the record head if necessary and check the azimuth position.
Ref. fig. 9.

6.10 BIAS ADJUSTMENT

Depress push-button No. 10.
Thread the tape recorder with instrumentation tape 499 from Scotch and connect the test prod to the phone jack.
Switch the output selector to position S. Set the record/playback lever to record position and move the operating lever to normal forward drive. Tune the signal generator to 400 c/s with an output level of .5V (0 dB at the VU meter), turn down the level 20 dB.
Change the frequency from the generator to 8.000 c/s and adjust the bias with C111 until the readings on the V. T. V. M. No. 2 are equal for both frequencies. Ref. fig. 49.
Connect a 100 ohms resistor in series with the lower recording head half (black wire). Check the voltage across the resistor (the bias current) to be 250—400 mV. Move the test prod back to the phone jack.
Switch the output selector to position M. Set the record/playback lever to record position and move the operating lever to normal forward drive. Tune the signal generator to 400 c/s with an output level of .5V (0 dB at the VU meter), turn down the level 20 dB.
Change the frequency from the generator to 8.000 c/s and adjust the bias with C 110 until the readings on the V. T. V. M. No. 2 are equal for both frequencies. Ref. fig. 49.
Connect a 100 ohms resistor in series with the upper recording head half (black wire). Check the voltage across the resistor (the bias current) 250—400 mV.

6.11 ADJUSTMENT OF THE RECORD AMPLIFIERS AND THE VU METER AMPLIFIER

Depress push-button No. 11.
Thread the recorder with instrumentation tape 499 from Scotch and set the output selector to position S + M. Shortcircuit the upper half of the playback head at the soldering strip for the heads. Tune the signal generator to 400 c/s with an output level of .5V (0 dB at the VU-meter). Move the record/playback lever to record position and set the operating lever to normal forward drive position.
Adjust R 108 until the V. T. V. M. No. 1 reads 70 mV.
Adjust R 140 until the VU meter reads 0 dB.
Ref. fig. 49.
Remove the short-circuit from the upper head half. Short-circuit the lower half of the playback head at the soldering strip for the heads.
Adjust R 106 until the V. T. V. M. No. 1 reads 70 mV.
Ref. fig. 49.
Depress the push-button No. 7 and check that the reading on the V. T. V. M. No. 2 is .5 V. Readjust R 3 if necessary. Ref. fig. 4.

6.12 CHECK OF DISTORTION

Depress push-button No. 12.
Thread the recorder with instrumentation tape 499 from Scotch and set the output selector to position S. Tune the signal generator to 400 c/s with an output level of .5V (0 dB at the VU meter). Move the record/playback lever to record position and set the operating lever to normal forward drive position.
Calibrate the distortion meter and measure the distortion.
Switch the output selector to M position. Check the calibration of the distortion meter and measure the distortion.
The distortion should be below 6 %.

6.13 CHECK OF WOW

Depress push-button No. 13.
Thread the recorder with tape. Move the record/playback lever to record position and set the operating lever to normal forward drive.
Calibrate the wow-meter and measure the wow.
The wow should be less than .6 % peak to peak.

6.14 LEVEL ADJUSTMENT OF EMITTER FOLLOWER I (MICROPHONE AMPLIFIER)

Depress push-button No. 14.
Set the output selector to position S + M and tune the signal generator to 400 c/s wiht an output level of .5V (0 dB at the VU meter).
Adjust R 325 until the V. T. V. M. No. 1 reads 70 mV.
Ref. fig. 50.

6.15 LEVEL ADJUSTMENT OF EMITTER FOLLOWER II (PROGRAM LINE)

Depress push-button No. 15.
Set the output selector to position S + M and tune the signal generator to 400 c/s with an output level of .5 V (0 dB at the VU meter).
Adjust R 330 until the V. T. V. M. No. 1 reads 70 mV.
Ref. fig. 50.

6.16 LEVEL ADJUSTMENT OF EMITTER FOLLOWER III (INTERCOMM. MIC.)

Depress push-button No. 16.
Set the output selector to position S + M and tune the signal generator to 400 c/s with an output level of .5 V (0 dB at the VU meter).
Adjust R 335 until the V. T. V. M. No. 2 reads .5 V.
Ref. fig. 50.

6.17 CHECK OF THE ALL-CALL LEVEL

Depress push-button No. 17.
Set the output selector to position S + M and tune the signal generator to 400 c/s with an output level of .5 V (0 dB at the VU meter).
The V. T. V. M. No. 1 should read 70 mV.
The V. T. V. M. No. 2 should read .5 V.

6.18 CHECK OF SM POSITION

Depress push-button No. 18.
The headset should be plugged into the respective jacks. Set the record-playback lever to record position and the output selector to position S. Make a recording from the microphone, rewind the tape and play back for check. Rewind the recording once more and set the record/playback lever in record position. Remove the mic. plug from the jack and start the tape recorder and let it run for a few minutes. Rewind the tape and play back. Check that the previous program is erased.

6.19 CHECK OF THE RED AND THE YELLOW SIGNAL LAMPS

Depress push-button No. 19.
Insert a tape and move the record/playback lever to record position. Set the operating lever to normal forward drive. The red and the yellow signal lamps should both be lighted.

6.20 CHECK OF REMOTE START-STOP

Depress push-button No. 20.
The tape should stop momentarily.

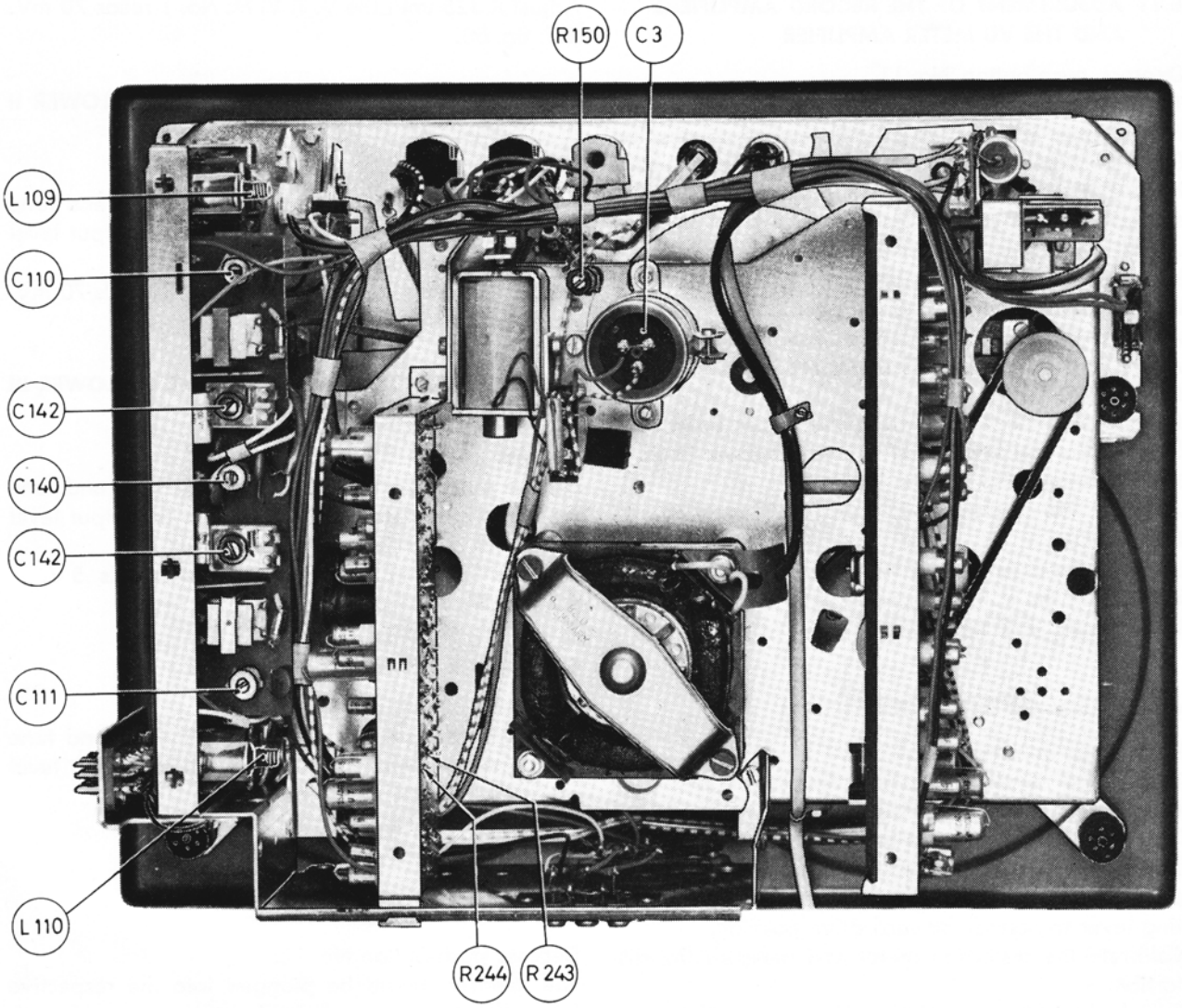


Fig. 48. Bottom view of the tape recorder.

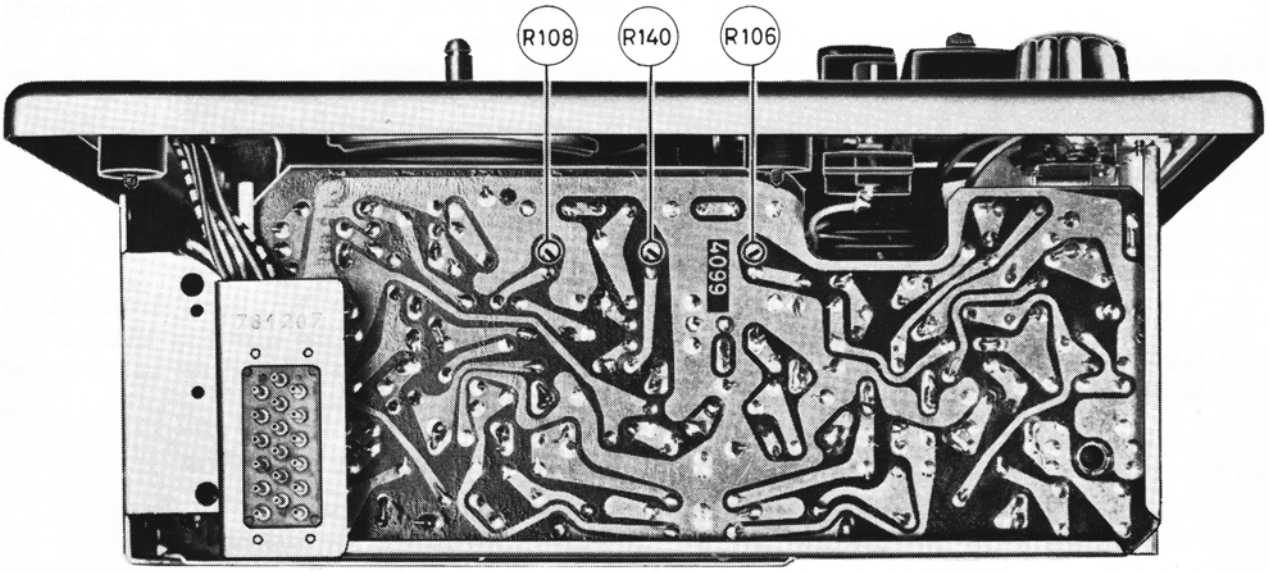


Fig. 49. Side view of the tape recorder showing the oscillator board.

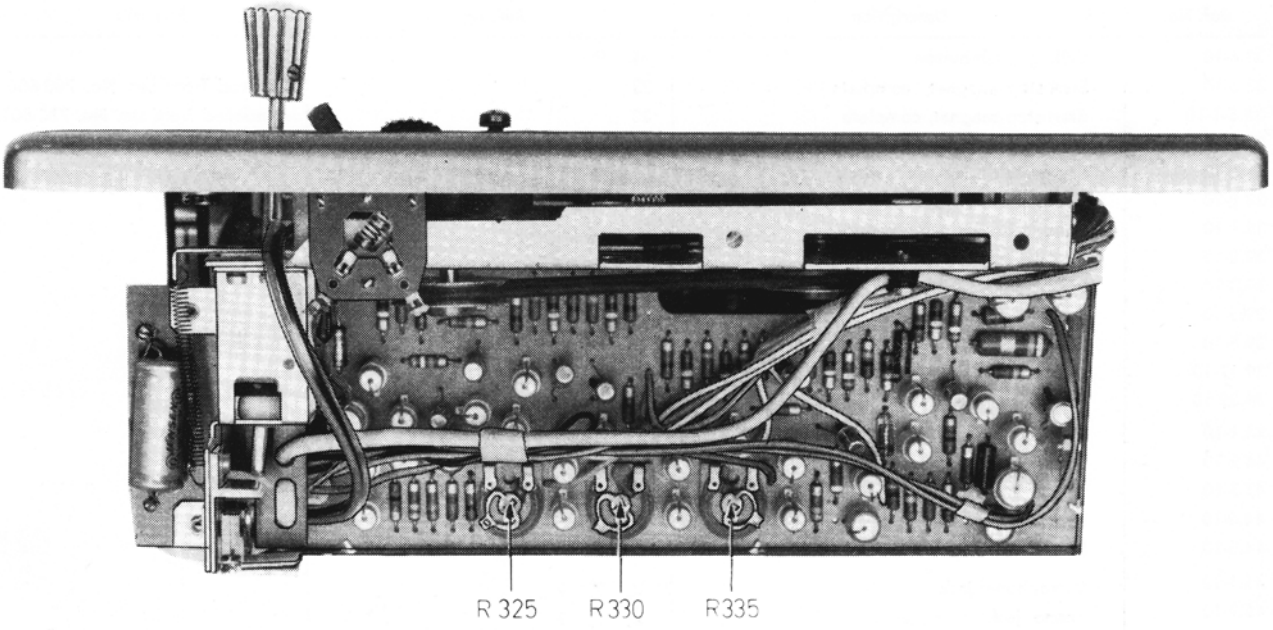


Fig. 50. Side view of the tape recorder showing the step 1 amplifier board.

7.0 Parts list

The complete referance number of the part and the serial number of the tape recorder must be specified when spare parts are ordered, i.e.

86.9 - 1 - 10 * Name of part.
1 2 3 4

1. The three or four first numbers state the part, and are refferred to in all figures.
2. This digit is present only when modification is introduced to the part. In some cases, this number also refers to subcontractors specification.
3. The type number state the type of tape recorder for which the part is used, i.e.
   10 — Parts for model 1021.
4. Modified parts indicated by an asterisk * may be used as replacement for parts of earlier design.

7.0.1 Mechanical parts.

Ref. No.	Description	Ref. fig.	Remarks
14.1-10	Motor	29	
14.2-10	Spacer for motor		
14.3-10	Bakelite tube		
14.4-10	Washer		
14.5-10	Spacer		
15.1-10	Mounting plate for heads	9	
18.1-10	Amplifier board with components step. 1		
18.2-10	Oscillator board with components		Removed from ser. No. 780 600
18.2-1-10	Oscillator board with components		Introduced from ser. No. 780 601
18.3-10	Playback amplifier board with components		
18.4-10	Cover frame for 18.1		
18.5-10	Cover frame for 18.2		
18.6-10	Cover frame for 18.3		
19.1-10	Soldering strip for head 1	9	
19.2-10	Soldering strip for head 2	9	
19.3-10	18 pin plug		
32.2-10	Knob for volume control	34	
33.1-10	Microswitch 1010		
33.2-10	Switch — 2 pole	4, 7	
33.3-10	Microswitch R x 1	5	

Ref. No.	Description	Ref. fig.	Remarks
33.4-10	Calling push-button	4, 9	
33.5-10	Start-stop magnet, complete	33	Removed from ser. No. 780 600
33.5-1-10	Start-stop magnet, complete	33	Introduced from ser. No. 780 601
33.6-10	Bracket for microswitch 1010		
33.8-10	Slip-on knob for mic. switch		
33.9-10	Actuator lever	5	
39.1-10	Knob, function selector switch	34	
39.2-10	Play switch	7	
39.3-10	Spring for play switch		
39.5-10	Spring, function selector switch		
39.8-10	Output selector		
39.17-10	Function selector bracket	7	
39.22-10	Interlock arm, function selector	7	
44.1-10	Pilot lamp		
44.2-10	Socket for pilot lamp	7	
44.3-10	Shield for pilot lamp		
44.4-10	Socket for Record M lamp	4, 9	
44.5-10	Record M lamp		
45.1-10	Microphone jack	4, 7, 9	
45.2-10	Phone jack	4, 7, 9	
48.1-10	Wooden case		
48.3-10	Buffer, polyethylene		
51.1-10	Pressure wheel	8, 9	
51.2-10	Shaft for pressure wheel	8, 9, 33	
51.3-10	Pressure wheel bracket (complete assembly)	4, 8	
51.4-10	Spring pressure wheel	8, 33	
51.5-10	Lever, pressure wheel	8, 9, 33	
51.6-10	Roller for pressure wheel bracket.	7	
51.7-10	Spring for pressure wheel bracket	7	
51.8-10	Tape brake assembly	9	
51.9-10	Shaft for lever pressure wheel	33	
51.11-10	Latch, spring for pressure wheel	8, 9, 33	
51.13-10	Brake block for tape brake	9, 33	
52.1-10	Trip bar	10	
52.2-10	Spring for trip bar		
53.1-10	Speed transfer wheel	4, 10, 29, 32	
53.2-10	Speed transfer wheel holder	10, 32	
53.3-10	Speed transfer wheel arm	10, 32	
53.5-10	Spring,speed transfer wheel holder	10, 32	
54.1-10	Operating lever, complete assembly	5	
54.2-10	Knob, operating lever	34	
54.7-10	Operating lever shaft with delrin ball	5	
54.8-10	Clip for operating lever	5	
59.1-10	Spring with felt for pressure pad	9, 33	
59.2-10	Pressure pad arm	9, 33	
59.3-10	Index lever	10, 19, 21, 23, 25, 27	
59.4-10	Shaft for index lever	10, 19, 21, 23, 25, 27	
59.5-10	Spring for index lever	19, 21, 23, 25, 27	
59.6-10	Clutch lever supply friction disc, left	10, 11, 12, 19, 21, 23, 25, 27	
59.7-10	Upper clutch lever take-up friction disc, right	10, 14, 15, 20, 22, 24, 26, 28	
59.8-10	Lower clutch lever take-up friction disc, right	10, 14, 15, 20, 22, 24, 26, 28	
59.9-10	Spring for 59.6 and 59.7	19—28	
59.14-10	Spring for pressure pad arm	33	
59.15-10	Spring for 59.8-10	20, 22, 24, 26, 28	
59.16-10	Spring for linkage arm	4, 10	
59.17-10	Eccentric segment	7	
59.18-10	Transfer wheel lifting arm, complete	4, 10, 32	
59.19-10	Delrin button	12, 15, 19—28	
59.22-10	Start-stop lever	33	
59.23-10	Spring for interlock arm	7	

Ref. No.	Description	Ref. fig.	Remarks
59.24-10	Transfer bracket	9, 33	
59.27-10	Clutch shaft	10, 19—28	
59.29-10	Shaft for eccentric segment	7	
61.1-10	Friction disc, take-up, complete	13, 14, 15, 20, 22, 24, 26, 28, 29	
61.2-10	Friction disc, supply, complete	11, 12, 13, 20, 22, 24, 26, 28, 29	
61.3-10	Mylar washer for friction disc	11, 13, 14	
61.5-10	Helical compression spring, supply friction disc	11, 19, 21, 23, 25, 27	
61.6-10	Helical compression spring, take-up friction disc	14, 20, 22, 24, 26, 28	
62.1-5834-10	Motor pulley 50 c/s	4, 29, 32	
62.1-5908-10	Motor pulley 60 c/s	4, 29, 32	
62.2-10	Rubber drive belt	4	
65.1-10	Take-up turntable	4, 14, 20, 22, 24, 26, 28, 29	Removed from ser. No. 780 600
65.1-1-10	Take-up tumtable	4, 14, 20, 22, 24, 26, 28, 29	Introduced from ser. No. 780 601
65.2-10	Supply turntable	4, 11, 19, 21, 23, 25, 27, 29	Removed from ser. No. 780 600
65.2-1-10	Supply tumtable	4, 11, 19, 21, 23, 25, 27, 29	Introduced from ser. No. 780 601
65.5-10	Delrin nut	11	Introduced from ser. No. 780 601
66.1-10	Flywheel	4, 30, 32	
66.3-10	Selflubricating bearing	7, 30	
66.4-10	Spring, upper flywheel bearing	30	
66.5-10	Spring, lower, flywheel bearing	30	
66.6-10	Latch, flywheel bearing, treaded	7, 30	
66.7-10	Latch, flywheel bearing, not threaded	10, 30	
66.8-10	Thrust washer	30	
66.9-10	Feltring for flywheel bearing	30	
69.1-10	Pulley for revolution counter (turntable)	14	Removed from ser. No. 780 600
69.1-1-10	Delrin pulley for revolution counter (turntable)	14	Introduced from ser. No. 780 601
69.2-10	Pulley for revolution counter (counter)	7	Removed from ser. No. 780 600
69.2-10	Delrin pulley for revolution counter (counter)	7	Introduced from ser. No. 780 601
69.3-10	Drive belt for revolution counter		
72.1-10	Flange for turntable housing	11, 13, 14	
73.1-10	Front trim cover	34	
73.2-10	Rear trim cover	34	
73.3-10	Screw for trim cover	34	
73.4-10	Bracket for front trim cover (left)	34	
73.5-10	Bracket for front trim cover (right)	34	
73.6-10	Bracket for rear trim cover	9	
74.1-10	Top plate		
74.2-10	Mounting screw 4 x 24 mm	4, 34	
74.3-10	Rubber mounting	4, 34	
74.4-10	Washer, mounting screw	34	
74.5-10	Rubber washer	34	
79.1-10	Window, counter		
79.2-10	V.U. meter	7	
79.6-10	Mounting bracket, left rear	10	
79.7-10	Mounting bracket, right rear	4, 10	
79.8-10	Lock spring turntables	11, 14	Removed from ser. No. 780 600
79.9-10	Cover plate with tape	4	
79.11-10	Cover plate with felt	4	
79.12-10	Tape guide	9	
79.13-10	Tape guide, left	9	
79.15-10	Tape guide, adjustable	9	
79.16-10	Revolution counter	4, 7	
79.17-10	Bracket for revolution counter	7	
79.21-10	Felt washer for cover plate and knob	34	
79.24-10	Tandberg emblem		
79.29-10	Tape guide, right	4, 9	
79.32-10	Guide for oscillator board		

Screws, washers and lock washers

M101	Screw 3 × 4 mm c.h.	M130	Screw 3 × 8 mm l.h.
M102	Screw 3 × 4.5 mm c.h.	M132	Unbraco screw $^1/_8$" × 3.5 mm
M104	Screw 3 × 6 mm c.h.	M301	Turbax washer 7.5 × 4.2 × 0.2 mm
M107	Screw 3 × 8 mm c.h.	M302	Turbax washer 7.5 × 4.2 × 0.3 mm
M112	Screw 4 × 6 mm c.h.	M303	Turbax washer 7.5 × 4.2 × 0.5 mm
M113	Screw 4 × 8 mm c.h.	M307	Turbax washer 11 × 6.5 × 0.5 mm
M114	Screw 4 × 10 mm c.h.	M313	Lock ring 2.5 mm
M116	Parker screw ¼" No. 4	M314	Lock ring 3 mm
M120	Screw 2.6 × 4 mm c.h.	M315	Lock ring 3.5 mm
M121	Screw 2.3 × 12 mm c.h.	M317	Lock ring 5 mm
M122	Screw 4 × 22 mm c.h.	M318	Lock ring 6 mm
M125	Screw 3 × 6 mm c.h. 1.5 mm head	M321	Lock ring 4 × 0.6 mm

M325	Washer 16 × 4.2 × 1.65 mm
M329	Lock ring 2.3 mm
M331	Bakelite washer 18 × 10 × 0.5 mm
M333	Spring washer $^1/_8$"
M348	Teflon washer 6.5 × 4.2 × 0.2 mm
M349	Lock washer 4 mm
M355	Teflon washer 6,5 × 4,2 × 0,5 mm
M403	Rivet 3.5 mm

Heads:

34H	Half-track erase head
33H	Half-track record head
31H	Half-track playback head

Transistors:

Ref. No.	Description	Notes
Q101-10	AC 153	
Q102-10	AC 153	
Q103-10	AC 153	
Q104-10	AC 153	
Q105-10	AC 151	
Q106-10	AC 151	
Q107-10	AC 153	
Q108-10	AC 153	
Q109-10	AC 151	
Q201-10	AC 107	
Q202-10	AC 107	
Q203-10	AC 151	The transistor AC 151
Q204-10	AC 151	can be replaced by AC 162
Q205-10	AC 151	
Q206-10	AC 151	
Q207-10	AC 151	
Q208-10	AC 151	
Q301-10	AC 162	
Q302-10	AC 162	
Q303-10	AC 162	
Q304-10	AC 162	
Q305-10	AC 162	
Q306-10	AC 162	
Q307-10	AC 162	
Q308-10	AC 162	
Q309-10	AC 162	
Q310-10	AC 153	

Diodes:

Ref. No.	Description	Notes
D101-10	D 2 (D3, Fairschild) (1S130, Texas)	
D102-10	D 2 (D3, Fairschild) (1S130, Texas)	
D103-10	D 2 (D3, Fairschild) (1S130, Texas)	
D104-10	AA 119 (OA 81)	
D105-10	AA 119 (OA 81)	
D106-10	AA 119 (OA 81)	
D107-10	AA 119 (OA 81)	
D108-10	1N 3196	
D301-10	OA 81	

7.0.2 Electrical parts

Resistors:

Ref. No.	Description			Notes
R1-10	20 ohm			Removed from ser. No. 780 600
R2-10	72 ohm			Removed from ser. No. 780 600
R3-10	10 kohm pot.meter, log. 54ZP			
R4-10	10 komp pot.meter, log. 55U			
R5-10	51 ohm	½ w	10 %	
R6-10	220 ohm	4 w	10 %	Introduced from ser. No. 780 601
R8-10	1 Mohm	½ w	10 %	
R101-10	10 kohm	½ w	10 %	Removed from ser. No. 780 600
R101-1-10	33 kohm	½ w	10 %	Introduced from ser. No. 780 601
R102-10	10 kohm	½ w	10 %	Removed from ser. No. 780 600
R102-1-10	33 kohm	½ w	10 %	Introduced from ser. No. 780 601
R103-10	10 kohm	½ w	10 %	Removed from ser. No. 780 600
R103-1-10	68 kohm	½ w	10 %	Introduced from ser. No. 780 601
R104-10	10 kohm	½ w	10 %	Removed from ser. No. 780 600
R104-1-10	68 kohm	½ w	10 %	Introduced from ser. No. 780 601
R105-10	100 ohm	½ w	10 %	
R106-10	20 kohm pot.meter EO97AD/20K, lin			
R107-10	100 ohm	½ w	10 %	
R108-10	20 kohm pot.meter EO97AD/20K, lin			
R109-10	68 kohm	½ w	10 %	
R110-10	6.8 kohm	½ w	10 %	
R111-10	68 kohm	½ w	10 %	
R112-10	6.8 kohm	½ w	10 %	
R113-10	1.5 kohm	½ w	10 %	
R114-10	180 ohm	½ w	10 %	
R115-10	1.5 kohm	½ w	10 %	
R116-10	180 ohm	½ w	10 %	
R117-10	100 ohm	½ w	10 %	
R118-10	100 ohm	½ w	10 %	
R119-10	330 ohm	½ w	10 %	
R120-10	820 ohm	½ w	10 %	Removed from ser. No. 780 600
R120-1-10	1,2 kohm	½ w	10 %	Introduced from ser. No. 780 601
R121-10	330 ohm	½ w	10 %	
R122-10	820 ohm	½ w	10 %	Removed from ser. No. 780 600
R122-1-10	1,2 kohm	½ w	10 %	Introduced from ser. No. 780 601
R123-10	200 ohm	½ w	10 %	Removed from ser. No. 780 600
R123-1-10	220 ohm	½ w	10 %	Introduced from ser. No. 780 601
R124-10	200 ohm	½ w	10 %	Removed from ser. No. 780 600
R124-1-10	220 ohm	½ w	10 %	Introduced from ser. No. 780 601
R125-10	8.2 kohm	½ w	10 %	
R126-10	130 ohm NTC B 8320-01-A/130E			
R127-10	270 ohm	½ w	10 %	
R128-10	8.2 kohm	½ w	10 %	
R129-10	130 ohm NTC B 8320-01-A/130E			
R130-10	270 ohm	½ w	10 %	
R131-10	220 ohm	1 w	10 %	
R132-10	10 ohm	½ w	10 %	
R133-10	220 ohm	1 w	10 %	
R134-10	10 ohm	½ w	10 %	
R135-10	3.3 kohm	½ w	10 %	
R136-10	3.3 kohm	½ w	10 %	
R137-10	2 kohm	½ w	10 %	
R138-10	2 kohm	½ w	10 %	
R139-10	2 kohm	½ w	10 %	
R140-10	20 kohm pot.meter EO97AD/20K, lin			
R141-10	82 kohm	½ w	10 %	
R142-10	15 kohm	½ w	10 %	
R143-10	5.6 kohm	½ w	10 %	
R144-10	3.3 kohm	½ w	10 %	

Ref. No.	Description			Notes
R145-10	560 ohm	½ w	10 %	
R146-10	3.3 kohm	½ w	10 %	
R150-10	200 ohm	4 w		
R201-10	20 kohm	½ w	10 %	
R202-10	3.9 kohm	½ w	10 %	
R203-10	20 kohm	½ w	10 %	
R204-10	3.9 kohm	½ w	10 %	
R205-10	10 kohm	½ w	10 %	
R206-10	10 kohm	½ w	10 %	
R207-10	15 kohm	½ w	10 %	
R208-10	3.9 kohm	½ w	10 %	
R209-10	15 kohm	½ w	10 %	
R210-10	3.9 kohm	½ w	10 %	
R211-10	51 ohm	½ w	10 %	
R212-10	51 ohm	½ w	10 %	
R213-10	4.7 kohm	½ w	10 %	
R214-10	4.7 kohm	½ w	10 %	
R215-10	8.2 kohm	½ w	10 %	
R216-10	8.2 kohm	½ w	10 %	
R217-10	15 kohm	½ w	10 %	
R218-10	3.3 kohm	½ w	10 %	
R219-10	15 kohm	½ w	10 %	
R220-10	3.3 kohm	½ w	10 %	
R221-10	15 kohm	½ w	10 %	
R222-10	15 kohm	½ w	10 %	
R223-10	3.9 kohm	½ w	10 %	
R224-10	270 ohm	½ w	10 %	
R225-10	3.9 kohm	½ w	10 %	
R226-10	270 ohm	½ w	10 %	
R227-10	33 ohm	½ w	10 %	
R228-10	33 ohm	½ w	10 %	
R229-10	51 kohm	½ w	10 %	
R230-10	10 kohm	½	10 %	
R231-10	51 kohm	½ w	10 %	
R232-10	10 kohm	½	10 %	
R233-10	1.2 kohm	½ w	10 %	
R234-10	390 ohm	½ w	10 %	
R235-10	1.2 kohm	½ w	10 %	
R236-10	390 ohm	½ w	10 %	
R237-10	330 ohm	½ w	10 %	
R238-10	330 ohm	½ w	10 %	
R239-10	43 kohm	½ w	10 %	
R240-10	43 kohm	½ w	10 %	
R241-10	390 ohm	½ w	10 %	
R242-10	390 ohm	½ w	10 %	
R243-10	20 kohm pot.meter EO97AD/20K			
R244-10	20 kohm pot.meter EO97AD/20K			
R245-10	33 kohm	½ w	10 %	
R246-10	51 kohm	½ w	10 %	
R247-10	33 kohm	½ w	10 %	
R248-10	51 kohm	½ w	10 %	
R249-10	100 ohm	½ w	10 %	
R250-10	100 ohm	½ w	10 %	
R251-10	2 kohm	½ w	10 %	
R252-10	2 kohm	½ w	10 %	
R253-10	5.1 kohm	½ w	10 %	
R254-10	5.1 kohm	½ w	10 %	
R301-10	2 kohm	½ w	10 %	
R302-10	100 kohm	½ w	10 %	
R303-10	22 kohm	½ w	10 %	
R304-10	7.5 kohm	½ w	10 %	

Ref. No.	Description			Notes
R305-10	3.3 kohm	½ w	10 %	
R306-10	10 kohm	½ w	10 %	
R307-10	33 ohm	½ w	10 %	
R308-10	2 ohm	½ w	10 %	
R309-10	100 kohm	½ w	10 %	
R310-10	22 kohm	½ w	10 %	
R311-10	10 kohm	½ w	10 %	
R312-10	3.3 kohm	½ w	10 %	
R313-10	560 ohm	½ w	10 %	
R314-10	39 kohm	½ w	10 %	
R315-10	100 kohm	½ w	10 %	
R316-10	82 kohm	½ w	10 %	
R317-10	6.8 kohm	½ w	10 %	
R318-10	3.9 kohm	½ w	10 %	
R319-10	1 kohm	½ w	10 %	
R320-10	150 ohm	½ w	10 %	
R321-10	1 kohm	½ w	10 %	
R322-10	100 kohm	½ w	10 %	
R323-10	22 kohm	½ w	10 %	
R324-10	2 kohm	½ w	10 %	
R325-10	20 kohm pot.meter EO97AD/20K			
R326-10	100 kohm	½ w	10 %	
R327-10	22 kohm	½ w	10 %	
R328-10	2 kohm	½ w	10 %	
R329-10	5.1 kohm	½ w	10 %	
R330-10	20 kohm pot.meter EO97AD/20K			
R331-10	100 kohm	½ w	10 %	
R332-10	22 kohm	½ w	10 %	
R333-10	2 kohm	½ w	10 %	
R334-10	5.1 kohm	½ w	10 %	
R335-10	20 kohm pot.meter EO97AD/20K			
R336-10	100 kohm	½ w	10 %	
R337-10	22 kohm	½ w	10 %	
R338-10	2 kohm	½ w	10 %	
R339-10	5.1 kohm	½ w	10 %	
R340-10	100 kohm	½ w	10 %	
R341-10	22 kohm	½ w	10 %	
R342-10	3.9 kohm	½ w	10 %	
R343-10	470 ohm	½ w	10 %	
R344-10				
R345-10	20 kohm	½ w	10 %	
R346-10	10 kohm	½ w	10 %	
R347-10	10 kohm	½ w	10 %	
R348-10	100 ohm	½ w	10 %	
R349-10	51 ohm	½ w	10 %	
R350-10	100 kohm	½ w	10 %	
R351-10	22 kohm	½ w	10 %	
R352-10	3.9 kohm	½ w	10 %	
R353-10	100 ohm	½ w	10 %	
R354-10	1 kohm	½ w	10 %	
R355-10	5.1 kohm	½ w	10 %	
R356-10	430 ohm	1 w	5 %	
R357-10	15 kohm	½ w	10 %	
R358-10	22 ohm	½ w	10 %	

Capacitors:

Ref. No.	Description			Type	Notes
C1-10	175 pF	500 V	5 %		Removed from ser. No. 780 600
C2-10	.1 μF	400 V	20 %		
C3-10	1000 μF + 1000 μF	35 V		Electrolytic	
C101-10	.01 μF	150 V	10 %	Paper	Removed from ser. No. 780 600
C101-1-10	5000 pF	150 V	10 %	Paper	Introduced from ser. No. 780 601
C102-10	.01 μF	150 V	10 %	Paper	Removed from ser. No. 780 600
C102-1-10	5000 pF	150 V	10 %	Paper	Introduced from ser. No. 780 601
C103-10	.01 μF	150 V	10 %	Paper	Removed from ser. No. 780 600
C103-1-10	2500 pF	125 V	5 %	Styroflex	Introduced from ser. No. 780 601
C104-10	.01 μF	150 V	10 %	Paper	Removed from ser. No. 780 600
C104-1-10	2500 pF	125 V	5 %	Styroflex	Introduced from ser. No. 780 601
C105-1-10	.1 μF	250 V	20 %	Polyester	Removed from ser. No. 780 600
C106-10	100 μF	20 V		Electrolytic	Removed from ser. No. 780 600
C106-1-10	.1 μF	250	20 %	Polyester	Introduced from ser. No. 780 601
C107-10	100 μF	15 V		Electrolytic	Removed from ser. No. 780 600
C107-1-10	.1 μF	250	20 %	Polyester	Introduced from ser. No. 780 601
C108-10	.02 μF	250 V	5 %	Styroflex	Removed from ser. No. 780 600
C108-1-10	500 pF	125 V	2,5 %	Styroflex	Introduced from ser. No. 780 601
C109-10	.02 μF	250 V	5 %	Styroflex	Removed from ser. No. 780 600
C109-1-10	500 pF	125 V	2,5 %	Styroflex	Introduced from ser. No. 780 601
C110-10	50-250 pF Trimming capacitor				Removed from ser. No. 780 600
C110-1-10	10- 40 pF Trimming capacitor				Introduced from ser. No. 780 601
C111-10	50-250 pF Trimming capacitor				Removed from ser. No. 780 600
C111-1-10	10- 40 pF Trimming capacitor				Introduced from ser. No. 780 601
C112-10	25 μF	15/18 V		Electrolytic	
C113-10	25 μF	15/18 V		Electrolytic	
C114-10	100 μF	15/18 V		Electrolytic	
C115-10	100 μF	15/18 V		Electrolytic	
C116-10	.1 μF		5 %	Miniprint	Removed from ser. No. 780 600
C116-1-10	.047 μF	100 V	5 %	Styroflex	Introduced from ser. No. 780 601
C117-10	.1 μF		5 %	Miniprint	Removed from ser. No. 780 600
C117-1-10	.047 μF	100 V	5 %	Styroflex	Introduced from ser. No. 780 601
C118-10	.22 μF		20 %	Miniprint	Removed from ser. No. 780 600
C118-1-10	.1 μF	100 V	5 %	Styroflex	Introduced from ser. No. 780 601
C119-10	.22 μF		20 %	Miniprint	Removed from ser. No. 780 600
C119-1-10	.1 μF	100 V	5 %	Styroflex	Introduced from ser. No. 780 601
C120-10	25 μF	15/18 V		Electrolytic	
C121-10	25 μF	15/18 V		Electrolytic	
C122-10	100 μF	15/18 V		Electrolytic	
C123-10	100 μF	15/18 V		Electrolytic	
C124-10	25 μF	15/18 V		Electrolytic	
C125-10	2,5 μF	64 V		Electrolytic	
C126-10	25 μF	15/18 V		Electrolytic	
C127-10	2,5 μF	64 V		Electrolytic	
C128-10	5000 pF	150 V	10 %	Paper	
C129-10	5000 pF	150 V	10 %	Paper	
C130-10	100 μF	3 V		Electrolytic	
C131-10	100 μF	3 V		Electrolytic	
C132-10	500 pF	400 V	10 %	Paper	
C133-10	500 pF	400 V	10 %	Paper	
C134-10	3000 pF	400 V	10 %	Paper	
C135-10	3000 pF	400 V	10 %	Paper	
C136-10	3000 pF	400 V	10 %	Paper	
C137-10	2,5 μF	64 V		Electrolytic	
C138-10	100 μF	3 V		Electrolytic	
C139-10	2,5 μF	64 V		Electrolytic	
C140-10	22000 pF	30 V	20 %	Polyester	Removed from ser. No. 780 600
C140-1-10	10- 40 pF Trimming capacitor				Introduced from ser. No. 780 601
C141-10	22000 pF	30 V	20 %	Polyester	Removed from ser. No. 780 600
C141-1-10	22 pF	500 V	5 %	Ceramic	Introduced from ser. No. 780 601

Ref. No.	Description			Type	Notes
C142-10	50-250 pF Trimming capacitor				Introduced from ser. No. 780 601
C143-10	25 pF	500 V	5 %	Ceramic	Introduced from ser. No. 780 601
C144-10	22pF	500 V	5 %	Ceramic	Introduced from ser. No. 780 601
C145-10	50-250 pF Trimming capacitor				Introduced from ser. No. 780 601
C146-10	270 pF	500 V	20 %	Styroflex	Introduced from ser. No. 780 601
C147-10	270 pF	500 V	20 %	Styroflex	Introduced from ser. No. 780 601
C201-10	25 µF	15/18 V		Electrolytic	
C202-10	100 µF	3 V		Electrolytic	
C203-10	25 µF	15/18 V		Electrolytic	
C204-10	100 µF	3 V		Electrolytic	
C205-10	10 pF	500 V	5 %	Ceramic	
C206-10	10 pF	500 V	5 %	Ceramic	
C207-10	25 µF	15/18 V		Electrolytic	
C208-10	100 µF	3 V		Electrolytic	
C209-10	25 µF	15/18 V		Electrolytic	
C210-10	100 µF	3 V		Electrolytic	
C211-10	100 µF	15/18 V		Electrolytic	
C212-10	100 µF	15/18 V		Electrolytic	
C213-10	25 µF	15/18 V		Electrolytic	
C214-10	25 µF	15/18 V		Electrolytic	
C215-10	25 µF	15/18 V		Electrolytic	
C216-10	25 µF	15/18 V		Electrolytic	
C217-10	25 µF	15/18 V		Electrolytic	
C218-10	.1 µF	30 V		Polyester	
C219-10	25 µF	15/18 V		Electrolytic	
C220-10	.1 µF	30 V		Polyester	
C221-10	3000 pF	400 V	10 %	Paper	
C222-10	3000 pF	400 V	10 %	Paper	
C223-10	25 µF	15/18 V		Electrolytic	
C224-10	320 µF	10 V		Electrolytic	
C225-10	25 µF	15/18 V		Electrolytic	
C226-10	320 µF	10 V		Electrolytic	
C227-10	.1 µF	30 V		Polyester	
C228-10	.1 µF	30 V		Polyester	
C229-10	100 µF	25/30 V		Electrolytic	
C230-10	100 µF	25/30 V		Electrolytic	
C231-10	25 µF	15/18 V		Electrolytic	
C232-10	25 µF	15/18 V		Electrolytic	
C233-10	25 µF	15/18 V		Electrolytic	
C234-10	25 µF	15/18 V		Electrolytic	
C235-10	25 µF	15/18 V		Electrolytic	
C236-10	25 µF	15/18 V		Electrolytic	
C301-10	320 µF	2,5 V		Electrolytic	
C302-10	2,5 µF	64 V		Electrolytic	
C303-10	100 µF	3 V		Electrolytic	
C304-10	25 µF	15/18 V		Electrolytic	
C305-10	25 µF	15/18 V		Electrolytic	
C306-10	25 µF	15/18 V		Electrolytic	
C307-10	25 µF	15/18 V		Electrolytic	
C308-10	100 µF	3 V		Electrolytic	
C309-10	25 µF	15/18 V		Electrolytic	
C310-10	100 µF	3 V		Electrolytic	
C311-10	25 µF	15/18 V		Electrolytic	
C312-10	25 µF	15/18 V		Electrolytic	
C313-10	100 µF	25/30 V		Electrolytic	
C314-10	25 µF	15/18 V		Electrolytic	
C315-10	25 µF	15/18 V		Electrolytic	
C316-10	25 µF	15/18 V		Electrolytic	
C317-10	25 µF	15/18 V		Electrolytic	
C318-10	25 µF	15/18 V		Electrolytic	
C319-10	25 µF	15/18 V		Electrolytic	

Ref. no.	Description		Type	
C320-10	25 μF	15/18 V	Electrolytic	
C321-10	25 μF	15/18 V	Electrolytic	
C322-10	25 μF	15/18 V	Electrolytic	
C323-10	100 μF	3 V	Electrolytic	
C324-10	25 μF	15/18 V	Electrolytic	
C325-10	100 μF	25/30 V	Electrolytic	
C326-10	3000 pF	400 V 10 %	Paper	
C327-10	25 μF	15/18 V	Electrolytic	
C328-10	3000 pF	400 V 10 %	Paper	
C329-10	100 μF	3 V	Electrolytic	
C330-10	25 μF	15/18 V	Electrolytic	
C331-10	25 μF	15/18 V	Electrolytic	
C332-10	100 μF	25/30 V	Electrolytic	

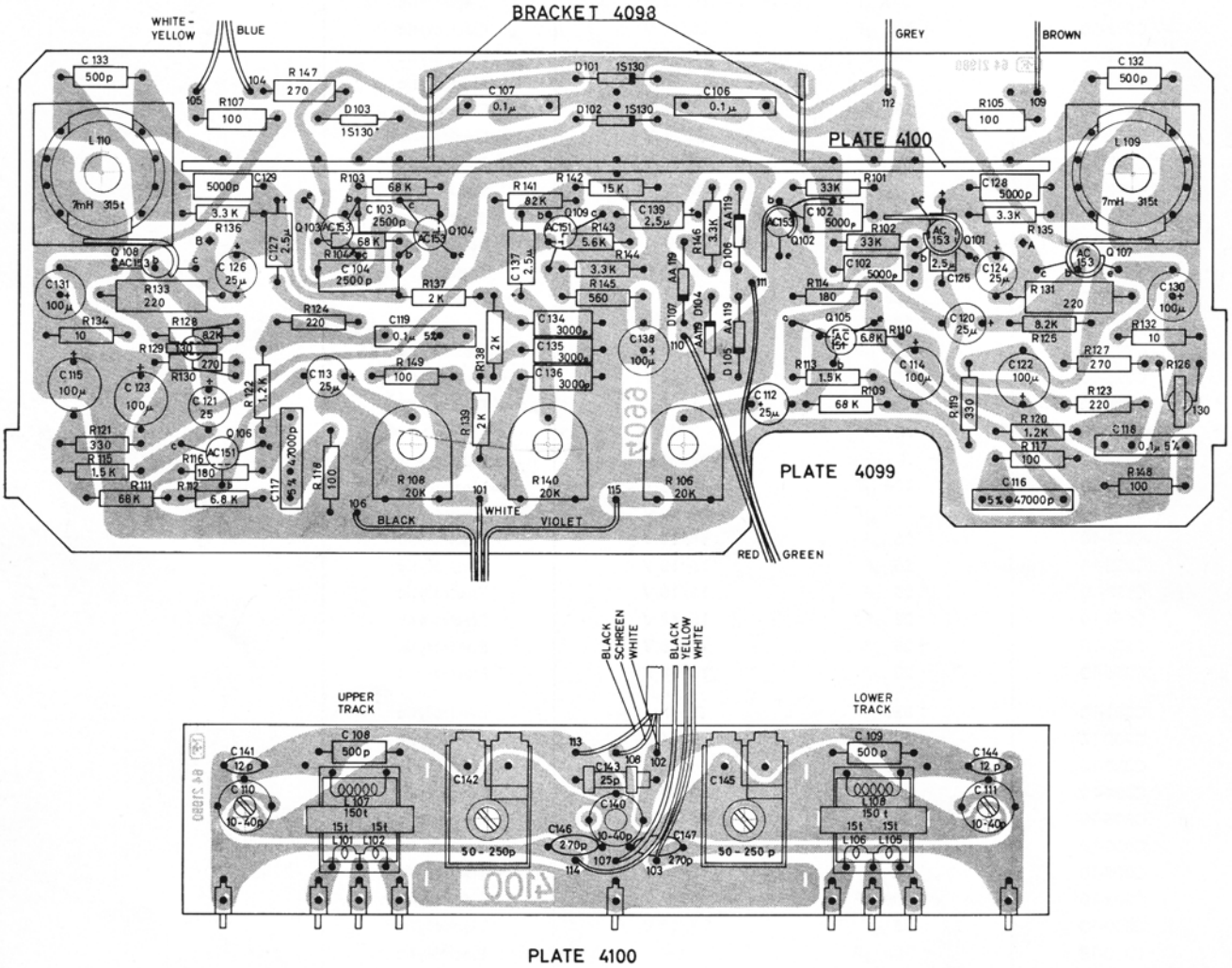


Fig. 51. The oscillator board, component side.

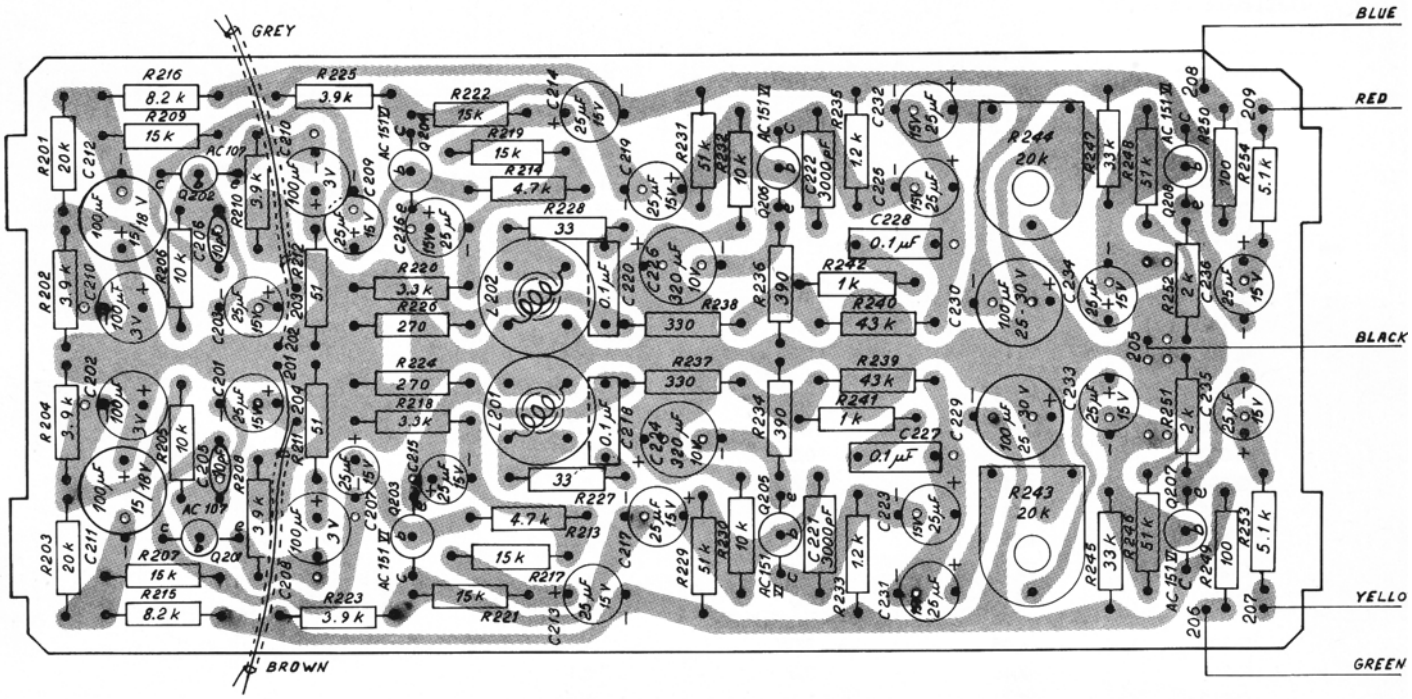


Fig. 52. The playback amplifier board, component side.

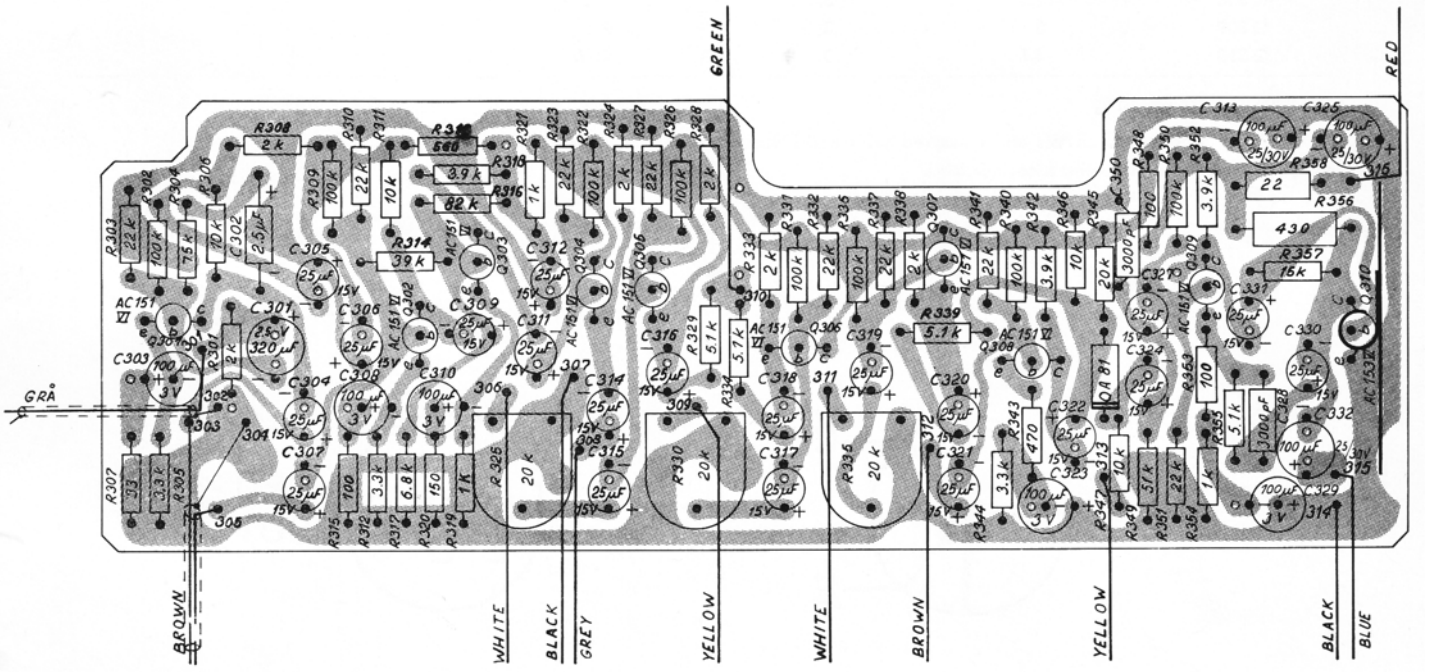


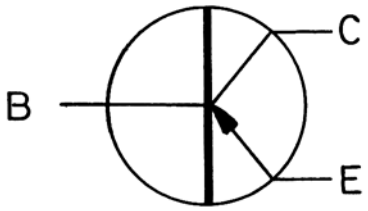
Fig. 53. The step 1 amplifier board, component side.

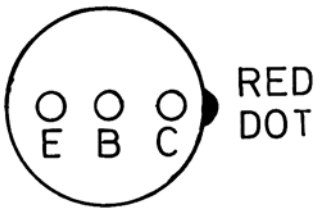
VOLTAGE LEVELS:

Transistor	U_C (V)	U_E (V)	U_B (V)	Notes
Q 101	11,5	0	+ 7,5	transistors must be matched
Q 102	11,5	0	+ 7,5	
Q 103	11,5	0	+ 7,5	
Q 104	11,5	0	+ 7,5	
Q 105	5	1	1,1	
Q 106	5	1	1,1	
Q 107	6,3	0,4	0,5	
Q 108	6,3	0,4	0,5	
Q 109	11	2,35	2,4	
Q 201	5,07	1,55	1,7	
Q 202	5,07	1,55	1,7	
Q 203	8,5	0,6	0,75	
Q 204	8,5	0,6	0,75	
Q 205	10,4	2,5	2,65	
Q 206	10,4	2,5	2,65	
Q 207	18	10,6	10,8	
Q 208	18	10,6	10,8	
Q 301	6,05	2,03	2,14	
Q 302	7,65	2,0	2,1	
Q 303	10,5	1,1	1,24	
Q 304	17,5	3,1	3,2	
Q 305	17,5	3,1	3,2	
Q 306	17,5	3,1	3,2	
Q 307	17,5	3,1	3,2	
Q 308	14,5	3,1	3,2	
Q 309	8	3	3,1	
Q 310	4,1	0	0,18	

ALL TOLERANCES ± 10 %

All levels are referred to chassis and measured with a DC vacuum tube volt meter. The chassis is positive if not otherwise indicated.





LUBRICATING

The motor:

The motor should be lubricated after approx. every 3000 hours of use.
The upper and the lower bearing should be lubricated with a Teresso oil 43 or 47 from Esso.

The self-lubricating bearings:

The turntables, the flywheel and the speed transfer wheel are mounted in self-lubricating bearings and should usually not be lubricated. If, however, it should be necessary to lubricate the bearings for any reason use Teresso oil 43 or 47 from Esso.

Note: Utmost care must be taken while lubricating, use only one fraction of a drop of oil for each bearing. Excessive oil might seriously affect the friction drive.

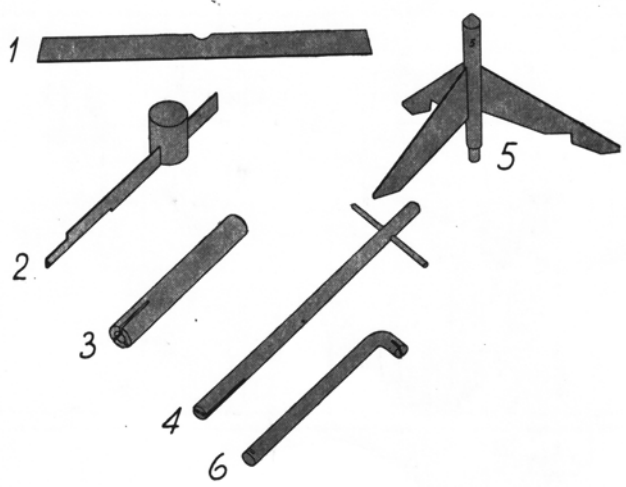
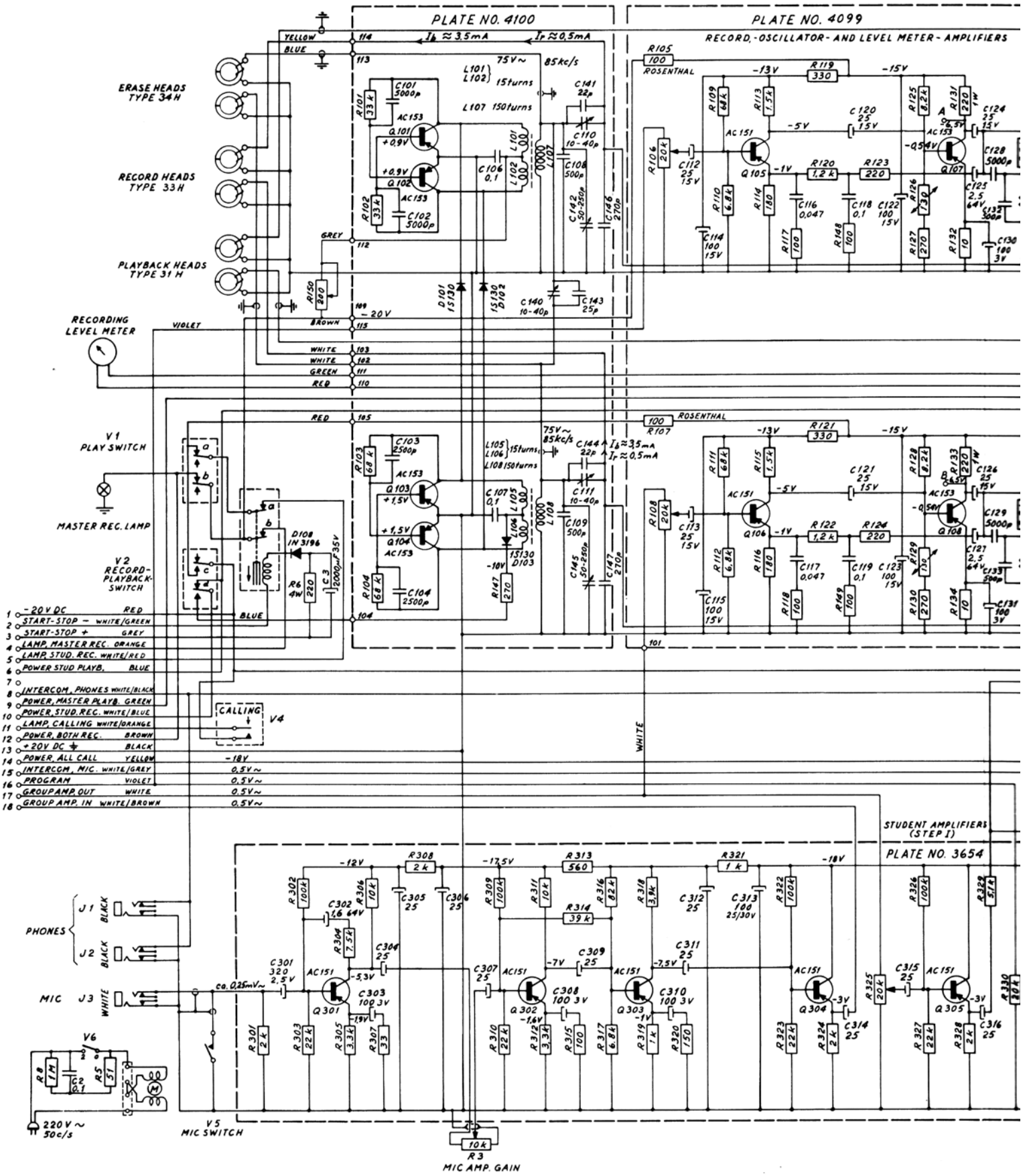


Fig. 54. The special tools.

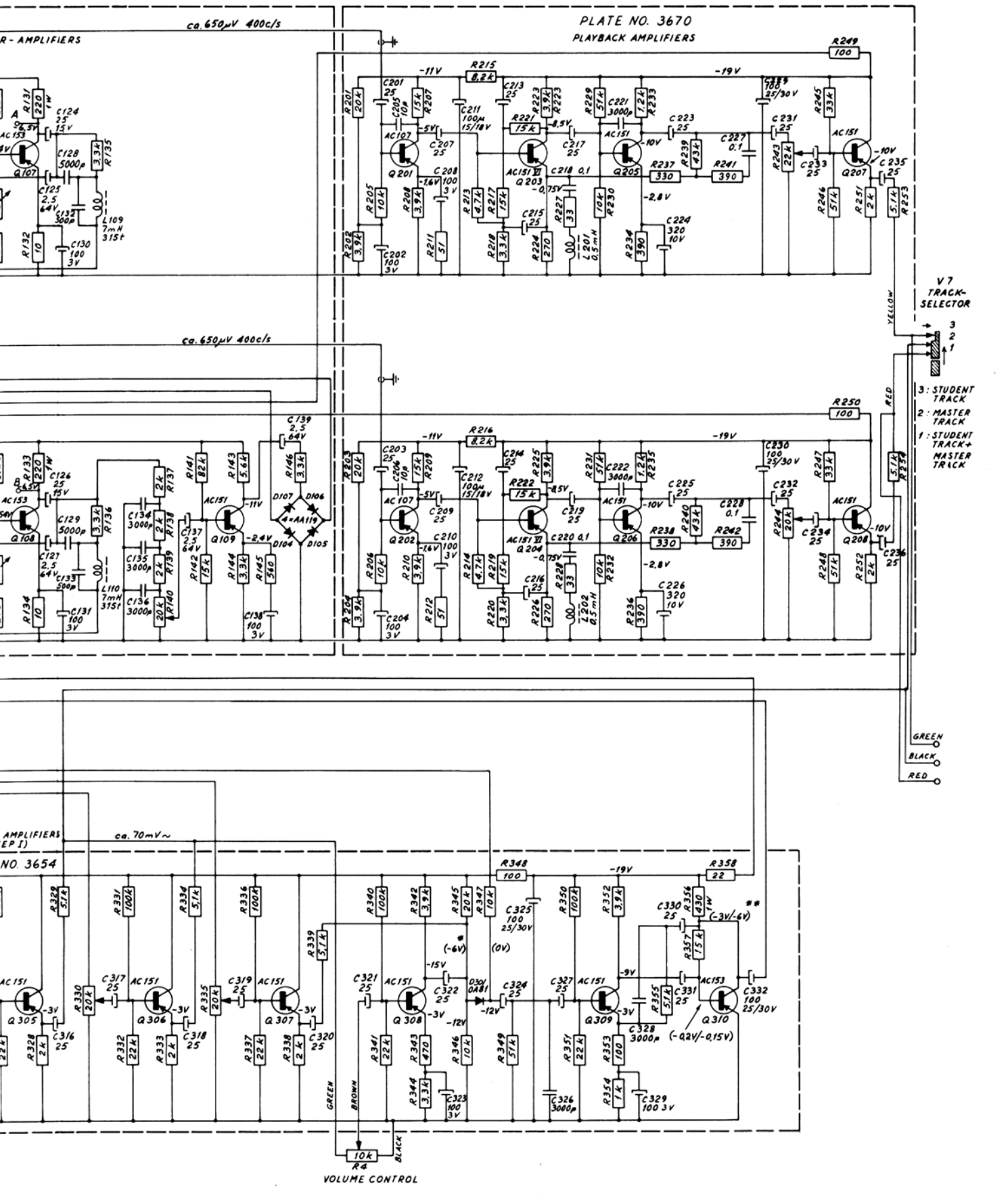


POSITIONS OF SWITCHES:

V1 : NORMAL FORVARD DRIVE
V2 : PLAYBACK
V3 : START
V4 : OFF
V5 : ON
V6 : ON
V7 : S+M

* IN POSITION „ ALL CALL"
** DEPENDING ON OUTPUT

VOLTAGES ARE MEASURED WITH V-METER 20000 Ω/V



WIRING DIAGRAM
MODEL TB 1021
FROM SER. NO. 780601
DRAWING NO. 4118-1
SEPT. 1964

J. Petlitz Boktrykkeri (Rolf Rannem), Oslo, Norge