

- . Loosen screws "83a" and remove plates "83".
- . Remove springs "53", "25", tape guide "46" and the brackets "84".
- . Loosen screws "71" and "116", and remove bearing plate "72" and bearing "73".
- . Unscrew the three connection screws of the mounting plate, on to which amongst other things bearing plate "72" is mounted, and remove this plate so that the fly-wheel can be removed.
- . Take care that the connecting wires of the record/playback head, erasing head and SK8 are not broken.
- . Remove the flywheel.

Remark: When remounting, the fixation screws of the mounting plate and of the bearing plate must be turned on slightly.

b. Adjustments

1. Plate "83"

- . This plate has to be pushed upwards till the raised edge of the turntable, on to which the reel has to be placed, is between 50 and 50.5 mm above the frame.

2. Flywheel "44"

- . Depress speed button $7\frac{1}{2}$ /sec.
- . Switch the apparatus off by depressing knob "12". The flywheel should now keep running for $3\frac{1}{2}$ to 4 mins. During this running, the intermediate wheel "47" should not touch the flywheel. This running can be regulated by slowly moving the mounting plate to and fro.
- . If the running time is all right, screws "71" can be tightened.
- . After that the running time has to be tested again. If it is all right, the three connection screws of the mounting plate can be properly tightened.
- . Check the running time of the flywheel.
- . Check now whether the upper intermediate wheel is under the edge of the flywheel when the speed button is depressed. The height can be adjusted with thrust screw "82", after which its locking nut must be properly tightened.
- . Check the winding and rewinding and the tape path during recording and playback. The tape should not twist when passing the heads and run smoothly along the pressure roller "43".
- . Depress speed button $7\frac{1}{2}$ /sec. The other push-buttons may not be depressed. The starting voltage must now be < 180 V, whereby the voltage adaptor must be at 220 V.

XII. Tape guide "46"

Adjustments

The tape guide should be mounted in such a way that the point points to the middle of the capstan.

XIII. Intermediate wheels "47" (fig. 9)

a. Replacement

1. Upper intermediate wheel

- . Remove the release bracket of the mains flex.
- . Loosen the connection screws of the mounting brackets of the push-buttons and pull the assembly forwards.
- . Remove cap "154" clamping ring "153" and ring "152"
- . Now the intermediate wheel can be removed.

2. Middle intermediate wheel

- . Remove the upper intermediate wheel.
- . Remove cap "150" squeeze ring "149" and ring "148".
- . Lift the upper guide bracket and remove the intermediate wheel.

3. Lowermost intermediate wheel

- . Turn the complete assembly along its longitudinal axis
- . Remove cap "133" clamping ring "132" and ring "131".
- . Now the intermediate wheel can be removed.

b. Test

1. If none of the speed buttons is depressed, the intermediate wheels should be removed at least 0.5 mm from the flywheel and the pulley.
2. The pressure of the intermediate wheels against the pulley and the flywheel should be 400-500 grammes. This can be measured as follows:
 - . Depress the $1\frac{7}{8}$ /sec. speed button.
 - . Hold the end of the arm of the spring-pressure meter behind the protruding part of the upper guide bracket "51" at the rear of the bracket "156".
 - . Now move the spring-pressure gauge in the direction of the upper intermediate wheel and read the deflection of the meter at the moment that the intermediate wheel of the flywheel is lifted from the flywheel and the motor pulley.
 - . The pressure of the other intermediate wheels is measured in the same way.

3. When the speed button is depressed, the intermediate wheels should run in the middle of the corresponding pulley part, and not at one of the sides.
4. The upper intermediate wheel may not run at the edge of the flywheel. For the adjustment of the flywheel, see point XX.
5. When knob "12" is depressed, the mains switch will be switched off through lever "146a".

XIV. Motor "52" (figs. 2 and 10)

a. Replacement

- . Unsolder the connections.
- . Remove driving belt "61".
- . Loosen the four connection screws.
- . Loosen the connection screws of the bearing support a few turns.
- . Remove clamping spring "158" and propeller "159".
- . Block the rotor of motor "52" and turn pulley "54" anti-clockwise and pull at the same time the spindle out of the coupling spring.

Remark: When mounting again, tighten the screws of the bearing support slightly.

b. Adjustments

- . Connect the apparatus to 85 V, whereas the voltage adaptor must be at 220 V.
- . Switch the mains switch on by turning bracket "146a" upwards.
- . Adjust the bearing support with pulley "54" with respect to the motor in such a way that the motor starts to run. Attention should be paid that none of the intermediate wheels touch the pulley.
- . Tighten screws on the bearing support somewhat more, and switch the mains switch a couple of times on and off. Each time the motor should start to run.
- . Tighten now these screws, and check the starting of the motor once again to see whether the bearing support has not been shifted.
- . Apply driving cord "61".
- . Check whether the intermediate wheels run in the middle of the races of the pulley and not at the edges. Check the interference level. If this is too high, the connection leads of the motor have to be interchanged.

XV. Bearing support with pulley "54"

a. Replacement

- . Remove the driving belt "61".
- . Loosen screws "600".
- . Block the rotor of motor "52" and turn pulley "54" anti-clockwise and pull at the same time the spindle out of the coupling spring.

Remark: When mounting again, tighten the connection screws slightly.

b. Adjustments

See point XIV-b.

XVI. Turntable "56" right-hand (figs. 2 and 5)

Adjustment

1. Depress the "STOP" button. The underside of the turntable should now be about 1 mm above coupling caps "88". This distance can be adjusted by adding one or more PVC rings pos. 91. 150 rings with different thickness are supplied in a bag, under code no. A9 868 66.
2. Depress the push-button for winding. Now the turntable should lie properly on the three coupling caps.
3. Slip coupling
 - . Place a full 7" reel on to turntable "56".
 - . Make a knot in the end of the tape.
 - . Put the arm of the spring-pressure gauge in the knot and measure the force, necessary to make the reel turn counter-clockwise. This force should be 18 ± 2 grammes.
 - . Turn the reel and measure the force necessary to make the reel turn clockwise. This force should be 23 ± 2 grammes. If these values should not be correct, the felt ring and the top of the carrier disc "92" must be cleaned with tetra carbon chloride.

XVII. Turntable "62" left (see XVI, but slip coupling 8-10 g. turning anti-clock-wise)

Brake

Adjustments

1. The braking force of the left-hand brake should be 100 - 200 grammes which can be checked in the following way:
 - . Depress the "STOP" button.
 - . Place a full 7" reel on the left-hand turntable, and make a knot in the end of the tape.

Technical data

Mains tension : 110-127-220-245 V-50 c/s

Consumption : 60 W approx.

Tubes : EF86-ECC83-ECL82-EM81-EZ80

Tape Speed : 1 7/8"/sec - 3 3/4"/sec - 7 1/2"/sec

Frequency response : 50-7000 c/s -50-15000 c/s -50-20000 c/s

Reel diameter : up to 7"

Play time : 1 7/8"/sec 3 3/4"/sec 7 1/2"/sec

Normal tape : 2 x 120 2 x 60 2 x 30 min.

Longplay tape : 2 x 180 2 x 90 2 x 45 min.

Winding and rewinding time for 360 m. tape : 2 min. approx.

Sensitivity : Microphone : 5 mV

Radio (diode) : 5 mV

Pick-up : 200 mV

Output : Diode (radio) : 2 volt 500 kΩ

loudspeaker : 2,5 watt 5 Ω

Bias and erasing frequency : 60 kc/s

Interference level : better than - 42 dB.

Replacement and adjustment of parts

Remarks: After repair, the loosened screws and nuts when tightened again should be properly locked with lacquer.

For the lubrication of the parts replaced we refer to chapter H.

I. Taking the mechanism out of the case

- Remove the knobs "5" and "6" and the caps "4" and "10".
- Unscrew the three ornamental screws "3" and the two cylindrical screws.
- Remove the cover.
- Remove the lid "199" from the bottom plate, and the P.V.C. ring from the mains flex.
- Remove the nuts "17".
- Lift the mechanism out of the case.

II. Buttons "9" (see figs. 3 and 6)

a. Replacement

- Loosen screws "116" and remove pen "70".
- Unhook springs "68", "69" and "95" from brackets "97", "34", "32", and springs "37" and "109" from brackets "100" and "100a".
- Remove screw "112" and bracket "103".
- Unscrew the four connection screws of the two mounting brackets.
- Now the whole assembly must first be pushed to the left and then to the front, after the brackets "97" and "32" have been slightly unbent.
- Now clamping ring "104" is removed, after which spindle "101" can be pulled to the left, as far as this is necessary to replace a damaged push-button.
- Do not forget the rings and bushes between the buttons. Remove the spindle "98", "99" or "102" from the replaced button by drilling.
- The new part is mounted in reverse order.

b. Test

With SK2 and SK3 in rest position, the switch strips are pulled forwards through the springs "107" and "108" till their first contact touches the raised mounting bracket. (See fig. 6).

SK3:

Depress the playback button.

- The stator contact and the contacts of the switch strip of SK3 should properly face each other. If necessary, this can be achieved by bending the lip of bracket "32", by which the strip is pushed backwards.
- If the playback button is depressed up to its stop, the playback may not be interrupted and the apparatus may not start howling. If this is the case, indeed, screw the nuts which lock bracket "66" a few turns on bar "38" so that the playback button cannot be depressed any further.

SK2:

Depress the record button.

- The stator and interconnection contacts of SK2 should properly face each other. Adjustment: see under SK3; however, bend the tag of bracket 97 into shape.
- Depress the wind and after that the rewind button. Now the record and playback buttons should be blocked by strip "100".

III. Buttons "11" (fig. 2)

- Remove springs "25" and "53".
- Loosen screw "112" a few turns.
- Remove clamping ring "104" and pull bar "101" as far as necessary out of the apparatus.
- After the parts have been mounted again, test on stopping, winding and rewinding.
- When the rewind and wind buttons are depressed, the record and playback buttons should be blocked.

IV. Buttons "14" and "15" (fig. 9.)

a. Replacement

- Remove the split pin, ring "143", "144" or "145", clamping rings "134" and "135" and spindle "142a".
- Pull spindle "142" as far as necessary to the right out of the apparatus to replace the damaged button.

b. Remarks

- Check the exact position of the switch-strip of SK1 with the positions of this switch, which are represented on the circuit diagrams.
- The exact position of the switch-strip at impressed 3 3/4"/sec and 1 7/8"/sec can be adjusted with these apparatus by bending the upright lips of bracket "120" forward or backward.

V. Playback switch SK3 "23" (fig. 2 and 3)

a. Replacement

- Remove the driving belts.
- Remove the left-hand turntable, the carrier disc, spindle and coupling roller.
- Remove spring "108".
- Pull at the rear side of the apparatus the switch strip out.
- Remove the strip with the stator contacts.

b. Test

The contacts of the switch strip in zero position as well as in playback position have to lie in the middle of the stator contacts. These contacts should make good contact. In rest position, the switch strip is pulled with the first contact against the mounting bracket.

VI. Record switch SK2 "24" (fig. 2 and 3)

- For replacement and test, see point V.

VII. Relay Re1 "57" (fig. 2)

a. Adjustments

- Contacts 93 and 94 of SK8 should make good contact with each other of the recording or playback button or the wind/rewind button has been depressed.
- If necessary bend the brass strip of SK8.

b. Test

- Depress the playback button.
- Connect the apparatus to 180 V whereas the voltage adaptor is in the position 220 V.
- Short-circuit the contacts of SK9. Now the relay should close its contacts and Re2 should pull away the locking strip "100a".

VIII. Record/playback head K1-K101 (fig. 12)

The head K1-K101 must be so adjusted that the distance between the four tracks is equal.

Adjustment

Adjust the height of the head by means of the three screws 171, 180 and 181 so that the upper side of the core of the upper head lies at the same level as the upper side of the tape.

- Put the track selector switch in position 1-4.
- Depress the true key during recording.
- Record a signal of 1000 c/s with a depth of modulation of 100% on a new and unused piece of tape.
- Turn the tape and record the same signal.
- Put the track selector switch in position 2-3.
- Now record the 1000 c/s signal again.
- Turn the tape and record the same signal once more.

The piece of tape has now been modulated on 4 tracks. Now fill a glass cup with 100 gr. carbon tetrachloride. Add about 1/2 gr. iron powder with a corn size of 3 to 5 µ to this. Shake this mixture until the iron powder has been fully spread through the liquid. Cut a piece of about 10 cm out of the middle of the piece of tape just recorded. Plunge this piece of tape into the cup and shake a few times. Take the tape cautiously out of the cup after approx. 10 sec. and let the tape dry. The tracks recorded are now visible, since the iron powder became attached to them. The modulation tracks should look as represented in A of fig. 15. When the modulation tracks show a deviation as in B or C in fig. 15, then the tape guide of the record/playback head should be re-adjusted. For the deviation under B the tape guide has to be bent upwards, for the deviation under C downwards (see fig. 15-D). Code number iron powder A9 881 36/F10.

Adjusting the gap

Connect a vacuum tube voltmeter to Bu6. Lay a test tape of 8000 c/s 7 1/2" (A9 868 39) in the apparatus. Switch the apparatus in position playback. Now adjust to maximum output voltage with screw 181.

IX. Erase head K2-K102 (fig. 12)

For checking the adjustment of the erase head, the whole process as described under record/playback must be repeated, however, without depressing the true key. The width of the modulation tracks may not deviate more than 0.1 mm from each other now. If this deviation is greater, then the erase head should be adjusted higher or lower, which depends on the track which deviates.

X. Pressure felt "41" (fig. 12)

Test

- The pressure felt must be pressed against the head K1 without getting jammed against the protection cap and should press well against the core of the head.
- The pressure of the felt against the core should be about 15-25 grammes, which can be measured as follows:
- Apply a piece of tape in the heads but at the outside of the capstan.
- Make a knot at the end of the tape near the capstan.
- Depress the playback button.
- Put the arm of the spring-pressure gauge in the knot, and pull the tape to the right.
- The force necessary to make the tape move should lie between 15 and 25 grammes.
- Any adjustments can be made by bending the spring of the protection cap.

XI. Flywheel "44" (fig. 2, 4, 5)

a. Replacement

Remove the brake rod, driving belts "60" and "61", turntables, spindles and coupling wheels.

Put the arm of a spring-pressure gauge in the knot. Measure the pulling force, necessary to make the reel turn counter-clockwise.

2. The braking force of the right-hand brake should be 100 - 350 gr. It can be measured as described under 1, however turning clockwise.
Counter-clockwise: 65 - 85 gr.
If necessary, replace spring "58" one hole.

XVIII. Sintered bearing "73" (fig. 4)

a. Replacement

- . Loosen screws "71".
- . Loosen the nut of guide roller "46".
- . Take now the bearing plate and the bearing from the capstan.
- . After the bearing has been mounted, the capstan should be cleaned from grease by means of tetra carbon chloride.

b. Test

Test the time the flywheel keeps running as described under XI, point b-2.

Remark: The bearing of the flywheel may not be completely clamped by the bearing plates.

XIX. Sintered bearing "78" (fig. 4)

a. Replacement

- . Remove flywheel as described in XI, point a.
- . The bearing can be replaced after screws "81" have been loosened.
- . After the bearing has been mounted, screws "81" should not be completely tightened.

b. Adjustments

- . See XI, point b.
- . After the flywheel has been adjusted, screws "81" have to be tightened in turn one turn. In this case, however, the bearing may not be clamped by the bearing plate.
- . After screws "81" have been tightened, the time the flywheel keeps running must be tested again.

XX. Thrust screw "82" (fig. 4)

a. Replacement

Loosen the locking nut a few turns, after which the thrust screw can be loosened.

b. Adjustment

The screw has to be adjusted in such a way that:

1. the upper intermediate wheel "47" is under the edge of the flywheel if button $1\frac{7}{8}$ /sec. is depressed.
2. the axial play is 0.5 mm.

XXI. Coupling wheels "87" (fig. 5)

a. Adjustment

The height of the coupling wheels have to be adjusted in such a way that positions of the pulley and the two coupling wheels in front of the driving cord lie in the same horizontal plain.

The height can be adjusted by adding one or more rings "86". 150 Rings of different thickness are supplied in

b. Test

Test the winding and rewinding with a 5" - reel. If there should be any irregularities during the rewinding, the coupling caps of the left-hand coupling wheel should be replaced.

XXII. Switch SK1 "124" (fig. 7)

a. Replacement

- . Unsolder the connections.
- . Remove spring "123".
- . Turn bracket "120" counter-clockwise and lift bar "118" from its place.
- . Pull the switch strip by the protruding end out of the apparatus.
- . Remove now the strip with the stator contacts.

b. Adjustments

- . See IV, point b.

XXIII. Coupling spring "161" (fig. 10)

For replacement and adjustment, see XIV.

XXIV. Relay Re2 "175" (fig. 6 and 12)

a. Adjustment

The height of this relay has to be adjusted in such a way that the locking bracket "100a" can be pulled out till the depressed record- and playback buttons can jump back to their rest positions if this relay is energized.

b. Check

At a mains voltage of 180 V, whereby the voltage adaptor must be in the position 220 V, the relay must still function correctly.
To be checked as mentioned under VII-point b.

XXV. Volume controls R30 and R31 (figs. 2 and 7)

a. Replacement

- . Remove bracket "30". Measure first the distance between the top of this bracket and the edge of the hollow spindle on to which this clamped.
- . Remove the protection cap of the amplifier.
- . Unsolder the connections.
- . Remove spring "123".
- . Turn bracket "120" counter-clockwise and lift bar "118" from its place.
- . Pull the switch strip by its protruding end out of the apparatus.
- . Now the nut of the volume control can be loosened by means of an open-end wrench.

Remark: When the switch strip is pushed in, it has to be slightly lifted with a screwdriver.

XXVI. Tape contact SK9

The bracket of the tape contact should be in such a position with a full 7" reel, the beginning of the tape does not touch the bracket. Only after half the length of the tape has been wound off the reel, it may touch the bracket.

Tape speed

a. $1\frac{1}{2}$ " / sec.

- . Depress the 19 cm/sec button.
- . Measure a length of 9.525 m (375") on the loose end of a full reel, and mark the beginning and the end of this piece.
- . Place the reel with tape on the turntable.
- . Remove the ornamental caps "4" and "10".
- . Depress the playback-button.
- . The time between the passing of the first and the second mark should be 50 ± 1 sec.

b. $3\frac{3}{4}$ " / sec.

- . See under a.

The time between the passing of the first and the second mark should lie between 102 and 98 secs.

c. $1\frac{7}{8}$ " / sec.

- . See under a

The time between the passing of the two marks should lie between 206 and 194 sec.

XXVII. Maintenance and lubrication

a. Maintenance

From time to time any powdery tape grindings will have to be removed from the heads, capstan, pressure roller and guide rollers. For that reason the covers "4" and "10" will have to be removed, after which the parts mentioned can be cleaned with a piece of cloth with some tetra carbon chloride or a brush (no nylon). The push buttons may only be cleaned with a dry piece of cloth, and no use should be made of tetra carbon chloride, tri, etc., as otherwise the lacquer on the push-buttons would be affected.

b. Lubrication

After the apparatus has been in operation for about 1000 hours, the following bearings will have to be lubricated with one or two drops of oil.

1. The bearings "73" and "78" of the flywheel.
2. The motor bearings.
3. The bearing of the pressure roller.
4. The pulley bearings.

It is recommended to us "Esso Handy Oil", which is supplied by us under code no. C1 602 17.
The following parts should be greased with "Shell Alvania Grease EB2" (code no. A9 024 11):

1. the beds of the bearings "73" and "78" of the flywheel,
2. the bearings of the intermediate wheels "47" ,
3. the sides of the record, playback, wind and rewind push-buttons,
4. the brackets "32", "34", "97" at either side of the slotted hole,
5. the lip of the bracket of knob "7" near spring "67",
6. the tags of the brackets "19", "65", "66", "120", "178" and "183",
7. the ends of the brackets "51" and "84",
8. bracket "67" at either side of the slotted hole, just behind the raised lip with the felt pad,
9. the tags for the coupling wheels "87" and spindles "89" over the whole length,
10. the end of blocking strip "100".

When the parts are lubricated, attention should be paid that no grease or oil is spilt on the rubber parts.

I. Instructions for changing a 50 c/s into a 60 c/s recorder vice versa

- Remove the feed mechanism from the box.
- Solder the connections of the motor to the mains transformer as follows:

wire : motor-mains transformer from 2' to 3' } from 50 c/s
wire : motor-mains transformer from 5' to 4' } into 60 c/s
wire : motor-mains transformer from 3' to 2' } from 60 c/s
wire : motor-mains transformer from 4' to 5' } into 50 c/s
- Replace the guide brackets of the intermediate wheels. The distance to the new pulley is too great with an apparatus rebuilt into 60 c/s or too small with an apparatus rebuilt into 50 c/s.
 - Remove the discharge bracket of the mains flex.
 - Untighten the four fixation screws of the mounting bracket.
 - Then withdraw the whole unit.
 - Remove successively cap "154", clamping ring "153", ring "152" and the upper intermediate wheel "47".
 - Now straighten lip "125" and remove the upper guide bracket "51".
 - Remove cap "150", clamping ring "149", ring "148" and the central intermediate wheel "47".
 - Now straighten lip "125" and remove the central guide bracket "51".
 - Mount the new guide brackets in reverse order. Then turn the whole unit round its longitudinal spindle, replace the lower guide bracket and slide the unit again on its place.
- Now replace the pulley
 - For this purpose remove the driving belt "61".
 - Unscrew the screws of the bearing support.
 - Hold the propeller of the motor, turn the pulley to the left and at the same time withdraw the spring "161" from the motor shaft.
 - Turn the spring of the new pulley on the motor shaft in the same way.
 - Connect the apparatus at 80 V-, whereby the voltage adaptor must be in the position 220.V.
 - Switch on the mains switch SK7 by turning up the bracket "146a". Now the pulley must be so adjusted that the motor starts turning. (None of the intermediate wheels may touch the pulley).

Tighten the screws of the bearing support and switch SK7 still some time on and off and check the starting of the motor.

Fit the driving cord again.
Check the tape speed and the winding and rewinding.

5. Set of guide brackets for 50 c/s - A9 868 69
60 c/s - A9 868 70
- The pulley for 50 c/s - WT 860 82
60 c/s - WT 860 83

Test measurements

a. Valve voltages

- Depress one of the speed buttons.
- Turn the volume controls to minimum.

Measure the voltages given below with respect to earth. The figures between brackets indicate the numbers of the valve poles. The characters indicate the measuring points on the mounting strips, sketched in fig. 19.

Vf 6.3 V \pm 3.5 %
+1 280 V
+2 250 V
+3 220 V

Tolerance \pm 5 %

	B1	B2	B3	B4
Va	85 (E)	130 (F)	260 (L)	40 (7) V
Va'	-	110 (H)	-	250 (9) V
Vg2	76	-	200 (7)	V
Vk	1.7 (E)	1.3 (8)	17.5 (2)	V

b. Recording amplifier

- Remove B3.
- Depress the record button and the speed button mentioned below.
- Connect a V.T.V.M. between measuring point M and earth.

1. Frequency response curve of the radio/pick-up input

- Connect a tone generator to Bu3.
- Turn the volume control "6" clockwise and the volume control "5" counter-clockwise.
- Adjust the input voltage Vi in such a way that the output voltage Vu at 1000 c/s amounts to 4.15 mV (Vi must be 73 mV \pm 1.5 dB) if the button $\frac{3}{4}$ " / sec (9.5 cm/sec) has been depressed.
- For the measuring diagram we refer to fig. 17.

Frequency	1 $\frac{7}{8}$ " / sec	$\frac{3}{4}$ " / sec.	$\frac{1}{2}$ " / sec.
60	4.1	4.1	4.1
1000	4.4	4.15	4.15
8000	11.0 ++	7.6	5.15
10000		11.5	5.95
13000		12.5	8.1
16000			12.5

Tolerance : \pm 1.5 dB \pm 1 dB \pm 1 dB

+ Measured with $\frac{1}{2}$ Vi; ++ measured with $\frac{1}{4}$ Vi

2. Frequency response-curve for the microphone input

- Connect a tone generator to Bu1.
- Depress speed button $\frac{1}{2}$ " / s.
- Turn the volume control "5" clockwise and volume control "6" counter-clockwise.
- Adjust the input voltage Vi in such a way that the output voltage Vu at 1000 c/s is 4.15 mV (Vi must be 0.77 mV \pm 1.5 dB).
- For the measuring diagram, see fig. 16.

Frequency	Vu
60 c/s	4.0 mV
1000 c/s	4.15 mV
8000 c/s	5.4 mV
10000 c/s	6.2 mV
14000 c/s	9.1 mV
16000 c/s	14 mV
Tolerance:	\pm 1.5 dB

- Connect the V.T.V.M. now to the listening output Bu7.
- Adjust the input voltage Vi in such a way that the output voltage at 1000 c/s amounts to 335 mV (Vi must be 0.77 mV \pm 1.5 dB).

Frequency	Vu
60 c/s	310 mV
1000 c/s	335 mV
8000 c/s	385 mV
10000 c/s	430 mV
14000 c/s	590 mV
16000 c/s	925 mV
Tolerance:	\pm 1.5 dB

3. Adjustments of L1

- Loosen the screws "B", "D" and "G" a few turns and remove the protection cover.
- Connect a tone generator to Bu3.
- Depress the speed button $\frac{3}{4}$ " / sec.
- Adjust the frequency of the tone generator to 13000 c/s.
- Adjust the input voltage at 13000 c/s to 36 mV.
- Move the core of L1 in such a way that the output voltage is 12.5 mV.
- Seal the core with lacquer.

c. Playback amplifier

- Depress the playback button and the speed button mentioned below.
- Connect a tone generator via a 47 k Ω resistor between measuring point M and earth.
- Turn the timbre control entirely clockwise.
- For the measuring diagram we refer to fig. 18.

1. Frequency response-curve, measured at the second loudspeaker output

- Connect a V.T.V.M., to which a resistor of 5.6 Ω has been connected in parallel to the second loudspeaker output BU4.

. Measure with the input voltages given below Vi the output voltage as a function of the frequency.					
Vi	Frequency	4.75 1 7/8	9.5 3 1/4	19 7 1/2	cm/sec. inch/sec.
10	60 c/s	1780	1780	1780	mV
10	200 c/s	775	775	775	mV
31	1000 c/s	900	600	525	mV
31	8000 c/s	610	390	205	mV
31	10000 c/s	450	270	150	mV
31	14000 c/s		170	100	mV
31	16000 c/s	-	-	80	mV

Tolerance: ± 1.5 dB ± 1 dB ± 1 dB

2. Sensibility of the L-output

- . Connect a V.T.V.M., to which a resistor of 500 k Ω and a capacitor of 100 pF have been connected in parallel to the L-output BU6.
- . Depress speed button 3 1/4" (9.5 cm/sec.).
- . The output voltage must be 130 mV ± 1.5 dB at an input signal of 31 mV - 1000 c/s.

3. Test of timbre control

- . Depress speed button 3 1/4"/s.
- . Connect a V.T.V.M. with in parallel a 5.6 Ω resistor to the second loudspeaker output BU4.
- . With an input signal of 300 mV - 10000 c/s the output voltage of BU4, when R31 has been turned entirely clockwise, must be 2.3 V and if R31 has been turned entirely counter-clockwise 0.72 V (tolerance 1.5 dB).

d. Overall frequency response-curve

- . Depress speed button 3 1/4"/sec.
- . Turn the volume control R30 maximum and volume timbre control R31 minimum.
- . Connect a tone generator to the radio/pick-up input.
- . Depress the recording button.
- . Record with a constant input signal of 10,5 mV various frequencies between 60 and 13000 c/s.
- . Connect a V.T.V.M. to the L-output BU6.
- . Turn the timbre control entirely clockwise.
- . Depress the playback button.
- . The output voltage should lie within a range of 6 dB. This voltage at 1000 c/s should be > 60 mV.
- . To be adjusted with C12. (see remark)

The overall frequency response-curve can be measured in the same way with a tape speed of 7 1/2"/sec. as with a tape speed of 1 7/8"/sec. With a tape speed of 7 1/2"/sec, the output voltage at the frequencies between 60 and 16000 c/s must be within a field of 6 dB. The frequency field at 1 7/8"/sec. tape speed lies in between 60 and 7000 c/s.

Remark: By changing C12, one regulates the bias through the record head. This bias can be tested if one measures the voltages between M and earth. If one decreases the value of C12, this results in more high tones, and when the value of C12 is increased, in fewer higher tones.

LIST OF MECHANICAL PARTS

Pos.	Code number	Description	Pos.	Code number	Description
			195	WT 865 98	Connecting plate
1	WT 898 21	Counting mechanism		WT 336 17	Indicator plate for pos. 195
2	WT 855 98	Case	196	WT 231 01	Ornamental window
3	WRB801 UU/4x6	Ornamental screw	197	WT 886 61	Voltage adaptor
4	WT 252 15	Ornamental cover		WT 231 02	Ring for fixing pos. 196
5	WT 261 72	Knob, complete with spring	198	WT 835 98	Bottom plate
			199	WT 855 04	Lid for the bottom plate
	WRB903 TT/5/32"	Spring for knob 5	38+178	WT 836 46	Knee lever
6	WT 261 73	Knob	300	WT 892 15	Track selector switch
7	WT 836 70	Locking knob	301	WT 914 55	Knob
8	WT 912 64	Loudspeaker grid	302	WT 890 56	Truc button with bracket
9	WT 261 75	Push-button	303	WT 914 54	Truc button
			304	WT 902 29	Lever
10	WT 856 07	Ornamental plate	305	WT 887 56	Bowden cable
11	WT 261 75	Push button		A9 869 75	Hinge
12	WT 261 68	"OFF" button		WT 888 31	Switch SK10
13	V3 468 59	Lock for case		56 681 53/20	Core of L1
14/15	WT 261 74	Speed button		WT 765 17	Fixing spring for EF86
				WT 741 03	Tension spring for truc button
16	A9 868 74	Handle		LD 3501/74	Loudspeaker
18	WT 86. 87	Idler wheel			
19	WT 882 37	Idler wheel bearing			
22	WT 740 69	Tension spring			
23	WT 888 29	Switch SK3			
24	WT 888 30	Switch SK2	T1	WT 510 92	
25	WT 740 67	Tension spring	T2	WT 511 21	
27	WE 398 75	Microphone plug	L1	WT 561 79	
35	WT 765 23	Profiled spring	VL1	974/63	
36	WT 740 66	Tension spring	R30	B1 640 16	M
			R31		M'
37	WT 740 59	Tension spring			
39	WT 855 49	Erasing head	R32	B8 305 08E/10K	10 k Ω
40	WT 855 39	Recording/playback head	C1	909/B50	50 μ F (12,5 V)
41	WY 820 10	Pressure felt	C16	AC 8102/100	100 μ F (35 V)
43	WT 881 66	Pressure roller	C18	A 6027	50+32+32 μ F 400 V
			C5	907/1E-6E	1-6 pF
44	WY 886 03	Flywheel with capstan	C12	908/30E	3-30 pF
45	WY 646 12	Spindle of pressure roller	C25	908/30E	3-30 pF
46	WT 902 26	Tape guide	L2	WT 561 89	
47	WT 881 86	Intermediate wheel			
48	A9 869 12	Mains switch SK7			

ELECTRICAL PARTS LIST

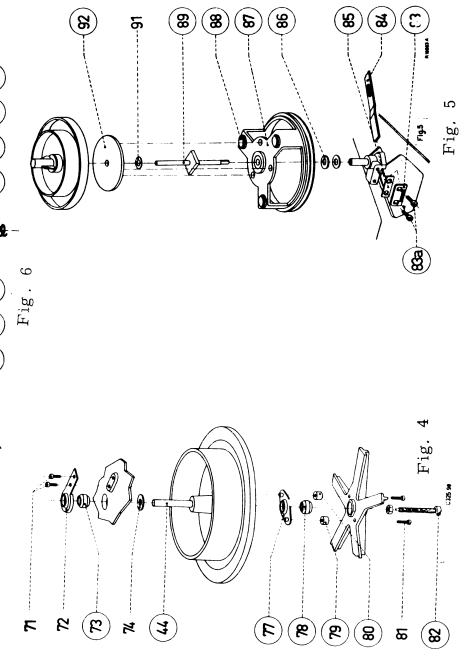
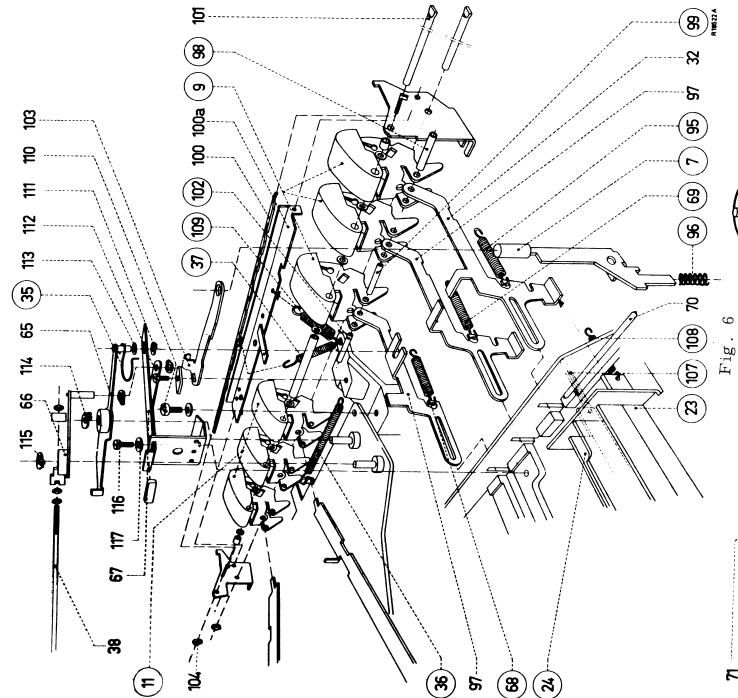
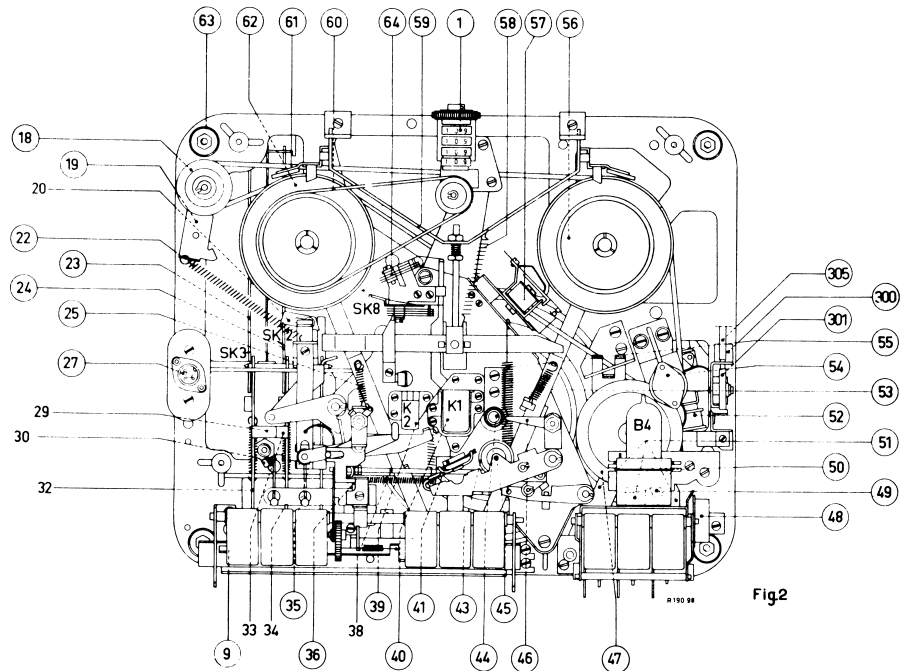
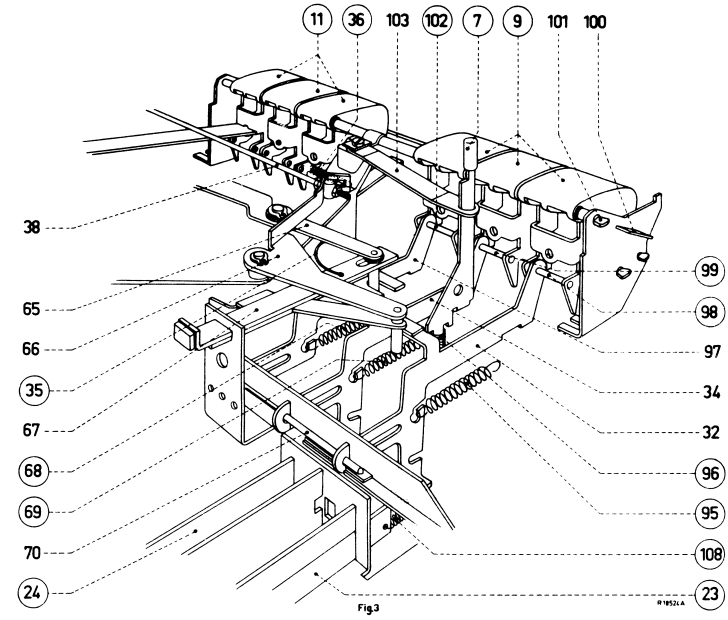
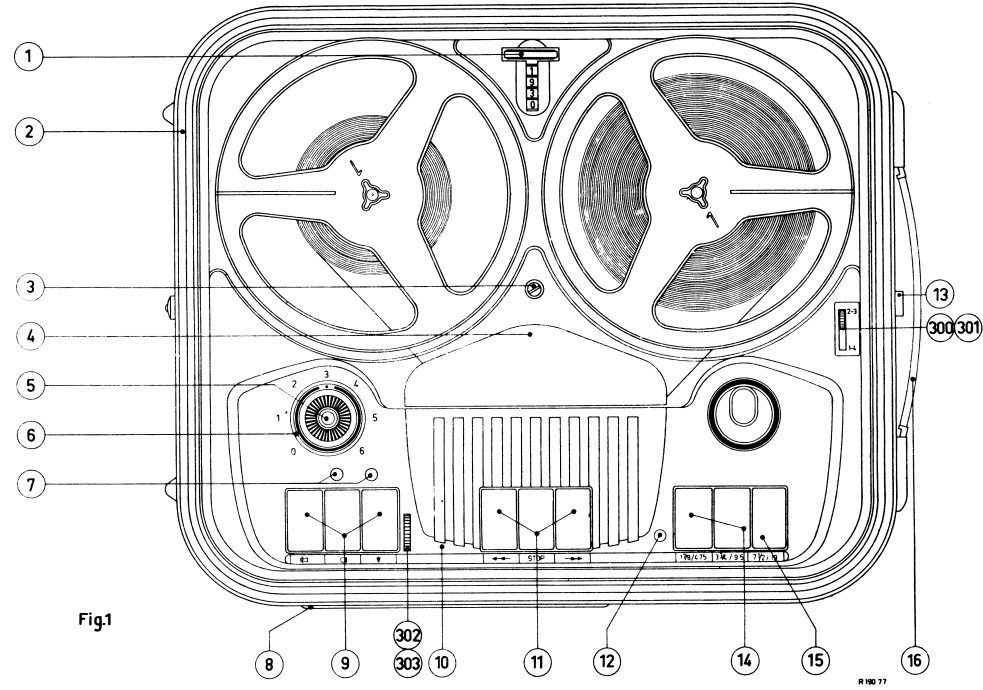
Lampholder B4
Profiled spring
Set of guide brackets for 50 c/s
Set of guide brackets for 60 c/s
Motor
Tension spring
Bearing support with pulley 50 c/s
Bearing support with pulley 60 c/s
Tension spring
Turntable, right

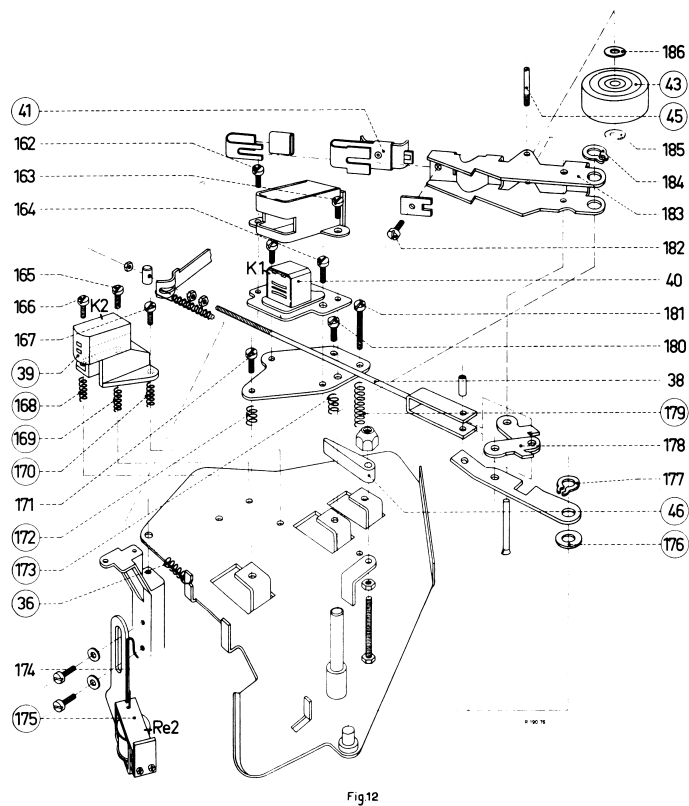
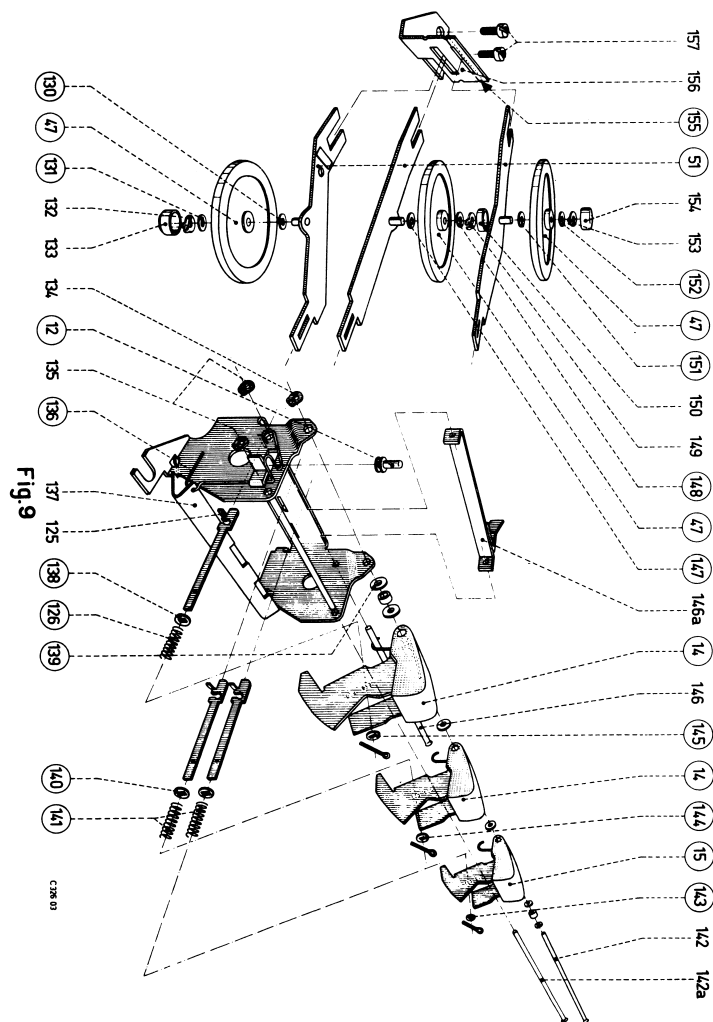
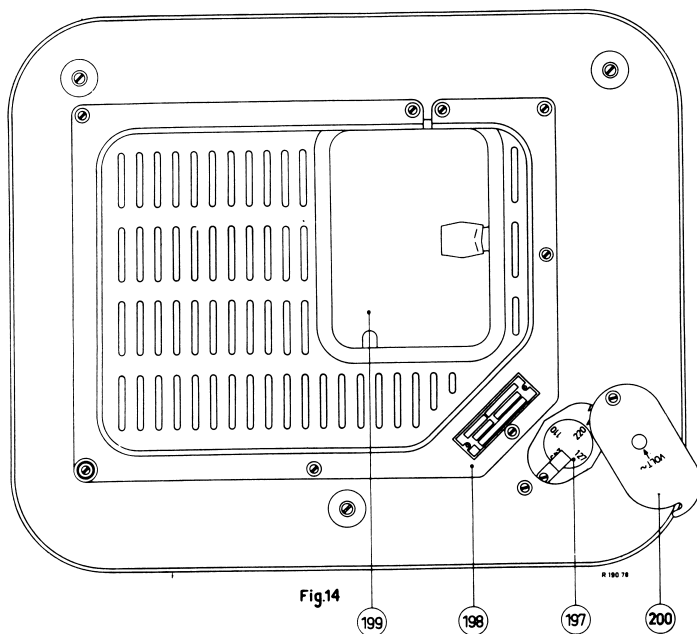
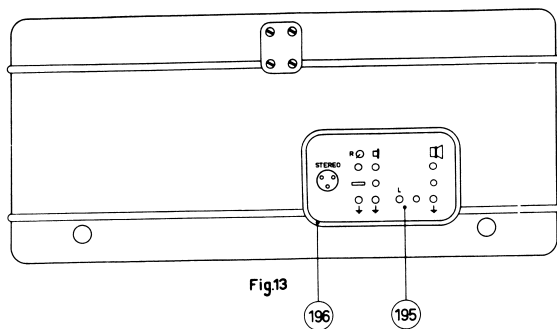
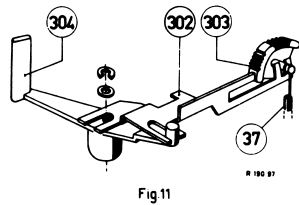
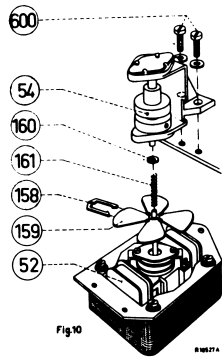
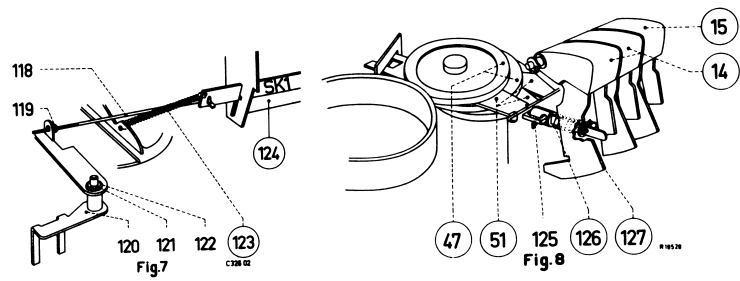
49 976/PW4x12
50 WT 765 27
51 A9 868 69
A9 868 70
52 JW 315 60
53 WT 740 67
54 WT 860 82
WT 860 83
55 WT 740 81
56 WT 821 93

Pos.	Code number	Description
57	WT 882 93	Relay Re1
59	WT 822 93	Brake bracket
60	WT 496 08	Driving cord for counting mechanism
61	WT 496 09	Driving cord
62	WT 821 94	Turntable, left
63	WT 135 16	Rubber grommet
64	WY 837 32	Switch SK8
68-69	WT 740 56	Tension spring
73	WT 265 28	Bearing
77	WT 277 17	Bearing plate
78	WT 265 28	Bearing
79-80	WT 477 20	Rubber grommet
82	WT 835 88	Thrust screw
86	A9 868 65	Bag with P.V.C. rings
87	WT 882 34	Coupling wheel right and left
88	WT 252 12	Rubber cap
89	WT 887 00	Spindle left
	WT 886 99	Spindle right
92	WT 477 97	Driving disc left
	WT 886 55	Driving discs right
94	WT 740 67	Tension spring
95	WT 740 56	Tension spring
96	WT 730 46	Pressure spring
98-99-102	WT 616 97	Spindle
107	WT 740 84	Tension spring
108	WT 740 56	Tension spring for SK3
109	WT 740 58	Tension spring
123	WT 740 65	Tension spring for SK1
124	WT 886 65	Switch SK1
126	WT 730 50	Pressure spring
130-131	A9 868 95	P.V.C. ring
136	WT 765 26	Profiled spring
138)		
139)	A9 868 95	Rings
140)		
141	WT 730 43	Pressure spring
143-148	A9 868 95	Rings
151-152	A9 868 95	Ring
155	WT 765 34	Profiled spring
158	WT 944 16	Fan
159	WT 765 52	Profiled spring
160	A9 868 95	Ring
161	WT 760 12	Coupling spring
168-170	WT 730 42	Spring
172-173	WT 730 68	Spring
174	WT 882 91	Relay Re2
176	A9 868 95	Ring

P13-5

PHILIPS MODEL EL3542





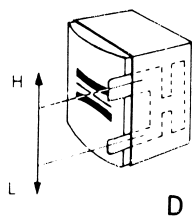
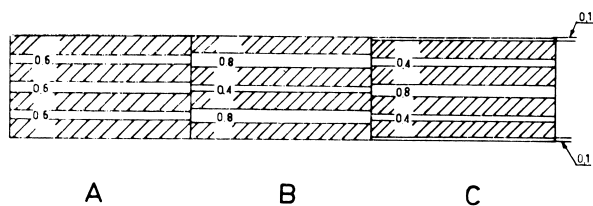


Fig.15

R 191 03

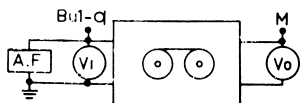


Fig.16

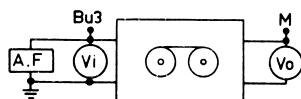


Fig.17

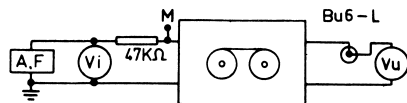


Fig.18

R 190 79

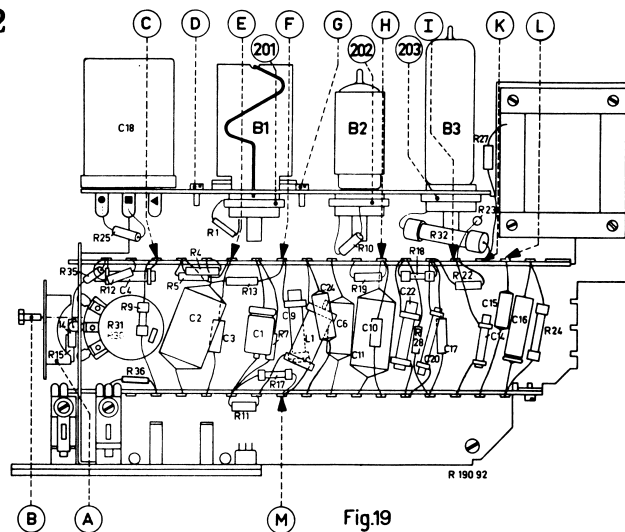


Fig.19

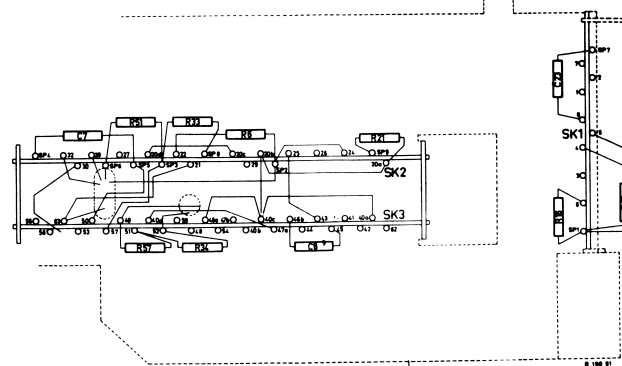
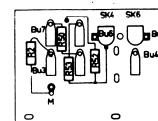
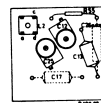
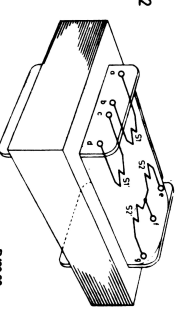
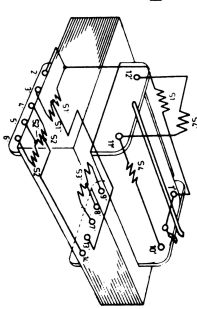
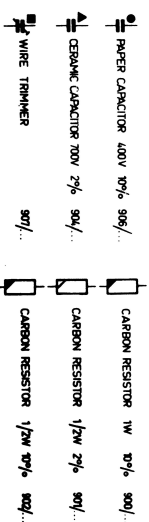
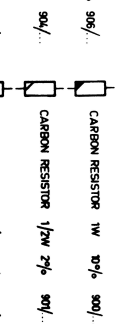
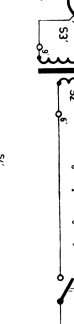
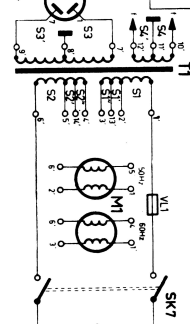


Fig20



P13-9 PHILIPS MODEL EL3542

Bc 221

EL 3515 - EL 3516 - EL 3516G -
EL 3536 - EL 3538 - EL 3541 -
EL 3542

Re : Driving cord

Before mounting a new cord it is recommended to first make the cord grooves free from oil and grease by means of alcohol. This is because the material of the cord has the property to easily absorb oil. In practice it has appeared to be very difficult to degrease this cord. During mounting one should therefore be careful that the cord does not come in touch with grease or oil.

Bc 298

EL 3542A-00

Use herewith the Service Documentation of the EL 3542.

re: Adjustment of bias current.

- Put the volume control for Radio recording to maximum and switch the apparatus to recording at a tape speed of 3 3/4" sec.
- Apply a signal of 1000 c/s 10.5 mV to BU3.
- Then record a signal of 13 kc/s 10.5 mV.
Play back these two signals and measure the output voltage.
Here the difference in output voltage at 1000 and 13000 c/s may not be more than 6 dB.
- If the difference is more than 6 dB then the biasing is too great and should be reduced.
- As a result, the distortion increases and since this may not be more than 5% a compromise should be found between the distortion and the frequency characteristic.
- For the adjustment of track 1 - 4 C12 should be turned, and for the adjustment of track 2 - 3, C30.
After adjustment the trimmers must be sealed with A9 881 01/Z120.

EL 3542 Bc 192

Re : New tape switch SK9

In order to obtain a better working of the tape switch, the switch lip of the left tape guide has been moved to the right-hand tape guide pos. 46.

As a result also pos. 46 has been modified. The parts of the new tape switch can be supplied under the following code numbers :

Tape guide	WT 902 30
Tape contact	WT 077 81

Cleaning of the Recording/playback head

In order to simplify the cleaning of the recording/playback head, the fixing of the mu-metal protecting cap has been modified. This fixing has now been executed with an elongated hole

As a result the screening can be taken off the head after the fixing screws have been undone only a few turns, see fig.1. This new screening of the head can be supplied under code number WT 855 75.

Deformation of the coupling spring

When reswitching from 19 cm/sec to 9.5 or 4.75 cm/sec the spring pos. 110, is loaded too heavily and may therefore become deformed. In order to counteract this deformation, the foam rubber damping block has been replaced by a rubber block of greater hardness.

EL 3515-EL 3516-EL 3536
EL 3538-EL 3541-EL 3542

Bc 190

Filling rings under the friction disc of the winding discs

The material of the above mentioned rings has been changed from P.V.C. to Teflon. The latter material is more resistant to wear and tear than P.V.C. as a result of which the adjustment of the height of the winding discs does no longer shift. These rings can be supplied under code number A9 868 66.1.

Winding discs

For the winding discs applied in the above apparatuses, one winding disc is supplied for the left and right-hand side under code number WY 820 01.

The diameter of the felt ring is 38 mm. and the material of the plastic upper cap is now of shock-proof polystyrene. In this way it is avoided that the three cams which take along the reel break off.

Bc 210

EL 3536 - EL 3538 - EL 3542

In the above mentioned apparatuses it may happen that the coupling spring between motor and motor pulley causes a rattle. This can be remedied as follows :

- a. remove the cooling fin.
 - b. adjust the pulley with respect to the motor as described in the service notes.
 - c. turn the pulley by hand and apply a layer of pliobond glue with a brush on the coupling spring, that means provide the coupling spring with a cover of pliobond. Turn the pulley further around until the glue has sufficiently dried in and does not flow anymore.
 - d. after that provide the seams and the fixing rile of the cooling fin with pliobond.
 - c. mount the cooling fin on the motor shaft and allow the spring and the cooling fin to dry for about 15 minutes.
- The code number of the required glue pliobond 30 is A9 881 42/t30.

Supplement to Bc 210

It has been mentioned in the Service Information Bc 210 that the coupling spring should be greased with pliobond. By this, however that part of the spring is meant which has not been clamped on the motor or pulley shaft. The parts of the spring which have not been clamped on the shafts, should remain from pliobond, as otherwise the spring cannot slip over the shaft anymore when switching back to a lower tape speed. As a result, deformation of the spring may occur.