

Fig. 1

R20107

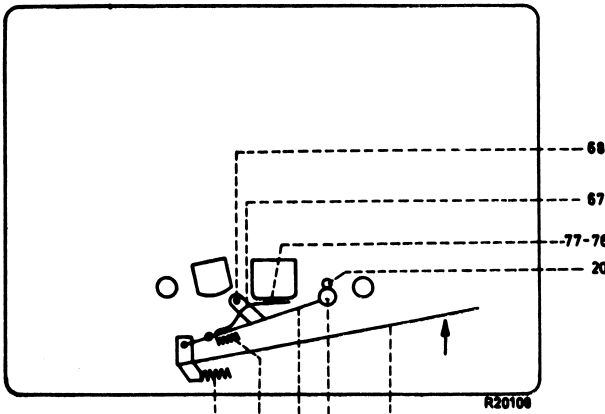


Fig. 2

R20108

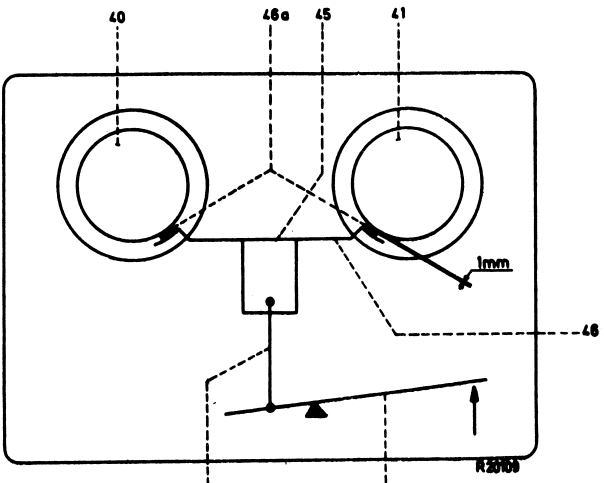


Fig. 3

R20109

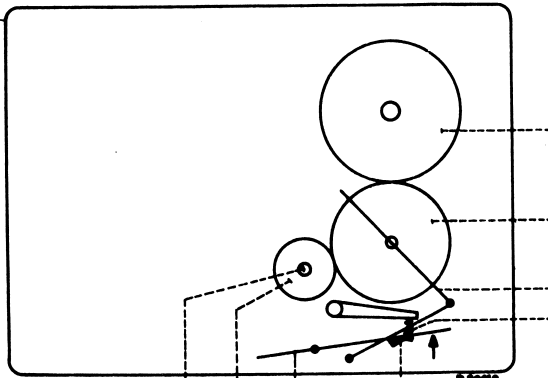


Fig. 4

R20110

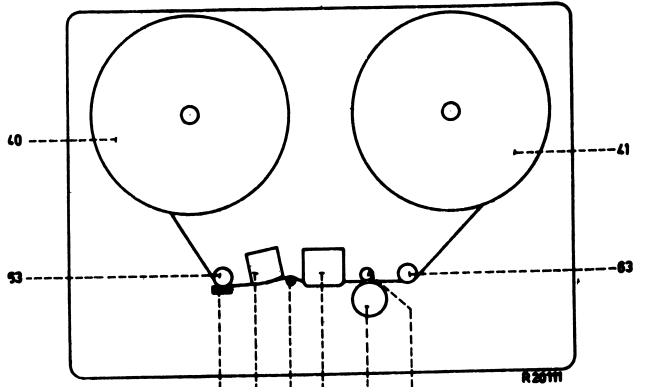


Fig. 5

R20111

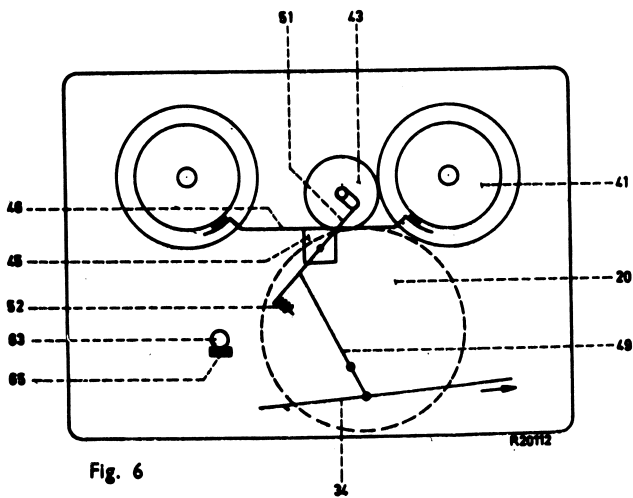


Fig. 6

R20112

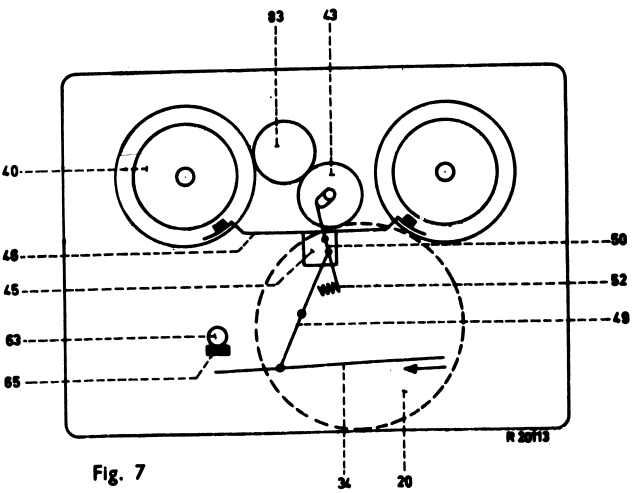
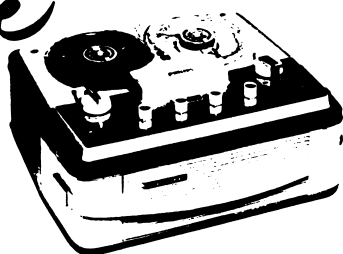


Fig. 7

R20113

RECORDERS

EL 3547A/00



Specification

Mains voltage	: 110-127-220-245 V, 50 c/s
Power consumption	: approx. 20 W
Tape speed	: 1 7/8"/sec - 3 3/4"/sec.
Dimensions	: 390 x 320 x 170 mm
Loudspeakers	: AD 2401-49 at the left, AD 3460M at the front
Weight	: 9 kg.
Reel diameter	: maximum 6"
Winding and rewinding time	: 180 sec. for 260 m tape

Transistors

TS1 - TS101	: OC58 or AC107
TS2 - TS102	: OC75
TS3 - TS103	: OC44
TS4 - TS104	: OC75
TS5 - TS105	: 2OC74
TS6 - TS106	:
TS7 -	: OC79

Sensitivities

BU4	: Microphone 2 x 0.6 mV over 5 k Ω
BU1 + BU2	: pick-up 2 x 130 mV over 1 M Ω
BU3	: radio 2 x mV over 20 k Ω

Output voltage

BU5	BU7 - BU107	BU3
headphone	loudspeaker	diode
2 x 350 mV	2 x 600 mW	2 x 1.5 V
2 x 15 k Ω	2 x 5.6 k Ω	2 x 20 k Ω
microphone	: EL 3757-00	
5" reel	: EL 3912-00	
5" reel	: EL 3915-80	
starting tape-red	: EL 3918-65	
starting tape-green	: EL 3917-65	
adhesive tape	: EL 3916	
connecting cable-radio	: EL 3768-04	
headphone-stereo	: EL 3992-38	

Description of the working of the mechanism

a) The motor 17 has been coupled with the flywheel 20 by means of a belt. As soon as the apparatus is switched on, the motor and, as a result, the flywheel starts turning, fig. 1.

b) Tape Transport

During recording and playback the tape transport takes place from the left-hand winding disc 40 to the right-hand winding disc 41. By depressing the key 31 the bracket 34 is pressed forward. By this, the pressure roller 72 is pressed against the capstan 20 by means of the pin at the pressure roller lever 73, fig. 2.

The pressure spring 38 ensures a correct pressure against the capstan. By turning the pressure roller lever the felt 77 on the bracket 76 is freed by the lip on bracket 67. The tension spring 78 presses the pressure felt 77 against the recording playback head as a result of which the tape is pulled properly positioned along the slit of this head. By the pressing forward of bracket 34, the brake 46 is lifted, the friction coupling for the right-hand winding disc is switched on and the pressure felt 65 is pressed against the tape guide.

The brake is lifted because the bracket 49 pulls back the slide 45, which retains the brake bracket 46. As a result, the brake shoes 46a are lifted about 1 mm from the winding discs, fig. 3.

The friction coupling is switched on because the bracket 81 is freed and is attracted by spring 55. By this, the idler wheel bracket 54 with idler wheel 53 is pressed between right-hand winding disc 41 and driving ring 152, fig. 4.

The driving wheel 152 has been coupled by a felt ring with the flywheel. The force is determined by the pressure of three pressure springs 150 and the friction coefficient of the felt. By this friction coupling it is obtained that the number of revolutions of the right-hand winding disc depends on the quantity of tape on the reel.

The felt 65 is freed by the bracket 34 and is pressed by the spring 66 against the left-hand tape guide 63 and the tape is braked with a constant force. So it is obtained that the tape is pulled with a constant tension along the heads since this tension does not depend on the quantity of tape on the left-hand winding disc 40.

In the positions "recording" and "playback" the tape comes from the left-hand winding disc and goes to the capstan 20 via left-hand tape guide 63 with felt 65, erasing head 71, pin 68 and recording/playback head.

Pin 68 ensures that the tape runs over a great part along the erasing head and the recording playback head. The capstan 20 pulls the tape through the apparatus in combination with the pressure roller 72. After this, the tape is wound on the right hand winding disc 41 via the right-hand tape guide 63, fig. 5.

c) Fast forward winding

By turning knob 31 in the direction \rightarrow bracket 34 is pushed to the right. By this, bracket 49 is turned so that the coupling wheel 43 is pressed against flywheel 20 and winding disc 41, by bracket 51 and spring 52, fig. 6.

The tape is now wound at great speed on the right-hand winding disc 41.

By turning bracket 49 the slide 45 is also pulled back as a result of which brake 46 is lifted.

In order to be able to wind forward the tape tightly, the felt 65 has been liberated and is pushed against the left-hand guide 63 by the spring 66, as a result of which the tape is kept taut.

d) Fast rewinding

By turning the knob 31 in the direction \leftarrow the bracket 34 is pushed to the left. By this, the coupling wheel 43 (by the turning of bracket 49) is pushed by bracket 50 and spring 52 against the flywheel 20 and idler wheel 83.

Since the idler wheel 83 drives the left-hand winding disc 40, that tape will be wound at great speed on the left-hand winding disc. At the same time, (by the turning of bracket 49) the slide 45 is pulled back as a result of which the brake 46 is lifted, fig. 7.

In order to be able to rewind the tape tightly, the pressure felt 65 has been freed and is pressed against the left hand tape guide 63 by the spring 66, as a result of which the tape is kept tight.

Mechanical adjustments

A. Recording/playback head

The recording/playback head must be so adjusted that the tape guide of the head is at the same level as the tape guides pos. 63. At the same time the air gap should be in vertical position, fig. 8.

This can be adjusted and checked in the following way.

Screw the pin 68 out of the apparatus.

Adjust the height of the head (without protecting cap 16) in such a way with the aid of the 3 screws A+B that it stands straight at about the correct level, fig. 9.

Play a super longplaying tape (for instance EL 3915/80) in the apparatus.

Push the pressure roller lever forward and see whether the tape, without touching the tape guide, is pulled against the head. Here, the felt on bracket 76 should be retained by hand.

If the tape, however, remains jammed on the lower or upper lip of the tape guide, then the height of the head should be re-adjusted by the screws A+B until the tape is pulled against the head without jamming by moving the pressure roller lever forward. (if necessary, tighten the tape a little here by turning the left-hand winding disc somewhat anti-clockwise by hand).

Now place the test tape WT 939 15 in the apparatus.

Switch on the apparatus and put it in the position "reproduction".

Connect a valve voltmeter to BU7 with a resistor 5.6 Ω in parallel. Adjust with screw B to maximum output voltage "A" on channel 1-4.

After that, effect the same on channel 2-3 to maximum value "B".

Now measure the output voltage of track 1-4 again.

Suppose this value to be "C". If the distance from "A" to "C"

≤ 2 dB, then the adjustment is in order.

If, however, the distance from "A" to "C" > 2 dB, then track 1-4 should again be adjusted to maximum output voltage. This is "A". Now measure the output voltage of channel 2-3 and suppose this value to be "D". The distance between "B" and "D" may not be more than 2 dB.

Checking

For this check, we need about 100 cc carbon tetrachloride with dissolved therein $\frac{1}{2}$ gramme iron powder with a grain size of 3-5 μ . (A9 881 36/F10).

It is advisable to pour this liquid into a bottle which has a wide neck.

Record 4 tracks of 1000 c/s at 100 % modulation on a piece of tape, (short-circuiting the erasing head). Immerse a piece of about 10 cm in the bottle containing the abovementioned liquid, then shake the bottle thoroughly, wait for about 10 seconds and take the piece of tape cautiously out of the liquid. The iron powder has deposited itself on the place of the 4 tracks.

The track picture should be nicely symmetrical as drawn in fig. 10. Should this track picture not appear properly symmetrical, then the following can be checked:

1. The tape rubs against the tape guide on the head during recording or playback;

2. The tape guide on the head has moved with respect to the cores (replace head).

B. Erasing head

The height of the erasing head should be so adjusted that the tracks to be erased are entirely erased and the tracks not to be erased are not to be attenuated more than 1.5 dB.

Adjustment

Place a tape in the apparatus.

Adjust the height by means of the three screws so that the upper core protrudes about 0.1 mm above the upper side of the tape. The core should run parallel to the tape.

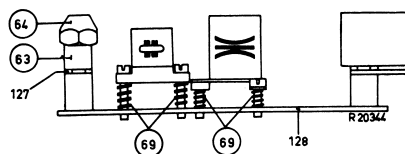


Fig. 8

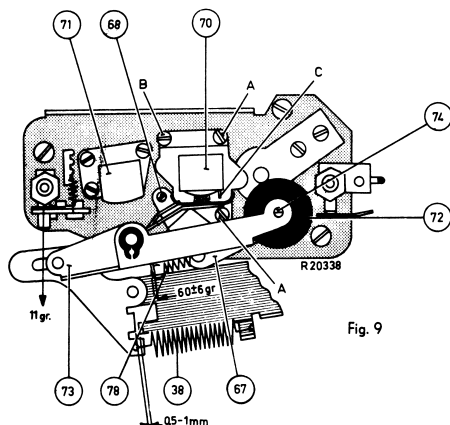


Fig. 9

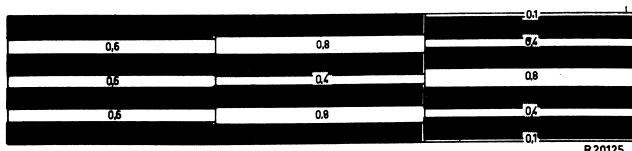


Fig. 10

Checking

Make a stereo recording.

Play this back and adjust the output voltage to 1 V with the volume control.

Do not turn volume control anymore.

Turn over the tape and erase on track 1 (1-4) and track (2-3).

Turn the tape over again and measure the output voltage of the tracks 2 and 4.

This should be ≥ 850 mV.

If the signal of track 2 was attenuated too much in the position 2-3, then the head should be adjusted lower.

If the signal of track 2 was attenuated too much in the position 1-4, then the head should be adjusted higher.

If the signal of track 4 was attenuated too much, then the head must be adjusted higher.

If necessary, repeat the above.

Erase the tracks 2 and 4 then play them back. No sound may now be heard.

C. Tape guide

With a 4-track apparatus it is very important that the tape runs at the correct height, and without wrinkling, through the apparatus. This implies that if one or more of the following parts are replaced or readjusted, it must also be checked whether the course of the tape is interfered with or not.

These parts are:

Erasing head
Pin 68
Recording/playback head
Capstan
Right-hand winding disc

The point of departure from this adjustment is the height of the left-hand/right-hand tape guide, pos. 63.

The height of the recording/playback head should be adjusted as described under "Recording/playback head".

The pin 68 should be removed with these adjustments. Here the pin must be so turned that the adjusted course of the tape is not interfered with. After the adjustment of the pin 68, this should be sealed with wax.

If the above adjustments are in order, it still may occur that if the apparatus is switched to recording or playback, the tape rubs against the tape guide or gets out of shape. This is due to the fact that the capstan has not been perpendicularly adjusted.

This can be adjusted as follows:

Undo the 3 screws 215 so that the mounting plate 128 can just be moved.

Place a super long playing tape in the apparatus and switch it into the position playback.

Now adjust the capstan by moving the plate 128 so that the tape is pulled without wrinkling through the apparatus.

The last thing to do is, to check the height adjustment of the winding discs 40 and 41. Here one should be careful that the tape is wound in the middle of the reel or at least does not rub against the flanges of the reel, fig. 13.

This height of the right-hand winding disc can be adjusted by reducing or increasing the number of filling rings 112, fig. 12.

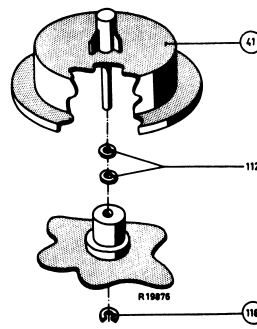


Fig. 12

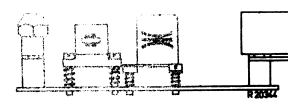


Fig. 11

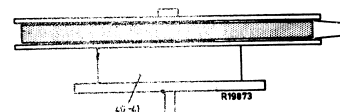


Fig. 13

Taking the chassis out of the casing

- Pull the knobs from the spindle.
- Undo the four screws 12 and cap nut 13.
- Remove ornamental plate 14.
- Undo the four screws with which the mechanism has been mounted in the case.
- Take the mechanism out of the case.

Replacement of pressure roller 72

- Remove ornamental plate 14 as described under "taking the chassis out of the casing".
- Undo spindle 74 of pressure roller 72.
- Remove pressure roller 72. Pay attention to washers 75 under and over pressure roller 72.
- Mount in reverse order.

Replacement of pressure felt 77 which presses against recording/playback head 70

- Remove ornamental plate 14 as described under "taking the chassis out of the casing".
- Unhook spring 78 from pressure bracket 73.
- Loosen retaining rings 115d and pull pressure roller lever 73 upwards. The pressure felt 77 can easily be removed now and replaced by a new one.
- Mount in reverse order after replacement.

Replacement of turntables 40 or 42

- Take the chassis out of the casing.
- Remove retaining ring 118 from turntable at bottom of apparatus.
- Pull brake bracket 46 from turntables and lay it on the left for right-hand turntable and to the right for left-hand turntable.
- When mounting adjust the height correctly.

Replacement of driving belt 82

- Take the chassis out of the casing.
- Undo screws 146.
- Remove belt 82 from motor pulley 18.
- Take belt out of groove of flywheel 20.
- Lift bracket 142 so far from mounting plate 136 so that belt 82 can be taken out between mounting plate and bracket 142.
- Mount in reverse order.

Replacement of brake bracket 46

- Remove ornamental plate 14 as described under "taking chassis out of casing".
- Remove tension spring 52, retaining ring 116a and brackets 50 and 51.
- Dismount brake bracket 46 afterwards.
- Mount the new brake bracket 46 in reverse order.

Replacement of brake shoe 46a

- Remove the ornamental plate 14 as described under "taking chassis out of the casing".
- Removing old brake shoe with small knife.
- Clean the metal with white spirit or acetone.
- Smear brake shoe 46a and metal slightly with pliobond, code number A9 881 15/t30.
- Allow to dry for about 15 minutes and press brake shoe on bracket 46.
- Allow to dry for another one and a half hour more and mount it in the apparatus.

Replacement of idler wheel 43

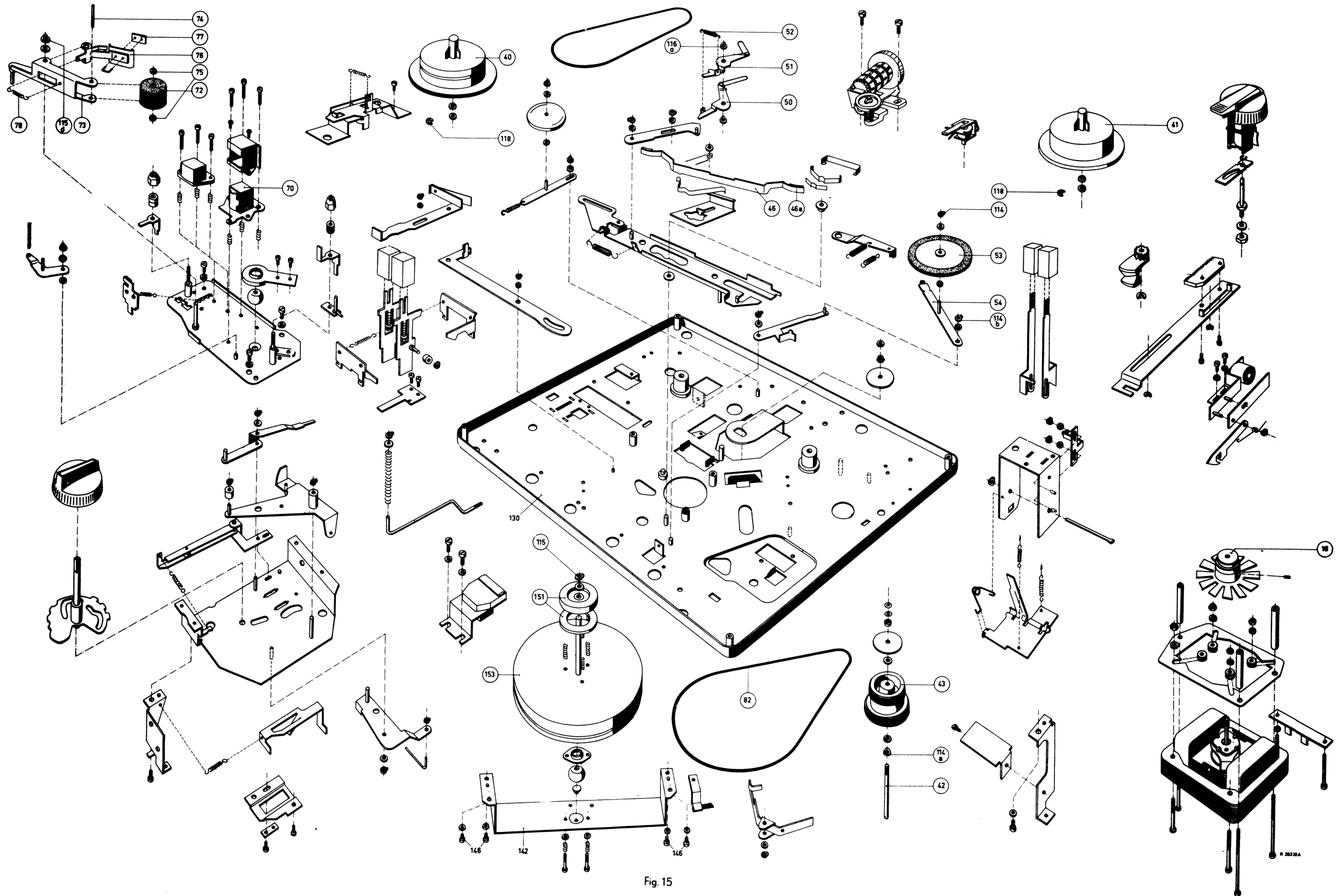
- Take the chassis out of the casing.
- Remove retaining ring 114a.
- Idler wheel 43 can then be taken from spindle 42.
- Mount in reverse order.

Replacement of idler wheel 53

- Remount the ornamental plate 14 as described under "taking chassis out of the casing".
- Remove retaining ring 114b.
- Turn bracket 54 with idler wheel 53 sideways.
- Remove retaining ring 114c and replace idler wheel.
- Mount in reverse order.

Replacement of winding friction

- Take the chassis out of the casing
- Undo screws 145 and 146 and pull bearing bracket 142 upwards.
- Take flywheel from apparatus.
- Remove the clamping ring 115.
- Dismount winding friction.
- The components can now be cleaned or replaced.
- The felt rings can be cleaned with a brush.
- The polyamid ring can be cleaned with white spirit or alcohol.
- Mount in reverse order. Pay attention that ears of bearing bracket 142 should fall into the holes of mounting plate.
- The clamping ring 115 should be so mounted that it can be moved 1 mm.



Maintenance

After about 500 operating hours it is recommended to clean apparatus and to lubricate at various points.

Clean with white spirit or alcohol

Guiding rollers 63 - erasing head - recording/playback head - capstan - pressure roller- driving belt - running surface of flywheel- running surface of idler wheels - running surface of turntables 40-41.

The pressure felts 65 and 77 should be cleaned with a brush.

Lubricate with oil : X100 Multigrade 20 - 40

About one drop per bearing.

Bearing of motor - bearing of idler wheel 53 - bearing of turntables 40-41 - pressure roller bearing - bearing of idler wheel - bearing of flywheel.

Lubricate with grease : Sheel Alvania EP2

Cam and plate springs and control lever 34 - switch knob 31 and control lever 34 - stop bracket 45 and mounting plate - pen on bracket 49 and stop bracket 45 - discs for idler wheel 43 - idler wheel bracket on mounting plate - locking of recording key.

Note: After replacement the newly mounted parts should be lubricated as well.

Modification from 50 to 60 c/s and vice versa

From 50 to 60 c/s

- Take the chassis out of the casing.
- Undo the screws 138 with which the motor unit has been fixed.
- Remove the pulley 18 and mount a 60 c/s pulley.
Code number WT 897 11.
- This pulley should be mounted as the same height as the old one.

From 60 to 50 c/s

As from 50 to 60 c/s however, mount 50 c/s pulley.
Code number WT 896 98.

Step by step amplification plus voltages

In position "recording" the following supply voltages should be measured:

V ~ GL1	14.2 V	± 5 %
V = C21	18 V	
V = C13	15 V	
V = C 4	12 V	± 10 %
V = C19	11.5 V	

The abovementioned voltages are measured with a moving coil instrument (P 817 00/01) of 40,000 Ω /Volt.

Recording Sensitivity

Turn the volume control R50 (R150) to maximum and put the apparatus in position "Stereo recording" at $3\frac{3}{4}$ " /sec. Apply to the tone generator a signal of 1000 c/s with an input voltage of 250 mV on BU2 point 1 (3).

The following collector voltages should then be measured:

Collector	TS1 - TS101	(K1 - K101)	13 - 30
"	TS2 - TS102	(K2 - K102)	1.5 - 5.5 mV
"	TS3 - TS103	(K3 - K103)	100 - 350 mV
"	TS4 - TS104	(K4 - K104)	2.5 - 6.5 V
Base	TS5 - TS105	(B5 - B105)	2.3 - 2.4 V
"	TS6 - TS106	(B6 - B106)	750 - 850 V
	C20 - C120		1.5 - 1.7 V

In figure 17 it has been stated that the abovementioned voltages have been measured on the print.

The voltages indicated in a rectangle apply to playback.

The voltages indicated in a circle apply to recording.

These voltages have been measured with valve voltmeter GM 6012.

Playback sensitivity

- . Turn R48 (R148) and R47 (R147) to maximum.
- . Turn R46 (R146) - balance - to the centre position.
- . Switch the apparatus in position "Stereo playback" to $3\frac{3}{4}$ " /sec.
- . Apply via 100 k Ω a signal of 200 mV to BU5 point 4 (5).
- . The following alternating voltages should then be measured.

Collector	TS1 - TS101	5 - 14 mV
"	TS2 - TS102	4 - 5.5 mV
"	TS3 - TS103	400 - 600 mV
"	TS4 - TS104	7.5 - 8.8 V
Base	TS5 - TS105	6.8 - 7.2 V
"	TS6 - TS106	2.2 - 2.3 V
Top of	T 2 - T102	4.8 - 4.9 V

Description of diagram

The apparatus can be switched electrically into eight positions.

These are:	Stereo	- Recording 1	Playback 11	Amplifier 111
	Mono 1-4	- Recording 1V	Playback V	
	Mono 2-3	- Recording V1	Playback V11	
	Multi-play	V111		

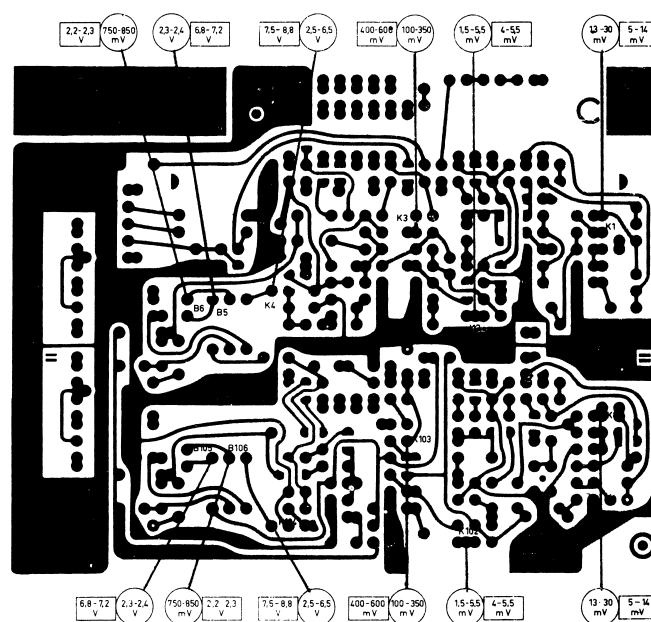
These positions are described hereunder.

The components mentioned between brackets apply to the description of the right channel and the others to the left channel.

Position 1 - Stereo recording, fig. 18

The pick-up signal originating from BU1 point 1 (4) or BU2 point 4 (s) is applied via R1 (R101) and C1 (C101) to the base of TS1 (TS101). The radio signal originating from BU3 point 1 (4) is applied via R2 (R102) and C1 (C101) to the base of TS1 (TS101).

The microphone signal originating from BU4 point 1 (4) is applied via R3 (R103) and C1 (C101) to the base of TS1 (TS101).



The signal applied to the base of TS1 (TS101) is amplified and applied via C2 (C102), R50 (R150), R43 (R143) (R166) and C12 (C112) to the base of TS2 (TS102).

With R50 (R150) the volume is controlled.

The signal amplified by TS2 (TS102) is applied via C5 (C105) to the base of TS3 (TS103) which amplifies and via C10 (C110), R27 (R127) and C11 (C111) to the base of TS4 (TS104). From C10 (C110) the signal is fed back in counterphase via R22 (R122), R55 (R155), R49 (R149) and C6 (C106) to the emitter of TS2 (TS102).

Because there is a frequency dependent network between R22 (R122) and R55 (R155) which has been connected with mass, the degree of negative feedback is consequently frequency dependent. As a consequence the highest frequencies which can be recorded with the corresponding tape speed can be amplified additionally. With $3\frac{3}{4}$ " /sec. the circuit C23 (C123), R45 (R145) and L1 (L101) will operate. With $1\frac{7}{8}$ " /sec. the circuit C8 (C108), R40 (R140) and L1 (L101) will operate.

From the collector of TS4 (TS104) the bases TS5 and TS6 (TS105 and TS106) are controlled by means of T4 (T101).

These two output transistors are mounted in the single ended push-pull circuit.

The output signal is applied via C20 (C120) and R42 (R142) to head K1 (K101).

Via R59 (R159) and R51 (R151) the signal is fed back in counterphase to the output amplifier.

GR2 (GR102) rectifies this L.F. signal by which C30 is charged and meter I will show deviation.

Via potentiometer R53-R54 (R153-R154) a signal for headphone connection is applied to point 1 (3) of BU5.

The H.F. bias current is applied via C26 (C126) to head K1 (K101). Its new value is adjusted by trimmer C26 (C126).

The measuring place for the head current of head K1 (K101) has been led outward via point 4 (5) of BU5.

The H.F. current is generated by TS7 and applied to head K2 (K102) from point 3 of L3.

The oscillator frequency is determined by self-inductance of K2 (K102) and the capacitance of C203 (C204). The H.F. bias current is conducted from point 4 of L3 to the trimmer C26 and (C126).

Position 11 - Stereo playback - fig. 19

The signal of K1 (K101) is applied via C1 (C101) to the base of TS1 (TS101). The amplified signal is applied via C2 (C102), R63 (R163), R166 and C12 (C112) to the base TS2 (TS102). TS2 (TS102) amplifies this signal after which it is applied via C5 (C105) to the base of TS3 (TS103). The signal amplified by TS3 (TS103) is applied via C10 (C110). R48-R46-R25 (R148-R146-R125) R27 (R127) and C11 (C111) to the base of TS4 (TS104).

From C10 (C110) the signal is fed back in counterphase via C7 (C107), R18 (R118) or R52 (R152), R49 (R149) and C6 (C106) to the emitter of TS2 (TS102). The two output transistors TS5 (TS105) and TS6 (TS106) are controlled by means of T1 (T101) by the amplified signal of TS4 (TS104). The output signal is applied via C20 (C120) and T2 (T102) to loudspeaker L (R).

From C27 (C127) the signal of the output stage is fed back in counterphase by R51 (R151) to the base of TS4 (TS104).

The high frequencies are controlled by R47 (R147) and C24 (C124).

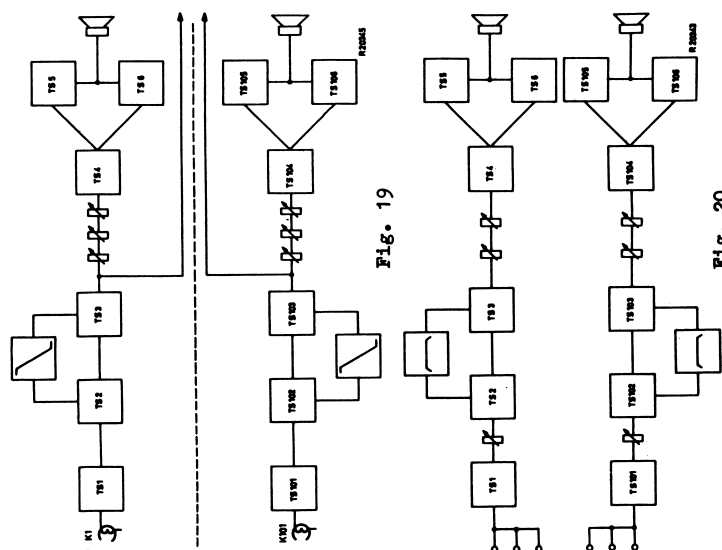


Fig. 19

Fig. 20

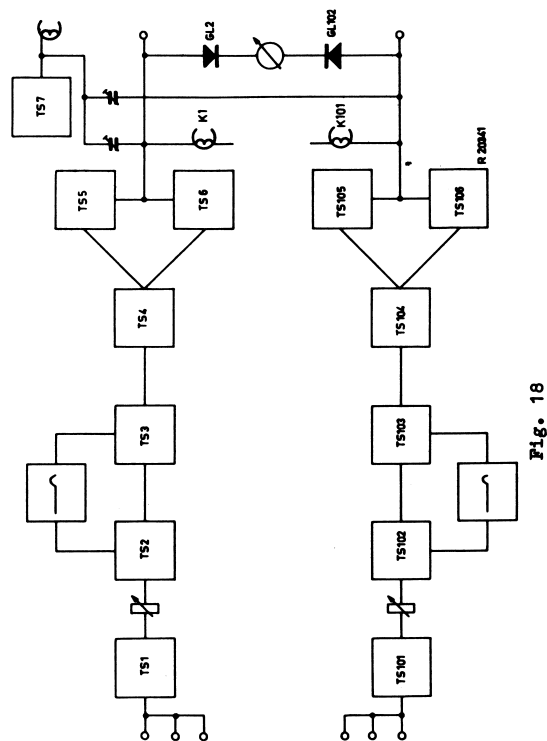


Fig. 18

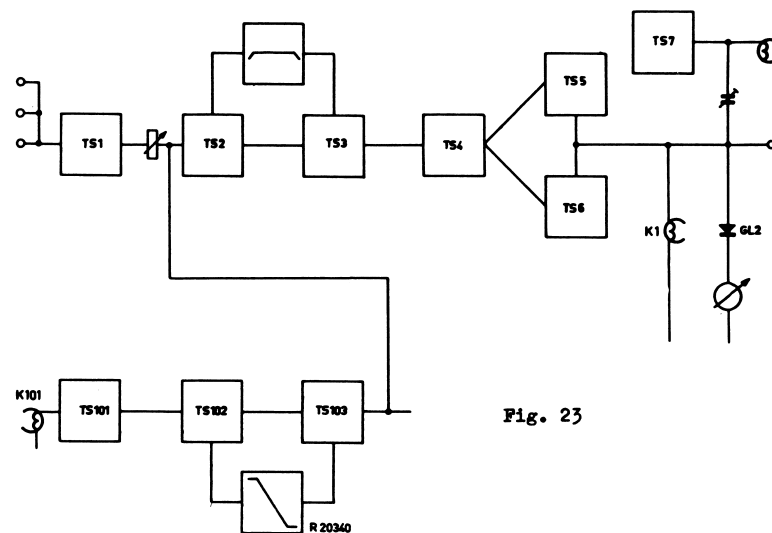


Fig. 23

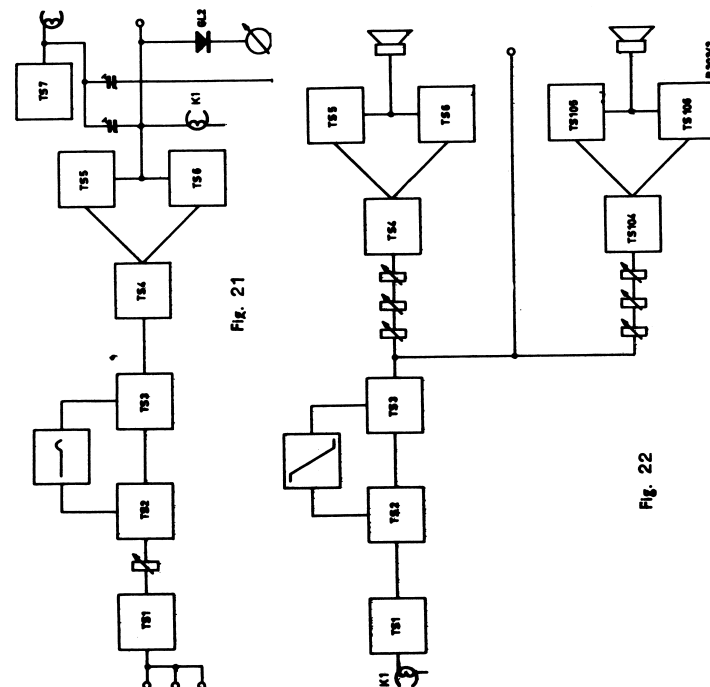


Fig. 21

Fig. 22

Position 111 - Amplifier P.A. - fig. 20

In this position the signals of radio, pick-up or microphone are amplified by TS1 (TS101) to TS6 (TS106) and passed on to loudspeaker L (R).

Position IV - Mono 1-4 - Recording - fig. 21

In this position the signal is amplified by TS1 to TS6 and applied to head K1. TS7 has been mounted as an oscillator for H.F. erasing current and bias current. To K2 the erasing current is applied and via C26 the bias current is applied to K1.

Position V - Mono 1-4 - Playback - fig. 22

In this position the signal of head K1 is amplified by TS1 to TS3 and played back via two output stages and two loudspeakers, namely TS4 to TS6 and TS104 to TS106 and L and R.

Position VI - Mono 2-3 - Recording

Like position IV, but the signal is applied to K101, the erasing current to K102 and the bias current via C126 and K101.

Position VII - Mono 2-3 - Playback

Like position V, but the signal is taken from K101.

Position VIII - Multi-play, fig. 23

In this position the signal is taken from K1 or K101 and applied to K101 or K1, whereas signal of radio, pick-up or microphone can also be mixed. The signal originating from the playback head is amplified by TS101 to TS103 and applied via R62 and R44 to C12. Here, the signal is mixed with the radio, pick-up or microphone signals amplified by TS1. The mixed signal is amplified further by TS2 to TS6 and applied to the recording head. TS7 ensures the H.F. erasing and bias currents.

Bias current

After replacement of a recording/playback head the bias current should be adjusted again. This should be done as follows:

- Switch the apparatus on to $3\frac{3}{4}$ " /sec.
- Record a signal of 1000 and 13000 c/s on a piece of super long play tape with an input voltage of 13 mV on BU 1, points 1 and 3.
- During this the volume control should be adjusted to maximum.
- Play back this recording and measure the output voltage on BU3, points 4 and 5.

This voltage should have the following requirements:

- The output voltage with 13 kc/s should not deviate more than 6 dB (factor 2) from the output voltage with 1000 c/s.
- The distortion should not be more than 5%.

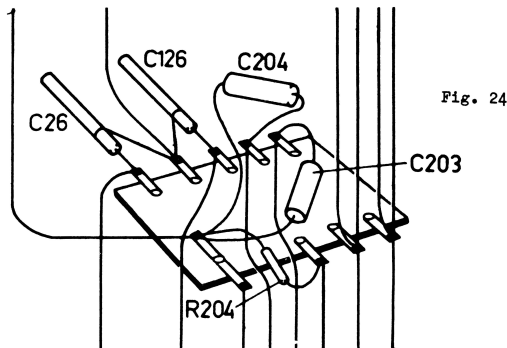
If a is not met, the bias current should be reduced. For channel 1-4 it can be done by means of C26 and for channel 2-3 by means of C126.

If requirement b is not met, the bias current should be raised by soldering either a small ceramic capacitor of about 20 pF in parallel with C26 or C126 or mounting a new trimmer and adjusting it to the right level.

Adjustment amplification of TS1-R64 (TS101-R164)

After replacement of TS1 (TS101), R64 (R164) should be adjusted again.

- Switch on the apparatus to Stereo recording $3\frac{3}{4}$ " /sec.
- Turn R50 (R150) to maximum.
- Apply to BU3 point 1 (3) a signal of 1000 c/s with an input of 130 mV.
- Connect a valve voltmeter to BU5, point 4 (5).
- Adjust with R64 (R164) the output voltage to 15 mV.



Adjustment of R63 (R163)

- Turn R63 and R163 to minimum resistance.
- Turn R48 (R148 and R47 (R147) to maximum.
- Turn R46 (R146) to centre position.
- Put a test tape modulated with 4000 c/s (A9 868 39) in the apparatus and switch on to "Stereo playback".
- The strength of the louder signal should be adjusted to the strength of the other signal.
- If the left-hand channel is stronger than the right-hand channel, a correction should be made with R63.
- If the right-hand channel is stronger than the left-hand channel a correction should be made with R163.

Adjustment of L1 (L101)

- Turn R50 (R150) to maximum.
- Apply a signal with a frequency of 1000 c/s to BU1, point 3 (1).
- Connect a valve voltmeter to BU5, point 4 (5).
- Switch the apparatus on in position Stereo to $1\frac{7}{8}$ " /sec. and push recording key only.
- The input signal should be adjusted in such a way that the valve voltmeter indicates 3 mV.
- During this the input voltage should be $26\text{ mV} \pm 2\text{ dB}$.
- Maintain the input voltage and raise the frequency to 10 kc/s.
- Adjust by means of core of L1 (L101) the output voltage at BU5, point 4 (5) to 19 mV.

Adjustment of L102

- Switch on the apparatus in position "Multi-play".
- Connect a valve voltmeter to BU3, point 5.
- Adjust with the core of L102 the output voltage to minimum deviation.

Note: L102 and C116 filter during "Multi-play", the H.F. voltage originating from the recording head from the playback amplifier.

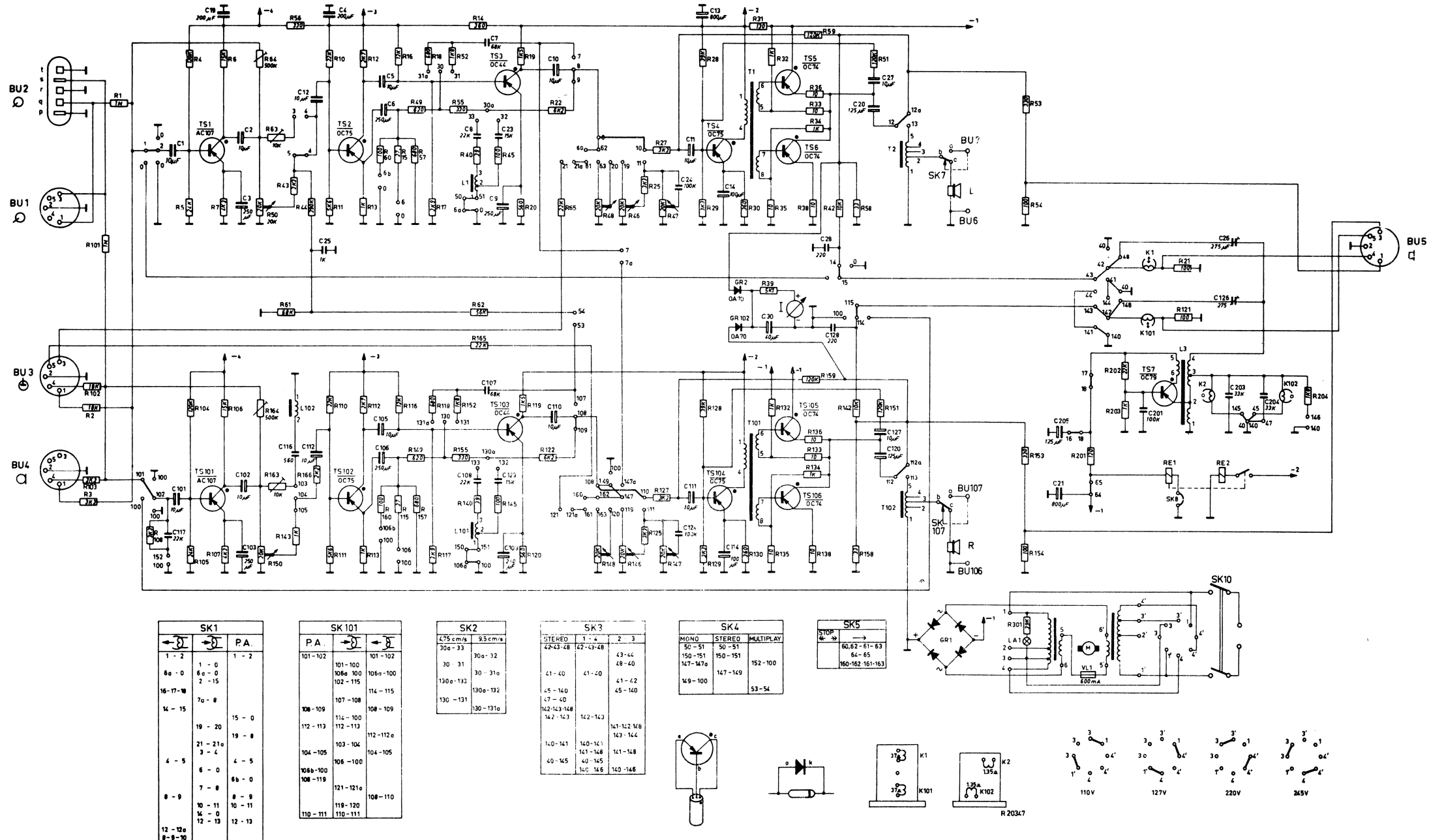
TS1-Ts101	AC107-OC58	C6-C106	C426 AM/B250
TS2-Ts102	OC75	C7-C107	C426 AM/B250
TS3-Ts103	OC44	C10-C110	909/W10
TS4-Ts104	OC75	C11-C111	909/W10
TS5-Ts105)	OC74	C12-C112	909/W10
TS6-Ts106)			

TS7	OC79	C13	C430 BL/F800
		C14-C114	C426 CE/B100
GR1	WRE 981 21/826	-C116	904/560E
GR2-102	OA70	-C117	906/22K
LA1+R301	WY 851 58	C19	909/W200

T1 -T101	WT 511 25	C20-C120	909/C125
T2 -T102	WT 511 26	C21	C 430 BL/F800
L1 -L101	WT 562 22	C26-C126	907/45E-275E
L 102	WT 591 01	C27-C127	909/W10
L 3	WT 562 21	C30	C 426 AM/E40

R46+R146	E 091 ZZ/26
R47+R147	E 091 AG/30D30
R48+R148	E 091 AD/30D30
R50+R150	E 091 AG/30D30
R63-R163	E 097 AC/10K
R64-R164	E 097 AC/500K

16	WY 820 40	Screening cap for head
17	JW 412 17	Motor
18	WT 896 98	Pulley 50 c/s
18	WT 897 11	Pulley 60 c/s
19	997/3x4	Set screw
25	WT 265 56	Shaft Support
26	WT 478 64	Trust plate
27	WT 277 17	Bearing plate
28	WT 730 42	Pressure spring
30	WT 856 89	Selector knob
31	WT 856 90	Control knob
34	WT 837 26	Control bracket
35	WT 478 65	Nock
36	WT 765 99	Leaf spring
37	WT 741 44	Tension spring
38	WT 741 37	Tension spring
40	WY 820 71	Turntable, left
41	WT 478 70	Turntable, right
42	WT 646 74	Shaft
43	WT 882 59	Winding roller
44	WT 741 38	Tension spring
45	WT 064 55	Stop bracket
46	WT 888 62	Brake
46a	WT 277 36	Brake shoe
47	WT 760 23	Torsion spring
48	WT 750 91	Leaf spring
50	WT 836 10	Lever
51	WT 836 11	Lever
52	WT 741 35	Tension spring
53	WT 888 69	Idler wheel
54	WT 889 52	Bracket with spindle for idler wheel
55	WT 741 39	Tension spring
56	WT 882 66	Relay
56a	WT 562 27	Coil
57	WT 760 24	Torsion spring
58	WT 078 23	Stop bracket
59	WT 765 88	Profile spring
60	WT 765 87	Profile spring
61	WT 265 57	Upper bearing
63	WT 458 58	Guiding roller
64	WT 924 52	Nut
65	WT 866 92	Continuous brake felt
66	WT 741 43	Tension spring
67	WT 823 63	Lever
68	WT 617 29	Lifting pin
69	WT 730 47	Pressure spring 6x
70	WT 857 14	Recording/playback head
71	WT 857 19	Erasing head
72	WT 881 66	Pressure roller
73	WT 837 02	Pressure roller lever
74	WT 646 12	Shaft for pressure roller
75	P5 515 93/16	Ring
76+77	WT 857 18	Pressure felt with bracket
77	WY 820 38	Pressure felt
78	WT 741 45	Tension spring
79	WT 857 64	Relay
80	WT 078 28	Bracket
81	WT 837 20	Bracket
82	WT 496 63	Driving belt



SK1	PA.	PA.
1 - 2	1 - 0	1 - 2
6a - 0	6a - 0	
2 - 15	2 - 15	
16 - 17 - 18	7a - 8	
14 - 15	15 - 0	
	19 - 20	
	21 - 21a	
	3 - 4	
	4 - 5	
	6 - 0	
	7 - 8	
	8 - 9	
	10 - 11	
	12 - 13	
	12 - 13	

SK101	PA.	PA.
101 - 102	101 - 102	
101 - 102	106a - 100	
106a - 100	106a - 100	
106a - 100	114 - 115	
108 - 109	108 - 109	
112 - 113	114 - 100	
112 - 113	112 - 112a	
104 - 105	103 - 104	
106 - 100	104 - 105	
108 - 119	121 - 121a	
119 - 120	119 - 120	
110 - 111	110 - 111	

SK2	475 cm/m	9.5 cm/m
30a - 33	30a - 32	
30 - 31	30 - 31	
130a - 133	130a - 132	
130 - 131	130 - 131a	

SK3	STEREO	1 - 2	2 - 3
42-43-48	42-43-48		
43-44	43-44		
48-40	48-40		
41-40	41-40		
45-140	45-140		
47-40	47-40		
142-143-148	142-143		
142-143	142-143		
140-141	140-141		
141-148	141-148		
140-145	140-145		
140-146	140-146		

SK4	MONO	STEREO	MULTIPLAY
50 - 51	50 - 51		
150 - 151	150 - 151		
147 - 149	147 - 149		
53 - 54	53 - 54		

SK5	STOP	60.62 - 61.63	64 - 65	160-162-161-163
60.62 - 61.63				
64 - 65				
160-162-161-163				

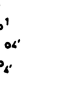
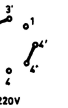
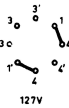
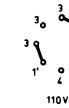
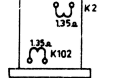
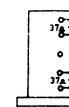
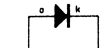
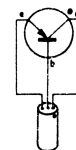
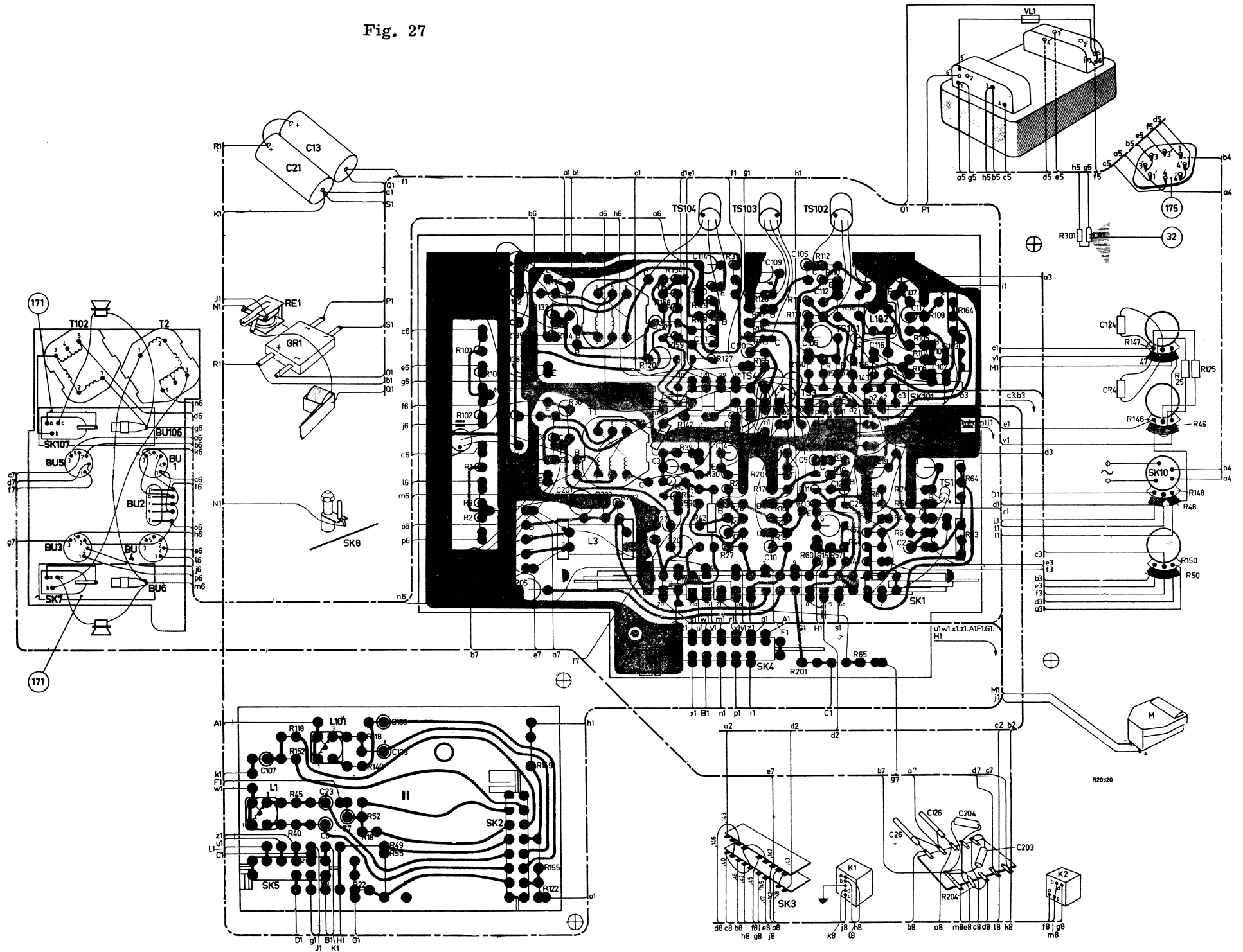
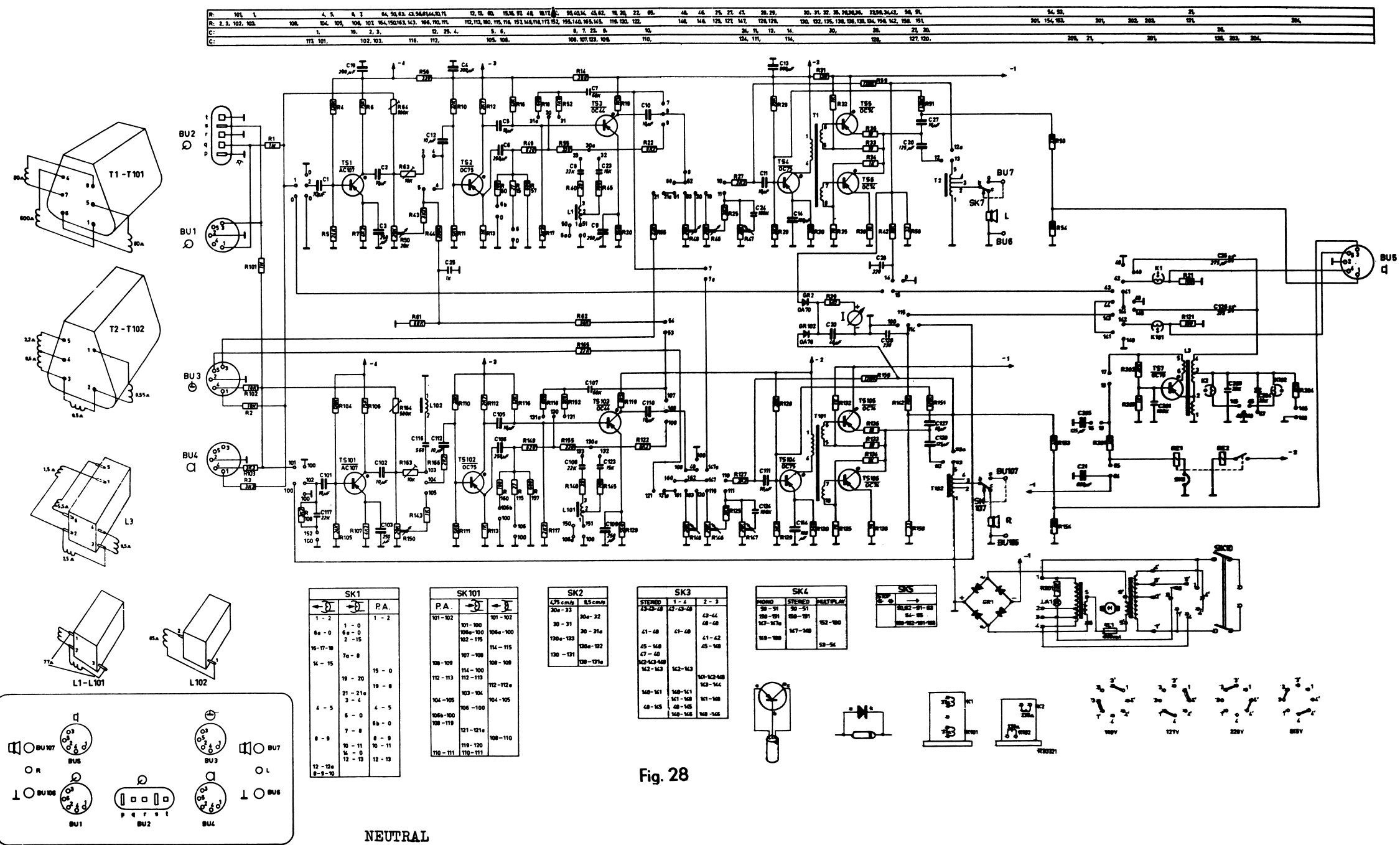


Fig 25



Fig. 27





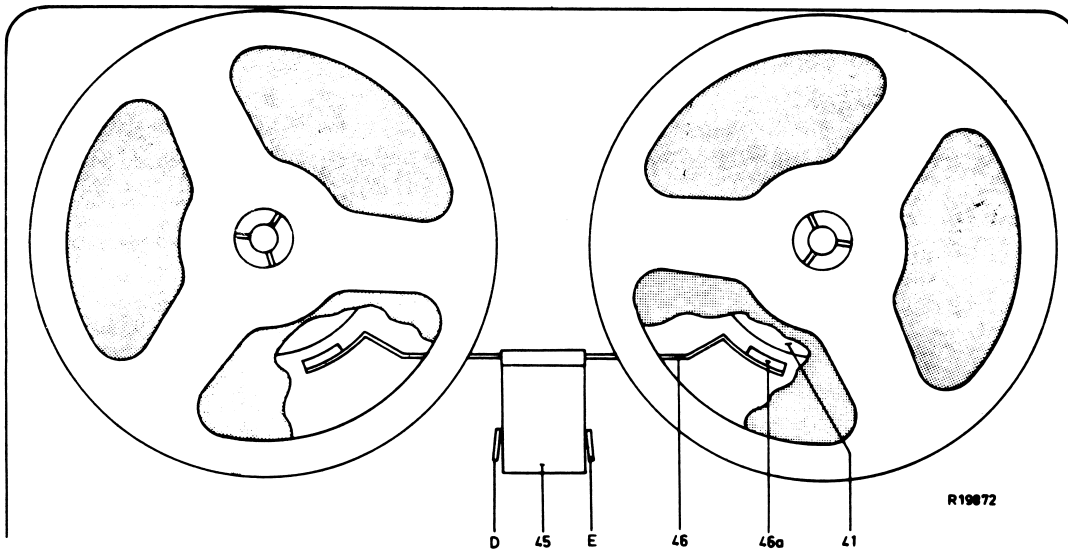


Fig. 30

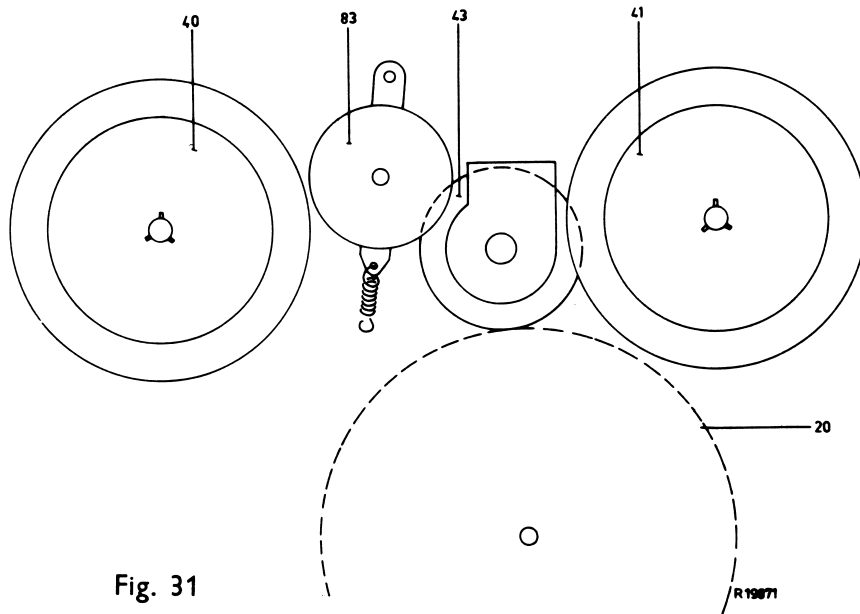


Fig. 31

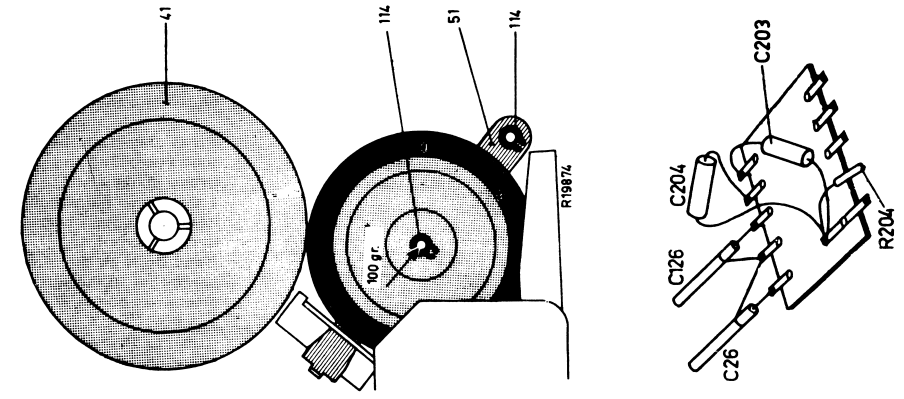


Fig. 33

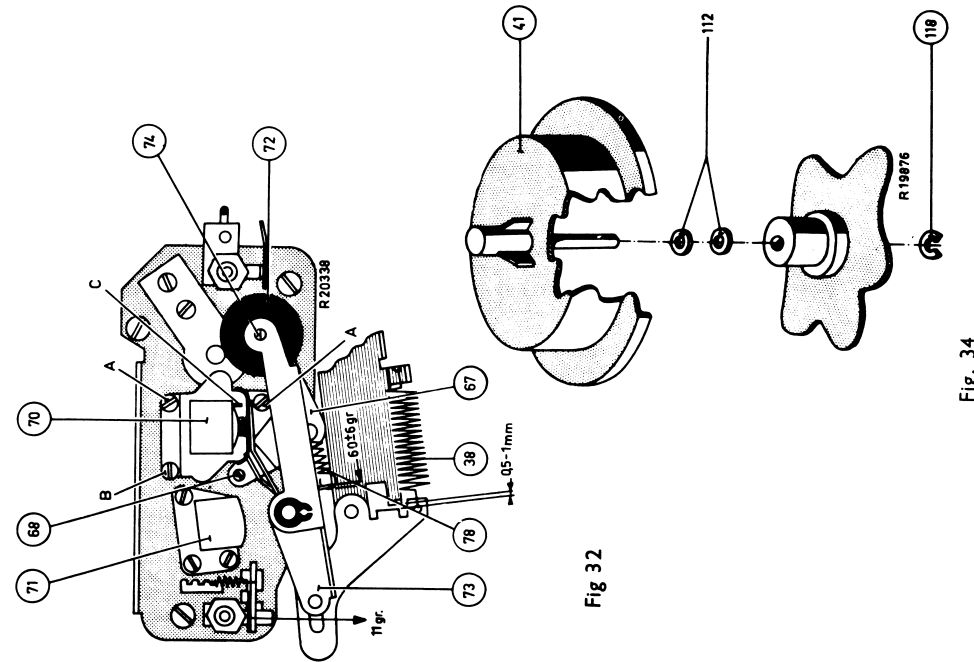


Fig. 32

Fig. 34

P15-13

PHILIPS MODEL EL3547A

Phenomenon	Possible cause	Remedy
1. No recording/playback	a. Fuse blown.	a. Localise fault and replace fuse.
2. Tape loops after fast rewinding.	a. Right-hand brake shoe 46a is soiled. b. Right-hand brake shoe 46a comes with too little force or too late against the winding disc 41.	a. Clean or renew. b. First check whether in the positions recording and playback both brake shoes 46a are removed about 1 mm from the winding discs. If not, then adjust by rebending brake bracket 46. Bend lip E on the mounting plate somewhat to the left until the minimum distance amounts to 0.5 mm.
3. Tape loops after fast winding.	a. Left-hand brake shoe 46a soiled. b. Left-hand brake shoe 46a comes with too little force or too late against the winding disc 40	a. Clean and renew. b. First check whether in the positions recording and playback both brake shoes 46a are removed about 1 mm from the winding discs. If not, then adjust by rebending brake bracket 46. Bend lip D on the mounting plate somewhat to the left until the minimum distance amounts to 0.5 mm.
4. Tape does not rewind or rewinds badly.	a. Cord 82 greasy, soiled or strained b. Contact surfaces of idler wheel 83 winding disc 40 or idler wheel 43 greasy. c. Coupling wheel 43 has slipped under nylon idler wheel 83.	a. Degrease cord and run-in grooves or replace cord. b. Degrease with white spirit or alcohol. c. Adjust coupling wheel 43 higher. The vertical clearance here should be 0.1 - 0.2 mm.
5. Tape does not wind or winds badly.	a. Contact surfaces of right-hand winding disc 41 and coupling wheel 43 soiled or greasy.	a. Degrease with white spirit or alcohol.
6. Whining during playback.	b. Cord 82 greasy, soiled or strained. a. Bad recording. b. Capstan 20 and pressure roller 72 greasy. c. Cord 82 greasy. d. Friction coupling soiled. e. Pressure roller 72 is not pressed with sufficient force against the capstan 20. f. Capstan bent.	b. Degrease cord and run-in grooves or replace cord. a. Try with good recording. b. Degrease with petrol or replace pressure roller. c. Degrease with petrol or replace. d. Clean coupling or replace. e. Check whether the distance between the lips A and A' on the slide 34 amounts to 0.5 to 1 mm. f. Straighten or replace.
7. Tape is not erased or badly erased.	a. Erasing head 71 defective. b. Erasing head soiled. c. Part of the erasing head adjusted incorrectly. d. Oscillator does not work	a. Replace. b. Clean with white spirit or alcohol c. Properly adjust the height, see "Mechanical adjustments" sub. "Erasing head".
8. Apparatus does not record or records badly	a. Recording/playback head defective b. Recording/playback head soiled c. Biasing current incorrect d. Fault in amplifier e. No biasing current	a. Replace b. Clean with petrol c. Readjust by means of C26 for track 1-4 and C126 for track 2-3 d. Localise fault and remedy same. e. Break in wiring or switch.
9. Hesitant reproduction	a. Recording/playback head soiled. b. Tape is not pressed properly against the recording playback head by the felt 76.	a. Break in wiring or switch. b. Check the pressure of the felt and adjust (60±6 grammes) or clean the felt with a brush.
10. Hum during reproduction	a. Fault in amplifier.	a. Remedy the fault.
11. Noise during reproduction	a. Recording/playback head magnetised	a. Switch the apparatus on and off a few times in the position recording. De-magnetise the head with de-magnetising device. Here one should not come in the neighbourhood of the modulation indicator.

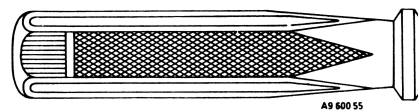
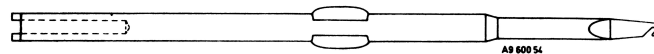
Phenomenon	Possible cause	Remedy
12. Noise in the position playback without tape in the apparatus.	a. One of the pre-amplifier transistors make noise .	a. Localise and replace.
13. Tape loops at the right hand winding disc after switching to recording or playback.	b. Fault in amplifier. a. Idler wheel 53 does not come properly against winding disc 41 and driving ring 23.	b. Localise fault and remedy. a. Check elastic force with which the idler wheel presses against winding disc 41 and driving wheel 23.
14. Tape rubs against reel	a. Height of the winding disc 40 or 41 not correct.	a. First check whether the tape runs properly along the erasing head 71, recording playback head and tape guide 63. Then adjust the height of the winding disc 40 or 41 in such a way with the aid of the ring 112 that the tape runs in the middle of the reel.
15. Tape is not wound taut	a. Felt 65 does not press or does not properly press against left hand tape guide 63.	a. Check whether the bracket 65 has been freed. b. Clean the felt with a brush and increase the elastic force of spring 66 to max. 11 grammes. Replace felt.
16. The apparatus is insensitive.	a. Fault in amplifier b. R64 (R164) has shifted	a. Check stage amplification b. Adjust R64 (R164)(amplification Ts1 (Ts101)).
17. Playback key does not stop.	a. Bracket 56 not properly adjusted.	a. Adjust bracket 56 so that the lip F at the slide 34 properly stops and is freed after re-depressing. Be careful here that in the stop position of bracket 34: 1. the lip F carries over the whole length; 2. the distance between A and A' amounts to about 0.5 to 1 mm; 3. the brake shoes 46a are lifted about 1 mm.

83	WT 479 79	Idler wheel
84	WT 837 06	Bracket with shaft
86	WT 885 02	Fuse holder
87	WT 850 03	Modulation indicator
88	WT 940 02	Speed switching lever
89	WT 948 38	Toothed rack
90	WT 262 28	Push button
91	WT 730 98	Pressure spring
92	WT 064 77	Stop bracket
93	WT 741 52	Tension spring
108	WRB861UD/3x2	Nut
109	WT 277 88	Bearing clamping plate
110	WT 002 54	Shaft
111	WT 458 66	Distance ring
112	A9 868 66.1	Ring - plastic
125	WT 478 66	Guiding ring
136	975/5x10	Grommet
150	WT 730 91	Pressure spring
151	A9 888 83	Winding friction
150-153	WT 888 63	Flywheel
160	WT 898 61	Programme indicator
160a	A9 888 72	Knob
161	WT 496 08	Driving belt
162	WT 889 60	Control bracket
163	WT 262 35	Knob
164	WT 766 08	Spring
165	WT 741 51	Tension spring for SK 4
166	WT 730 95	Pressure spring
167	WT 823 83	On/off contact
168	WT 836 71	Control bracket for switch
169	WT 837 22	Control bracket
170	WT 837 23	Control bracket
171	WT 867 03	Connecting bush Bu 6
173	WT 937 68	Indication plate
174	WT 944 19	Indication plate
175	WT 886 61	Voltage adaptor
178	WT 741 50	Tension spring
179	WT 766 05	Torsion spring
180	WT 823 91	Stop bracket
181	WT 740 87	Tension spring
192	WT 832 90	Brush
201	WHB 108UA/5	Clamping ring
202	WT 040 24	Leaf spring
210	WT 478 98	Roller
233	WT 823 93	Quick stop bracket - complete
234	WT 741 75	Tension spring
235	WT 679 44	Bracket - multipay
236	WT 890 74	Bracket- recording
237	WT 064 83	Bracket - 1 7/8" /sec.
238	WT 064 83	Bracket - 3 3/4" /sec.
	WT 889 21	Switch SK1
	WT 889 24	Switch SK2
	WT 889 22	Switch SK3
	WT 889 25	Switch SK4
	WT 889 26	Switch SK5
	979/S4	Switch SK7-SK107
	WT 823 83	Switch SK8
	WT 889 23	Switch SK101

Pos.	Code number	Nomenclature
1	WT 856 67	Case
2a	WT 888 87	Upper hinge
2b	WT 888 88	Lower hinge
3	WT 943 22	Lock
4	WT 890 67	Handle.
5	WT 912 90	Loudspeakergrill, front
6	WT 912 86	Loudspeakergrill, left and right
7	AE 005 89	Ventilationgrill
8	WT 910 44	Foot
9	WT 262 36	Plug
10	WT 856 68	Lid of flex compartment
11	WT 840 62	Ornamental plate for handle
12	WRB 801 uY/4x8	Ornamental screw
13	WHB 899 22/01	Ornamental nut
14	WT 867 24	Ornamental cover plate
15	WT 856 71	Knob
29	WT 867 06	Screening plate
30	WT 856 89	Selector knob
31	WT 856 90	Control knob
32	WY 851 58	Lamp
40	WY 820 71	Turntable, left
41	WT 478 70	Turntable, right
87	WT 850 03	Modulation indicator
90	WT 262 28	Push, button
160	WT 898 33	Programme indicator
163	WT 262 35	Knob
172	WT 923 09	Lens of programme indicator
176	WT 262 42	Knob
177	WT 697 69	Indication plate

A new tool has been designed in supplement to the tool bag 968/OX. The left hand side (see fig.) serves for tightening slotted nuts, which are at present used in tape recorders. With the aid of the other side springs and cords can be easily positioned. The tool can be used in combination with the handle incorporated in the above mentioned bag.

Code numbers
A9 600 55 Handle
A9 600 54 Tool



Before raising the printed plate for repairs the marked screws must be loosened.

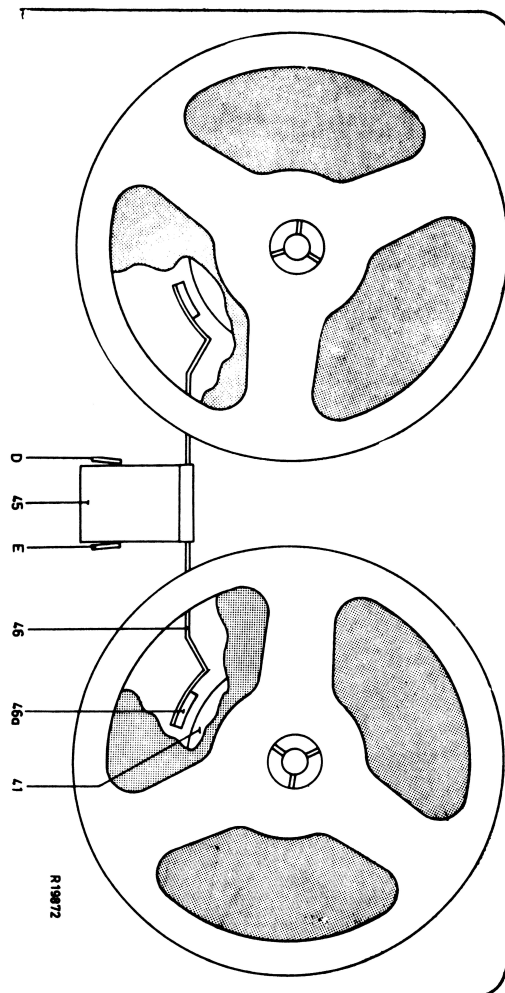
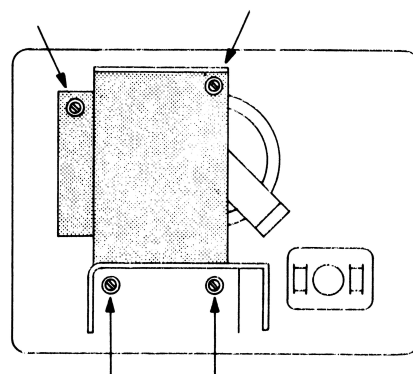


Fig. 34

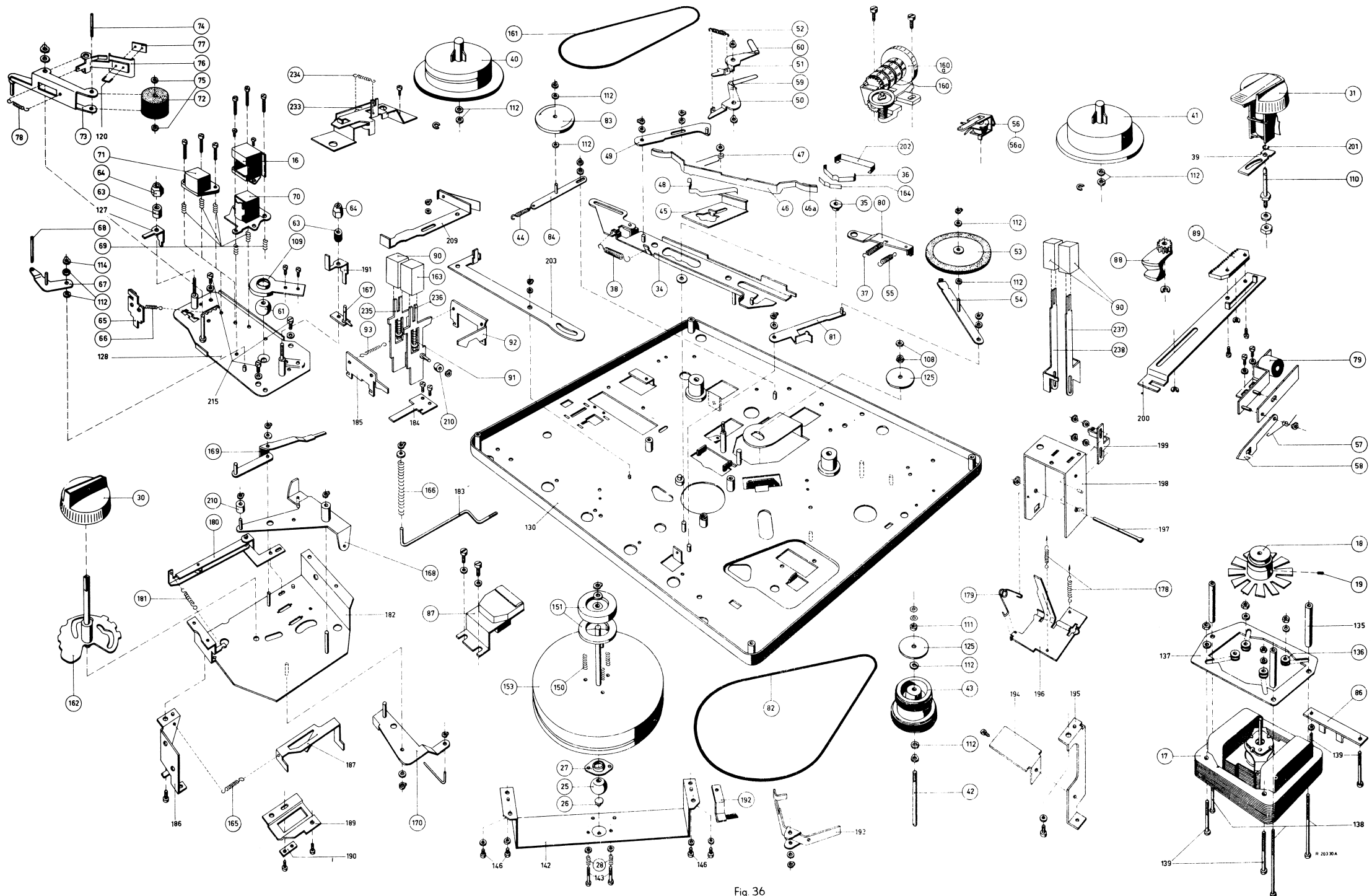
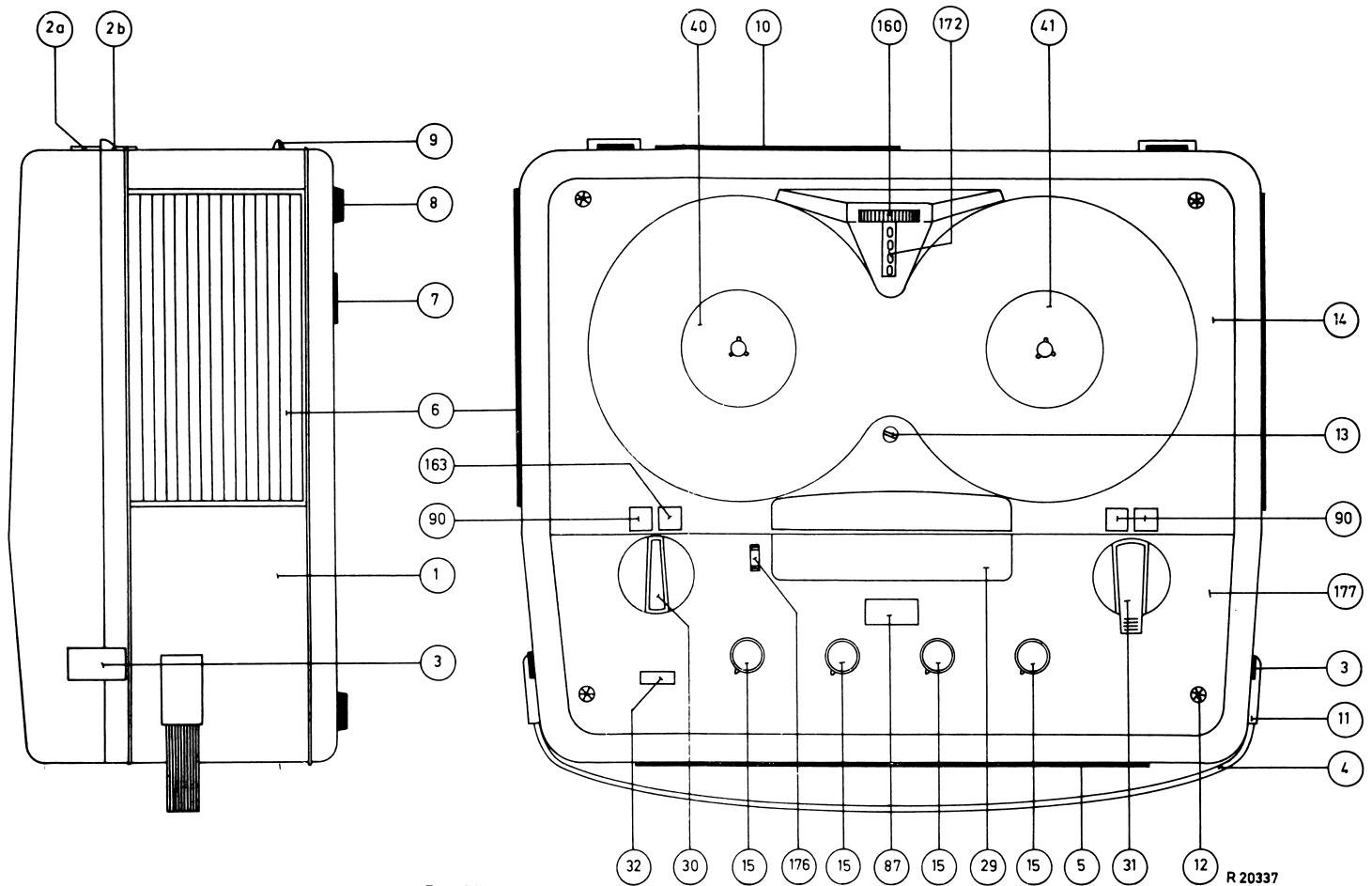


Fig 36



PHILIPS SERVICE INFORMATION EL 3547A-00 Bc 365

Various modifications

WR-05 The remedy against hum, mentioned in Bc 305, has been introduced in the printed panel as from stamp WR-05.
As a result R31-R32 and R132 have been modified:
R31 was 130 Ω , becomes 68 Ω
R32-R132 was 1 k Ω becomes 750 Ω

In the enclosed wiring diagram the new position of R31-R32 and R132 on the printed panel is shown, see fig. 4.

WR-06 The shape of the command bracket, pos. 162 for the switch SK1 and SK101 has been altered, see fig. 1. As a result the switches SK1 and SK101 are forced to slide back when switching back.
The code number of the new bracket, pos. 162 is WT 889 60.

WR-07 a. In order to improve the recording of the low frequencies, a capacitor C31 (C131) has been connected in series with R59 (R159).
As a result the amplification at 80 c/s has been increased by about 3 dB.
Code number C31-C131 906/L15K.

b. Owing to tolerances in the operation of SK1 and SK101, it could happen that after a stereo recording, the recording/playback head was switched off before the oscillator was switched off by SK1.

Due to this the lower half of the recording/playback head (track 2-3) could be magnetised. In order to remedy this, the oscillator is switched off by SK1 as well as SK101.
See circuit diagram, fig. 3.

c. In position "mono-recording" the amplifier of the right-hand channel remains in position "playback". The diode output BU3, point 5 (right-hand channel) is then connected to the volume control R148 of the right-hand output stage via R165.

In the case of radio receivers without mono/stereo switch, this results in an additional load of the receiver. In order to avoid this the following has been modified.

a. Connection from contact 161 of SK5 to R165 is made via the contacts 7a and 7b of SK1.

b. In position "mono-playback" the signal to the right-hand output stage is applied via contact 7-7c of SK1.

c. In position P.A. the signal to the left-hand output stage is applied via contact 121-121a of SK101, see fig. 2.

The new switches are supplied under the following code numbers:

SK1 215 007 14
SK101 215 007 15.

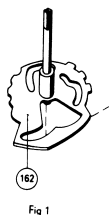


Fig 1

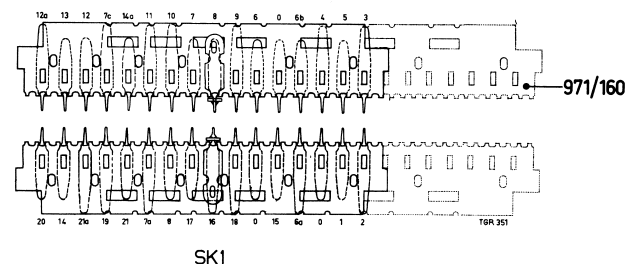
971/155

971/157

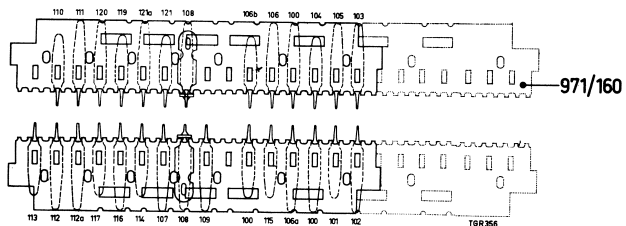
971/156

971/158

971/162



SK1



SK101

Fig 2

Bc 419

Some apparatuses from the series, stamped WR-06 19/63 - 20/63, may produce a clicking sound. This is caused by a burr on the running surface of the flywheel. Since it is very difficult to remove this burr, it is easier to replace the flywheel in the case of repair.

With a few apparatuses employing the AC 107 as input transistor it may occur that the right-hand channel starts oscillating in position P.A. This can be avoided by fitting a 22 k Ω resistor between point 151 and point 100 of SK4.

Bc 485

Should the recording or multiplay key jam, this may be due to a burr on the front part of the bracket so that the latter sticks to the locking bracket, item 92.

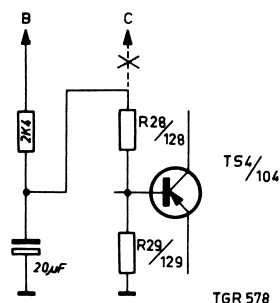
In some apparatuses a clicking sound may be produced by one of the turntables. This may be due to contamination on the brake surface; it may be removed with the aid of a knife. It is also possible that contamination or metal particles have settled on the rubber rollers. This also should be removed.

As described in Bc 419, it sometimes happened that the cord run off the flywheel groove. This may be due to the rough finish of the groove. To finish the groove more smoothly, use a piece of sandpaper. Possible noise caused by the flywheel will then be eliminated too.

TS2 and TS102 should be replaced by OC75N type transistors. Employing the OC75 transistor may result in too high a noise level.

Bc 495

It may occur that in some apparatuses the signal of the left-hand channel is reproduced via the right-hand channel. A Service-remedy for this is given in the accompanying diagram.



TGR 578

Bc 498

In some series of the above-mentioned apparatus transistors of the AC 107M type have been applied for the input transistors TS1 and TS101. This transistor is not marked. In case of replacement an AC107 or AC107M marked with a red dot should always be used.

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In some instances it may happen that the driving cord slips upwards along one of the edges of the V-groove of the flywheel. This will cause "knock", as the cord continually slips back.

Sometimes however, it may occur that the cord leaves the groove and tracks on the cylindrical part of the flywheel, thus increasing the tape-speed by 4%. The cord then hits the movement-limiter spring, consequently causing undesired oscillations. As the cord is then braked, "wow" will arise.

The above-mentioned defect can be remedied by roughing the cord with sandpaper.

Some apparatuses may produce a scratching sound during change-over from Stereo to PA. This is probably due to the fact that the wire from contact 127 has been soldered to contact 9. This can be corrected by soldering aforementioned wire to point 8, as indicated in the Service Notes.

Brake bracket, item 46 has been screwed to bracket item 45. This is done to prevent brake bracket item 46 from shifting. Consequently, the left-hand brake-shoe will run against the cord of the counter, so that the left-hand turntable is continuously braked.

In some apparatuses, the wiper of SK4 may stick. This can be remedied by lubricating the wiper with 971/71 type switch oil. Moreover, it is possible to shorten the tension spring of the wiper, so that the wiper does spring back.

BC 365

R:	101, 1	4, 5	6, 7	84, 50, 63, 43, 56, 61, 44, 10, 11	12, 13, 60	15, 16, 57, 48	18, 17, 52	55, 40, 14	45, 62	19, 20	22, 65	46	46	25, 27, 47	28, 29	30, 31, 32, 35, 38, 39, 36	33, 59, 34, 42	54, 51	54, 53	21			
R:	2, 102	100	104	105	106	107	164, 150, 163, 163	166, 170, 171	112, 113, 160, 115, 116	152, 148, 118, 117, 152	155, 140, 165, 145	119, 120, 122	148	146	125, 127, 147	124, 129	130, 132, 135, 138, 136, 133, 134, 154, 142	158, 151	301, 154, 153	201	202, 203	121	204
C:		1	19	2, 3	5	6	8, 7, 23	9	10	11	12	13	14	24	11, 31, 13	30	28	27, 20	26	28	204		
C:		118, 101	102, 103	116	112	105, 106	108, 107, 123, 109	110	114	124	111, 131	114	128	127, 120	205, 21	201	124, 203	204					

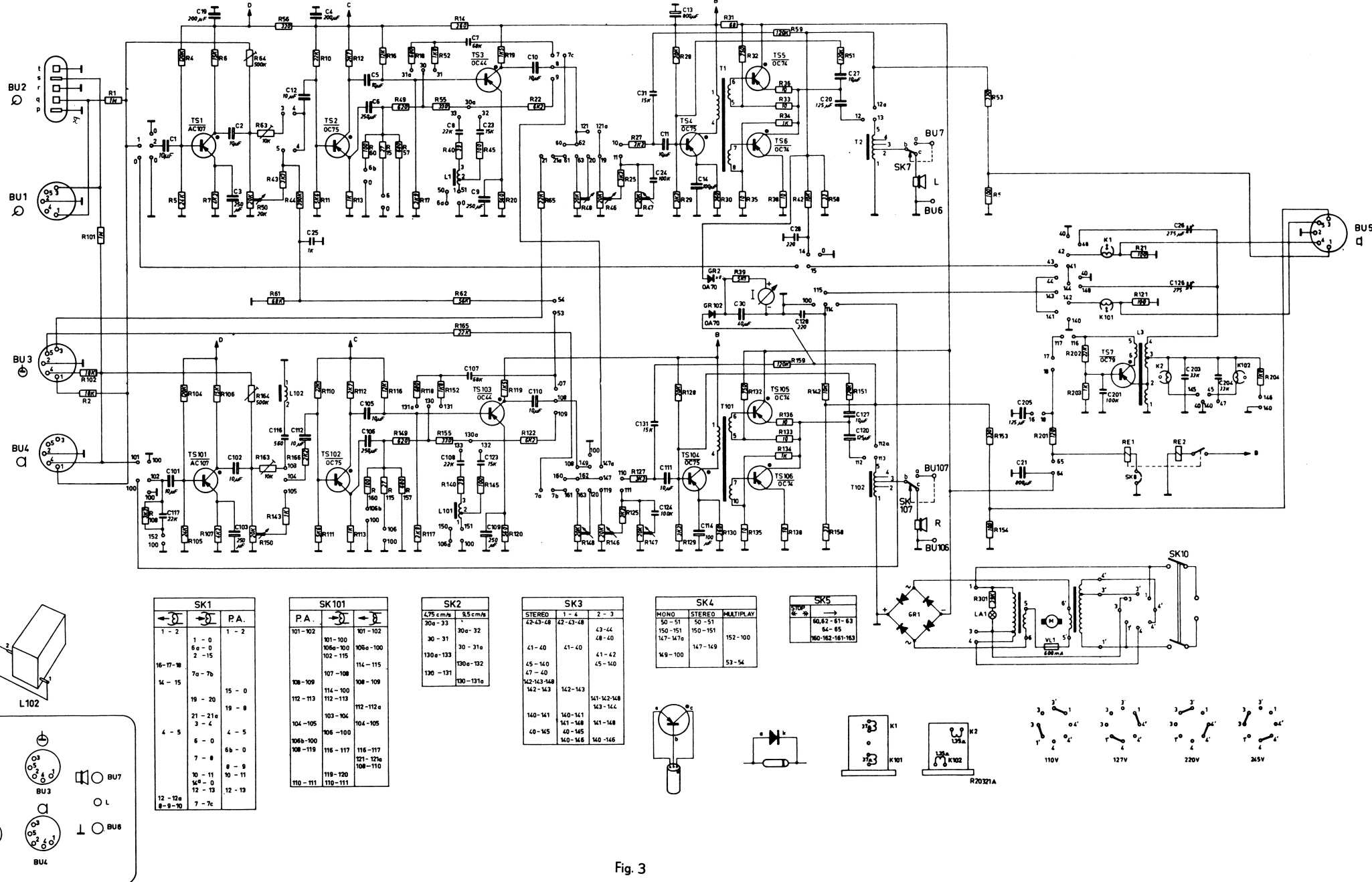


Fig. 3

