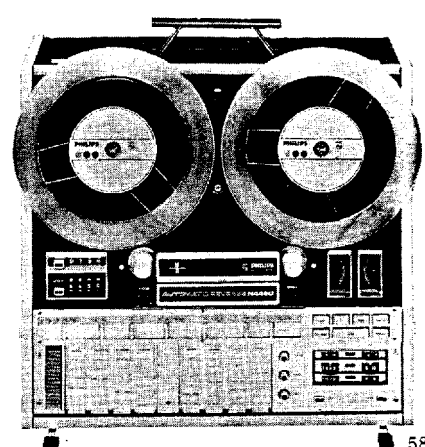


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# RECORDERS N4450

00/15/19/43



# Service manual

# HILIPS



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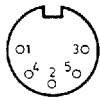


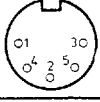


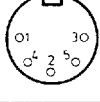

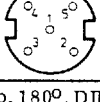


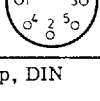

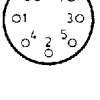

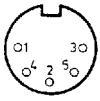

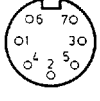

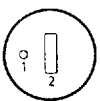

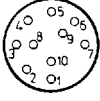

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## TECHNICAL SPECIFICATION

Mains voltages	: 110-127-220-240 V
Mains frequency	: 50 - 60 Hz (timer must be adapted only)
Power consumption	: min. 29 W max. 120 W
Number of tracks	: 4
Tape speeds	: 4.75 cm/sec - 1 7/8 ips (+ 2 %) 9.5 cm/sec - 3 3/4 ips (+ 1 %) 19 cm/sec - 7 1/2 ips (+ 1 %)
Max. reel diameter	: 26.5 cm (10 1/2")
Number of heads	: 6 (2 recording, 2 playback, 2 erase heads)
Number of motors	: 4 (one Hall motor - collectorless d.c. motor - for driving the capstan, two d.c. motors for driving the reel discs, one synchronous motor for driving the tape transport)
Wow and flutter	: 4.75 cm/sec $\leq$ 0.35 % 9.5 cm/sec $\leq$ 0.2 % 19 cm/sec $\leq$ 0.15 %
Winding time	
26 cm reel with LP tape (1080 m)	: $\leq$ 250 secs
18 cm reel with LP tape (540 m)	: $\leq$ 150 secs
Input sensitivities:	
Micro	: 0.15 mV / $> 2$ k $\Omega$
Tape	: 2 mV / 20 k $\Omega$ (1, 4) 100 mV / 1 M $\Omega$ (3, 5)
Tuner	: 100 mV / 100 k $\Omega$
Phono	: 1.5 mV / 47 k $\Omega$ (MD/ceramic HiFi) 100 mV (X-tal)
Aux	: 2 mV / 20 k $\Omega$ (1, 4) 100 mV / 1 M $\Omega$ (3, 5)
Output voltages:	
Tape	: 1 V / $> 50$ k $\Omega$
Monitor	: 1 V / $> 50$ k $\Omega$
Headph	: 3 V / 400-600 $\Omega$
Output power	: 2 x 20 W (d $<$ 1 % - 8 $\Omega$ )
Frequency range (within 6 dB)	: 4.75 cm/sec 60 - 8,000 Hz 9.5 cm/sec 40 - 15,000 Hz 19 cm/sec 40 - 20,000 Hz 40 - 16,000 Hz (with stereofilter)
Rumble filter	: -10 dB at 30 Hz
Scratch filter	: -15 dB at 15 kHz
Physiological tone control	: +14 dB at 50 Hz, + 6 dB at 10 kHz
Erase frequency	: 100 kHz (+ 10 %)
Dimensions (including lid)	: 520 x 500 x 210 mm (20 1/2" x 19 5/8" x 8 3/8")
Weight	: approx. 20 kg (44 lbs)

## INPUTS AND OUTPUTS

Marking	For connection of	Sensitivity	Impedance	Kind of socket	Connection	Place
MICRO L + ST BU8	a microphone with either 3-pole, 180°, DIN plug for recording any channel in position 1-4, 3-2 and for recording left-hand channel in position ST, or with 5-pole, 180°, DIN plug for stereo recording	0.15 mV *)	>2 kΩ	5p, 180°, DIN 	1 - left 4 - right 2 -  5 -  3 -	front
MICRO R BU9	a microphone with either 3 or 5-pole, 180°, DIN plug for recording the right-hand channel in position ST	0.15 mV *)	>2 kΩ	5p, 180°, DIN 	1/4 - right 2 -  5 -  3 -	front
TAPE IN/OUT BU2 BU10	a second tape recorder or any apparatus provided with a 5-pole 180° DIN in/output socket: input : pins 1 and 4 pins 3 and 5 output : pins 3 and 5	2 mV 100 mV 1 V	20 kΩ 1 MΩ >50 kΩ	5p, 180°, DIN 	1 - left 4 - right 2 -  5 - left 3 - right	rear front
HEADPH. BU11	a stereo headphone, provided with a 5-pole, symmetrical DIN plug	3 V	400-600 Ω	5p, sym. DIN 	1 - 2 -  3 -  4 - left 5 - right	front
TUNER BU1	a tuner	100 mV	100 kΩ	5p, 180°, DIN 	1 - 4 - 2 -  5 - right 3 - left	rear
PHONO BU4	a record player with either a crystal, a ceramic, or a dynamic P. U. element. The input sensitivity for crystal and ceramic HiFi/dynamic P. U. elements can be set by means of a switch underneath the socket to crystal ceramic HiFi/dynamic	100 mV **) 1.5 mV	- 47 kΩ	7p, DIN 	1 - right 4 - 2 -  5 - right 3 - left 6 - MP1 7 - MP101	rear
AUX. BU3	any kind of electronic musical equipment, e.g. an electronic organ, or a tape recorder, a record player with a crystal P. U. element input : pins 1 and 4 pins 3 and 5	2 mV 100 mV	20 kΩ 1 MΩ	5p, 180°, DIN 	1 - left 4 - right 2 -  5 - right 3 - left	rear
MONITOR BU5	a monitor amplifier	1 V	> 50 kΩ	7p, DIN 	1 - 4 - 2 -  5 - right 3 - left 6 - MP2 7 - MP102	rear
LOUDSP. L LOUDSP. R BU6 BU7	a loudspeaker enclosure either 4 Ω or 8 Ω	-	4 Ω/8 Ω 4 Ω/8 Ω	2p, DIN 	1 - 4 Ω/8 Ω 2 - 	rear
REMOTE BU201	the remote control unit N6719 (optional)	-	-	10p  692A	1 - recording 2 - stop 3 - fast wind left 4 - fast wind right 5 - pause 6 -  7 - left/right 8 - right 9 - -26 V 10 - left	rear

\*) In case only one mono microphone is connected, and the track selector is in position 1-4 or 3-2 (mono) the sensitivity is 0.2 mV at > 2 kΩ.

\*\*) Measured with series capacity of 2,000 pF.

# REMOVING THE CABINET (see Fig. 1 and 2)

- Remove the five screws A at the rear to take off the rear panel.
  - The black ornamental plate at the front can be removed after loosening the five screws A and removing the switch knob between the two turntables.
  - Also remove the head covers D; these can be slid forwards off the mounting pins.
  - In most cases it is recommendable to take the complete amplifier unit out of the cabinet for repairs to this unit. For this, remove the five screws B and screw C in the middle above the ornamental surround of the switches. The complete unit can now be carefully slid forwards out of the cabinet.
- The amplifier unit is connected to the rest of the circuitry with three wire forms, viz.:
- a. one thick wire form between the switch p.c. board and the amplifier board. This wire form is connected to the amplifier board by means of connectors.
  - b. one three-fold wire form between the heads p.c. board and the amplifier board.
  - c. two wires between the mains switch and the timer.

## Attention

The wires mentioned under c. carry mains voltage. A warning plate is fitted near the place where the wires are plugged onto the connection tags at the rear left of the recorder.

When fitting the amplifier unit, check that the wire forms do not touch the flywheels. The flywheel bracket has been provided with a cable tie for fixing wire form b.

# Replacing the buttons 168 and the switch wipers

- Buttons 168 can be withdrawn from the switch wipers by pulling them forwards.
- Remove the two output amplifier units P8/P108.
- Push the spring slightly back and remove the pawl and spring.
- Remove the pin from the switch wiper; the wiper can now be pulled forwards out of the switch.
- When refitting the wiper, the stop spring should be slightly lifted so that it fits into the labyrinth.

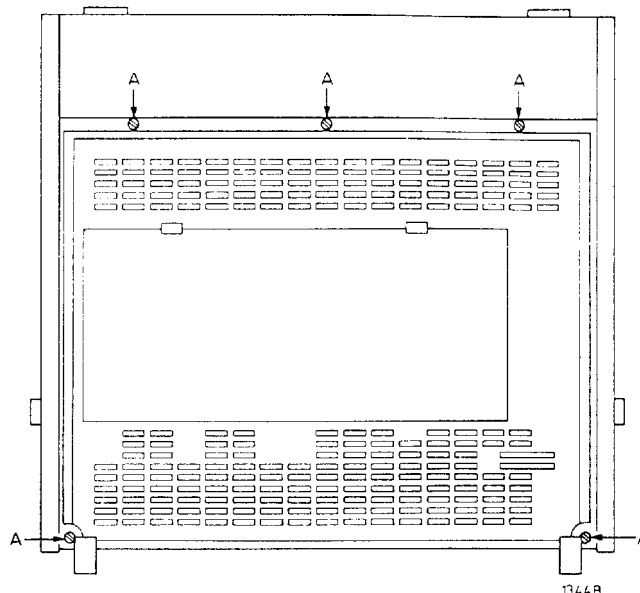


Fig. 1

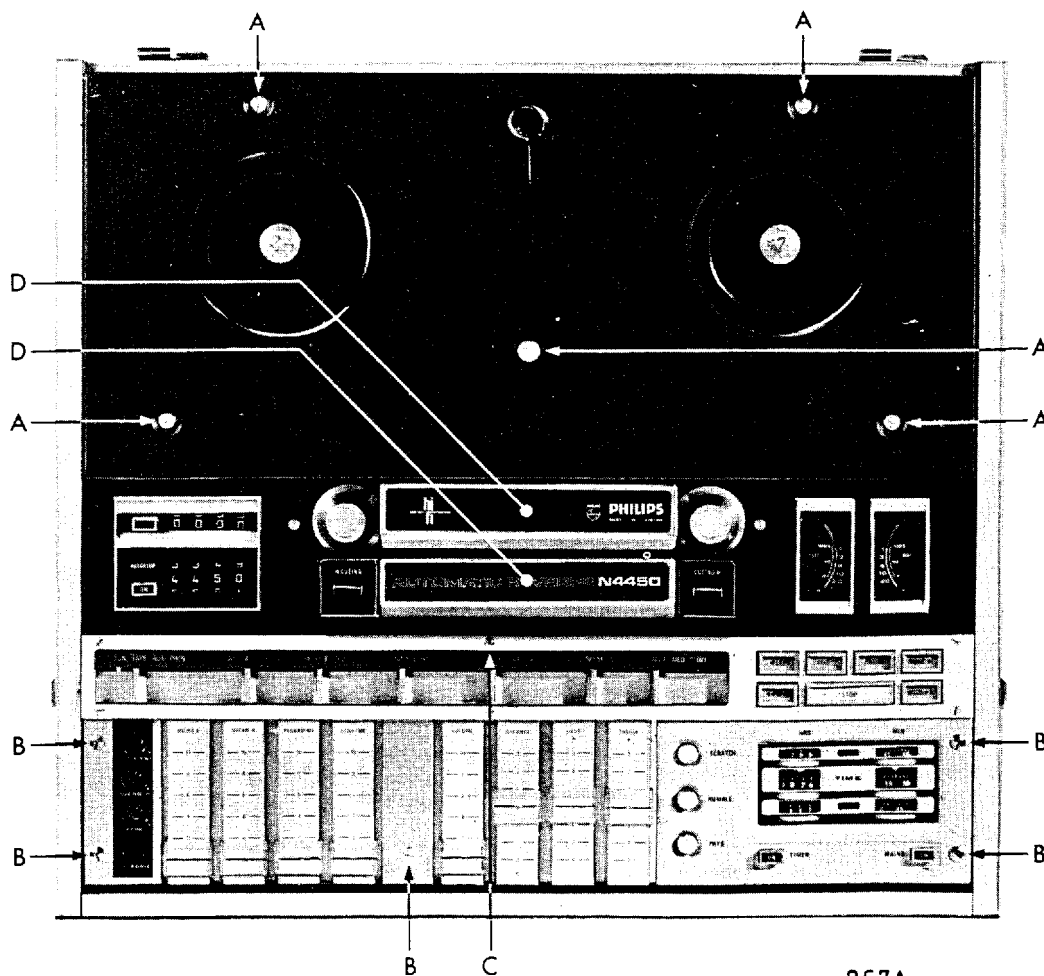
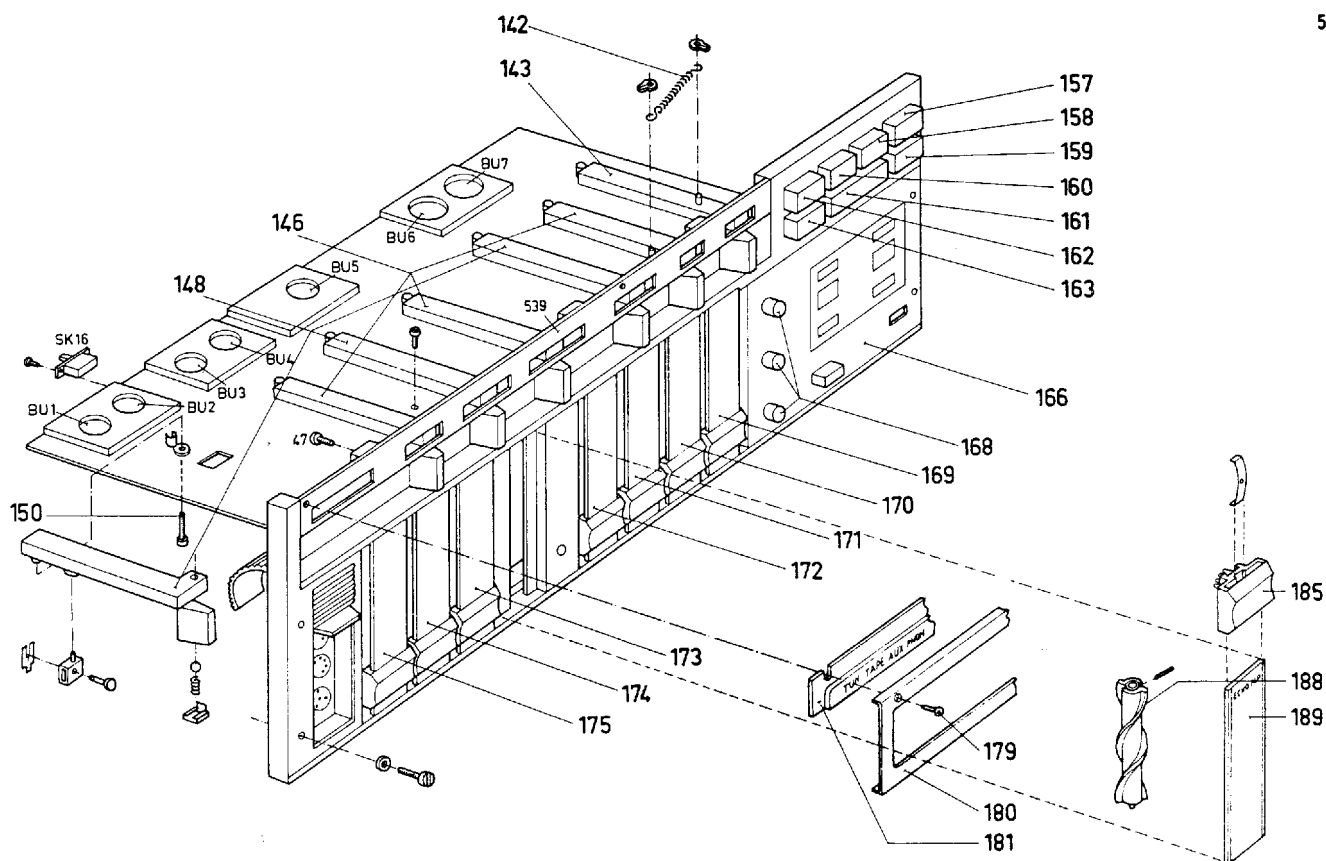


Fig. 2



1308 D

Fig. 3

#### REPAIR HINTS (see Fig. 3)

##### Amplifier unit

To remove this unit, see "Removing the cabinet".

##### Replacing the switch brackets 143/146/148

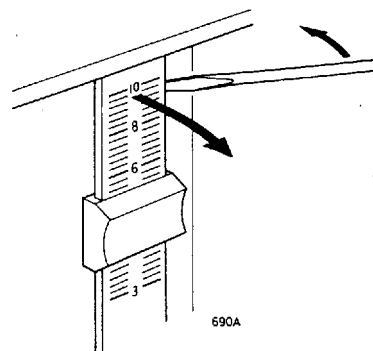
- Remove the ornamental surround 180 round the switches and buttons (9 Philips head screws), indication strip 181 and bracket 539.
- Remove the 3 screws 47 with which the stop bar of the switch brackets is secured and lift the bracket slightly.
- Loosen the screw on which the switch bracket to be replaced hinges (for "FAST-MED-SLOW" switch also detach spring 142).
- Replace the switch bracket, taking care that the switch wiper engages the relevant opening in the bracket.

##### Replacing the recorder control buttons 157...163

- Remove the ornamental surround 180 round the switches and buttons (9 Philips head screws), indication strip 181 and bracket 539.
- Bend the tags on the edge of ornamental plate 166 round the buttons, aside.
- Pull out the spindle on which the buttons are hinged.
- The button can now be replaced.
- Refit the spindle and bend the tags back.
- Refit the ornamental surround etc.

##### Replacing the slide controls 185 and panels 169...175, 189

- Remove the ornamental surround 180 round the switches and buttons (9 Philips head screws), indication strip 181 and bracket 539.
- Insert a screwdriver at the top between the panel of the slide control and the front panel (see Fig. 4).
- Prize off the glued panel with the screwdriver.
- When refitting, check that the control 185 just fits over wormwheel 188 of the potentiometer.
- To fit the panel, apply some glue.



690A

Fig. 4



Multi-meter 40 k $\Omega$ /V	P 81700 or PM 2411
RF millivoltmeter	GM 6012 or PM 2454
AF signal generator	GM 2317 or PM 5105
Reference tape	8222 305 1138 (according to DIN 45513)

This unit requires no adjustments.

```
Recorder set
to position : recording-"TUN"- "B"- "ST"- "NOR"- "19"
              potentiometer "RECORDING" to maximum;
              other potentiometers to minimum
```

Input	: BU1 TUNER 3/5	19 kHz - 1 V
Output	: BU5 MONITOR 3/5	Adjust for min. voltage with L1

The unit supplied for service purposes has already been adjusted for max. rejection of the 19 kHz signal by the manufacturer.

Recorder set  
to position : playback-"ST"-19.5"  
Input : BU5 MONITOR 6/7 333 Hz - 330 mV  
(MP2/102)  
Output : BU5 MONITOR 3/5 Adjust for output  
voltage of 1 V with R4

Input:		Output:
BU5 MONITOR 6/7		BU5 MONITOR 3/5
9.5 cm/sec	40 Hz - 100 mV	0.6 - 1 V
	10 kHz - 1000 mV	0.57 - 0.69 V
19 cm/sec	333 Hz - 100 mV	0.27 - 0.33 V
	40 Hz - 100 mV	0.45 - 0.7 V
	10 kHz - 1000 mV	0.32 - 0.38 V
4.75 cm/sec	333 Hz - 100 mV	0.28 - 0.34 V
	40 Hz - 100 mV	0.6 - 1 V
	10 kHz - 1000 mV	0.9 - 1 V

Recorder set  
to position : recording-"TAPE"- "A"- "ST"- "NOR"- "9.5"  
potentiometer "RECORDING" to maximum;  
other potentiometers to minimum; no tape on  
the set

The unit supplied for service purposes has already been adjusted for max. rejection of the erase oscillator signal by the manufacturer.

```

Recorder set
to position : recording-"TAPE"-"B"-"ST"-"9.5"
Input       : BU2 TAPE IN/OUT 3/5    333 Hz - 1 V
Output      : BU5 MONITOR 5           Adjust for 1 V with
                                         potentiometer
                                         "RECORDING"
                                         R721/751
BU5 MONITOR 3       Value to be measured
                    1 V + x V (x = max.
                    0.8  $\bar{V}$ )
                    Halve the difference
                    with 1 V with R4 on P5
BU4 PHONO 6 (MP1)   Adjust for 1.5 mV
                    with R9 on P4 *)
BU5 MONITOR 5       Value to be measured
                    1 V + y V (y = max.
                    0.8  $\bar{V}$ )
                    Halve the difference
                    with 1 V with R4 on
                    P105
                    If thereupon  $\frac{x}{2} \neq \frac{y}{2}$ ,
                    halve the difference
                    voltage once more in
                    respect of 1 V
BU4 PHONO 7 (MP101) Adjust for 1.5 mV
                    with R9 on P104 *)

```

\*) To make sure that the bias current is measured as well, remove oscillator unit P9 from the apparatus (see Fig. 5).

Rejection 38 kHz signal

## Recorder set

to position : recording-"TUN"- "B"- "ST"- "NOR"- "9.5"  
 potentiometer "RECORDING" to maximum;  
 other potentiometers to minimum

Input : BU1 TUNER 3/5 38 kHz - 0.1 V

Output : point 2 of unit P4/104 Adjust for min.  
 amplitude of this  
 38 kHz signal with  
 L1 (< 600 mV)

The unit supplied for service purposes has already been adjusted for max. rejection of the 38 kHz signal by the manufacturer.

## P5/P105

## BEFORE TAPE UNIT

## Recorder set

to position : recording-"TAPE"- "B"- "ST"- "NOR"- "9.5"  
 potentiometer "RECORDING" to maximum;  
 other potentiometers to minimum.

Input : BU2 TAPE IN/OUT 3/5 333 Hz - 100 mV

Output : BU5 MONITOR 3/5 Adjust for 1 V with  
 R4

For further adjustments, see "RECORDING UNIT" (P4/104).

## P6/P106

## INDICATOR UNIT

## Recorder set

to position : "STOP"

Adjust R3 on P6 so that the left indicator gives a just noticeable deflection with respect to zero.  
 The same applies to R3 on P106.

## Recorder set

to position : recording-"TAPE"- "B"- "ST"- "NOR"- "9.5"  
 Input : BU2 TAPE IN/OUT 3/5 333 Hz - 1 V  
 Output : BU5 MONITOR 3/5 Adjust for 1 V with  
 potentiometer  
 "RECORDING".

Adjust R5 on P6 so that the pointer of the left-hand indicator indicates 100 % (0 dB).  
 The same applies to R5 on P106.

## P7/P107

## TONE CONTROL UNIT

This unit requires no adjustments.

## P8/P108

## POWER OUTPUT UNIT

## Recorder set

to position : "AMP"  
 all potentiometers to minimum

No input signal, if desired, short-circuit the input of the amplifier section (points 13 and 14).  
 Immediately after switching on, adjust the direct voltage on the output (points 4, 5) to +100 mV with R3.  
 Owing to the temperature rise, this value decreases to approx. +30 mV after a few minutes; if desired readjust with R3.

Adjusting the quiescent current

The quiescent current through TS7/TS8 must be adjusted to 50 mA with R19. Check value after 1 min. and if necessary readjust.  
 The quiescent current can be checked by measuring the voltage across R28/R30 (approx. 25 mV).  
 As the quiescent current through TS5/TS6 is negligible compared with that through TS7/TS8, it is also allowed to measure the current by connecting the measuring instrument instead of the fuse.

## P9

## OSCILLATOR UNIT

The unit requires no adjustments.

Oscillator frequency : 100 kHz  $\pm$  10 %  
 Voltage measured across erase head  
 K3/K6 : 36 - 40 V

## P10

## PRE-EMPHASIS/SPEED SELECTOR UNIT

## Recorder set

to position : recording-"TAPE"- "B"- "ST"- "NOR"- "4.75"  
 potentiometer "RECORDING" -20 dB (approx. 6);  
 other potentiometers to minimum

Input : BU2 TAPE IN/OUT 3/5 10 kHz - 100 mV

Output : BU4 PHONO 6/7 1.0 mV, to be  
 adjusted with  
 L1/L101

For adjustment of the tape speed, see under "Mechanical adjustments" Speed adjustment.

Adjusting the bias current

For this adjustment, use a new, non-modulated tape of good quality. Make sure that the magnetic heads are clean.

## Recorder set

to position : recording-"TAPE"- "B"- "ST"- "NOR"- "19"  
 Input : BU2 TAPE IN/OUT 3/5 1 kHz - 1 V  
 Output : BU5 MONITOR 3/5 Adjust for 1 V with  
 potentiometer  
 "RECORDING". The  
 indicators should  
 deflect as far as 100 %.

Remove the core from the coil to be adjusted completely. Now adjust the core until the output voltage does not decrease any more. Secure the cores with wax. To check this adjustment, the distortion and the frequency response of a recording can be measured. The after-tape distortion should be < 3 % at 1 kHz (100 % modulation).  
 For the correct values of the frequency response see the appropriate measurement.

## P203/P204

## TAPE TENSION UNIT

For adjustment of the motor current, see under "Mechanical adjustments" Adjusting the tape tension.

## P201

## RESET/AUTOMATIC REVERSE UNIT

## P202

## MOTOR STOP UNIT

## P205/P206

## FLIP-FLOP UNIT

## P207

## SPEED CONTROL UNIT

These units require no adjustments.

## II. INPUT SENSITIVITIES

## Recorder set

to position : "AMP"  
 potentiometers not mentioned set to minimum

Input:		Output:
"TUN"; potentiometer "RECORDING" maximum		BU5 MONITOR 3/5
BU1 TUNER 3/5	333 Hz - 100 mV	0.75 - 1.25 V
"AUX"		
BU3 AUX 3/5	333 Hz - 100 mV	0.75 - 1.25 V
"PHON"- "DYN" (SK16); potentiometer "RECORDING" -20 dB (6)		
BU4 PHONO 3/5	40 Hz - 1.2 mV	0.56 - 1.32 V
	333 Hz - 12 mV	1.5 - 2.5 V
	10 kHz - 12 mV	0.14 - 0.34 V
"CRYST" (SK16); potentiometer "RECORDING" maximum; apply signal via 2000 pF		
BU4 PHONO 3/5	40 Hz - 1 V	0.32 - 0.76 V
	333 Hz - 1 V	0.6 - 1.4 V
	10 kHz - 100 mV	0.2 - 0.5 V
Potentiometers "MICRO L" and "MICRO R" maximum		
BU8/BU9 MICRO 1/4	333 Hz - 0.15 mV	0.75 - 1.25 V

### III. FREQUENCY RESPONSE

Recorder set

to position : recording-"TAPE"- "A"- "ST"- "NOR"- "19"  
all potentiometers to minimum  
Input : BU2 TAPE IN/OUT 3/5 1 kHz - 1 V  
Output : BU5 MONITOR 3/5 Adjust for 1 V with  
potentiometer  
"RECORDING". The  
indicators should  
deflect as far as 100 %

Now decrease the input voltage to 0.1 V (= -20 dB).  
Make a recording of the following frequencies: 40 Hz - 60 Hz -  
1 kHz - 8 kHz - 20 kHz. (The input voltage must remain the  
same.) The play-back frequency response which is now  
measured relative to 1 kHz, must be in accordance with the  
curve given in Fig. 6.  
It is also possible to measure this curve at a speed of  
9.5 cm/sec.

The highest frequency must now be 15 kHz (see Fig. 7).  
In position "TUNER" and "AUX" a rejection filter for the  
stereo pilot signal is included.  
This results in frequencies above 16 kHz being considerably  
attenuated, as can be seen in Fig. 8.  
At the speed 4.75 cm/sec the frequency response in the range  
60 ... 8000 Hz is within 6 dB.  
For the complete frequency curve see Fig. 9.

### IV. CHECKING THE CROSS-TALK

Recorder set

to position : recording-"TAPE"- "B"- "ST"- "NOR"  
potentiometer "RECORDING" to maximum;  
other potentiometers to minimum  
Input: Output:  
BU2 TAPE IN/OUT 3 BU5 MONITOR 5 <50 mV  
10 kHz - 100 mV  
BU2 TAPE IN/OUT 5 BU5 MONITOR 3 <50 mV  
10 kHz - 100 mV

#### Cross-talk between inputs not used:

Input : BU2 TAPE IN/OUT 3/5 10 kHz - 2 V  
BU3 AUX 3/5 10 kHz - 2 V  
BU4 PHONO 3/5 10 kHz - 50 mV  
(SK16 DYN)  
BU8/BU9 MICRO 1/4 10 kHz - 0.15 mV  
Output : BU5 MONITOR 3/5

The voltage on points 3/5 of the monitor socket caused by  
cross-talk of the signal to the non-used sockets must not  
exceed 30 mV.

#### Cross-talk in position "1-4" - "3-2"

##### Tracks 1-4

Input : BU5 MONITOR 6 15 kHz - 1 V  
Output : Point 2 P104 <20 mV

##### Tracks 3-2

Input : BU5 MONITOR 7 15 kHz - 1 V  
Output : Point 2 P4 <20 mV

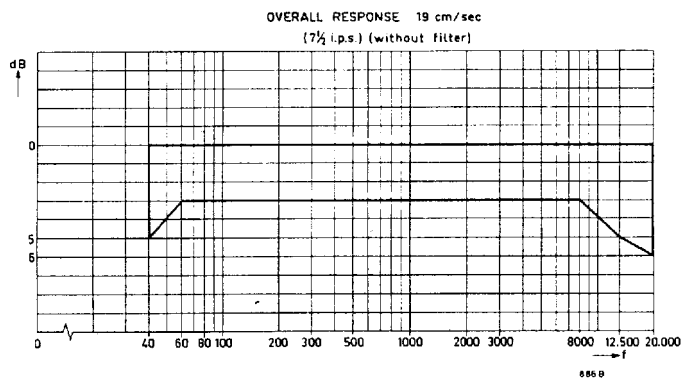


Fig. 6

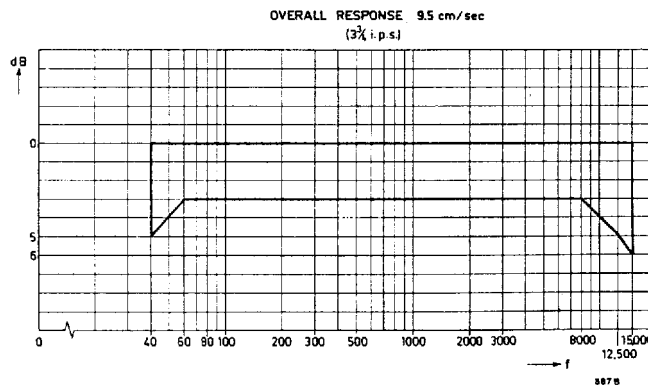


Fig. 7

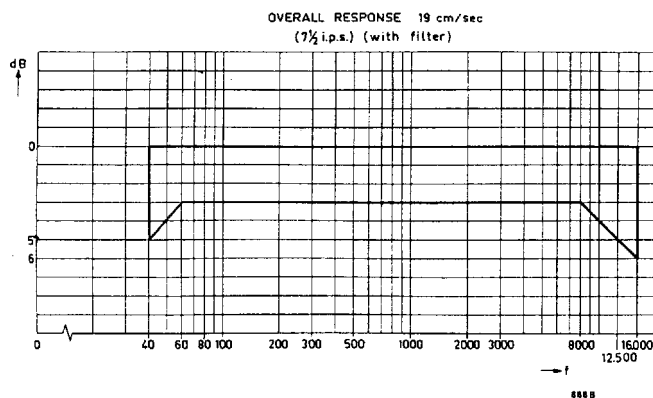


Fig. 8

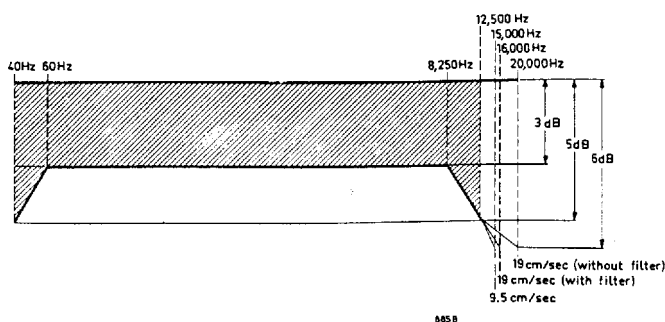


Fig. 9



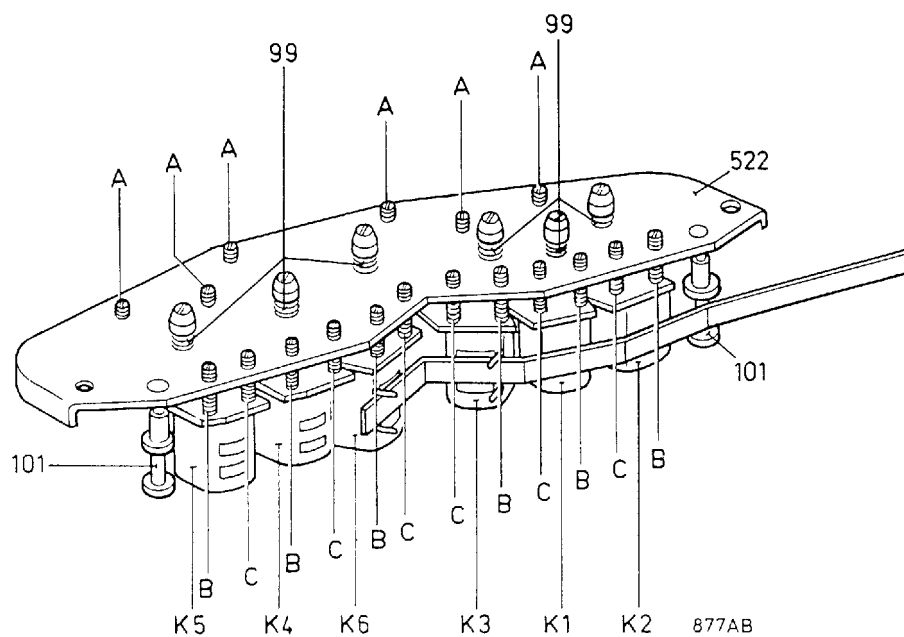


Fig. 10

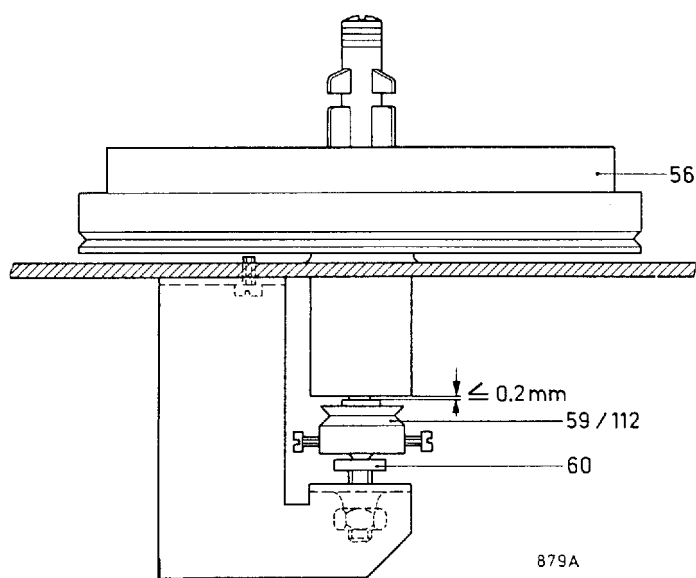


Fig. 11

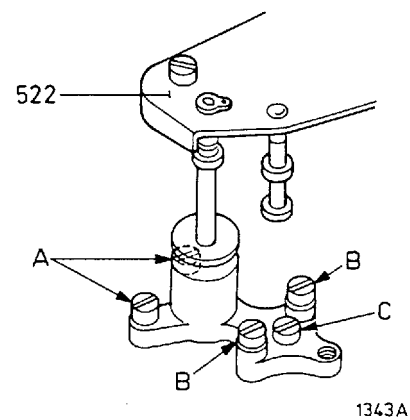


Fig. 12

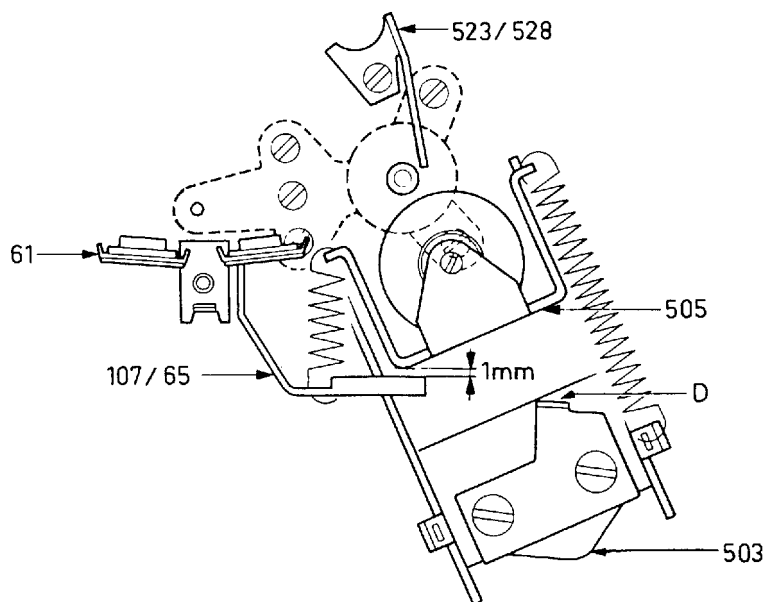


Fig. 13

880AA

CS32937

### 3. Solenoids

Remove head covers 120 and 121, button 137 and cover plate 134.

#### Pressure-roller solenoids (see Fig. 14)

- When the solenoid is energised, the force at the top of the pressure-roller bearing-bracket 505 must be approx. 1300 grammes. This force must occur at the moment that a perceptible clearance arises between the lower bolts on drawrod 73 and bushing 71 in the solenoid armature. The force can be adjusted with the upper bolts 15 on the drawrod.
- When the solenoid is energised, the clearance between bushing 71 and the lower bolts on the drawrod must be just perceptible (0.1 to 0.2 mm).
- End stops 531 must be adjusted so that the clearance between the bottom of the pressure-rollers and a tape which is tensioned around the guide rollers is approx. 1 mm when the solenoids are de-energised (see Fig. 15).
- The clearance between the control bracket for the head switching 74 and 75, and the ring 72 on the drawrod should be approx. 0.2 mm when the solenoid is energised.

#### Centre-pin solenoid

The first three procedures for adjusting the pressure-roller solenoid also apply to the centre-pin solenoid. The force at the top of the bracket 518 should be approx. 300 grammes.

#### Brake solenoid and brakes (see Fig. 17)

- When both brake shoes are applied, the two brake brackets 82 and 90 must be in parallel. Adjust by bending the brackets. Check that the brackets do not touch each other after they have been bent.
- When the two brake shoes are positioned against the turntables, cams A and B should be bent so that they are positioned in the middle of the recesses.
- When the solenoid is energised, the clearance between the brake shoes and the turntables must be 0.5 to 1 mm. This can be adjusted by means of the upper nut 15 on drawrod 86.
- When the solenoid is de-energised and the brake shoes have been reversed, end stop 531 must be positioned so that the clearance at the top of drawrod 86 in the recesses of the brake bracket is approx. 0.5 mm.
- Check the braking force of the left-hand and right-hand reel disc as stated in Fig. 16; this force must be about 1000 grammes (force  $\times$  radius of wound tape). Adjustment is possible by shortening or stretching the springs 80 in Fig. 17.

### 4. "Cueing" switches (see Fig. 18)

Remove head covers 120 and 121, button 137 and cover plate 134.

- Bend connecting rod 512 so that the clearance between the plastic brackets 511 and 513 and the solenoid armatures is the same.
- Adjust the clearance between the plastic brackets and the solenoid armatures to 1-2 mm with the aid of end stop 515.
- Bend the end stop for the cueing switch (D in Fig. 13) so that the clearance between the pressure-roller and capstan is approx. 2 mm when the cueing button is depressed.
- Move mounting bracket 524 of cueing switches SK703 and SK704 so that both pins touch the top of the plastic bracket 513 when the cueing buttons are depressed.
- Bend bracket 524 so that switches SK703 and SK704 are operated when the cueing buttons are depressed.

### 5. Adjusting the tape tension (see Fig. 19)

Remove head covers 120 and 121, button 137, cover plate 134 and rear panel 115.

- The clearance between the contact points of SK706 and SK707 must be approx. 0.5 mm.
- The clearance between the cam of the tape tension comparator and the centre contact of the switch must be 0.1 to 0.2 mm in the rest position. Adjust by bending bracket 516.
- The force on the pin of the tape tension comparator must be approx. 20 grammes when the contacts just open. Adjust by hooking the tension spring into another hole (higher: force increases; lower: force decreases).
- Adjust the motor current of the left as well as the right winding motor to 150 mA (= 75 mV across resistors R708//R709 and R706//R707 on the mounting strips on either side of the winding motors). For this, connect the meter to the resistors, depress button "◀LEFT" or "RIGHT▶" and block the relevant reel disc by hand.

When the meter indication is stable, the motor current may be corrected, if necessary, with potentiometer R9 on the tape tension units (lower unit for left winding motor; upper unit for right winding motor).

- Adjust the belt dampers so that they just touch the belts.

### 6. Capstan motor

Remove rear panel 115 and remove the bracket with capstan motor 533.

- Adjust the height of pulley 111 so that the core of head K7 and the magnet ring on the pulley are flush.
- The clearance between the magnet ring and head must be approx. 0.1 mm. This can be adjusted by loosening the fixing screws of the head and moving the head.

### 7. Capstans (see Fig. 20)

Remove head covers 120 and 121 and rear panel 115.

- Adjust lower pivot bearing 60 so that drive belt 93 runs in parallel with the mounting plate. When the recorder is in the vertical position, the flywheels must be clear of the bearing bushes.
- The upper pivot bearings 105 must spring against the capstans. When the recorder is in the vertical position, there must be no play between the bearing and capstan.
- The play between the bearing bush and the oil seal must be approx. 1 mm.

### 8. Speed adjustment (see Fig. 21)

- Remove the amplifier unit from the recorder.
- Insert a test tape with a frequency of 3150 Hz, recorded at 4.75, 9.5 or 19 cm/sec, depending on the speed to be adjusted.
- Connect the wow and flutter meter to BU2 TAPE IN/OUT 3/5.
- Adjust the speed with one of the preset potentiometers on unit P10. The potentiometers can be adjusted with an alignment tool through one of the openings in the heatsink of the output amplifier.

#### Attention

- The speed can also be adjusted with the aid of a stroboscope.
- Place the stroboscope next to the recorder and feed the tape around the roller.
- Set the speed selector to 9.5 cm/sec.
- Adjust the correct speed with potentiometer R14.

After adjusting the speed, wow and flutter must be  
 $\leq 0.35\%$  at 4.75 cm/sec  
 $\leq 0.2\%$  at 9.5 cm/sec  
 $\leq 0.15\%$  at 19 cm/sec

## MAINTENANCE

It is recommended to clean and lubricate the recorder at regular intervals. The following parts may be cleaned with e.g. alcohol:  
 tape guides  
 erase, recording and playback heads  
 drive belts  
 capstans  
 pressure rollers  
 grooves in pulleys, flywheels and reel discs  
 brake shoes.  
 The pressure felts for the heads may be cleaned with a brush.

## LUBRICATING INSTRUCTIONS

### Shell Clavus 17 - 4822 390 10048

Bearings of flywheels 95, turntables 56, guide rollers 51 and pressure rollers 63.  
 The part of the capstan which protrudes above the seal must be thoroughly cleaned after lubrication.

### Shell Alvania 2 - 4822 389 10001

The various pivots such as those of the pressure felt bracket 65/107, centre pin 78, pressure-roller bracket 506, brake brackets 82/90 etc., the pivot bearings of the reel discs and flywheels 60, the various contact faces such as those between drawrod 83/73 and pressure-roller brackets 506.

## MECHANICAL ADJUSTMENTS

### Required tools and test equipment:

- . set of feeler gauges 0.1 ... 2 mm
- . spring-pressure gauge, 30 g
- . spring-pressure gauge, 1500 g
- . head alignment jig, code number 4822 403 50686
- . test tape 13 kHz - 1 kHz, code number 4822 397 30014
- . test tape
  - 3150 Hz, 4.75 cm/sec., code number 8222 305 11170
  - 3150 Hz, 9.5 cm/sec., code number 8222 305 11190
  - 3150 Hz, 19 cm/sec., code number 8222 305 11150
- . stroboscope, 50 Hz, 4822 395 90001
- 60 Hz, 4822 395 90002
- . "wow and flutter" meter, e.g. Bruno Woelke, type ME104

### 1. Adjusting the recording, playback and erase head

Remove head covers 120 and 121.

#### Coarse adjustment (see Fig. 10)

- Remove head assembly 522.
- With the aid of the gauge and screws A, B and C adjust the heads so that:
  - . the top of the upper cores of the right-hand recording and playback heads (K1 and K2) are flush with the top of the gauge.
  - . the underside of the lower cores of the left-hand recording and playback heads (K4 and K5) is flush with the underside of the gauge.
  - . the gauge can move freely between the guide pins of the erase heads (K3 and K6) and tape guides 101.
  - . the front of the heads is perpendicular to the mounting plate.

#### Fine adjustment (with test tape 13 kHz - 1 kHz)

- Set the speed selector to position "19" and the track selector to position "1-4".
- Adjust the height of the right-hand playback head (K2) by turning screw B until the 1 kHz signal is just audible above the noise.
- Set the speed selector to position "9.5".
- Adjust the azimuth of the right-hand playback head (K2) by turning screw C until the reproduction of the 13 kHz signal is optimum. If desired, this adjustment can be checked with an oscilloscope connected to BU5 MONITOR 3/5.
- The left playback head (K5) is adjusted in the same way. Do not forget to reverse the test tape and to set the recorder to tape transport to the left!

#### Phase adjustment

First of all, the playback head should be adjusted so that the upper and lower core gaps are in line. Subsequently, the adjustment of the recording head should be adapted to this.

#### Adjusting the playback head (with test tape 13 kHz - 1 kHz)

- Set the speed selector to "9.5" and the track selector to position "ST"; tape transport to the right.
- Connect a double beam oscilloscope to BU5 MONITOR (e.g. output left channel (3) to Ya input and output right channel (5) to the Yb input).
- Adjust the right-hand playback head (K2) by turning screw C until both signals are in phase and have max. amplitude.
- Adjust the left playback head (K5) in the same way. Do not forget to reverse the test tape and to change the tape transport direction to the left!

#### Attention

It may occur that the amplitude of the two signals is not the same. This is caused by dirt on the heads or head wear, poor solder joints etc.

#### Adjusting the recording head

- Insert a normal tape (preferably a high-output tape) and apply a signal of e.g. 10 kHz to the inputs of both channels (e.g. to socket BU2 TAPE IN/OUT 3/5).
- Set the recorder to position recording, the speed selector to "19" and the track selector to "A".
- Connect a double beam oscilloscope to BU5 MONITOR (e.g. output left channel (3) to Ya input and output right channel (5) to the Yb input).
- Adjust the right-hand recording head (K1) by turning screw C until both signals are in phase.
- Adjust the left recording head (K4) in the same way. The tape should now run to the left.

#### Attention

- Coarse adjustment of the heads is also possible with a normal tape. However, this should be done only if both tape guides 101 are perpendicular.
- To replace one head, unscrew it from the base plate; this will not affect the adjustment.
- During all adjustments check that springs 99 are not fully compressed.
- After the complete adjustment procedure, set screws A, B and C should be lock-painted.
- Erase heads K3 and K6 are supplied in one version only. By fitting the fixing nut either in the upper or lower recess at the back of the erase head, it can be rendered suitable for mounting to the left or right of the centre pin.

### 2. Tape path

Remove head covers 120 and 121, button 137, cover plate 134 and rear panel 115.

#### Pulley of winding motors

- The height of the pulley 55 on the shaft must be adjusted so that the groove is at the same height as the groove of the reel disc.

#### Reel discs (see Fig. 11)

- The height of the reel disc must be adjusted so that the tape runs in the middle of the reel. Adjust with pivot bearing 60.
- The axial play must be adjusted to  $\leq 0.2$  mm by moving pulley 59 and ring 112 respectively.

#### Guide rollers

- The axial play of the guide rollers 51 must be adjusted to  $\leq 0.2$  mm with the aid of the circlip.

#### Attention

The height of the guide rollers have been factory-adjusted with the aid of shims. When replacing the roller, the height must be checked with the aid of the head alignment jig.

#### Capstan bearings (see Fig. 12)

- Block the relay of the centre pin, so that this relay cannot be energised.
- Remove the head assy 522.
- Thread a normal tape.
- Loosen the screws A, B and C half a turn.
- Adjust screws B so that the tape runs straight between the capstan and pressure-roller.
- Tighten screw C, so that the adjustment is not disturbed.
- Tighten the screws A and B.

#### Pressure-rollers (see Fig. 13)

- Position the bearing bracket of pressure-roller 503 so that the roller presses flatly against the capstan without any clearance at the top or bottom.

#### Centre pin

- Bend the stop cam on bracket 527 so that the centre pin is perpendicular to the mounting plate when the relay is energised.

#### Spacer brackets (see Fig. 13)

- Bend brackets 523 or 528 so that the clearance to the capstan is approx. 1 mm.

#### Pressure felts (see Fig. 13)

- The pressure felts must seat accurately against the heads.
- The clearance between the bearing bracket of pressure roller 505 and the cam of pressure-felt bracket 107 or 65 must be approx. 1 mm when the relay is energised.

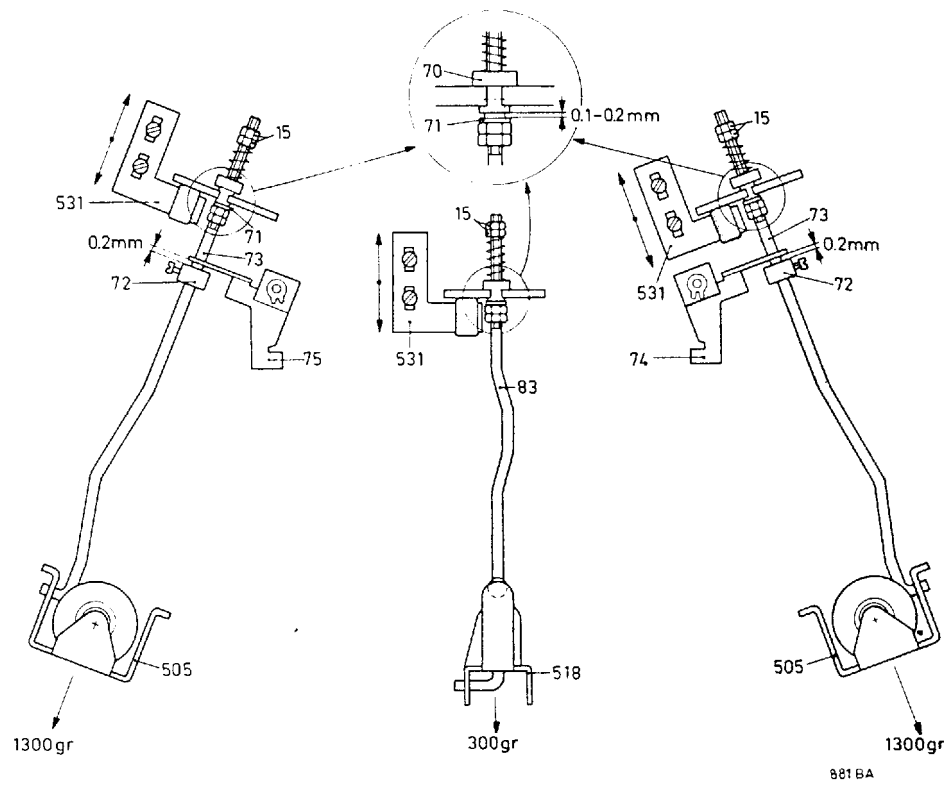


Fig. 14

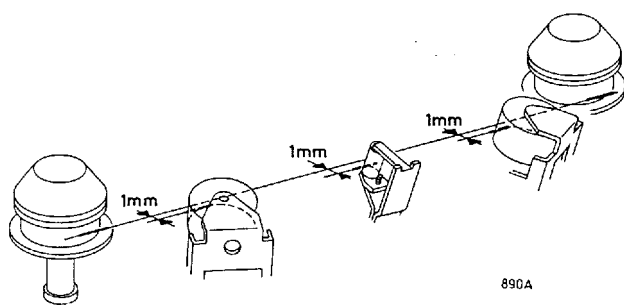


Fig. 15

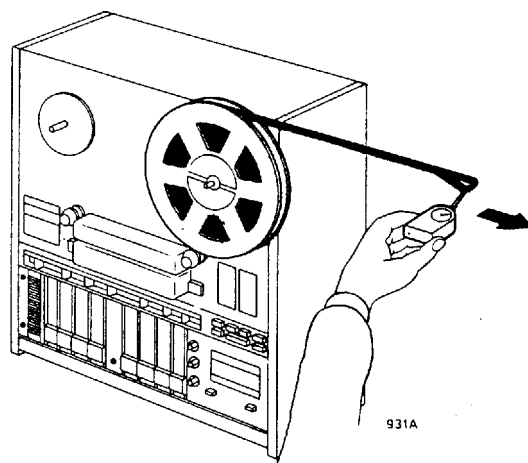


Fig. 16

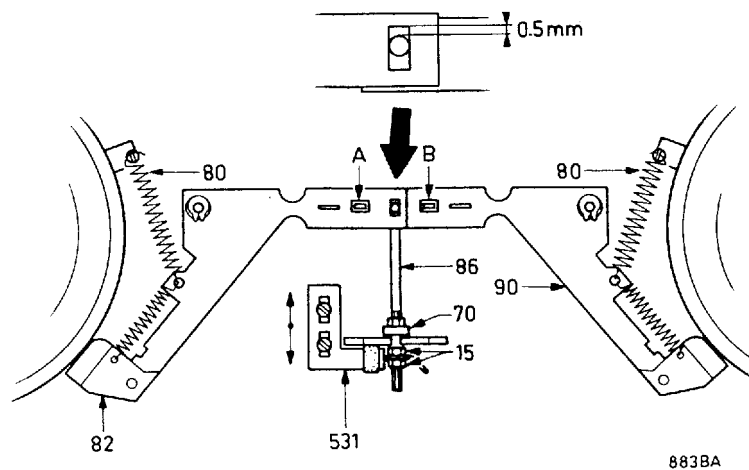


Fig. 17

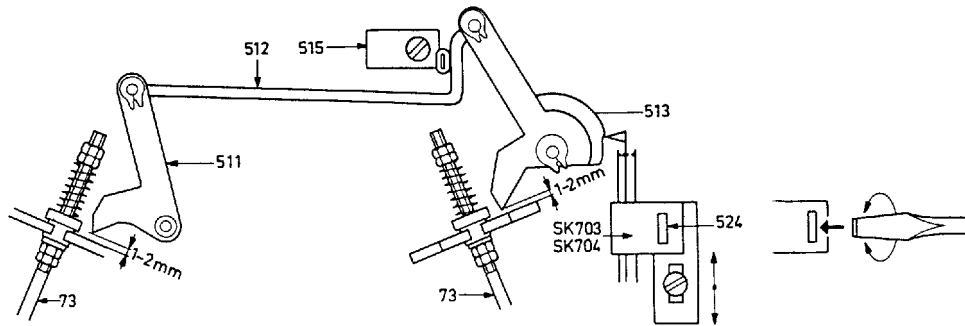


Fig. 18

882B

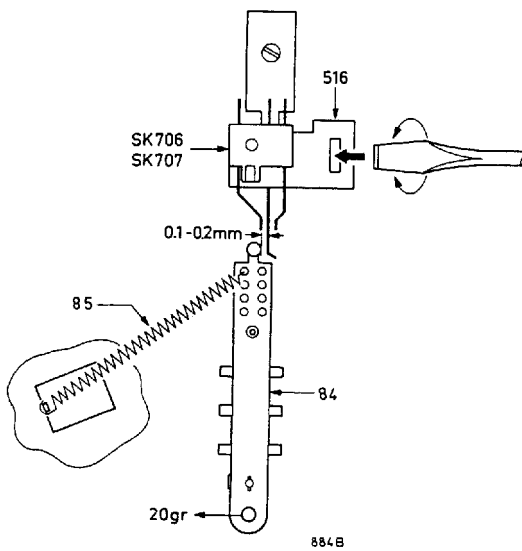


Fig. 19

884B

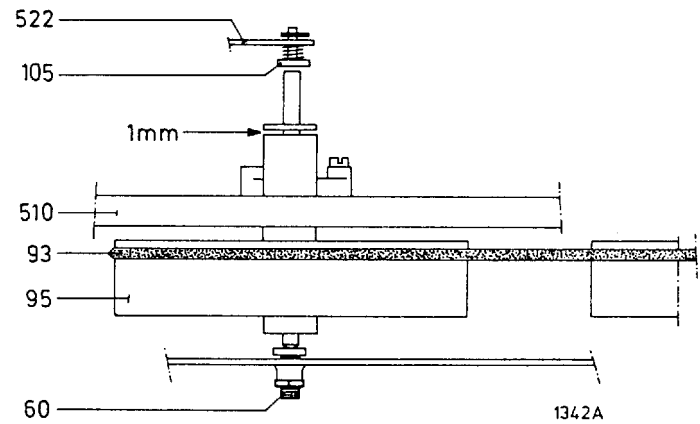


Fig. 20

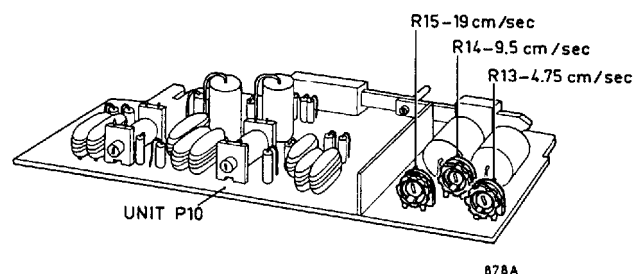


Fig. 21

For Service Manuals  
**MAURITRON SERVICES**  
 8 Cherry Tree Road, Chinnor  
 Oxfordshire, OX9 4QY.  
 Tel (01844) 351694  
 Fax (01844) 352554  
 email:- sales@mauritron.co.uk

## LIST OF MECHANICAL PARTS

## I. Tape transport

1	Screw M2x5	4822 502 10679	94	Belt damper	4822 479 30051
2	Screw M3x4	4822 502 11189	95	Flywheel	4822 528 60069
3	Washer	4822 532 50725	96	Grub screw M3x10	4822 535 80528
4	Screw M3x8	4822 502 11053	97	Screw	4822 502 11217
5	Nut M5	4822 505 10327	98	Nut	4822 505 10408
6	Screw M4x6	4822 502 11065	99	Compression spring	4822 492 50924
7	Retaining ring 3 dia.	4822 530 70115	100	Washer	4822 532 10657
8	Washer 7 x 3.2 x 0.3	4822 532 50298	101	Bush	4822 532 20433
9	Washer 4.3 Ø	4822 532 10333	102	Washer	4822 528 70246
10	Washer	4822 532 50268	103	Hexagon nut M1.6	4822 505 10514
11	Screw M3x6	4822 502 11064	104	Bearing	4822 535 70468
12	Screw M4x12	4822 502 10694	105	Compression spring	4822 492 50925
13	Screw M3x10	4822 502 10689	106	Screw	4822 502 11216
14	Washer 3 dia.	4822 530 80082	107	Splicing device	4822 403 50639
15	Nut M3	4822 505 10325	108	Pressure felt assy	4822 403 50614
16	Screw M2.5x4	4822 502 10812	109	Bearing bracket assy	4822 403 50612
18	Selftap screw 4.2 x 25	4822 502 30101	110	Grommet	4822 325 60029
19	Lock washer	4822 530 80083	111	Pulley	4822 528 80476
20	Screw M4x10	4822 502 11066	112	Ring	4822 532 30253
22	Screw M2.5x10	4822 502 10814			
23	Screw M2x3	4822 502 10908			
24	Washer 4 dia.	4822 530 70116			
25	Washer 3.2 dia.	4822 532 10332			
27	Curved washer	4822 530 80069			
28	Screw M3x15	4822 502 10691			
30	Screw M2x4	4822 502 11059			
31	Washer	4822 492 61711			
32	Screw M3x20	4822 502 11004			
33	Distant bush 3.1x16	4822 532 20607			
34	Screw M2x6	4822 502 10745			
36	Screw M2.5x6	4822 502 10813			
37	Washer	4822 532 50928			
38	Spring washer	4822 530 80144			
51	Guide roller	4822 528 70232			
52	Screw of reel disc	4822 502 11218			
53	Catch piece of reel disc	4822 532 20578			
54	Compression spring	4822 492 50923			
55	Pulley	4822 528 80477			
56	Reel disc assy	4822 528 10251			
57	Drive belt	4822 358 30127			
58	Belt damper	4822 479 30049			
59	Pulley	4822 528 80478			
60	Hexagon nut	4822 502 10765			
61	Pressure felt assy	4822 403 50638			
62	Set screw	4822 502 10522			
63	Pressure roller	4822 528 70018			
64	Tension spring	4822 492 30934			
65	Pressure felt assy	4822 403 50615			
66	Bearing bracket assy	4822 403 50613			
67	Tension spring	4822 492 30681			
68	Tension spring	4822 492 30933			
69	Compression spring	4822 492 50923			
70	Bush	4822 532 30256			
71	Tubular rivet	4822 532 20618			
72	Washer	4822 532 30255			
73	Rod	4822 535 80491			
74	Bracket	4822 403 50627			
75	Bracket	4822 403 50628			
76	Centre pin	4822 535 80529			
77	Counter switch unit assy	4822 349 50058			
78	Bracket	4822 403 40042			
79	Driving belt	4822 358 30045			
81	Tension spring	4822 492 30935			
82	Brake bracket left	4822 403 10119			
83	Rod	4822 535 80492			
84	Tape tension comparator	4822 403 50629			
85	Tension spring	4822 492 30936			
86	Rod	4822 535 80493			
87	Washer	4822 532 50716			
88	Capstan bearing	4822 520 10311			
89	Compression spring	4822 492 50152			
90	Brake bracket right	4822 403 10121			
91	Tension spring	4822 492 30678			
92	Bearing bracket assy	4822 403 50611			
93	Drive belt	4822 358 30163			

## II. Cabinet and amplifier unit

7	Retaining ring 3 dia.	4822 530 70115	173	Ornamental plate (PHONO)	4822 454 20204
9	Washer 4.3 dia.	4822 532 10333	174	Ornamental plate (MICRO RIGHT)	4822 454 20203
16	Screw M2.5x4	4822 502 10812	175	Ornamental plate (MICRO LEFT)	4822 454 20202
39	Screw	4822 502 10053	176	Cover	4822 443 60369
40	Selftap screw	4822 502 30048	177	Socket plate assy	4822 267 20131
41	Wood screw 2.2x15	4822 528 70246	178	Screw	4822 502 10856
42	Nut M4	4822 505 10262	179	Screw M3x8	4822 502 11074
43	Screw M4x22	4822 502 11161	180	Cover	4822 460 20067
44	Selftap screw	4822 502 30091	181	Plate	4822 454 20212
46	Screw M1.7x4	4822 502 10948	182	Isolator	4822 325 10057
47	Screw M4x8	4822 502 10693	183	Spring	4822 492 61712
48	Selftap screw	4822 502 30081	184	Leaf spring	4822 492 61709
49	Washer	4822 532 10479	185	Slider	4822 278 30091
113	Lid	4822 443 60368	187	Screw M3x4	4822 502 10663
114	Bolt	4822 500 10181	188	Worm	4822 522 31099
115	Rear panel	4822 443 50193	189	Ornamental plate (ECHO)	4822 454 20205
116	Foot	4822 462 40017			
117	Tubular rivet	4822 535 90914			
118	Support	4822 532 20063			
119	Handle assy	4822 498 40314			
120	Head cover	4822 443 60366			
121	Head cover	4822 443 60367			
122	Button assy	4822 410 30061			
123	Button assy	4822 276 10447			
124	Plate	4822 459 80053			
125	Plate (foot)	4822 443 60365			
126	Catch piece	4822 403 50683			
127	Strip	4822 403 50624			
129	Slider	4822 403 50625			
130	Ornamental cap	4822 462 50178			
131	Hinge	4822 417 10295			
132	Spring	4822 492 40502			
133	Housing assy	4822 443 40069			
134	Cover plate assy	4822 443 30214			
135	Washer	4822 532 50924			
136	Cover	4822 443 20071			
137	Knob	4822 411 50268			
138	Ornamental screw	4822 502 11215			
139	Meter right	4822 347 10071			
141	Meter left	4822 347 10069			
142	Tension spring	4822 492 30937			
143	Bracket	4822 403 50626			
144	Button	4822 410 21244			
145	Cover	4822 459 40261			
146	Bracket assy (light channel)	4822 403 50616			
147	Cover	4822 459 80038			
148	Bracket assy (light channel)	4822 403 50617			
149	Cover	4822 459 80037			
150	Full dog point screw	4822 502 11259			
151	Ball 5/32"	4822 520 40024			
152	Leaf spring	4822 492 61812			
153	Catch	4822 535 70419			
154	Bolt	4822 535 90912			
155	Compression spring	4822 492 50927			
156	Bracket	4822 403 50682			
157	"RIGHT▷" button assy	4822 410 21174			
158	"PAUSE" button assy	4822 410 21173			
159	"WIND▷▷" button assy	4822 410 21176			
160	"REC" button assy	4822 410 21172			
161	"STOP" button assy	4822 410 21169			
162	"◁LEFT" button assy	4822 410 21171			
163	"◁◁WIND" button assy	4822 410 21175			
164	Cover (clock)	4822 459 80037			
165	Clock assy	4822 282 10096			
166	Ornamental plate	4822 454 20211			
168	Button	4822 410 21243			
169	Ornamental plate (TREBLE)	4822 454 20208			
170	Ornamental plate (BASS)	4822 454 20209			
171	Ornamental plate (BALANCE)	4822 454 20207			
172	Ornamental plate (VOLUME)	4822 454 20206			

## LIST OF ELECTRICAL PARTS

## I. Control part

P201	Reset/automatic reverse unit	4822 218 30063
P202	Motor stop unit	4822 218 30069
P203, 204	Tape tension unit	4822 218 30067
P205, 206	Flip-flop unit	4822 218 30068
P207	Speed control unit	4822 218 30062
P10	Speed selector/pre-emphasis unit	4822 218 30064
SK6	Slide switch (MP-NOR-ECH-AMP)	4822 277 30497
SK8	Slide switch (NOR-REV)	4822 277 30498
SK9	Slide switch (FAST-MED-SLOW)	4822 277 30499
SK30	Slide switch (head switch)	4822 277 60118
SK701	Push button switch (AUTOSTOP)	4822 276 10448
	Button for SK701	4822 276 10447
SK705	Switch (reel-size selector)	4822 273 40283
SK706, 707	Switch (tape tension)	4822 278 90035
SK712	Push button switch (TIMER)	4822 276 10448
	Button for SK712	4822 276 10447
all diodes except	BA217	4822 130 30703
D225	Zener diode BZX79/C16	4822 130 30438
D242 t/m		
D245, D248		
D249, D263		
D264	Diode OF223	4822 130 30791
D255, 256	Diode BAX16	4822 130 30273
D257	Zener diode BZX79/C4V7	4822 130 30773
D269	Stabistor BZX75/C2V1	4822 130 30789
D279, 280	Zener diode BZX79/C30	4822 130 30701

BU201	Socket 10p (REMOTE)	4822 267 50149
RE1	Relay	4822 280 60177
RE201, 202, 203, 204	Solenoid	4822 280 70134
TS201	Transistor 2SC931	4822 130 40799
TS701, 702	Transistor 2N6107	4822 130 40903
TS703	Transistor BD135	4822 130 40645
M1, 2	Winding motor	4822 361 20091
M3	Capstan motor	4822 361 20092
K7	Pulse head	4822 249 20025
L701, 702, 703, 704	Coil	4822 158 10224
LA501, 602	Lamp 19 V - 50 mA (button illumination)	4822 134 40078
603, 604		
605, 606	Socket for functional unit, 14p	4822 267 50151
	Socket for functional unit, 8p	4822 267 50156

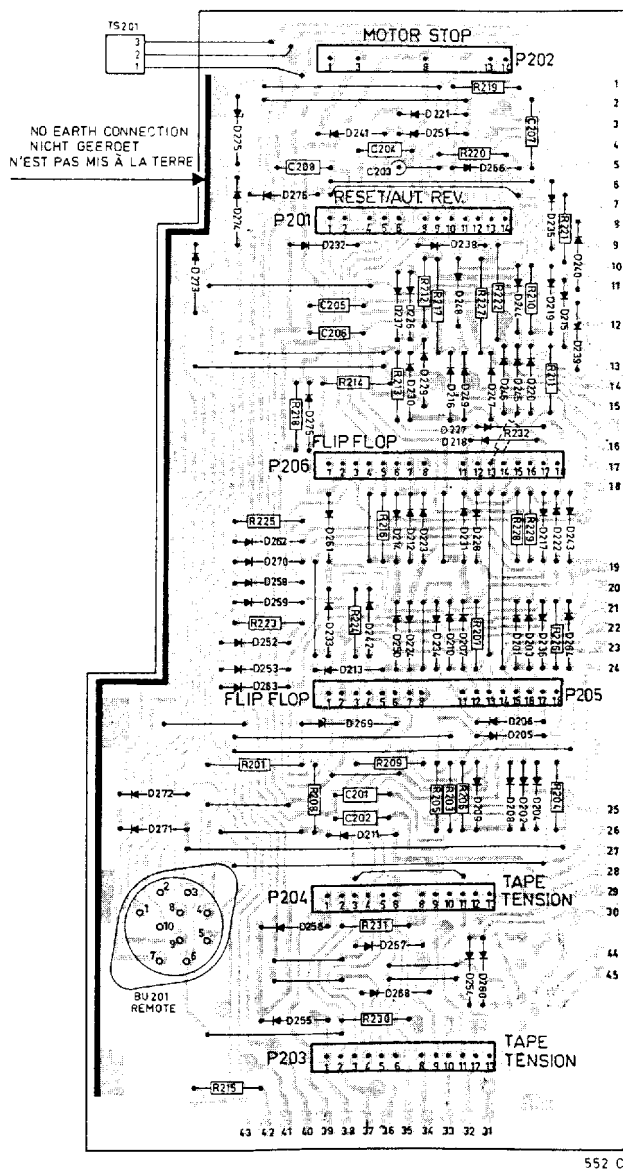
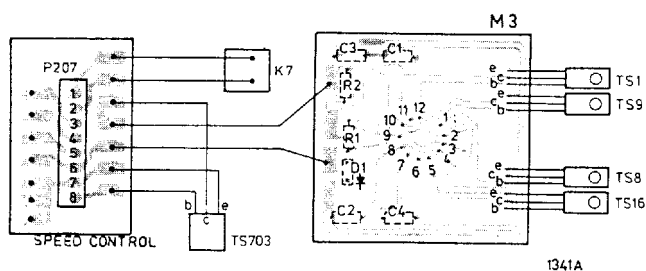


Fig. 24



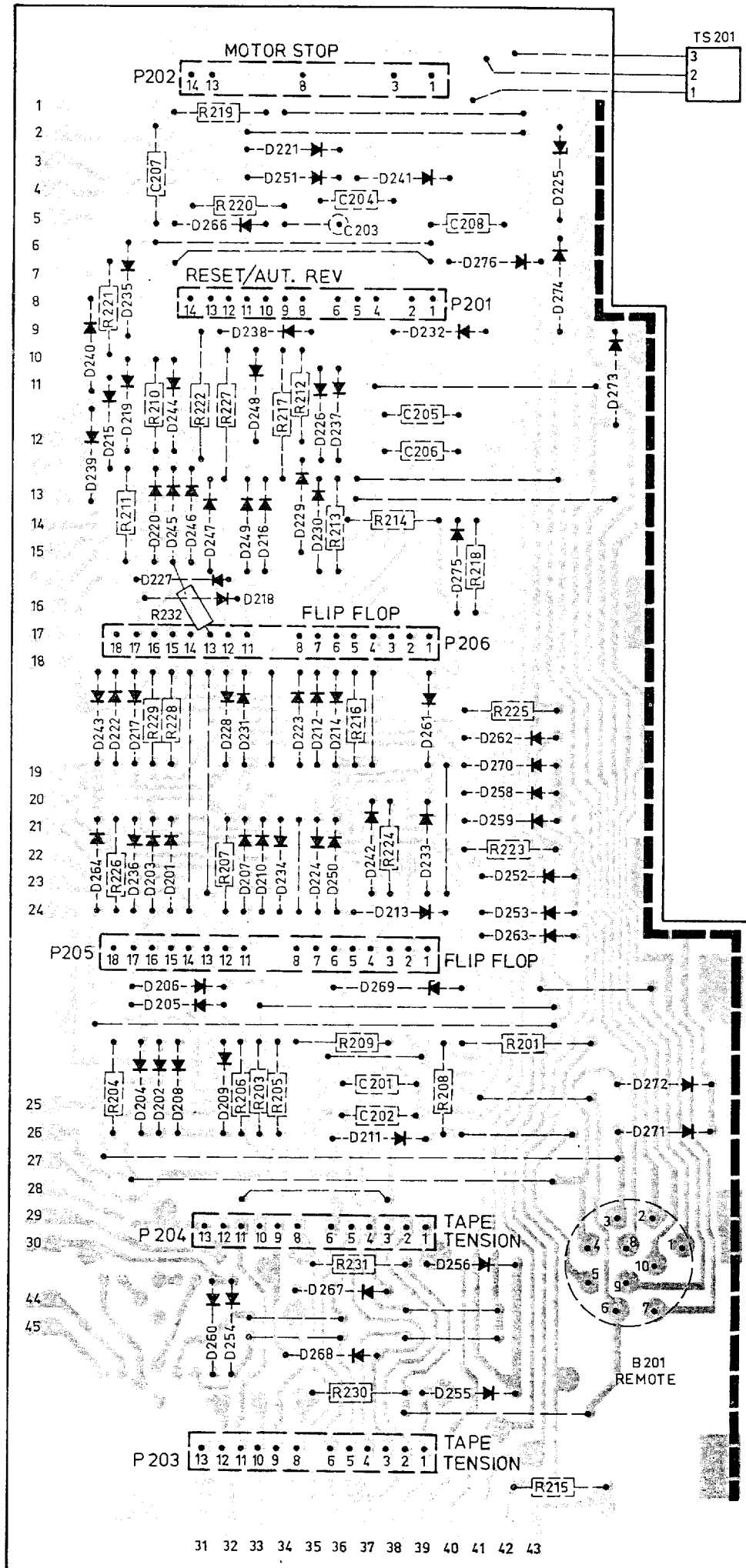


Fig. 29

1339C

CS32900

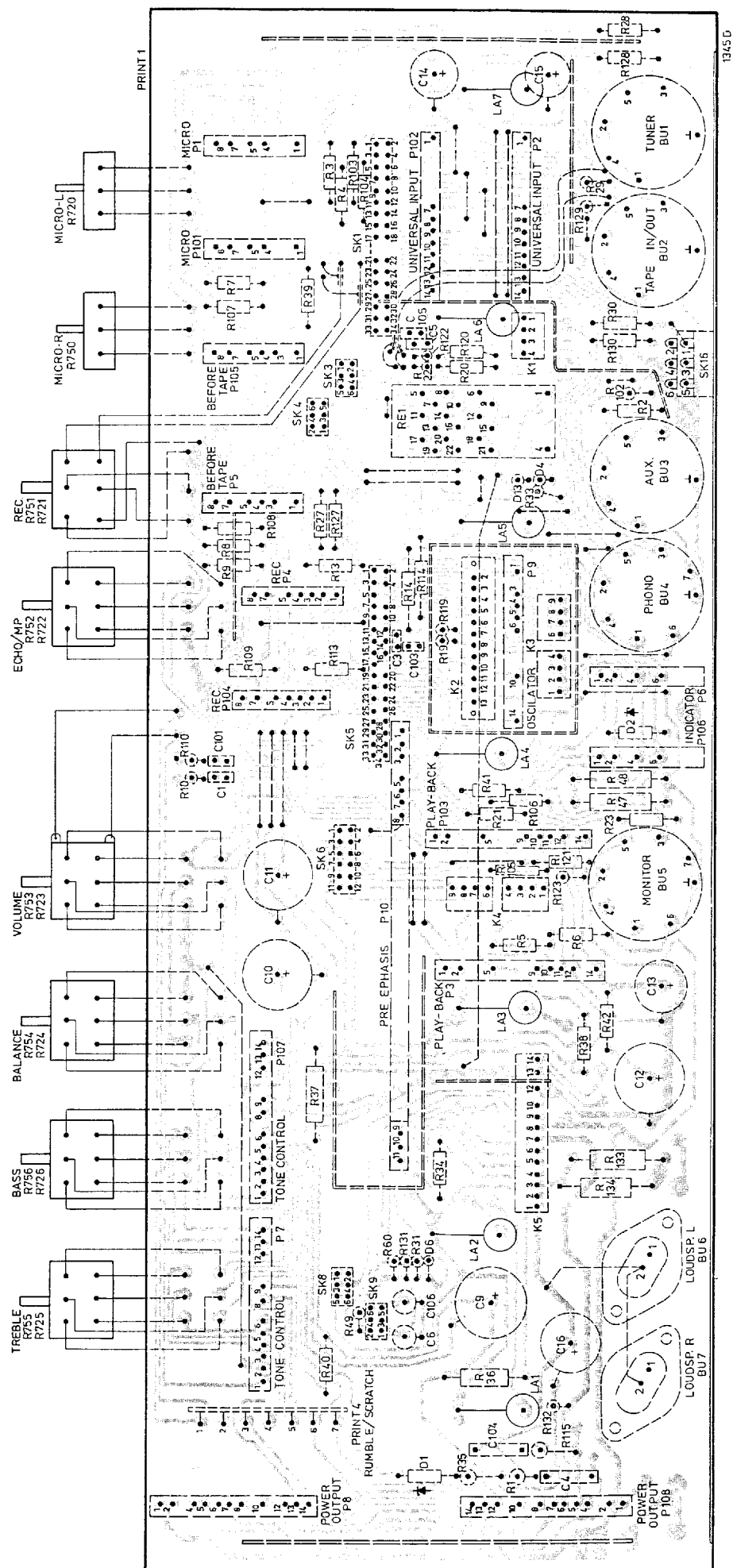


Fig. 30

## II. TAPE LOOPS DURING RECORDING/PLAYBACK

- Check the tape transport functions of the apparatus.  
Check in particular that the tape is tensioned if the set is switched on and if the centre pin and the pressure rollers are attracted.
- Check the motor current of the two winding motors (M1 and M2). See Mechanical adjustments "Adjusting the tape tension".
  - 1. Motor currents are not correct → Adjust →
    - Motor current of M1 (left) cannot be adjusted exactly → Replace P203 or TS701 (readjust motor current)
    - Motor current M2 (right) cannot be adjusted exactly → Replace P204 or TS702 (readjust motor current)
    - The two motor currents can be adjusted properly →
  - 2. Motor currents are correct → Replace P203 or P204 (Adjust motor current)
- The tape is still looping →
  - Remove the tape
  - Recorder in position "RIGHT ▷"
- Push the left-hand tape tension comparator (SK706) in the direction of the tape guide.  
Left-hand reel disc does not stop within about 2 seconds → Check SK706, D262 or R228.

- Push the right-hand tape tension comparator (SK707) in the direction of the tape guide.  
Right-hand reel disc does not stop within about 5 seconds → Check SK707, D258 or R225
- Recorder in position "◁ LEFT".
- Push the right-hand tape tension comparator (SK707) in the direction of the tape guide.  
Right-hand reel disc does not stop within about 2 seconds → Check D270 or R229
- Push the left-hand tape tension comparator (SK706) in the direction of the tape guide.  
Left-hand reel disc does not stop within about 5 seconds → Check D252 or R223

### TAPE LOOPS DURING FAST WINDING

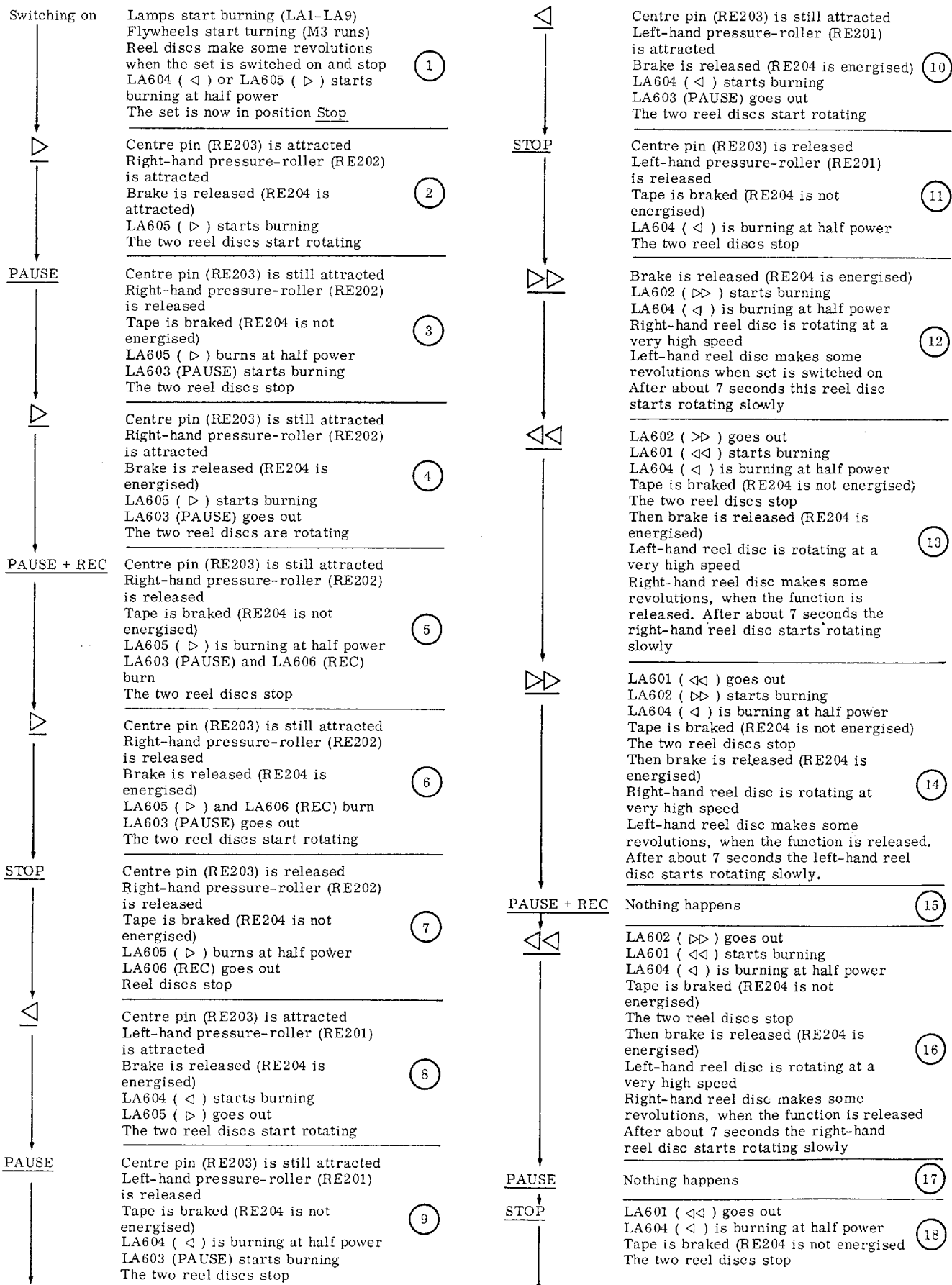
- Check the braking forces, see under "Mechanical Adjustments" Brake solenoid and brakes.
- Check the brake solenoid for attracting and repelling properly (in particular zener diode D 257).
- Recorder in position "WIND ▷▷"
- Push the left-hand tape tension comparator (SK706) in the direction of the tape guide.  
Left-hand reel disc does not stop within about 2 seconds → Check D253 or R224
- Recorder in position "◁◁ WIND"
- Push the right-hand tape tension comparator (SK707) in the direction of the tape guide.  
Right-hand reel disc does not stop within about 2 seconds → Check D259 or R226

## III. SPECIAL FAULTS

- Recorder does not start after a certain command when the tape contact is switched on →
  - ▷ → D274
  - ◁ → D273
  - ▷▷ → D272
  - ◁◁ → D271
  - ▷+◁+▷▷+◁◁ → P201 or D225
- When two keys are depressed at the same time both commands are carried out →
  - ▷+◁◁ } → D203
  - ◁+▷▷ } → D207
  - ▷+▷▷ } → D231
  - ◁+◁◁ } → D222
- Recorder stops after a certain key has been depressed repeatedly →
  - ▷ → D230
  - ◁ → D220
  - ▷▷ → D209
  - ◁◁ → D204
- Automatic reverse does not operate → P201, SK8, D216, D235, R217, C208

## IV. CHECKING SEQUENCE FOR THE CONTROL SECTION

- The encircled figures in the last column correspond to those stated in the fault finding tree (A) of the control section.
- In order to find your way about in the repair method always begin with the first instruction in the table. After some practice this will take you only a few minutes.
- 10 → NOR
- 27 → NOR
- TIMER/AUTOSTOP → off



## REPAIR METHOD

### General remarks

Apart from fault finding tree **A** (to check the control section) and fault finding tree **B** (to check the amplifier), both present in an envelope at the back of this service manual, this repair method includes:

- I. an example
- II. tape loops during recording/play-back and fast winding
- III. special faults
- IV. checking sequence for the control section
- V. an explanation of the symbols used in this method

### Attention

- Check the control circuit without tape.
  - Check the recording/playback printed panel with tape.
  - After P203, P204, TS701, TS702, M1 or M2 have been replaced, always readjust the motor current of M1 and M2 respectively.
  - All control keys, except for the stop key, are fitted with pilot lamps:
    - . if the lamp burns at full power, the function concerned has been adjusted.
    - . if lamp LA604 of key "◁ LEFT" or lamp LA605 of key "RIGHT ▷" burns at half power, the latest playing direction is indicated; burning at half power does not mean that the function has been switched on. Burning at half power is not mentioned in the repair method any more and is considered to be not burning.
  - The symbols or indications underlined mean that an operation has to be carried out with one of the operating controls.
- 
- If the repair method refers to a certain component or to a printed panel, not only the component but also connecting leads, print tracks, soldering connections and plug connections to the component/printed panel in question must be checked.
  - We suggest that the lower head cover is removed when you want to look at the pressure roller, centre pin etc.
  - The repair method does not deal with adjustments. See the adjusting instruction.

### I. EXAMPLE

Assume diode D205 has been short-circuited:

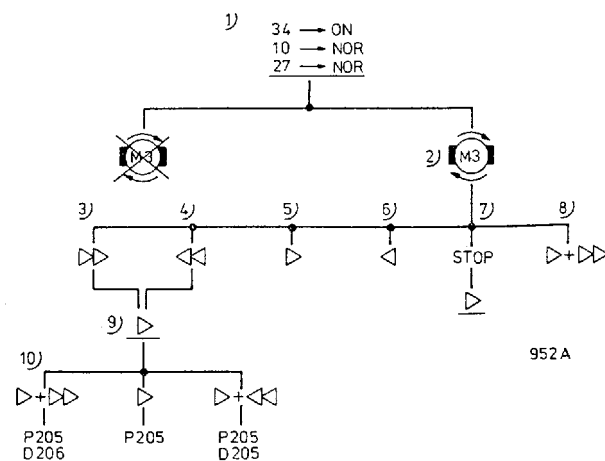
1. Remove the tape and set the knobs 34, 10 and 27 as indicated.
2. Check that M3 (capstan motor) runs.  
Result: M3 runs.  
There are now various possibilities when the recorder is being switched on.
3. ▷▷ → Fast winding right is switched on
4. ◁◁ → Fast winding left is switched on
5. ▷ → Playback right is switched on
6. ◁ → Playback left is switched on
7. Stop → This is the normal situation
8. ▷+▷ → Playback and fast winding right are switched on etc.

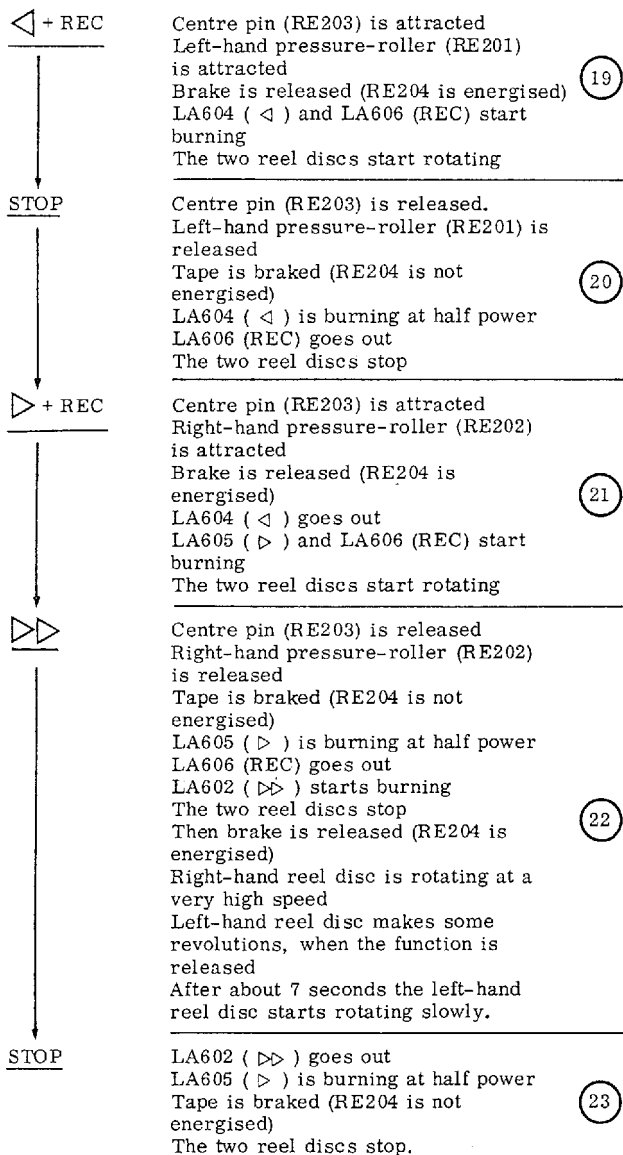
In case of this fault phenomenon 4) will reveal. This may have various causes (for example P205, D205 or D206). To distinguish between these parts, we continue with:

9. ▷ → Depress the key "RIGHT ▷"





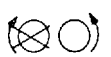
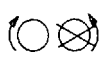





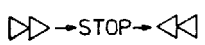






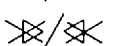







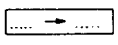


The consequence may be:

10. ▷+▷ → Playback right + fast winding right
11. ▷ → Playback right
12. ▷+◁ → Playback right + fast winding left. This means that for example, D205 may be defective.





## V. EXPLANATION OF THE SYMBOLS

	Motor M... runs
	Motor M... does not run
	The two reel discs turn immediately after the command has been given
	Reel discs do not rotate
	Left-hand reel disc does not rotate
	Right-hand reel disc does not rotate
	Relay is energised
	Relay is not energised
	Lamp does not burn
	Fit a short-circuit lead
	Remove the short-circuit load
	Recorder stops between two commands
	Recorder does not stop between two commands
	No deviation
	Deviation
	Measure the voltage
	Measure the resistance
	Playback is good
	Playback is not good
	Recording is good
	Recording is not good
	Echo is not good
	Multiplay is not good
	Sound
	No Sound
	Inject an LF signal
	Check circuit between ... and ...
	Indicator functions
	Indicator does not function

# Service Information



## PHILIPS

18-9-1972

N4450 - N4418 - N4416 - N4414 - N4510

Bc 1301

Due to a printing error the code number of a test tape as stated in some of the abovementioned service manuals is incorrect.  
The correct code number of the test tape, 3150 Hz - 19 cm/sec is 8222 305 11550.

-----

Par suite d'une faute d'imprimerie, le no.de code de la bande d'essai dans quelques documentations techniques est erroné. Le no.de code correct de la bande d'essai 3150 Hz - 19 cm/sec est 8222 305 11550.

-----

Debido a un error de imprenta en algunos de las documentaciones arriba mencionadas es dado un número de código erróneo para un cinta de prueba.  
El número de código correcto debe ser:  
Cinta de prueba 3150 Hz - 19 cm/sec., número de código 8222 305 11550.

Ten gevolge van een drukfout staat in een gedeelte van bovengenoemde dokumentaties het kodenummer van een testband verkeerd vermeld.

Het juiste kodenummer moet zijn:  
Testband 3150 Hz - 19 cm/sek, kodenummer 8222 305 11550.

-----

Infolge eines Druckfehlers ist die Code-Nummer für ein Testband in obengenannten Dokumentationen falsch angegeben. Die richtige Code-Nummer ist:  
Testband 3150 Hz - 19 cm/s, Code-Nummer 8222 305 11550.



# Service Information



PHILIPS

1974-01-02

RECORDERS N4450

AR 73-12

## A. Modifications in recorders

### Version WR09

In recorders, marked from WR09/243 the following resistors in the amplifier have been replaced:

	Original value	New value
R3/R103	5.1 k $\Omega$	6.8 k $\Omega$
R4/R104	75 k $\Omega$	100 k $\Omega$
R7/R8/R107/R108	22 k $\Omega$	7.5 k $\Omega$
R9/R109	820 k $\Omega$	270 k $\Omega$

(all resistors 1/8 W  $\pm$  5 %)

This modification has been made to improve the dynamics of the recording amplifier.

- In recorders, marked from WR09/303, the tape tension comparators 84 have been provided with dampers. These dampers consist of two plastic discs between which there is a silicon liquid. For the code numbers of the new parts and the sequence of mounting, see Fig. 1.

Note:

The two plastic discs (with silicon liquid) have been pressed together in a special manner. Therefore, the discs must on no account be separated when they are mounted.

- In recorders, marked from WR09/304, resistor R202 (2.2 k $\Omega$  - 1/8 W  $\pm$  5 %) has been added on p.c. board 2 (see Fig. 2). Furthermore, the diodes D10 and D11 (BZX88/C3V3) on the RESET/AUTOMATIC REVERSE UNIT P201 have been replaced by BZX79/C4V7. This modification has been introduced because the recorder sometimes stopped at any moment when the remote control unit N6719 was used.
- In recorders, marked from WR09/304, the coils L701, L702, L703 and L704 and the capacitors C703 and C704 have been left out. In recorders, marked from WR09/309, the capacitors have been reintroduced, to avoid motor sparks.
- In recorders, marked from WR09/309, resistor R39 has been replaced; the value was 560  $\Omega$  and is now 1.5 k $\Omega$  (safety resistor; code number 4822 110 63112), and capacitor C14 (220  $\mu$ F - 25 V) has been replaced by a capacitor of 220  $\mu$ F - 16 V (code number 4822 124 20473). As a consequence, C14 becomes smaller, and therefore the roll shutter 176 cannot push against the capacitor anymore.
- In recorders, marked from WR09/309, the following modifications on p.c. board 1 have been made (see Fig. 3):
  - the connecting surfaces for soldering the socket contacts have been enlarged;
  - the lampholders have been left out because the connecting wires of the lamps are soldered direct to the p.c. board.
- In recorders, marked from WR09/311, a screening plate has been fitted between switch SK5 and unit P10 (PRE-EMPHASIS/SPEED SELECTOR UNIT). This modification has been introduced to prevent crosstalk between track 3 and track 1.
- In recorders, marked from WR09/323, the following modifications have been made on p.c. board 2 (see Fig. 2):
  - the print tracks have been modified;
  - the diodes D277, 278, 279, 280, 281, 282 and the resistors R232, 233, 234 are fitted to the component side.

### Version WR10

In recorders, marked from WR10/334, transistor TS201 (2SC931) has been replaced by BD437. The code number of this transistor is 4822 130 40982.

Note:

Under code number 4822 130 40899, transistor D330D8D will be supplied by Service for the time being. This transistor can also be used instead of 2SC931.

- In recorders, marked from WR10/334, the frequency range has been increased from 20,000 Hz to 25,000 Hz at 19 cm/s. Therefore, the PLAYBACK UNIT and the PRE-EMPHASIS/SPEED SELECTOR UNIT have been modified. The new units

have the following code numbers:

- PLAYBACK UNIT 4822 218 30152
- PRE-EMPHASIS/SPEED SELECTOR UNIT 4822 218 30153

### Version WR11

In recorders, marked from WR11/335, the reel discs, have been provided with a conducting rubber ring and an earthing spring to eliminate the static charge.

The new reel discs can be used instead of the old ones. The code number is 4822 528 10293.

## B. Addenda to the Service Manual

### Modified adjusting method for RECORDING UNIT P4/P104

Recorder in

position : Recording - "TAPE" - "B" - "ST" - "NOR" - "9.5" potentiometer "REC" at maximum; other controls at minimum

Input:	BU2 TAPE IN/OUT 3/2	333 Hz - 0.1 V
Output:	BU5 MONITOR 3/2	to be adjusted to 1 V with R4 on P5
Input:	BU2 TAPE IN/OUT 5/2	333 Hz - 0.1 V
Output:	BU5 MONITOR 5/2	to be adjusted to 1 V with R4 on P105
Input:	BU2 TAPE IN/OUT 5/2	333 Hz - 1 V
Output:	BU5 MONITOR 5/2	to be adjusted to 1 V with recording control "REC"
Input:	BU2 TAPE IN/OUT 3/2	333 Hz - 1 V
Output:	BU5 MONITOR 3/2	value to be measured, 1 V + x V (x = max. 0.8 V). The difference with respect to 1 V to be halved with R4 on P5.
Output:	BU4 PHONO 6/2 (MP1)	to be adjusted to 1.5 mV with R9 on P4
Input:	BU2 TAPE IN/OUT 5/2	333 Hz - 1 V
Output:	BU5 MONITOR 5/2	value to be measured 1 V + y V (y = max. 0.8 V). The difference with respect to 1 V to be halved with R4 on P105. If then $\frac{x}{2} \neq \frac{y}{2}$ , the difference voltage with respect to 1 V is to be halved again.
Output:	BU4 PHONO 7/2 (MP101)	to be adjusted to 1.5 mV with R9 on P104

Note:

To avoid that the bias current is also measured, the oscillator unit P9 must be taken out of the recorder.

### Correction of the adjustment of the bias current.

With this adjustment, switch SK3 "B-A" must be in position "A".

- In some cases it may occur that the magnetic field of the ring on the pulley of capstan motor M3, decreases. This may be ascertained if the output voltage of pulse head K4 is measured.

The table below states these voltages for various tape speeds.

Tape speed	Output voltage K4
4.75 cm/s	54 mV
9.5 cm/s	110 mV
19 cm/s	175 mV

- In part I of the Service Manual, the impression is created that this circuit is protected from short-circuit of the output. However, the output stage is protected only from failing owing to too strong input signals.



## A. Änderungen im Gerät

### Ausführung WR09

Bei Geräten ab Stempelung WR09/243 wurden folgende Widerstände im Verstärker geändert:

R3/R103 war 5,1 k $\Omega$  wird 6,8 k $\Omega$   
R4/R104 war 75 k $\Omega$  wird 100 k $\Omega$   
R7/R8/R107/R108 war 22 k $\Omega$  wird 7,5 k $\Omega$   
R9/R109 war 820 k $\Omega$  wird 270 k $\Omega$

(alle Widerstände 1/8 W  $\pm$  5 %)

Durch diese Änderung wird die Dynamik des Aufnahmeverstärkers verbessert.

Bei Geräten ab Stempelung WR09/303 haben die Bandspannungskomparatoren 84 Dämpfer erhalten. Diese Dämpfer bestehen aus zwei Kunststoffscheiben mit einer Zwischenlage aus Silikonöl. Für die Kodenummern der neuen Einzelteile und die Montage siehe Abb. 1.

Achtung:

Die beiden Kunststoffscheiben werden in der Fabrik mit Silikonöl bestrichen und nach einem bestimmten Verfahren zusammengepresst. Die Scheiben dürfen deshalb bei der Montage auf keinen Fall getrennt werden.

Bei Geräten ab Stempelung WR09/304 ist auf Leiterplatte 2 der Widerstand R202 (2,2 k $\Omega$  - 1/8 W  $\pm$  5 %) hinzugefügt (siehe Abb. 2). Gleichzeitig mit dieser Änderung wurden auf der RESET/AUTOMATIC REVERSE UNIT P201 die Dioden D10 und D11 von BZX85/C3V3 in BZX79/C4V7 geändert. Diese Änderung wurde eingeführt, weil das Gerät bei Verwendung der Fernbedienungseinheit N6719 manchmal ohne Grund stoppte.

Bei Geräten ab Stempelung WR09/304 sind die Spulen L701, L702, L703 und L704 sowie die Kondensatoren C703 und C704 entfallen. Ab Stempelung WR09/309 wurden diese Kondensatoren wieder eingeführt, um Störungen durch den Motor zu unterdrücken.

Bei Geräten ab Stempelung WR09/309 ist Widerstand R39 von 560  $\Omega$  in 1,5 k $\Omega$  (Sicherheitswiderstand; Kodenummer 4822 110 63112) und Kondensator C14 von 220  $\mu$ F - 25 V in 220  $\mu$ F - 16 V (Kodenummer 4822 124 20473) geändert. Weil der neue Kondensator C14 kleiner ist, kann die Jalousie 176 nicht mehr an den Kondensator stossen.

Bei Geräten ab Stempelung WR09/309 wurden auf Leiterplatte 1 u.a. folgende Änderungen vorgenommen (siehe Abb. 3):

- die Anschlussflächen für das Löten der Buchsenkontakte wurden vergrößert;
- die Lampenfassungen sind entfallen, weil die Anschlussdrähte der Lampen jetzt direkt auf die Leiterplatte gelötet werden.

Bei Geräten ab Stempelung WR09/311 wird zwischen Schalter SK5 und Einheit P10 (PRE-EMPHASIS/SPEED SELECTOR UNIT) eine Abschirmplatte montiert. Durch diese Änderung soll Übersprechen zwischen Spur 3 und Spur 1 vermieden werden.

Bei Geräten ab Stempelung WR09/323 wurden auf Leiterplatte 2 u.a. folgende Änderungen vorgenommen (siehe Abb. 2):

- Leiterbahnen geändert
- die Dioden D277, 278, 279, 280, 281 und 282 und die Widerstände R232, 233, 234 werden auf der Bauelementeseite der Leiterplatte montiert.

### Ausführung WR10

Bei Geräten ab Stempelung WR10/334 ist Transistor TS201 von 2SC931 in BD437 geändert. Kodenummer dieses Transistors: 4822 130 40982.

Anmerkung:

Unter der Kodenummer 4822 130 40899 liefert der Service vorläufig den Transistor D330D8D, der ebenfalls an Stelle des 2SC931 verwendet werden kann.

Bei Geräten ab Stempelung WR10/334 ist der Frequenzbereich bei 19 cm/s von 20.000 Hz auf 25.000 Hz erhöht. Hierzu wurden die PLAY-BACK UNIT und die PRE-EMPHASIS/SPEED SELECTOR UNIT geändert. Die neuen Einheiten sind unter folgenden Kodenummern lieferbar:

- PLAYBACK UNIT 4822 218 30152  
- PRE-EMPHASIS/SPEED SELECTOR UNIT 4822 218 30153

### Ausführung WR11

Bei Geräten ab Stempelung WR11/335 erhalten die Spulenteiler einen Ring aus leitendem Gummi und eine Erdungsfeder, um statische Ladung abzuleiten. Diese neuen Spulenteiler können an Stelle der alten montiert werden. Kodenummer: 4822 528 10293.

## B. Ergänzungen der Dokumentation

. Geänderte Einstellmethode RECORDING UNIT P4/P104

Tonbandgerät

in Stellung : Aufnahme - "TAPE" - "B" - "ST" - "NOR" - "9,5"  
Aufnahmeregler "REC" auf Maximum; andere Regler auf Minimum

Eingang: BU2 TAPE IN/OUT 3/2 333 Hz - 0,1 V  
Ausgang: BU5 MONITOR 3/2 mit R4 auf P5 einstellen auf 1 V

Eingang: BU2 TAPE IN/OUT 5/2 333 Hz - 0,1 V  
Ausgang: BU5 MONITOR 5/2 mit R4 auf P105 einstellen auf 1 V

Eingang: BU2 TAPE IN/OUT 5/2 333 Hz - 1 V  
Ausgang: BU5 MONITOR 5/2 mit Aufnahmeregler "REC" einstellen auf 1 V

Eingang: BU2 TAPE IN/OUT 3/2 333 Hz - 1 V  
Ausgang: BU5 MONITOR 3/2 zu messender Wert 1 V + x V (x = max. 0,8 V). Die Differenz gegenüber 1 V mit R4 auf P5 halbieren, mit R9 auf P4 einstellen auf 1,5 mV

Eingang: BU2 TAPE IN/OUT 5/2 333 Hz - 1 V  
Ausgang: BU5 MONITOR 5/2 zu messender Wert 1 V + y V (y = max. 0,8 V). Die Differenz gegenüber 1 V mit R4 auf P105 halbieren.

Wenn danach  $\frac{x}{2} \neq \frac{y}{2}$

erneut die Differenzspannung gegenüber 1 V halbieren.

Ausgang: BU4 PHONO 7/2 (MP101) mit R9 auf P104 auf 1,5 mV einstellen.

Achtung:

Um zu verhindern, dass auch die Vormagnetisierungsspannung gemessen wird, die Oszillatoreinheit P9 aus dem Gerät nehmen.

. Korrektur der Einstellung des Vormagnetisierungsstromes  
Bei dieser Einstellung muss Schalter SK3 "B-A" in Stellung "A" stehen.

. In Einzelfällen kann es vorkommen, dass das Feld des magnetisierten Ringes auf der Stufenscheibe des Bandantriebsmotors M3 abnimmt. Dies kann man durch Messen der Ausgangsspannung des Impulskopfes K4 feststellen.

In untenstehender Tabelle sind diese Spannungen für die einzelnen Bandgeschwindigkeiten angegeben:

Bandgeschwindigkeit	Ausgangsspannung K4
4,75 cm/s	54 mV
9,5 cm/s	110 mV
19 cm/s	175 mV

. Bei der Beschreibung der Endstufe in Teil I der Dokumentation wird der Eindruck erweckt, dass der Ausgang der Schaltung kurzschlussfest ist. Das ist nicht der Fall. Die Endstufe ist nur vor Beschädigungen durch zu hohe Eingangsspannungen geschützt.

## A. Modificaciones en el aparato

### Versión WR09

En los aparatos a partir del estampillado WR09/243 han sido modificados las siguientes resistencias:

R3/R103 era 5,1 k $\Omega$  y es ahora 6,8 k $\Omega$   
 R4/R104 era 75 k $\Omega$  y es ahora 100 k $\Omega$   
 R7/R8/R107/R108 era 22 k $\Omega$  y es ahora 7,5 k $\Omega$   
 R9/R109 era 820 k $\Omega$  y es ahora 270 k $\Omega$

(todas las resistencias 1/8 W + 5 %)

Esta modificación es introducida a fin de mejorar la dinámica del amplificador de registro.

En los aparatos a partir del estampillado WR09/303 los "tape tension comparators" 84 son provistos de amortiguadores. Estos amortiguadores son compuestos de dos discos de material sintético entre los cuales hay un líquido de silicon. Para los números de código de estos nuevos componentes y el orden de montaje véase a la figura 1.

Atención:

Los dos discos de material sintético son provistos por la fábrica de líquido silicona y comprimidos de una manera especial. Por ello estos discos no deben ser separados jamás durante el montaje.

En aparatos a partir del estampillado WR09/304 es anadido la resistencia R202 (2,2 k $\Omega$  - 1/8 W + 5 %) sobre la placa impresa 2 (véase la fig. 2). Al mismo tiempo son modificados los diodos D10 y D11 sobre la unidad RESET/AUTOMATIC REVERSE P201 de BZX88/C3V3 en BZX79/C4V7. Esta modificación es introducida debido a que el aparato se paraba a veces sin razón alguna al ser usado la unidad de mando a distancia N6719.

En aparatos a partir del estampillado WR09/304 han sido suprimidos las bobinas L701, L702, L703 y L704 y los condensadores C703 y C704. A partir del estampillado WR09/309 los condensadores son nuevamente introducidos a fin de evitar chasquidos de motor.

En aparatos a partir del estampillado WR09/309 es modificado la resistencia de 560  $\Omega$  en 1,5 k $\Omega$  (resistencia de seguridad; número de código 4822 110 63112) y el condensador C14 de 220  $\mu$ F - 25 V en 220  $\mu$ F - 16 V (número de código 4822 124 20473). Como que por ello C14 es más pequeño, la tapa corrediza no chocará más contra este.

En aparatos a partir del estampillado WR09/309 son introducidos los siguientes modificaciones sobre la placa impresa 1 (véase la fig. 3)

- las superficies de conexión para soldar a los contactos del enchufe son agrandadas
- los portalamparillas han quedado suprimidos ya que las lamparillas son soldados directamente sobre la placa impresa.

En aparatos a partir del estampillado WR09/311 es montado una plaqueilla de blindaje entre el conmutador SK5 y la unidad P10 (PRE-EMPHASIS/SPEED SELECTOR UNIT). Esta modificación es introducida a fin de evitar la influencia mutua entre los pistas impresas 3 y 1.

En aparatos a partir del estampillado WR09/323 son introducidos las siguientes modificaciones sobre la placa impresa 2 (véase la fig. 2):

- trazado impreso modificado
- los diodos D277, 278, 279, 280, 281, 282 y las resistencias R232, 233, 234 son montados sobre el lado de componentes de la placa impresa.

### Versión WR10

En aparatos a partir de WR10/334 es modificado el transistor TS201 de 2SC931 en BD437. El número de código de este transistor es 4822 130 40982.

Nota:

El Servicio suministra temporaneamente al transistor D330D8D bajo el número de código 4822 130 40899, cual puede ser aplicado también en lugar del 2SC931.

En aparatos a partir del estampillado WR10/334 es aumentado el margen de frecuencia de 20 000 Hz hasta 25 000 Hz para 19 cm/seg.

Para esto son modificados la unidad de PLAYBACK y la unidad de PRE-EMPHASIS/SPEED SELECTOR. Las nuevas unidades son suministrados bajo los siguientes números de código:

- PLAYBACK UNIT 4822 218 30152
- PRE-EMPHASIS/SPEED SELECTOR UNIT 4822 218 30153

### Versión WR11

En aparatos a partir del estampillado WR11/335 los platos de bobina son provistos de un aro de caucho conductor y un resorte lámina de masa a fin de hacer afluir la carga electrostática.

Los platos de bobina no modificados pueden ser sustituidos sin más por estos nuevas.

El número de código es 4822 528 10293.

## B. Suplemento a la documentación

Método de ajuste modificado para RECORDING UNIT P4/P104.

Magnétopono

en posición: Resistro - "TAPE" - "B" - "ST" - "NOR" - "9.5"  
 Control de registro "REC" al máximo; todos los demás controles al mínimo.

Entrada:	BU2 TAPE IN/OUT 3/2	333 Hz - 0,1 V
Salida:	BU5 MONITOR 3/2	ajústese con R4 sobre P5 a 1 V
Entrada:	BU2 TAPE IN/OUT 5/2	333 Hz - 0,1 V
Salida:	BU5 MONITOR 5/2	ajústese con R4 sobre P105 a 1 V
Entrada:	BU2 TAPE IN/OUT 5/2	333 Hz - 1 V
Salida:	BU5 MONITOR 5/2	ajústese con el control de registro "REC" a 1 V
Entrada:	BU2 TAPE IN/OUT 3/2	333 Hz - 1 V
Salida:	BU5 MONITOR 3/2	valor a medirse 1 V + x V (x = 0,5 V max). Mediar la diferencia con respecto a 1 V mediante R4 sobre P5. ajústese mediante R9 sobre P4 a 1,5 mV
Salida:	BU4 PHONO 6/2 (MP1)	ajústese mediante R9 sobre P4 a 1,5 mV
Entrada:	BU2 TAPE IN/OUT 5/2	333 Hz - 1 V
Salida:	BU5 MONITOR 5/2	valor a medirse 1 V + y V (y = 0,5 V max). Mediar la diferencia con respecto a 1 V mediante R4 sobre P105. Si luego $\frac{x}{2} \neq \frac{y}{2}$ entonces mediar nuevamente la diferencia con respecto a 1 V. ajústese mediante R9 sobre P104 a 1,5 mV
Salida:	BU4 PHONO 7/2 (MP101)	ajústese mediante R9 sobre P104 a 1,5 mV

Atención:

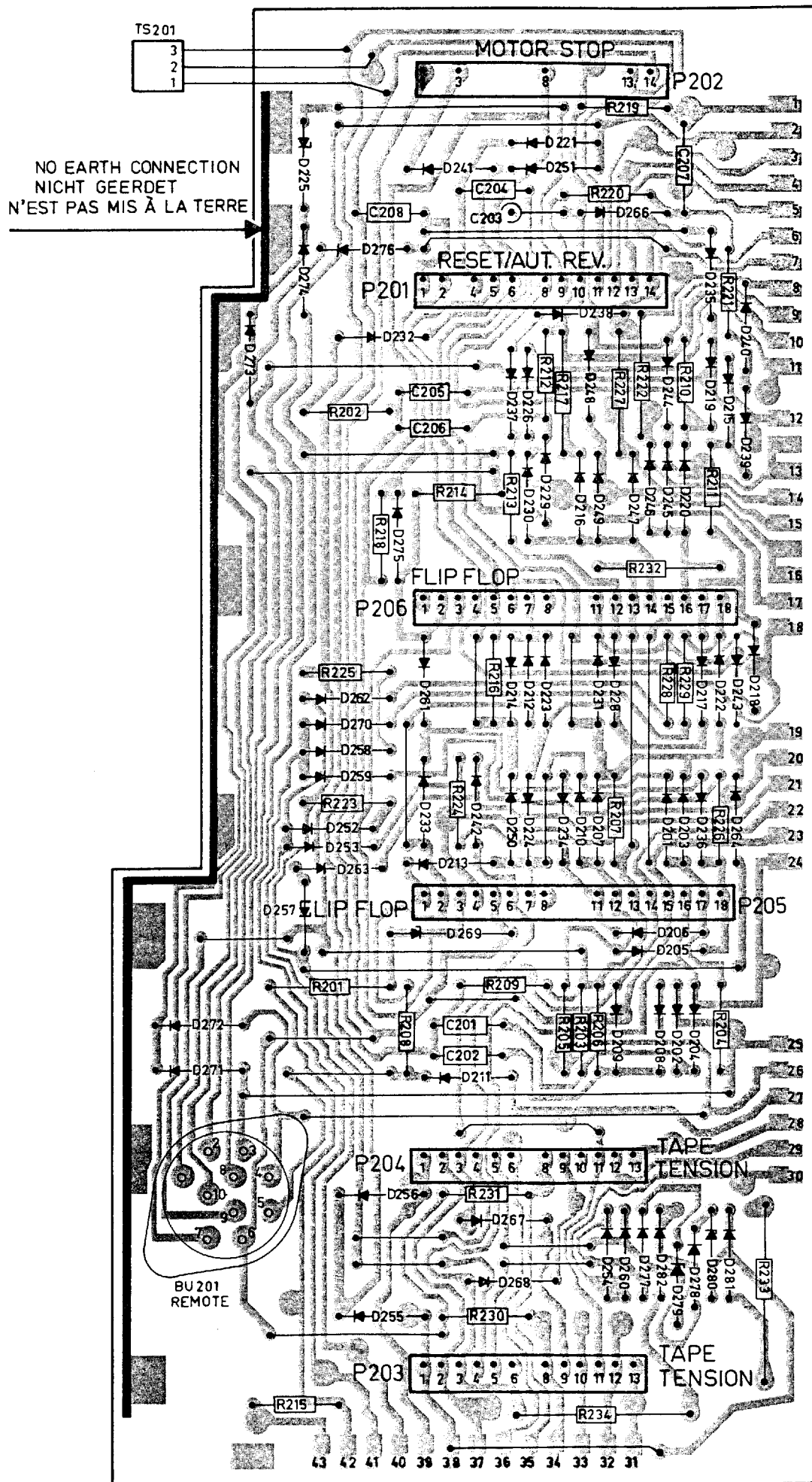
Afin de evitar de que se nude a la vez a la tensión de premagnetización hay que quitar del aparato a la unidad osciladora P9.

Rectificación del ajuste de la corriente de premagnetización  
 Para este ajuste el conmutador SK3 "B-A" debe hallarse en la posición "A".

En algunos casos puede suceder que el campo magnético del aro magnetizado, cual se encuentra sobre la polea del motor de cabrestante M3, disminuye. Esto puede ser constatado nudiéndose a la tensión de salida de la cabeza de impulsos K4. En la tabla a continuación son dados estas tensiones para los diversos velocidades de cinta.

Velocidad de cinta	Tension de salida K4
4,75 cm/seg.	54 mV
9,5 cm/seg.	110 mV
19 cm/seg.	175 mV

En la parte I de la documentación es dado la impresión en la descripción de la etapa final de que este circuito es asegurado contra el cortocircuitado de la salida. Esto no es así. La etapa final es solamente asegurado contra el defectuarse debido a senales de entrada demasiados grandes.



# Service Information



PHILIPS

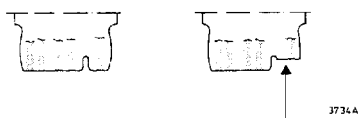
1973-09-28

FUNCTIONAL UNITS  
N4414, N4416, N4418, N4450, N4510

AR 73-24

This information summarises the modifications to all Functional Units of the above-mentioned recorders.

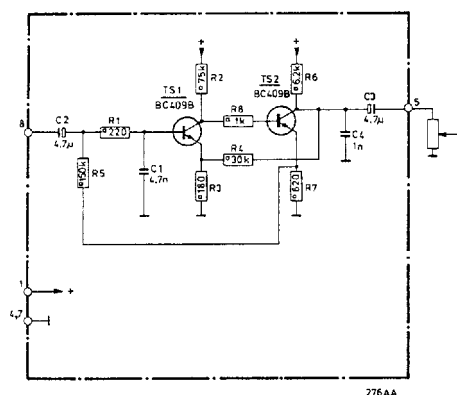
## General remark



- The form of the unit has been modified. Thus, it will not occur that, when a unit is drawn out of the recorder, one of its corners breaks off.

## MICRO INPUT UNIT

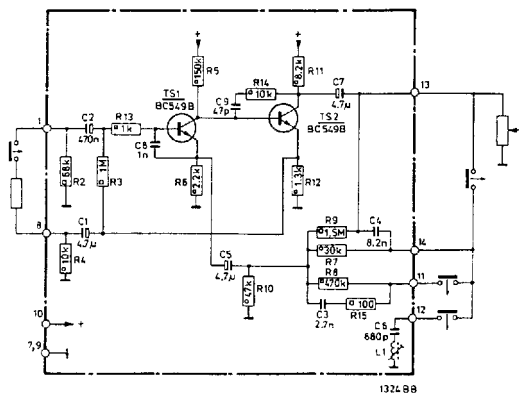
N4450



- TS1,2 - BC149B have been replaced with BC409B. Thus, the roller shutters in front of the input sockets will not slide against the transistors.

## UNIVERSAL INPUT UNIT

N4418, N4450, N4510



- R9 - 620 kΩ has been replaced with a resistor of 1.5 MΩ. Thus, the frequency range for "Phono" has been improved. This modification has been made in recorders N4450 marked from WR07/150.  
Note: The N4418 and the N4510 have been featuring this modification from the start of production.
- TS1,2 - BC149B have been replaced with BC549B. Thus, fitting the transistors has been facilitated.

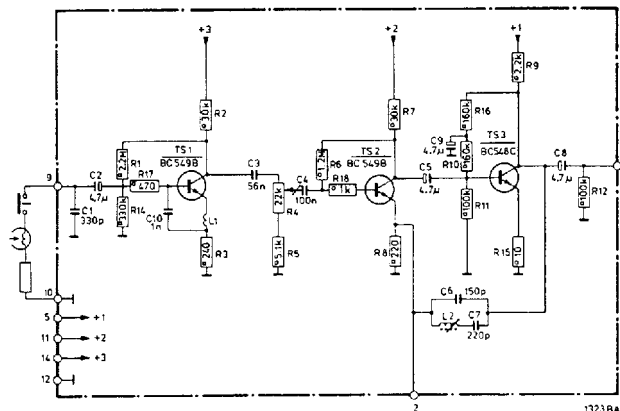
For Service Manuals  
MAURITRON SERVICES  
8 Cherry Tree Road, Chinnor  
Oxfordshire, OX9 4QY.  
Tel (01844) 351694  
Fax (01844) 352554  
email:- sales@mauritron.co.uk



CS38591

## PLAYBACK UNIT

N4418, N4450, N4510



- C1 - 680 pF has been replaced with a capacitor of 330 pF. Thus, the frequency characteristic has been improved up to 25 kHz at  $v = 19$  cm/s.

This modification has been made in recorders marked from WR07/327 (N4418), WR10/334 (N4450) or WR02/327 (N4510).

- Three transistors have been replaced.

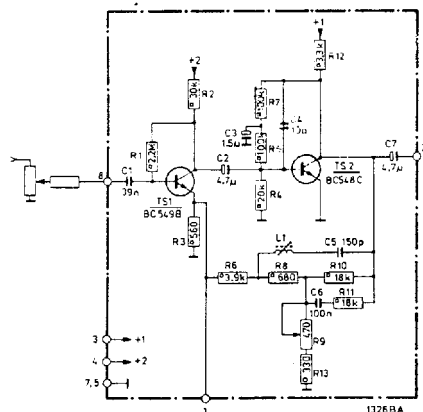
Original types	Replacement types
TS1,2 - BC149B	BC549B
TS3 - BC148C	BC548C

Thus, fitting the transistor has been facilitated.

Note: The units containing the modifications to obtain an improved frequency characteristic are supplied under code number 4822 218 30152.

## RECORDING UNIT

N4418, N4450, N4510

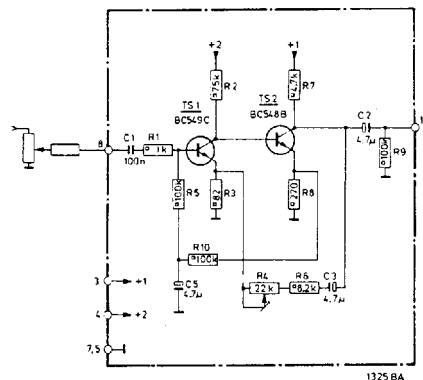


- The correct value of R13 is 330  $\Omega$ .

- TS1 - BC149C has been replaced with BC549C, and TS2 - BC148B with BC548B. Thus, fitting these transistors has been facilitated.

## BEFORE TAPE UNIT

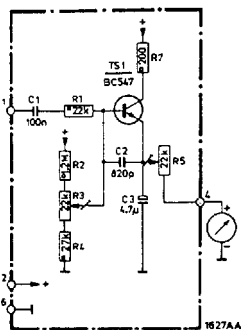
N4418, N4450, N4510



- TS1 - BC149C has been replaced with BC549C, and TS2 - BC148B with BC548B. Thus, fitting these transistors has been facilitated.

## INDICATOR UNIT

N4416, N4418, N4450, N4510



- Two resistors have replaced:

Original type	Value of replacement type
R2 - 1.5 M $\Omega$	1.2 M $\Omega$
R4 - 12 k $\Omega$	27 k $\Omega$

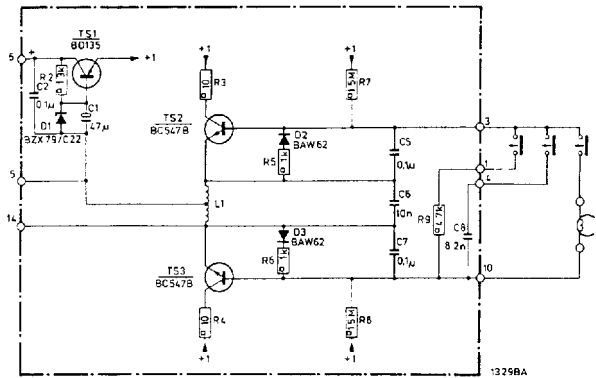
Thus, the quiescent current can be better adjusted.

The recorders have been featuring this modification from the start of production.

- TS2 - BC147 has been replaced with BC547. Thus, fitting this transistor has been facilitated.

## OSCILLATOR UNIT

N4418, N4450, N4510



- The erase frequency has been reduced from 114 kHz to 100 kHz. Thus, MW reception has been improved. Owing to this modification, C3, C4, C9 and C10 are no longer used. Besides, some capacitors have been replaced.

Replaced capacitors	Value of replacement type
C5 and C7 - 56 pF	0.1 $\mu$ F
C6 - 8.2 nF	10 nF
C8 - 6.2 nF	8.2 nF

D1 - BZX79/C20 has been replaced with BZX79/C22; besides, R5 and R6 (10 k $\Omega$  each) have been replaced with resistors of 1 k $\Omega$ ; they are now in series with D2 and D3 respectively. Thus, the erasing capacity has been improved. These modifications have been made in recorders marked from WR06/148 (N4450).

The N4418 and N4510 have been featuring these modifications from the start of production.

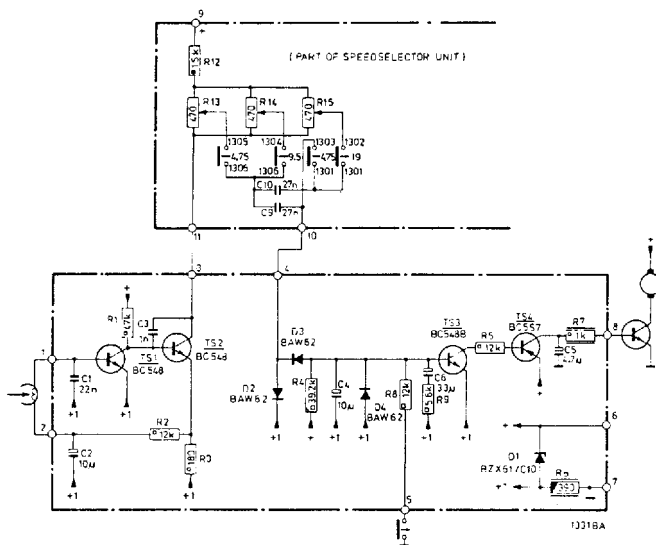
- D2,3 - BA216 have been replaced with BAW62. Thus, the reliability has been improved.

This modification has been made in: N4418 marked from WR07/322, N4450 marked from WR09/322, N4510 marked from WR02/322.

- TS2,3 - BC147B have been replaced with BC547B. Thus, fitting the transistors has been facilitated.

## SPEED CONTROL UNIT

N4418, N4450, N4510



- D1 - BZX79/C10 has been replaced with BZX61/C10. Thus, the reliability has been improved.

This modification has been made in recorders marked from WR07/317 (N4418), from WR09/316 (N4450), or from WR02/317 (N4510).

- D2,3 - BA217 have been replaced with BAW62; D4 - BA216 has been replaced with BAW62. Thus, the reliability has been improved. These modifications have been made in recorders marked from: WR07/304 (N4418),

WR09/304 (N4450),  
WR02/304 (N4510)

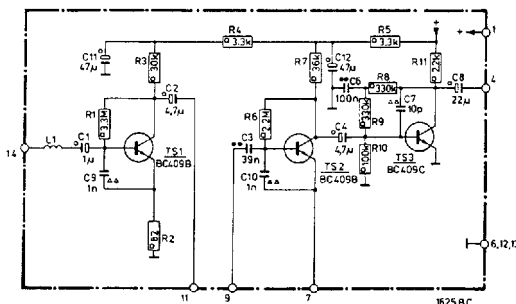
- Some transistors have been replaced.

Original type	Replacement type
TS1,2 - BC148	BC548
TS3 - BC148	BC548B
TS4 - BC157	BC557

Thus, fitting these transistors has been facilitated.

## REC/PLAYBACK UNIT

N4414, N4416



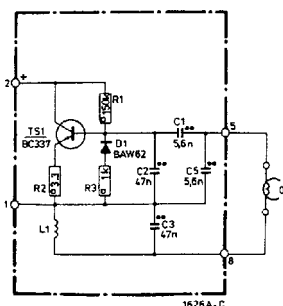
- The circuit has been modified as a consequence of standardisation. The unit can now also be used in the N2407, N2408 and N2509.

The modified unit can also be used in recorders of an earlier production.

In recorders produced after this modification was made, the new unit (marked 11.2 on the track side) must be used. This modification has been made in recorders marked from WR02/304 (N4414) or WR04/302 (N4416).

## OSCILLATOR UNIT

N4414, N4416

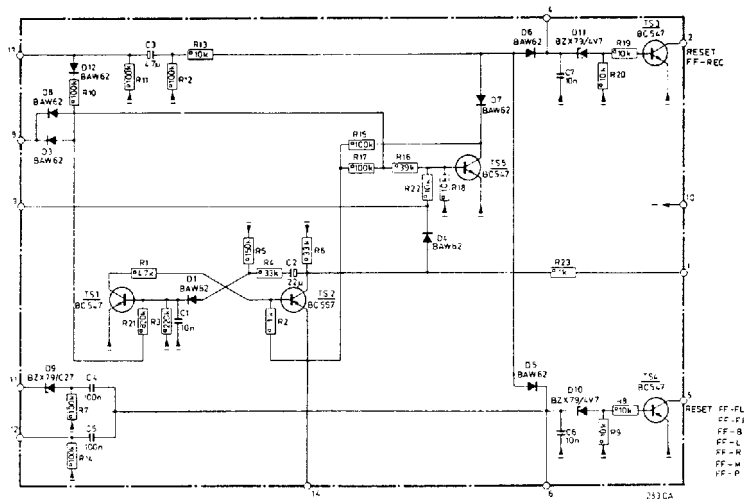


- D1 - BA217 has been replaced with BAW62. Thus, the reliability has been increased.

This modification has been made in recorders marked from WR02/304 (N4414) or WR04/304 (N4416).

## RESET-AUTOMATIC REVERSE UNIT

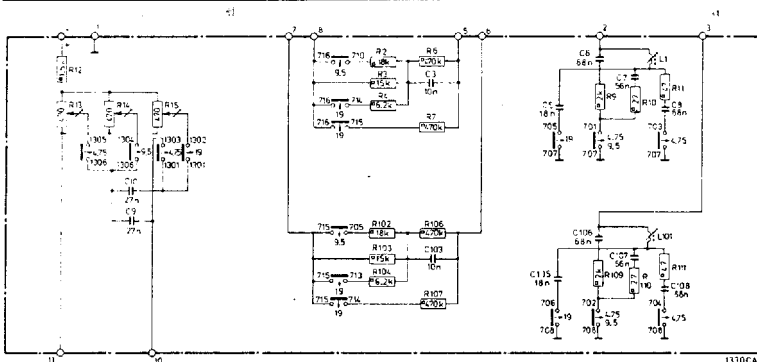
N4450



- D10, 11 - BZX88/C3V3 have been replaced with BZX79/C4V7. Thus, it has been avoided that the recorder suddenly stops when remote control N6719 is being used. This modification has been made in a limited number of recorders marked from WR09/240 and in all recorders marked from WR09/304.
- D9 - BZX79/C30 has been replaced with BZX79/C27. Thus, the switch clock will again function properly at too low a mains voltage. This modification has been made in recorders marked from WR09/333.
- D1,3,4,5,6,7,8,12 - BA217 have been replaced with BAW62. Thus, the reliability has been increased. This modification has been made in WR09/304.
- TS1,3,4 and 5 - BC147 have been replaced with BC547; TS2 - BC157 has been replaced with BC557.

## PRE-EMPHASIS/SPEED SELECTOR UNIT

N4418, N4450, N4510

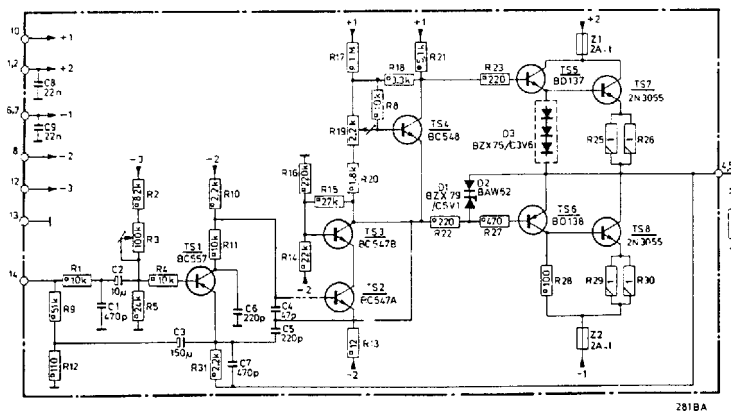


- R8, 108 are no longer used and C5, 105 - 27 nF have been replaced with capacitors of 8 nF. Thus, the frequency characteristic has been improved up to 25 kHz at  $v = 19$  cm/s. This modification has been made in recorders marked from:  
WR07/327 (N4418)  
WR10/334 (N4450)  
WR02/327 (N4510)

Note: The units containing the modifications to obtain an improved frequency characteristic are supplied under code number 4822 218 30153.

## POWER OUTPUT UNIT

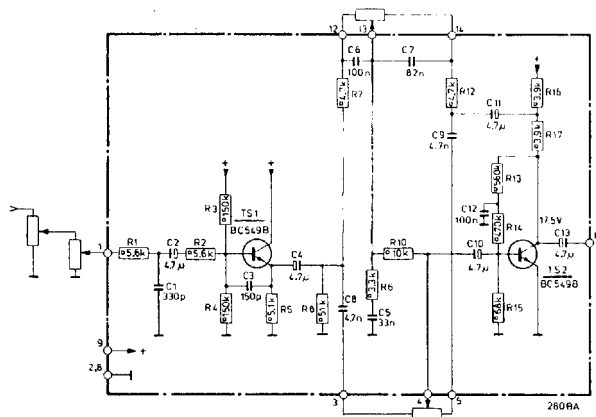
N4450



- TS5,6 - 2N2219A, 2N2905A have been replaced with transistor pair BD137/138. This modification has been made in recorders marked from WR09/306. R24 has been replaced with stabistor D3 - BZX75/C3V6. Thus, the fuses cannot fail. This modification has been made in recorders marked from WR09/329.
  - D2 - BAX13 has been replaced with BAW62 because of a new supply programme. The following transistors have been replaced.
- | Original type | Replacement type |
|---------------|------------------|
| TS1 - BC157   | BC557            |
| TS2 - BC147A  | BC547A           |
| TS3 - BC147B  | BC547B           |
| TS4 - BC148   | BC548            |
- Thus, fitting these transistors has been facilitated.

## TONE CONTROL UNIT

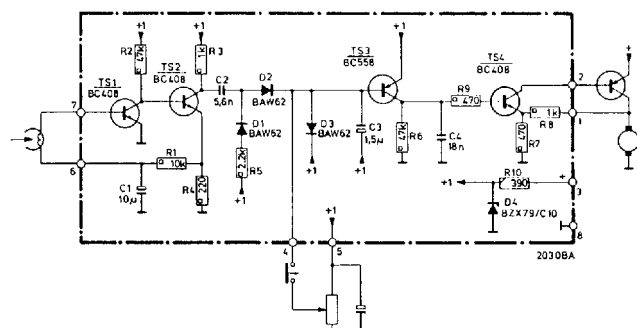
N4450



- TS1,2 - BC149B have been replaced with BC549B. Thus, fitting these transistors has been facilitated.

## SPEED CONTROL UNIT

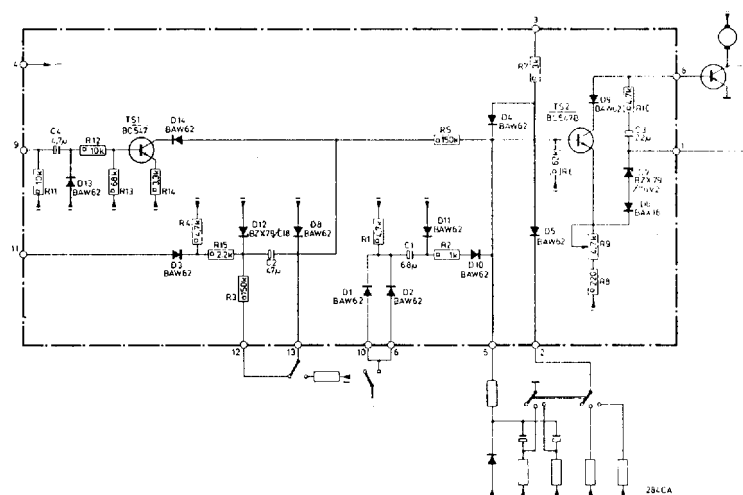
N4414, N4416



- D4 - BZX79/C10 has been replaced with BZX61/C10. Thus, the reliability has been improved. This modification has been made in recorders marked from WR02/317 (N4414) or from WR04/317 (N4416).
- D1,2,3 - BA217 have been replaced with BAW62 because the range of diodes has been changed.
- TS3 - BC158 has been replaced with BC558. Thus, fitting this transistor has been facilitated.

## TAPE TENSION UNIT

N4450

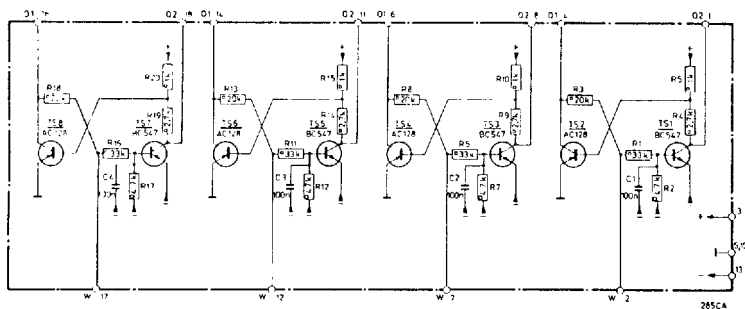


- D1,2,3,4,5,9,10,11,13,14 - BA217 have been replaced with BAW62 because of the changed range of diodes.
- TS1 - BC147 and TS2 - BC147B have been replaced with BC547 and BC547B respectively. Thus, fitting these transistors has been facilitated.



## FLIP FLOP UNIT

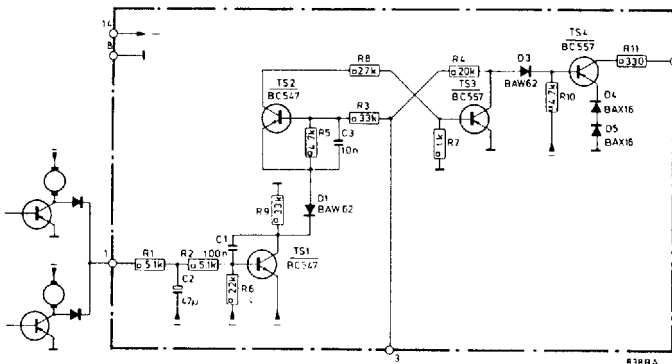
N4450



- TS1,3,5,7 - BC147 have been replaced with BC147. Thus, fitting these transistors has been facilitated.

## MOTOR STOP UNIT

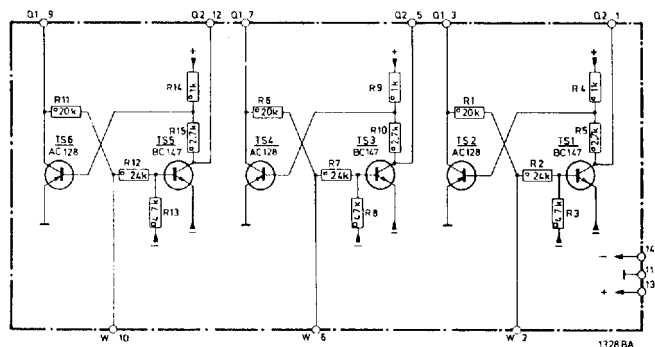
N4450



- D1,3 - BA217 have been replaced with BAW62 because of the new range of diodes.
  - Replaced transistors
- | Original type | Replacement type |
|---------------|------------------|
| TS1,2 - BC147 | BC547            |
| TS3,4 - BC157 | BC557            |
- Thus, fitting these transistors has been facilitated.

## FLIP FLOP UNIT

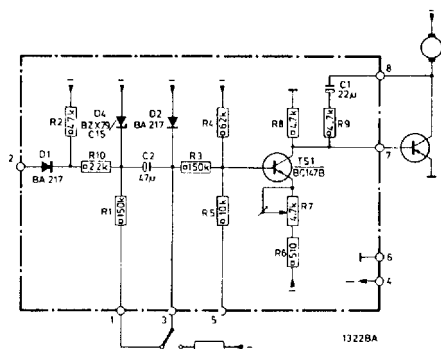
N4418, N4510



- R2,7,12 - 33 kΩ have been replaced with resistors of 24 kΩ. Thus, the brake and coil magnets are prevented from not being actuated at lower mains voltages. This modification has been made in recorders marked from WR06/244 (N4418) or from WR01/244 (N4510).

## TAPE TENSION UNIT

N4418, N4510



- R7 - 2.2 kΩ has been replaced with a resistor of 4.7 kΩ. Thus, the adjustment of the quiescent current has been facilitated. This modification has been made in recorders marked from WR04/202 (N4418) and in recorders N4510 from the start of production.
- R5 - 27 kΩ has been replaced with a resistor of 10 kΩ. Thus, the winding torque during forward winding has been increased. This modification has been made in recorders marked from WR06/236 (N4418) or WR01/236 (N4510).

# Service Information



**PHILIPS**

1974-08-19

RECORDERS N4414-N4416-N4418-  
N4510-N4450

AR74-6

To obtain an optimal sound reproduction and minimal head wear, the record and playback heads must be adjusted correctly. The tape transport can vary for each recorder; the heads are also made with certain tolerances. Therefore replaced heads must be re adjusted.

The height of the head and the azimuth can be adjusted with one single test tape. On this test tape a 10-kHz signal has been recorded over the full width. About 1.2 mm from the upperside of the tape there is a 1-mm wide track on which a signal of 1-kHz has been recorded.

When the height of the head has been adjusted correctly, the 1-kHz track is just under the uppermost core. The 1-kHz signal should then be just audible above the noise. When the azimuth alignment is correct, the core gaps are perpendicular to the running direction of the tape. Then there is a maximum reproduction of the 10-kHz signal.

## N4414-N4416

Required tools and measuring instruments:

- Head adjusting jig 4822 403 50718
- Test tape 1 kHz-10 kHz 4822 397 30014
- Spring pressure gauge 3-55 g 4822 395 80029
- mV-meter GM6012 or PM2454B
- Dual-beam oscilloscope PM3230 or PM3130

## Adjusting the head inclination (Fig. 1)

Carefully check whether the front of the head is perpendicular to the mounting plate. Adjust with nut C.

## Adjusting the height of the head

- With the adjusting jig
  - Place the jig in the recorder (Fig. 2)
  - The upperside of the uppermost core must be situated just below the upperside of the adjusting jig. Adjust with nuts B and C and screw A.
- With test tape
  - Insert the test tape into the recorder
  - Recorder in position "1-4" - "9.5" - "PLAY"
  - Adjust, with nuts B and C and screw A, the height of the head so that the 1 kHz signal is still just audible above the noise.

Attention:

The nuts B and C and screw A must be equally turned when the height of the head is being adjusted. Otherwise the adjustment of the head inclination would be changed.

## Adjusting the azimuth

- Insert the test tape into the recorder
- Recorder in position "1-4" - "9.5" - "PLAY"
- Adjust with screw A the azimuth of the head so that the reproduction of the 10-kHz signal is maximal. Consequently, the reproduction of the 1-kHz signal may become stronger. Then the height of the head must be readjusted.

## Adjusting the head mirror

- Connect a mV-meter so socket TAPE IN/OUT (point 5)
- Insert the test tape into the recorder
- Recorder in position "1-4" - "9.5" - "PLAY"

- Pull off the pressure felt pad in front of the head. The meter reading may decrease by 1 dB at most. If the deviation should be larger, loosen screw E and turn the head so that the deviation is  $\leq 1$  dB.
- Check the azimuth adjustment of the head

Attention:

When fitting a new head, push it forwards as much as possible.

## Erase head

Check whether the surface of the core next to the core gap is smooth. If this surface should be rough, the erase head must be replaced; otherwise the tape might be damaged.

A new erase head need not be readjusted. The tape guides of the erase head are a fixed point for the tape transport.

It is therefore suggested to check the tape transport after the erase head has been replaced. If necessary, correct the adjustment of the other tape guides as well. Use an adjusting jig for checking and adjusting.

## Pressure felt pads

Check the condition of the pressure felt pads. If they should have become hard, they must be replaced.

Check the pressure force. The force of the felt pad in front of the erase head must be 5...10 g, and is measured at the upperside of bracket 72. To adjust the force, shorten or stretch spring 92. The force of the felt pad in front of the record/playback head must be 20...40 g, and is measured at the upperside of bracket 106. When rings (dia 2.2 mm) are added under spring 109, the force can be increased; by shortening the spring, the force is reduced. The clearance between the pressure roller bearing bracket and the nuts on pull rod 108 must be about 1.5 mm (pressure roller magnet attracted). Be sure that the pull rod can move freely !

## Capstan

Check the adjustment of the capstan (see Service Manual). A slanting capstan causes a heavy wear of the tape. A slanting position of the capstan can recognised by the stepwise wear of the pressure roller.

## Cleaning

After the heads have been adjusted or replaced, all tape guides, tape tension comparators, the capstan, the pressure roller etc. must be carefully cleaned with alcohol or methylated spirit.

## N4418-N4510

Required tools and measuring instruments:

- Head adjusting jig 4822 403 50718
- Test tape 1 kHz-10 kHz 4822 397 30014
- Spring pressure gauge 3-55 g 4822 395 80029
- mV-meter GM6012 or PM2454B
- Dual-beam oscilloscope PM3230 or PM3130
- LF generator PM5105



CS31379

### Adjusting the head inclination of the record and playback head (Fig. 3)

Carefully check whether the front of the head is perpendicular to the mounting plate.

Adjust with nut C.

### Adjusting the height of the playback head

- With adjusting jig
  - . Place the jig in the recorder (Fig. 4)
  - . The upperside of the uppermost core must be situated exactly under the upperside of the adjusting jig. Adjust with nuts B and C and screw A.
- With test tape
  - . Insert the test tape into the recorder
  - . Recorder in position: "1-4" - "9.5" - "PLAY"
  - . Adjust with nuts B and C and screw A, the height of the head so that the 1-kHz signal is still just audible above the noise.

Attention:

The nuts B and C and screw A must be equally turned. Otherwise the head inclination would be changed.

### Adjusting the azimuth of the playback head

- Insert the test tape into the recorder
- Recorder in position "1-4" - "NOR" - "9.5" - "PLAY"
- Adjust with screw A the azimuth of the head so that the reproduction of the 10-kHz signal is maximal. Consequently, the reproduction of the 1-kHz signal may become stronger again. Then the height of the head must be readjusted again.

### Adjusting the head mirror of the playback head

- Connect a mV-meter to socket MONITOR (point 5)
- Insert the test tape in the recorder
- Recorder in position "1-4" - "NOR" - "9.5" - "PLAY"
- Pull off the pressure felt pad in front of the head. The meter reading may decrease by 1 dB at most. If the deviation should be larger, loosen screw E and turn the head so that the deviation is  $\leq 1$  dB.
- Check the azimuth adjustment of the head.

Attention:

When fitting a new head, push it forwards as much as possible.

### Adjusting the head height, the azimuth and the head mirror of the record head

- Unsolder the wiring from the playback head and resolder it to the record head.
- Connect a mV-meter to socket MONITOR (point 5).
- Insert the test tape into the recorder.
- Recorder in position "1-4" - "NOR" - "9.5" - "PLAY"
- Adjust with nuts B and C and screw D, the height of the head so that the 1-kHz signal is still just audible above the noise.

Attention:

The nuts B and C and screw D must be equally turned when the height of the head is being adjusted. Otherwise the head inclination would be changed.

- Adjust with screw D the azimuth of the head so that the reproduction of the 10-kHz signal is maximal. Consequently, the reproduction of the 1-kHz signal may become stronger again. The height of the head must then be readjusted.
- Pull off the pressure felt pad in front of the head. The meter reading may decrease by 1 dB at most. If the deviation should be larger, loosen screw F and turn the head so that the deviation is  $\leq 1$  dB.
- Check the azimuth adjustment.
- Restore the wiring

### Adjusting the phase difference of the record/playback head

This adjustment must be carried out only if the other head adjustments have already been checked.

- Connect an LF generator to socket TAPE IN/OUT (points 3/2 and 5/2) and supply a 1-kHz signal.
- Connect a dual beam oscilloscope to socket MONITOR (for example, the output of the right-hand channel (point 5) to the Ya input and the output of the left-hand channel (point 3) to the Yb output).
- Recorder in position: "TAPE" - "A" - "ST" - "19" - "REC" - "PLAY".
- Adjust with screw D the record head so that the two signals are in phase.
- Check the phase difference also at higher frequencies and readjust the record head, if necessary.

### Erase head

Check whether the surface next to the core gap is smooth. If this surface should have become rough, the erase head must be replaced. Otherwise the tape might be damaged.

A new erase head need not be readjusted. The tape guides of the erase head are a fixed point for the tape transport. Therefore, it is suggested that, after the erase head has been replaced, the tape transport is checked and that, if necessary, the other tape guides are readjusted. Use an adjusting jig for both purposes.

### Pressure felt pads

Check the condition of the pressure felt pads. If they should have become hard, they must be replaced. Check the pressure force. The force of the felt pad in front of the erase head must be 5...10 g, and is measured at the upper side of bracket 88. When spring 55 is shortened or stretched, the force can be adjusted. The force of the felt pads for the record and playback head must be 20...40 g, and is measured at the upperside of bracket 106. When rings (dia. 2.2 mm) are added under spring 109, the force can be increased; shortening the spring results in an decrease in force. The clearance between the pressure roller bearing bracket and the nuts on pull rod 108 must be about 1.5 mm (pressure roller magnet attracted). Check whether the pull rod can move freely!

### Capstan

Check the adjustment of the capstan (see Service Manual). A slanting capstan causes a heavy wear of the tape. A slanting position of the capstan is recognised by the stepwise wear of the pressure roller.

### Cleaning

After the heads have been adjusted or replaced, all tape guides, tape tension comparators, the capstan, the pressure roller, etc. must be carefully cleaned with alcohol or methylated spirit.

### N4450

Required tools and measuring instruments:

- |                               |                   |
|-------------------------------|-------------------|
| - Head adjusting jig          | 4822 403 50686    |
| - Test tape 1 kHz - 10 kHz    | 4822 397 30014    |
| - Pressure spring gauge 3-5 g | 4822 395 80029    |
| - mV-meter                    | GM6012 or PM2454B |
| - Dual beam oscilloscope      | PM3230 or PM3130  |
| - LF generator                | PM5105            |

The record and playback heads of the N4450 can be adjusted in the same way as with the N4418-N4510. However, the record and playback head for left transport and the record and playback head for right transport must be adjusted separately.

## A. Modifications apportées aux appareils

### Version WR09

Sur les appareils portant la marque WR09/243 et les suivants, les résistances suivantes ont été changées:

R3/R103	passé de 5,1 à 6,8 kΩ
R4/R104	passé de 75 kΩ à 100 kΩ
R7/R8/R107/R108	passé de 22 à 7,5 kΩ
R9/R109	passé de 820 à 270 kΩ

(toutes résistances 1/8 W + 5 %)

Ces modifications ont été apportées afin d'améliorer la dynamique de l'amplificateur d'enregistrement.

Sur les appareils portant la marque WR09/303 et les suivants, les comparateurs de tension de bande 84 sont pourvus d'amortisseurs. Ceux-ci se composent de deux disques en plastique entre lesquels il a été inséré du liquide silicone. Pour ce qui est des numéros de code des nouvelles pièces et de l'ordre de succession du montage, voir fig. 1.

#### Attention:

Les deux disques en plastique sont pourvus de ce liquide silicone à l'usine et sont pressés de façon spéciale.

Ces disques ne doivent absolument pas être séparés pendant le montage.

Sur les appareils portant la marque WR09/304 et les suivants, la résistance R202 (2,2 kΩ - 1/8 W + 5 %) a été insérée (voir fig. 2). Cette transformation est allée de pair avec le remplacement des diodes D10 et D11 de type BZX88/C3V3 de l'unité RESET/AUTOMATIC REVERSE P201, par des diodes BZX79/C4V7. Cette transformation a été apportée parce que l'appareil s'arrêtait brusquement et sans raison apparente à l'usage de la télécommande N6719.

Sur les appareils portant la marque WR09/304 et les suivants, les bobines L701, L702, L703 et L704 et les condensateurs C704 et C703 sont supprimés. Sur les appareils marqués WR09/309 et les suivants, les condensateurs sont à nouveau montés afin d'éviter les crachements de moteur.

Sur les appareils portant la marque WR09/309 et les suivants, la résistance R39 est passée de 560 Ω à 1,5 kΩ (résistance de sécurité - 4822 110 63112) et le condensateur C14, de 220 μF à 220 μF - 16 V (4822 124 20473). Du fait que C14 en est réduit, la paroi 176 ne cogne plus le condensateur.

Sur les appareils portant la marque WR09/309 et les suivants, les modifications suivantes ont été apportées sur la platine 1 (voir fig. 3):

- les surfaces de connexion pour le soudage des douilles de contact ont été agrandies;
- les supports de lampes sont supprimés parce que les fils des lampes sont soudés directement sur la platine.

Sur les appareils portant la marque WR09/311 et les suivants, il a été monté une paroi d'isolation entre le commutateur SK5 et l'unité P10 (PRE-EMPHASIS/SPEED SELECTOR UNIT). Cette modification a été apportée afin d'éviter la diaphonie des pistes 3 et 1.

Sur les appareils portant la marque WR09/323 et les suivants, les modifications suivantes ont été faites sur la platine 2 (voir fig. 2):

- trace imprimée
- les diodes D277, 278, 279, 280, 281, 282 et les résistances R232, 233, 234 seront montées côté composants de la platine.

### Version WR10

Sur les appareils portant la marque WR10/334 et les suivants, le transistor TS201 - 2SC931 - est remplacé par un BD437. Numéro de code: 4822 130 40982.

#### N.B.:

Le Service fournit momentanément sous le numéro

4822 130 40899 le transistor D330D8D, qui peut aussi être utilisé à la place du 2SC931.

Sur les appareils portant la marque WR10/334 et les suivants, la gamme de fréquence est passée de 20.000 Hz à 25.000 Hz à 19 cm/sec. A cet effet, les unités PLAY-BACK et PRE-EMPHASIS/SPEED SELECTOR ont été adaptées. Les nouvelles unités sont livrables sous les numéros suivants:

- PLAY-BACK UNIT: 4822 218 30152
- PRE-EMPHASIS/SPEED SELECTOR UNIT 4822 218 30153

### Version WR11

Sur les appareils portant la marque WR11/335 et les suivants, les plateaux à bobine sont pourvus d'un anneau-guide en caoutchouc et d'un ressort de terre afin de dévier la charge statique. Les nouveaux plateaux à bobine peuvent être montés au lieu des anciens. Numéro de code: 4822 528 10293.

## B. Complément à la Notice Technique

Méthode de réglage de l'unité RECORDING P4/P104 modifiée:

### Magnétophone

en position : enregistrement-"TAPE"- "B"- "ST"- "NOR"- "9,5"  
commande d'enregistrement "REC" au maximum  
autres commandes au minimum

Entrée:	BU2 TAPE IN/OUT 3/2	333 Hz - 0,1 V
Sortie:	BU5 MONITOR 3/2	régler sur 1 V avec R4 sur P5
Entrée:	BU2 TAPE IN/OUT 5/2	333 Hz - 0,1 V
Sortie:	BU5 MONITOR 5/2	régler sur 1 V avec R4 sur P105
Entrée:	BU2 TAPE IN/OUT 5/2	333 Hz - 1 V
Sortie:	BU5 MONITOR 5/2	régler avec la commande d'enregistrement "REC" sur 1 V
Entrée:	BU2 TAPE IN/OUT 3/2	333 Hz - 1 V
Sortie:	BU5 MONITOR 3/2	valeur à mesurer 1 V $\pm$ x V (x = max. 0,8 V). Diviser en deux la différence par rapport à 1 V avec R4 sur P5. régler sur 1,5 mV avec R9 sur P4
Sortie:	BU4 PHONO 6/2 (MP1)	333 Hz - 1 V
Entrée:	BU2 TAPE IN/OUT 5/2	valeur à mesurer 1 V $\pm$ y V (y = max. 0,8 V). Diviser en deux la différence par rapport à 1 V avec R4 sur P105. Si par la suite on obtient $\frac{x}{2} \neq \frac{y}{2}$ diviser de nouveau en deux la tension de différence par rapport à 1 V
Sortie:	BU4 PHONO 7/2 (MP101)	Régler sur 1,5 mV avec R9 sur P104

#### Attention:

Afin d'éviter que la tension de prémagnétisation ne soit aussi mesurée, enlever l'unité d'oscillateur P9.

Correction du réglage du courant de prémagnétisation

Le commutateur SK3 "B-A" doit se trouver en position "A" pour ce réglage.

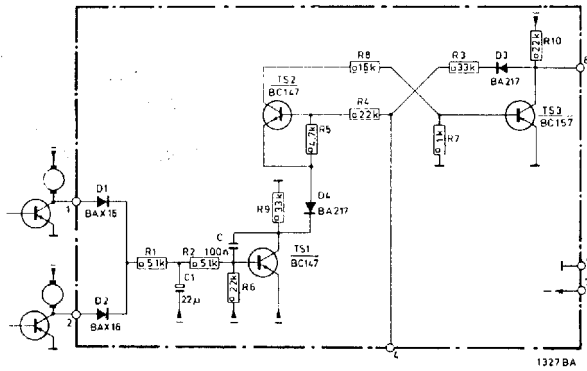
Dans certains cas, il peut arriver que le champ de l'anneau aimanté monté sur la poulie du moteur de cabestan M3, se réduise. Ceci pourra être constaté en mesurant la tension de sortie de la tête K4. On trouvera ci-dessous une table donnant ces tensions aux différentes vitesses.

Vitesse	Tension de sortie K4
4,75 cm/sec	54 mV
9,5 cm/sec	110 mV
19 cm/sec	175 mV

Dans la partie I de la Notice Technique, il est donné l'impression dans la description de l'étage de sortie, que ce circuit est protégé contre les court-circuits de la sortie. L'étage de sortie n'est en fait protégé que contre la panne résultant de signaux d'entrée trop élevés.

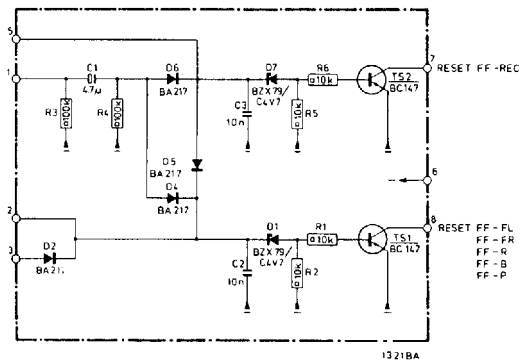
## MOTOR STOP UNIT

N4418, N4510



## RECORDER STOP UNIT

N4418, N4510



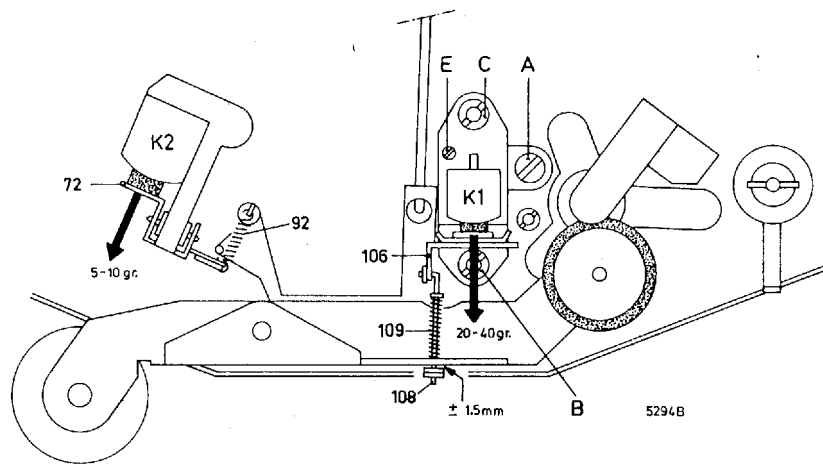


Fig. 1

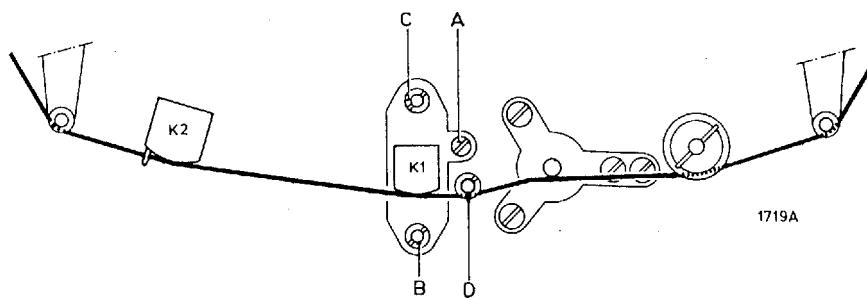


Fig. 2

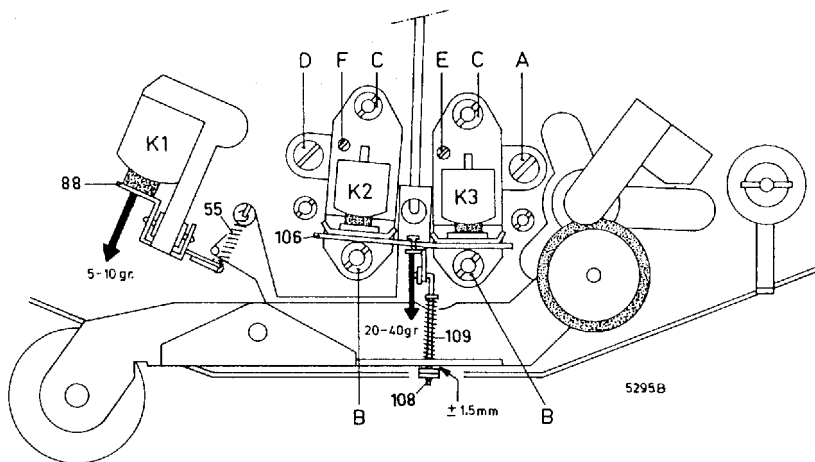


Fig. 3

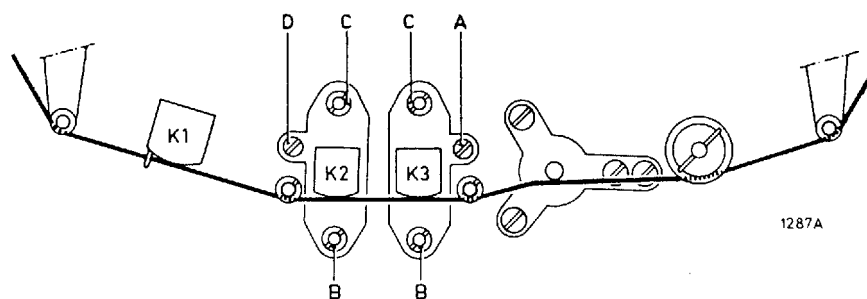


Fig. 4

# Service Information

1975-10-23

REEL - to REEL RECORDERS

AR 75-13

Concerning: Replacing the heads.

The heads 4822 249 10057 and 4822 249 20032 may be replaced by the heads 4822 249 10085 and 4822 249 20037 respectively, which are of the long-life type.

However, when the replacement types are used, the bias current adjustment is more critical. The approximate value of the bias current, when long-life heads are used, is 4 dB lower than when mu-metal heads are employed. Anyhow, a compromise between the frequency response and distortion must be found:

- If there are too few treble tones and if distortion is too great, the bias current must be reduced.
- If there are too many treble tones and if distortion should be too great, the bias current must be increased.

Distortion must not exceed 3 %.

Betreft: Vervangen van koppen.

De koppen 4822 249 10057 en 4822 249 20032 kunnen worden vervangen door de koppen 4822 249 10085 resp. 4822 249 20037.

Deze laatste zijn van het "long-life" type.

Bij vervangen is het instellen van de voormagnetisatiestroom kritischer. De richtwaarde van de voormagnetisatiestroom bij "long-life" koppen is 4 dB lager dan bij "mu-metalen" koppen.

In alle gevallen geldt een kompromis tussen de frekwentie-karakteristiek en de vervorming:

- Bij te weinig hoge tonen en te grote vervorming moet de voormagnetisatiestroom verlaagd worden.
- Bij te veel lage tonen en te grote vervorming moet de voormagnetisatiestroom verhoogd worden.

De vervorming moet kleiner dan 3 % zijn.

Concernant: Remplacement de têtes.

Les têtes 4822 249 10057 et 4822 249 20032 peuvent être remplacées par, respectivement, les têtes 4822 249 10085 ou 4822 249 20037; ces dernières étant de type "long-life".

Lors du remplacement le réglage du courant de pré-magnétisation est plus critique. La valeur d'orientation pour le courant de pré-magnétisation avec des têtes de type "long-life" est inférieure de 4 dB à celle avec têtes au  $\mu$ -métal. Dans les deux cas, un compromis entre la courbe de fréquence et la distortion doit être trouvé:

- En présence d'un manque de tous aigus et de trop de distortion, le courant de pré-magnétisation doit être réduit
- En présence de trop d'aigus et d'une trop forte distortion, le courant de pré-magnétisation devra être baissé.

La distortion doit être inférieure à 3 %.

Betrifft: Ersetzen der Köpfe.

Die Köpfe 4822 249 10057 und 4822 249 20032 darf man durch die Köpfe 4822 249 10085 bzw. 4822 249 20037 ersetzen. Die Ersatz-Köpfe sind vom "long-life" Typ.

Beim Ersetzen ist zu berücksichtigen, dass das Einstellen des Vormagnetisierungsstromes kritischer ist. Der Dichtwert des Vormagnetisierungsstromes ist bei "long-life" Köpfen um ca 4 dB niedriger als bei Mu-Metall-Köpfen. Es ist jedenfalls ein Kompromiss zwischen dem Frequenzgang und der Verformung anzustreben:

- Bei zu wenig hohen Tönen und zu grosser Verformung ist der Vormagnetisierungsstrom zu erniedrigen.
- Bei zu viel hohen Tönen und zu grosser Verformung ist die Vormagnetisierungsstrom zu erhöhen.

Die Verformung soll geringer als 3 % sein.

ES LIMITEDAMENDMENTS AND ADDITIONS TO N4450 SERVICE MANUALREVISED CIRCUIT DIAGRAM, CABINET AND MECHANICAL EXPLODED VIEWS

During production several changes have been made to the N4450 tape recorder, details of which are given in the following paragraphs.

Models bearing Factory Code WRO4-144 and onwards

Pulleys 55 are secured by means of 2 Allen screws 3mm x 8mm (Item 4). For code number see spare parts list.

Models bearing Factory Code WRO5-147 and onwards

In order to extend the life of the lamps, safety resistors R43, R44, R45, R46 180 $\Omega$  have been added in series with lamps LA1, LA2, LA3, LA4 respectively.

In addition the values of safety resistors R47 and R48 have been changed from 22 $\Omega$  to 120 $\Omega$ .

For code numbers of safety resistors see spare parts list.

Models bearing Factory Code WRO6-147 and onwards

An 80mA fuse was added in series with timer motor M4, and this fuse continued in use until version WRO8-206 appeared, at which time the fuse was changed to 250mA-T. For code number see spare parts list.

Model bearing Factory Code WRO7 and onwards

In recorders marked -149 serial number 4600 and onwards transistors type 16-175 (2N6107) were introduced to control the winding motors. For code number see spare parts list.

Models marked -150 and onward had a recess made to the right of bracket 540 in order that bracket 550 might be adjustable. The adjustment was necessary in cases when switch SK9 (Fast-Med-Slow) failed to operate.

Models bearing Factory Code WRO8 and onwards

Recorders marked -203 and onward incorporate the following changes.

- (a) The screws (11) securing the capstan motor 173 to bracket 531 have been sealed with locking paint.
- (b) Ornamental frame 180 is fitted with 10 retaining screws rather than six. The code number of the 10 hole frame 180 remains the same i.e. 460.20067.
- (c) To prevent a grinding sound when the recorder is tilted forward, a washer (200) was fitted between each flywheel 95 and capstan bearing 88. Washer code number 532.50301.
- (d) The lower part of ornamental cover 136 can be fixed in position when opened.

Cover 136 complete with closing bracket 140 continues with the same code number i.e. 443.20071.

Closing bracket 140 code number 403.50738.

/Cont'd....



- (e) In this model fuse Z701 in series with motor M4 changed from 80mA to 250mA-T. (See models bearing Factory Code WRO6-147).

Models bearing Factory Code WRO9 and onwards

In versions coded -210 onwards head adjusting screws 96 have finer threads to facilitate precise adjustments of the heads.

In versions coded -227 onwards thermal conduction between TS701/702 and their mounting plate has been improved by means of silicone paste.

In versions coded -238 (serial number 6001) onwards on extra bracket 542 has been fitted to prevent movement of oil seals 87.

MULTI-WAY CONNECTORS

The various functional units are connected to printed circuit boards 1 and 2 via multi-way connectors with provision for a total of 3, 8 or 14 contacts. As the circuits of the units vary, different combinations of pin arrangements are required on many connectors.

For servicing purposes, only 3 types of connector will be supplied, 3, 8, and 14 pole versions each complete with a full set of connecting pins.

Un-necessary contacts should be removed before fitting.

SPARE PARTS LIST

(Additions and Amendments only)

MECHANICAL PARTS

Item

2	Screw 3mm x 4mm	502.11069
4	Screw 3mm x 8mm	502.10174
5	Nut 5mm	505.10513
8	Washer 3.2 x 7 x 0.3mm	532.50298
9	Washer 4.2 x 8 x 0.5mm	532.10333
14	Washer 3.2 x 6 x 0.4mm	530.80082
17	Washer 3.2 x 9 x 0.8mm	532.10582
24	Circlip	530.70116
25	Washer 3.2 x 7 x 0.5mm	532.10332
26	Screw 3 x 4mm	502.11189
27	Washer	532.10332
29	Washer 3.2 x 4.5 x 0.3	532.50938
32	Screw 3 x 20mm	502.11096
33	Spacer 3.1 x 16 x 5mm	532.20607
35	Screw 2 x 8mm	502.10681
47	Screw 4 x 8mm	502.10693
49	Washer 4.2 x 8 x 0.1mm	532.10479

/Cont'd....

Item

50	Washer 3.2 x 8 x 0.2mm	532.50298
57	Belt	358.30145
60	Bearing	502.10765
71	Washer	532.30266
79	Belt	358.30045
96	Screw	502.10665
97	Screw 3mm	502.11217
98	Nut 3mm	505.10408
104	Pressure spring	492.50925
105	Bearing	535.70468
110	Grommet	528.80545
200	Washer 5.2 x 9 x 0.5mm	532.50301
201	Screw 3 x 8mm	502.11053
202	Washer 3.6 x 12 x 1mm	532.10489
203	Washer	532.50786
204	Tension spring	492.30355
205	Belt damper	479.30045

CABINET AND AMPLIFIER

Item

3	Washer	532.50725
15	Nut 3mm	505.10325
39	Screw 4 x 30mm	502.10053
40	Screw 3mm	502.11287
41	Screw 3.9 x 9.13mm	502.30006
43	Screw 4 x 22mm	502.10051
44	Screw (self-tapping) 2.9 x 15mm	502.30048
45	Screw (self-tapping) 2.9 x 4.37mm	502.30065
118	Support	325.20063
131	Hinge	417.10516
139	Meter ME101	347.10069
140	Bracket	403.50738
141	Meter ME1	347.10071
149	Socket cover plate	459.80039
151	Ball 5/32"	520.40012
154	Pin	535.90912
	Ball for switch SK5	535.90913
155	Pressure spring	492.50927
	Pressure spring for switch	
	Fast-Med-Slow	492.51037
187	Screw 3 x 4mm	502.10663
190	Lens	381.10401
191	Lamp holder	256.90135

ELECTRICAL MISCELLANEOUS

(a) Control section

Switch SK8 (NOR-REV)	277.30378
Switch 702 (Counter)	278.90231
Plug for BU201	264.50043
TS201 Transistor 2SC931	130.40899
TS701 ) Transistor 16-175 (2N6107)	130.40903
TS702 )	
Lamp holder for LA601 - LA606	401.10561

/Cont'd....

(b) Supply

Switch SK105 Voltage adaptor	272.10202
Lamp LA8/9 19V-50mA (timer)	134.40078
Lamp-holder for LA1 - LA4	256.90135
Lamp-holder for LA701, 702	401.10561
Holder for fuses Z501,502	492.60063
Holder for fuse Z701	256.30128
Fuse Z701 250mA-T	253.30013

Safety Resistors

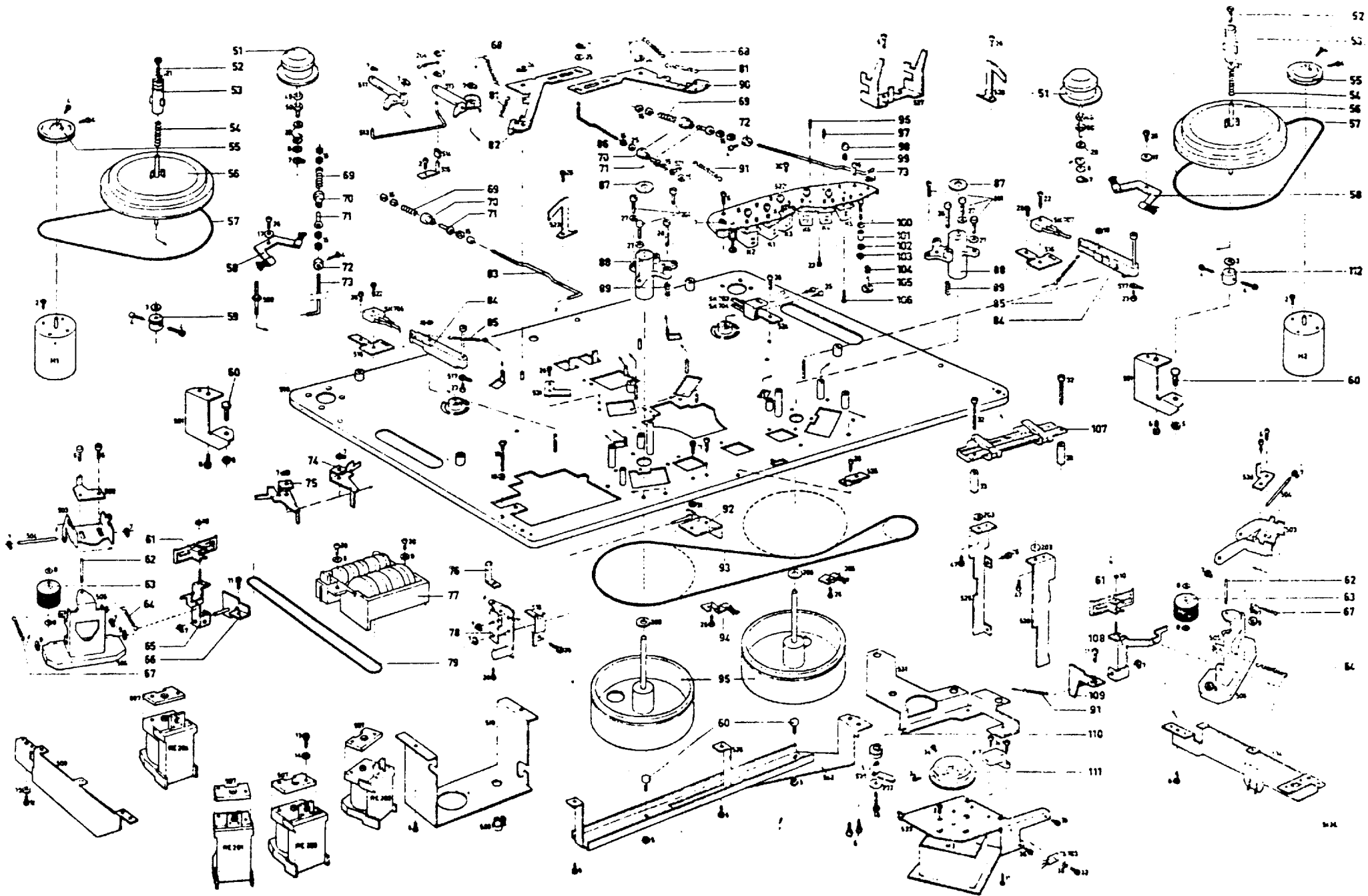
R35	10k $\Omega$	110.53134
R36,R132	68 $\Omega$	110.53076
R37	330 $\Omega$	110.43094
R38	820 $\Omega$	111.30424
R39	560 $\Omega$	111.30374
R40	1k $\Omega$	111.30404
R41	3k3 $\Omega$	111.30413
R42	3k $\Omega$	111.30442
R47,R48	120 $\Omega$	111.50135
R43,R44,R45		
R46,R133,R134	180 $\Omega$	110.43087
R502	33 $\Omega$	111.30418

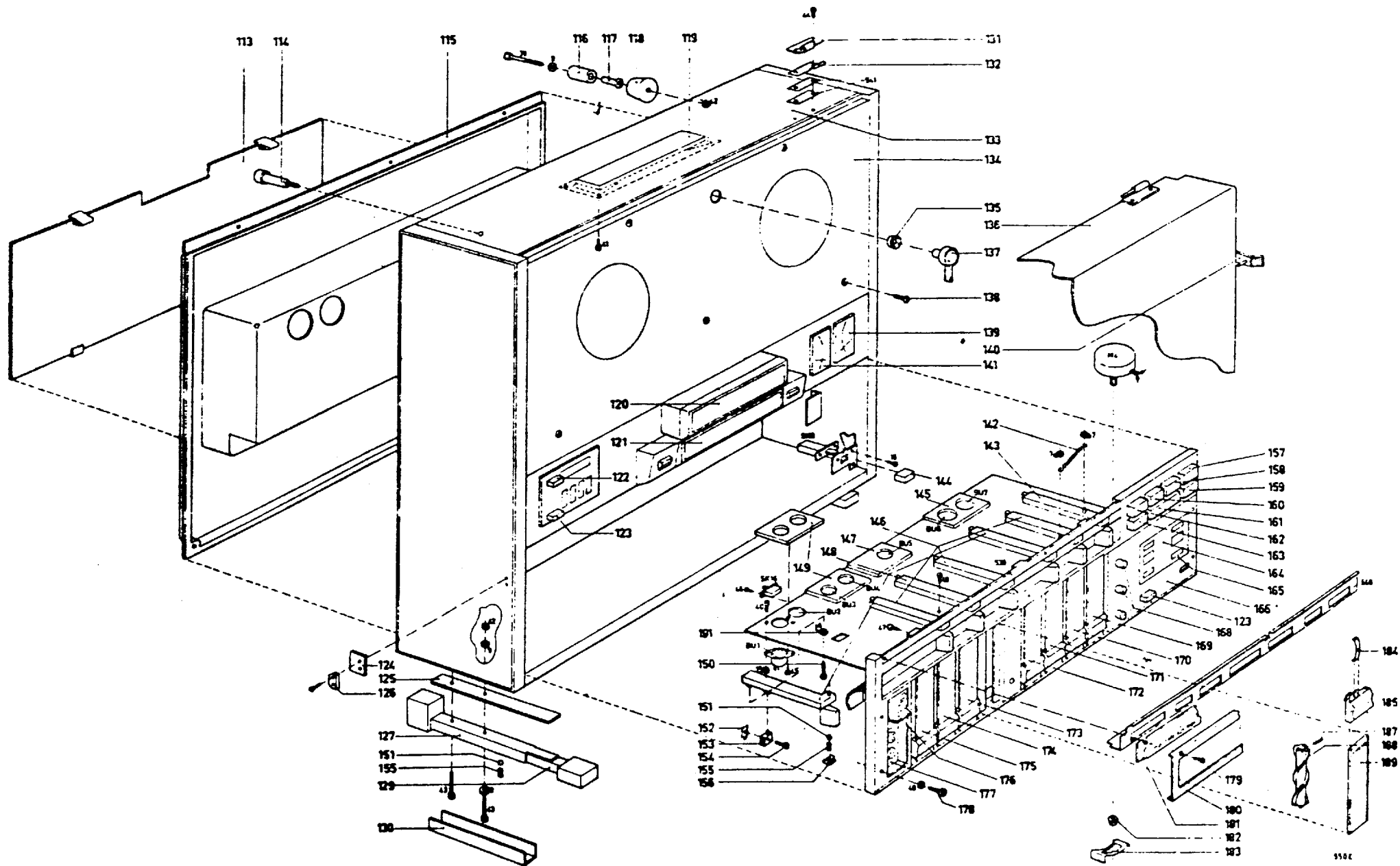
(c) Amplifier

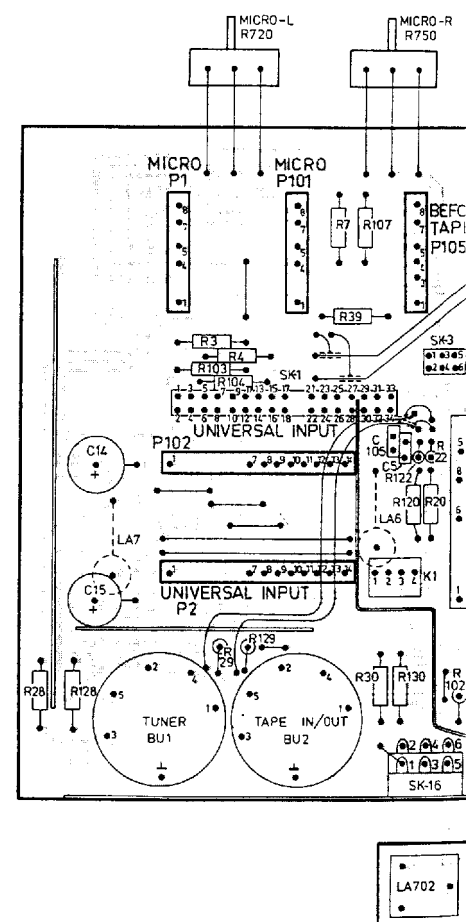
Switches SK703,704	278.90232	
Contact spring for BU8 - BU10 (signal)	268.20032	
Contact spring for BU8 - BU10 (earth)	492.61313	
Plug for BU1 - BU5, and BU8 - BU10	264.40023	
Plug for BU6, BU7	264.30041	
Plug for BU11	264.40092	
Adjusting core for L301 - L304	526.10014	
Plug on multiple cable 14 pole	264.50079	
C13	150uF - 25V	124.20388
C508	330uF - 63V	124.20404
C705	1000uF - 63V	124.70215

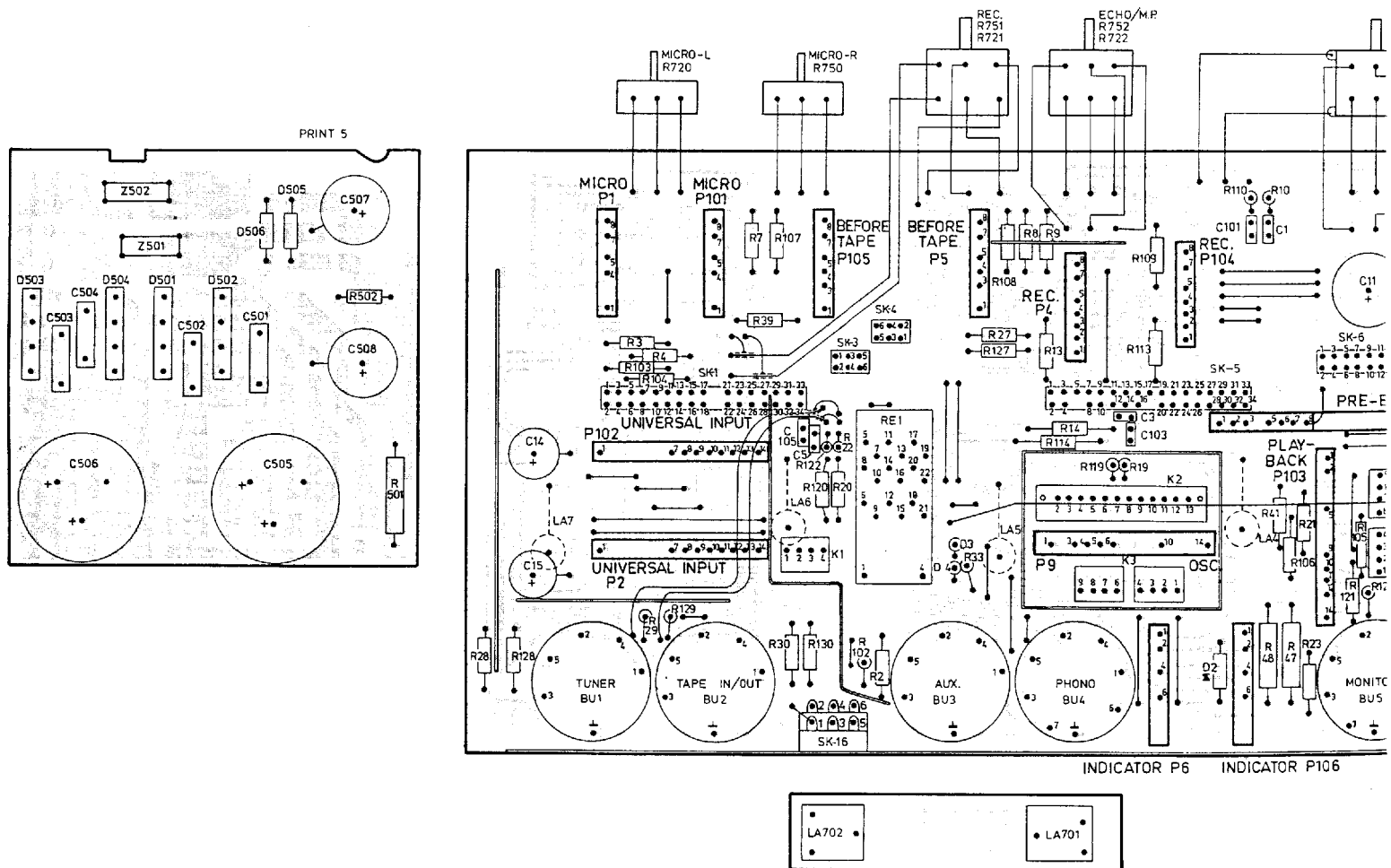
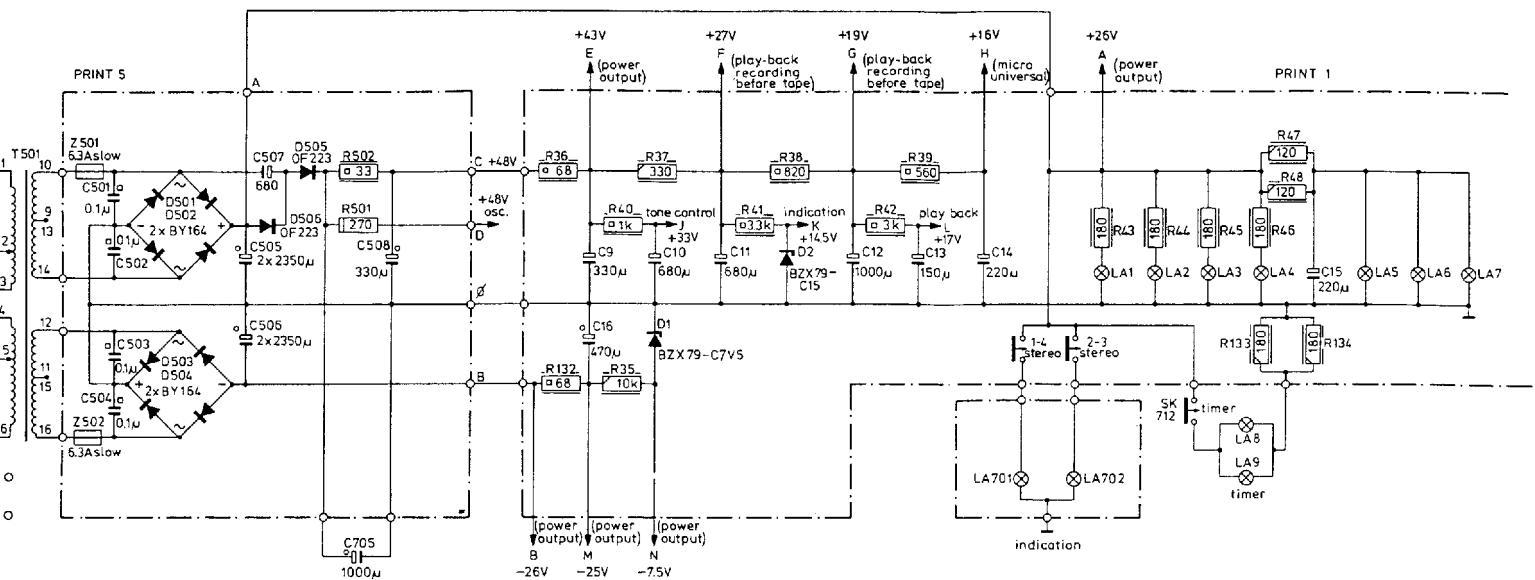
Safety Resistors

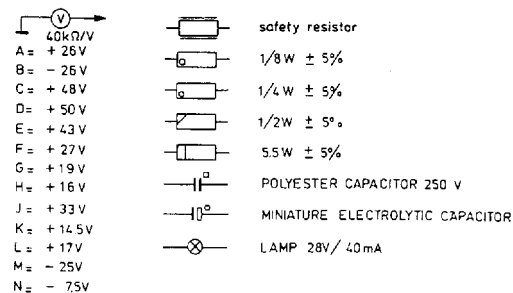
R15, R115	20 $\Omega$	111.50372
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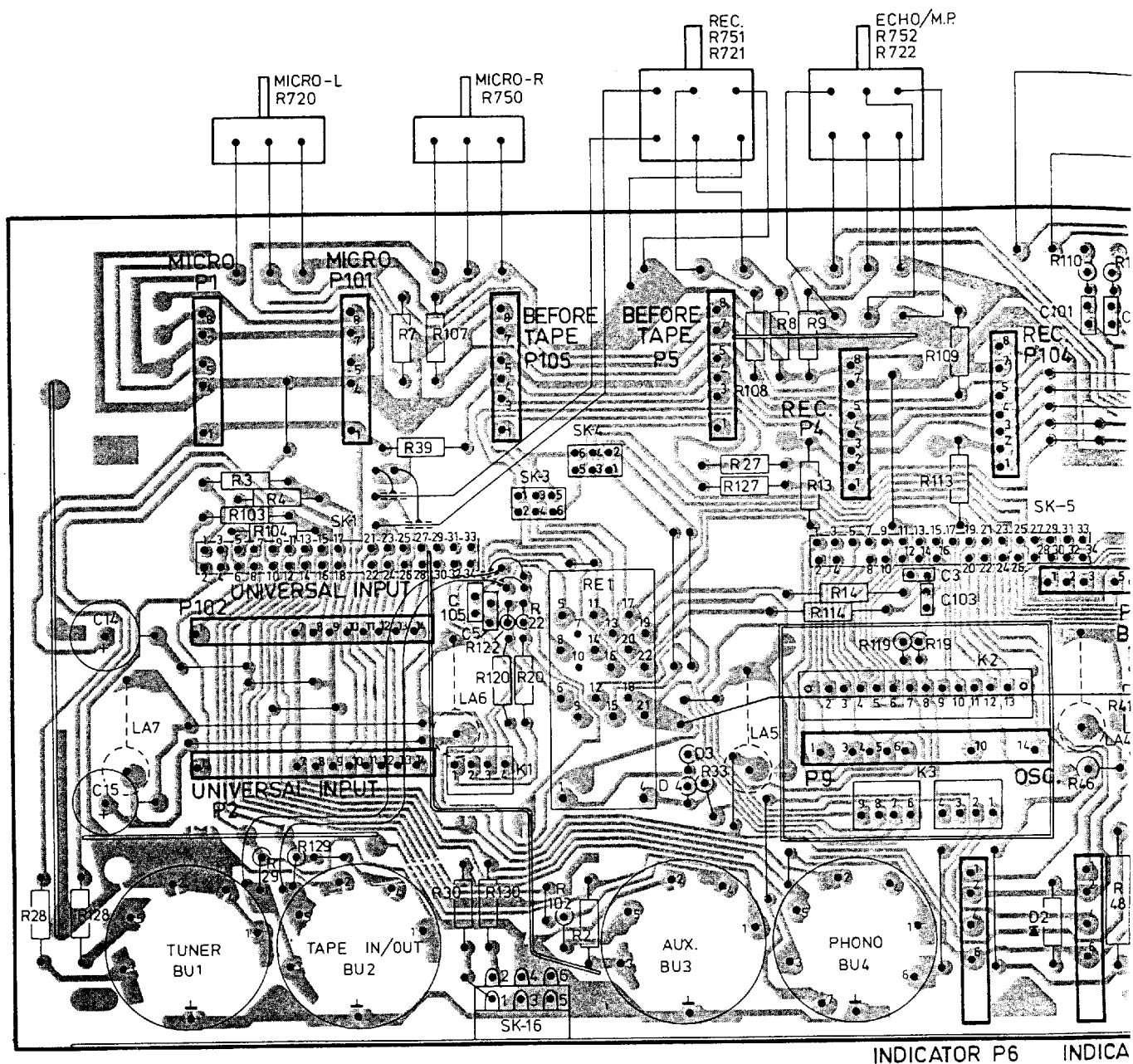












INDICATOR P6 INDICA

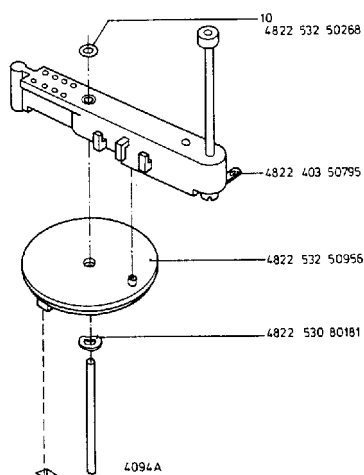


Fig. 1

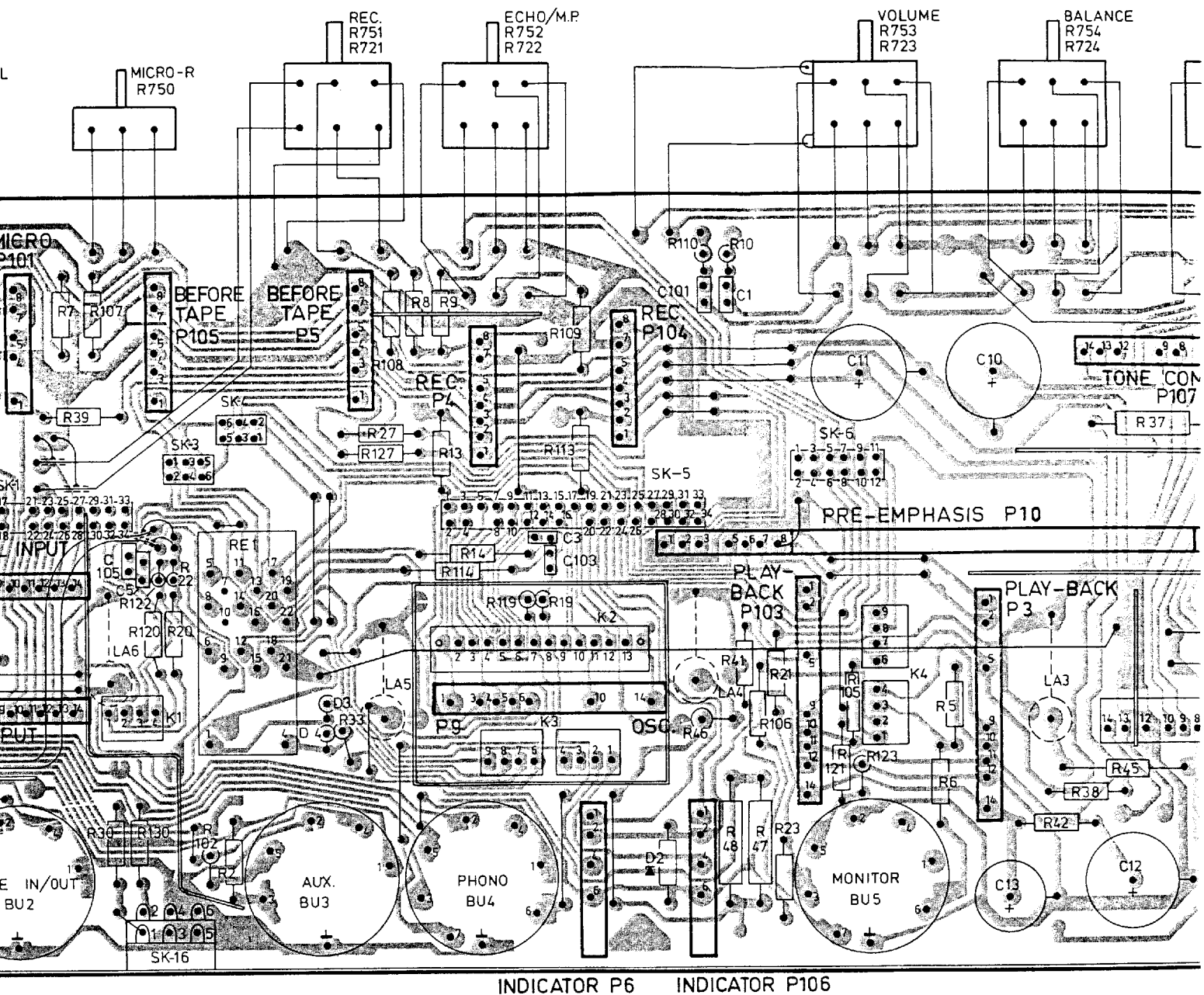


Fig. 3

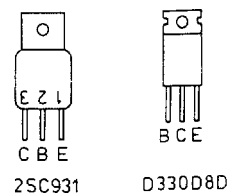
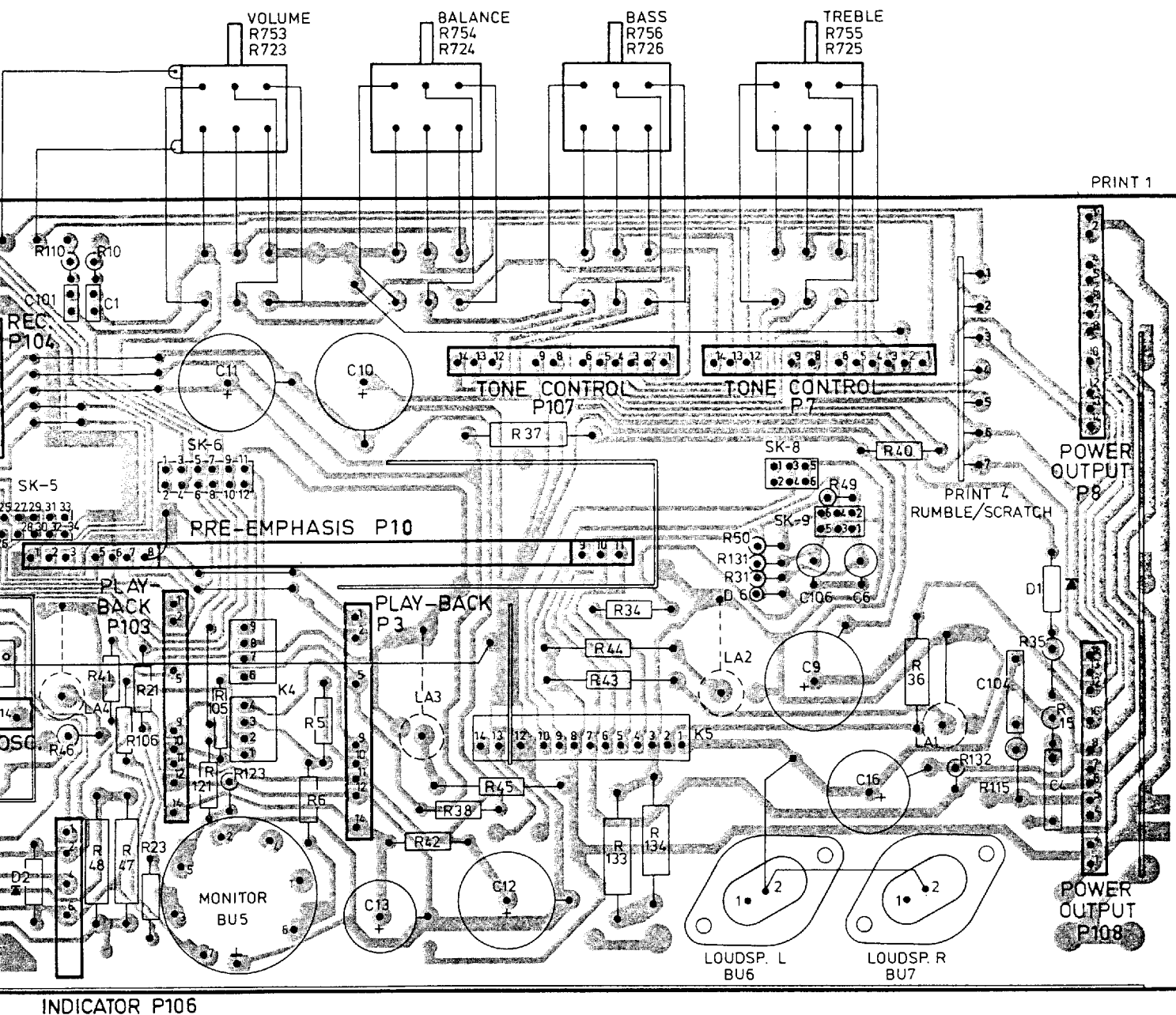
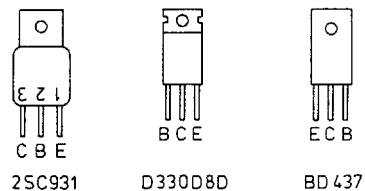


Fig. 4



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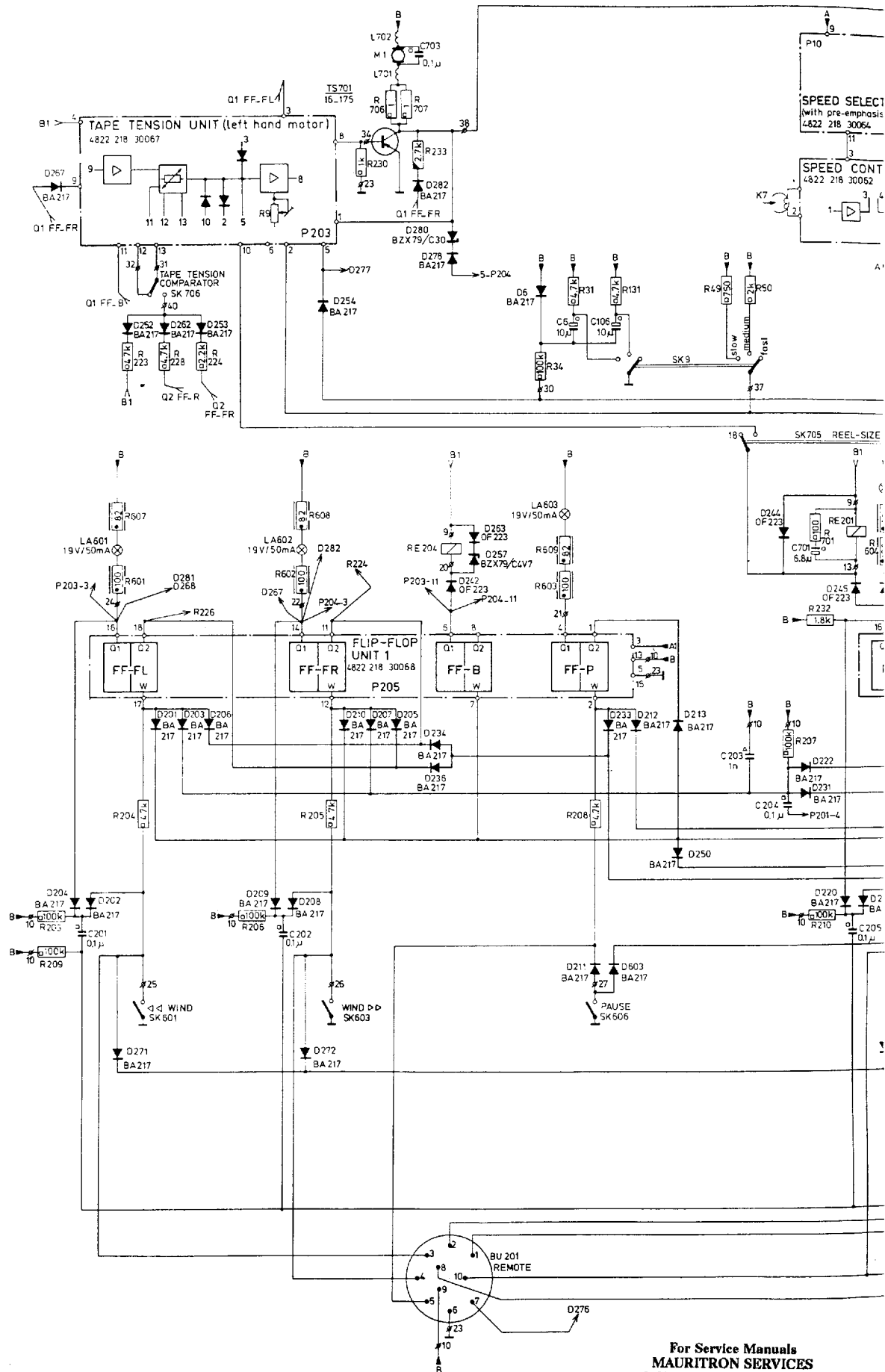
Fig. 3



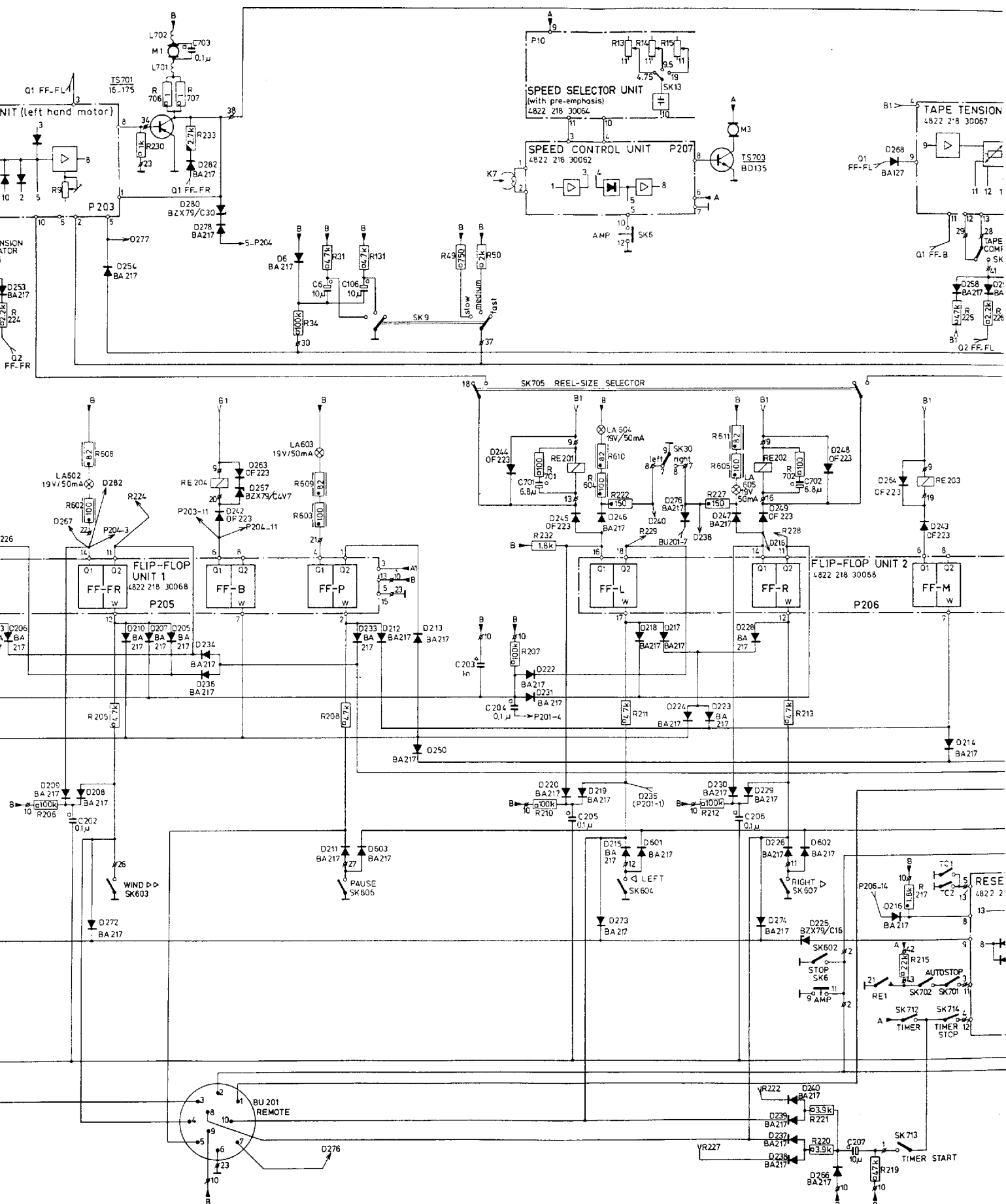
4174 A

Fig. 4

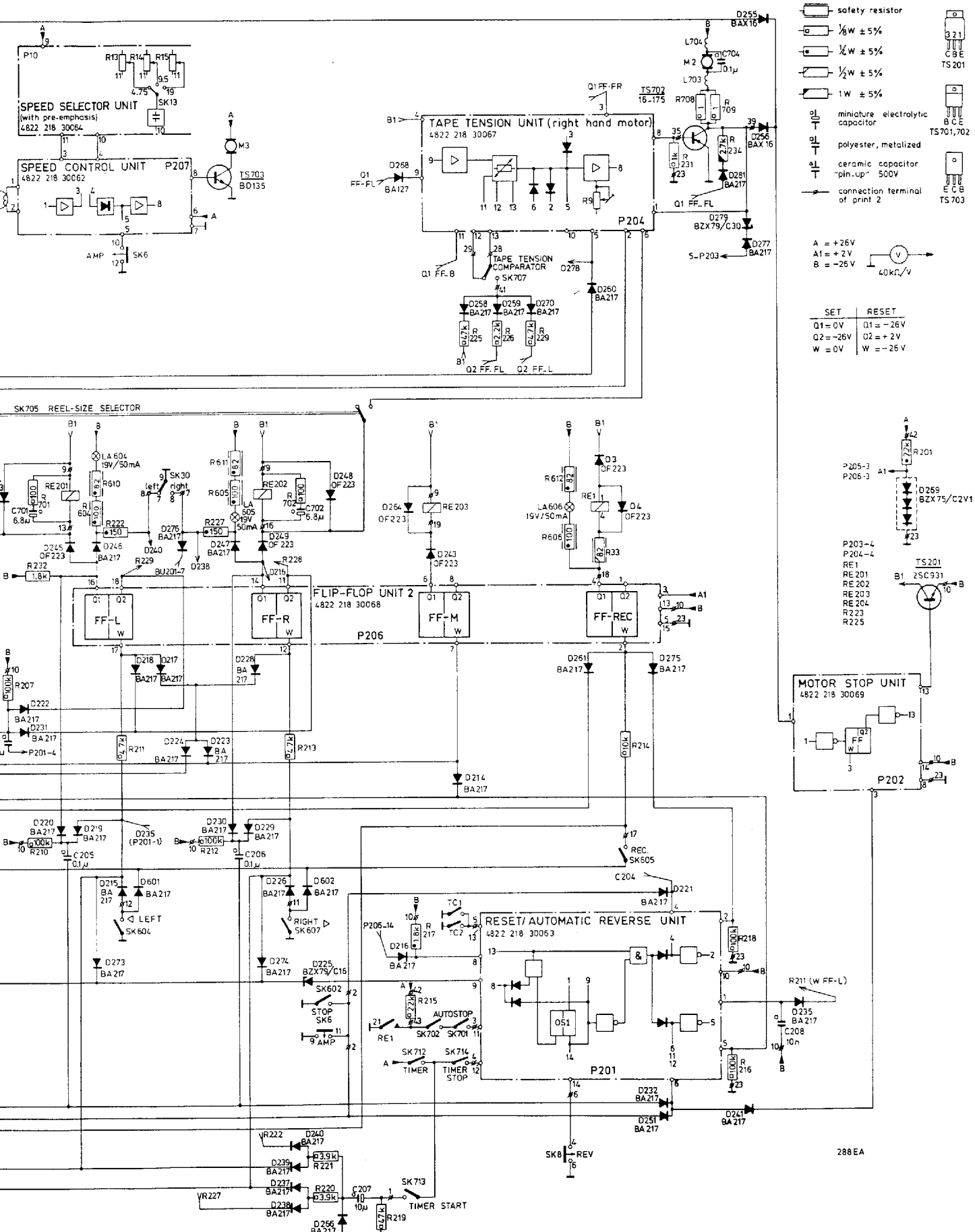
D.	252	262	203	253	206	209	208	272	254	210	207	205	234	280	242	253	5	211	233	212	213	244	222	220	245	246	
	267	204	202	271	201							282	236	278	257			603	250			231			219	273	
R.C.L	R203	R607	R223	R204	R228	R224	R206	C202	R608	R205	R230	R706	L702	R707	C703		R34	R609	R31	R131	R208	R49	R50	R207	R701	R232	C205
	R204	R601	C201						R602				L701	R233			R603	C6	C106			C203	C204	C701	R210		
MISC.	LA601	SK601	SK706						LA602	P203	P205	TS701	M1	RE204	BU201		LA603	SK606	SK9			K7	SK705	RE201		LA60	



3	253	206	209	208	272	254	210	207	205	234	280	242	263	257	6	211	233	212	213	250	244	222	220	245	246	215	218	217	276	224	223	247	228	249	226	240	237	502	248	268	264	243	258	2
224	R205	C202	R608	R205	R230	R706	L702	R707	C703	L701	R233				R34	R609	R31	R131	R208	R49	R50	R207	R701	R232	C205	R610	R222	R604	R211	R227	R611	C206	R213	R702	R221	C207	R219	R217	R215	R225	R226	R		
	LA602	P203	P205	TS701	M1	RE204	BU201				LA603	SK606	SK9								K7	SK705	RE201	LA604	SK6	SK30	P207			M3	LA605	SK607	SK6	SK602	P206	SK712	RE203	TC2	SK7					



4	222	220	245	245	215	218	217	275	223	247	228	249	226	240	237	502	248	268	264	243	258	259	270	260	3	4	275	232	279	241	255	235	269
07	R701	R232	C205	R610	R222	R504	R211	R227	R611	R217	R605	C206	R213	R702	R221	C207	R219	R217	R215	R225	R226	R229	R612	R33	R214	R231	R708	L704	R709	C704	R218	C208	R201
04	C701	R210				SK604						TS703		SK6				SK713	SK702	TC2	SK714	SK8			P201								
705	RE201	LA604	SK5	SK30	P207			M3	LA605	SK607	SK602	P205	SK712	RE203	TC1	SK701	SK707	LA606	RE1	SK605	P204	TS702	M2			P202							

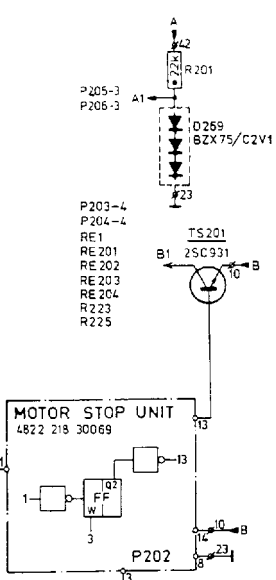


- safety resistor
  - 1/8W ± 5%
  - 1/4W ± 5%
  - 1/2W ± 5%
  - 1W ± 5%
  - miniature electrolytic capacitor
  - polyester, metalized
  - ceramic capacitor "pin-up" 500V
  - connection terminal of print 2
- TS201  
 TS701,702  
 TS703

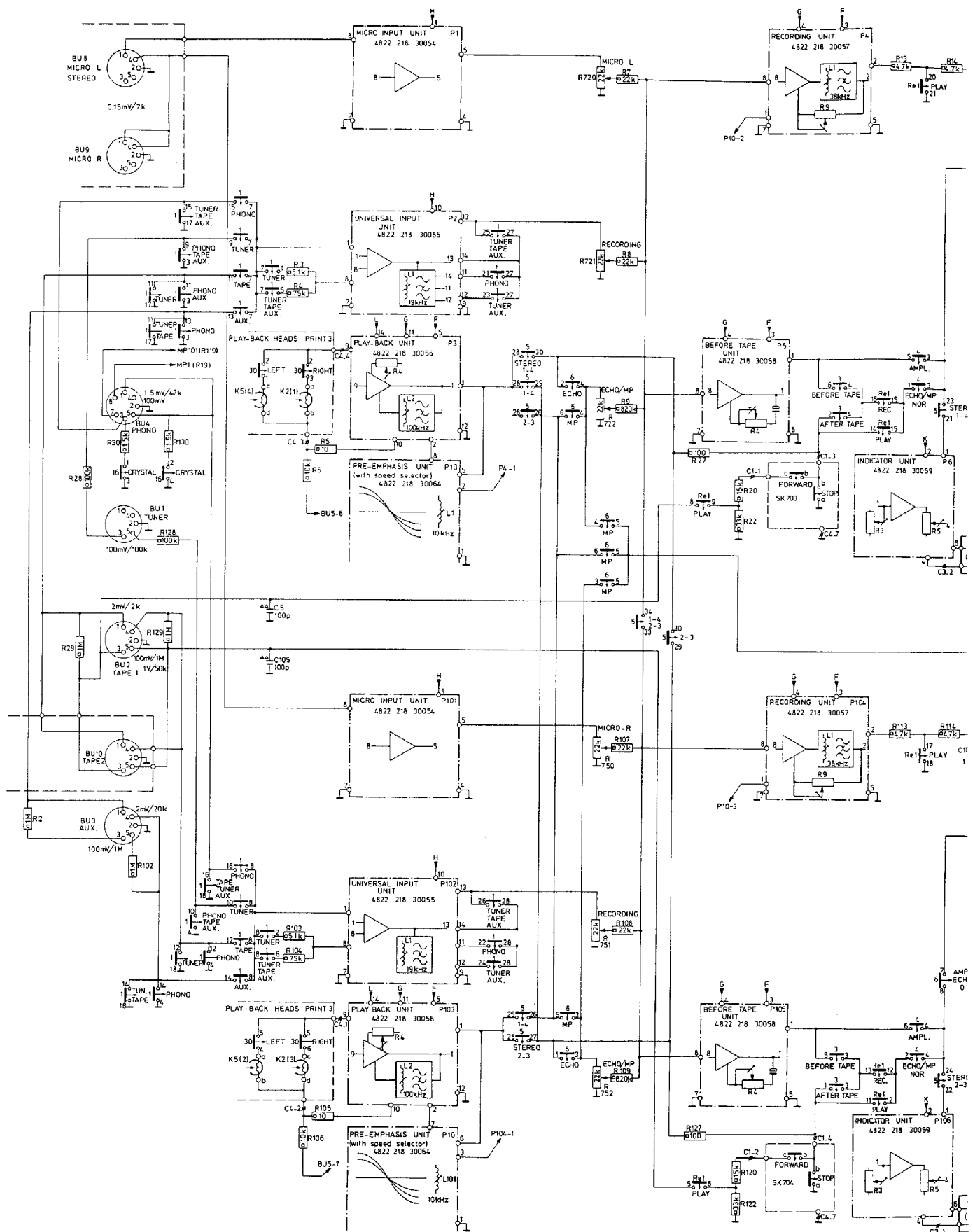
A = +26V  
 A1 = +2V  
 B = -25V

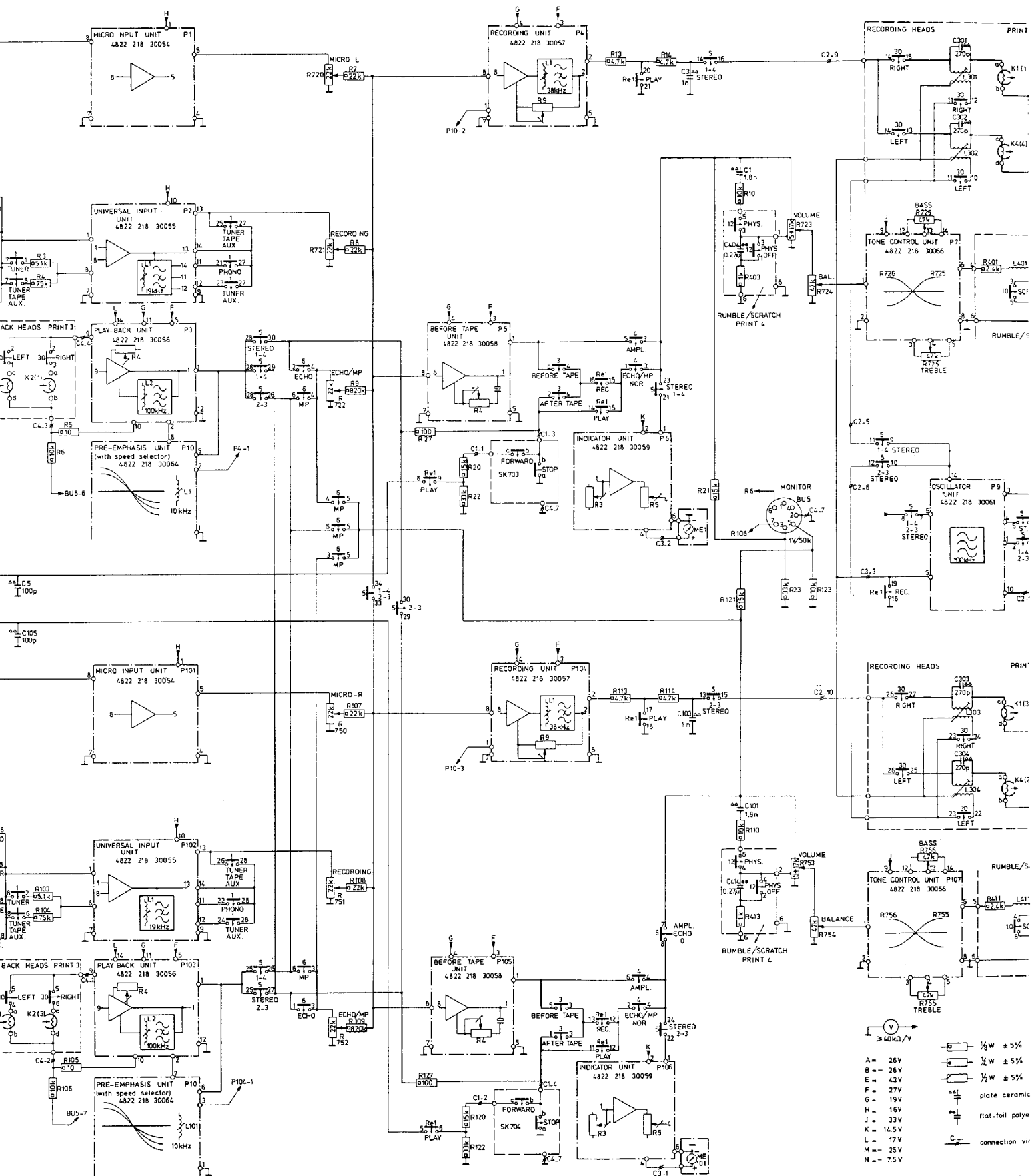
40k $\Omega$ /V

SET	RESET
Q1 = 0V	Q1 = -26V
Q2 = -26V	Q2 = +2V
W = 0V	W = -25V

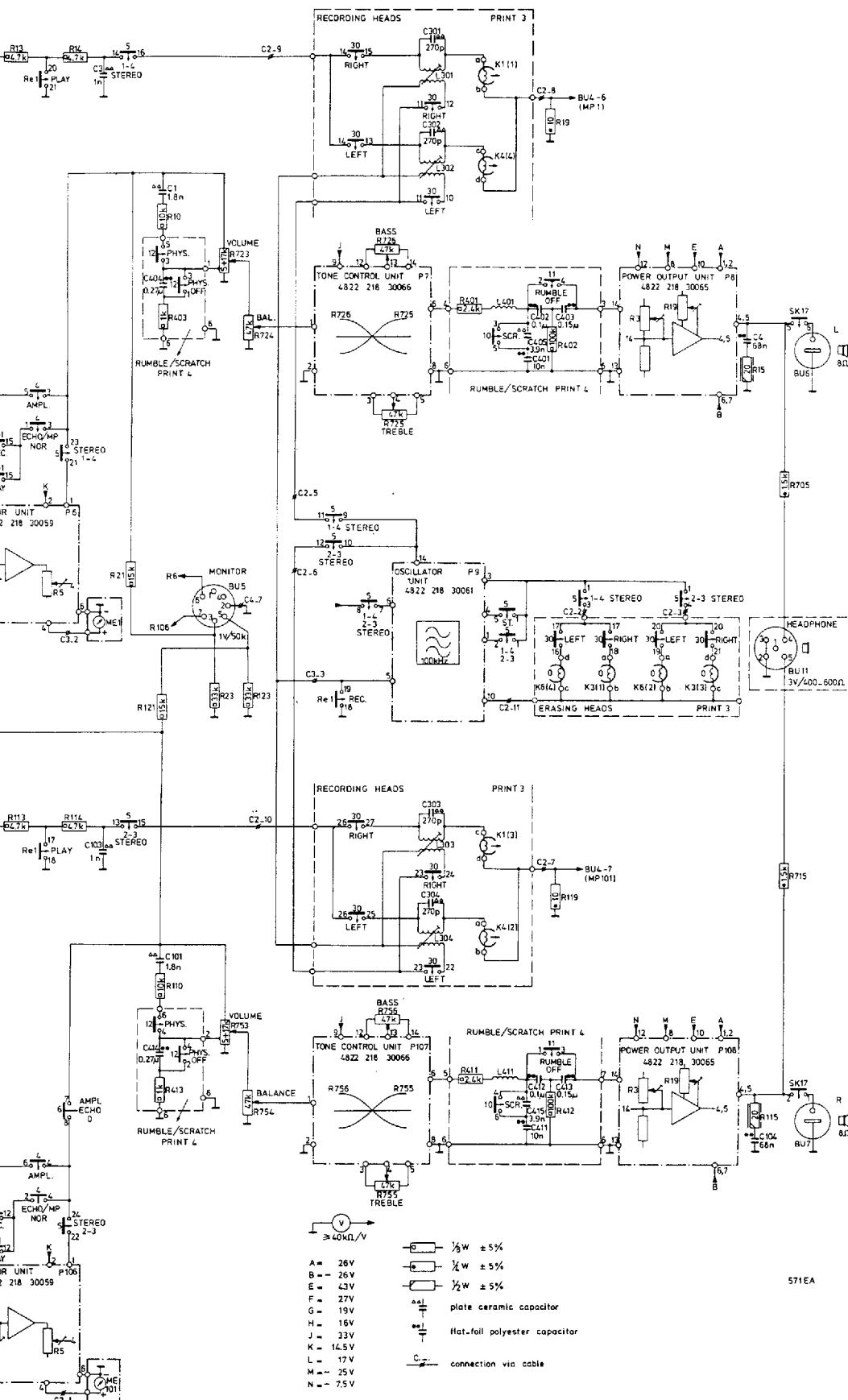


MISC	C	R
P1 P4		
BU8	7	720
BU9		
P2	8	721
	3	
	4	
P3 P5		
KS(4) K2(1)	9	
BU4	722	
	5	
P10	27	
	6	
SK703	28	
BU1	20	
	22	
	128	
	5	
	129	
BU2	25	
	105	
P101 P104		
BU10	107	
	750	
BU3	2	
	102	
P102		
	108	
	103	
	751	
	104	
P103 P105		
KS(2) K2(3)	109	
	752	
	105	
P10	127	
	106	
	120	
SK704	122	

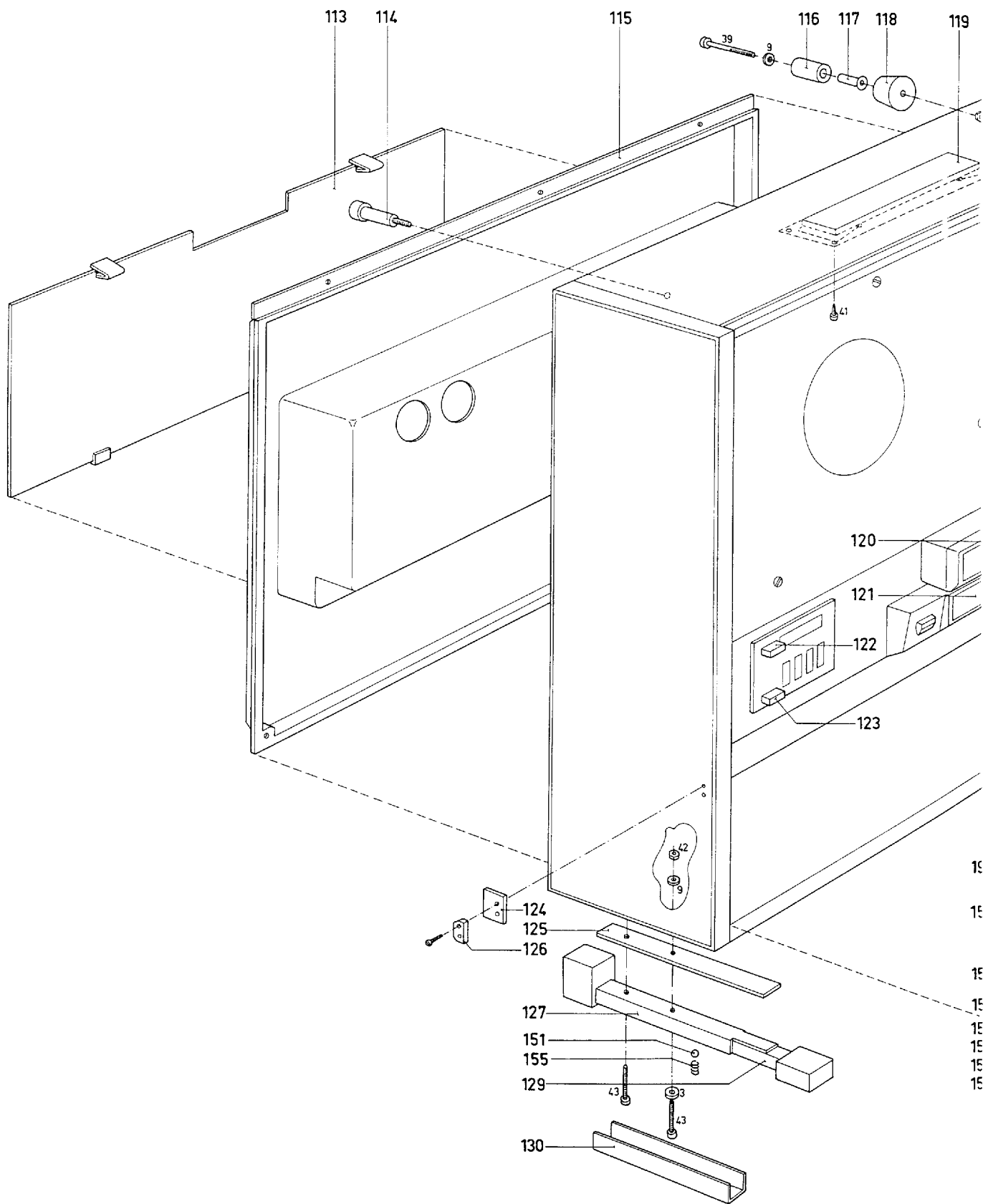


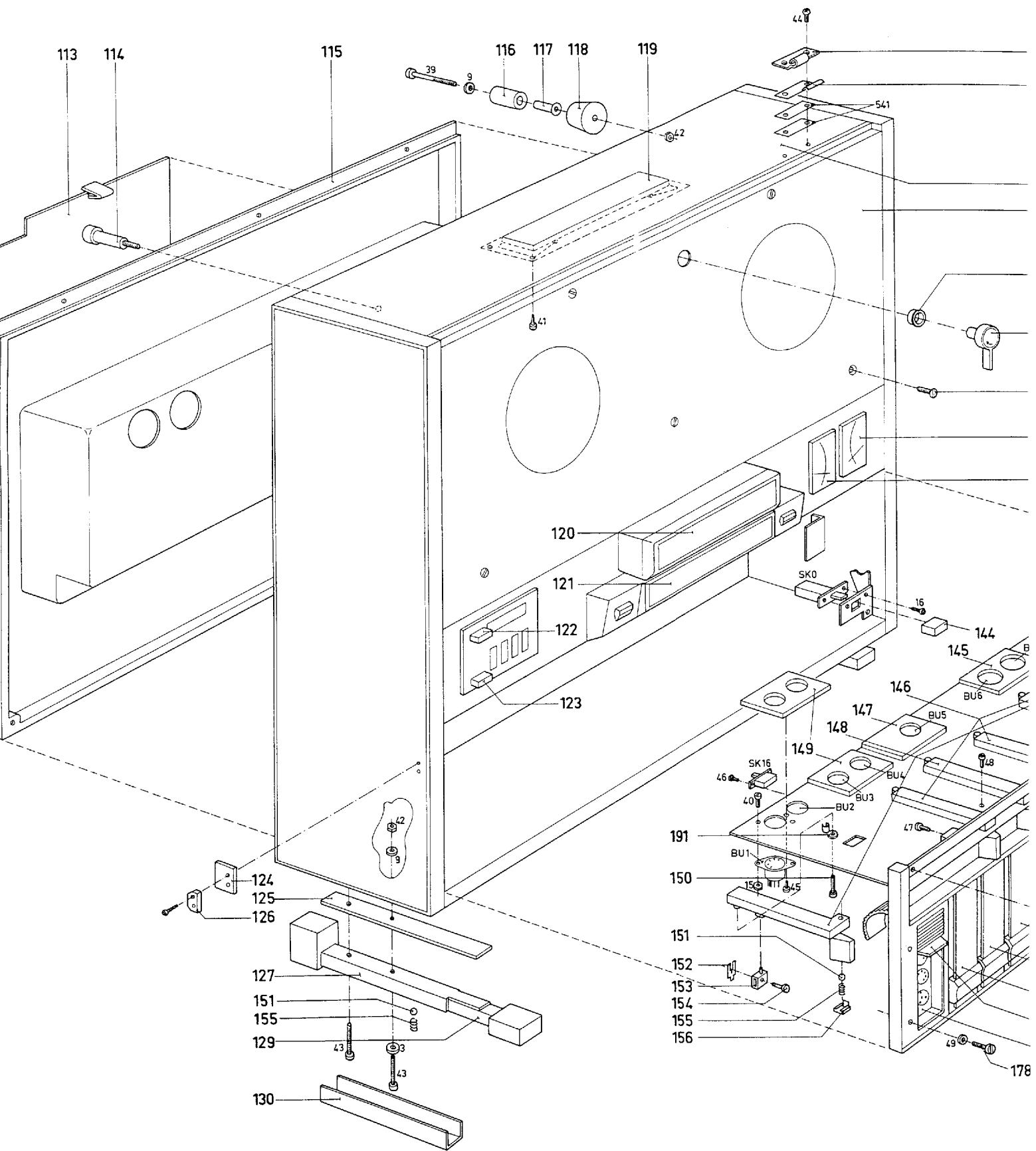


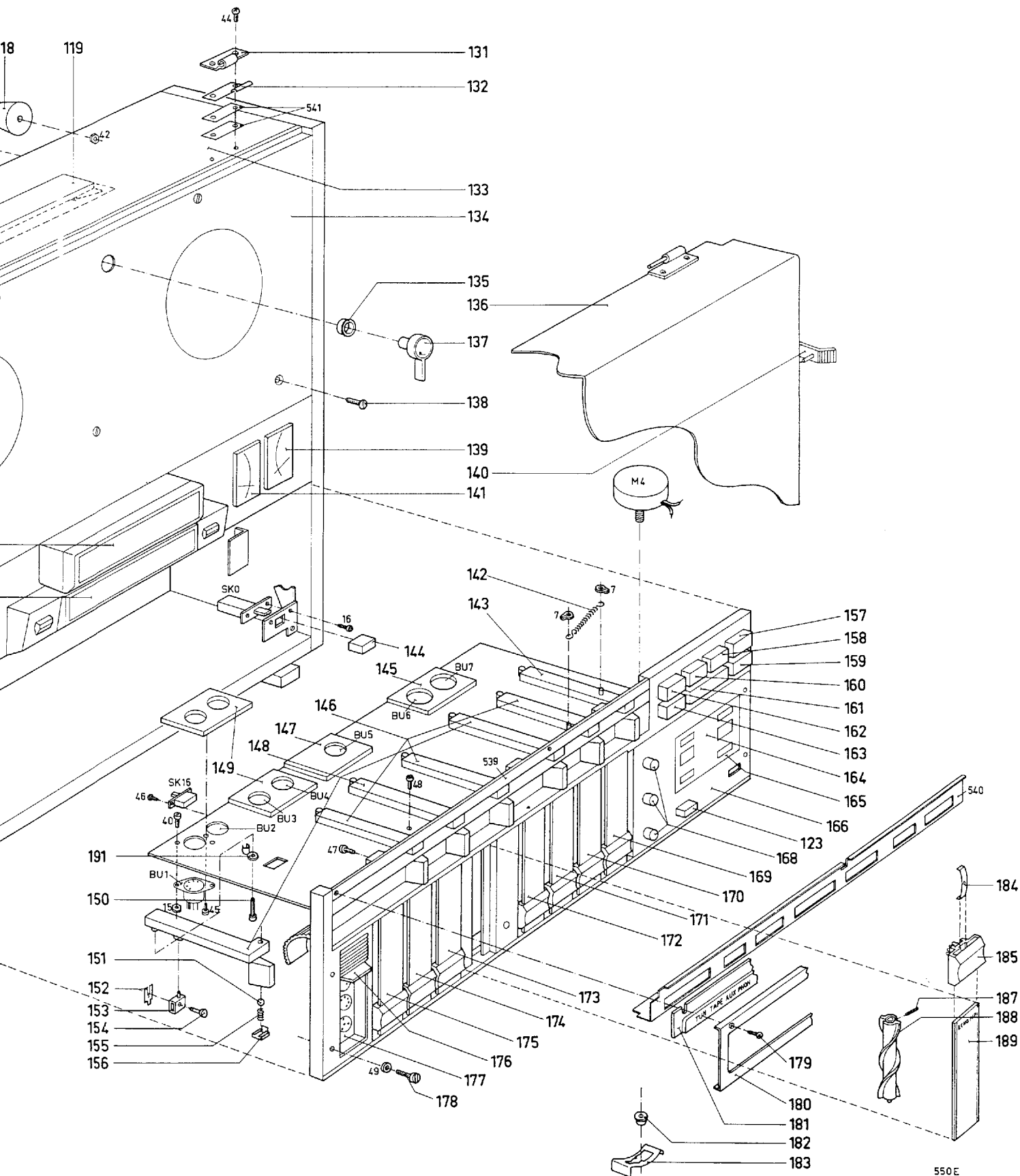


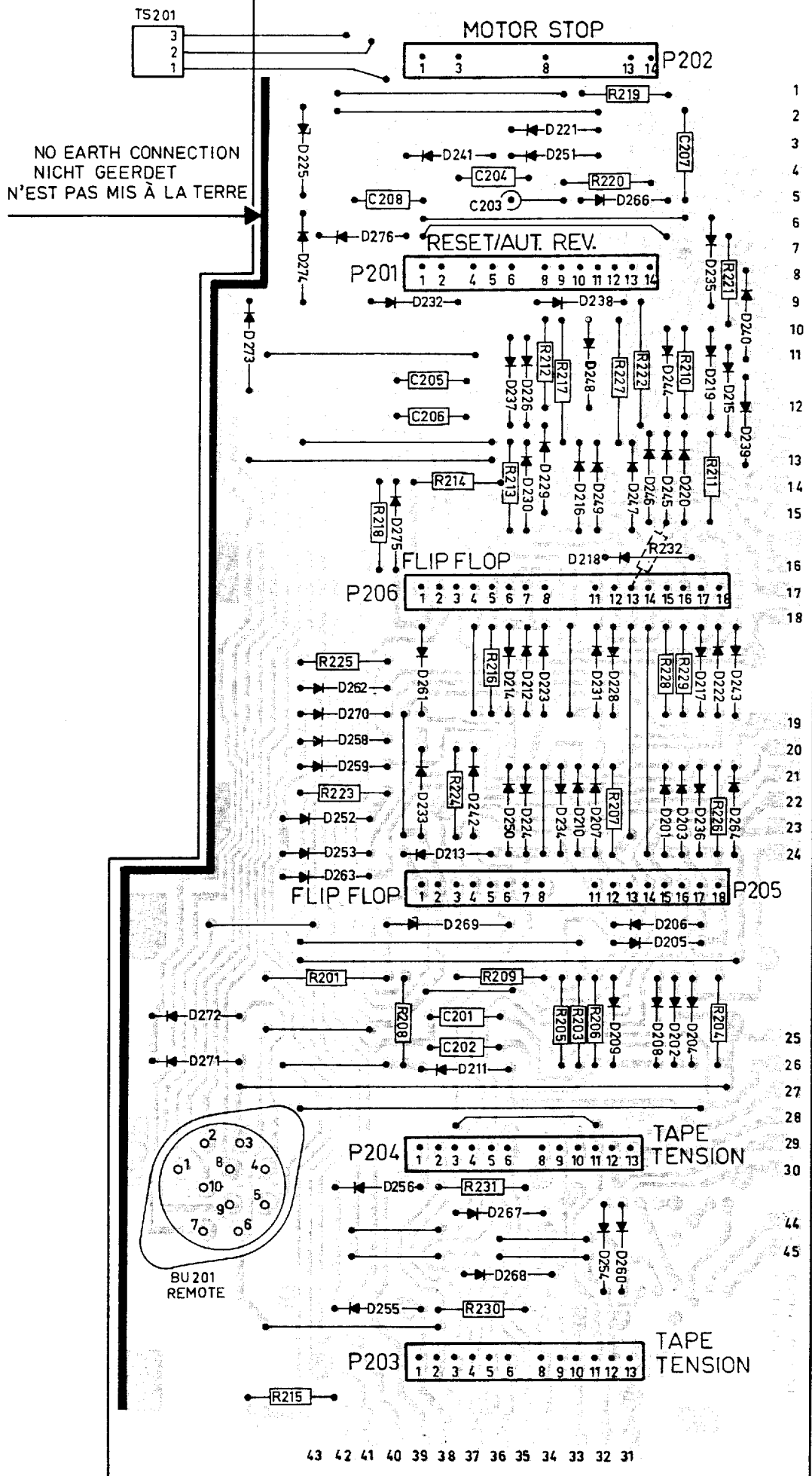


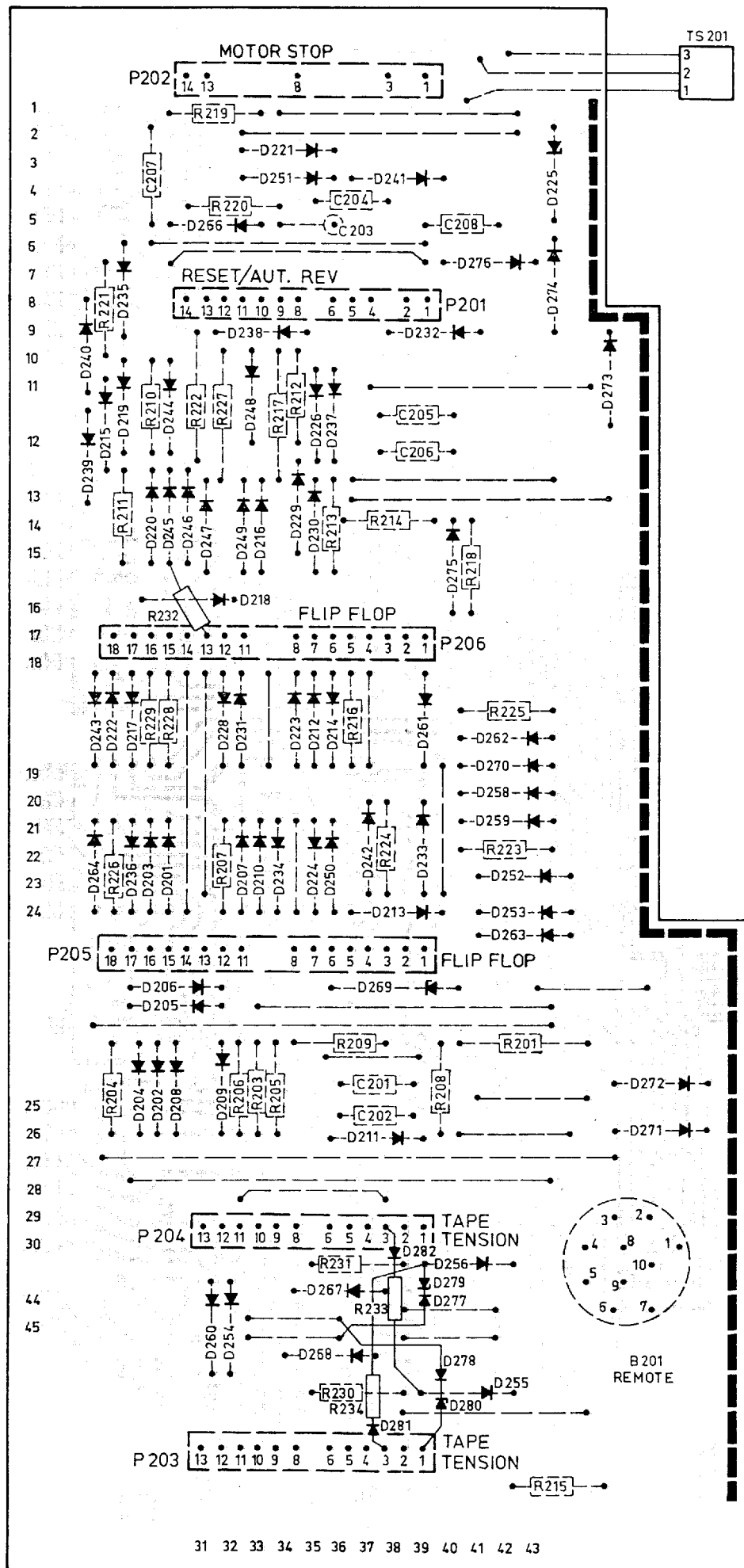
R	C	MISC.
13	301	
14	3	K1(1) L301
19	302	
		K4(4) L302
10		
726		P7
723		P8
401		L401
403		SK17
724		405
402		401
15		BU6
725		
		P5
21		P9
		BU5
		ME1
23		BU11
123		K5(2)
121		K3(1)
		K6(2)
		K3(3)
113	303	
114		
103		K1(3) L303
715		
119	304	
		K4(2)
101		L304
110		
756		P107
753		P108
411		L411
412		SK17
413		415
412		415
754		411
115		104
		BU7
755		
		P106
		ME101











# Service Information

28-12-1972

RECORDERS N 4450

Bc 1329



## PHILIPS

### I. SEVERAL MODIFICATIONS

#### A. Version WR04

- In sets, marked from 144, the pulleys 55 are secured with two Allen screws M3x8 (item 4).  
The code number of these screws is 4822 502 11069.
- The glue of the tape on the anchor plate of the electromagnets RE201...RE204 had not hardened enough. Consequently, the anchor was sticking in some cases.  
In sets WR04/05, from serial number 3100, the glue has better hardened.

#### B. Version WR05

- In sets, marked from 147, safety resistors R43...R46 of 180  $\Omega$  have been added in series with lamps LA1...LA4. This has been done to extend the lives of these lamps. Besides, the values of R47 and R48 have been changed from 22  $\Omega$  into 120  $\Omega$ .  
For code numbers, see the List of Electrical Parts, B Supply.

#### C. Version WR06

- In sets, marked from 147, a 80-mA fuse has been added in series with timer motor M4. In sets WR08, marked from 206, the value of this fuse has been changed into 250 mA-T.
- In sets, marked from 148 - serial number 3350, diode D227 (connected to W/FF-R) has been left out.  
In position "REV", the pulse from the tape contact is applied, via the reset/automatic reverse unit P201, to flip-flop FF-L. Owing to tolerances of the components used in the flip-flops, it may happen that FF-L is preferred to FF-R. Under these circumstances, FF-R cannot be switched on any more. Now that D227 is no longer used, FF-R is preferred to FF-L.

#### D. Version WR07

- In sets, marked from 149 - serial number 4600, the transistors TS701, 702 (controlling the winding motors) have been replaced by type 16-175 (=2N6107).  
The code number of TS701, 702 is 4822 130 40903.
- In sets, marked from 150, a recess has been made to the right of bracket 540. Via this recess, bracket 550 is adjustable. This was necessary because, in a few cases, switch SK9 (FAST-MED-SLOW) did not operate.

#### E. Version WR08

- In sets, marked from 203, the screws securing the capstan motor M3 (11 in bracket 536) have been lockpainted.
- In sets, marked from 203, ornamental frame 180 has been secured with 10 instead of with 6 screws.  
The code number of ornamental frame 180 with 10 screw holes remains unchanged: 4822 460 20067.
- In sets, marked from 203, a ring has been added between flywheels 95 and capstan bearings 88. This has been done because the sets produced a scouring noise when being tilted forwards.  
The code number of ring 200 is: 4822 532 50301.
- In sets, marked from 203, the lower part of ornamental cover 136 can be fixed when it is opened.  
The code number of ornamental cover 136 with closing bracket 140 remains unchanged: 4822 443 20071.  
The code number of bracket 140 is: 4822 403 50738.
- In sets, marked from 206, the value of fuse Z701 (in series with timer motor M4) has been changed from 80 mA into 250 mA-T.  
The code number of the fuse is: 4822 253 30013.

#### F. Version WR09

- In sets, marked from 210, the screws 96 (for adjusting the heads) have finer threads so that it is possible to adjust the heads more precisely.  
The code number of screw 96 is: 4822 502 10665.
- In sets, marked from 227, silicone paste has been applied between the mounting plate and transistors TS701, TS702 with a view to a better thermal conduction.
- In sets, marked from 238, serial number 6001, an additional bracket 542 has been fitted to prevent the oil seals 87 from shifting.

### II. MULTIWAY CONNECTORS

The functional units are secured to p.c. boards 1 and 2 with multiway connectors for three, eight or fourteen contacts. Whether or not these contacts are available, depends upon the circuit on the units; consequently, there is a great number of versions. For servicing purposes, only three versions are supplied, namely: the 3-pole, the 8-pole and the 14-pole versions with all contacts. Non-functional contacts can be easily removed with tweezers.

### III. MODIFICATIONS AND ADDITIONS TO LIST OF MECHANICAL PARTS.

#### A. Tape deck

2	Screw M3x4	4822 502 11069
4	Screw M3x8	4822 502 10174
5	Nut M5	4822 505 10513
8	Ring 3,2 x 7 x 0,3	4822 532 50298
9	Ring 4,2 x 8 x 0,5	4822 532 10333
14	Ring 3,2 x 6 x 0,4	4822 530 80082
17	Ring 3,2 x 9 x 0,8	4822 532 10582
20	Ring	4822 532 20619
24	Clamping ring 4 dia	4822 530 70116
25	Ring 3,2 x 7 x 0,5	4822 532 10332
26	Screw M3x4	4822 502 11189
27	Ring	4822 532 10332
29	Ring 3,2 x 4,5 x 0,3	4822 532 50938
32	Screw M3x20	4822 502 11096
33	Spacer 3,1 x 16 x 5	4822 532 20607
35	Screw M2x8	4822 502 10681
47	Screw M4x8	4822 502 10693
49	Ring 4,2 x 8 x 0,1	4822 532 10479
50	Ring 3,2 x 8 x 0,2	4822 532 50298
57	Cord	4822 358 30145
60	Bearing	4822 502 10765
71	Ring	4822 532 30266
79	Cord	5322 358 30045
96	Screw	4822 502 10665
97	Screw M3	4822 502 11217
98	Nut M3	4822 505 10408
104	Pressure spring	4822 492 50925
105	Bearing	4822 535 70468
110	Grommet	4822 528 80545
200	Ring 5,2 x 9 x 0,5	4822 532 50301
201	Screw M3x8	4822 502 11053
202	Ring 3,6 x 12 x 1	4822 532 10489
203	Ring	4822 532 50786
204	Tension spring	4822 492 30355
205	Cord damper	4822 479 30045

## B. Cabinet and amplifier

3	Ring	4822 532 50725
15	Nut M3	4822 505 10325
39	Screw M4x30	4822 502 10053
40	Screw M3	4822 502 11287
41	Screw 3.9 x 9,13	4822 502 30006
43	Screw M4x22	4822 502 10051
44	Self-tapping screw 2.9 x 15	4822 502 30048
45	Self-tapping screw 2.9 x 4,37	4822 502 30065
118	Support	4822 325 20063
131	Hinge	4822 417 10516
139	Meter on the right (ME101)	4822 347 10069
140	Bracket	4822 403 50738
141	Meter on the left (ME1)	4822 347 10071
149	Socket-cover plate	4822 459 80039
151	Ball 5/32"	5322 520 40012
154	Pin	4822 535 90912
	Ball for SK5	4822 535 90913
155	Pressure spring	4822 492 50927
	Pressure spring (light conductor for switch FAST-MED-SLOW)	4822 492 51037
187	Screw M3x4	4822 502 10663
190	Lense	4822 381 10401
191	Lamp holder	4822 256 90135

## IV. MODIFICATIONS AND ADDITIONS TO LIST OF ELECTRICAL PARTS

## A. Control section

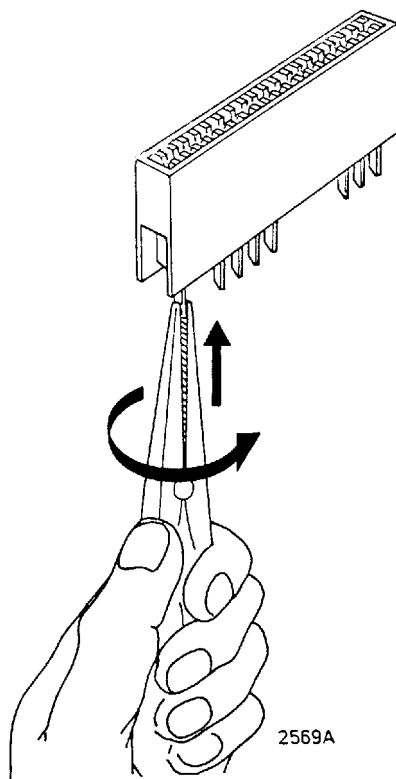
SK8	Slide switch (NOR-REV)	4822 277 30378
SK702	Switch (counter)	4822 278 90231
	Plug for BU201	5322 264 50043
TS201	Transistor 2 SC931	4822 130 40899
TS701, 702	Transistor 16-175 (=N1607)	4822 130 40903
	Lampholder for LA601...LA606	4822 401 10561

## B. Supply

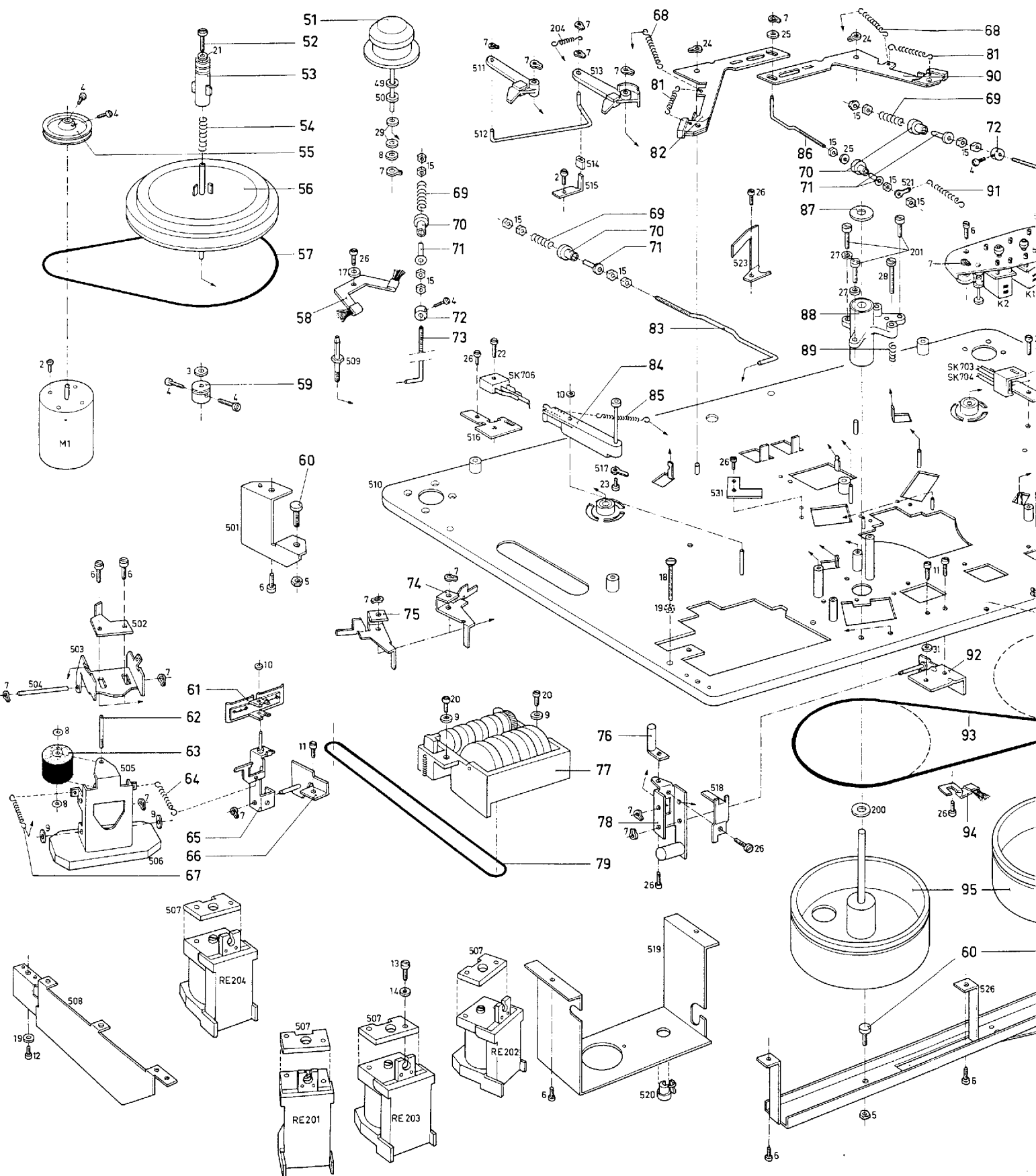
SK105	Voltage adapter	4822 272 10202
LA8, 9	Lamp 19 V-50 mA (timer)	4822 134 40078
	Lampholder for LA1...LA4	4822 256 90135
	Lampholder for LA701, 702	4822 401 10561
	Fuse holder for Z501, 502	4822 492 60063
Z701	Fuse 250 mA-T	4822 253 30013
	Fuse holder for Z701	4822 256 30128
R35	Safety resistor 10 k $\Omega$	4822 110 53134
R36, 132	Safety resistor 68 $\Omega$	4822 110 53076
R37	Safety resistor 330 $\Omega$	4822 110 43094
R38	Safety resistor 820 $\Omega$	4822 111 30424
R39	Safety resistor 560 $\Omega$	4822 111 30374
R40	Safety resistor 1 k $\Omega$	4822 111 30404
R41	Safety resistor 3k3	4822 111 30413
R42	Safety resistor 3 k $\Omega$	4822 111 30442
R47, 48	Safety resistor 120 $\Omega$	4822 111 50135
R133, 134, 43		
44, 45, 46	Safety resistor 180 $\Omega$	4822 110 43087
R502	Safety resistor 33 $\Omega$	4822 111 30418

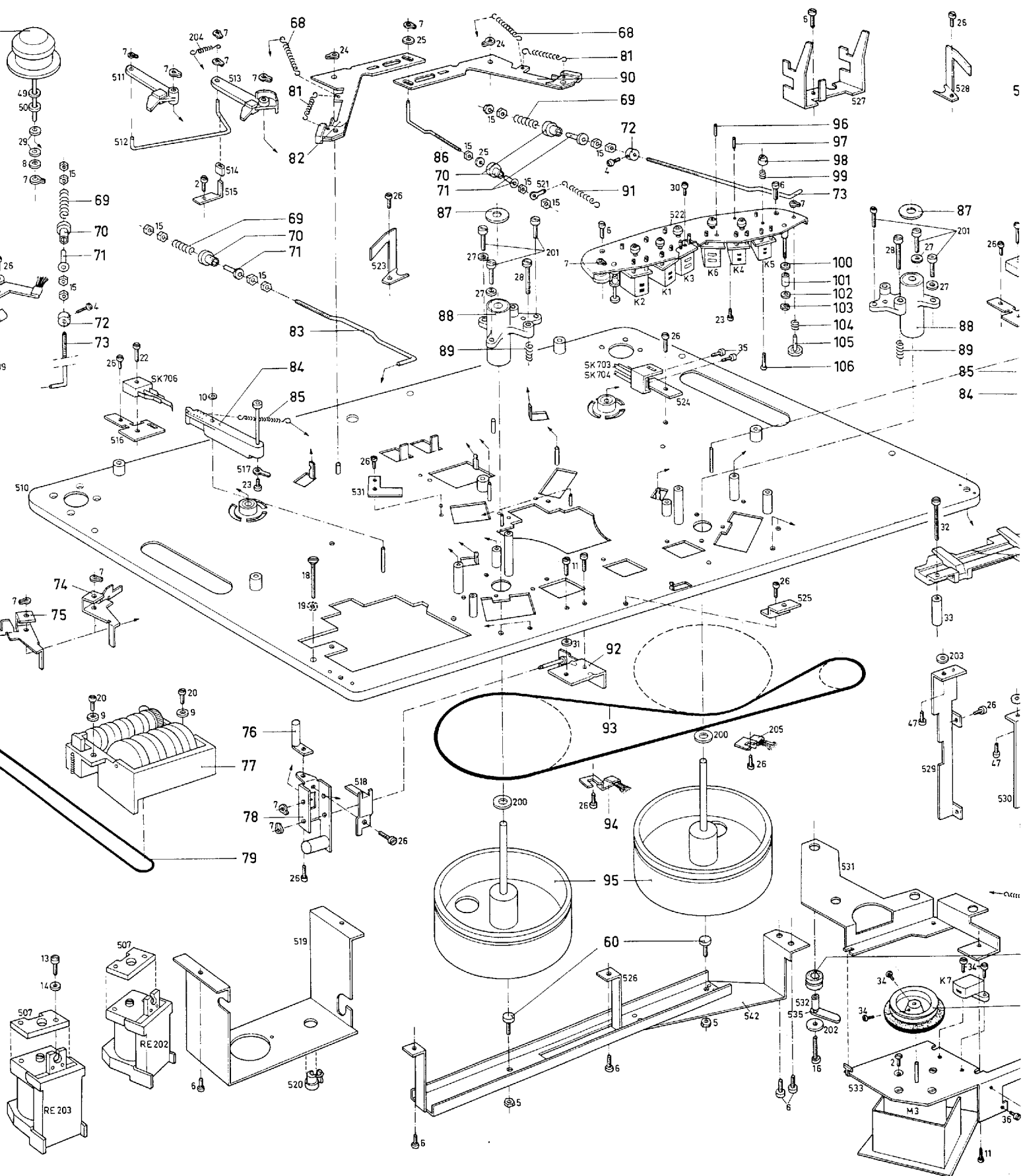
## C. Amplifier

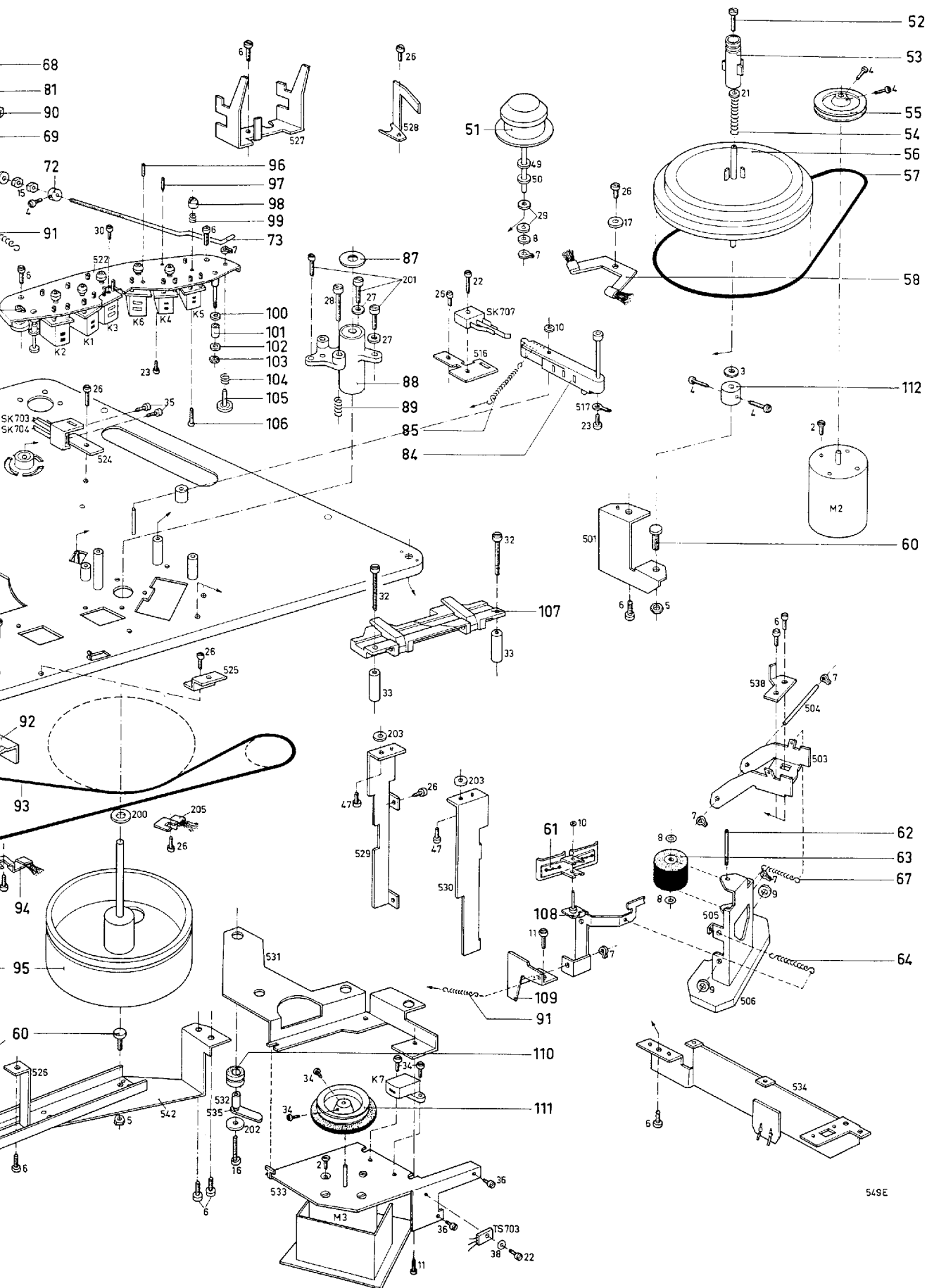
SK703, 704		4822 278 90232
	Contact spring for BU8...BU10 (signal)	4822 268 20032
	Contact spring for BU8...BU10 (earth)	4822 492 61313
	Plug for BU1...BU5 and BU8...BU10	4822 264 40023
	Plug for BU6, 7	4822 264 30041
	Plug for BU11	4822 264 40092
	Adjusting core for L301...L304	4822 526 10014
ME1	Meter, left	4822 347 10071
ME101	Meter, right	4822 347 10069
	Plug on cable tree, 14 poles	4822 264 50079
C13	150 $\mu$ F-25 V	4822 124 20388
C508	330 $\mu$ F-63 V	4822 124 20404
C705	1000 $\mu$ F-63 V	4822 124 70215
R15, 115	Safety resistor 20 $\Omega$	4822 111 50372











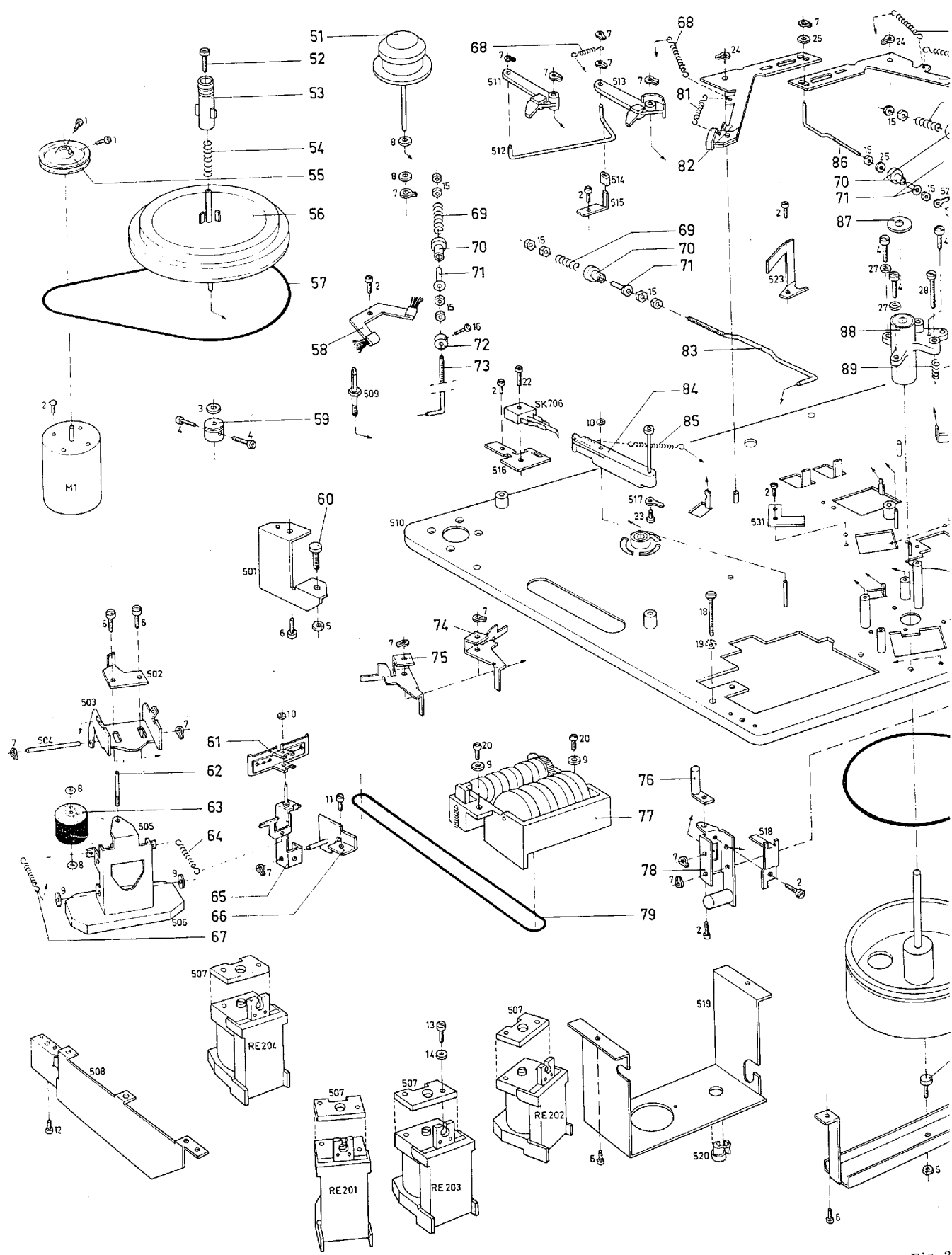


Fig. 2

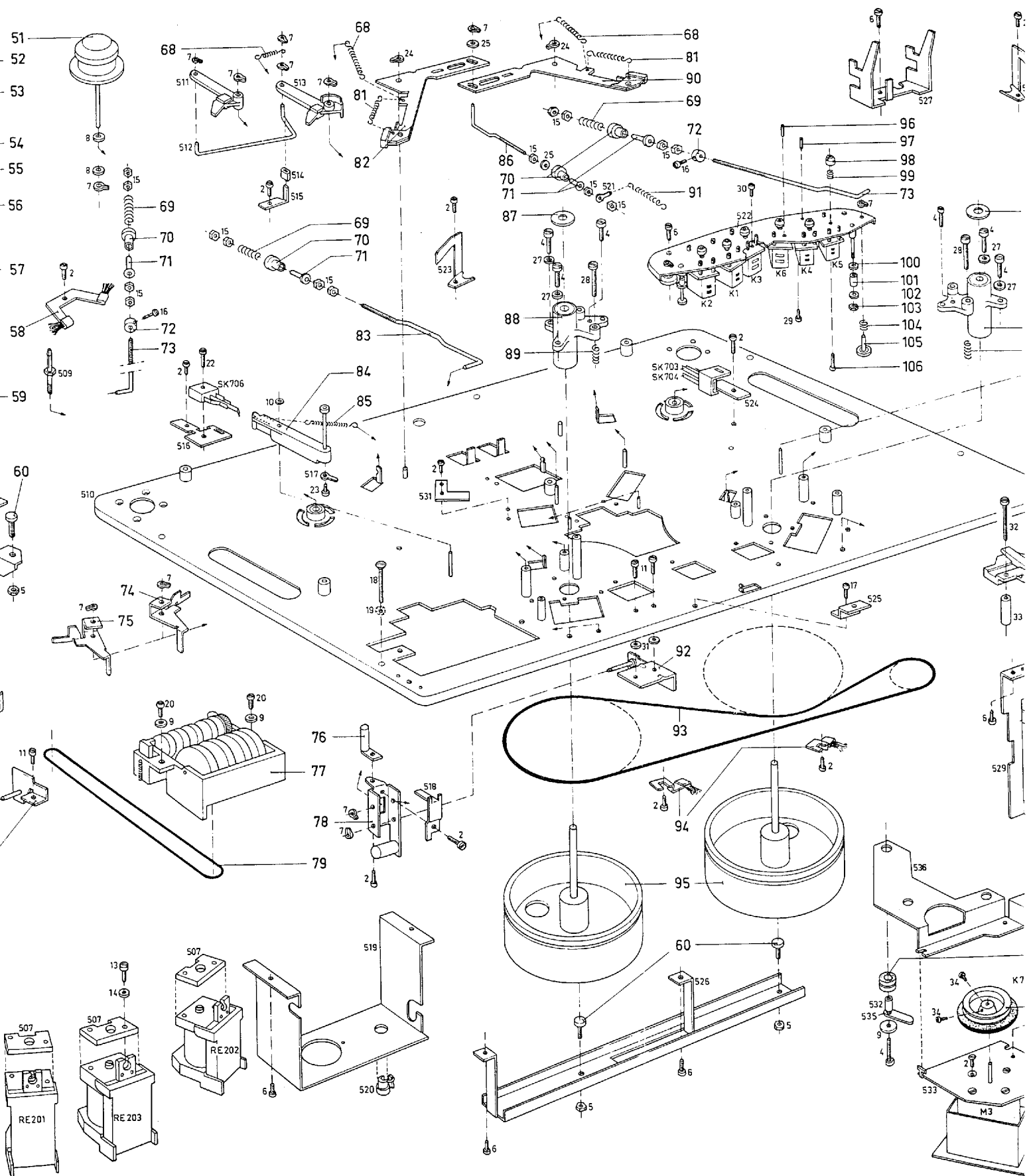


Fig. 22

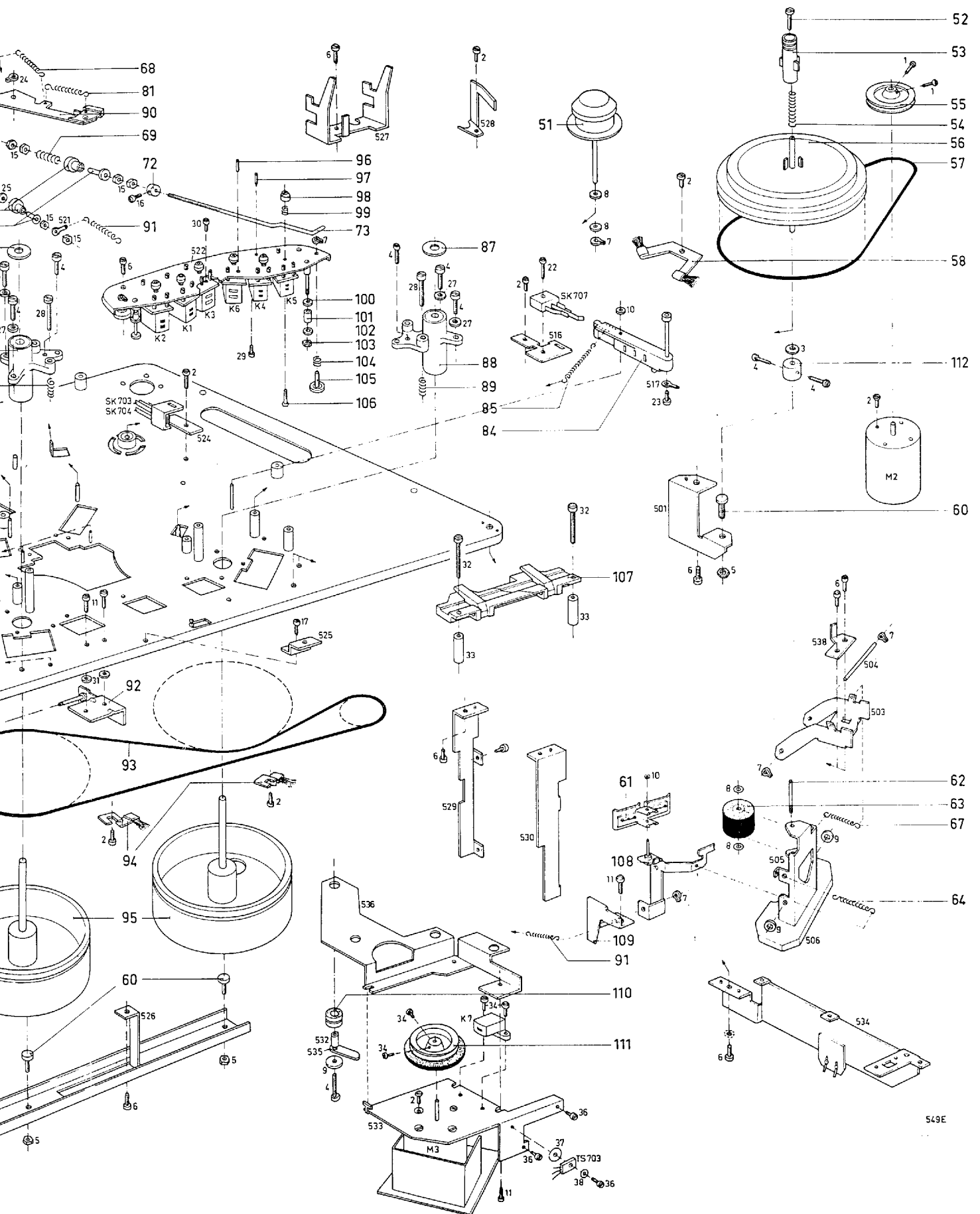


Fig. 22

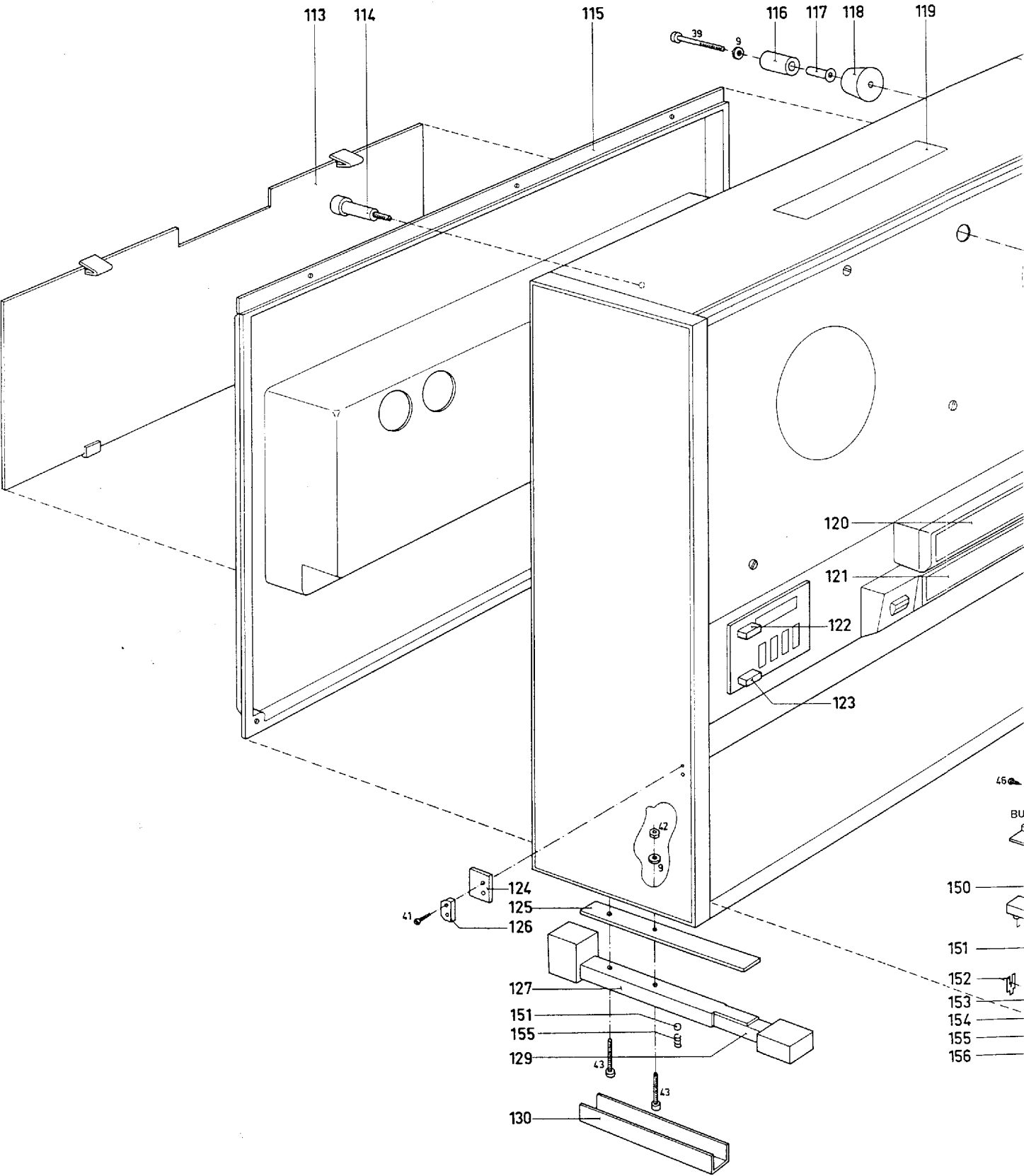


Fig. 23

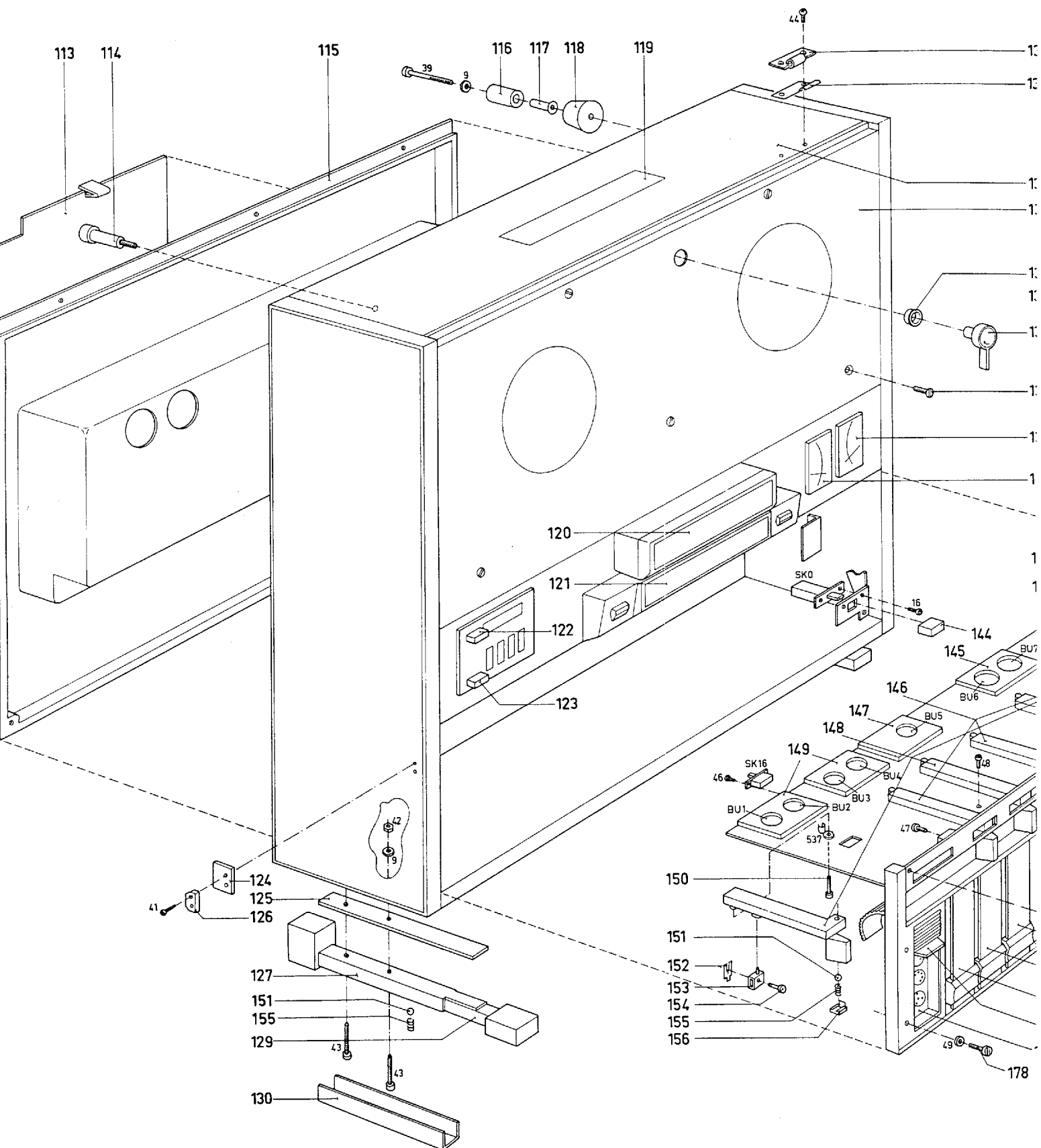
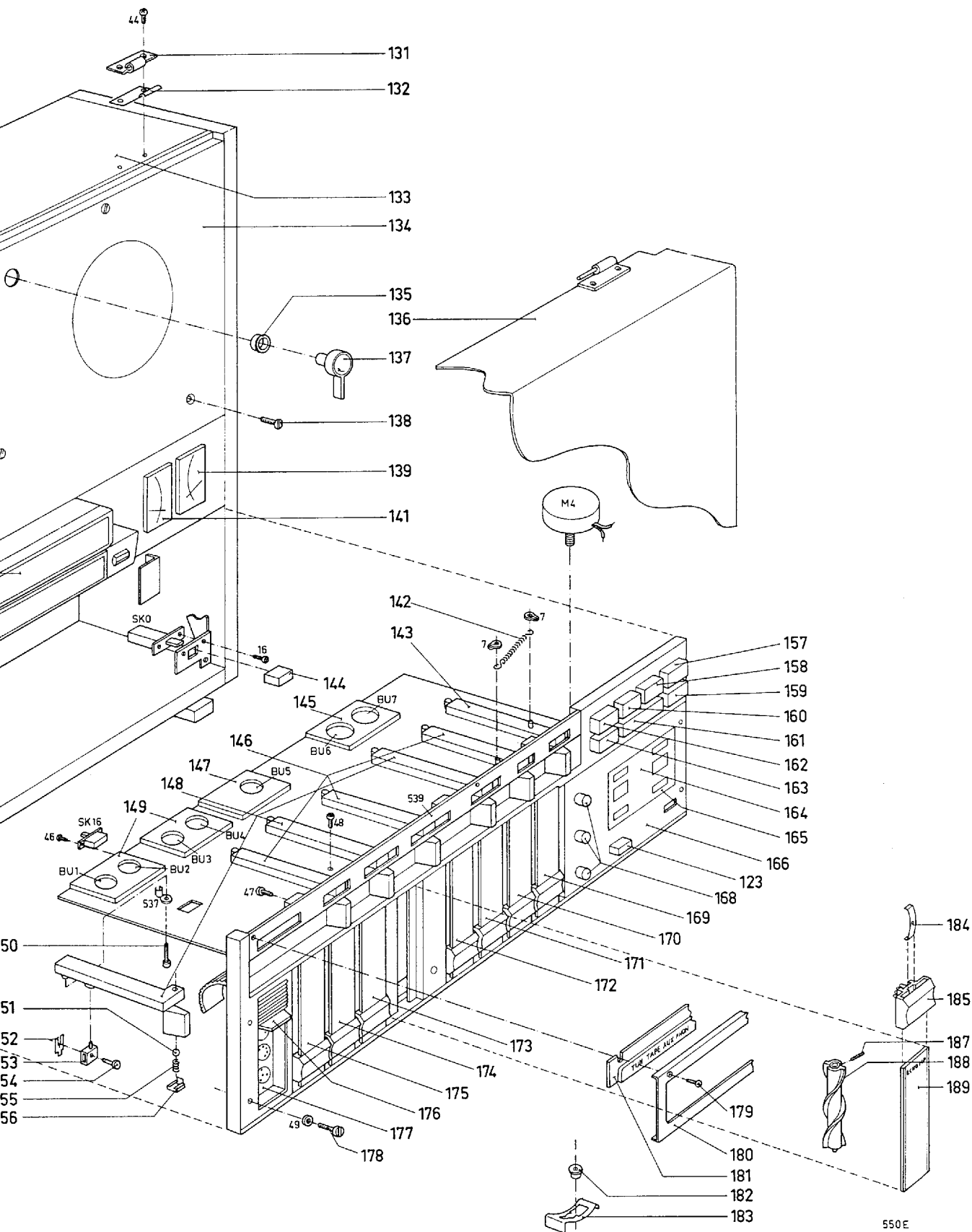
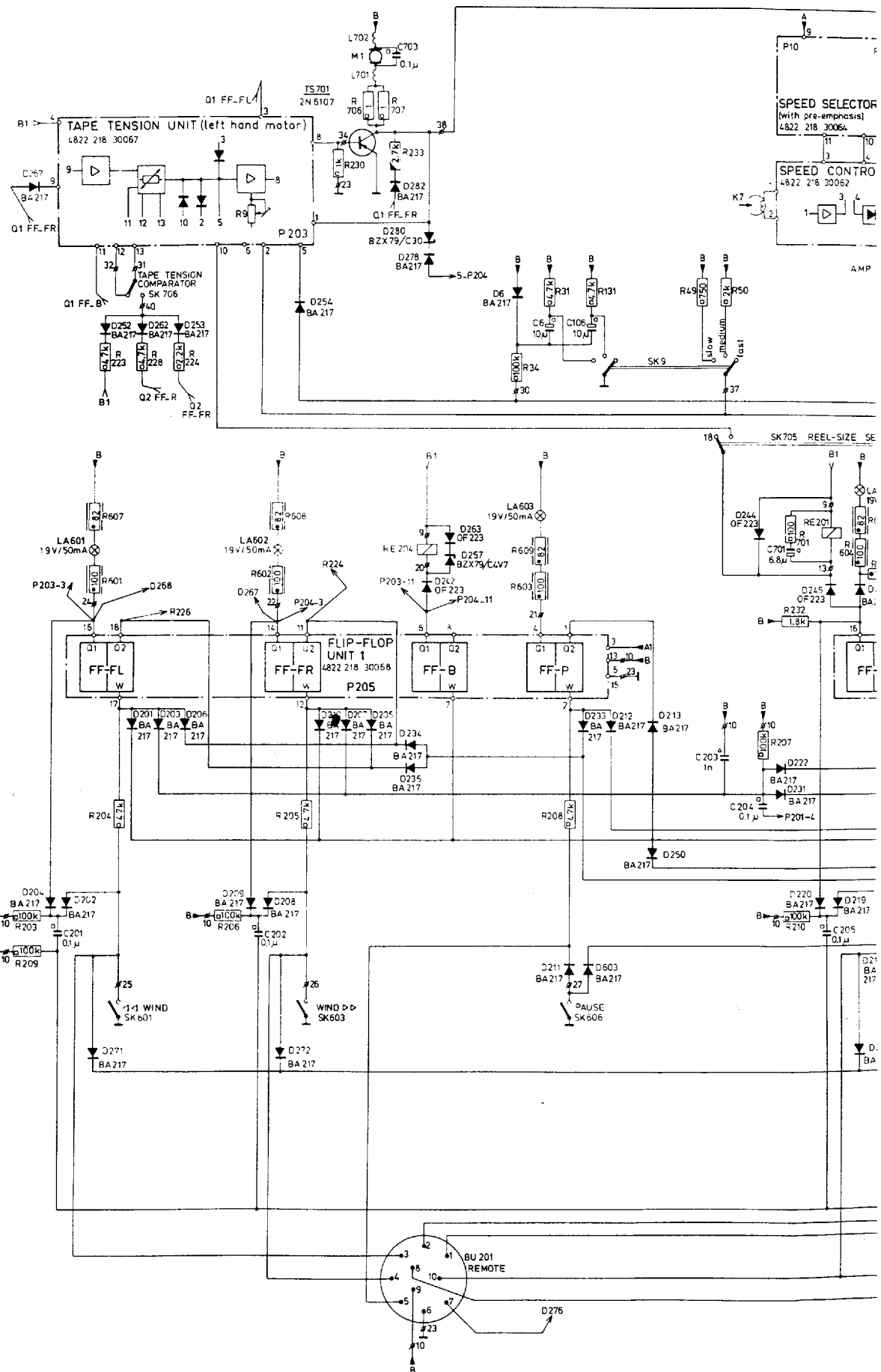


Fig. 23





D.	252	262	233	253	206	209	208	272	254	210	207	205	234	280	242	263	6	211	233	212	213		244	222	220	245	246	215
	267	204	202	271	201								282	236	278	257			603		250		231	219	212	273		
R.C.L	R203	R607	R223	R204	R228	R224	R206	C202	R608	R205	R230	R706	L702	R707	C703		R34	R609	R31	R131	R208	R49	R50	R207	R701	R232	C205	R61
	R204	R601	C201						R602			L701	R233				R603	C6	C106				C203	C204	C701	R210	R61	
MISC.		LA601	SK601	SK706					LA602	P203	P205	TS701	M1	RE204	BU201		LA603	SK606	SK9				K7	SK705	RE201	LA604	SK	



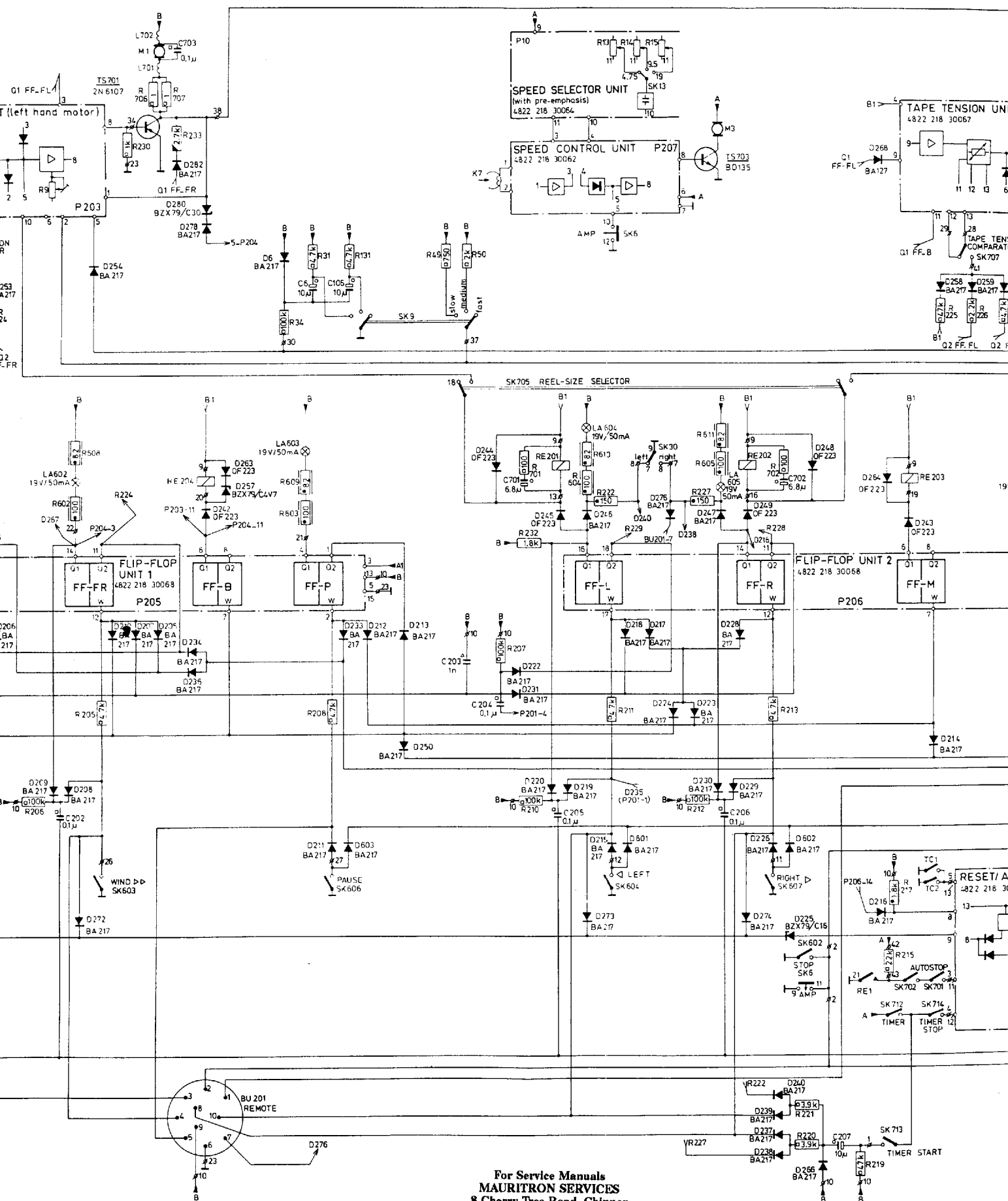
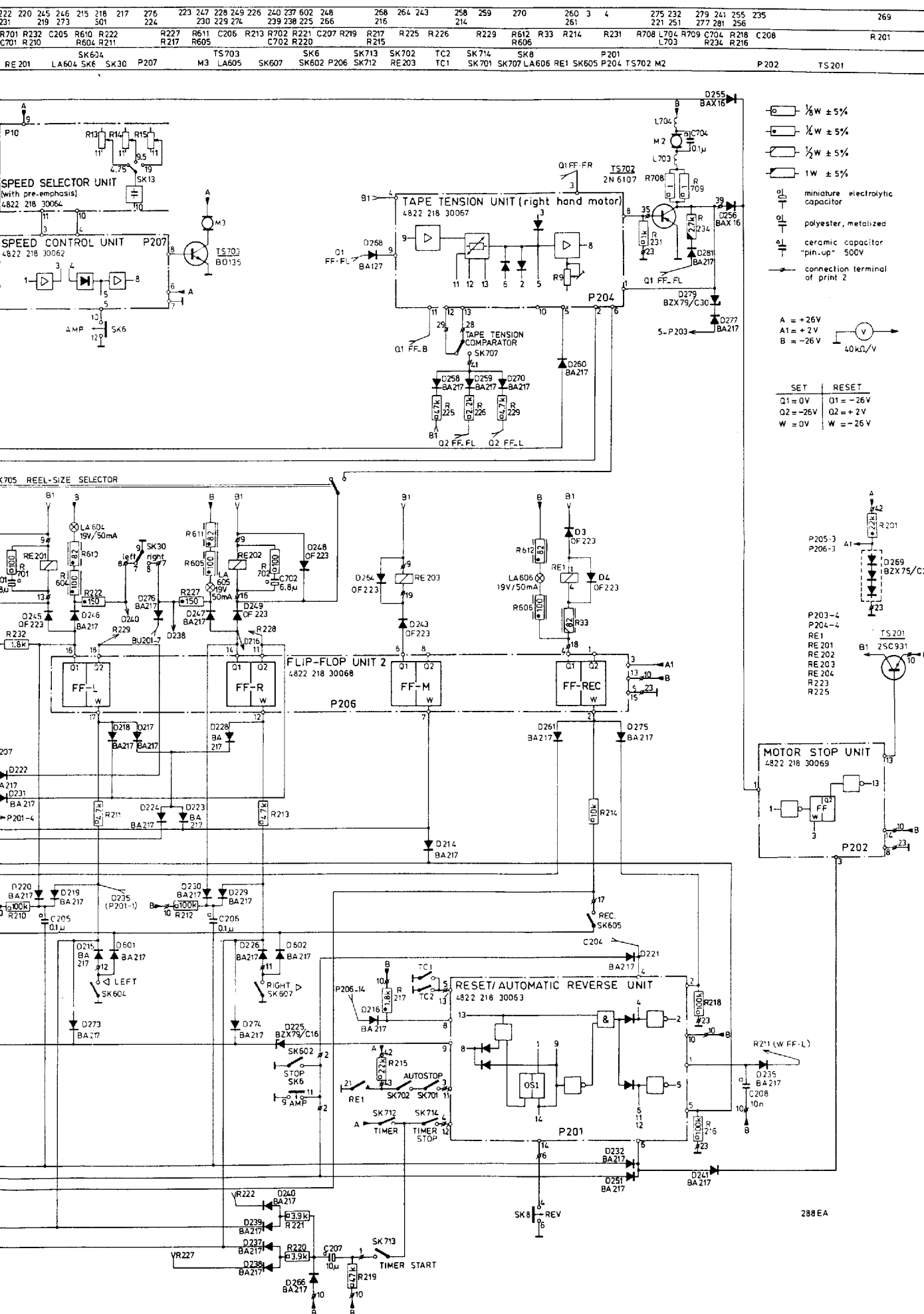


Fig. 25



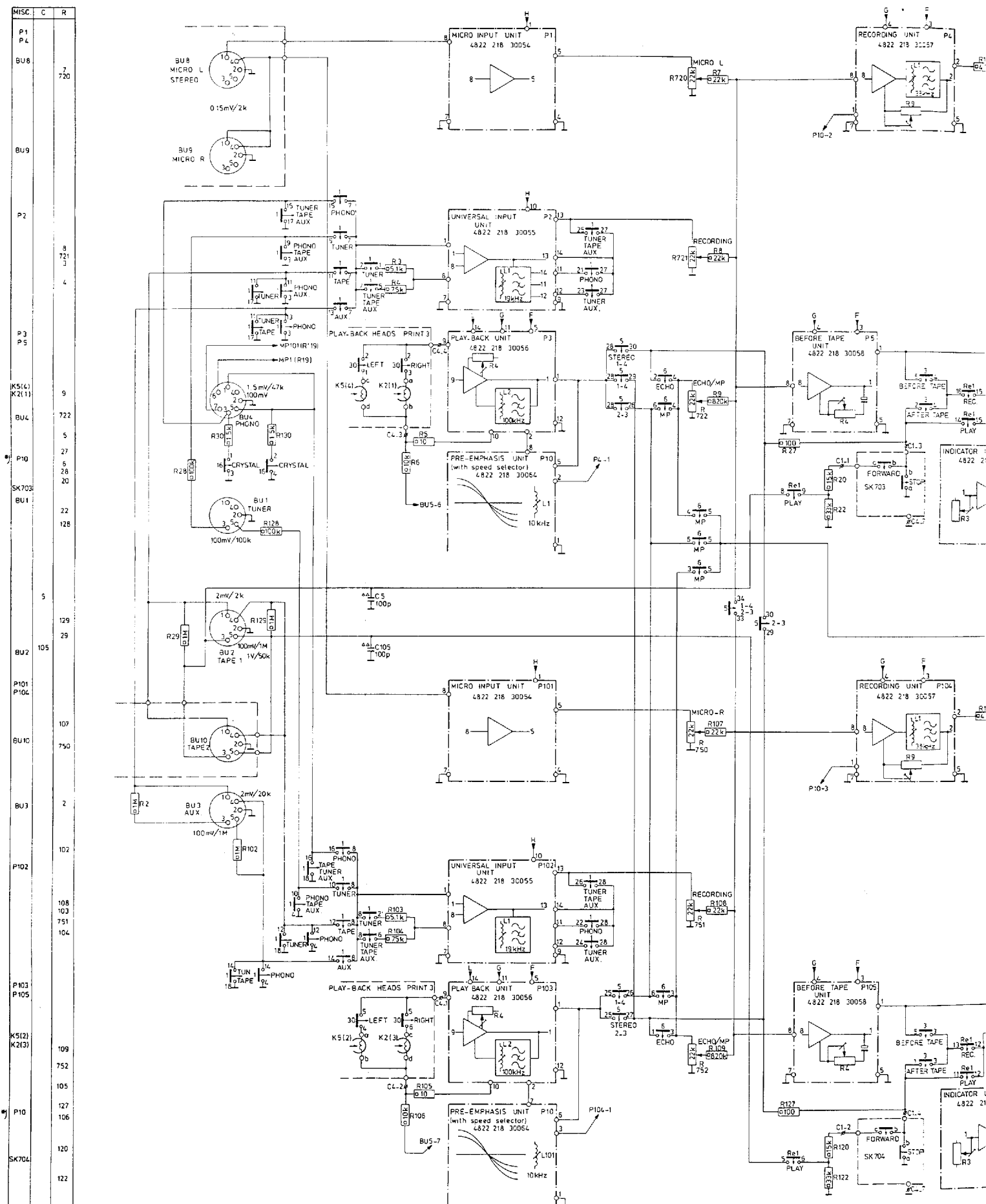


Fig. 26

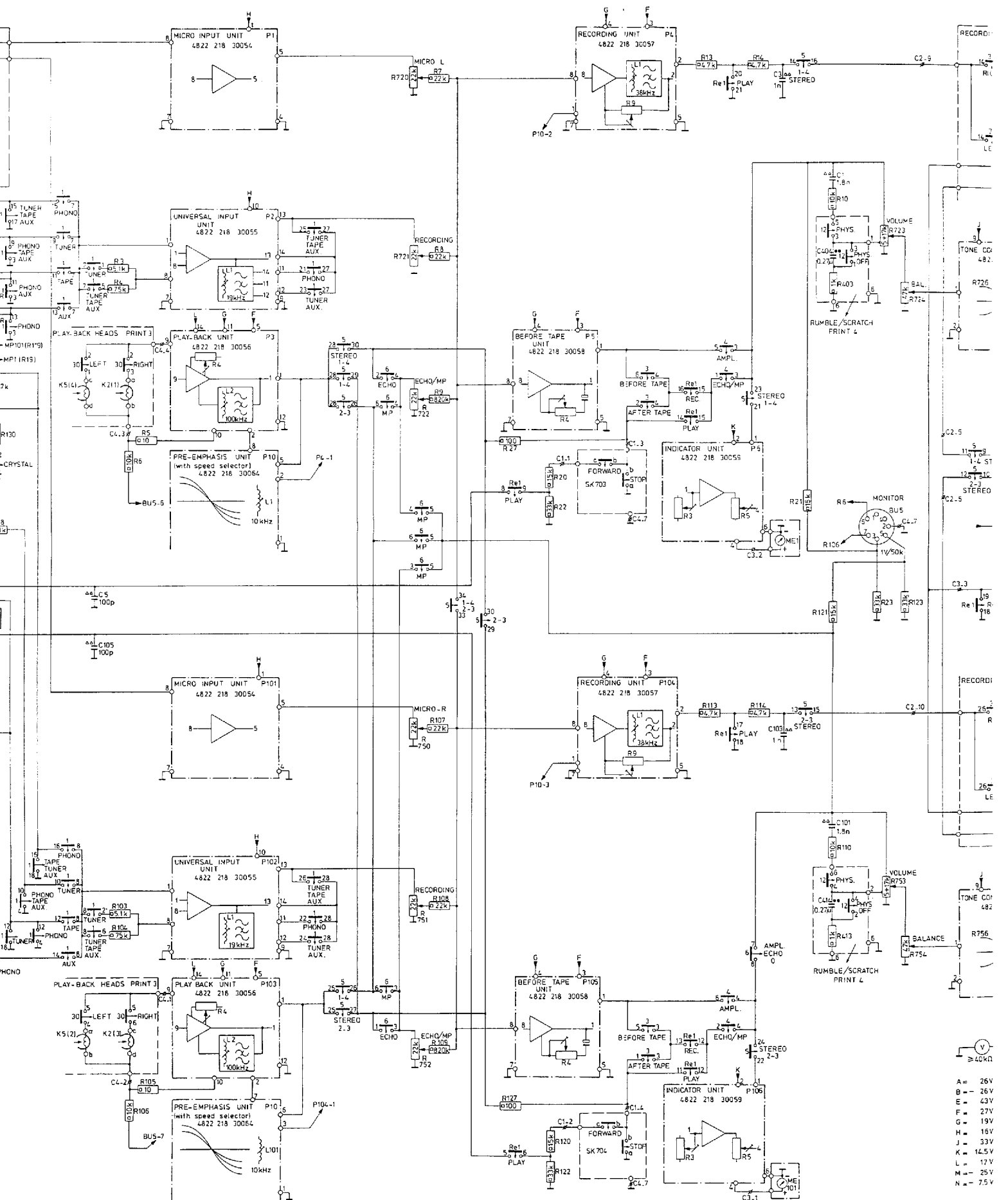


Fig. 26

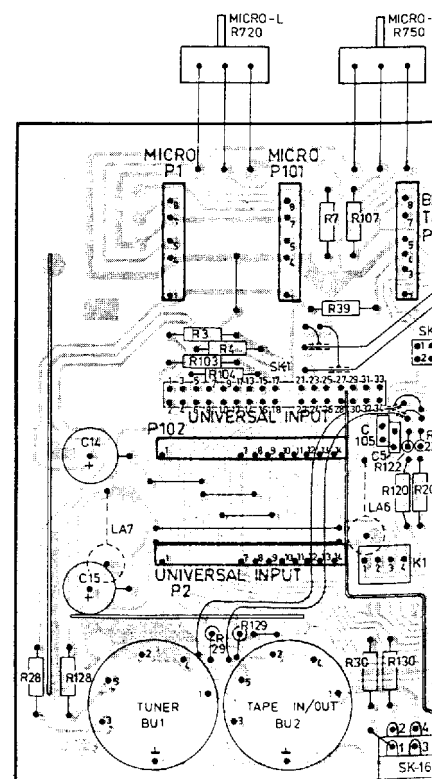
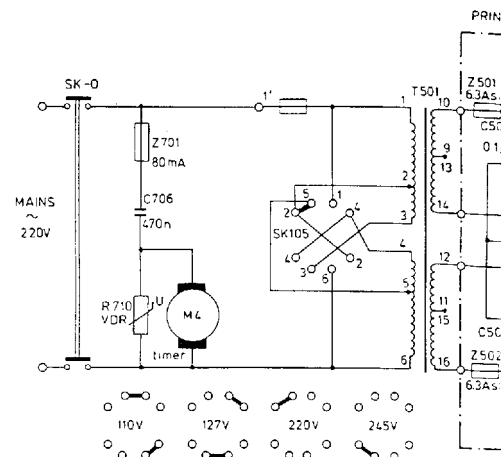


## II. Supply

SK0	Mains switch	4822 276 10483
SK105	Mains voltage selector	4822 272 10102
M4	Timer motor	4822 361 60185
L1, 2, 3, 4, 5,		
6, 7, 8, 9,		
701, 702	Lamp 28 V - 40 mA	4822 134 40127
R710	VDR-resistor	4822 116 20103
T501	Mains transformer	4822 146 40197

## III. Amplifier part

P1, 101	Micro input unit	4822 218 30054
P2, 102	Universal input unit	4822 218 30055
P3, 103	Play-back unit	4822 218 30056
P4, 104	Recording unit	4822 218 30057
P5, 105	Before tape unit	4822 218 30058
P6, 106	Indicator unit	4822 218 30059
P7, 107	Tone control unit	4822 218 30066
P8, 108	Power output unit	4822 218 30065
P9	Oscillator unit	4822 218 30061
P10	Speed selector/pre-emphasis unit	4822 218 30064
SK1	Slide switch (TUN-TAPE-AUX-PHON)	4822 277 30494
SK3	Slide switch (AB)	4822 277 30378
SK4	Slide switch (MP-NOR-ECH-AMP)	4822 277 30495
SK5	Slide switch (1-4 ST 3-2)	4822 277 30496
SK6	Slide switch (MP-NOR-ECH-AMP)	4822 277 30497
SK10, 11, 12	Push button switch assy (SCRATCH-RUMBLE-PHYS)	4822 276 30201
SK16	Switch (CRYST-DYN)	4822 277 60119
SK30	Slide switch (head switch)	4822 277 60118
BU1, 2, 3	Socket, 5p (TUNER, TAPE IN/OUT, AUX)	4822 267 40174
BU4, 5	Socket, 7p (PHONO, MONITOR)	4822 267 50148
BU6, 7	Socket, 2p (LOUDSP L, R)	4822 267 30233
BU8, 9, 10	see list of mechanical parts, cabinet and amplifier unit	
BU11	Socket, 5p (HEADPH)	4822 267 40175
K1, 4	Recording head	4822 249 20032
K2, 5	Play-back head	4822 249 30032
K3, 6	Erase head	4822 249 40058
L301, 302, 303, 304	Coil p.c. board 3	4822 156 40557
L401, 411	Coil p.c. board 4	4822 156 20594
R720, 750	Potentiometer (MICRO) 22 k $\Omega$ , log	4822 101 30266
R721/751, 722/752	Potentiometer (PHONO, ECHO) 22 k $\Omega$ , log	4822 102 30178
R723/753	Potentiometer (VOLUME) 5+17 k $\Omega$ , log	4822 102 30179
R724/754	Potentiometer (BALANCE) 47 k $\Omega$	4822 102 30168
R725/755, 726/756	Potentiometer (TREBLE, BASS) 47 k $\Omega$ linear	4822 102 30177
ME1	Meter, left	4822 347 10069
ME101	Meter, right	4822 347 10071
	Socket for functional unit, 14p	4822 267 50151
	Socket for functional unit, 8p	4822 267 50156
	Socket for functional unit, 3p	4822 267 50161
	Connector for wire form, 14p	4822 267 50163
	Connector for wire form, 4p	4822 267 40179
Z501, 502	Fuse 6, 3 A-T	4822 253 30031
Z701	Fuse 80 mA	4822 253 20005
D1	Zenerdiode BZX79/C7V5	4822 130 30666
D2	Zenerdiode BZX79/C15	4822 130 30781
D501, 502, 503, 504	Diode BY164	4822 130 30414
D505, 506	Diode OF223	4822 130 30791
C9	330 $\mu$ F - 63 V	4822 124 20404
C10, 11	680 $\mu$ F - 40 V	4822 124 20413
C12	1000 $\mu$ F - 25 V	4822 124 20419
C13	150 $\mu$ F - 25 V	4822 124 20394
C14, 15	220 $\mu$ F - 25 V	4822 124 20398
C16	470 $\mu$ F - 40 V	4822 124 20407
C505, 506	2 x 2350 $\mu$ F - 40 V	4822 124 70226
C507	680 $\mu$ F - 40 V	4822 124 20413
C706	470 nF - 630 V	4822 121 40331





4822 124 2041  
4822 121 4033

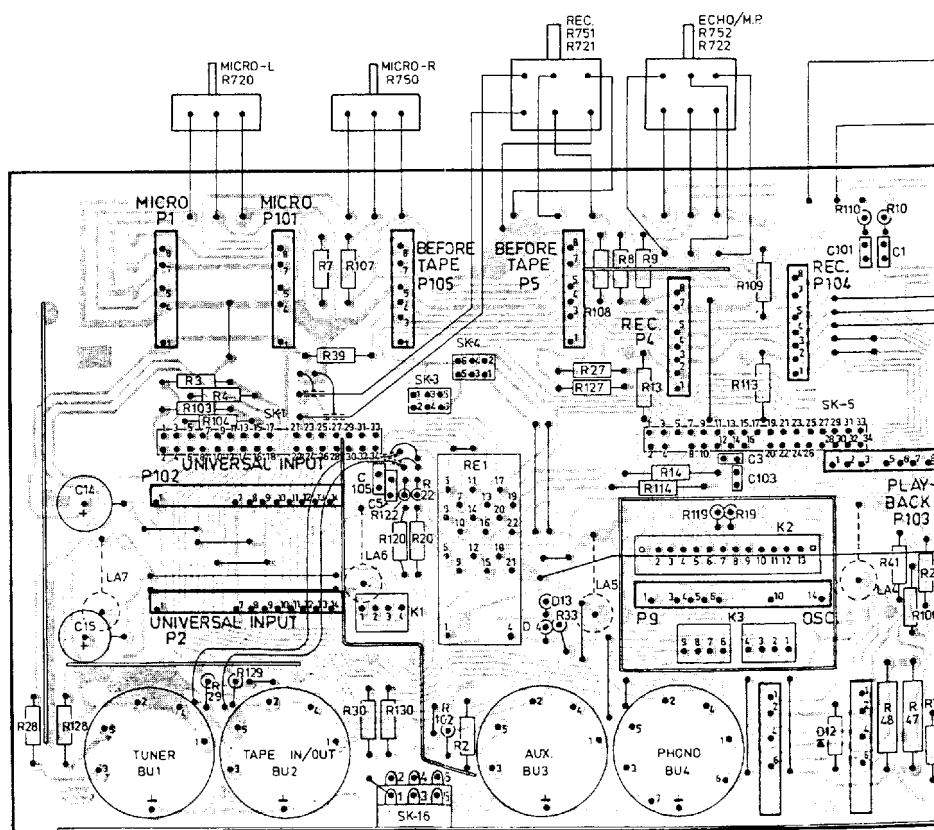
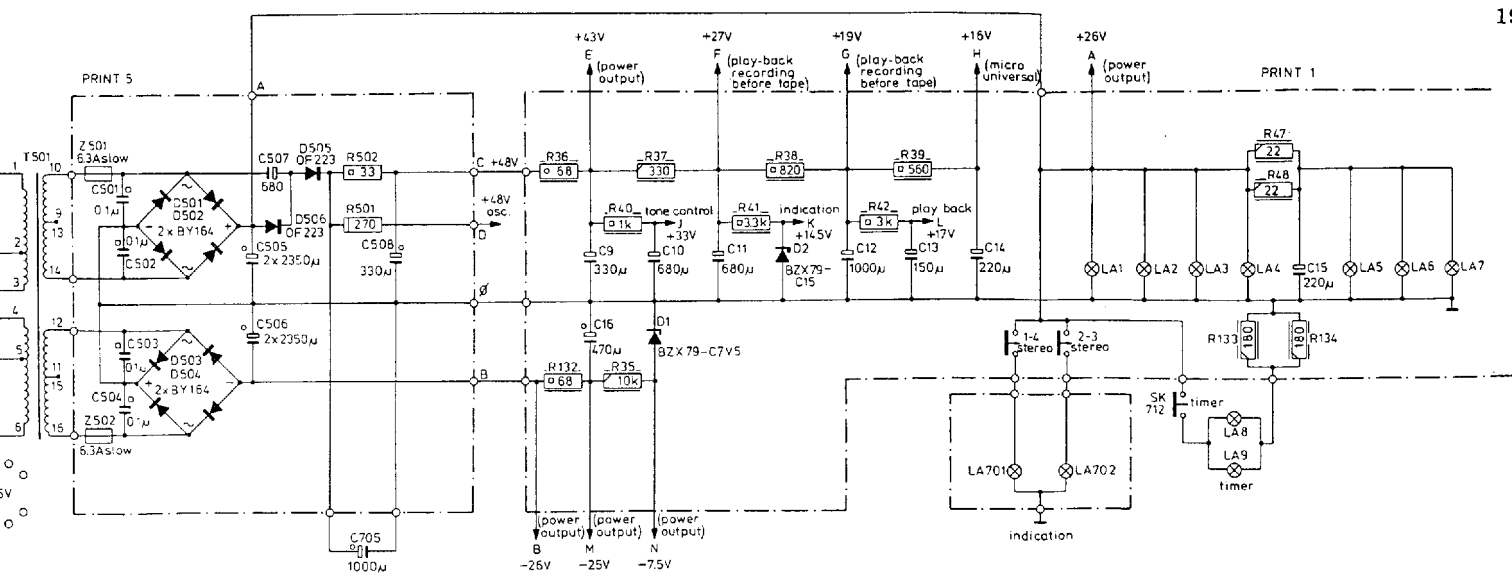
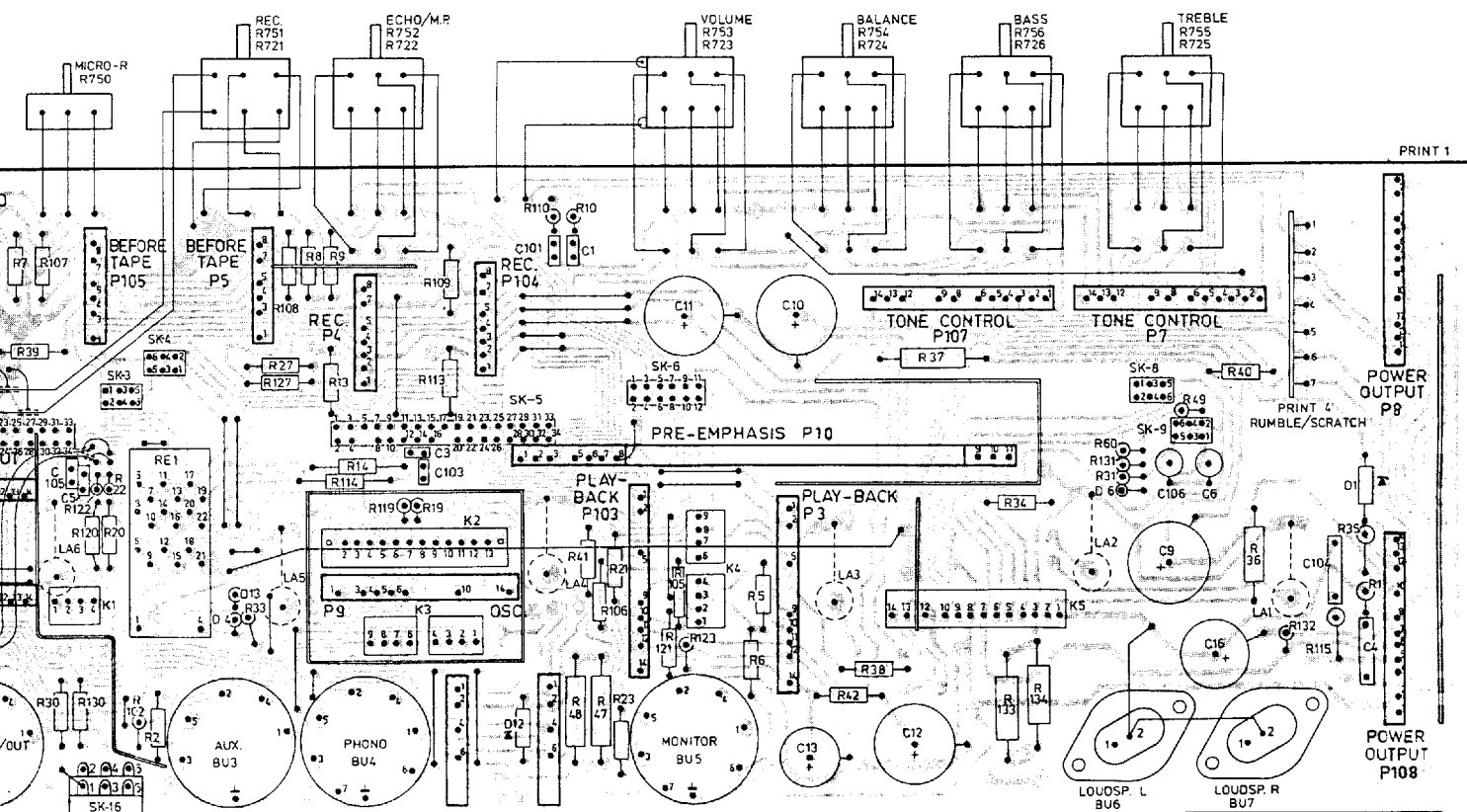
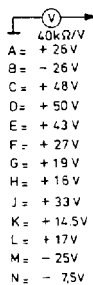
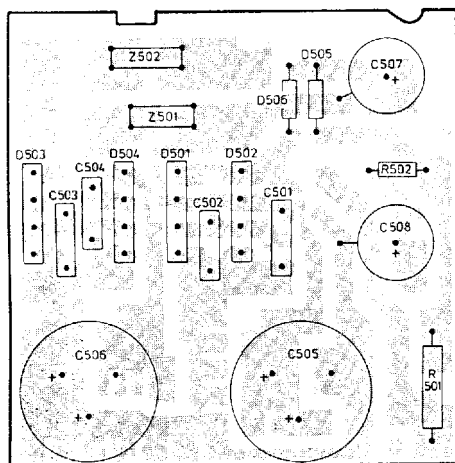


Fig. 27



PRINT 5



INDICATOR P5 INDICATOR P106

Fig. 27

R:	709		708		502		401 + 403		411 + 413						
	601 + 612				501										
C:	704				705		501+508		401 + 405						
									411 ÷ 415						
MISC:	SK712÷714		D602		SK606 ME101		L704 L703		D603 D601 L601+606		BK2 TS701 TS702		Z502 Z501 SK703+705 L411 L401		R:
	SK 0	M4	SK603	SK607	M2	TS703	ME1	K7	SK602	SK605	M3	SK601	SK604	D501+506	SK10+12

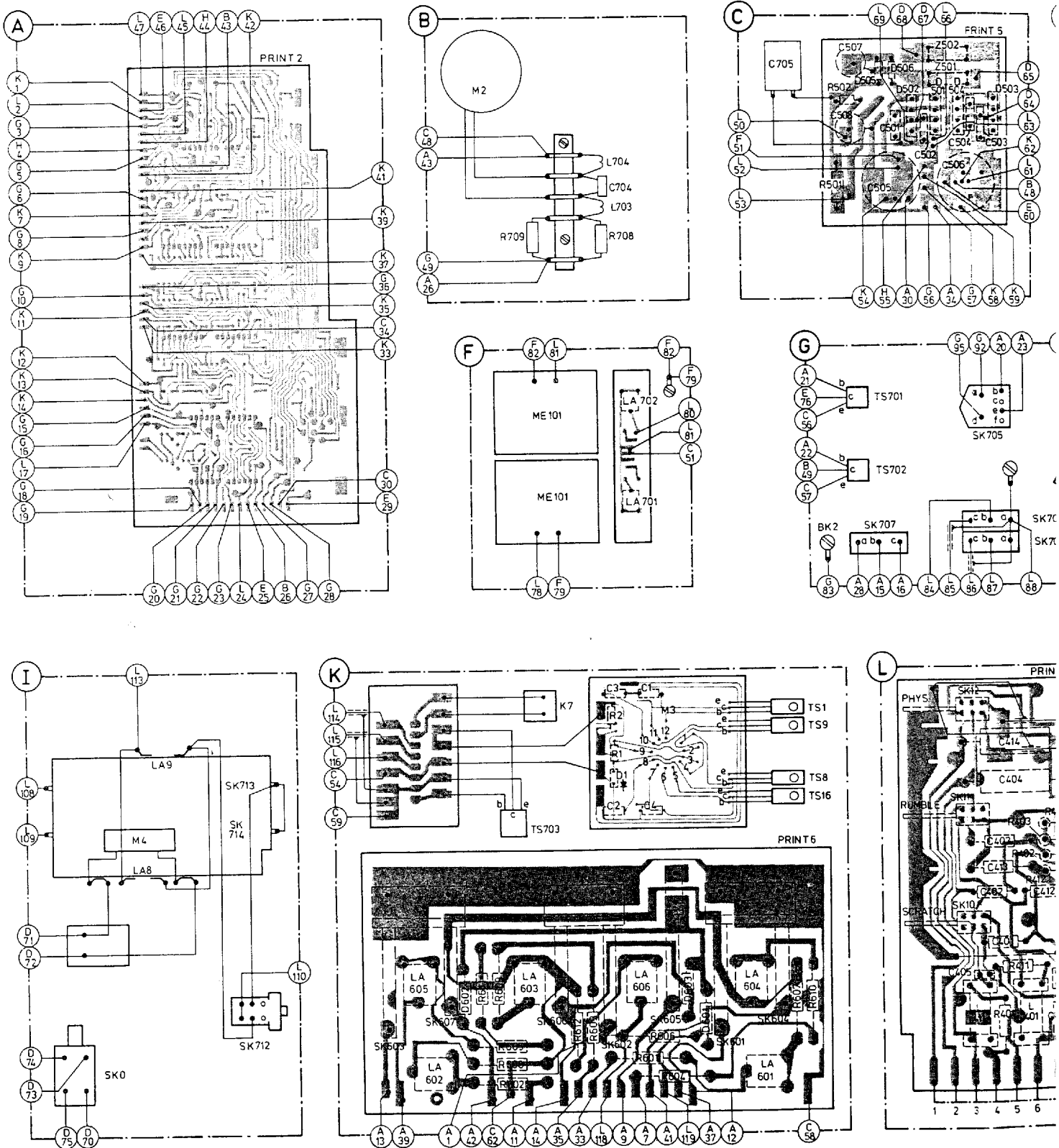
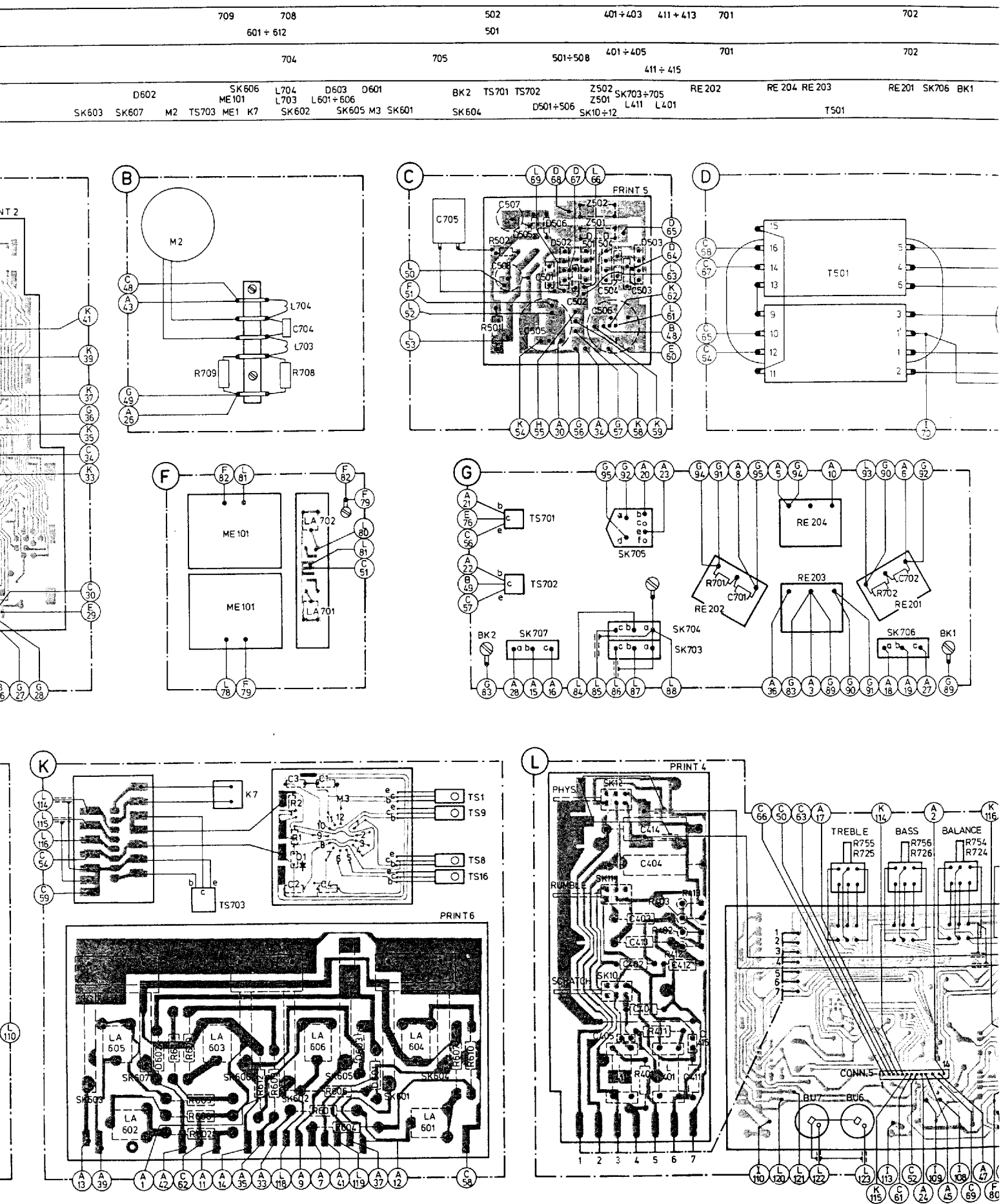


Fig.



+403	411 + 413	701	702	720 + 725	710	707	706	705	715
				750 + 756					
+405	701	702	706	301 + 304	703				
411 + 415									
K703+705 L411 L401	RE 202	RE 204 RE 203	RE 201 SK706 BK1	SK105 K5	SK30 K4 Z701	L301+304 K3 M1	L702 BU8+11 L701 K1	SK701 SK16	SK702 K2
		T501							

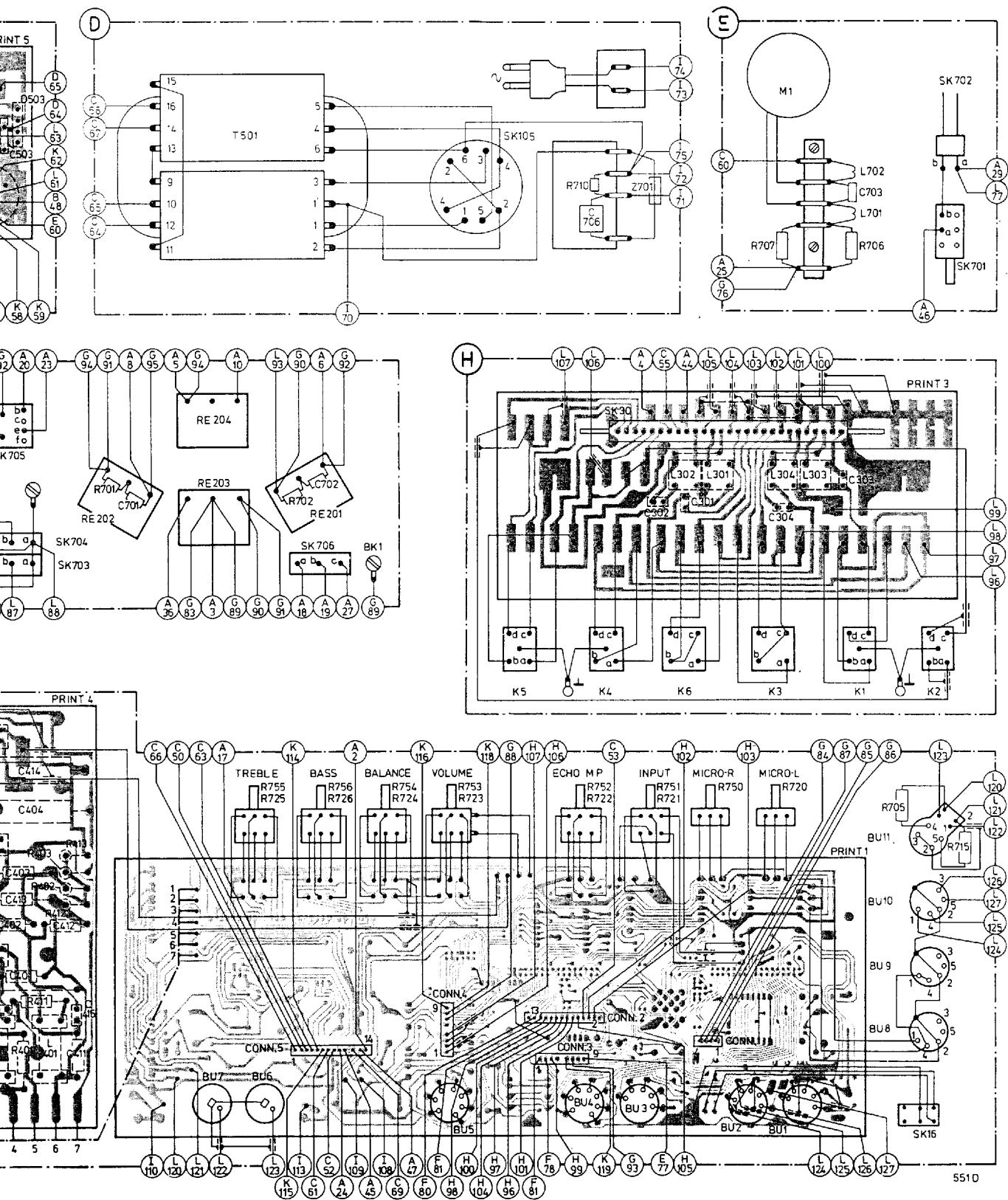
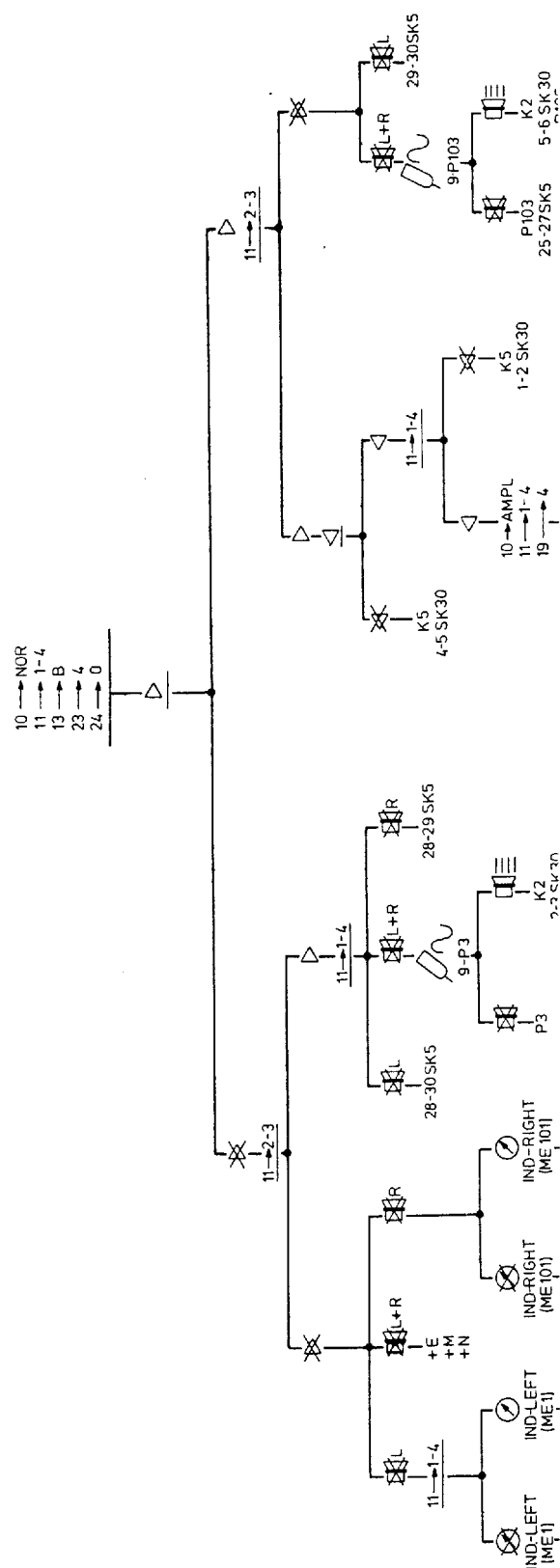
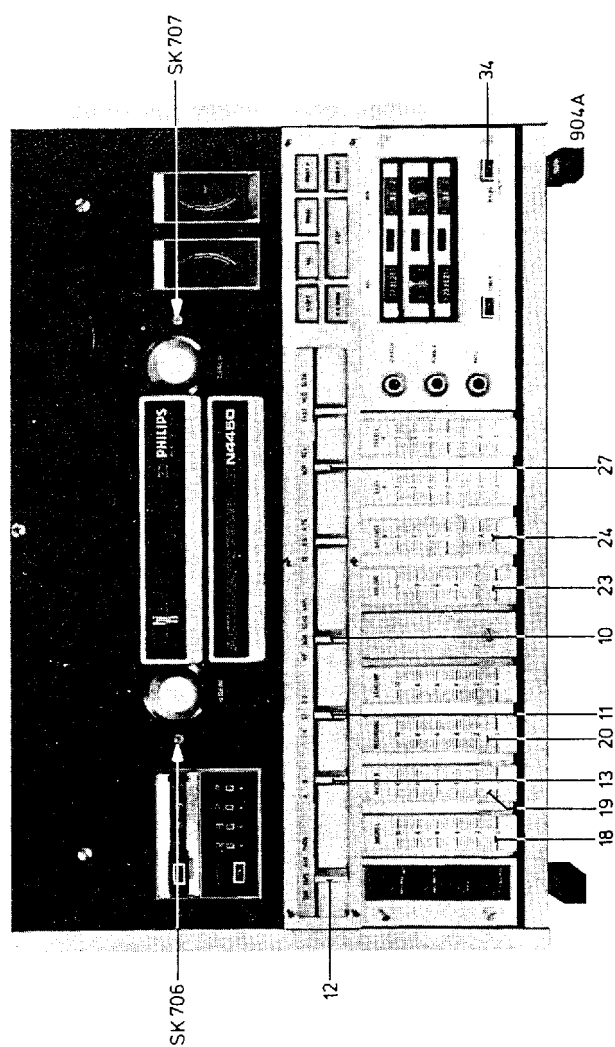
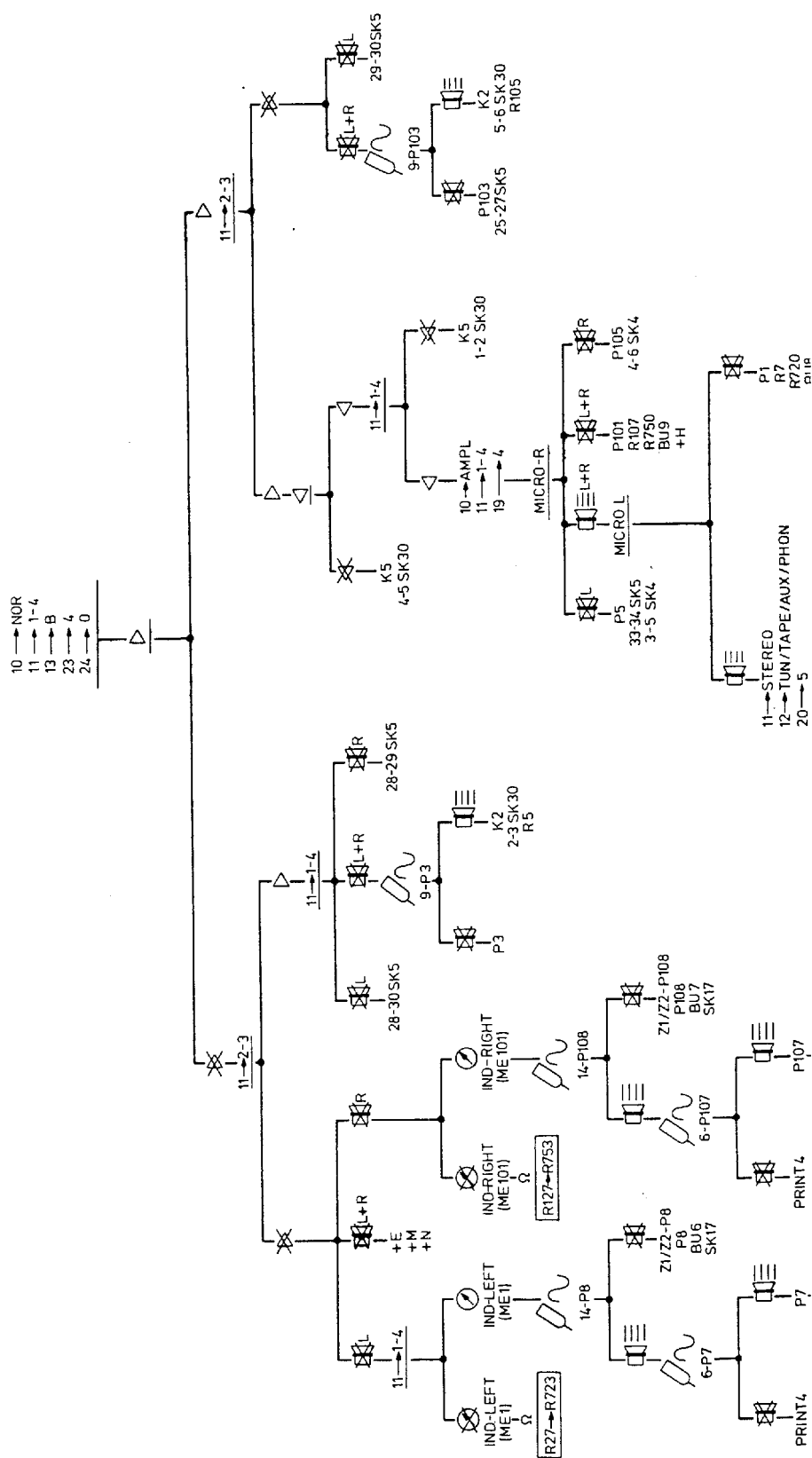
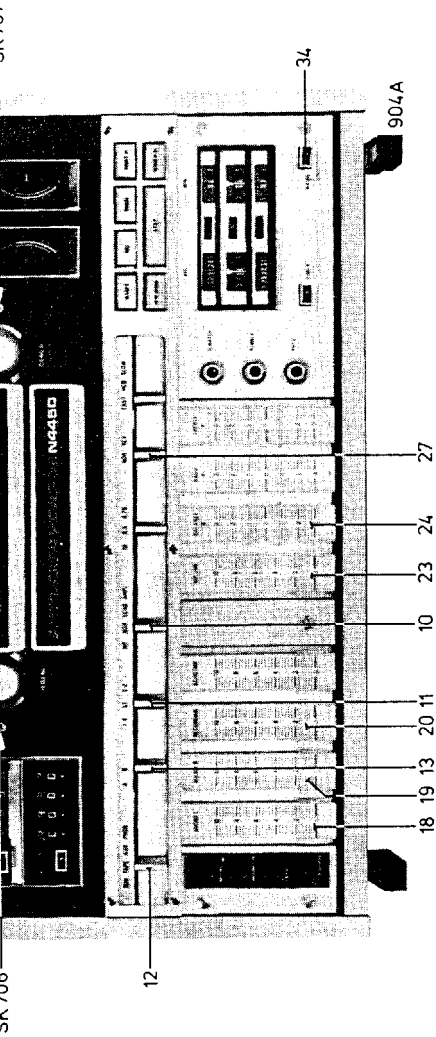


Fig. 28





# B





