

## E. Adjustment of the mechanism

1. Adjustment of the reel disc 179 and 180, the recording playback head K1 and the pressure roller lever 125.
2. Adjustment of the brakes 99 and 100.
3. Adjustment of brake brackets 118 and 121 and friction of play-wheel 42.
4. Adjustment of slide 57 and pressure roller lever 125.
5. Adjustment of pressure brackets 131 and 133.
6. Course limitation of flywheel 17 in vertical direction.
7. Adjustment of winding friction unit 42.
8. Adjustment of winding roller 49.
9. Adjustment of cord wheel 112.
10. Check of the tape speed.

1. Adjustment of the reel discs 179 and 180, the recording playback head K1 and the pressure roller lever 125.

For a correct plate drive, the reel discs 179 and 180 should be adjusted at the correct level. The height is  $14 \pm 0.2$  mm with respect to the mounting plate. (figure 3)

The adjustment is done by turning the pivot screws 181. The height of the round tape guide 173 should be so adjusted that the tape runs through this tape guide without rucking up. This height should be adjusted with the aid of the rings 195 under the centre of rotation of the pressure roller lever (Figure 4).

The flanges of tape guide 133 should fall outside the opening of the tape guide of the erasing head (Figure 5).

The pressure roller should be parallel to the capstan. By removing the pressure roller, it can be checked (visually) whether the pressure roller shaft is in parallel position, with respect to the capstan.

Adjust if necessary by bending the pressure roller lever.

Then the height of the recording playback head K1 is so adjusted by means of the screws 74, 75 and 76, that here too, the tape runs through the tape guide A without rucking up. (Figure 6) The front side of the head K1 should be parallel to the front side of the head K2.

### Air gap adjustment

1. Lay a test tape WT 939 15 into the apparatus.
2. Connect a valve voltmeter to points 2 and 3 of the radio plug.
3. Switch the apparatus in the position playback.
4. Now adjust the maximum output voltage by means of screw 76.

### Check

With this check a liquid must be used which consists of a mixture of  $\frac{1}{2}$  gramme iron powder, size of the grains, 3 to 5  $\mu$  and 100 gramme tetra carbon chloride. This iron powder can be obtained under code number A9 881 32/F10.

Record a signal of 1000 c/s with 100 % modulation depth on four tracks.

Lay a piece of this magnetised tape of about 10 cm in the mixture as described above and shake it thoroughly. After about 10 to 15 seconds, take the piece of tape out of the mixture and allow it to dry. The four tracks should now be clearly visible and should lie symmetrically.

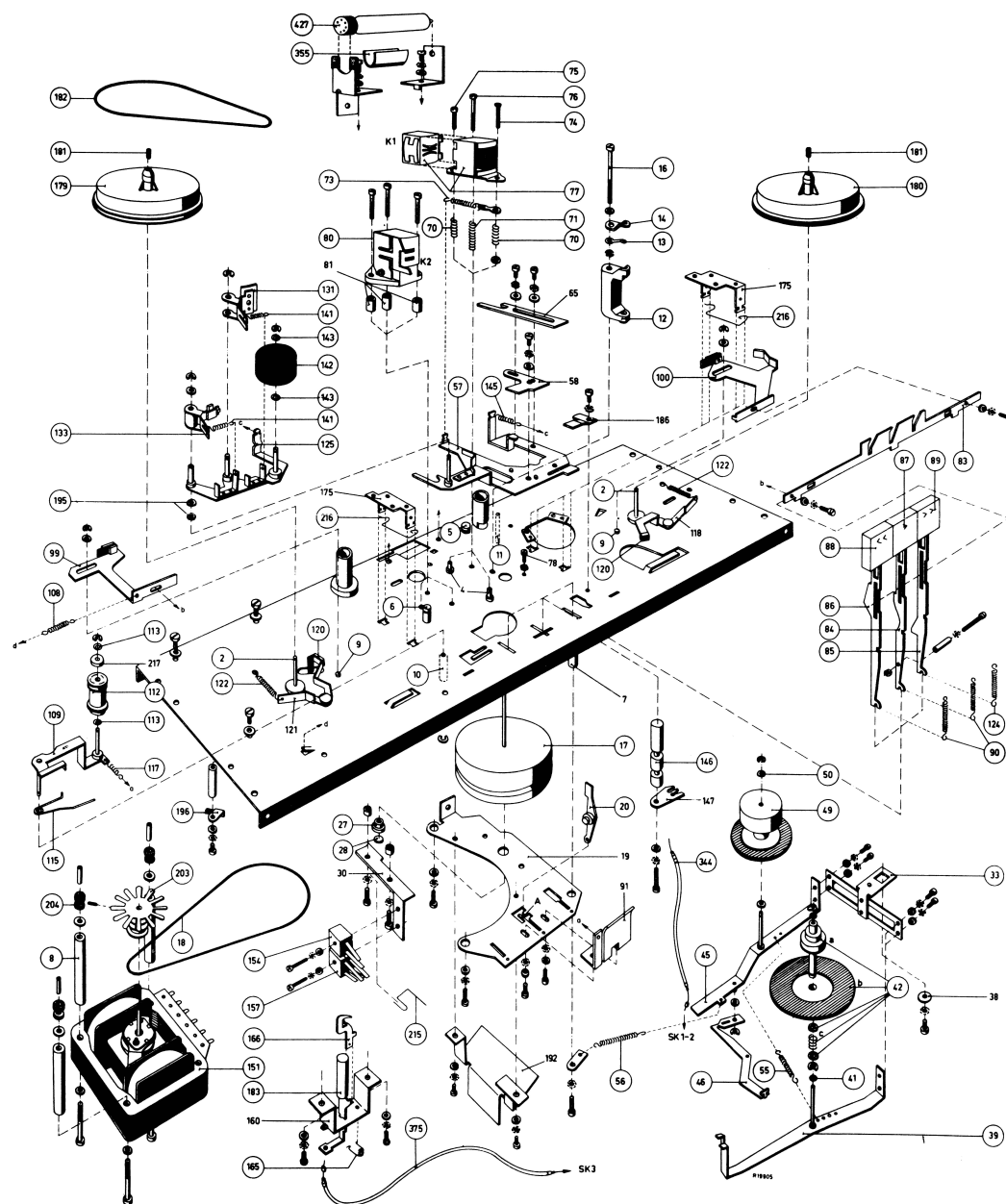
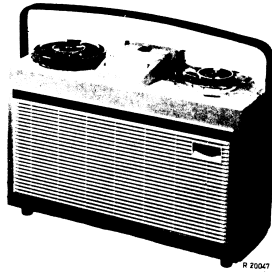


Fig.2

# EL 3514 /oo



## A. Technical data

### 1. Specification

Mains voltage	: 110 - 127 - 220 - 240 V 50 c/s
Consumption	: approx. 25 W
Output power	: 1.5 W
Tape speed	: 9.5 cm/sec (3 $\frac{3}{4}$ " / sec)
Number of tracks	: 4
Reel diameter	: max. 12.5 cm (5")
Winding and rewinding time	: less than 130 sec. for 180 metre tape
Dimensions of the apparatus	: 240 x 230 x 125 mm
Weight	: 4.8 kg
Transistor	: TS1 AC 107 - pre-amplifier
Valves	: B1 ECC 83 - pre-amplifier B2 DM 71 - modulation indicator B3 EL 95 - oscillator - output valve
Loudspeaker	: AD 3700X Impedance = 5 $\Omega$
Frequency range	: 80-10,000 c/s
Erasing frequency	: 46 kc/s

### 2. Sensitivities

	Input impedance :	
Microphone	: 0.2 mV	3000 $\Omega$
Gramophone	: 130 mV	2.2 M $\Omega$
Gramophone	: 130 mV	2.2 M $\Omega$
Radio	: 3 mV	50 k $\Omega$

### 3. Accessories

Microphone	: EL 3756-00-03
Empty 5" reel	: EL 3912-00
Full 5" reel	: EL 3915-80
Empty 4" reel	: EL 3909-00
Full 4" reel	: EL 3908-80
Connecting cable	: EL 3768-00-01
Telephone coil	: EL 3969-11
Connecting box for two microphones	: EL 3969-01

## B. List of figures

Fig. 1	Hints for repairs
Fig. 2	Exploded view of the mechanism
Fig. 3-21	Mechanical adjustments
Fig. 22-28	Replacement of parts difficult to replace
Fig. 29	Greasing instructions
Fig. 30	Circuit diagram general
Fig. 31	Circuit diagram of position
Fig. 32	Circuit diagram of position playback
Fig. 33	Mounting of the switches SK1, 2 and 3
Fig. 34	Print, parts and wiring (front side)
Fig. 35	Print, parts and wiring (rear side)
Fig. 36	View of the recorder
Fig. 37	Exploded view of the mechanism
Fig. 38	Connecting cables
Fig. 39	Exploded view of the microphone

## C. Description of mechanism

### Position playback

For playing back the start knob 87 is depressed. The start strip 84 pushes the brake slide 83 to the right, as a result of which the brakes 99 and 100 are lifted. At the same time the braking felt 120 of the right-hand reel disc 180 is lifted by the brake 100. The braking felt 120 of the left-hand reel disc is not lifted, however, and presses against the inner side of the reel disc 179, as a result of which some friction is obtained and the tape is kept taut. Because the start strip 84 is depressed, SK5 (pos. 154) is also opened, as a result of which the short-circuit of the loudspeaker is interrupted. At the same time the switch SK4 (pos. 157) is closed. By this the signal to be played back comes across points 3 and 2 of the radio plug (line output). The tumbler 20 is pressed backwards by the start strip 84. As a result, the slide 57 moves with the pressure roller lever 125 to the heads. The tension spring 145 pulls the pressure roller 142 against the shaft of the flywheel 17. The pressure brackets 131 and 133 are pulled by the spring 141 against the heads. The flywheel 17 is driven by the pulley 203 of motor 151 by the cord 18. Since the slide 57 moves backwards, the play wheel bracket 39 is also pulled backwards by tension spring 55. By this the pulley 42a comes against the right-hand reel disc 180, whilst the play wheel 42b is pushed against the flywheel 17. Under the pulley 42a, a felt disc is found. The play wheel 42b is pressed against the pulley 42a by pressure spring 42c. In this way the winding friction is obtained which is necessary to wind the tape on the reel firmly enough. The strip 65 has been fixed on the slide 57. This strip locks the recording key 146 during playback.

### Position recording

For recording, the recording key 146 is depressed first and then the start key 87. The strip 65 on the slide 57 locks the recording key 146. By the recording key the switches SK1 and SK2 are controlled by means of the bowden cable 344. The other part of the mechanism comes into the position as described under point : position playback.

### Position fast forward winding

For forward winding, the key 89 is depressed. The brake slide 83 is pushed to the right by winding strip 85. The brakes 99 and 100 are lifted. The brake felt 120 of the right-hand reel disc 180 is also lifted by the brake 100. The brake felt 120 of the left-hand reel disc 179 is not lifted. This in order to prevent loops being formed and to ensure that the tape is wound taut enough. As the strip 85 is pressed downwards, the bracket 46 and the bracket 45 are pulled forward by the spring 56. As a result, the winding roller 49 comes against the reel disc 180 and the flywheel 17. The flywheel 17 is driven by the pulley 203 of the motor 151 by the cord 18. The reel disc is now driven accelerated.

### Position fast rewinding

For fast rewinding, the key 88 is depressed. The brake slide 83 is pushed to the right by winding strip 86, in this way the brakes 99 and 100 are lifted. The braking felt 120 is also lifted from the left-hand reel disc by the brake 99. The braking felt 120 of the right-hand reel disc 180 is not lifted. This counter-friction serves to prevent loop-formation and also to ensure that the tape is wound sufficiently taut. Because of the fact that the winding strip 86 is pressed downwards, the bracket 109 is pressed backwards by the torsion spring 115, as a result of which the winding roller 112 is pressed against the flywheel 17. The winding roller drives the reel disc 179 via cord 18. The flywheel is driven by the pulley 203 of the motor 151 by the cord 18. The reel disc is now driven accelerated by the flywheel.

## D. Service hints

- The possibility exists to screw the tape deck vertically on both side brackets. For this purpose.
  - the four screws (see figure 1) are removed and
  - the bowden cable should be loosened from the recording playback switch.
 In this vertical position the apparatus can function normally, unless the recording playback switch must be operated by hand and can be locked if necessary with, for instance, a paper clip.
- By removing the five screws (see figure 1) and by loosening at the same time the bowden cable of the recording playback switch again, it is possible to place the whole print sheet beside the chassis. Then the apparatus still also functions normally.
- In figure 1 a sawn-open reel disc has been drawn which can be easily made. With the aid of same it will be possible to check the brakes and braking brackets and to adjust them visually.

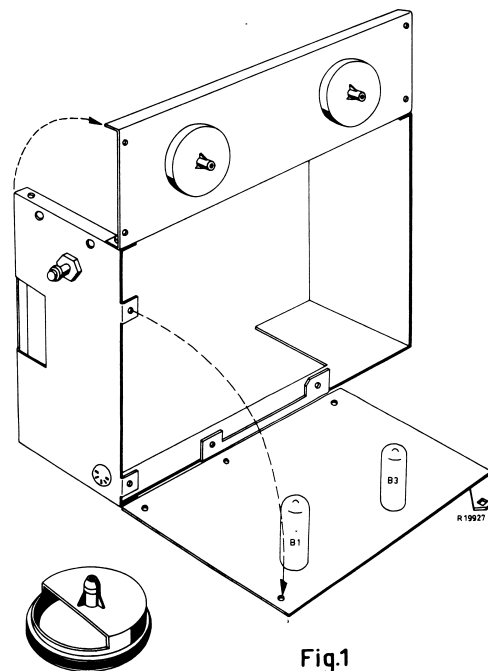


Fig.1



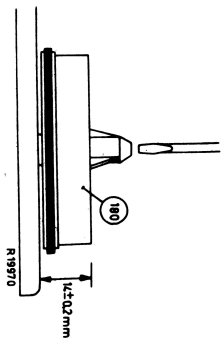


Fig. 3

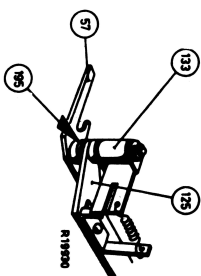


Fig. 4

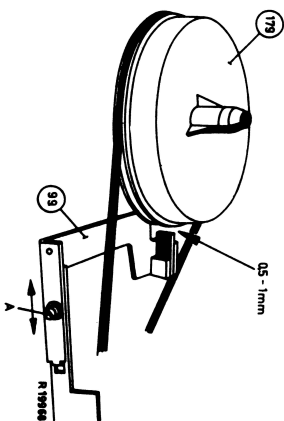


Fig. 7

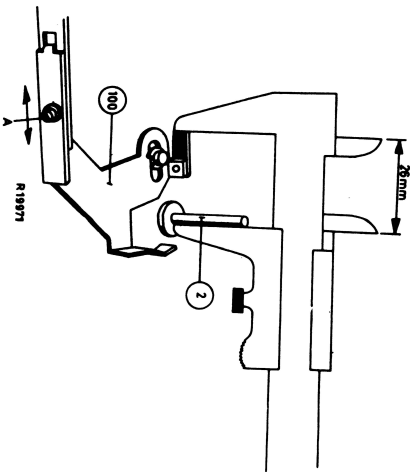


Fig. 8

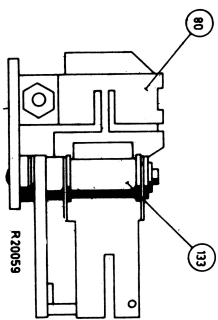


Fig. 5

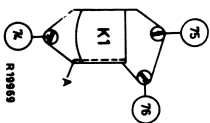


Fig. 6

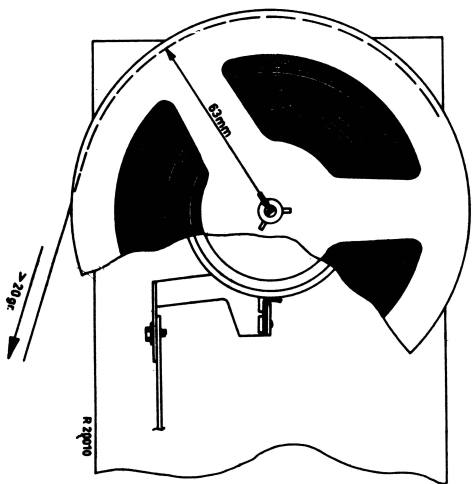


Fig. 9

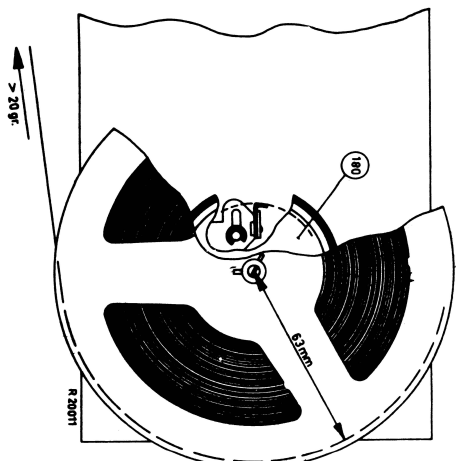


Fig. 10

#### Adjustment of the brakes 99 and 100

Switch the apparatus in the position fast rewinding. The brake block of the left braking bracket 99 should now be lifted 0.5 - 1 mm from the reel disc (fig. 7). This can be adjusted by moving the brake bracket 99 with respect to the brake slide. Firmly tighten screw A after adjustment. The adjustment of the right-hand brake should follow according to fig. 8.

Adjustment by moving the brake bracket 100 with respect to the brake slide.

**N.B.** With the aid of a sawn-open reel disc, visual adjustment is possible.

#### Checking the brakes 99 and 100

Lay a full 5" reel (diameter 127 mm) on the left-hand reel disc. The apparatus should be in rest position. At the same time the brake block of brake 99 should be between the lip of the brake bracket and the reel disc 179 (fig. 9).

The brake 99 should press with such a force against the reel disc 179 that for unwinding the tape from the 5" reel, a force of at least 20 grammes is necessary.

Lay a full 5" reel on the right-hand reel disc.

The brake 100 should press with such a force against the reel disc 180 that for unwinding the tape of the 5" reel, a force of at least 20 grammes is necessary.

**N.B.** Here the apparatus should also be in a rest position and the brake block of brake 100 should be between the lip of the brake bracket and the reel disc 180 (see figure 10).

If these forces are too small, the brake blocks and reel discs should be cleaned with alcohol.

#### Adjustment of brake brackets 118 and 121 and friction of playwheel 42.

Put the apparatus in the position fast rewinding.

The right-hand brake felt 120 should now press against the inner side of the right-hand reel disc. At the same time, a clearance of 0.1 - 0.3 mm should exist between the brake bracket 100 and the brake bracket 118 (Fig. 11). This space is adjusted by bending the lip on brake bracket 100.

The felt block 120 should press with such a force against the inner side of the reel disc that for unwinding the tape from a full 5" reel a force of 6 to 8 grammes is necessary (fig. 11). The pressure of the felt can be adjusted by bending the lip on bracket 118 from which the spring 122 has been suspended. Put the apparatus in the position playback.

The friction of the playwheel 42 must be so great that the tape on a full 5" reel pulls with a force of 8 to 13 grammes.

If this force is greater than 13 grammes, then the felt under pulley 42a should be cleaned with alcohol.

Then very slightly oil with thin oil. If the force is still too great, then the pressure spring 42c should be shortened or replaced.

If the force is too small, then the felt ring can be too greasy.

If cleaning with alcohol does not give any improvement, then the pressure spring 42c should be cautiously stretched a little.

#### Adjustment of brake bracket 121

Put the apparatus in the position fast forward winding.

The brake felt 120 should now press against the inner side of the left-hand reel disc. At the same time a space of 0.1 to 0.3 mm should exist between the brake bracket 99 and the brake bracket 121 (fig. 12). This space is adjusted by bending the lip of the brake bracket 121 onto the felt block 120 has been glued.

The felt block 120 should press with such a force against the inner side of the reel disc that for unwinding the tape of a full 5" reel, it is necessary to pull with a force of 6 to 8 grammes (fig. 12).

The pressure of the felt can be adjusted by bending the lip on brake bracket 121 to which the spring 122 has been hooked.

#### 4. Adjustment of slide 57 and pressure roller lever 125.

The course of slide 57 is adjusted by moving plate 197.

- . Depress start key 87.
- . Undo screws B and C (fig. 13).
- . Loosen spring 145 from pressure roller lever.
- . Place a tape in the apparatus.
- . Push slide 57 by hand so far forward that the angles which the tape makes with the axial line of the erasing head are equally great on both sides (fig. 14).
- . Slide plate 58 against tumbler 20 and tighten screw B.
- . Slide lip 65 forward into the recording key and tighten screws C.
- . A space of 0.3 to 1.5 mm should be between the lip on slide 57 and the lip on the pressure roller lever 125 (fig. 15). This distance can be adjusted by bending the lip on slide 57.

The force necessary for lifting the pressure roller 142 from the capstan should be 400 to 500 grammes (fig. 15). This force can be adjusted by bending the fixing lip for spring 145 on slide 57.

#### 5. Adjustment of pressure brackets 131 and 133.

Put the apparatus in the position playback.

The pressure of the pressure brackets 131 and 133 against the heads measured according to fig. 16, should lie between 15 and 25 grammes.

This force can be adjusted by bending the lips A. The pressure brackets should lie 0.5 to 1.5 mm free from the stop lips (fig. 16).

The pressure bracket 131 should be adjusted as drawn in fig. 17 when the apparatus stands in the position playback.

#### 6. Course limitation of the flywheel 17 in vertical direction (fig. 18).

- . Undo the counter nut of screw 78.
- . During turning of the apparatus tighten screw 78 so far that the flywheel is just touched.
- . Now turn the screw a full turn backwards.
- . Tighten counter nut, (retain screw 78).

#### 7. Adjustment of winding friction 42.

In the rest position the playwheel 42b of winding friction 42 should remain at least 0.5 mm free from the flywheel. This can be adjusted by bending the lip on slide 57 against which lies the playwheel bracket 39.

In the play position, the spring 55 should pull the playwheel 42b against the flywheel. The pulley 42a should then press against the rubber rim of reel disc 180.

**N.B.** The rubber rim for playwheel 42b may not be pressed in more than 1 mm by the flywheel. In this case the spring 55 should be stretched a little or be replaced. If necessary, the playwheel 42b should be replaced.

#### 8. Adjustment of the winding roller 49.

In the rest position the winding roller 49 should remain at least 0.5 mm free from flywheel 17 and reel disc 180 (fig. 19). This can be adjusted by bending the coupling strip 46 (fig. 20).

In the position fast forward winding, the spring 56 should pull the winding roller 49 against the reel disc 180.

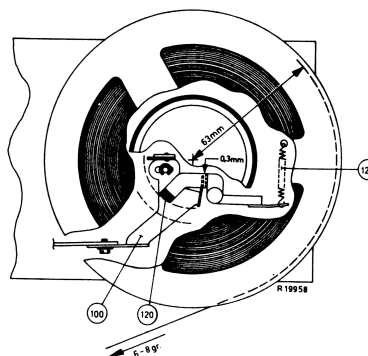


Fig. 11

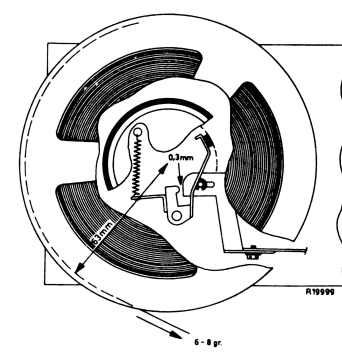


Fig. 12

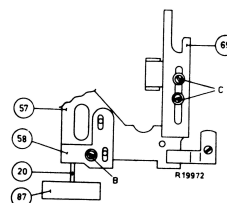


Fig. 13

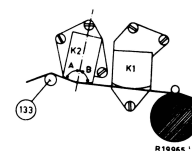


Fig. 14

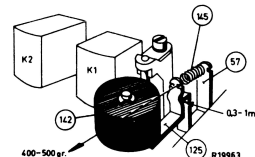


Fig. 15

#### 9. Adjustment of cord wheel 112.

In the rest position the cord wheel 112 should remain at least 0,5 mm free from the flywheel 17 (fig. 19). This can be adjusted with the aid of lip A in the mounting plate (fig. 21).

In the position fast rewinding, the idler wheel should lie with a force of 35 to 45 grammes against the flywheel. (fig. 22). At the same time there should be a clearance of at least 0,3 mm between lip B of bracket 109 and the torsion spring 115 (fig. 21).

In the rest position the spring 117 should pull the cord wheel free from the flywheel.

#### 10. Checking tape speed.

The tape speed of the apparatus should be  $9\frac{1}{2}$  cm/sec. ( $3\frac{1}{4}$  in). This can be measured as follows :

- . Stake out a length of 0,525 m on the loose end of a full reel and mark the start and the finish of this piece.
- . Place the reel with tape in the apparatus.
- . Depress the playback key.
- . The time between the passing of the first and the second mark should lie between 97 and 103 seconds.

If this speed is too low, then the motor bearings, pressure roller bearings and flywheel bearings should be cleaned and greased again.

#### F. Replacement of parts

1. Taking the apparatus out of the casing.
2. Replacement of winding friction unit.
3. Replacement of winding roller brackets, winding roller and bracket 46.
4. Replacement of brake slide 83 and start strips 84, 85 and 86.
5. Replacement of flywheel and tumbler 20.
6. Replacement of fuse Z1.
7. Replacement of cord 18.
8. Replacement of winding shafts 2.
9. Replacement of Bowden cable 344.
10. Replacement of Bowden cable 375.
11. Replacement of winding roller 112 and winding roller bracket 109 and torsion spring 115.
12. Replacement of slide 57.

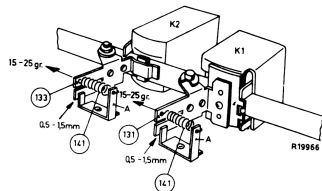


Fig. 16

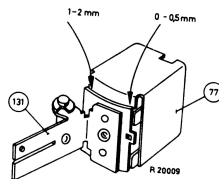


Fig. 17

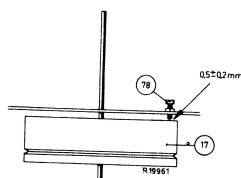


Fig. 18

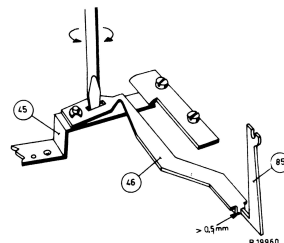


Fig. 20

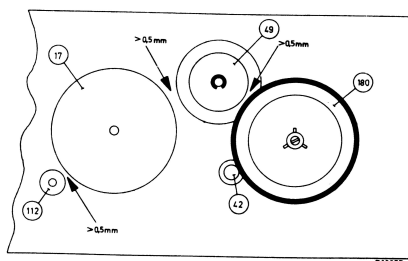


Fig. 19

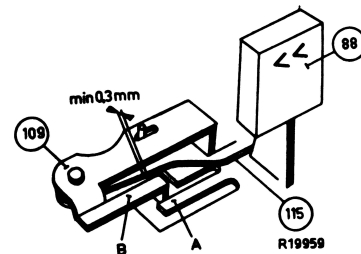


Fig. 21

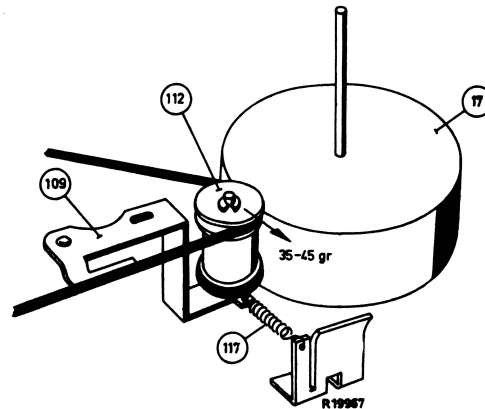


Fig. 22

#### 1. Taking the apparatus out of the casing fig. 23.

- . Remove the screws 373 on the upper side of the apparatus.
- . Remove the outer lock rings 367 on the sides.
- . Remove the feet 370 on the lower side.
- . Both casing halves can now be removed.

Mounting is done in the reverse order. One should be careful, however, that the knob of the volume control properly fits into the slit of the foremost casing half.

**N.B.** If the parts mentioned here under have to be replaced, then the apparatus should be first taken out of the casing. After replacement of these parts, they should be greased according to the greasing instructions. See chapter H.

#### 2. Replacement of winding friction unit 42.

- . Unhook spring 55 from the playwheel bracket 39.
  - . Remove the screws with which the cord wheel bracket 39 has been fixed on leaf spring 33. These screws are accessible through the holes in the right-hand side bracket using a screw driver.
  - . Put the apparatus in the position playback.
  - . Now the bracket 39 with the winding friction unit affixed thereto can be taken out of the apparatus.
- Mounting is done in the reverse order.

#### 3. Replacement of winding roller bracket 45, winding roller 49 and bracket 46.

- . Unhook springs 55 and 56 from winding roller bracket 45.
  - . Remove the clamping ring which the bracket 46 has been fixed on winding roller bracket 45.
  - . Remove the screws, with which the winding roller bracket 45 has been fixed on leaf spring 33. These screws are accessible through the holes in the right hand side panel using a screw driver.
  - . Bracket 46 and winding roller bracket 45 and winding roller 49 can now be taken out of the apparatus.
- Mounting is done in the reverse order.

#### 4. Replacement of brake slide 83, start strips 84, 85 and 86.

- . Unscrew brakes 99 and 100 from brake slide 83.
- . Unhook the springs 90 and 124 from the start strips 84, 85 and 86.
- . Remove the control bar of SK4 and SK5 of start strip 84.
- . Now lift brake slide 83 and the start strips out of the apparatus.

Mounting is done in the reverse order. After mounting, the brakes 99 and 100 should be readjusted according to chapter E.

#### 5. Replacement of flywheel 17 and tumbler 20.

- . Remove springs 90 and 124.
- . Remove spring 56.
- . Remove screws which affix lower plate 19 to spacers 7.
- . Remove the bracket which controls SK4 and SK5 on start key 84.
- . Unhook spring 117 from bracket 91.
- . Remove the clamping rings with which bracket 46 has been affixed to bracket 45, and pull lower plate 19 downwards.
- . Remove cord 18 from flywheel 17.
- . Flywheel 17 can now be replaced.
- . Tumbler 20 can now be replaced after lip A which keeps the tumbler in its correct position has been bent aside.

Mounting is done in the reverse order.

**N.B.** Be careful that tumbler 20 comes into the slit in the mounting plate.

#### 6. Replacement of fuse Z1 fig. 24.

- . Remove the screws of the voltage adaptor plate.
- . Unsolder the connection of the transformer to the fuse.
- . Pull the fuse out of the transformer with the aid of a flat nose plier.

Mounting is done in the reverse order.

#### 7. Replacement of cord 18 fig. 25.

- . Remove the spring 56.
- . Remove the two foremost screws with which the lower plate 19 has been affixed against the spacers 7.
- . Undo rearmost screw, which keeps lower plate 19 against the spacer 7, a few turns.
- . Allow the cord 18 of the flywheel to run (lower side).
- . Press lower plate 19 so far downwards that the shaft of the flywheel comes out of the lower bearing 27.
- . Pass cord between shaft and lower bearing and remove the cord over the pulley.

Mounting is done in the reverse order.

**N.B.** The cord 18 may absolutely not come into touch with grease as it is very difficult to degrease same.

#### 8. Replacement of winding shafts 2 fig. 26.

When the winding shaft must be replaced, then the old shaft can be tapped out of the insert bush by means of a punch. Then using a plastic or wooden hammer, tap the new shaft cautiously into the new insert bush. The smoothed end uppermost.

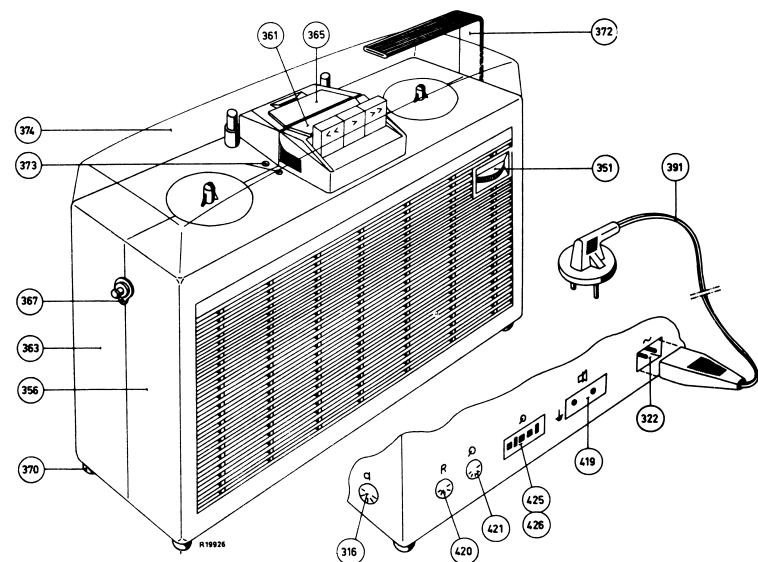


Fig.23

#### 9. Replacement of Bowden cable 344 fig. 27.

- . Remove old Bowden cable.
- . Push control bracket of switch SK1/2 in the position recording.
- . Insert lock pin  $\pm 1.5$  mm through the hole of switch.
- . Mount new Bowden cable.
- . If the inner cable should be too long or too short, this can be remedied by bending the lip A on switch SK1/2 (fig. 27).

#### 10. Replacement of Bowden cable 375 fig. 28.

- . Remove old Bowden cable.
- . Place lock pin of 1.5 mm through the hole in switch SK3.
- . Mount new Bowden cable.
- . When the inner cable appears to be too long or too short, this can be remedied by rebending the lip A on the switch SK3. (fig. 28).

#### 11. Replacement of winding roller 112 and winding roller bracket 109 and torsion spring 115.

- . Remove the clamping ring which locks the pressure bracket to the erasing head.
- . Remove the tension spring 145 from the pressure roller lever.
- . Lift the pressure roller lever out of the apparatus.
- . Remove the clamping ring from the shaft of the winding roller bracket 109 (under hub 10).
- . Remove the cord 18 from winding roller 112.
- . Remove the tension spring 117 which pulls the winding roller bracket 109 forward.

- . Put the apparatus in position playback.
- . Lift the winding roller bracket 109 and winding roller 112 out of the apparatus.
- . The torsion spring 115 can now be replaced.

Mounting is done in the reverse order.

#### 12. Replacement of slide 57.

- . Remove the clamping ring which locks the pressure bracket of the erasing head.
- . Remove tension spring 145 from the pressure roller.
- . Lift the pressure roller lever from the apparatus.
- . Remove the brackets 186 and 175.
- . Unhook from slide 57 the tension spring 73.
- . Undo the screws 74, 75 and 76 of the recording playback head and remove these screws. Also remove pressure roller 70 and tension spring 73.
- . Replace the slide 57.
- . Mounting is done in the reverse order. Now, however, the recording playback head should be adjusted as described under Chapter "Mechanical Adjustments". At the same time the new slide 57 should be adjusted as described under Chapter E.

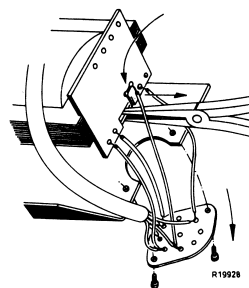


Fig. 24

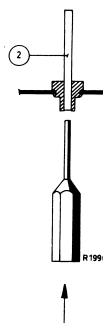


Fig. 26

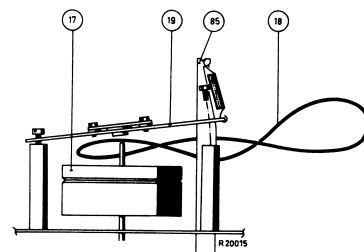


Fig. 25

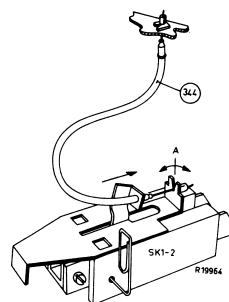


Fig. 27

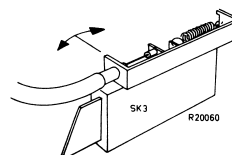


Fig. 28

## Maintenance

After about 500 hours of service it is desirable that the apparatus be cleaned and greased again at various points.

With alcohol or methylated spirits must be cleaned:

- . Tape guide 133.
- . Erasing head and recording playback head.
- . Capstan.
- . Pressure roller.
- . Cords 18 and 182.
- . Pulley 203.
- . The groove in the flywheel 17.
- . The bearing surfaces of the idler wheels.
- . The brake blocks of the brakes 99 and 100.
- . The inner and outer sides of the reel discs.

With a brush should be cleaned:

- . The pressure felts 131 and 133.
- . The brake felts 120.

## After greasing

For after greasing, see greasing instructions below.

## Greasing instructions (fig. 29)

### Greasing with watchmakers oil A9 881 04/F30

Winding shafts 2

Bearings of reel discs 179 and 180.

The shaft of winding friction 42.

Bearing of winding friction 42 (grease sparingly in view of slip coupling).

Flywheel bearings 12 and 27. (Grease bearing 12 very sparingly in view of pressure roller).

### Grease with graphite grease A9 881 39/F50

Hinge point of tumbler 20 with under-plate 19.

Friction surfaces of brake brackets 99 with mounting plate.

Friction surface of brackets 39 with mounting plate.

Friction surface of bracket 46 with bracket 45.

Friction surface of bracket 46 with under-plate 19.

Guide bracket of track selector knob 183.

Locking hoof 166 of track selector knob 183.

All friction surfaces of slide 57 with other parts.

All friction surfaces of the strips 84, 85 and 86 with brake slide 83, under-plate 19 and mounting plate.

Friction surface of bracket 91 with spring 84.

Friction surface of punch 11 with pressure plate 147.

### Grease with oil A9 881 21/F30

Shaft of pressure roller 142 and rings 143.

The shaft of winding roller 49 and the rings 50.

Bearing of winding roller 49.

Insert hub 10.

Shaft of cord wheel 112 and rings 113.

Bearing of cord wheel 112.

Centres of rotation of pressure brackets 131 and 133.

Shaft of pressure roller lever.

### Grease with calypsol grease A9 881 27/T50

Sump of pressure roller 142.

Roller on tumbler 20.

### Grease with calypsol oil 17 A9 881 29/F50

Bearings of motor 151.

## Modification from 50 to 60 c/s, and vice versa.

The apparatus is suitable for 110/120-127-220-245, V, 50 c/s, and for 115 V, 60 c/s.

For the modification from 50 to 60 c/s, the drive cord 18 of motor 151 to flywheel 17 should be moved to lower groove (greatest diameter) in pulley 203 to the upper groove (smallest diameter). At the same time the knob of the voltage adaptor should be put in the position 110/120 V.

The apparatus is then only suitable for 115 V - 60 c/s.

For the modification from 60 to 50 c/s, the drive cord 18 of motor 151 to flywheel 17 should be moved from the upper groove of pulley 203 to the lower groove. At the same time, the knob of the voltage adaptor should be adjusted to the required voltage.

## Description of electrical parts.

### Position recording.

Recordings can be made via four inputs:

	sensitivity	0.2 mV across 3000 $\Omega$	
Microphone input	"	3 mV	50 K $\Omega$
Radio input	"	130 mV	2.2 M $\Omega$
Pick-up input	"	130 mV	2.2 M $\Omega$

These inputs apply the signal to be recorded via C8 to the base of transistor Ts1 (AC 107). The resistor R6 serves for the adjustment of the input impedance of Ts1. This resistor is 6K8, 15K or is entirely deleted at times.

The base adjustment of Ts1 is done with the resistors R8 and R9. The values of R6, R8 and R9 are so chosen that the input impedance is practically independent of the temperature.

The signal applied is amplified about 300 times by the AC 107. The amplified signal arrives across R11 and is applied via C9, to the potentiometer R13, with which the modulation depth is adjusted. From the slide contact of R13 the signal is applied to the grid of the ECC 83, which has been connected as a frequency corrector.

The correct frequency characteristic is obtained by the negative feedback network C16-17 and R19-R21 of the anode of B1' to the cathode of B1. The corrected signal is now present across R17 and is applied via C19 -R22 to the tuned circuit S9-C20.

From here the signal is applied to the recording playback head, depending on the position of the track selector switch to track 1-4 or 2-3.

In the recording head the signal magnetises the passing tape. At the same time the biasing current is applied to the recording head.

This current has a frequency of 46 kc/s and is generated by a Colpitt oscillator.

The valve B3, which is used therefore, is an EL 95, whilst the coil of the erasing head is used as an oscillator coil.

In order to prevent the flowing of the bias magnetisation, to the amplifier, the parallel circuit S9-C20 is tuned to the erasing frequency.

The modulation indication is done by the valve B2 (DM71). This valve obtains the low frequency signal via R25 onto the grid. The cathode current which at the same time is filament current is obtained from the cathode of B3.

### Position Playback

During playback, the tape is scanned by the playback head. The signal induced in the head is applied to the base of Ts1 via C8. The signal is now 300 times amplified and arrives across R11. Via C9 the signal is applied to the volume control R13 which applies the signal to the grid of the ECC83. This valve works as a frequency corrector.

The signal is negatively fed back from the anode of B1' by C15 and R20 to the cathode of B1. The capacitor C12 serves for boosting the high notes.

The corrected signal is now across R17 and is applied via C18-R29 to the control grid of B3.

The leak resistor of this grid is a voltage divider, namely, R23 and R24. From this R24, the signal for the line output is taken. The valve B3 has been connected as a final amplifier. The amplified signal arrives across the output transformer S6/S7. The transformer ensures the adaptation of the loudspeaker (5  $\Omega$ ) to the output valve.

The valve B2 serves for on/off indication.

### Switches

SK1 and SK2	- recording playback switches
SK3	- track selector switch
SK4	- is closed when depressing the play key 87
SK5	- is opened when depressing the play key 87
SK6	- mains switch
SK7	- is closed when connecting an additional loudspeaker

In the figures 33 has been drawn how the stators of the switches SK1-SK2-SK3 can be made.

## K. Checking measurements

### 1. Voltages and currents

The adjustments of the transistor and the valves have been indicated in the circuit diagram.

These measurements have been carried out with a meter of 20000  $\Omega$  /V at a temperature of 20 to 25 degrees C.

### 2. Playback amplifier

Apparatus in the position playback.

### Current consumption

The current consumed at 220 V should be <70 mA, measured in the primary of the mains supply transformer, (without the current of the motor).

The total current consumed of the apparatus should be <120 mA at 220 V.

### Sensitivity

- . Unsolder the loudspeaker and replace this by a load resistor of 5  $\Omega$ .
- . From a tone generator, apply a signal of 1 kc/s via a resistor of 22 k $\Omega$   $\pm$  1% to the point of junction of R7 with the recording playback head.
- . Put the volume control to maximum.
- . Connect the valve voltmeter to the load resistor of 5  $\Omega$  and adjust the output voltage to 500 mV with the aid of the tone generator.
- . The input signal measured across the tone generator should now lie between 80 mV  $\pm$  2dB.
- . The voltage measured on the line output should be 190 mV  $\pm$  2 dB with the same input voltage.

### Frequency characteristic

Connections as above mentioned.

1. Apply from the tone generator a signal of 100 c/s to R7 (via 22 k $\Omega$   $\pm$  1%) and adjust the output voltages to 160 mV measured across the load resistor of 5  $\Omega$  (volume control maximum).
2. With a variation of the frequency and with input voltage remaining equal, the output voltage should then vary as follows:

f	Output in mV	Tolerance
1000 c/s	160	0 dB
166 c/s	715	$\pm$ 2 dB
6000 c/s	160	$\pm$ 2 dB
8000 c/s	180	$\pm$ 2 dB
10000 c/s	190	$\pm$ 2 dB
13000 c/s	152	$\pm$ 2 dB

HUM

If no signal is applied to the amplifier, the hum measured with a valve voltmeter across the load resistor of 5 Ω (instead of loudspeaker) may not be more than:

Potentiometer R13 open : 25 mV  
Potentiometer closed : 4 mV

This measurement should be done on both tracks with properly adjusted recording playback head. The mains plug should be in the most favourable position.

Recording amplifier

Apparatus in the position recording

Adjustment of wave trap S9

- Connect valve voltmeter between S9-R22 and earth.
- Turn volume control to maximum.
- Adjust with S9 the circuit to minimum deflection of the valve voltmeter.
- This voltage should be smaller than 7 V.

Sensitivity recording amplifier

Note: With these measurements, the EL 95 may not oscillate. This can be realised by short circuiting the erasing head.

Pick-up input

- Connect a tone generator to the pick-up input and adjust the frequency to 1000 c/s.
- Turn the volume control to maximum.
- Connect a valve voltmeter across R7 and now adjust the deflection of the valve voltmeter to 4 mV with the aid of the tone generator.
- The input voltage measured across the tone generator should now be 125 mV ± 2 dB.

Radio input

- Connect tone generator to the radio input via a resistor of 1 MΩ ± 1 % and adjust this generator to a frequency of 1000 c/s.
- Turn volume control to maximum.
- Connect the valve voltmeter to R7 (under recording playback head and earth), and adjust the deflection of the valve voltmeter to 4 mV, with the aid of the tone generator.
- The input voltage measured across the tone generator should now be 65 mV ± 2 dB.

Microphone input

- Close the microphone input between points 1 and 2 with a resistor of 470 Ω 5 %.
- Connect the tone generator via a resistor of 470 kΩ 1 % to the microphone input at a frequency of 1000 c/s.
- Turn the volume control to maximum.
- Connect a valve voltmeter to R7 (under recording playback head and earth) and now regulate the deflection of the valve voltmeter to 4 mV with the aid of the tone generator.
- The input voltage measured across the tone generator should now be 190 mV ± 2 dB.

Checking the indicator B2 (DM71)

- Connect a tone generator to the P.U. input and adjust this to 1000 c/s.
- Short circuit the erasing head.
- Turn the volume control to maximum.
- Connect valve voltmeter to R7 (under recording playback head and earth) and now adjust the deflection of the valve voltmeter to 4 mV with the aid of the tone generator.
- The indicator B2 should now fully light up.

Frequency characteristic

- Connect a tone generator to the radio input via a resistor of 1 MΩ 1 % and adjust same to a frequency of 1000 c/s.
- Volume control to maximum.
- Connect a valve voltmeter to R7 (under recording playback head and earth) and now adjust the deflection of the valve voltmeter to 4 mV with the aid of the tone generator.
- The input voltage measured across the tone generator should now be 65 mV ± 2 dB.
- Now vary the frequency whilst the output voltage measured with the valve voltmeter across the resistor R7 is kept constant (4 mV).
- The input voltages should vary as follows:

Frequency : 1000 c/s 166 c/s 6000 c/s 8000 c/s  
: 10000 c/s 13000 c/s

Vi tone generator : 65 mV 52 mV 37 mV 26 mV 21 mV 14 mV.

4. Complete apparatus

A. Overall frequency characteristic

- Replace loudspeaker by a resistor of 5 Ω .
- Potentiometer to maximum.
- Connect tone generator to the pick-up input and adjust same to 1000 c/s.
- Connect valve voltmeter to R7 and adjust the voltage across R7 to 4 mV with the aid of the tone generator. The voltage across the tone generator is then 125 mV ± 2 dB.
- Now connect the valve voltmeter to the slider of the volume control R13 and make a note of this voltage.
- Now turn the volume control so far back that the voltage on the slider of the volume control if 1/10th of the voltage measured as above mentioned.
- Place a reel in the apparatus with super-long play tape and put the apparatus in the recording position.
- Now record signals of 100 c/s 166 c/s 6000 c/s 8000 c/s 10000 c/s and 13000 c/s. (Vi should remain constant at 125 mV and the volume control should remain as mentioned above).

- Put the apparatus in the position playback and play back the signals recorded. Put the volume control to maximum.
- The measuring of the output voltage across the resistor of 5 Ω and on the line output should be done with the valve voltmeter and amount to:

	1000 c/s	166 c/s	6000 c/s	8000 c/s	10000 c/s	13000 c/s
5 Ω	800 mV	1000 mV	1000 mV	1080 mV	900 mV	570 mV
line output:	280 mV	450 mV	450 mV	400 mV	380 mV	250 mV

All measuring values ± 2 dB.

These measurements should be carried out both for track 1-4 and for 2-3.

B. Bias magnetisation

The bias magnetisation should be so adjusted that the frequency characteristic as described above is met. If the voltages supplied at higher frequencies are lower than the above values, then the bias magnetisation should be reduced by means of C22 and C23 until the above characteristic is obtained. The bias magnetisation should however be greater than 24 mV (measured with valve voltmeter across R7 ).

N.B. An increase of the bias magnetisation gives a reduction of the high notes, reduction of bias magnetisation gives an increase in high notes. Too little bias magnetisation, however gives distortion.

C. Checking the erasing

- Connect tone generator to the pick-up input and adjust same to 1000 c/s.
- Place the tape in the apparatus and record a signal of 1000 c/s (modulate tape 100 %).
- Remove the tone generator.
- Erase the signal recorded.
- With the volume control at minimum, the signal recorded should not be perceptible anymore.

L. Electrical Parts' List

TS1	AC 107	T1	A3 145 36
B1	ECC 83	T2	A3 157 98
B2	DM 71	S 9	A3 910 37
B3	EL 95		
GR1	B 250 B 75	Z1	A3 425 53
		Z2	974/50
R1	E 001 AK/A2K7		
R2	E 001 AK/A6K8		
R13	E 098 AD/30D11		
C1)			
C2)	AC 5484/50 + 32 + 32		
C3)			
C8	C 425 CF/F10	10 uF	25 V
C10	-909/C25	25 uF	25 V
C11	C 426 AM/G64	64 uF	40 V
C14	C 426 AM/C80	80 uF	6.4 V
C21	907/45E-275E		
C26	909/C50	50 uF	25 V
C28	904/1K5		

N. Appendix

1. Service Notes connecting flex EL 3768-00-01

EL 3768-00 Connecting flex for radio set with recorder connection

Pos. 1	WT 888 38	Five pole plug
Pos. 2	R 365 KN/04HP10	Flex per meter
Pos. 3	AE 505 91	Three pole plug
R	B8 305 80A/470K	

EL 3768-01 Connecting flex for radio set without recorder connection

Pos. 1	AE 505 91	Three pole plug
Pos. 2	R 365 KN/04HP10	Flex per meter
Pos. 3	978/1x4AA	Single Pole plug - black
Pos. 4	978/1x4AF	Single pole plug - red
Pos. 5	AE 012 66	Single pole plug - white
R	B8 305 80A/1M5	

2. Service Notes microphone EL 3756-00-03

Versions

EL 3756/00 is an electrodynamic cardioid microphone for the recorder EL 3514.

EL 3756/03 is identical to -/00 however, the colour is different.

General

The microphone is suitable for speech and music. The button EL6084/10 has been suspended in foam plastic, as a result of which it is vibration and shock-proof. At the same time the microphone is suitable for use in the Tropics (up to 75°).

Sensitivity

At 1000 c/s the sensitivity amounts to 0.23 mV/u Bar measured at a distance of 70 cm. from the sound source.

Impedance

At 1000 c/s the impedance amounts to 500 Ω.

Connections

Pin 1 of the preh plug has been connected to the grey wire of the flex (live side). Pin 2 to the screening of the flex. The screening has been connected to one side of the coil and the casing of the button. Pin 3 is not used.

# List of Parts

Pos.	Code Number	Nomenclature
1	P5 649 31/350	Casing colour /00 grey, /03 beige
2	V3 131 56	Cap, assembly cream colour
3	EL 6084/10	Microphone button
4	P7 630 84/319	Ring
5	V3 449 48 1	Ornamental cloth
6	V3 190 01	Relieve plate
7	999/2.6x8	Screw
8a	R 367 KA/03AA10	Flex
8b	V3 608 19	Plug
10	P7 630 73/319	Spring plate (sponge)

## M. List of Mechanical Parts

Pos.	Code number	Nomenclature	Pos.	Code number	Nomenclature
2	AE 571 07	Winding shaft	145	AE 505 13	Tension spring
5	AE 504 33	Punch	146	AE 571 21	Recording knob
6	AE 504 34	Punch	151	JW 412 12	Motor
8	AE 506 02	Spacer	154	P5 512 18/159	Switch SK5
9	AE 504 36	Punch	157	P5 512 26/159	Switch SK4
10	AE 504 37	Insert hub	165	AE 503 77	Torsion spring
11	AE 504 38	Punch	166	AE 506 74	Blocking hook
12	P5 511 98/334	Upper bearing of flywheel	179	AE 571 81	Reel disc
13	AE 504 39	Leaf Spring	180	AE 571 82	Reel disc
14	AE 507 01	Bracket	181	P5 511 30/148NB	Pivot screw
17	AE 571 08	Flywheel	182	P7 520 50/000	Cord
18	P7 520 49/000	Drive cord	183	AE 606 40	Track selector knob
20	AE 606 06	Tumbler	195	P5 515 93/304	Ring
33	AE 606 07	Bracket + leaf spring	196	WT 832 65	Brush
39	AE 606 35	Assy. coupling bracket	203	JW 523 38	Pulley 50-60 c/s
41	P5 511 75/304	Ring	204	WRB 905 TU/8x1	Grommet
42	AE 571 48	Assy. winding friction	215	AE 507 07	Spring
42a	AE 606 09	Pulley + hub	216	AE 507 08	Spring
42b	AE 571 71	Playwheel	311	A3 228 39	Plate of voltage adaptor
42c	AE 504 55	Pressure spring	313	AE 571 75	Knob of voltage adaptor
45	AE 606 32	Assy. coupling bracket	316	979/5x180	Microphone plug
46	AE 504 59	Coupling strip	322	AE 571 70	Female plug
49	AE 571 51	Assy. winding roller	344	AE 571 73	Bowden cable SK1-SK2
50	P5 515 93/304	Ring	351	AE 571 80	Knob of volume control
55	AE 507 11	Tension spring	355	P5 511 91/723GR	Mask of DM71
56	AE 507 02	Tension spring	356	AE 606 49	Front casing half
57	AE 606 11	Assy. slide bracket	361	AE 606 18	Flap
70	AE 504 67	Pressure spring	363	AE 571 50	Rear Casing half
71	AE 504 68	Pressure spring	365	AE 606 17	Flap
73	AE 504 69	Tension spring	367	B 045 BF/13	Outer lock ring
77	AE 571 63	Assy. recording playback head	370	AE 606 34	Assy. foot
80	AE 571 67	Assy. erasing head	372	AE 571 57	Handle
83	AE 506 06	Brake slide	374	P5 511 82/931AB	Lid
84	AE 504 75	Start strip	375	AE 571 69	Bowden cable SK3
85	AE 504 76	Winding strip	391	P6 491 95	Mains flex
86	AE 504 77	Winding strip	410	AE 505 56	Spring in SK1/SK2
87	AE 571 03	Start Knob	412	976/PW7x10	Valve holder EL 95
88	AE 571 04	Winding knob	413	976/PW9x12	Valve holder ECC83
89	AE 571 05	Winding knob	414	A3 811 28	Valve holder spring
90	AE 504 78	Tension spring	416	A3 810 77	Clamping spring of fuse holder
99	AE 606 13	Assy. brake bracket	419	AE 571 56	Loudspeaker plug
100	AE 606 14	Assy. brake bracket	420	979/5x180	Radio plug
108	AE 506 59	Tension spring	421	979/5x180	pick-up plug
109	AE 606 05	Assy. bracket	425	979/F5x1	Pick-up female plug
112	AE 571 16	Assy. cord wheel	426	A3 647 73	Fixing spring
113	P5 515 93/304	Ring	427	976/8x6	Valve holder DM71
115	AE 504 88	Torsion spring	434	AE 506 79	Spring to SK3
117	AE 504 89	Tension spring		A3 092 12	Assy. switch SK1
120	AE 505 10	Pressure felt		A3 092 14	Assy. switch SK2
122	AE 506 94	Tension spring		A3 150 38	Assy. switch SK3
124	AE 507 10	Tension spring		A3 295 19	Final bracket SK1-SK2-SK3
125	AE 606 15	Pressure roller lever		A3 295 21	Deck profile SK3
131	AE 606 37	Pressure bracket		A3 295 22	Deck profile SK1-SK2
133	AE 606 39	Pressure bracket		A3 092 11	Slider SK1
141	AE 507 13	Tension spring		A3 092 13	Slider SK2
142	WT 881 66	Pressure roller		A3 150 37	Slider SK3
143	P5 515 93/304	Ring			



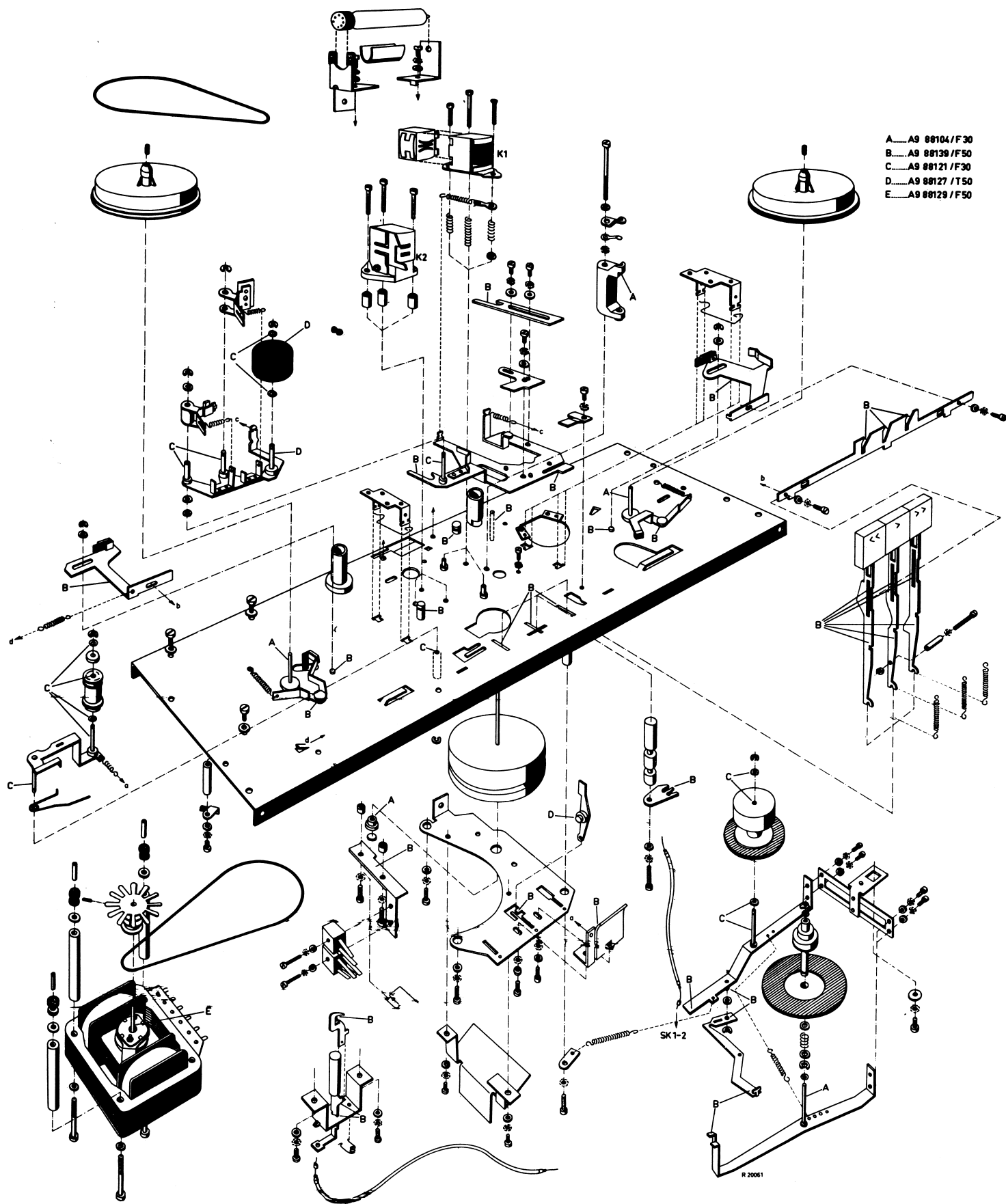


Fig.29

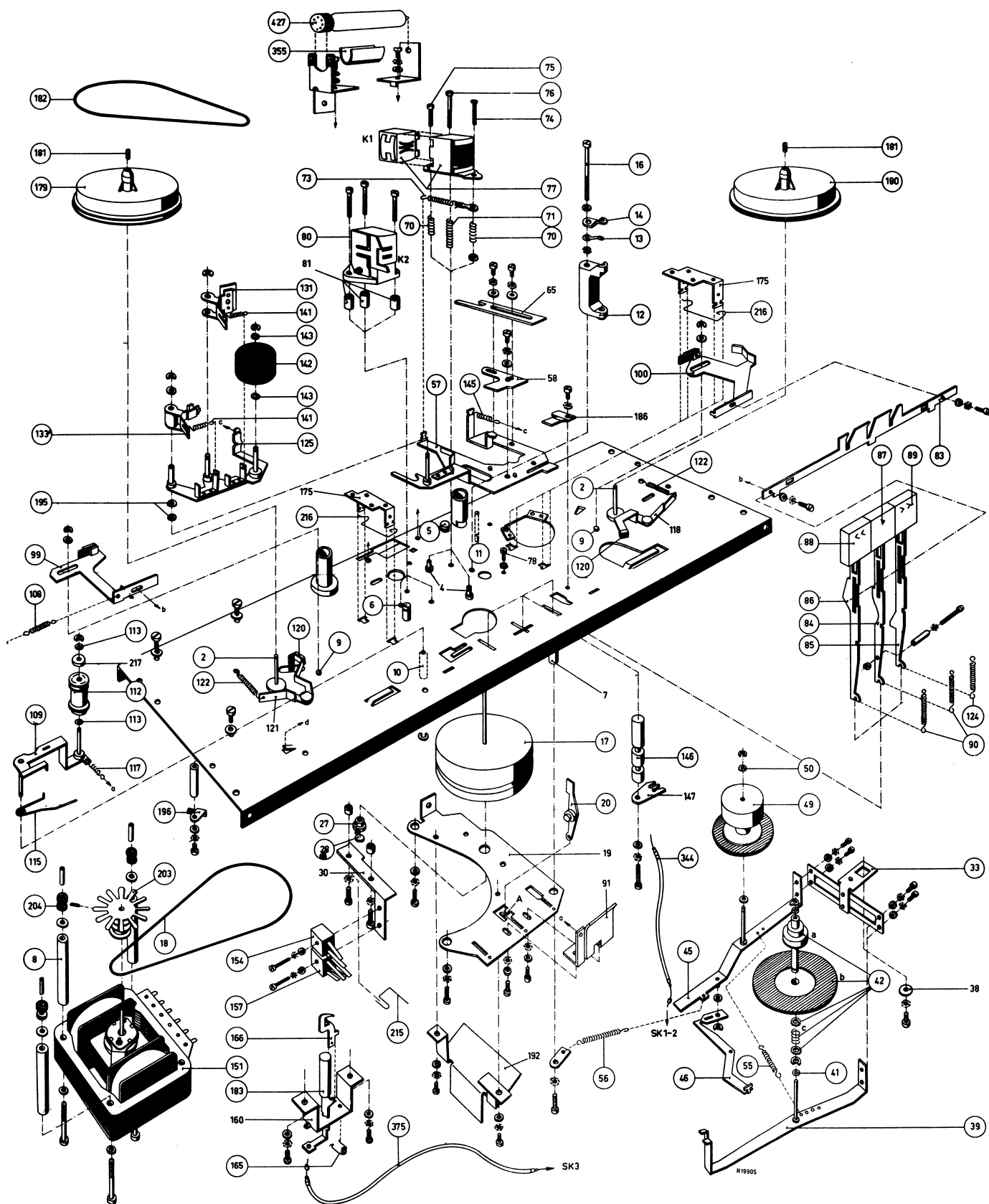


Fig.37

3, 4, 7, 6, 8, 9, 10, 11, 13, 12, 15, 14, 16, 18, 17, 20, 19, 21, 22, 23, 24, 25, 26, 28, 27, 30, 29, 31, 1, 2, 101, 102, 32, 3, 8, 9, 10, 11, 12, 13, 14, 15, 17, 19, 16, 18, 20, 24, 23, 25, 22, 21, 26, 27, 28, 1, 2, 3.

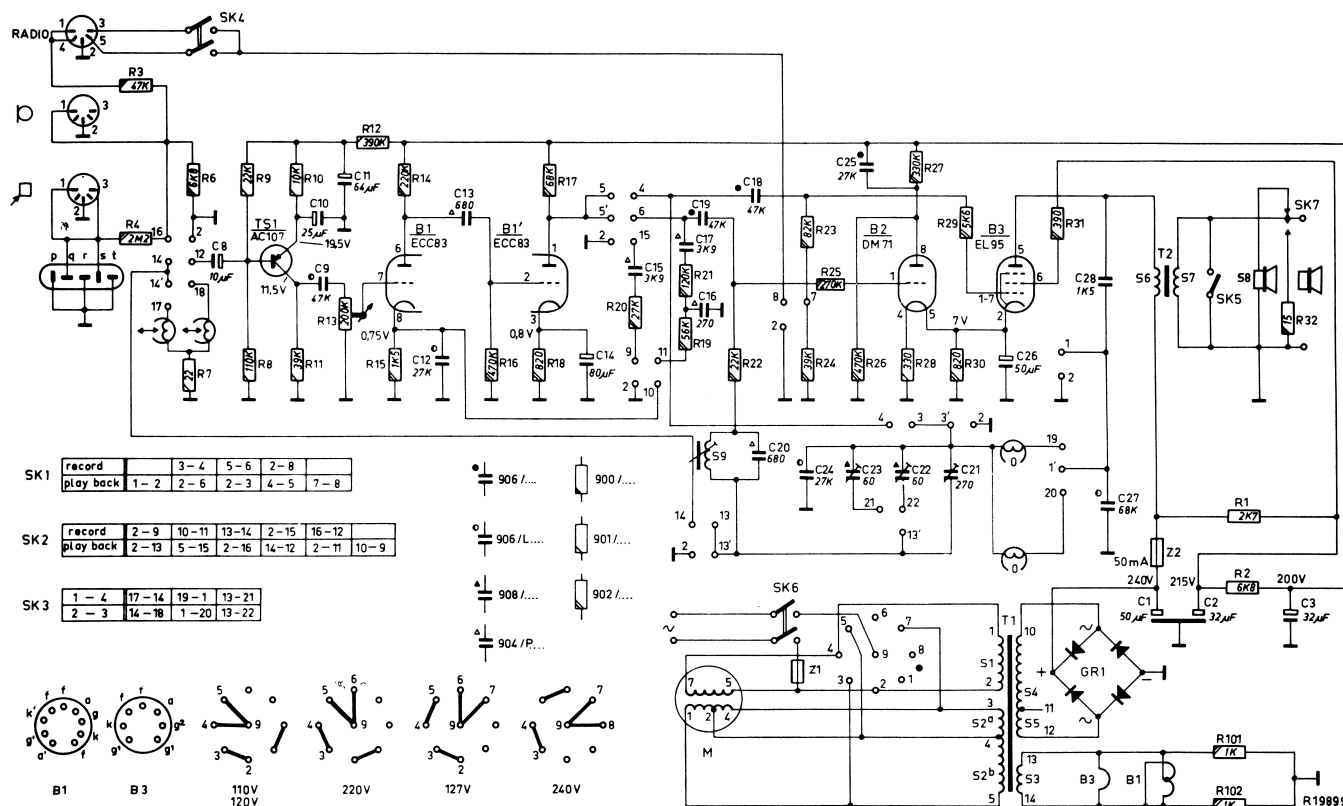
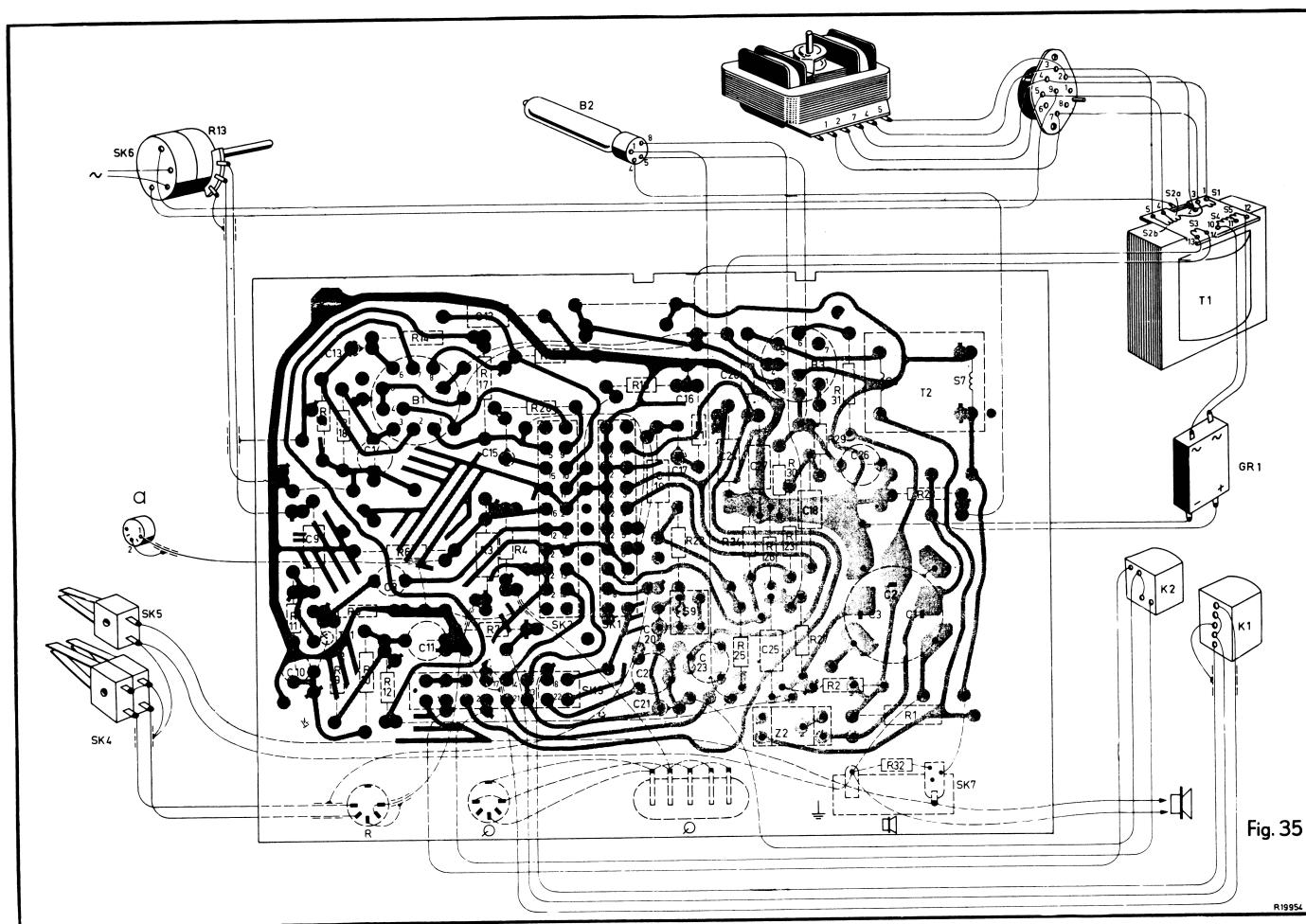
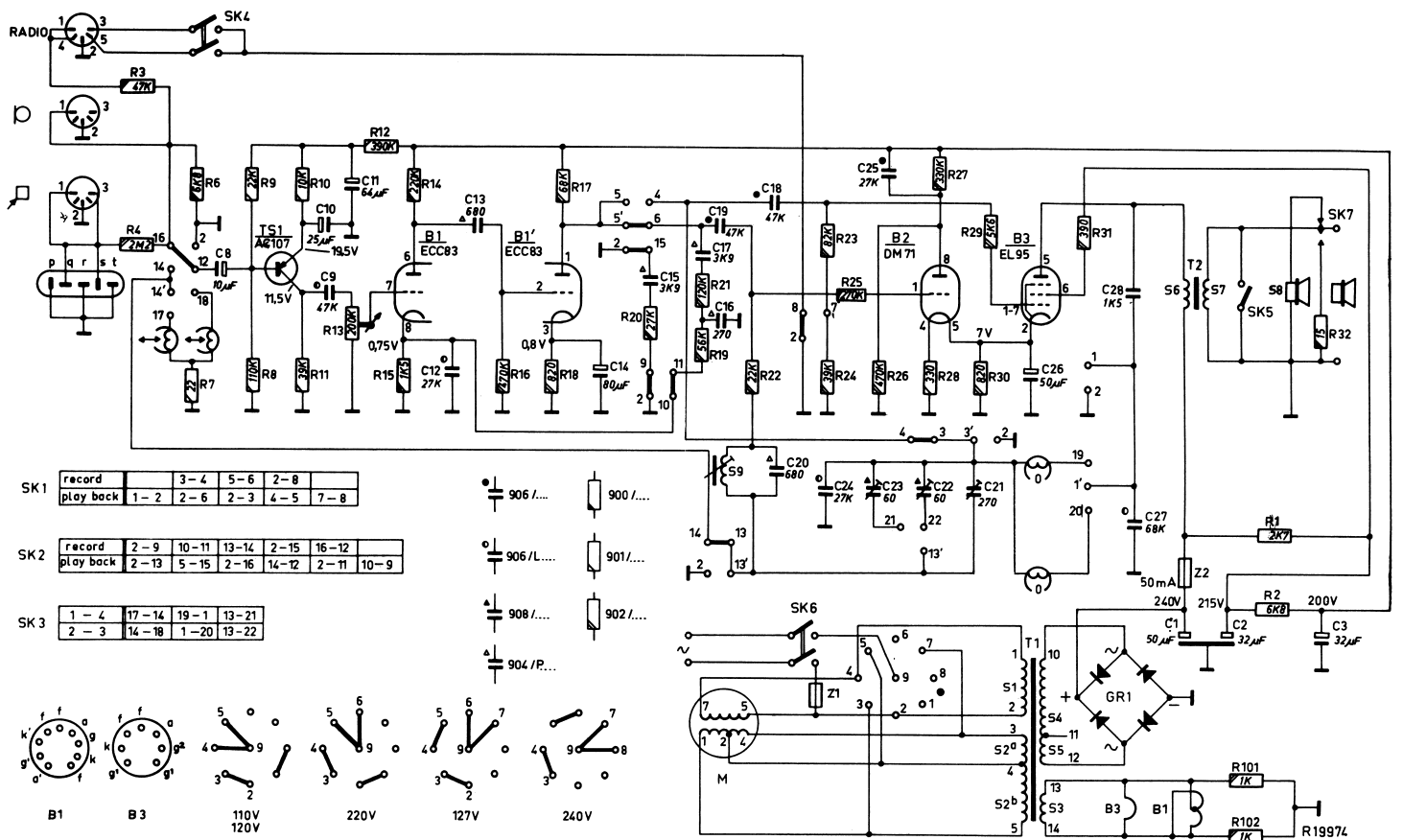


Fig. 30

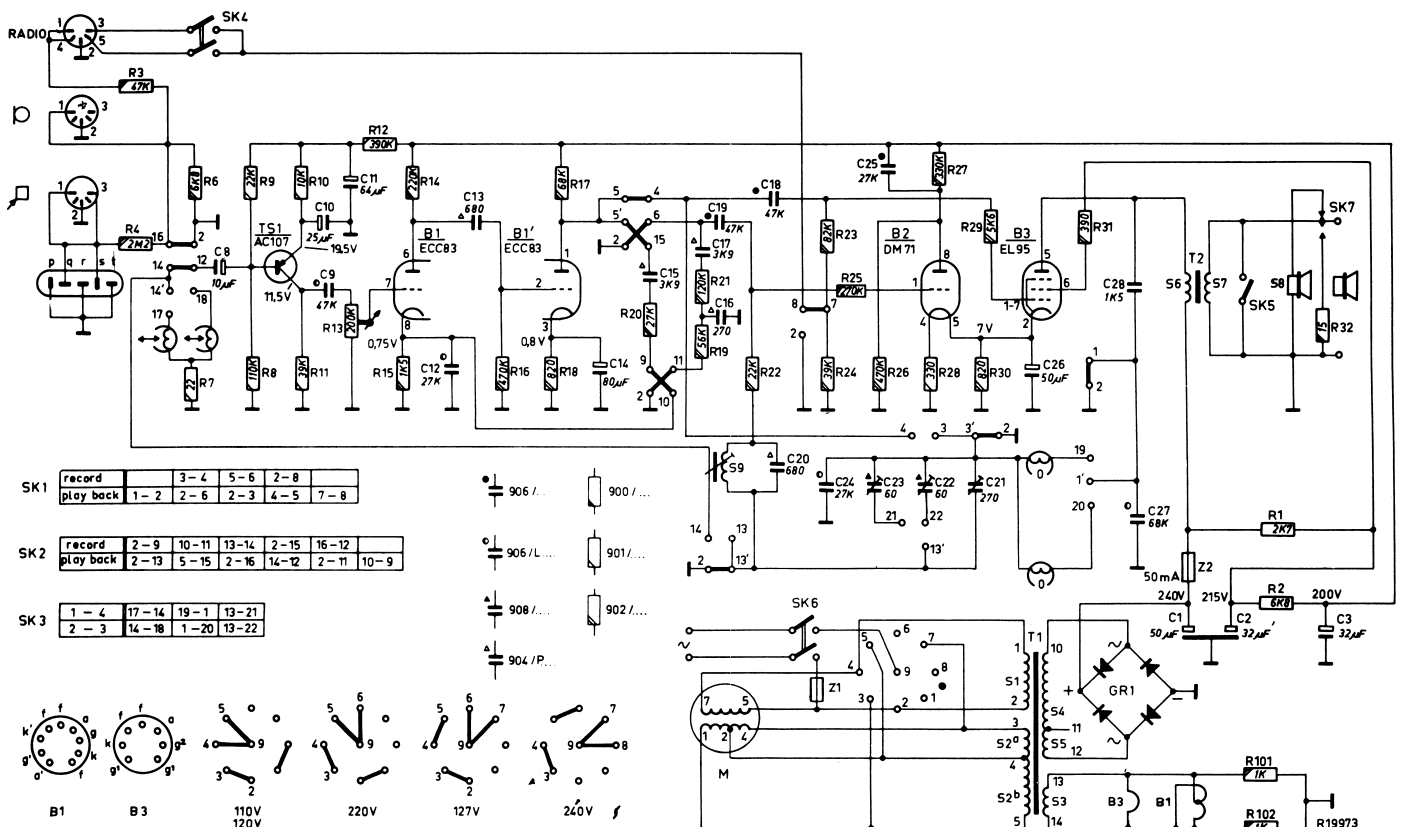


R:	3, 4, 7, 6, 8, 9, 10, 11, 13, 12, 15, 14, 16, 18, 17, 20, 19, 21, 22, 23, 24, 25, 26, 28, 27, 30, 29, 31, 1, 2, 101, 102, 32,
C:	8, 9, 10, 11, 12, 13, 14, 15, 17, 19, 16, 18, 20, 24, 23, 25, 22, 21, 26, 27, 28, 1, 2, 3,



RECORDING Fig. 31

R:	3, 4, 7, 6, 8, 9, 10, 11, 13, 12, 15, 14, 16, 18, 17, 20, 19, 21, 22, 23, 24, 25, 26, 28, 27, 30, 29, 31, 1, 2, 101, 102, 32,
C:	8, 9, 10, 11, 12, 13, 14, 15, 17, 19, 16, 18, 20, 24, 23, 25, 22, 21, 26, 27, 28, 1, 2, 3,



PLAY BACK

Fig. 32

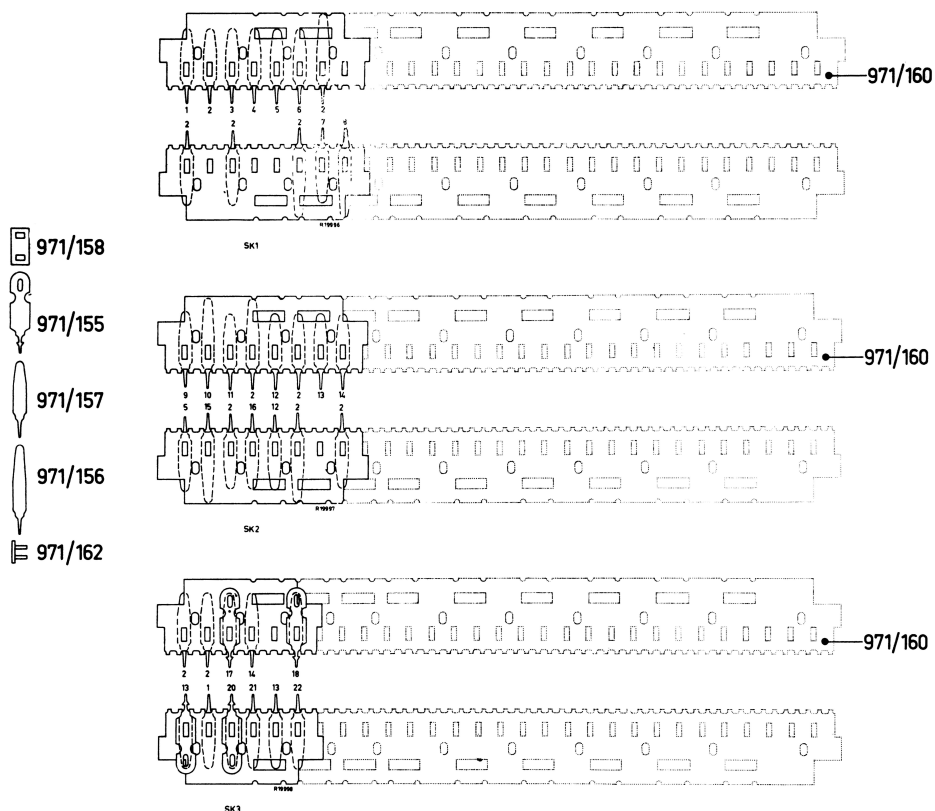
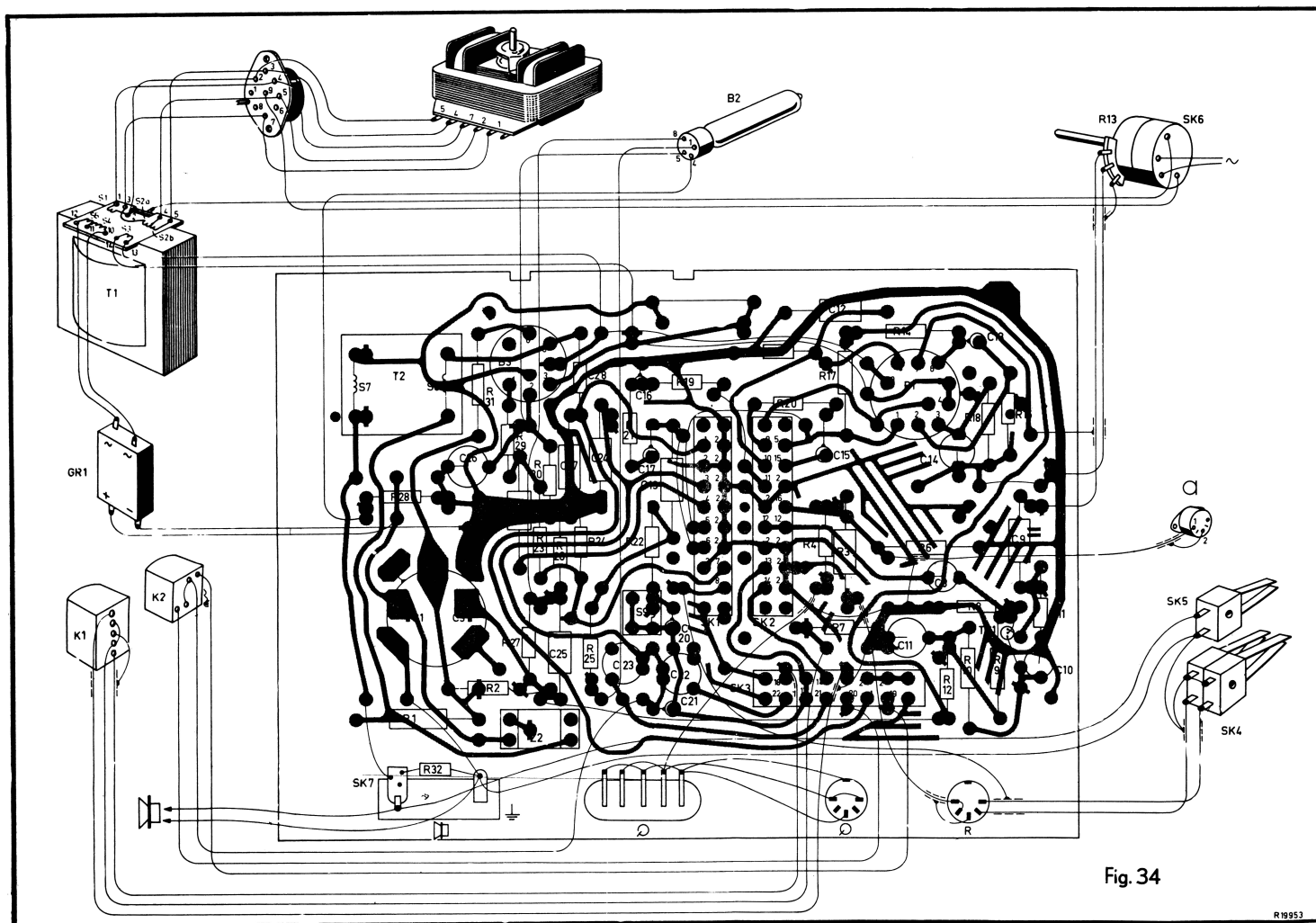
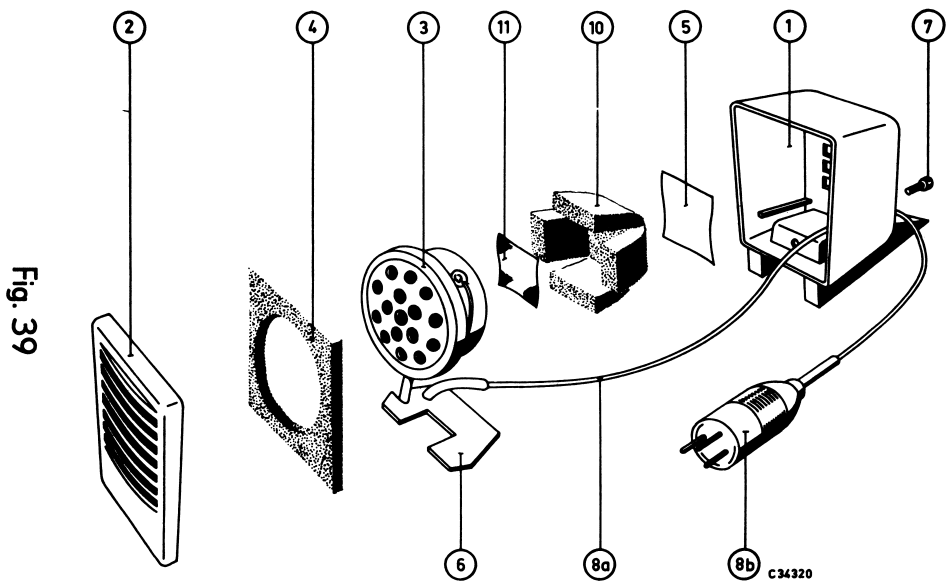
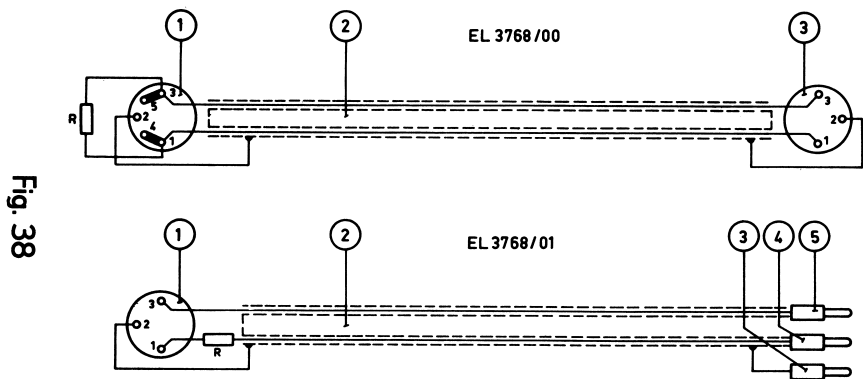
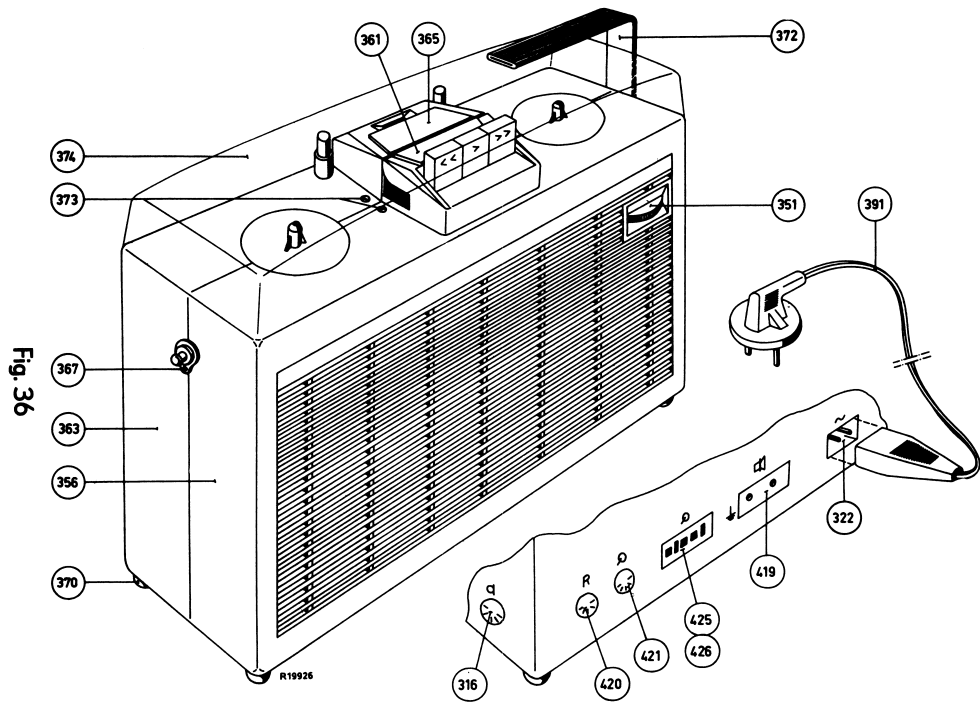
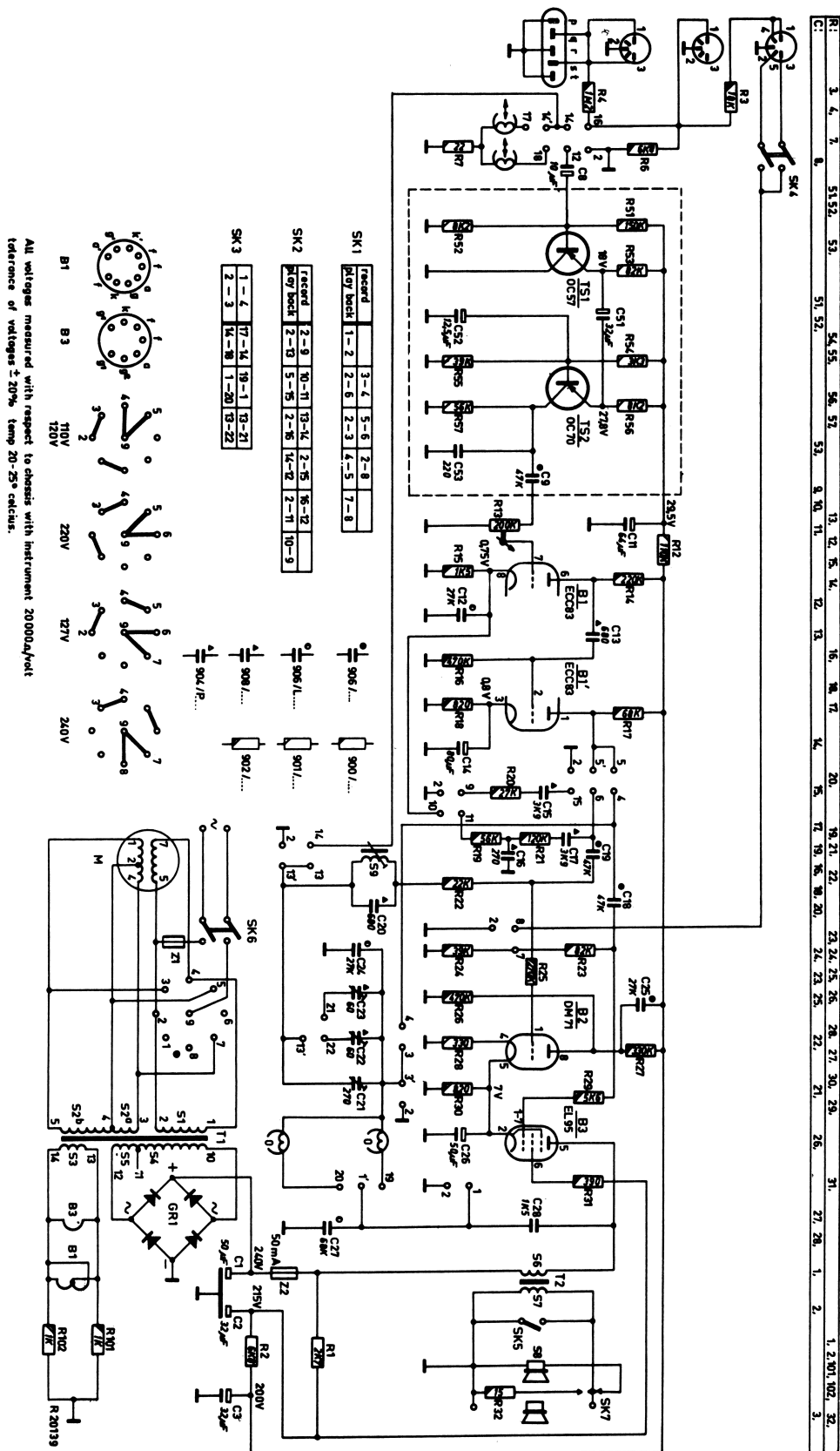


Fig. 33





# P6-15. PHILIPS MODEL EL3514





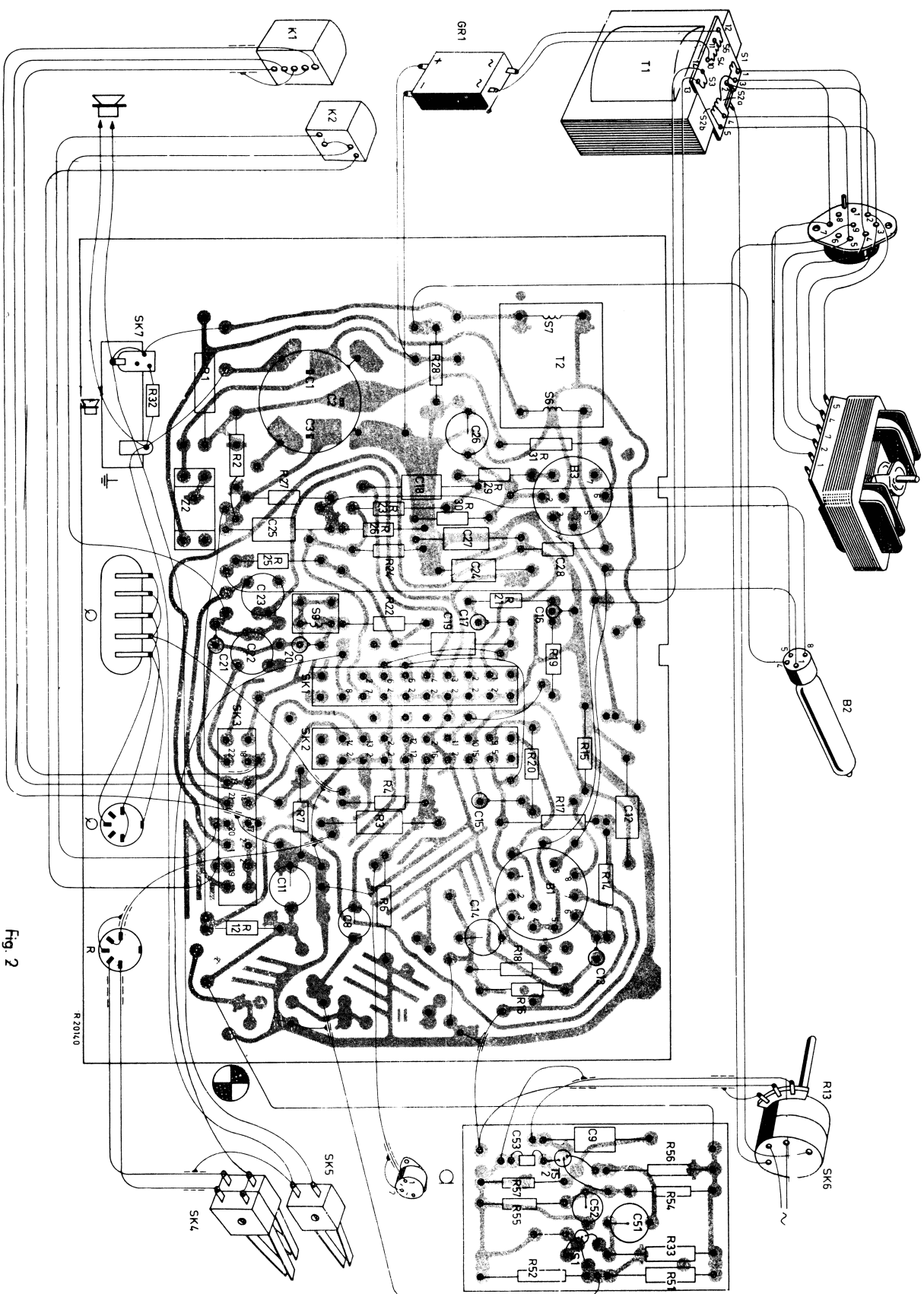


Fig. 2

Bc 241

Re : Apparatus with stamp AH02 and upwards (excluding AH11).

In order to facilitate the adjustment of the biasing current, the trimmers C21, C22 and C23 have been replaced by a fixed capacitor of 390 pF and two adjusting potentiometers of 20 kΩ each.

A capacitor C4 (4K7) has been added in order to prevent a d. c. voltage from coming onto the pick-up input. The transformer T1 has been modified.

The tap 11 on the secondary winding has been deleted.

for a better matching of the recorder to a radio, the following resistors have been modified. R3 is now 18K and R4 is now 1 M5. The torsion spring 215 has been replaced by a leaf spring (simplified mounting). Code number AE 507 19.

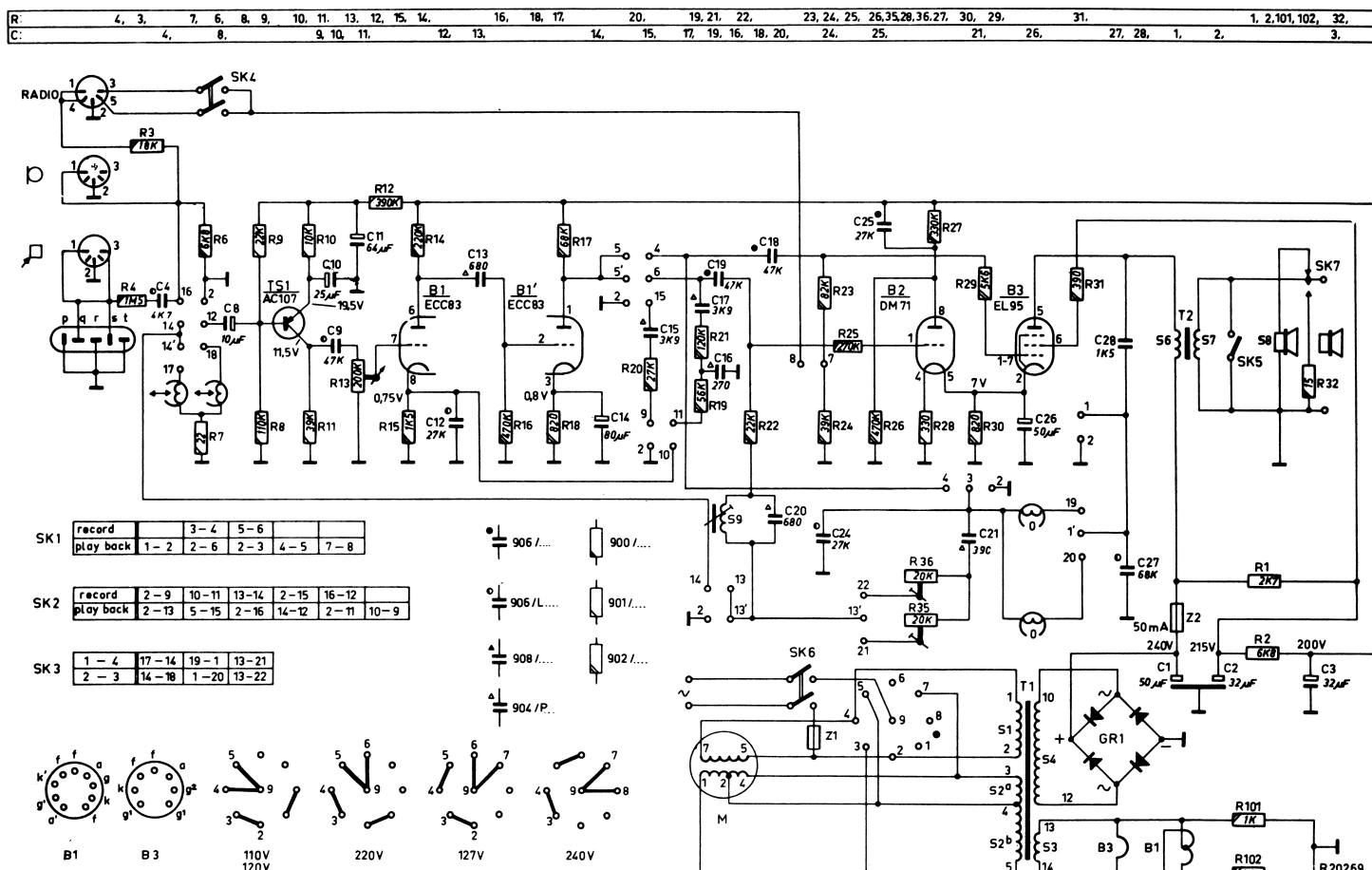
In order to prevent looping of the tape, the brake bracket 100 has been modified. New code number : AE 606 64.

The ring 113 has been modified in order to prevent jamming of the cord wheel 112 in the screening cap. New code number : AE 004 36.

In order to reduce hum, an additional mu-metal screening cap has been placed over the recording/playback head.

Code number : AE 507 38. This cap is pushed over the old screening.

In fig. 1 the modified circuit diagram and in fig. 2 the modified wiring diagram have been drawn.



All voltages measured with respect to chassis with instrument 20000A/volt tolerance of voltages  $\pm 20\%$  temp 20-25° celcius.

Fig. 1



P6-19. PHILIPS MODEL EL3514

Bc 263

Re : Sets with stamp AH03 and upwards.

In the recorder EL 3514 the control of the track selector switch SK3 has been modified.

The bowden cable 375 has been deleted.

The new control is done by means of bars (see figure).

Please add the mechanical parts list:

Pos.	375	-	AE 571 91	-	bar
Pos.	382	-	AE 507 44	-	switch bracket
Pos.	383	-	AE 507 43	-	centring ring
Pos.	385	-	AE 507 45	-	spacer
Pos.	386	-	AE 507 46	-	bar
Pos.	387	-	AE 012 22	-	threaded bush
Pos.	388	-	993/M4	-	nut

The adjustment of SK3 is done with the nut, pos. 388.

At the same time the value of capacitor C20 has been modified to 1000 pF.

Reason : better adjustment of S9.

Bc 267

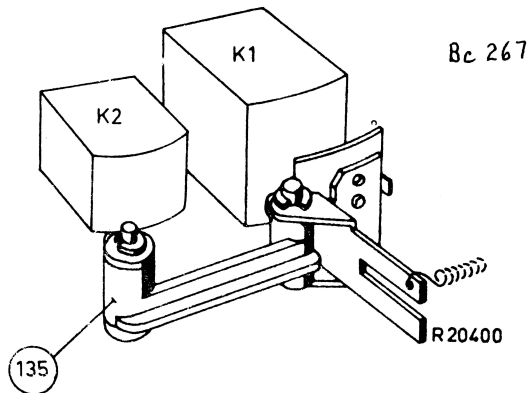
Re : Squeaking noise with tape drive.

Investigations regarding the squeaking during the tape drive have proved that the pressure felt of the erasing head was the cause of same.

As from stamp AH03/06/62 a nylon bridge (see figure) has been introduced in the place of the pressure felt.

Code number nylon bridge 1N 961 54.

N.B. The possibility of the jarring noise being produced, the erasing being insufficient and of the erasing head becoming dirty, has been reduced by this at the same time.



Bc 248

The fuse Z2 has been cancelled.

Reason : The fuse Z1 gives sufficient protection.

At the place of the fuse an interconnection has now been made.

Please add at the same time to the mechanical parts list:

AE 505 93 bag for microphone.

