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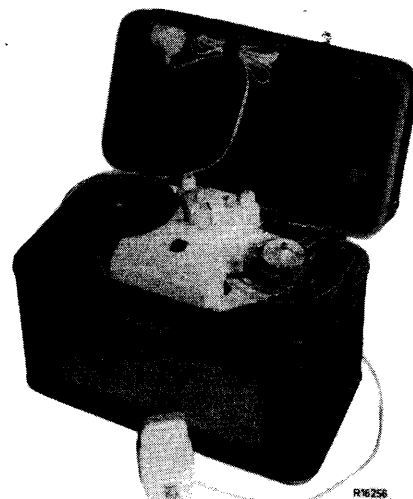
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THE CENTRAL SERVICE DIVISION
N.V. Philips' Gloeilampenfabrieken
Eindhoven

PHILIPS

SERVICE NOTES

EL 3510



1957. For A.C. mains supply

Dimensions : 350x190x245 mm
Consumption : 50 W approx.

Weight : 9.5 kg approx
Loudspeaker AD 3512

Tape length with normal tape 180m

Tape length with long play tape 260 m

Normal tape:

Long play tape :

Time of playing 2 x 30 min.
Fast forward winding 85 sec. approx.
Fast back winding 85 sec. approx.

Time of playing 2 x 45 min.
Fast forward winding 120 sec. approx.
Fast back winding 120 sec. approx.

Specification

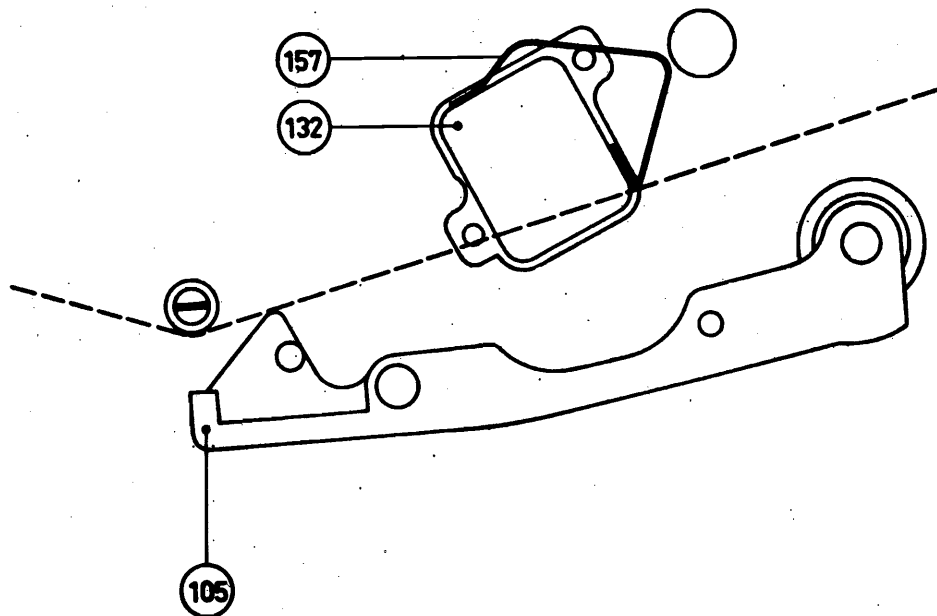
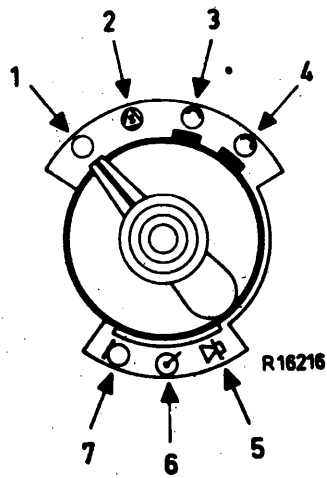
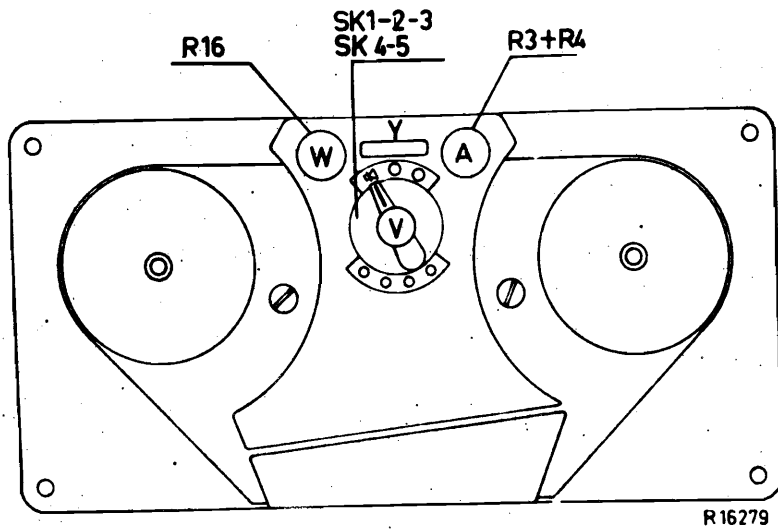
EL 3510-00 110 V- 240 V- 50 c/s
EL 3510-27 110 V- 240 V- 50 c/s
EL 3510-60 110 V- 240 V- 60 c/s

Some ordering numbers

Microphone	EL 6100
Empty reel 5"	EL 3912
5" reel with 180 m	EL 3915
5" reel with 260 m	EL 3915-50
Gummed tape	EL 3916
Leader tape (green)	EL 3917
Leader tape (red)	EL 3918

Amplifier part:

Valves :	B1a, b	ECC 83	Amplifier valve
	B2	DM 71	Indicator valve
	B3	EL 84	Output- and oscillator valve
	B4	EZ 80	Rectifier



Connections

The apparatus is supplied from A.C. mains, and can be adapted to the voltages indicated by means of the voltage adaptor.

This voltage adaptor is accessible by removing the plates pos. 252 (see page 18).

On this apparatus are connections for;

- a. an additional loudspeaker (in this case the internal loudspeaker is disconnected).
- b. Microphone
- c. Record player/Radio.

Controls

Knob A. With this knob the input signal of Radio/pick-up and microphone can be adjusted R3-R4 are connected to this knob.

Knob W. With this knob the output signal can be adjusted. R16 is connected to this knob.

Indicator Y. The input signal of microphone or pick-up should be adjusted in such a way by the knob A that the line and point which light up, just do not touch each other, at the greatest signal peaks.

Central control knob V

With the central control knob V the apparatus can be put both mechanically and electrically in the various positions.

In the description of this apparatus that follows for convenience' sake the various positions are numbered from 1 to 7 inclusive (see the diagram for comparison alongside).

Position 1. Motor and amplifier are switched off in this position.

Position 2. The amplifier receives high tension, because SK4 is switched on.

At the same time the amplifier is connected as a pick-up amplifier.

Position 3a. The motor is switched on by SK5.

(Knob not pressed in).

Position 3b. Fast forward winding of the tape.

(Knob pressed in). (Thus the turn tables turn to the left).

Position 4a. Like position 3a.

(Knob not pressed in).

Position 4b. Fast rewinding of the tape.

(Knob pressed in). (the turn tables turn to the right.)

-4-

Position 5. "Play back"

The tape is now jammed between the driving shaft 42 and the pressure roller 106.

The tape speed is determined by the rotation speed of the driving shaft.

Electrically the apparatus is connected by SK1 as play-back amplifier.

Position 6. "Recording" Radio pick-up signal.

The mechanism remains in the same position as with position 5.

Electrically, however, the amplifier is connected as a recording amplifier by SK1 + SK2.

Position 7. "Recording" microphone signal.

The mechanism remains in the same position as in position 5.

Electrically the amplifier is connected as a recording amplifier for microphone by SK1.

Inserting the tape.

Put the full reel on the left-hand turntable and the empty reel on the right-hand turntable. Be carefull that the dull side runs against the heads.

This should be done because the rull side is the sensitive side of the tape.

Now in order to bring the tape through the slit in the cap, the central control knob should be placed in the positions 1 or 2.

This is because in the other positions the pressure roller lever is straight under the inserting slit in the cap and as a result of this it is not possible to insert the tape.

Recording a radio/pick-up signal

Make the connections at the rear of the apparatus.

Place the central control knob V in the position 6.

Now adjust the signal strength with knob "A" (R3-R4) in such a way, that the indicator Y indicates the correct modulation depth.

Recording a microphone signal

Put the plug of the microphone into the plug at the rear of the apparatus.

Adjust the signal with knob "A" (R3-R4) in such a way that the indicator Y indicates the correct modulation depth.

Erasing the tape

Normally the signal that might still be present on the tape, is erased automatically during recording.

However if one wishes to erase the signal on the tape, without making a new recording, proceed in the following manner:

Turn the knobs W and A entirely to the left.

Now place the control knob V in the position 6 or 7.

After erasing put the knob V back in the rest position (1)

Twin track recording

The height and adjustment of the heads are such that in this apparatus the tape can be modulated with 2 programmes.

If the tape is full with the first programme and one wishes to record a second programme, in this case the tape should not be rewound on to the left-hand reel.

The full reel and the empty reel should be exchanged however in such a way, that the dull side of the tape again runs against the heads. The other side of the tape can now be modulated in the normal way. Now in order to be able to play back the 2 programmes one after the other, the reels should be exchanged after the first programme has been played back.

Greasing scheme

Grease the following points with graphitic lubricant X 013 58.

The bearing in the mounting plate 1 for the shaft 83 of the switch.

The bearing in the switch plate 70 for the switch shaft 83.

Pin 83 and the fork plates 74. Cam disk 80 and the lifting bracket 32 at those places where they touch each other when the cam disk moves.

The bearing places of shaft 33 with the lifting bracket 32.

The lip on the lifting bracket 32 and the points of contact of this lip on the intermediate wheel bracket 24. The feed through holes in the mounting plate 1 and the lips of the brake levers 62 and 63.

Slotted holes in the coupling levers 60 and 61 and the control strips on the brake levers 62 and 63.

The bearing places of the stop lever 91 and shaft 9.

The shaft 92 and the bearing roller 93 on the stop lever.

The bearing places on the guide lever 98 and the shaft 97.

The shaft 99 and the roller 15 on the guide lever 98.

The fork of the fork screw 101.

Smear the following points with grease X 013 15

The bearing surface of the locking plate 89 on the switch ring 85.

Shaft 103 of the guide lever in the pressure roller lever 105.

Shaft 108 and the bearing of the pressure roller 106.

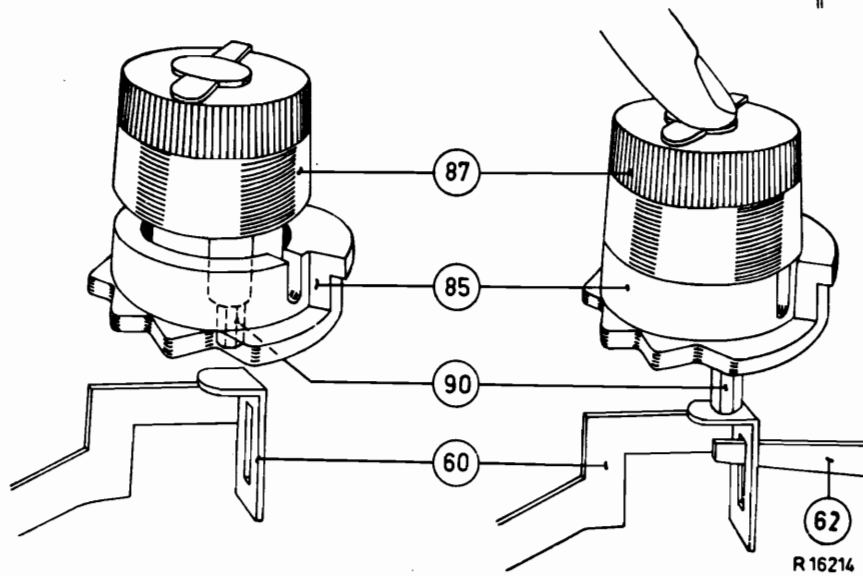
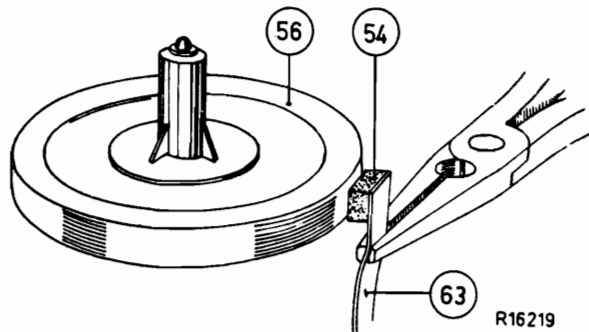
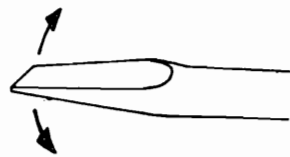
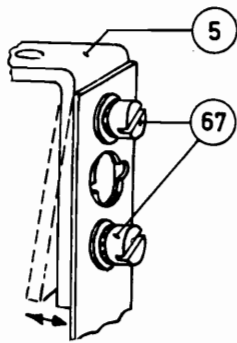
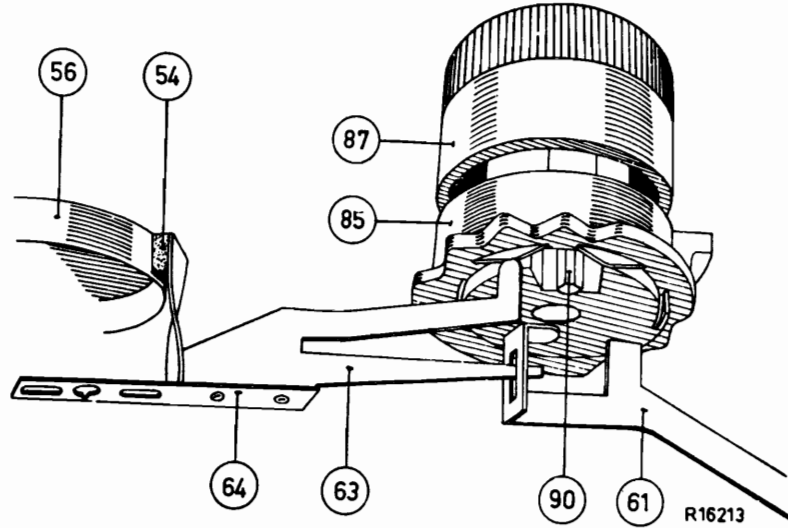
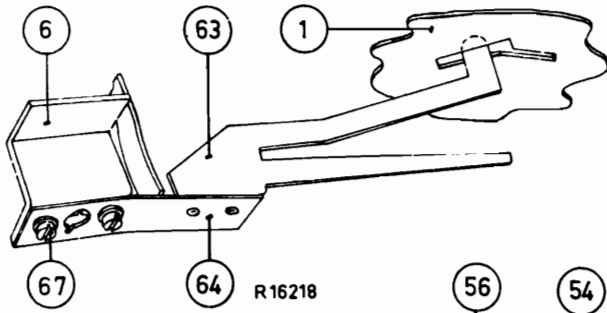
The ball 43 and the bearing surface of the shaft 42.

The pivot plates 66 and the bearing surface of the reel shafts 48 on the pivot plates.

Smear the following points with lubricating oil X 007 12

The bearing of the cup washers 56 and the shafts 48. The bearing 39 and the shaft 42. The bearing of the shafts 48.

Hub 19 and the shaft 21.



DESCRIPTION OF THE MECHANISM

The various levers in the apparatus can be controlled with the central control knob.

Brake brackets 62 and 63.

The brake brackets 62 and 63 protude with their ends through the mounting plate 1 against the lower side of the switching ring 85. The switching ring 85 has been fixed to the central control knob in such a way, that it can be carried along in all 7 positions of this knob.

In the positions 3 and 4 the control knob 87 can be pressed entirely and in the positions 5 to 7 inclusive partly. The lower side of the switch ring 85 has a defined toothed profile. By this the brake levers 62 and 63 are pushed downwards simultaneously or separately in some positions of the control knob. Thus the brake disks 54 come free from one or both reel-discs 56 so that these reel-discs can turn freely.

The adjustment of the brake brackets 62 and 63.

This is made in the following manner:

1. Unscrew the screws 67 a little.
2. Adjust the brake brackets 62 by fitting a screw driver in the hole in the brackets 6 and in the springs 64 in such a way, that the cam at the end runs freely through the slotted hole in the mounting plate 1.
3. Bend the raised lip at the brake brackets 62 and 63, to which the brake disc has been fixed, in such a way that in position 5 of the central control knob the distance between the brake disk 54 and the turntable 56 amounts to about 0.5 mm.

The coupling levers 60 and 61.

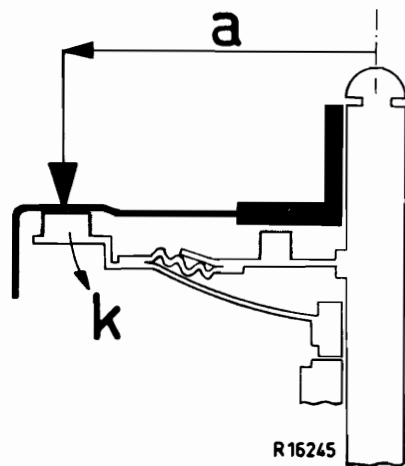
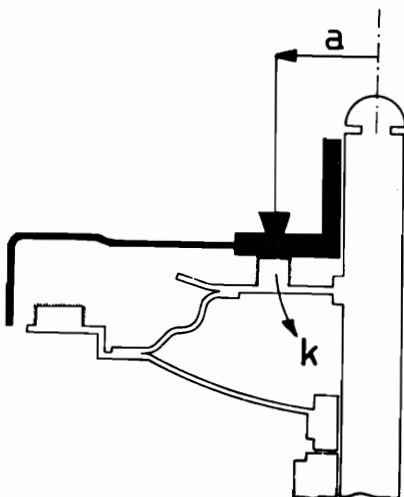
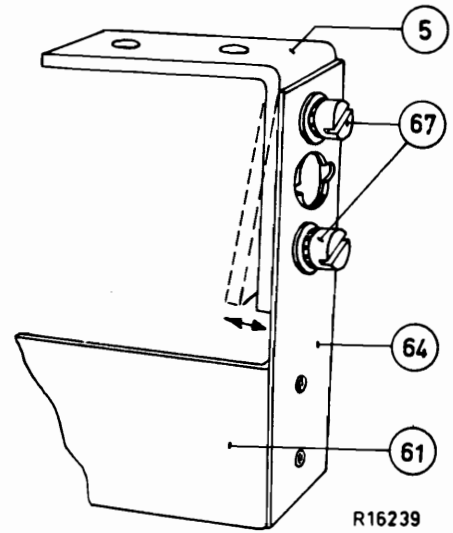
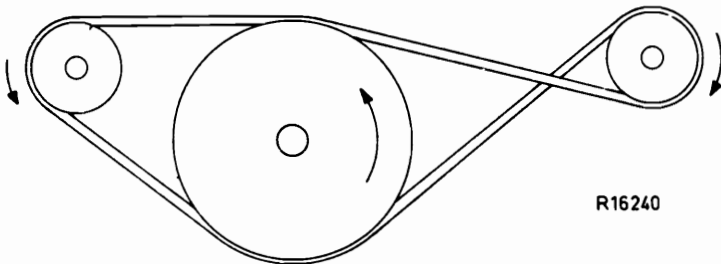
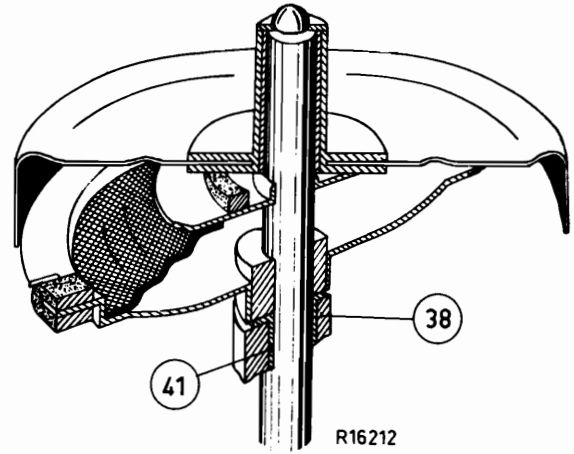
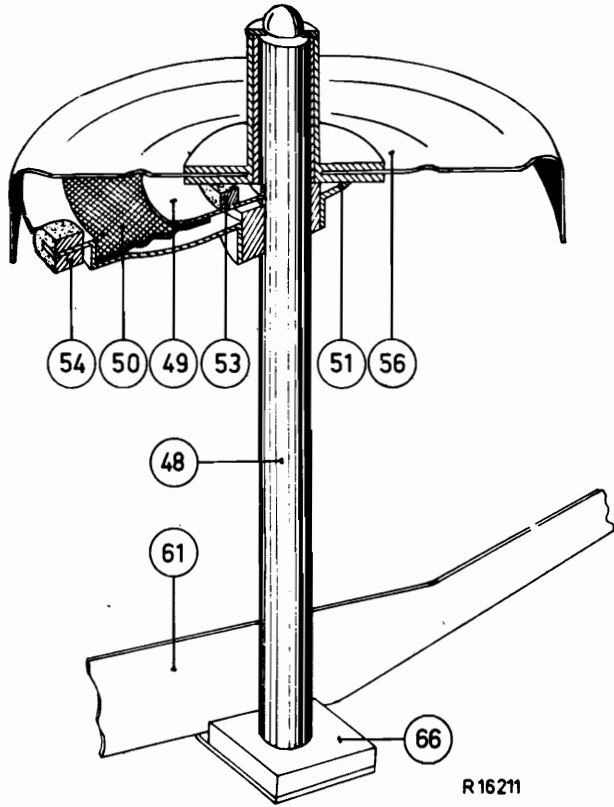
The control knob 87 can be pushed entirely downwards in the positions 3 and 4.

At the lower side of the control knob 87, the switch pin 90 and the plate 89 have been fixed, which slip into the switch ring 85 through a hollow.

In the control knob 87 a spring has been mounted, which keeps knob 87 raised upwards. The plate 89 is intended to prevent knob 87 from springing out.

If the control knob 87 is pushed downwards, the switch pin 90 slides through a slotted hole into the mounting plate 1 and pushes the end of the coupling lever 60 or 61 downwards. The latter depends on the position of the central control knob.

In the ends of the coupling levers 60 and 61 slotted holes have been made. If in position 3 for instance the left-hand coupling lever 60 is pushed downwards, the right-hand brake lever 62 is pushed along, too.



When pressing the control knob in position 4, just the reverse takes place, viz. here the left-hand brake lever 63 is pushed along by the right-hand coupling lever.

The first adjustment of the coupling lever 60 and 61.

This is made as follows:

1. Bend the brackets 5 in such a way that the cams at the ends of the coupling levers are straight before the slotted hole in the mounting plate 1 under the switch pin 90.

A plate 66 on which the pivot shaft 48 of the reel discs rests has been mounted on the horizontal part of the coupling lever 60 or 61. If the coupling levers 60 and 61 are pushed downwards by the control knob, the reel shaft 48 and the cord disc 58 will also move downwards. The latter by the weight of the shaft + cord disc, turn table and the reel on it, with or without tape.

A metal disc has been fixed to the said shaft 48, on which a felt ring has been fixed.

The friction disc 51 is connected to the metal disc by a corrugated flexible piece of linen (50).

The bearing of the friction disc can be shifted a certain distance over the shaft 48 and rests on the bearing 41 of the shaft 48.

In the highest position of the reel shaft 48 the reel disk 56 rests thus on the felt ring 53. In the lowest position, i.e. with the control pressed in, the felt ring moves downwards and the turn table comes on to the 3 felt or plastic discs.

In the positions 5 to 7 inclusive the cord 140 and the cord discs are turned by the flywheel 42, the left-hand turn table is turned to the left and the right hand turn table to the right.

This is caused by the friction between the felt ring 53 and the turn table.

During recording or playing back, i.e. in the positions 5 to 7 inclusive, the tape is jammed between the flywheel shaft 42 and the pressure roller 106.

By this the tape is given a constant speed.

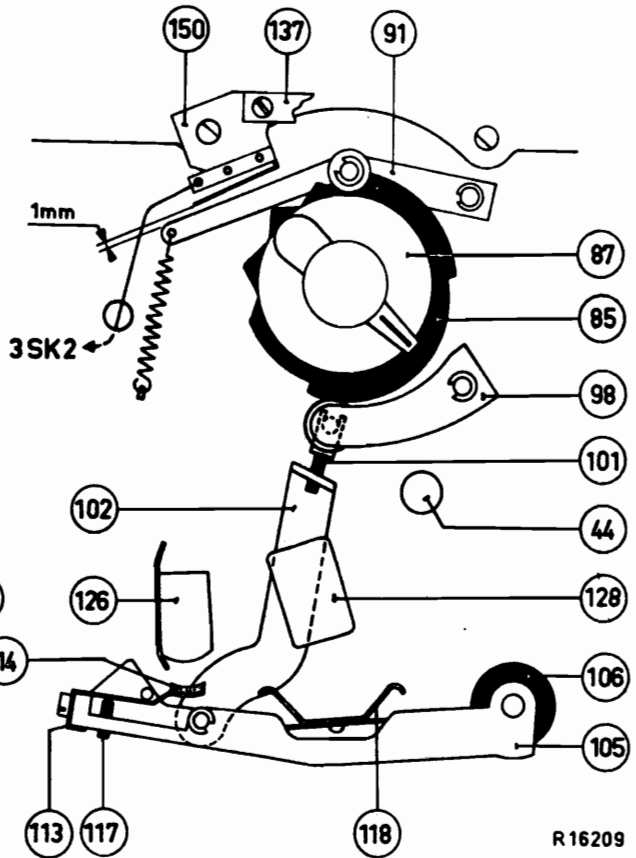
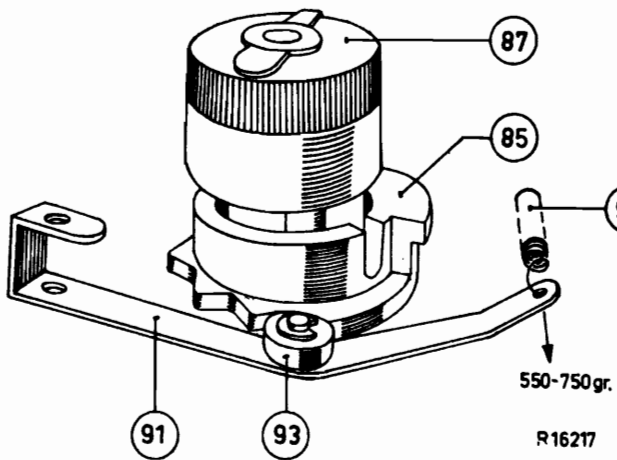
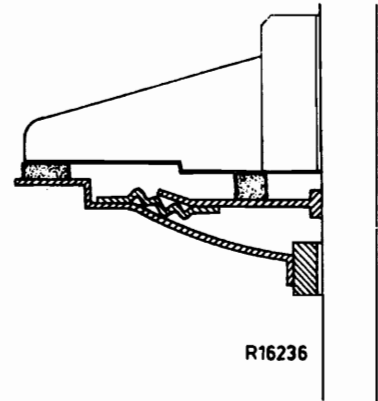
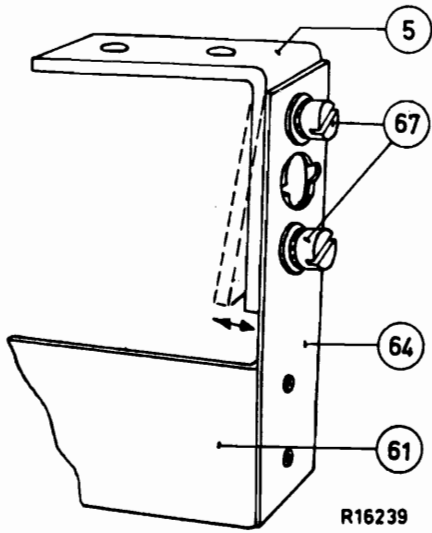
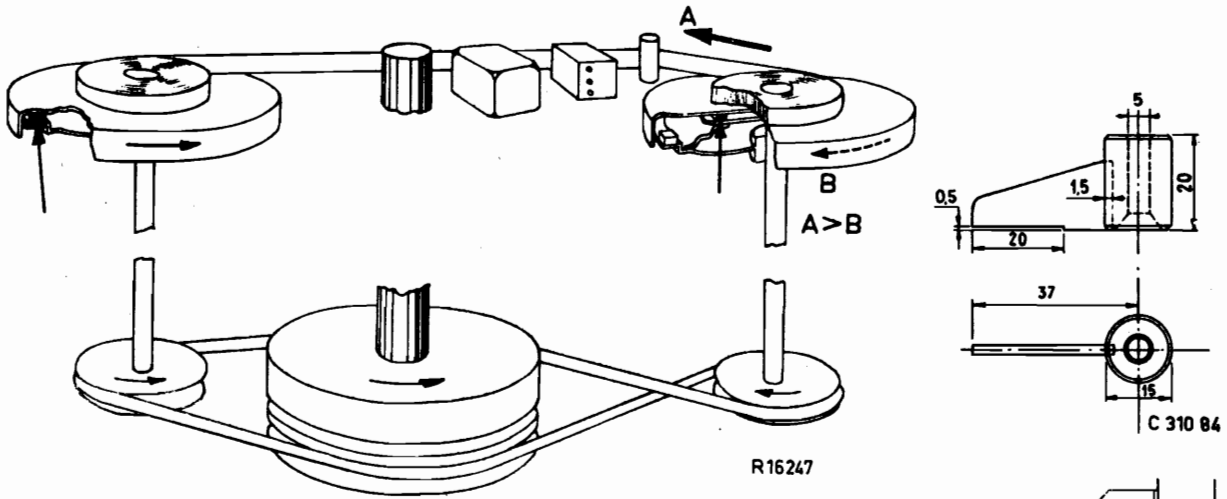
The left hand reel disc is then turned by the tape in a direction opposite to its original one.

As a result of this the tape obtains a slight tension. The right hand reel disc pulls at the tape, in view of its direction of rotation, so that here, too, a slight tension arises.

Both forces are very small, however, and only serve to keep the tape taut so as to avoid the forming of loops.

The friction coefficient between the plastic of the turn table and the felt ring 53 being very small, the force K is also small. Also the distance between the centre of the reel shaft 48 and the felt ring 53 is very small.

Therefore the coupling moment (= force x arm) of the turn table 56 will be small. If, by pressing the control knob 87, however, the felt ring 53, and so the bearing surface of the turn table, is pushed downwards, the turn table sinks on to the three felt or plastic discs 54.



The distance between the centre of the shaft 48 and the circle through the three pieces 54 now becomes several times greater and so the moment force x arm also becomes much greater.

This means therefore that with the pressed position 4 of the control knob 87, the turning moment of the left-hand turn table 56 is much greater than that of the right-hand turn table 56.

If the tape has been put normally into the apparatus, the left-hand reel will pull more strongly at the tape than the right-hand reel. The right-hand reel is now turned opposite to its original direction by the tape.

The turning moment of the left-hand reel should be so great that if the left-hand reel is full and the right-hand reel is empty, the tape should still be rewound.

When the control knob is pressed in position 3, the reverse applies. In this position the tape winds forward.

The second adjustment of the coupling levers 60 and 61

This is as follows :

For this adjustment one makes use of an auxiliary tool; for the dimensions see the figure.

1. Remove the turn tables 56 after removing the clamping rings 57.
2. Now slide the auxiliary tool on a reel shaft.
3. Place the control knob 87 in the position 4 or 3.
4. Press the control knob so that the reel shaft on which the auxiliary tool lies, sinks.
5. Let go the control knob again.
6. Adjust the coupling bracket 60 or 61 in such a way that the wing of the auxiliary tool just touches one of the blocks 54.
7. In the same way also adjust the other coupling bracket.
8. After that remount the turn table 56 and the damping rings 57 .
9. Check the apparatus for right-hand and left-hand winding.

The switch ring 85

The circumference of this switch ring has a definite toothed form. Owing to this, this ring is locked in the 7 positions of the control knob. This occurs by means of the spring 96 which presses the roller 93 on the lever 91 into the tooth of the switch ring 85.

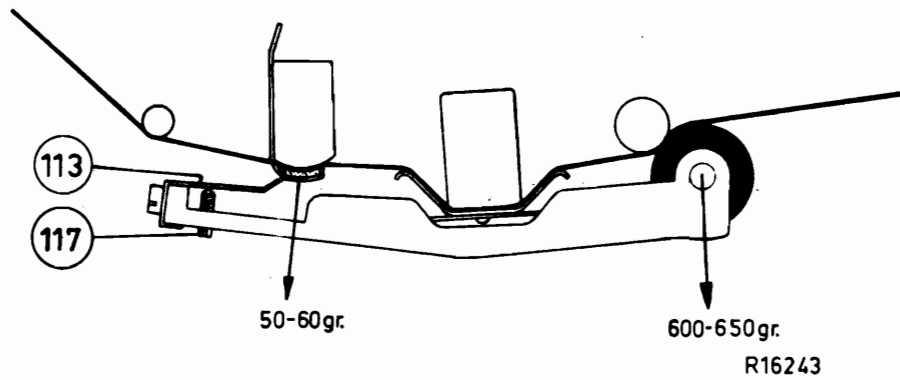
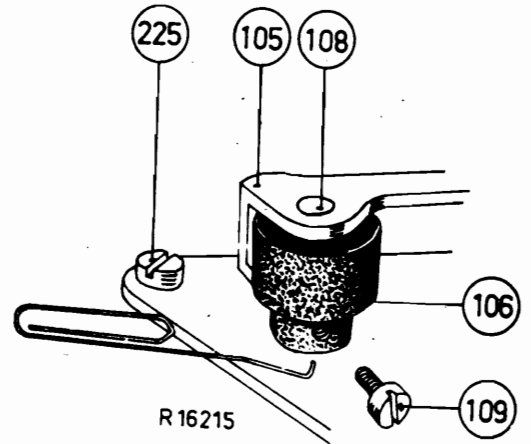
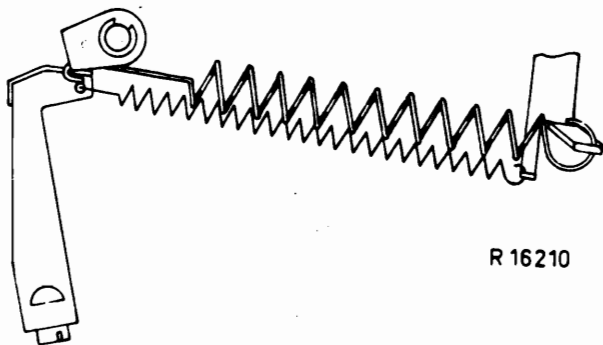
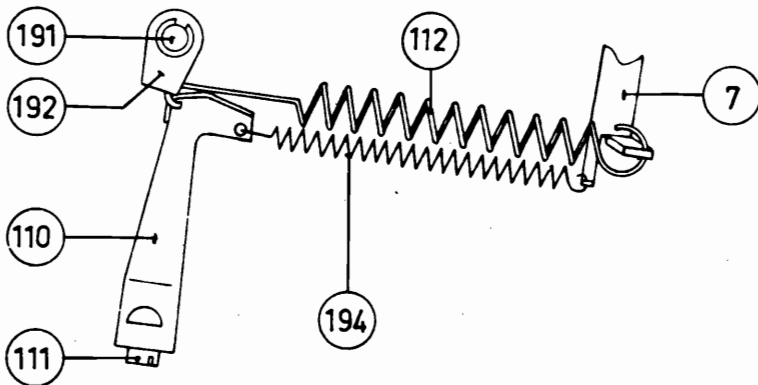
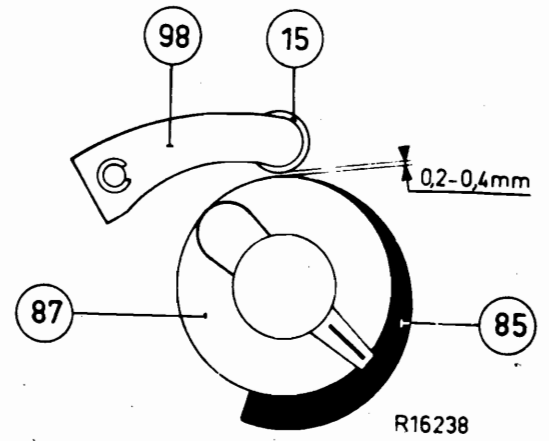
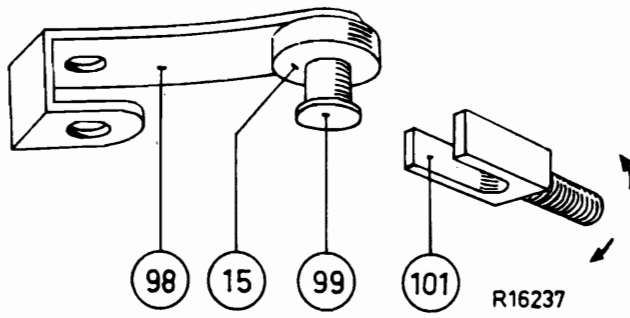
The adjustment of the lever 91

The tractive force of the spring 96 measured at the working point of this spring in the lever 91 should lie between 550 and 750 gr.

The circumference of the switch ring has also a cam with involute toothing.

Against this cam roller 15 runs on the shaft, which has been fixed on lever 98. The latter lever (98) rotates around the shaft 97 which has been fixed in the mounting plate 1. The lever 102 has been fixed rotating to the shaft 103 in the pressure roller lever 105. In a threaded hole at the end of lever 102 the fork screw 101 has been fitted rotating.

The fork screw 101 snaps around the shaft near the roller 15 in the lever 98.



The pressure roller lever 105 is always drawn in the direction of the driving shaft 42 by the tension of the springs 112 and 194. By the presence of the lever 102, fork screw 101, lever 98 and the roller 15 the position of the pressure roller lever depends on the position of the central control knob 87.

The adjustment of the fork screw 101

This has to be done in such a way that in position 5 of the central control knob the distance between the roller and the cam on the switch ring amounts to 0.2 - 0.4 mm.

In order to turn the fork screw 101, the pressure roller lever 105 should be turned away by hand from the driving shaft.

The pressure roller lever 105

This is drawn in the direction of the driving shaft by the tension of the springs 112 and 194.

Here a special construction has been applied with the springs 112 and 194, bracket 192 and lever 110.

If the strong spring 112 was fixed directly to the lever 110, an ever increasing force would be necessary for turning the pressure roller lever outwards.

With the above construction the bracket 192 absorbs a great part of the tractive force of the spring 112 in the positions 1-2-3- of the central control knob. The spring 112 therefore starts giving the full tractive force between the positions 4 and 5 of the control knob. The second advantage of this construction is that when releasing the central knob between the positions 4 and 5 the pressure roller 106 does not come against the driving shaft 42 with too great a speed, thus preventing loops from forming.

The adjustment of the pressure roller lever 105

The force with which the pressure roller 106 presses the driving shaft, measured at the place where it touches the driving shaft, lies between 600 and 650 gr. The latter can be adjusted if necessary by bending the bracket 7 a little in the desired direction. The pressure roller 106 can be taken out of the apparatus in the following way without dismounting of the pressure roller lever 105 being necessary.

1. Unscrew screw 109 a few turns.
2. With a piece of iron wire which has been bent over at one end, push the shaft 108 so far upwards that this can be pulled out of the pressure roller lever 105 at the upper side.

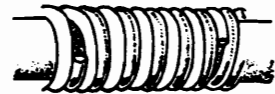
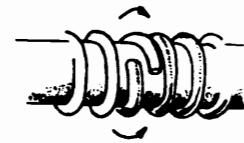
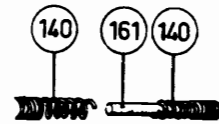
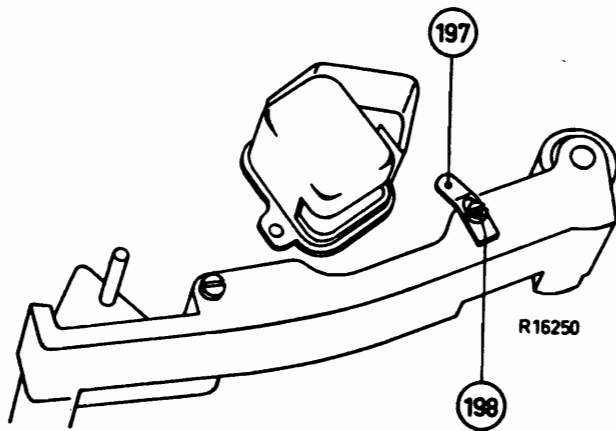
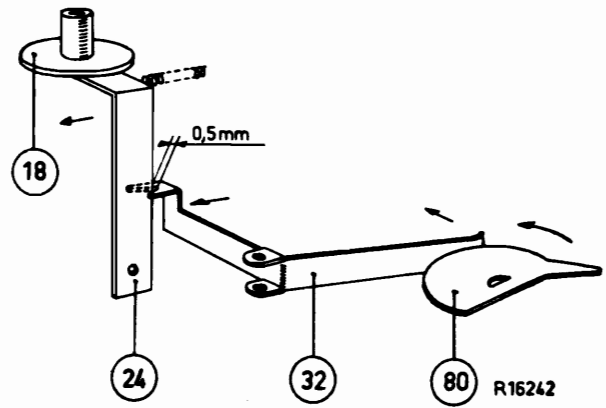
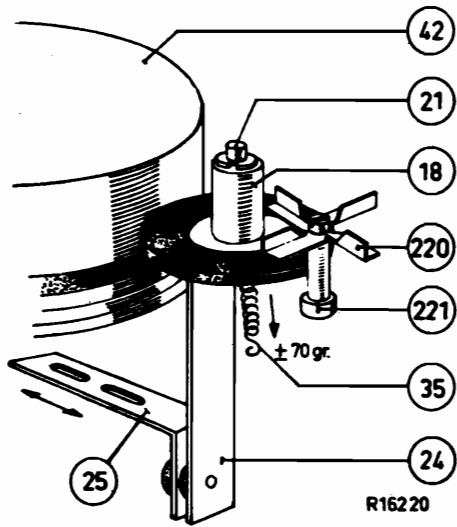
Damping bracket 118 and pressure felt 114

The damping bracket 118 pushes the tape over a greater surface against the recording/play back head K1 as a result of which the contact between head and tape becomes more firm.

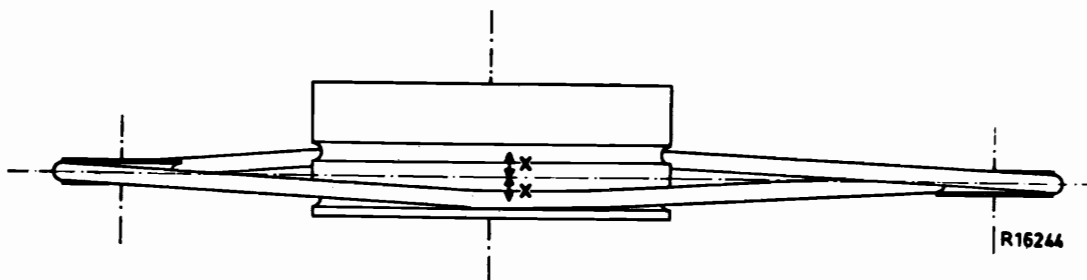
If now and then some space should arise between the head and the tape (for instance if the tape is not taut enough) this can be immediately observed by the occurring voltage fluctuations. The tape is kept taut by the pressure felt 114 and by the pulling at the tape of driving shaft 42 and pressure roller 106.

The adjustment of the pressure felt 114

The pressure felt should be adjusted by means of the adjusting screw 117 in such a way, that the pressure measured at the place where the felt 114 touches the erasing head, lies between 50 and 60 gr.



R16249



R16244

Intermediate wheel 18 and intermediate wheel bracket 24

The intermediate wheel 18 rotates on the spindle 21 at the bracket 24. The bracket 24 is fixed to bracket 25 so that it can rotate. Bracket 24 is pulled by the spring 35 in such a direction that the intermediate wheel is drawn against the motor pulley 221 and against the flywheel 42. By the special form of disc 80, which has been fixed to the shaft 83 of the control knob 87, this disc presses against the rear of the lever 32 in the positions 1 and 2. By this the intermediate wheel is lifted from the motor pulley 221 and flywheel 42 by the lifting lever 32 in the positions 1 and 2 of the control knob 87.

This is done in order to avoid the rubber intermediate wheel being dented by the motor pulley, when the mechanism is stopped.

The adjustment of the intermediate wheel 18

When the intermediate wheel turns, it should run perpendicular to the shaft of the motor pulley 221 and the flywheel 42.

This is adjustable with bracket 25. At the same time the intermediate wheel 18 should come against the motor pulley 221 and the flywheel 42 just after the motor has been switched in the position 3. By bending the lifting bracket a little in the desired direction, this can be adjusted.

The tractive force of spring 35 which draws the intermediate wheel 18 against the motor pulley 221 and the flywheel 42, should be about 70 gr in working direction.

In the positions of the control knob 3 to 7 inclusive there should be a play of about 0.5 mm between the intermediate wheel bracket 24 and the place where it hooks into the fork of the lever 32 in the rest position.

This can be adjusted by bending.

The driving cord 140

The flywheel 42 drives the cord discs 58 via the cord 140. The ends of this cord are connected to each other in a special manner.

1. Stretch about 5 turns at both ends of the cord.
2. Fit the plastic coupling piece 161 in one of the ends.
3. Insert the cord into the space between the flywheel 42 and the casing 38.
4. And put the cord in the right manner on the thin part of the cord disc. The path of the cord has been indicated in fig. B.
5. Give the cord an initial stress of 5 turns by retaining one of the ends and by turning the other end 5 turns counterclockwise.
6. Now slide one cord end over the coupling piece 161 and twist the ends together for 5 turns.
7. The cord ends should not have more than 5 turns initial stress. When they have too much initial stress, the cord ends are always twisted further together, as a result of which the cord becomes stiff over too great a length, which causes wow. In case of too little initial stress the cord ends work themselves loose after some time.
8. Stretch the cord a little as possible. For this reason the cord should not be put over the cord discs, when twisting the ends together.

The cord discs 58

The cord discs 58 are driven by the cord 140. The cord discs should be fixed in such a way on the reel shafts that the imaginary connecting line drawn by the grooves in both cord discs just falls between the 2 running grooves of the flywheel. This is adjustable after the set screw 59 has been loosened.

After this adjustment it should be checked whether the brake discs 54 slide under the turn tables 56, when they are pulled upwards. If this is the case, the cord disc 58 should be taken from the reel shaft 48 and an additional ring should be put between the bearing 41 and the cord disc 58.

After that the above should be checked again.

The switch plate 70 (see fig. B)

The switch plate is intended in the first place for the bearing of the switch shaft 83. This can be shifted after the screws 71 have been loosened.

The switch plate 70 should be screwed in such a way that the switch shaft is perpendicular to the mounting plate 1.

The switches 72 are fixed in the slotted holes in the switch plate 70 at the same time.

The switches 72

These can be shifted in the slotted holes in the switch plate 70 and should be adjusted as follows:

1. Place the central control knob 87 in position 1.
2. When switching to the position 2, the pin 81 on the plate 80 should just snap in the fork 74 and switch the first switch.
3. When turning through to position 3, the pin should just snap in the fork of the second switch and switch it, too.
4. Then turn the control knob 87 back to the positions 2 and 1, as a result of which the switches should switch back again. The pin 80 should not snap too deep in the forks 74, as otherwise these will be distorted.

Oil blocking ring 136

This has been fitted in order to prevent the oil from climbing up from the bearing of the flywheel shaft 42, which causes the driving shaft to become greasy and causes slipping.

The ring 136 should lie about 2 mm above the bearing of the flywheel spindle 42.

The driving (see fig. B)

Motor

The whole rotating mechanism is driven by the motor pos 210-223. The motor is an asynchronous motor. When the motor is connected to a frequency of 50 c/s the number of revolutions is about 2900 r.p.m. At a frequency of 60 c/s this number of revolutions is accordingly greater and at 40 c/s smaller.

In order to be able to use the same motor for 40-50 and 60 c/s, pulleys have been designed with different diameters, in order to compensate these speed differences with respect to 50 c/s.

As already mentioned the number of revolutions with 50 c/s is about 2900 r.p.m. At 60 c/s this speed is however $\frac{6}{5}$ times is about 3480 r.p.m.

The number of revolutions per minute and so the speed of circumference of the motor pulley becomes much greater. The flywheel 42 will start turning too quickly, as a result of which the tape runs too quickly through the apparatus. If a thinner pulley is now used, this speed difference can be compensated. The speed of the circumference is then equal again to that with a 50 c/s pulley, when the motor is connected to 50 c/s. For a mains frequency of 40 c/s the reverse holds good.

By replacing the motor pulley it is therefore possible to make the motor suitable for different frequencies. (See the list of parts). The motor has been provided with self-adjusting bearings of oil holding bearing bronze.

Against these bearings is a felt soaked in oil.

By this an efficient greasing of the rotor shaft arises. If the bearing is now greased at long intervals, the felt absorbs the oil and the bearing takes a uniform supply of this oil to the motor shaft.

The adjustment of the anti-plop construction pos. 157-197

When switching the central control knob to the different positions, various circuits are opened and closed, as a result of which switch pulses may occur.

These switch pulses are recorded on the tape and are perceptible in the loudspeaker.

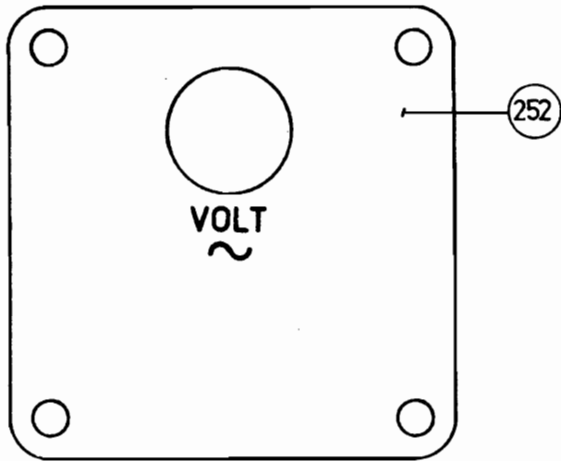
In order to avoid this, a so-called anti-plop construction has been applied.

By this the tape is pushed away from the recording/playback head, before the various switches make or break contact. Then the switch pulses can not be recorded on the tape.

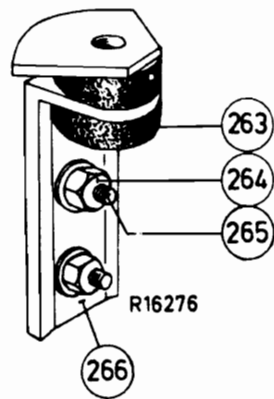
The adjustment of the plate pos. 197

1. Lay the tape normally into the apparatus.
2. Place the apparatus in the position play back (5)
3. Now adjust the plate pos. 197 in such a way that the spring pos. 157 just does not touch the tape.

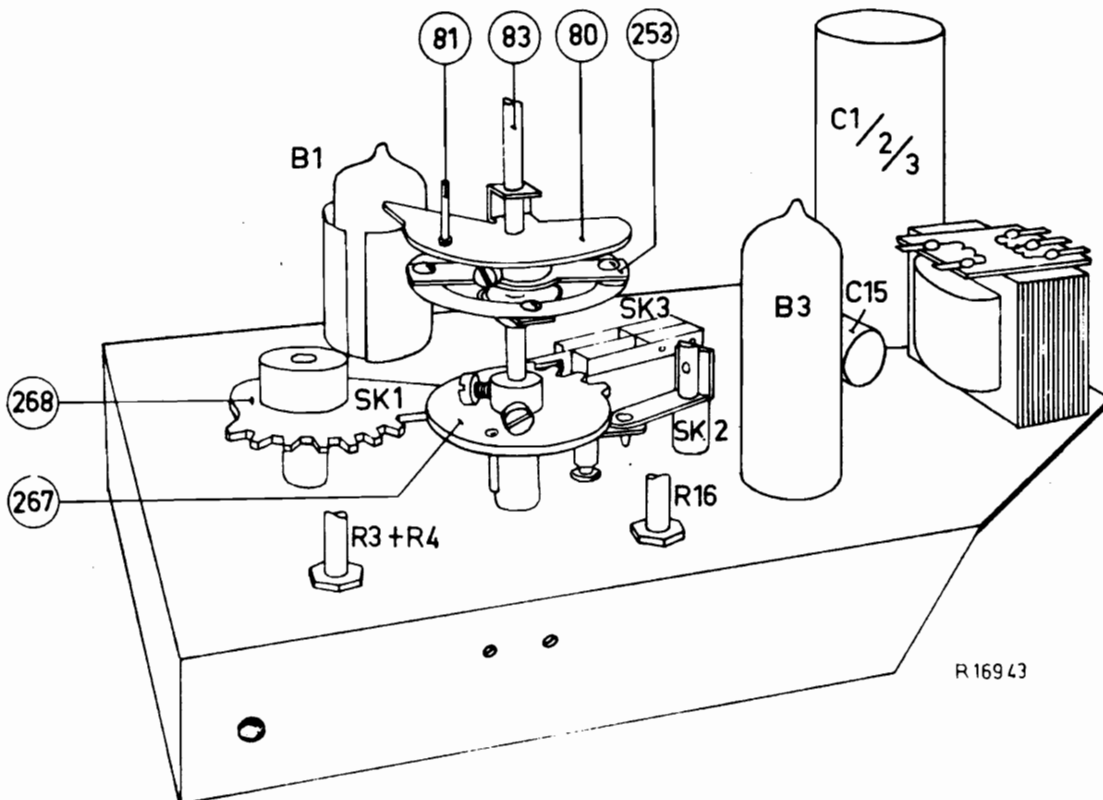
Important The bent over end of the springs pos. 157 should always lie against the screening casing pos. 128.



R164 61



R16276



R16943

The adjustment of the switches

The switches SK1 and SK2

1. Place the central knob in position 1.
2. Adjust SK1 and SK2 as indicated in the complete circuit diagram. In order to adjust SK1, the set screw of the toothed wheel (pos. 268) should be loosened. For the adjustment of SK2 the same holds good, however here the toothed wheel pos. 267 is concerned.
3. When turning the central control knob from position 1 to position 4 SK1 and SK2 should not switch.
4. When turning the central control knob from position 4 to position 5 SK1 should turn one step (seen from below) SK2 should then remain in its place.
5. When turning the central control knob from position 5 to position 6 SK1 and SK2 should turn one step further on.
6. When turning the central control knob from position 6 to position 7 SK1 should turn again one step. During this movement SK2 remains in its place.
7. If the central control knob is turned back again, the cycle mentioned should be repeated, however then in reversed order.

The switch SK3

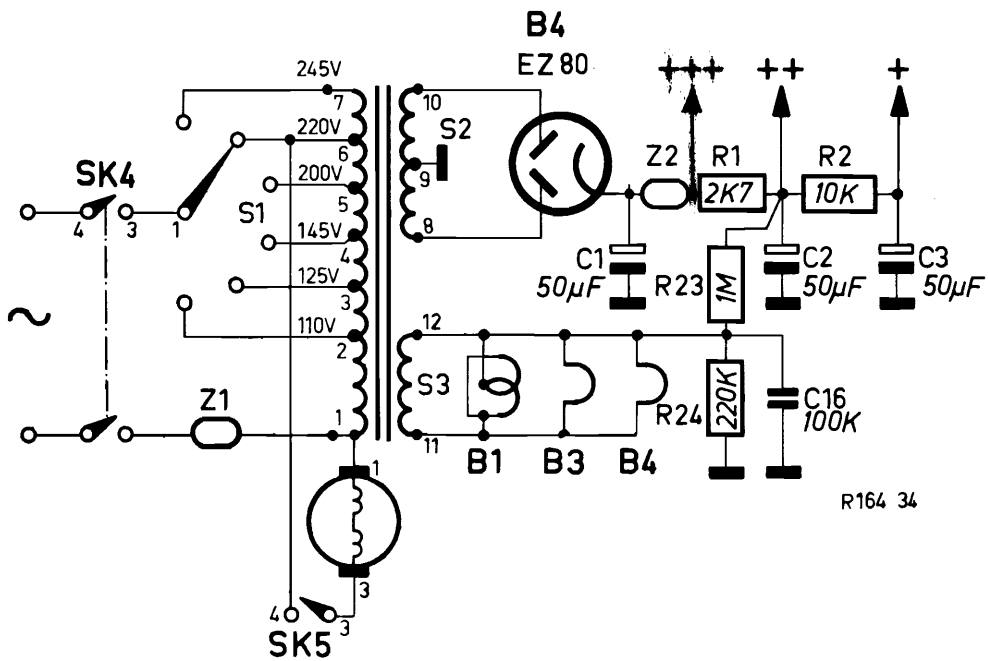
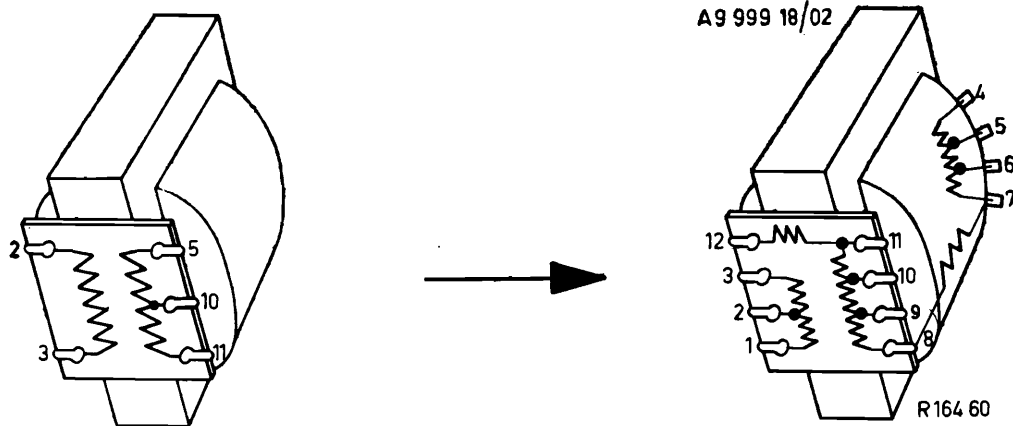
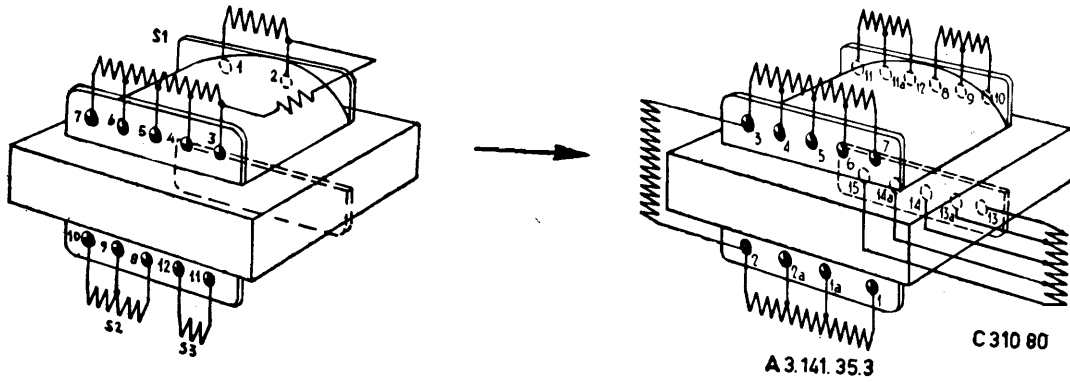
1. When turning the central control knob from the positions 1 to 4 inclusive, SK3 should not switch. The left-hand (3) and the middle contact (2) should then be interconnected, while the right-hand contact (1) is free.
2. When turning the central control knob from position 4 to position 5, SK3 should switch a moment. Right-hand (1) and middle contact (2) interconnected; left-hand contact (3) free.
3. When the central control knob is in the position 5, the contacts 3 and 2 are again interconnected and the contact 1 is again free.
4. During the whole turn of the control knob from position 5 to position 6, SK3 does not switch, the contacts are therefore as mentioned in 1.
5. In position 6 of the central control knob SK3 should remain in the rest position.
6. In position 7 of the central knob, SK3 remains at rest.

Anti howling switch

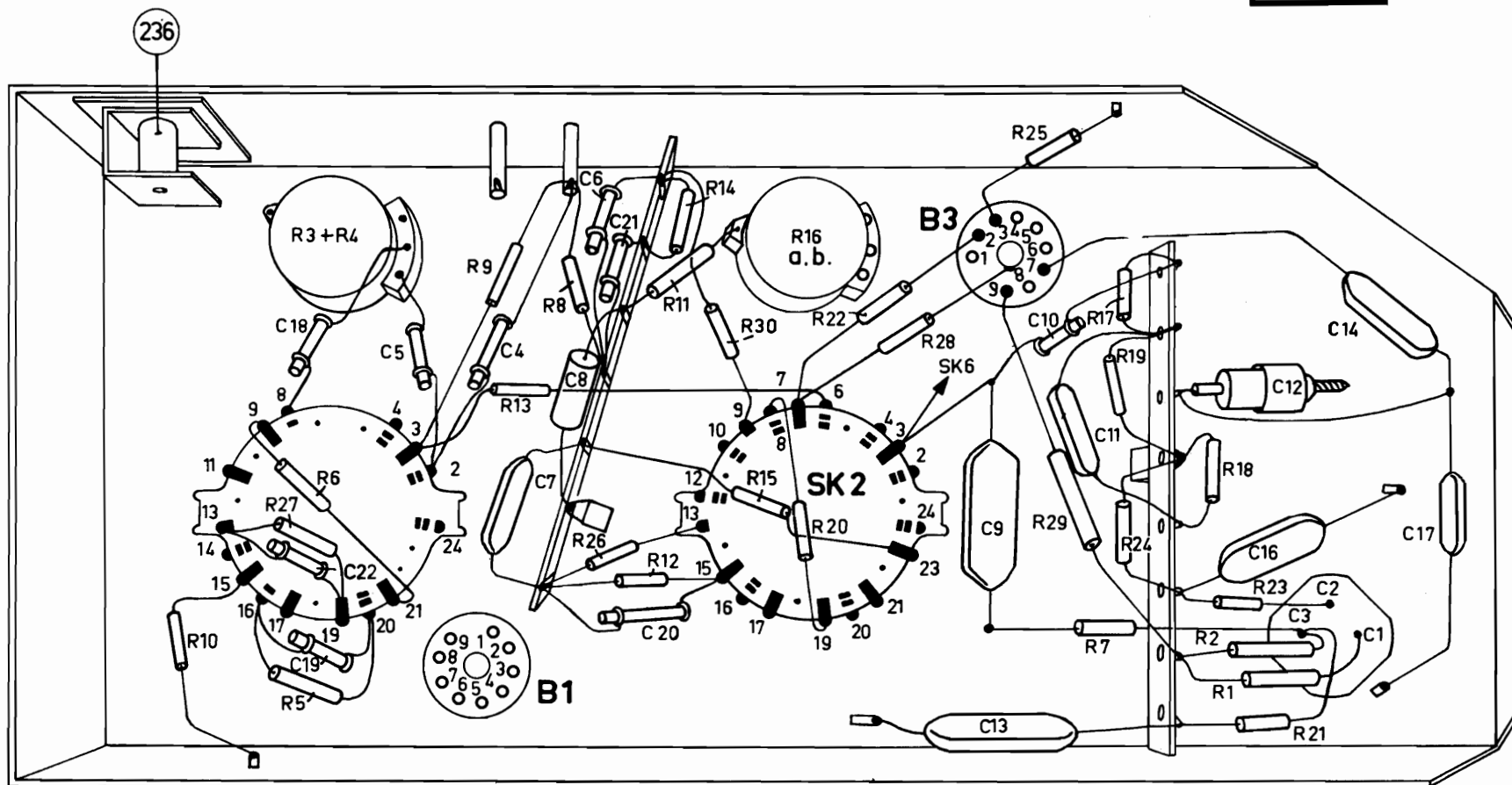
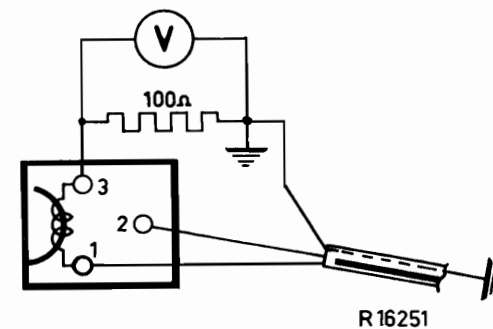
When switching the central control knob 87 from the position "winding" to "reproduction" and vice versa, it may occur, that some circuits are open, as a result of which the apparatus may start producing parasitic oscillation.

This can be heard by a loud howling. In order to prevent this, a so called anti-howling switch has been mounted in the apparatus. (See page 10, pos. 150).

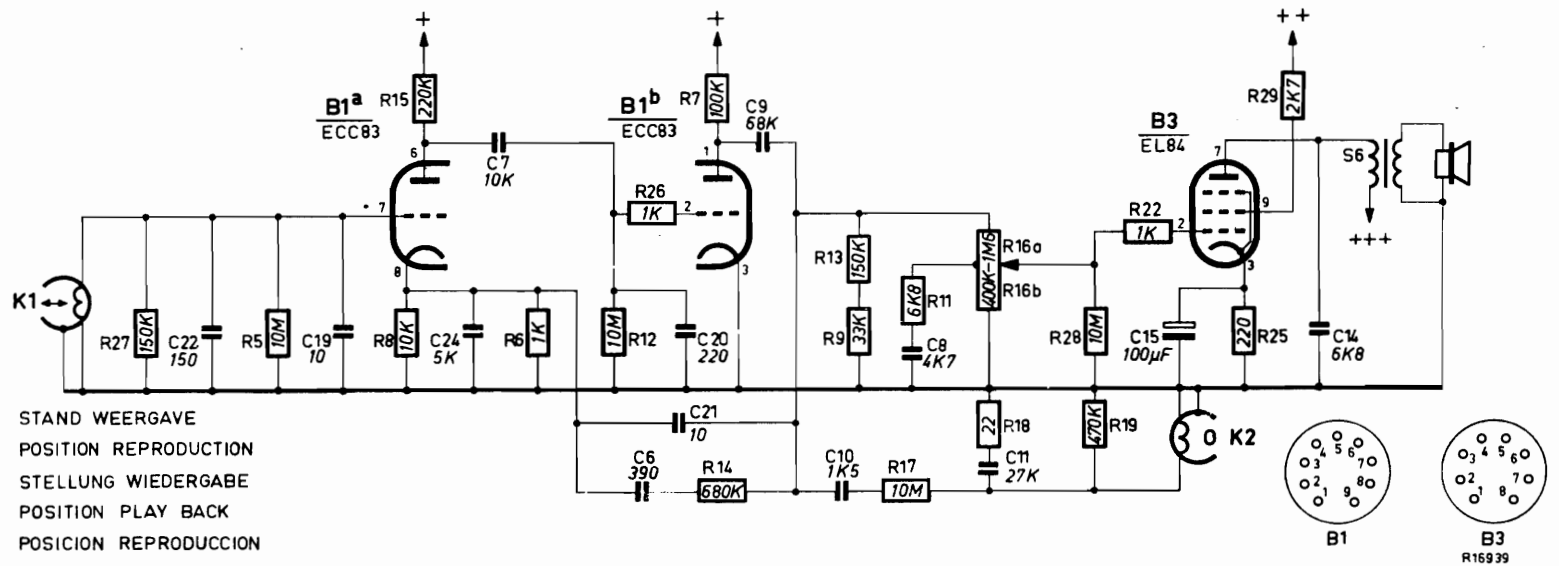
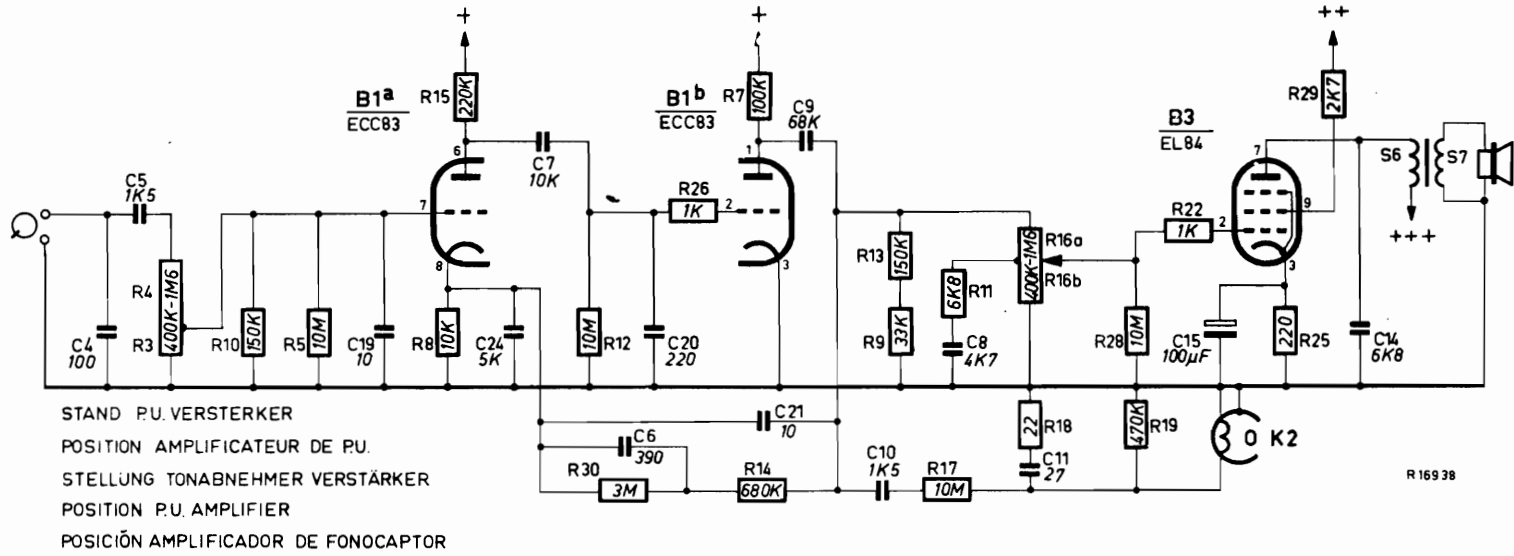
This switch shorts the signal of B1b with every switching. The distance between the contact spring of the switch and bracket pos. 91 should be about 1 mm.



R164 34



R164 35



Description of the electrical part

Position 1 to 4: If the control knob is placed in one of these positions, inclusive of the amplifier

the apparatus can be used as a pick-up amplifier. The signal applied to the pick-up input, is amplified by B1a, B1b and B3. (see page 22). The triode B1a is connected with negative feedback by the frequency dependent network R14-C6-C21 and R30, as a result of which the low notes are reinforced.

Position "5"
Playback

By placing the control knob in this position, SK1 is turned one step, as a result of which the signal generated by a tape in the recording/playback head K1, is amplified by B1a, B1b and B3 (see page 22).

The amplification of the triode B1a is increased by connecting R6 in parallel to R8, as a result of which the negative feedback decreases. C22 and R27 are connected in parallel to the coil of the recording/playback head K1. By this the coil of the head K1 is tuned to about 6000 c/s, as a result of which the high notes are reinforced.

When turning the control knob from position 4 to 5 inclusive, the switch SK3 is switched a moment, as a result of which the head K1 is demagnetised.

Position "6"
pick-up recording

When turning the control knob in this position, both SK1 and SK2 are turned one step (see page 32).

The amplifier is now switched to the position recording. Two signals are now applied to the recording/playback head K1, viz: (see page 24)

1. High frequency signal (about 50 kc/s) originating from the Collpits oscillator.
2. The amplified L.F. signal originating from the pick-up input.

As oscillator coil, the coil of the erasing head K2 has been used. The filament of the modulation indicator B2 has been incorporated in the oscillator circuit. In order to give the current through the filament the exact value, R18 has been connected across the filament.

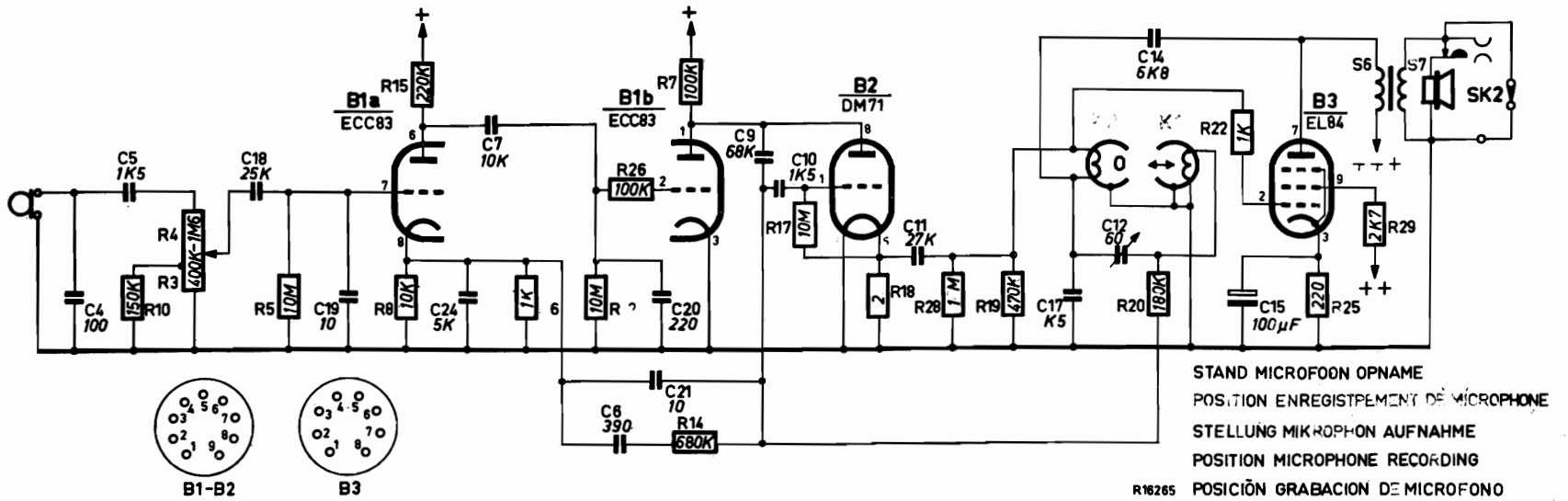
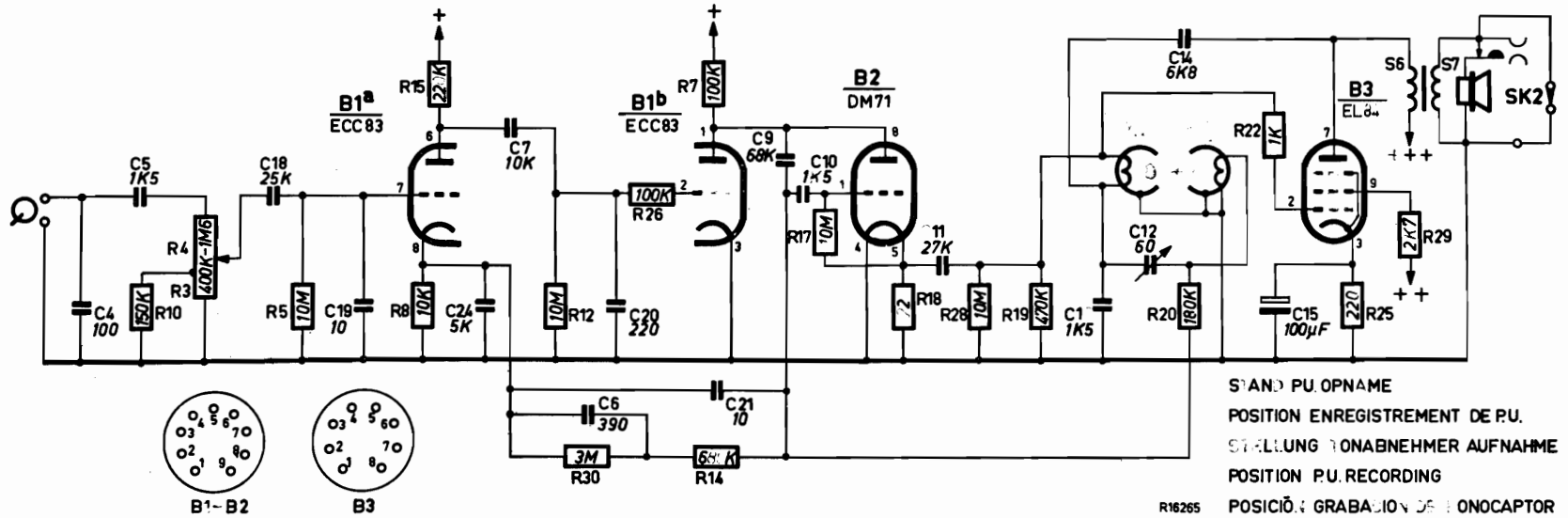
The valve B2 therefore operates only when the oscillator operates. The voltage of the oscillator is applied via the trimmer C12 to the coil of the recording/playback head K1. The bias magnetisation of the tape is obtained this way. The signal which is applied to the pick-up input, is amplified by B1a, b and applied via R20 to the head K1.

At the same time this A.F. signal is applied to g1B2 via C10.

The modulation depth can be adjusted with the potentiometer R3-R4.

Position "7"
Microphone recording

In this position SK1 is turned another step, but SK2 remains in the same position. The amplification of B1a is increased by parallel connection of R6 and R8. R30 is also taken out of the negative feedback circuit. Further the same description holds good as for recording via the pick-up input.



The adjustment of the bias magnetisation current

1. Remove the apparatus from its case.
2. Pull the 2 knobs from the shafts.
3. Loosen the ornamental screws and put the control knob 87 in the position fast forward winding (position 3).
4. The protecting cap can now be removed.
5. Remove the screening cap from the recording/playback head K1.
6. Connect a resistor of 100 Ω (A9 999 01/100E) (see page 21) in series with the coil of the recording/playback head and connect a vacuum tube voltmeter GM 6005 across the resistor. The earth side of the vacuum tube voltmeter should be put to the cord.
7. Switch on the apparatus and put the control knob in position pick-up recording (6).
8. With the aid of the trimmer C12 the voltage of the vacuum tube voltmeter should be adjusted to 17 mV.

The adjustment of the recording/playback head K1

With this adjustment it is necessary to have a test tape. This test tape can be made simply, if a good apparatus is available. Connect an A.F.generator to the pick-up input of the apparatus and measure the output voltage of the A.F.generator with a vacuum tube voltmeter.

Switch on the apparatus and put the control knob in position pick-up. (6). Turn the potentiometer R3-R4 to maximum and record a frequency of 5000 c/s for a few minutes at a constant AF generator voltage of 50 mV.

After that the frequencies for the overall characteristic still to be measured can be recorded on the tape in the same way. This is made, too, with a constant input voltage of 50 mV.

These frequencies are: 100-200-400-800-1000-2000-3000-4000-5000 and 6000 c/s.

The adjustment of the head K1 is done in the following manner:

1. Remove the apparatus from its case.
2. Remove the protecting cap, pos. 142.
3. Replace the loudspeaker by a resistor of 5 Ω (48 494 05/5E).
4. Connect a vacuum tube voltmeter across this resistor.
5. Remove the protecting cap of the recording/playback head K1
6. Now introduce a test tape and switch the apparatus in the position "5".
7. Now adjust the head K1 in such a way with the aid of the three screws 131 that the tape runs freely in the guide brackets of the heads.
8. Now use the test tape with the 5000 c/s and turn the volume control to maximum, with the control knob in the position play back.
9. Now adjust the output voltage to maximum with the screws 131.
10. Now check whether the tape still runs freely in the guide brackets. If not, readjust.
11. Seal the adjusting screws.

Characteristics and Measurements.

With the following measurements the measuring instruments stated below have been used:

AF generator	GM 2307
Vacuum tube voltmeter	GM 6005
Diode voltmeter	GM 6004

Checking measurements at the amplifier

The frequency response curves described below may deviate $\pm 20\%$ at maximum.

For recording the characteristics the apparatus should be uncased.

a. Frequency response curve of the pick-up amplifier

1. Connect an A.F. generator to the pick-up input and measure the voltage with a vacuum tube voltmeter GM 6005.
The input voltage should be kept constant to 100 mV.
2. Put the control knob in the position "2" and set the volume control R16 to maximum.
3. Unsolder the loudspeaker connections and connect a 5 Ω resistor to them (48 494 05/5E.).
4. Measure the voltage across this resistor as a function of the frequency with a vacuum tube voltmeter GM 6005.

Hereunder follows a table with the values measured:

Vi is constant at 100 mV	
Frequency	Vu across 5 Ω
100	230
200	430
400	590
800	610
000	580
2000	460
3000	380
4000	320
5000	260
6000	220
c/s	mV

b. Frequency response curve of the recording amplifier.

1. Connect an AF generator to the pick-up input and measure the voltage with the vacuum tube voltmeter GM 6005.
This voltage should be kept constant at 100 mV.
2. Put the control knob in position 6 and set the potentiometer R3-R4 at maximum.
3. Shortcircuit the oscillator, by connecting g1-B3 to the cathode.
4. Connect a 100 Ω resistor in series with the coil of head K1 and connect a vacuum tube voltmeter GM 6005 across it (see page 21)
5. Measure the voltage as a function of the frequency (see table alongside).

Vi constant at 100 mV	
Frequency	Vu across 100 Ω
100	5.3
200	5.9
400	5.65
800	4.7
1000	4.4
2000	3.7
3000	3.5
4000	3.4
5000	3.35
6000	3.3
c/s	mV

c. Frequency response curve of the playback amplifier

1. Connect a resistor of 100Ω between the coil of the head K1 and earth. This should be done in the same way as under "b".
2. Connect an A.F. generator GM 2307 to this resistor via a series resistor of 10 K.
3. Measure the output voltage of the A.F. generator with a vacuum tube voltmeter GM 6005. This should be kept constant at 300 mV.
4. Set the volume control R16 to maximum.
5. Replace the loudspeaker by a 5 resistor.
6. Measure the output voltage with a vacuum tube voltmeter across the resistor of 5 as function of the frequency. (See table below).

Vi constant at 300 mV	
Frequency	Vu across 5 Ω
100	2.2
200	2.83
400	2.8
800	2.3
1000	2.2
2000	1.93
3000	1.68
4000	1.48
5000	1.32
6000	1.2
c/s	V

d. Overall frequency response curve

In order to record an overall characteristic it is necessary to have a test tape. For making it, see page 25.

The loudspeaker is again replaced by the resistor of 5

The output voltage across this resistor is measured with a vacuum tube voltmeter with various frequencies.

For that purpose lay the test tape in the apparatus, switch on the apparatus and put the control knob in position 5 (playback).

The volume control R16 should be kept at maximum. (For voltages see table along-side).

Test tape recorded with an input voltage of 50 mV	
Frequency	Vu across 5 Ω
100	0.41
200	1.00
400	1.50
800	1.85
1000	1.90
2000	1.75
3000	1.40
4000	1.06
5000	0.78
6000	0.58
c/s	V

e. Step amplification

The step by step amplification has been measured at 1000 c/s and 100 mV at the pick-up input.

The control knob should remain in position 2 and the volume control R16 at maximum.

The voltages are measured with a vacuum tube voltmeter via a capacitance of 0.1 mF at the following points:

pick up input	100 mV
An. B1a	10.6mV
An. B1b	480 mV
An. B3	28 V

In the table below the D.C. voltages have been mentioned, which have been measured with the diode voltmeter GM 6004.

Measured at	Position 2-4	Position 5	Position 6	Position 7
C1	275	275	300	300
C2	260	260	270	270
C3	245	240	255	250
An.B1a	185	75	192	95
An.B1b	112	112	116	116
An.B2	112	112	116	116
An.B3	250	250	290	290
g2B3	242	242	240	240
	Volt	Volt	Volt	Volt

The oscillator voltage measured with the voltmeter GM 6005 at g1B3 should be 22-25 V. The voltage measured across R18 with the vacuum tube voltmeter GM 6005 should be about 1.76 V, when the DM 71 has been removed. In this case the erasing current is $\frac{1.76}{22} = 80$ mA which is the correct value.

Pos.	Description	Code number
12	Cheese head screw 3x35	A9 999 99/3x50
18-24	Intermediate wheel assembly	49 915 45.0
28	Ring 3.2 ϕ	A9 999 88/3
29	Cheese head screw 3x8	A9 999 99/3x10
30	Cheese head screw 3x8	A9 999 99/3x10
31	Ring 3.2 ϕ	A9 999 88/3
32	Lifting lever	49 897 39.0
34	Elastic ring 2.3 ϕ	A9 999 85/2.5
35	Tension spring	49 897 40.0
224-225+		
38-41	Casing assembly	49 914 78.0
42-44	Flywheel assembly	49 914 80.0
48-54	Turn table and spindle assembly	49 914 81.0
56	Cup assembly	P5 515 20/30
57	Washer 2.3 ϕ	A9 999 85/2.5
59	Adjusting screw 4x8	A9 999 97/4x10
60	Coupling lever assembly at the left	49 915 49.0
61	Coupling lever assembly at the right	49 915 50.1
62	Brake bracket assembly at the left	49 915 51.1
63	Brake bracket assembly at the right	49 915 52.1
67	Cheese head screw 3x6	A9 999 99/3x10
68	Ring 3.2 ϕ	A9 999 88/3
69	Toothed ring 3.2 ϕ	A9 999 87/3
71	Cheese head screw 3x6	A9 999 99/3x10
72-74	Mains switch assembly	08 529 10.0
76	Cheese head screw 2.6x6	A9 999 99/2.6x15
77	Ring 2.8 ϕ	A9 999 88/3
78	Toothed ring 2.8 ϕ	A9 999 87/3
79	Toothed ring 3.2 ϕ	A9 999 87/3
85	Switching ring (remove the cam of the service ring)	49 914 70.0
87	Switch knob assembly	49 918 08.0
88	Pressure spring	49 897 74.0
90	Switch pin	49 897 76.0
93	Roller	P5 515 37/34
95	Washer	A9 999 85/3
96	Tension spring	49 897 81.0
98	Guide lever assembly	49 915 53.0
100	Washer 4.2 ϕ	A9 999 85/4
101	Fork screw	49 897 85.0
104	Washer 4.2 ϕ	A9 999 85/4
106	Pressure roller assembly	49 914 79.0
109	Threaded pin 2.6x6	A9 999 98/2.6x8
111	Set screw 4x8	A9 999 99/4x8
112	Tension spring	49 936 84
113	Damping block assembly	A3 754 63.0
115	Toothed ring 2.8 ϕ	A9 999 87/3
116	Cheese head screw 2.6x6	A9 999 99/2.6x15
117	Threaded pin 2.6x10	A9 999 99/2.6x15
118+		
119	Damping bracket assembly	49 915 41.0
124	Ring 3.2 ϕ	A9 999 88/3
125	Cheese head screw 3x30	A9 999 99/3x30
126	Erasing head assembly	49 918 15.0

Pos.	Description	Code number
127	Cheese head screw 2.6x6	A9 999 99/2.6x15
128	Recording head assembly	49 918 14.0
131	Cheese head screw 2.6x15	A9 999 99/2.6x15
132+133+		
157	Protecting cap assembly	A9 868 30.0
135	Cheese head screw 3x6	A9 999 99/3x10
138	Cheese head screw 3x6	A9 999 99/3x10
140	Driving cord	49 898 10.0
142	Cap assembly	49 918 12.0
143	Plug	49 898 12.0
144	Screw	49 898 13.0
146	Knob assembly	49 915 04.0
147	Spring	28 753 01.2
150	Anti-howling switch	AE 570 14
153	Ring 3.2 \emptyset	A9 999 88/3
154	Toothed ring 3.2 \emptyset	A9 999 87/3
159	Strip off bracket	49 898 76.0
161	Coupling piece for cord	K 107 JB/01.6
173	Lubricating oil	X 007 12
174	Graphite grease	X 013 58
175	Ball bearing grease	X 013 15
193	Washer 3.2 \emptyset	A9 999 85/3
194	Tension spring	49 935 42.0
196	Elastic ring 3 \emptyset	A9 999 89/3
198	Cheese head screw 2.6x6	A9 999 99/2.6x15
210-223	Motor assembly	49 266 40.0
212	Ball 1/8"	89 205 02.0
215	Bearing assembly	49 927 05.0
216	Bearing assembly with feed through	49 927 04.0
221	Pulley 50 c/s assembly	49 898 81.0
221	Pulley 60 c/s assembly	49 898 82.0
222	Set screw for pulley	49 937 15.0
236	Microphone input assembly	A3 705 52.0
250	Coffer assembly (brown)	49 899 18.0
250	Coffer assembly (grey)	49 898 32
251	Countersunk screw	A9 999 98/4x12
253	Coupling assembly	M7 725 19.0
254	Knob assembly 110-245 V	A3 228 85.0
255	Socket plate assembly for speaker	A9 999 79/2x19
259	Three-pole plug	49 302 27.0
260	Connecting cord assembly	R209KA/93AA00

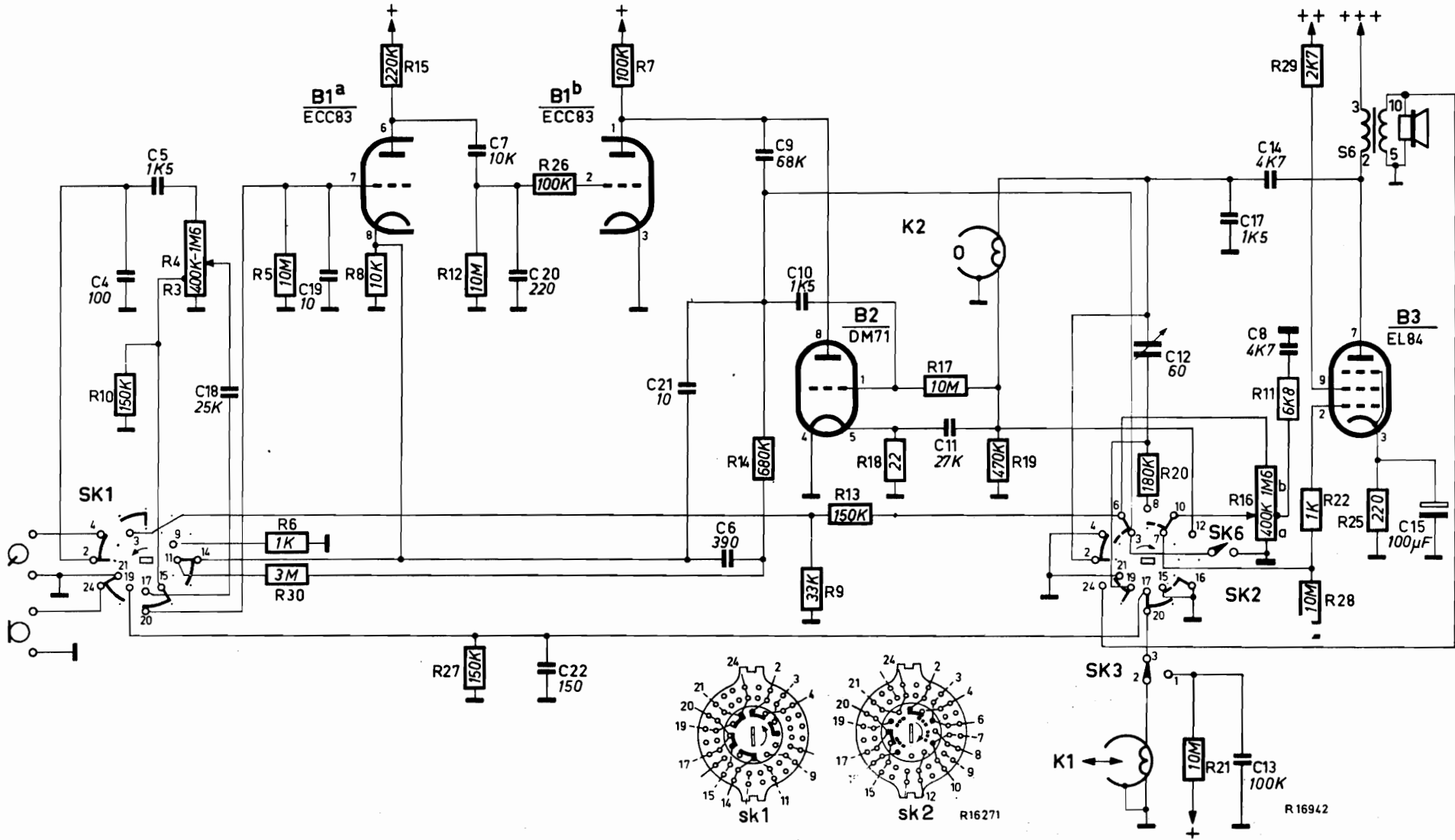
Gr/KD

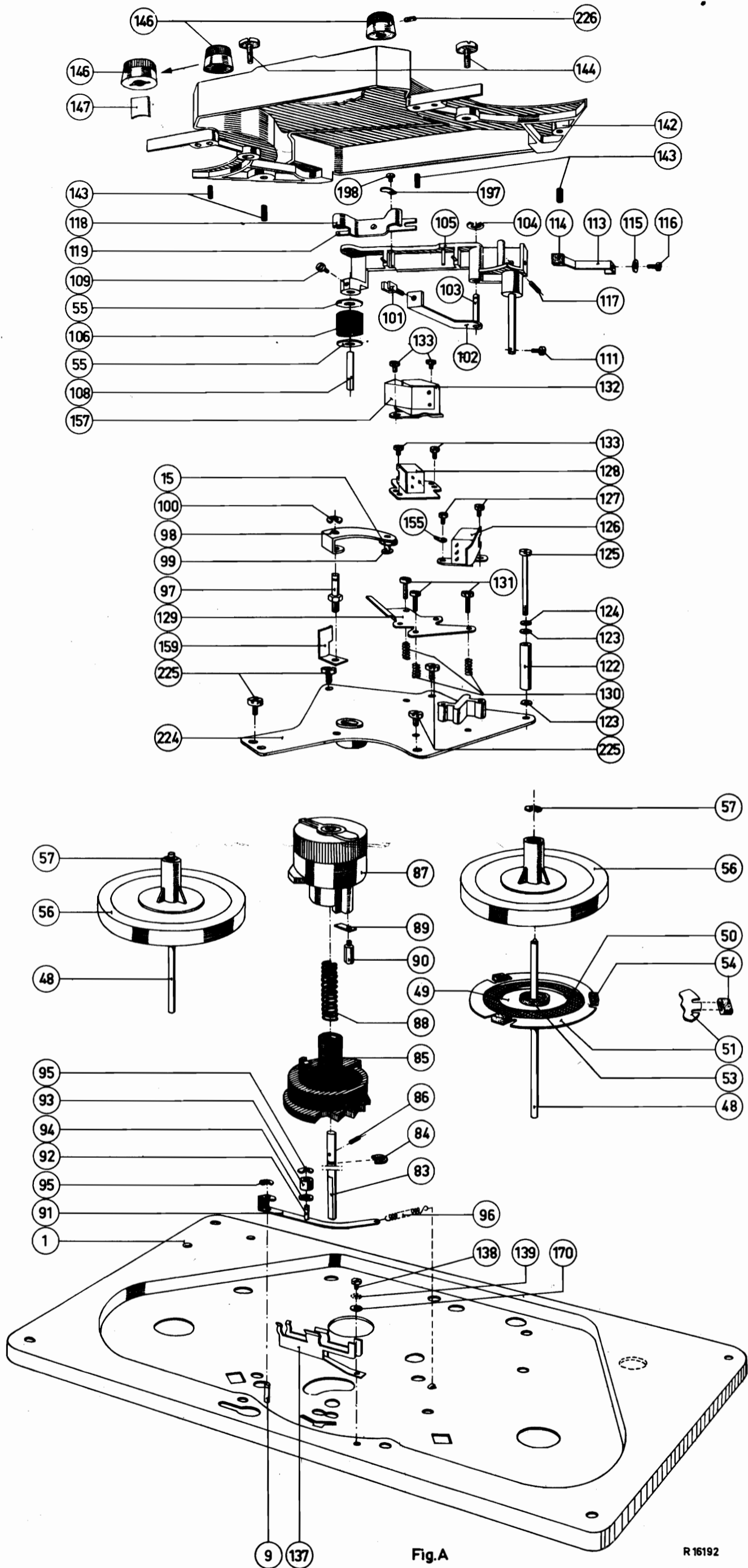
The switching ring which is supplied under this code number, has been provided with a cam on the rim. This cam should be removed, before the switch ring is mounted in the apparatus. This is because this switch ring is also applied in other apparatuses, but can also be made suitable for this apparatus in the abovementioned way.

S1)			R1	2700	Ω	A9 999 00/2K7
S2)		A3 141 35.3	R2	10.000	Ω	A9 999 00/10K
S3)			R3)	400.000	Ω	A9 999 16/GL)
S6)			R4)	1.6	MΩ	400K+1M6)
S7)		A9 999 18/02	R5	10	MΩ	A9 999 01/10M
C1+C2		A9 999 13/M50)	R6	1000	Ω	A9 999 00/1K
+C3	50+50+50	50+50	R7	100.000	Ω	A9 999 00/100K
C4	100	pF	R8	10.000	Ω	A9 999 00/10K
C5	1500	pF	R9	33.000	Ω	A9 999 00/33K
C6	390	pF	R10	150.000	Ω	A9 999 01/150K
C7	10.000	pF	R11	68.000	Ω	A9 999 01/68K
C8	4700	pF	R12	10	MΩ	A9 999 01/10M
C9	68.000	pF	R13	150.000	Ω	A9 999 01/150K
C10	1500	pF	R14	680.000	Ω	A9 999 01/680K
C11	27.000	pF	R15	220.000	Ω	A9 999 01/220K
C12	60	pF	R16a)	0.4M+1.6	MΩ	A9 999 16/)
C13	100.000	pF	b)			GL400K+1M6)
C14	4700	pF	R17	10	MΩ	A9 999 01/10M
C15	100	μF	R18	22	Ω	A9 999 01/22E
C16	100.000	pF	R19	470.000	Ω	A9 999 01/470K
C17	1500	pF	R20	180.000	Ω	A9 999 01/180K
C18	22.000	pF	R21	10	MΩ	A9 999 01/10M
C19	10	pF	R22	1000	Ω	A9 999 01/1K
C20	220	pF	R23	1	MΩ	A9 999 01/1M
C21	10	pF	R24	220.000	Ω	A9 999 01/220K
C22	150	pF	R25	220	Ω	A9 999 00/220E
			R26	100.000	Ω	A9 999 01/100K
			R27	150.000	Ω	A9 999 01/150K
			R28	10	MΩ	A9 999 01/10M
			R29	2700	Ω	A9 999 00/2K7
			R30	0.68	MΩ	A9 999 01/680K

Gr/JH

S:																6.	7.									
C:	4.	5.	18.	19.	7.	20.	22.	21.	6.	9.	10.	23.	11.	12.	17.	13.	14.	8.	15.							
R:	10.	3.	4.	5.	6.	30.	8.	15.	27.	12.	26.	7.	14.	9.	13.	18.	17.	19.	20.	21.	16.	11.	29.	22.	28.	25.





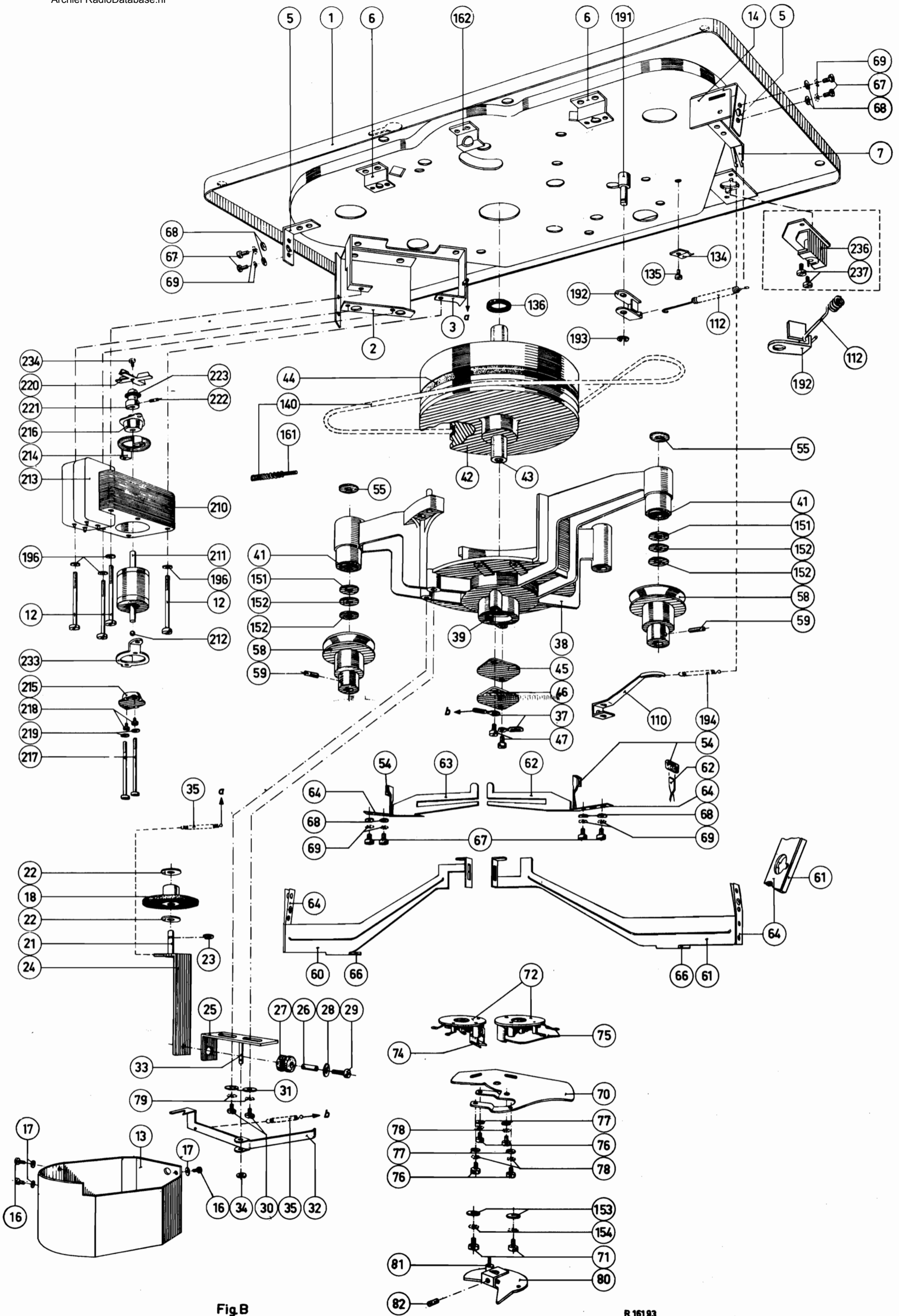


Fig. B

N.V. PHILIPS GLOEILAMPEN- FABRIEKEN EINDHOVEN	<i>Service Information</i>	No. Bc 24
		26.6.56
CENTRAL SERVICE DIVISION	GROUP: Apparatuses	Gr/RT
	ARTICLE: Tape recorder	
	TYPE: EL 3510	

ALREADY PUBLISHED:

RE: Anti-howling switch

In some apparatuses it may happen that when switching the central control knob 85 from the position play-back to the position winding and inversely, one hears a loud howl.

By switching the various contacts in the switches it is possible that at a certain moment some circuits are open, which causes the above described phenomenon.

In order to remove this difficulty in the apparatuses stamped Ho4 and higher a so-called anti-howling switch has been introduced. (See pos. 150).

When passing from one position to the other, lever 91 is pressed against the lip of switch 150 by the teeth of the switching ring 87. By this the signal from the second amplifier valve is shortcircuited and switch pulses will no more be heard.

The switch pos. 150 can be mounted under the fixing screw of the valve holder 137.

The switch pos. 150 can be supplied under code number AE 570 14.

Betr. Anti-gilschakelaar.

Bij sommige apparaten kan het voorkomen, dat bij overschakelen van de centrale bedieningsknop 87 van de stand weergave naar stand spoelen en omgekeerd, een luide gil hoorbaar is.

Door het omschakelen van de diverse contacten in de schakelaars, is het mogelijk, dat er op een bepaald moment enkele circuits open staan. Dit heeft dan bovenomschreven verschijnsel als gevolg.

Om dit verschijnsel op te heffen, is in de apparaten, gestempeld HO4 en hoger een zog. anti-gilschakelaar ingevoerd (zie pos. 150).

Door de tanden van de schakelring 87 wordt tijdens de overgang van de ene stand naar de andere, de hefboom 91 tegen de lip van de schakelaar 150 gedrukt. Hierdoor wordt het signaal van de 2de versterkerbuis kortgesloten en zijn omschakelstoten niet meer hoorbaar.

De schakelaar pos. 150 kan onder de bevestigingsschroef van de buishouder 137 gemonteerd worden.

De schakelaar pos. 150 is onder codenummer AE 570 14 leverbaar.

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Concerne: Commutateur anti-pleurage.

En quelques appareils il peut arriver qu'en commutant le bouton central de commande 85 de la position reproduction vers la position bobinage et inversement, on entend un fort pleurage.

Par la commutation des divers contacts dans les commutateurs, il est possible qu'à un moment donné quelques circuits sont ouverts. Ceci cause le phénomène décrit ci-dessus.

Pour remédier à cet inconvénient on a intercalé un dit commutateur ant-pleurage dans les appareils, estampés H04 et au delà (voir la pos. 150)

Par les dents de l'anneau de commutation 87 la manette 91 est posée contre la cosse du commutateur 150 lors du passage d'une position vers l'autre. Par là le signal du second tube amplificateur est court-circuité et on n'entend plus d'impulsion de commutation.

Le commutateur pos. 150 peut être monté sous la vis de fixation du support de tube 137.

Le commutateur pos. 150 peut être livré sous le numéro de code AE 570 14.

Betr.: Antiheultonschalter.

Bei einigen Apparaten kann es vorkommen, dass beim Umschalten des zentralen Bedienungsknopfes 85 von der Stellung Wiedergabe nach der Stellung Spulen und umgekehrt, ein lauter Heulton hörbar ist.

Durch das Umschalten der verschiedenen Kontakte in den Schaltern ist es möglich, dass an einem bestimmten Moment einige Kreise offen stehen. Dies hat dann die oben beschriebene Erscheinung zur Folge.

Um dieses Uebel abzustellen, ist in den H04 und höher gestempelten Apparate ein sogenannter Antiheultonschalter eingeführt (siehe Pos. 150).

Die Zähne des Schaltringes 87 drücken während des Uebergangs von der einen Stellung nach der anderen den Hebel 91 gegen die Zunge des Schalters 150. Dadurch wird das Signal der 2. Verstärkerröhre kurzgeschlossen und sind die Umschaltstösse nicht mehr hörbar.

Der Schalter Pos. 150 kann unter der Befestigungsschraube der Röhrenfassung 137 montiert werden.

Der Schalter 150 ist unter Codenummer AE 570 14 lieferbar.

Acerca de conmutador anti-aullido.

En algunos aparatos puede ocurrir que al conmutar el botón central de mando 85 de la posición reproducción hacia la posición bobinado e inversamente, se oye en fuerte aullido.

Por la conmutación de los diversos contactos en el conmutador es posible que en un momento determinado algunos circuitos estén abiertos. Esto trae consigno entonces el fenómeno descrito arriba.

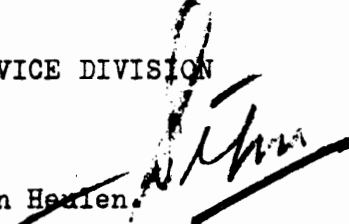
Para remover esta dificultad se ha introducido un llamado conmutador anti-aullido en los aparatos estampillados HO4 en adelante (véase la pos. 150).

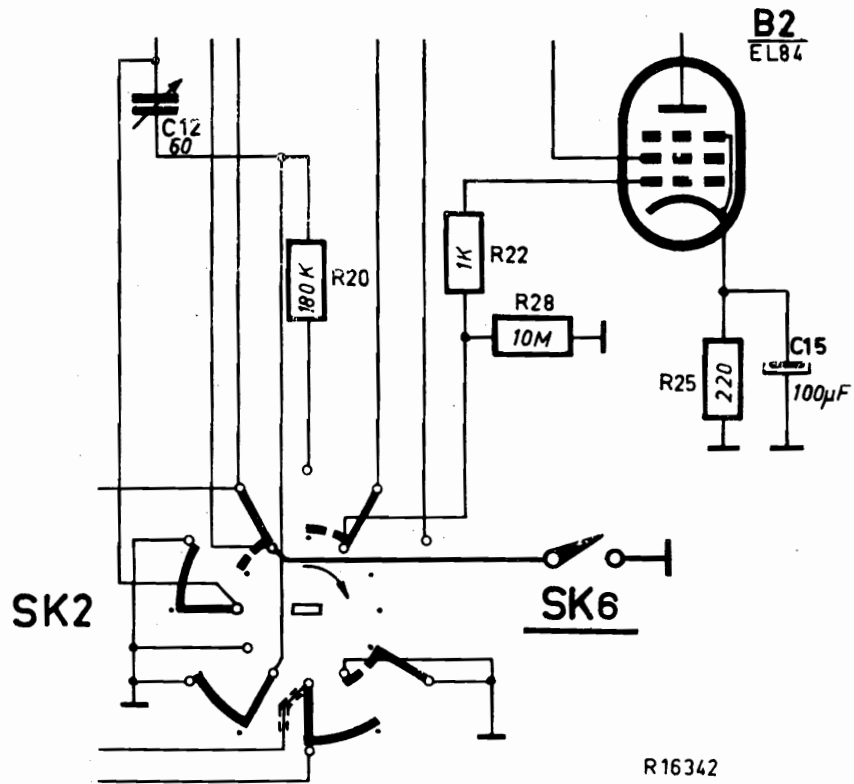
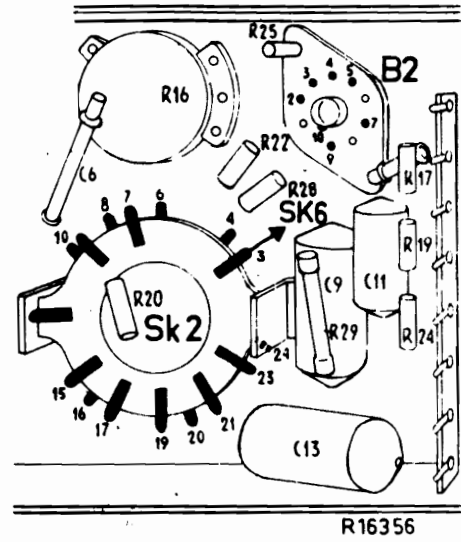
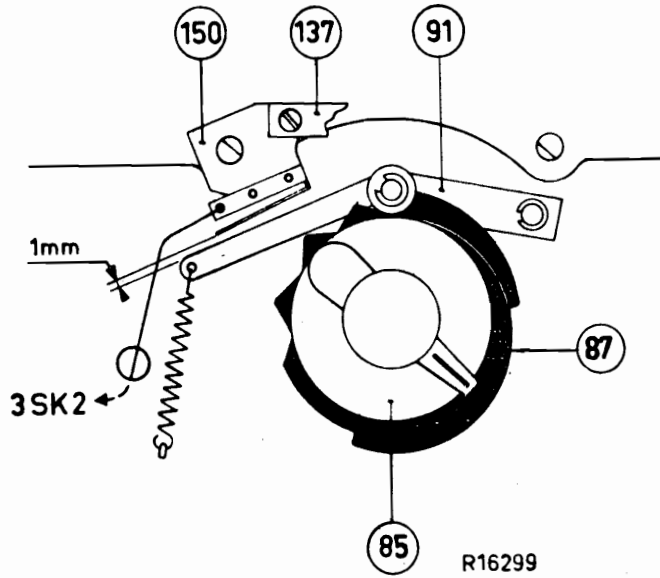
Por los dientes del anillo de conmutación 87 la manivela 91 se presiona contra el herrete del conmutador 150 durante el pasaje de una posición hacia la otra. Así la señal de la segunda válvula amplificadora se cortocircuita y ya no se entienden impulsos de conmutación.

El conmutador pos. 150 puede notarse bajo el tornillo de fijación del soporta-válvula 137.

El conmutador pos. 150 puede suministrarse bajo el núm. de código AE 570 14.

CENTRAL SERVICE DIVISION

A. van Heulen. 



N.V. PHILIPS GLOEILAMPEN- FABRIEKEN EINDHOVEN	<h1>Service Information</h1>	No. Bc40
		3.12.1956
CENTRAL SERVICE DIVISION	GROUP: Apparatuses ARTICLE: Tape recorders TYPE: EL 3510	Gr/JH

ALREADY PUBLISHED:

RE: Pressure roller lever which does not move when the central control knob is turned.

It may sometimes happen that when changing over the central control knob from the position 0 to the position recording or playback, the pressure roller lever does not go along but remains in zero position. The consequence of this is that the tape is not pressed against the capstan by the pressure roller. As a result of this no recording or playback takes place. When the apparatus is not used for quite a long time, the tilting bracket 61 presses a bend in the lever 60.

The pressure exerted by the said parts against each other presses the lubricating grease away, as a result of which a greater friction arises. The consequence of these effects is that in spite of turning the central control knob, the pressure roller lever remains stationary.

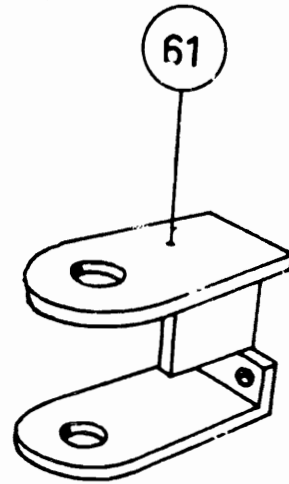
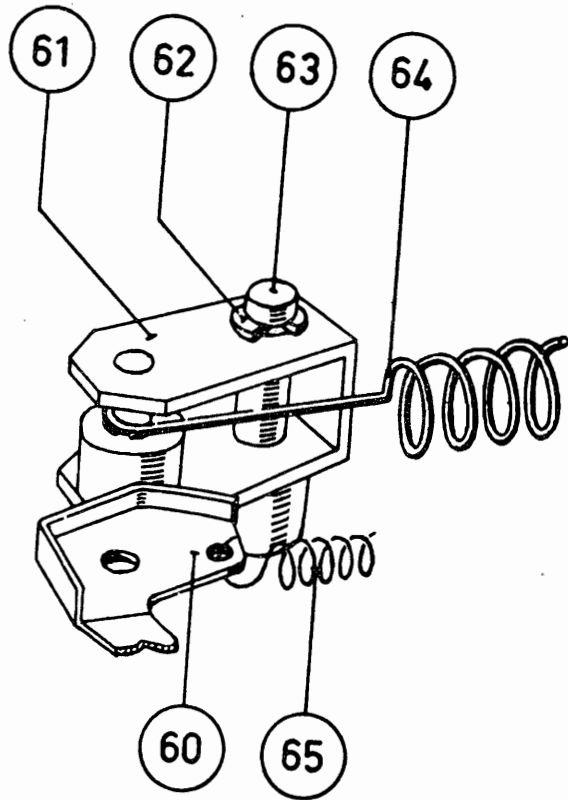
If the above phenomenon should occur in a apparatus, this can be remedied as follows:

A new tilting bracket will be supplied under code number AE 600 10. On this bracket a roller has been placed at the spot where the lever touches the bracket, as a result of which the friction between the said parts is reduced to a minimum.

In production the apparatuses marked with the code number H05 have already been provided with this new bracket.

CENTRAL SERVICE DIVISION


 A. van Heulen.



R16602

N.V. PHILIPS GLOEILAMPEN- FABRIEKEN EINDHOVEN	<h1 style="font-family: cursive;">Service Information</h1>	No. Bc70
		21-2-'58
CENTRAL SERVICE DIVISION	GROUP: Apparatuses ARTICLE: Tape recorders TYPE: EL 3510-EL 3517.	Gr/MB

ALREADY PUBLISHED:

RE: Demagnetizing switch.

From research in our laboratory it appeared that the demagnetizing switch in the EL 3517 can be superseded. This is SK4 of the EL 3517 and SK3 of the EL 3510. For some time this switch has therefore no more been built in, in the production of the EL 3510. For this reason C3 and R2 are also superseded. At the same time the spring called silent-switching spring item 164 at the screening housing of the recording head is superseded.

If however a demagnetizing switch is built in, as in the preceding series of apparatus, the silent-switching device item 164 must be present. These parts must be used in combination with each other, so both are used or they are not used at all.

The switch SK4 code number A3 186 78.0 disappears from our system and is no more supplied.

Central Service Department,

M.N. Grootveld
 M.N. Grootveld.