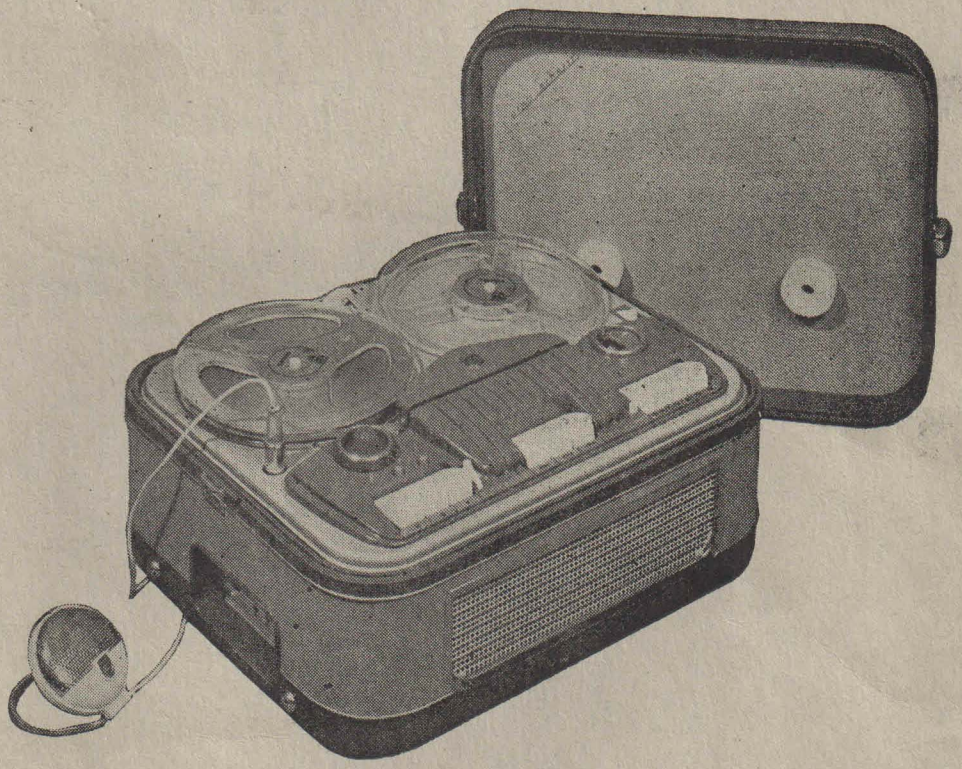
SERVICE INFORMATION

PHILIPS

TAPE RECORDER

TYPE EL3542



CENTRAL SERVICE DEPARTMENT
WADDON FACTORY ESTATE
CROYDON · SURREY

JUNE, 1960

Telephone . . . CROydon 7722
'Grams . PHILISERVE CROYDON

CIRCULATION RESTRICTED TO THE RADIO TRADE

Price 2s. 6d.

TECHNICAL DATA

Voltage Range
110-127 V., 200-250 V., 50 c/s.

Consumption
60 W. approximately.

Valves
EF86, ECC83, ECL82, EM81, EZ80.

Tape Speeds
1⅞″/sec., 3¾″/sec., 7½″/sec.

Frequency Response
50-7,000 c/s., 50-15,000 c/s., 50-20,000 c/s.

Reel Diameter
Up to 7″

Playing Time	1⅞″/sec.	3¾″/sec.	7½″/sec.
Longplay Tape	4 x 180 min.	4 x 90 min.	4 x 45 min.
Doubleplay Tape	4 x 240 min.	4 x 120 min.	4 x 60 min.

Winding and Rewinding Time for 7″ Reel L.P. Tape
3 min. approximately.

Inputs	*Sensitivity*	*Impedance*
Microphone	2.5 mV.	100 K.
Radio/Pickup	200 mV.	1 MΩ

Outputs

Line	1.5 V.	50 KΩ
Loudspeaker	2.5 W.	3-7Ω
Monitor Headphones	100 mV.	1 KΩ*
Stereo Socket 166 c/s	1 mV.	1 MΩ*
8 Kc/s	4.5 mV.	1 MΩ*

*From a 100% modulated tape.

Bias and Erasing Frequency
60 kc/s.

Signal to Noise Ratio
Better than 40 dB.

Wow and Flutter
<.2% at 7½″/sec., <.3% at 3¾″/sec.

REPLACEMENT AND ADJUSTMENT OF PARTS

Remark : After the completion of any repairs ensure that the loosened screws and nuts are fully tightened and properly locked with lacquer.

I. Taking the Mechanism out of the Case (see fig. 1)
Remove the knobs " 5 " and " 6 " and the plastic covers " 4 " and " 10."
Unscrew the three ornamental screws " 3 " and the two cheese-head screws.
Remove the metal cover plate.
Remove lid " 199 " from the bottom plate, and the P.V.C. ring from the mains flex.
Remove the four corner nuts " 17."
Lift the mechanism out of the case.

II. Buttons " 9 " (see figs. 3 and 6)
(*a*) *Replacement*
Loosen screws " 116 " and remove pin " 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.
Slightly straighten brackets " 97 " and " 32." Rock the whole assembly to the left and then pull gently in forward direction.
Remove clamping ring " 104 " after which spindle " 101 " can be pulled to the left, as far as is necessary to replace a damaged push-button.
Do not forget the rings and bushes between the buttons.
Remove 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 sliders are pulled forward through the springs " 107 " and " 108 " till their first contact touches the raised mounting bracket (see fig. 6).
SK3
Depress the playback button.
1. The stator contacts and the contacts of the switch slider of SK3 should properly face each other.
If necessary, this can be achieved by bending the tag of bracket " 32," by which the strip is pushed backwards.
If when the playback button is fully depressed tape motion does not commence, check that there is adequate movement on bar " 38." To adjust bar " 38 " screw the nuts which lock.
SK2
Depress the record button.
1. The stator and interconnection contacts of SK2 should properly face each other.
Adjustment : see under SK3 ; however, bend the tag of bracket " 34 " into shape.
2. Depress the wind and after that the rewind button. Now the record and playback buttons should be blocked by strip "100."

III. Buttons " 11 " (figs. 2 and 6)
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 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 play-back 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.
When the 3¾″/sec. or 1⅞″/sec. buttons are depressed the exact position of switch slider can be adjusted by bending the upright tags of bracket " 120 " forward or backward (see fig. 7).

V. Playback Switch SK3 (figs. 2, 3 and 6).
(*a*) *Replacement*
Remove the driving belts.
Remove the left-hand turntable, the carrier disc, spindle and coupling roller.
Remove spring " 108."
Pull the switch slider out from the rear of the apparatus.
Remove the strip with the stator contacts.
(*b*) *Test*
The contacts of the switch strip in zero position, as well as in play-back 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 " (figs. 2, 3 and 6)

For replacement and test, see item V. Read spring " 107 " for " 108."

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

(*a*) *Adjustments*

Contacts " 93 " and " 94 " of SK8 should make good contact with each other if the recording or play-back button or the wind/rewind button has been depressed.

If necessary adjust the brass strip of SK8.

(*b*) *Test*

Depress the play-back button.

Connect the apparatus to 180 V. with the voltage adaptor in the 220 V. position.

Short-circuit the contacts of SK9 on the left hand tape guide. Now the relay should close its contacts and Re2 should pull away the locking strip " 100a."

VIII. Record/Play-back Head K1-K101 (fig. 12)

Height Adjustment

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

Check that the distances between the four tracks are equal, by the following procedure : With an unused tape in position, record a 1000 c/s signal on track 1 with 100% modulation as indicated by the magic eye. Rewind to the start of the recording and repeat on track 3 using a 400 c/s signal. Turn the tape over and, with the selector switch in the 2-3 position, playback the same section of the tape. Neither tone should be perceptible. If the 1000 c/s tone is noticeable, then the head is too low and must be raised. If the 400 c/s tone can be heard then the head stands too high and must be lowered.

Azimuth Setting

Connect a valve voltmeter to Bu6.

Place a test tape in position.

Switch the apparatus in position play-back.

Now adjust to maximum output voltage with screw "181."

Note : To make a test tape use a recorder which is in good working order and connect a signal generator to the pick-up sockets. Place a good tape in position and record on to a section of the tape a frequency of 5 Kc/s at 100% modulation.

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

Height Adjustment

The height of the erase head should be adjusted so that the top edge of the upper core just protrudes above the top edge of the tape. Check the track spacing in the following manner : Record a 1000 c/s signal on track 1 with 100% modulation as shown on the magic eye. Rewind to the start of the recording and repeat on track 3. Playback the recording and adjust R30 for an output of 1 volt at the line output socket BU6. Turn the tape over and on the same section of tape, erase track 2. Turn the tape over again and playback the 1000 c/s signals in turn. The output voltage at BU6 should not be less than 850 mV on either track. If track 1 is attenuated, the erase head stands too low and must be raised. If track 3 is attenuated then the erase head is too high and must be lowered.

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 play-back 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 " (figs. 2, 4 and 5)

(*a*) *Replacement*

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

Loosen screws " 83a " and remove plates " 83."

Remove springs " 53," " 25," tape guide " 46 " and the brackets " 84."

Loosen screw " 71," 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 flywheel can be removed.

Take care that the connecting wires of the record/play-back head, erasing head and SK8 are not broken.

Remove the flywheel.

Remark : When remounting, the fixing screws of the mounting plate and of the bearing plate must be tightened and locked with lacquer.

(*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 7½"/sec.

Switch apparatus off by depressing knob " 12." The flywheel should now keep running for 3½ to 4 mins. During this running, the intermediate wheels " 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 play-back.

The tape should not twist when passing the heads and should run smoothly along the pressure roller " 43."

Depress speed button 7½"/sec.

The starting voltage must now be <180 V., with the voltage adaptor set at 220 V.

XII. Tape Guide " 46 "

Adjustments

The tape guide should be mounted in such a way that the finger 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," circlip " 153 " and ring " 152."

Now the intermediate wheel can be removed.

2.—*Middle Intermediate Wheel*

Remove the upper intermediate wheel.

Remove cap " 150," circlip " 149 " and ring " 148."

Lift the upper guide bracket and remove the intermediate wheel.

3.—*Lower Intermediate Wheel*

Turn the complete assembly along its longitudinal axis.

Remove cap " 133," circlip " 132 " and ring " 131."

Now the intermediate wheel can be removed.

(*b*) *Test*

1. If none of the speed buttons are depressed, the intermediate wheels should have at least 0.5 mm. clearance 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 are 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 para. 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 80 V., with the voltage adaptor set at 220 V.
Switch the mains switch on by turning bracket " 146a " upwards (see fig. 9).
Adjust the bearing support with pulley " 54 " and 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.
Slightly tighten the screws on the bearing support and switch the mains switch on and off a couple of times. Each time the motor should start to run.
Fully tighten the bearing support screws and recheck the starting of the motor to ensure the bearing support has not shifted.
Apply drive belt " 61."
Check whether the intermediate wheels run in the middle of the races of the pulley and not at the edges.
Check the noise 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 at the same time pull the spindle out of the coupling spring.
Remark : When mounting again, tighten the connection screws slightly.

(*b*) *Adjustments*
See para. 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.
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 the 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 $\pm$ 2 grammes.
Turn the reel and measure the force necessry to make the reel turn clockwise. This force should be 23 $\pm$ 2 grammes. If these values should not be correct, the felt ring and the top of the carrier disc " 92 " must be cleaned with carbon tetrachloride.

XVII. Turntable " 62 " left
(See XVI., but slip coupling 8-10 g. turning anti-clockwise)

Brakes
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.
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 grammes. It can be measured as described under 1, however, turning clockwise.
Counter-clockwise : 65-85 grammes.
If necessary, replace spring " 58 " one hole.

XVIII. Sintered bearing " 73 " (figs. 2 and 4)

(*a*) *Replacement*
Loosen screws " 71."
Loosen the nut of guide roller " 46."
Remove 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 carbon tetrachloride.

(*b*) *Test*
Test the time the flywheel keeps running as described under XI., para. b-2.
Remark : The bearing of the flywheel may not be completely clamped by the bearing plate.

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

(*a*) *Replacement*
Remove flywheel as described in XI, para. (*a*).
The bearing can be replaced after screws " 81 " have been loosened.
After 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 has to be adjusted in such a way that positions of the motor pulley and the two coupling wheels in front of the drive belt lie in the same horizontal plane. The height can be adjusted by adding one or more rings " 86."

(*b*) *Test*
Test the winding and rewinding with a 5″ reel. If there should be any irregularities during the rewinding, the coupling caps " 88 " 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., para. (*b*).

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

For replacement and adjustment, see XIV.

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

(*a*) *Adjustment*
The height of this relay has to be adjusted so that the movement on the locking bracket " 100a " when the relay is energised, will release the depressed record and play-back buttons allowing them to return to their rest position.

(*b*) *Check*
At a mains voltage of 180 V., with the voltage adaptor in the 220 V. position, the relay must still function correctly.
To be checked as mentioned under VII, para. (*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 is clamped.
Remove the amplifier screen.
Unsolder the connections.
Remove spring " 123."
Turn bracket " 120 " counter-clockwise and lift bar " 118 " from its place.
Pull the switch slider 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 slider is pushed in, it has to be slightly lifted with a screwdriver.

Tape Speed (fig. 1)

(*a*) 7½″/*sec.*
Depress the 7½″/sec. button.
Measure a length of 375″ on the loose end of a full reel, and mark the beginning and the end of this place.
Place the reel with tape on the turntable.
Remove the plastic covers " 4 " and " 10."
Depress the play-back button.
The time between the passing of the first and the second mark should be 50 ± 1 sec.

(*b*) 3¾″/*sec.*
See under (*a*).
The time between the passing of the first and second mark should be 100 ± 2 secs.

(*c*) 1⅞″/*sec.*
See under (*a*).
The time between the passing of the two marks should be 200 ± 6 secs.

INSTRUCTIONS FOR CHANGING A 50 c/s INTO A 60 c/s RECORDER OR VICE VERSA (fig. 9)

1. Remove the instrument from the case.

2. Solder the connections of the motor to the mains transformer as follows :
Rewire : motor-mains transformer from 2′ to 3′ ⎫ from 50 c/s
Rewire : motor-mains transformer from 5′ to 4′ ⎭ into 60 c/s
Rewire : motor-mains transformer from 3′ to 2′ ⎫ from 60 c/s
Rewire : motor-mains transformer from 4′ to 5′ ⎭ into 50 c/s

3. 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 clamping brackets of the mains flex.
Loosen the four fixing screws of the mounting bracket.
Then withdraw the whole unit.
Remove successively cap " 154," circlip " 153," ring " 152 " and the upper intermediate wheel " 47."
Now straighten lip " 125 " and remove the upper guide bracket " 51."
Remove cap "150," circlip "149," ring "148" and the central intermediate wheel " 47."
Now straighten lip " 125 " and remove the central guide brackets " 51."
Mount the new guide brackets in inverse order.
Then turn the whole unit round its longitudinal axis, replace the lower guide bracket and slide the unit back into place.

4. Now replace the pulley (see fig. 10).
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 to 80 volts mains supply, with the voltage adaptor in the 220 V. position.
Switch on the mains switch SK7 by turning up the bracket " 146a." The pulley must be adjusted so that the motor starts turning.
(None of the intermediate wheels may touch the pulley.)
Tighten the screws of the bearing support and switch SK7 on and off several times to check the starting of the motor.
Refit the driving cord.
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 numbers in brackets indicate the numbers of the valve pins. The letters indicate the measuring points on the mounting strips, sketched in fig. 19.

Vf 6.3 V ± 3.5%
Pin 3V5 280V
C23 250V
C24 220V
Tolerance ± 5%.

	B1	B2	B3	B4
Va	85 (E)	130 (F)	260 (L)	40 (7) V
Va[1]	—	110 (H)	—	250 (9) V
Vg[2]	76	—	200 (7)	V
Vk	1.7	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 1,000 c/s amounts to 4.15 mV (Vi must be 73 mV ± 1.5 dB) if the button 3¾"/sec. (9.5 cm/sec.) has been depressed.
For the measuring diagram we refer to fig. 17.

Frequency	1⅞"/sec	3¾"/sec.	7½"/sec.
60 c/s	4.1	4.1	4.1
1000 c/s	4.4	4.15	4.15
8000 c/s	11.0*	7.6	5.15
10000 c/s		11.5	5.95
13000 c/s		12.5‡	8.1
16000 c/s			12.5
Tolerance :	± 1.5 dB	± 1 dB	± 1 dB

‡ Measured with ½ Vi ; * measured with ¼ Vi.

2. Frequency Response Curve for the Microphone Input

Connect a tone generator to Bu1.
Depress speed button 7½"/sec.
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 Vo at 1000 c/s is 4.15 mV (Vi must be 0.77 mV ± 1.5 dB).
For the measuring diagram, see fig. 16.

Frequency	*Vo*
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 :	±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 ± 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 :	±1.5 dB

3. Adjustments of L1 (figs. 19 and 13)

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 3¾"/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) Play-back Amplifier

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

1. *Frequency Response-Curve, measured at the Extension Loukspeaker Output*

Connect a V.T.V.M., to which a resistor of 5.6 Ω has been connected in parallel to the extension loudspeaker output Bu4.
With the input voltages (Vi) at the frequencies given below Vi measure the output voltage.

Vi	*Frequency*	4.75 cm. 1⅞"	9.5 cm. 3¾"	19 cm. 7½"	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 :		±1.5dB	±1 dB	±1 dB	

2. *Sensitivity of the L-Output*

Connect a V.T.V.M., to which a resistor of 500 kΩ and a capacitor of 100pF have been connected in parallel to the L-output Bu6.
Depress speed button 3¾" (9.5 cm/sec.).
The output voltage must be 130mV ±1.5 dB at an input signal of 31mV.-1000 c/s.

3. *Test of Tone Control*

Depress speed button 3¾"/sec.
Connect a V.T.V.M. in parallel with a 5.6Ω resistor to the extension loudspeaker output Bu4.
With an input signal of 300mV.-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 3¾"/sec.
Turn the volume control R30 maximum and tone control R31 minimum.
Connect a tone generator to the radio/pick-up input.
Depress the recording button.
Record with a constant input signal of 10.5mV. various frequencies between 60 and 13000 c/s.
Connect a V.T.V.M. to the L-output Bu6.
Turn the tone control entirely clockwise.
Depress the play-back button.
The output voltage should lie within a range of 6dB.
This voltage at 1000 c/s should be > 60mV.
To be adjusted with C12.*
The overall frequency response-curve can be measured in the same way with a tape speed of 7½"/sec. as with a tape speed of 1⅞"/sec. With a tape speed of 7½"/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 1⅞"/sec. tape speed lies in between 60 and 7000 c/s.

* 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 an improved top response, and when the value of C12 is increased, it cuts top response.

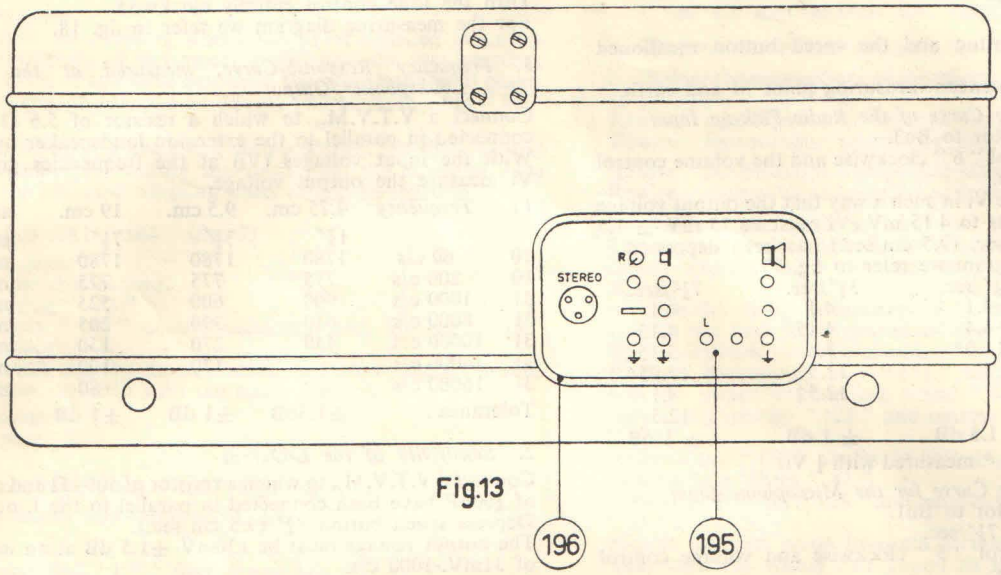


Fig.13

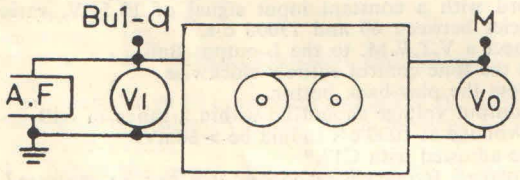


Fig.16

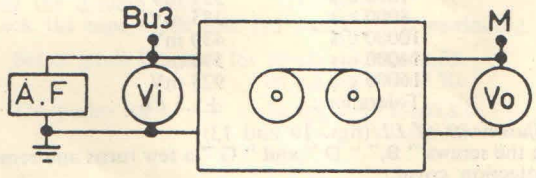
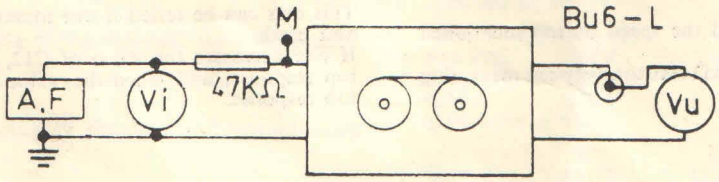


Fig.17



R 190 79

Fig.18

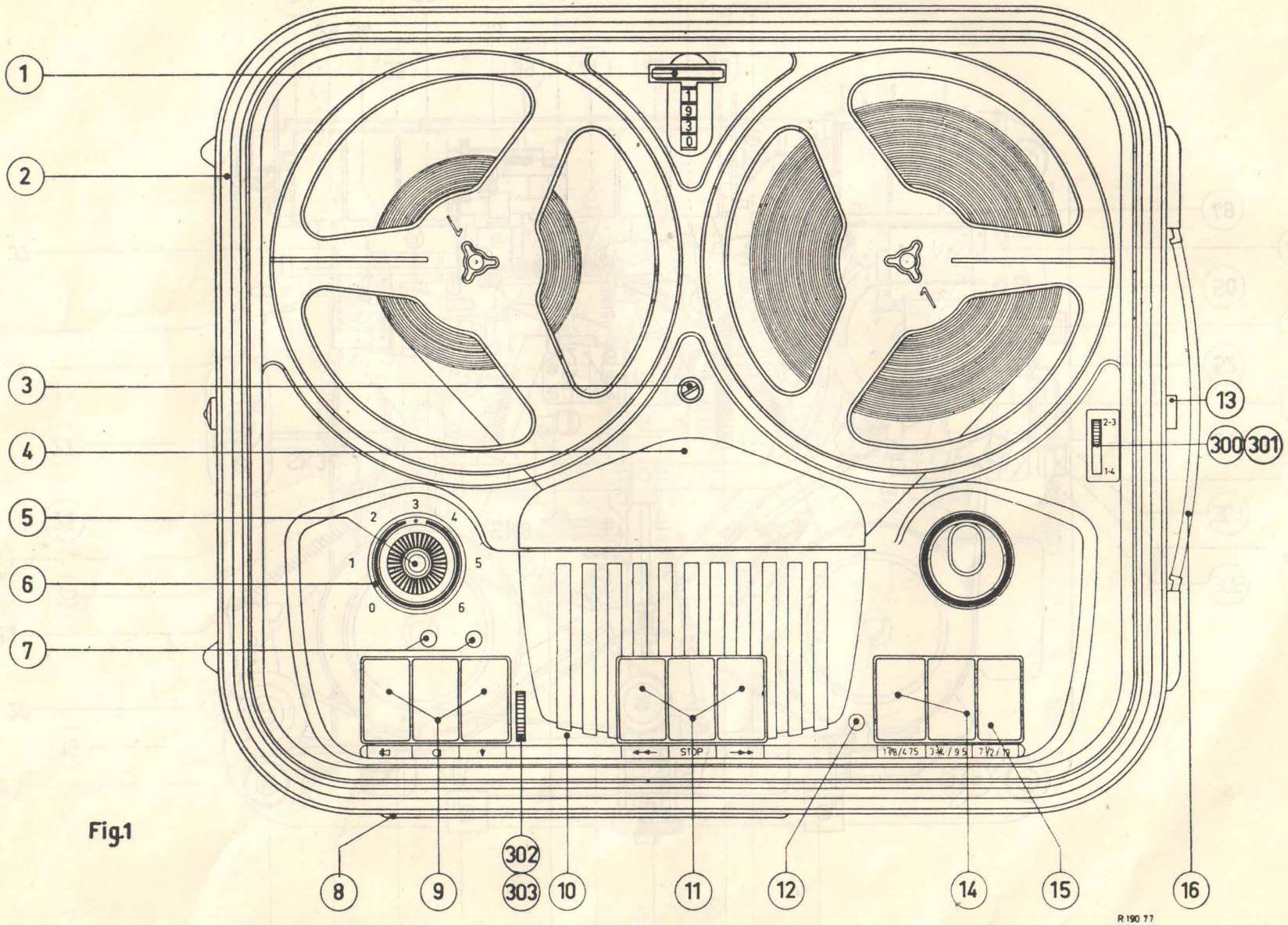
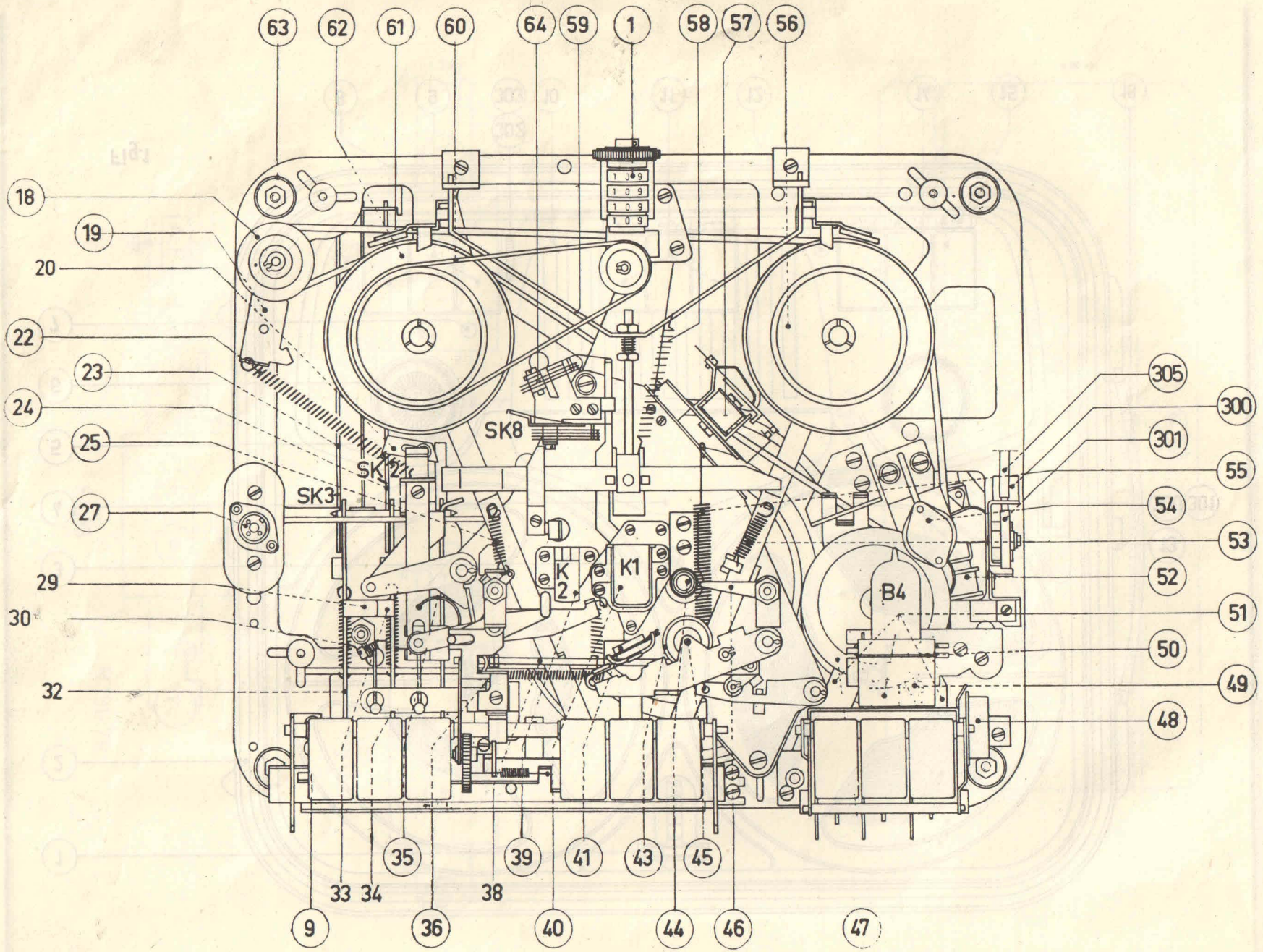


Fig.1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SK8
SK2
SK3
K1
K2
B4
305
300
301
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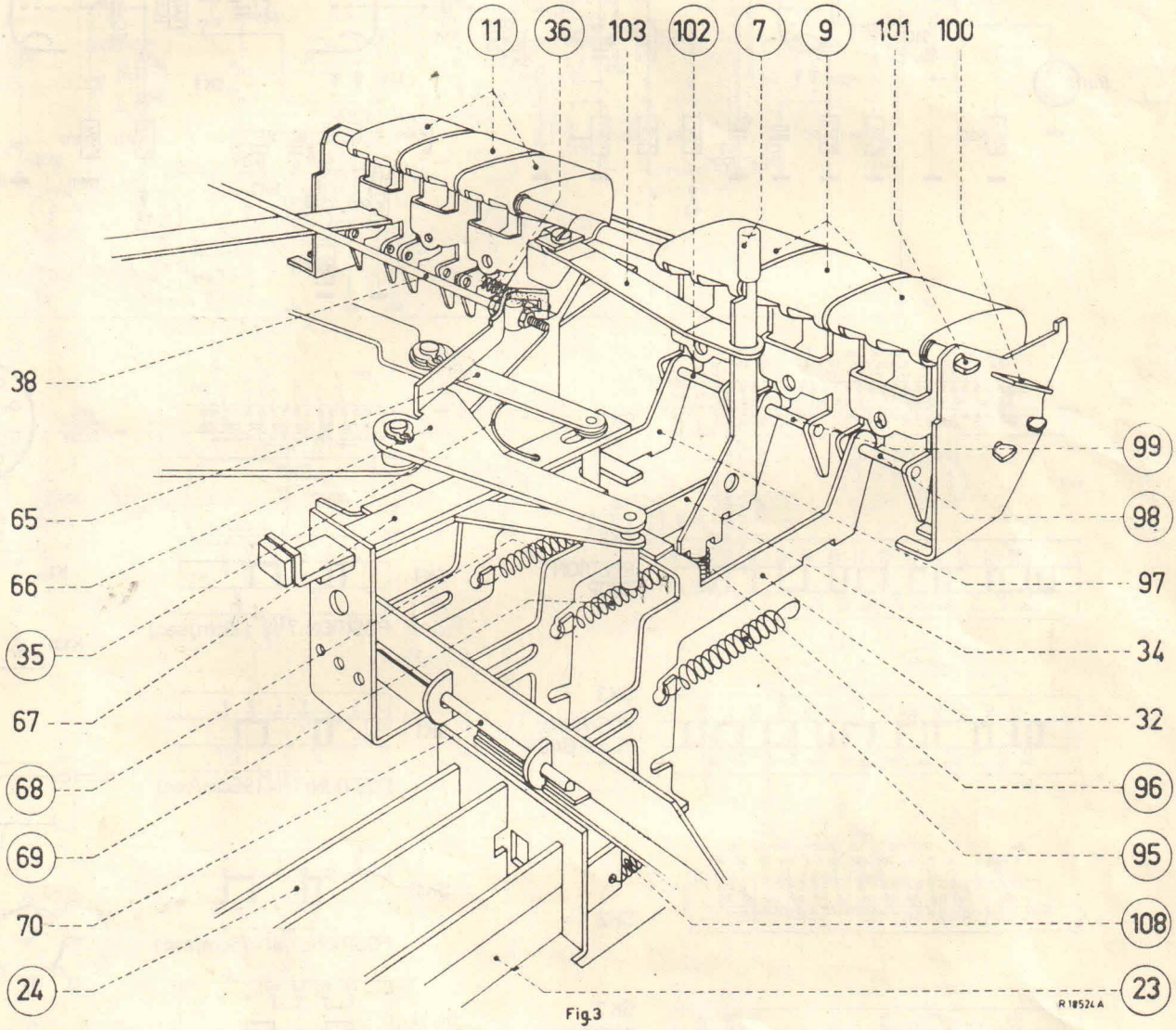
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R18524A

Fig.3

| | | |

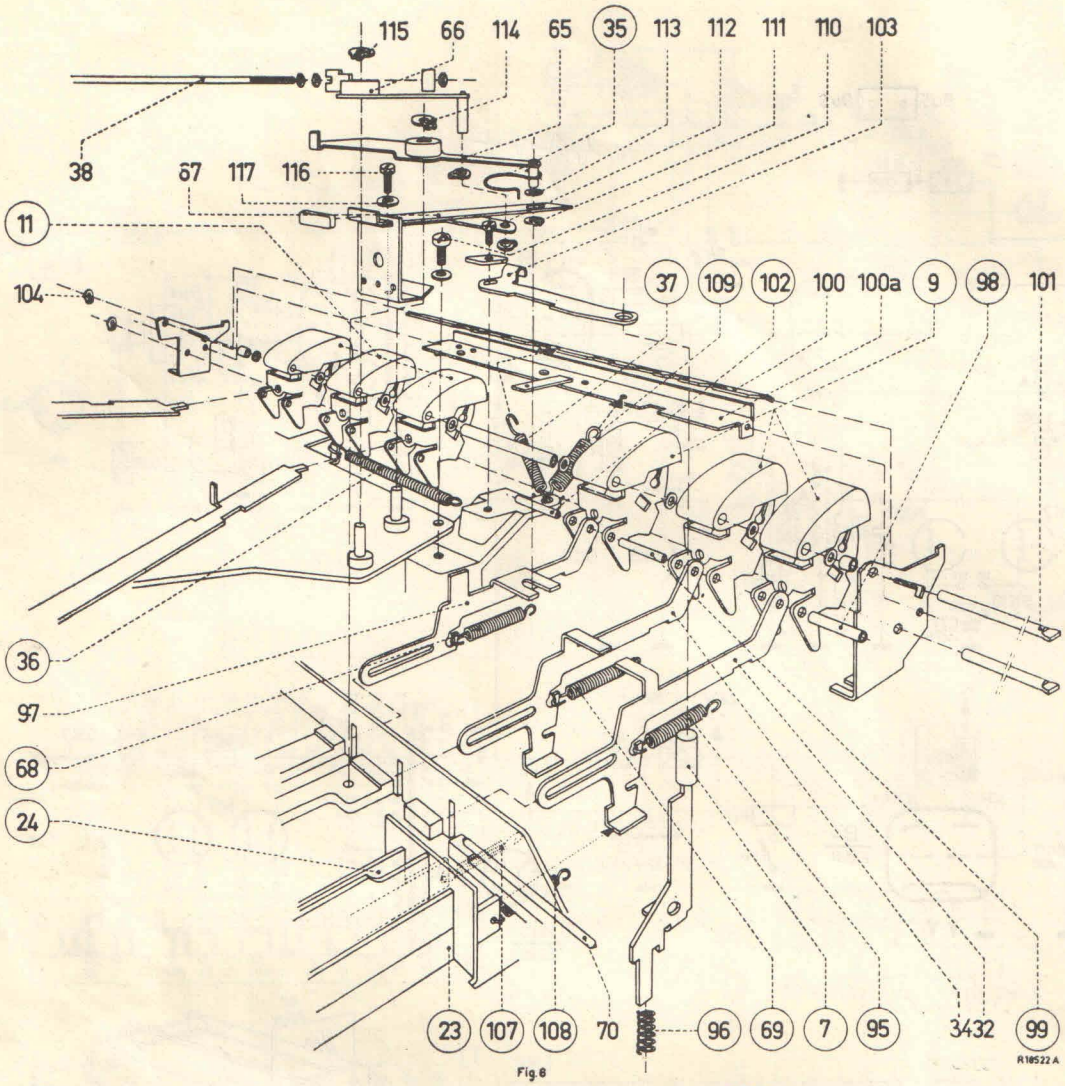

Fig.8

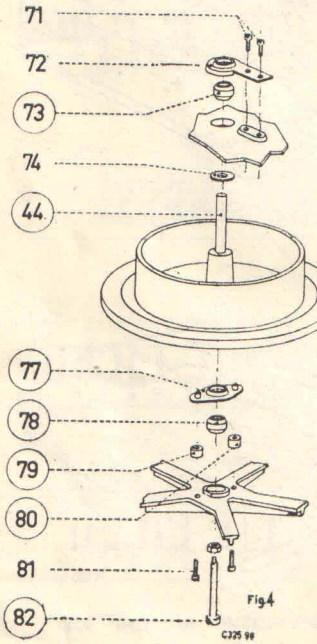

Fig.4

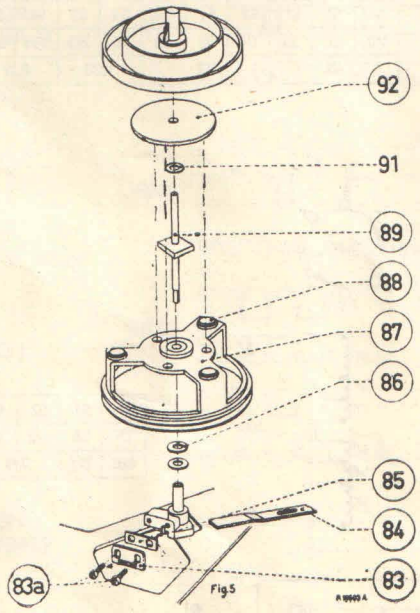

Fig.5

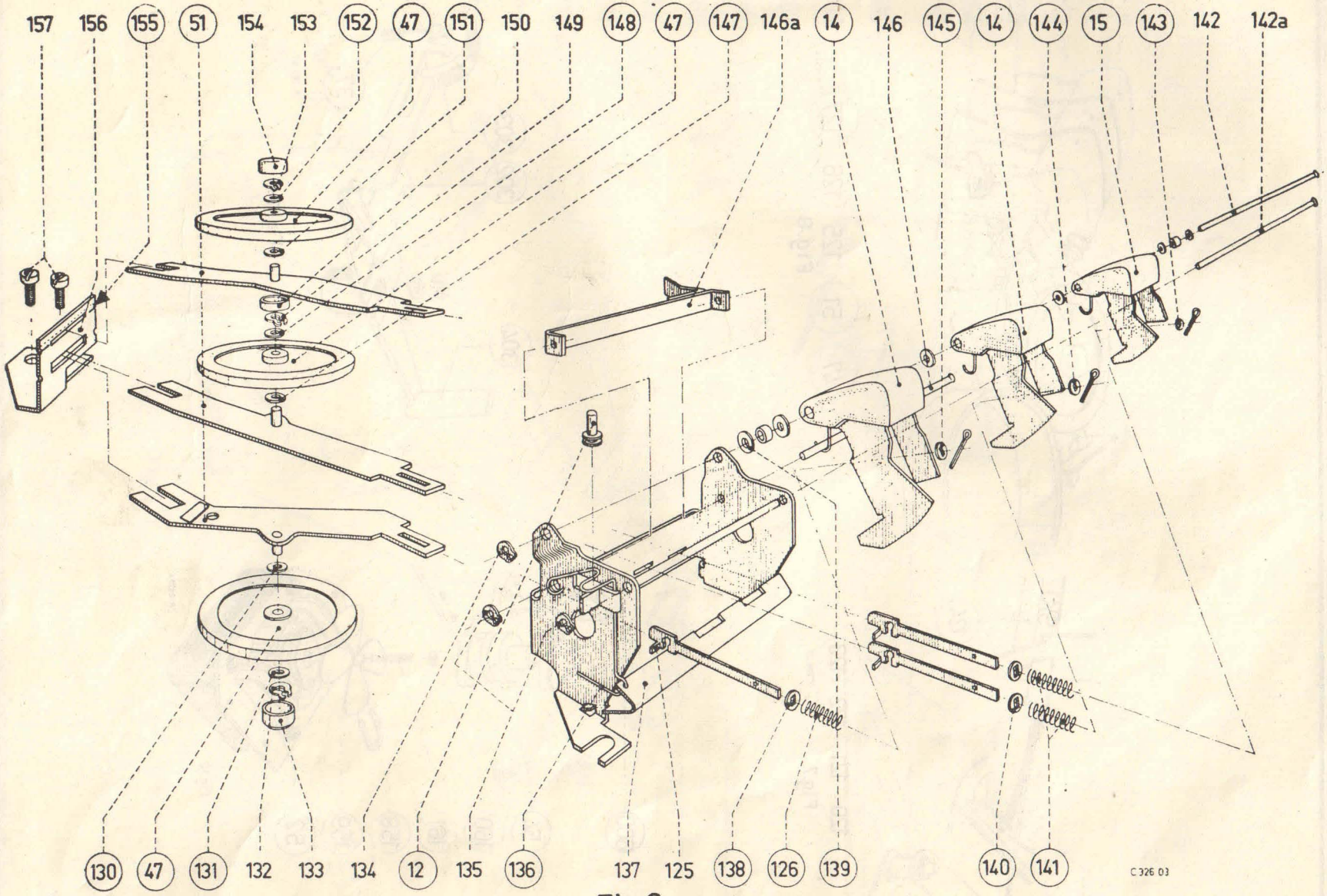
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Fig.9

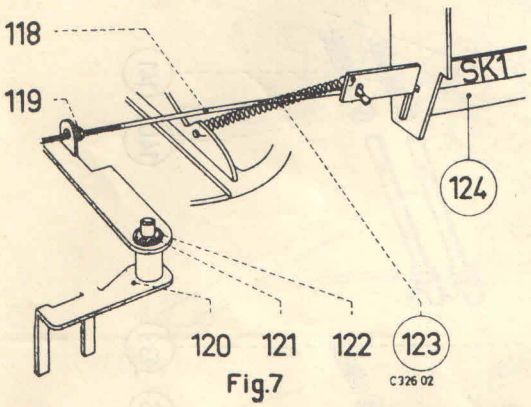


Fig.7

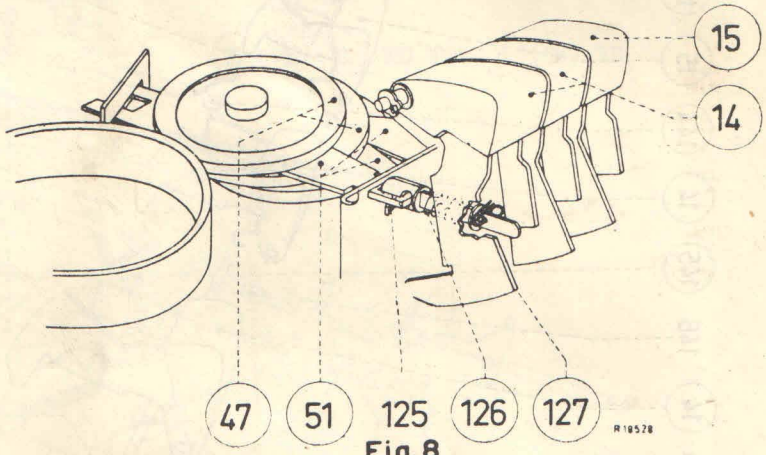


Fig.8

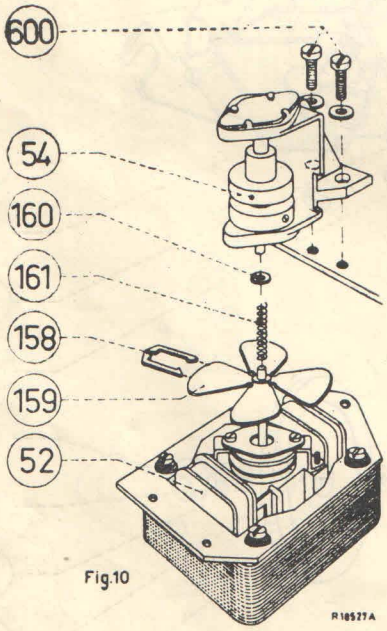


Fig.10

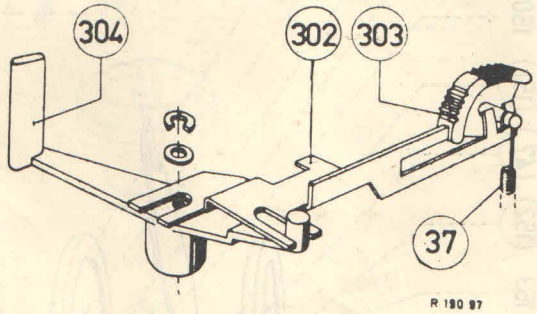
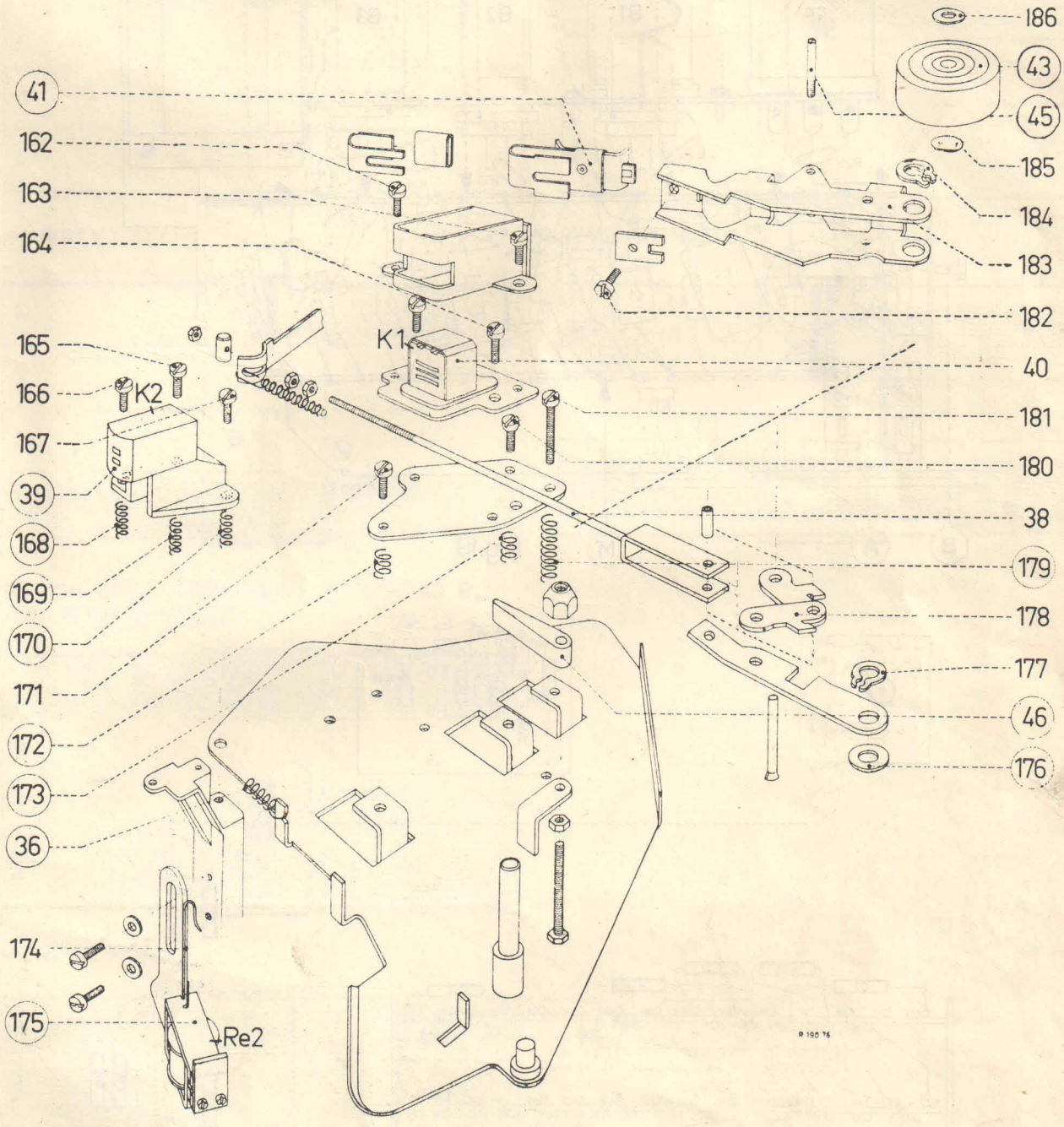


Fig.11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K1
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K2
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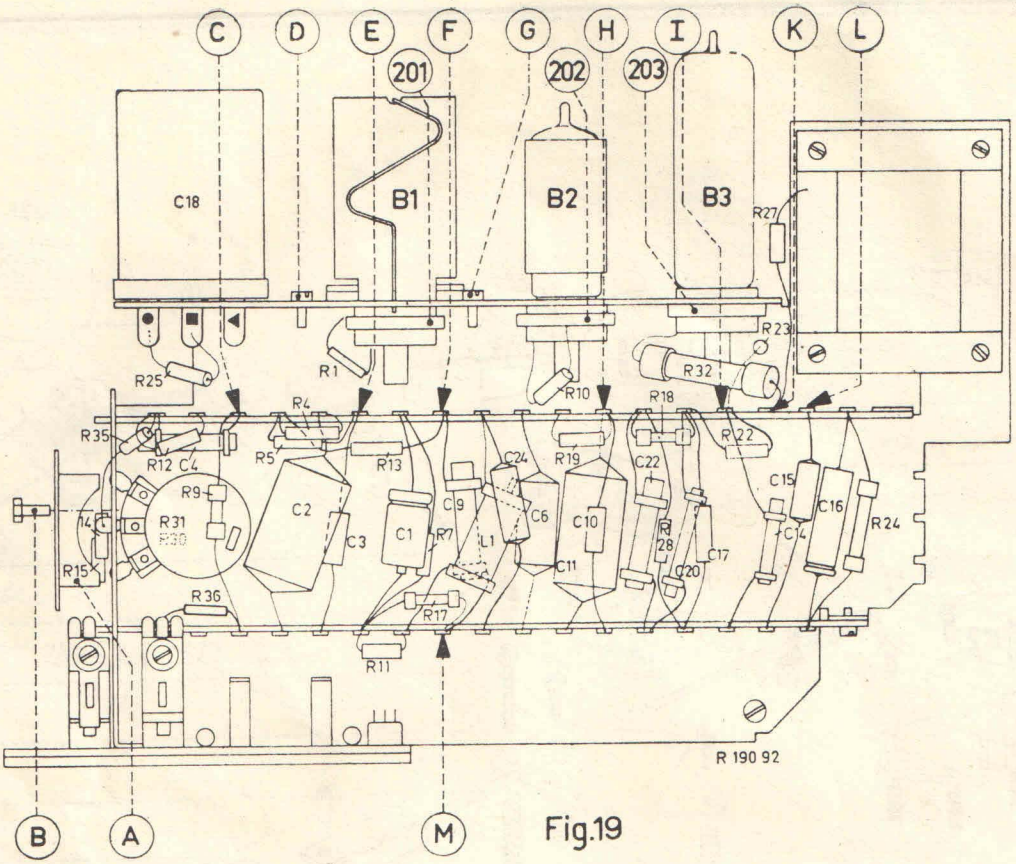
Re2

Fig.12


C
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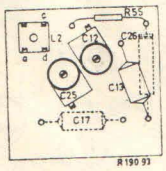
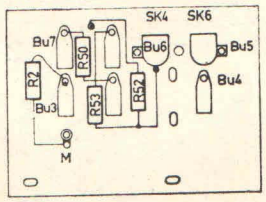
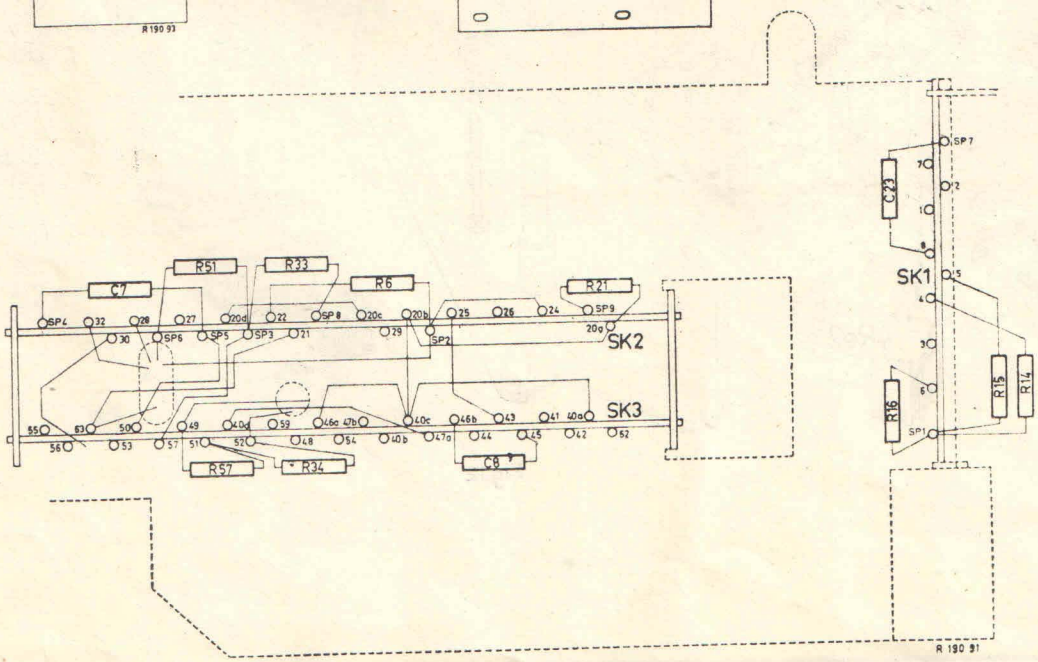
E
F
G
H
I
K
L
201
202
203
C18
B1
B2
B3
R27
R23
R25
R1
R32
R10
R18
R4
R35
R12
C4
R5
R13
C24
R19
C22
R22
C15
R9
C2
C9
C6
C10
R7
C1
C3
L1
C11
R28
C17
C20
C14
C16
R24
R31
R30
R15
R36
R17
R11
R 190 92
B
A
M

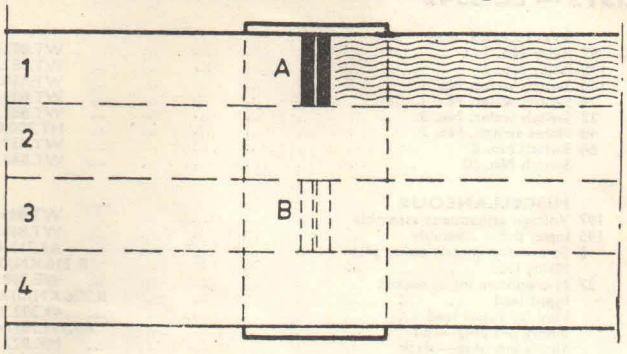
Fig.19


R55
L2
C12
C26
C25
C13
C17
R 190 93

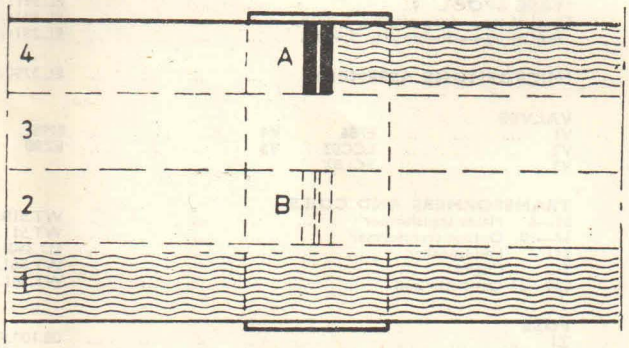

SK4
SK6
Bu7
Bu6
Bu5
Bu4
Bu3
R2
R50
R53
R52
M


C7
R51
R33
R6
R21
SK2
SK3
SK1
C23
R16
R15
R14
R57
R34
C8
R 190 91

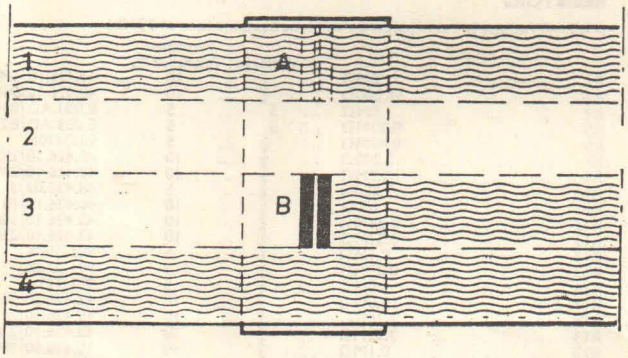
4-Track Monaural Recording



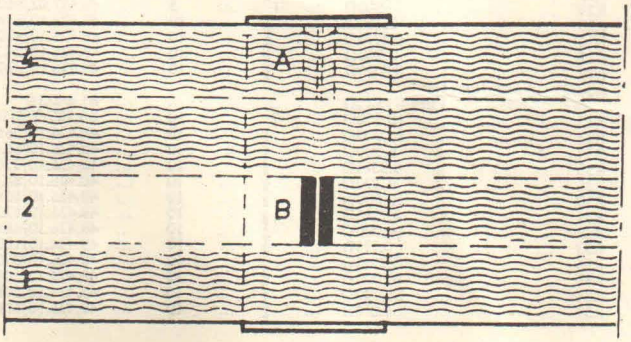
REVERSE REELS...



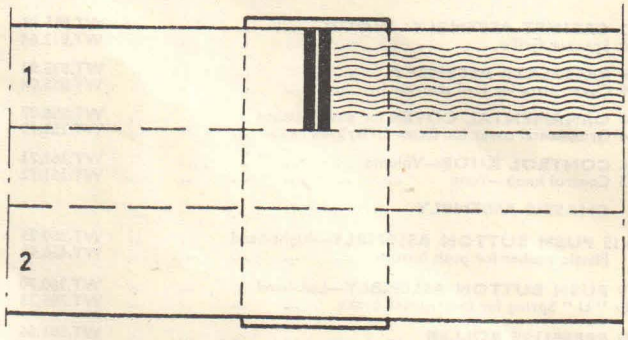
SWITCH OVER FROM HEAD A TO HEAD B, AND REVERSE REELS...



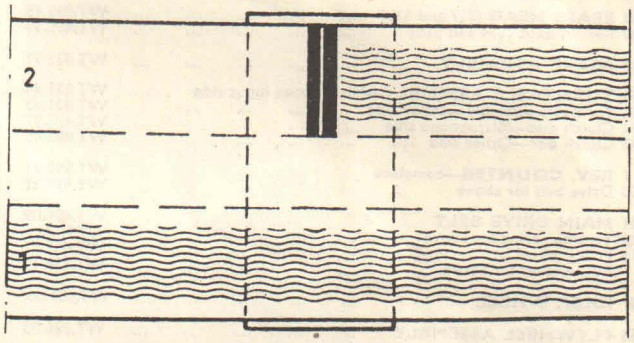
REVERSE REELS...



2-Track Monaural Recording



REVERSE REELS...



SPARE PARTS LISTS — EL 3542

2	**CABINET ASSEMBLY—WOOD**	WT.855.98
8	Speaker Grille	WT.912.64
198	**BASEPLATE ASSEMBLY**	WT.835.98
199	Cover plate for lead storage	WT.855.04
10	**ORNAMENTAL COVER** for push buttons	WT.856.07
4	Ornamental cover for Record/Playback heads	WT.252.15
6	**CONTROL KNOB**—Volume	WT.261.73
5	Control knob—Tone	WT.261.72

CHASSIS ASSEMBLY

14/15	**PUSH BUTTON ASSEMBLY**—Right-hand	WT.260.75
	Plastic washer for push button	WT.458.19
9	**PUSH BUTTON ASSEMBLY**—Left-hand	WT.260.70
35	" U " Spring for interrupter brake	WT.765.23
43	**PRESSURE ROLLER**	WT.881.66
46	Moulded tape guide	WT.902.26
	Tape-operated trip switch (Switch 9)	WT.598.11
41	Tape pressure assembly	WT.821.53
39	**ERASE HEAD** (S17 and S19)	WT.855.48
40	Record head (S14 and S18)	WT.855.39
59	**BRAKE ASSEMBLY**	WT.822.97
56	**TURNTABLE ASSEMBLY**—Microphone input side	WT.821.94
56	Turntable assembly—Other side	WT.821.93
92	Clutch disc—Microphone side	WT.477.97
93	Clutch disc—Other side	WT.886.55
1	**REV. COUNTER**—complete	WT.898.21
60	Drive belt for above	WT.495.21
61	**MAIN DRIVE BELT**	WT.496.09
22	Tension spring for above	49.897.81
18	Pulley wheel	WT.881.87
	PVC washer for above	WT.458.10
47	**IDLER WHEEL**	WT.881.86
44	**FLYWHEEL ASSEMBLY**	WT.886.03
52	**MOTOR ASSEMBLY**	JW.315.60
161	Coupling spring	WT.760.04

SWITCHES, etc.

57	Relay No. 1	WT.882.93
175	Relay No. 2	WT.882.91
124	Switch wafer, No. 1	WT.886.65
24	Switch wafer, No. 2	WT.888.30
23	Switch wafer, No. 3	WT.888.39
48	Mains switch, No. 7	HT.300.02
64	Switch No. 8	WY.837.32
	Switch No. 10	WT.888.31

MISCELLANEOUS

197	Voltage asjustment assembly	WT.885.61
195	Input panel assembly	WT.865.98
3	Screws for chassis cover plate	A3.713.10
	Mains lead	R.216.KN/05NE
27	Microphone input socket	WE.398.75
	Input lead	R.206.KN/01AA10
	Plug for input lead	49.302.27
	Single pin plug—red	A9.999.78/1x4AF
	Single pin plug—black	MK.872.72
12	Mains OFF button	WT.261.68
7	Record safety button and pause locking button	WT.836.70
	*TAPE SPOOL	EL.3911/00
	*Reel of tape—long playing, 1,800ft.	EL.3914/50
	Reel of tape—double play, 2,400ft.	EL.3914/80
	***MICROPHONE ASSEMBLY**	EL.3750/00

VALVES

V1	EF86	V4	EM81
V2	ECC83	V5	EZ80
V3	ECL82		

TRANSFORMERS AND COILS

S1—6	Mains transformer	WT.510.92
S7—10	Output transformer	WT.511.21
S11	Loudspeaker	LD.3501/74
S12	Choke	WT.561.79
S20—22	Oscillator coil	WT.561.89

FUSE

Z1		08.100.97

* Orders for these items must be placed with our E.L.A. Dept.

CAPACITORS

			Working Voltage	Permitted Tolerance %	
C1	Electrolytic	50uF	12.5		MK.183.02/50
C2	Polyester	0.1uF	400		C.296.AC/A100K
C3	Polyester	22,000pF	400		C.296.AC/A22K
C4	Polyester	68,000pF	250		C.296.AC/A68K
C6	Moulded	6,800pF	400		906/6K8
C7	Ceramic	680pF	500	5	C.304.GB/B680E
C8	Ceramic	820pF	500	10	904/820E
C9	Ceramic	15,000pF	500		904/15K
C10	Polyester	22,000pF	400	10	C.296.AC/A22K
C11	Polyester	0.1uF	400	10	C.296.AC/A100K
C12	Trimmer	30pF			908/30E
C13	Polyester	68,000pF	125	10	C.296.AA/A68K
C14	Ceramic	220pF	500	10	C.304.GH/A220E
C15	Polyester	22,000pF	400	20	C.296.AC/A22K
C16	Electrolytic	50uF	25		C.425.AF/F50
C17	Polyester	15,000pF	125	10	C.296.AC/A15K
C18	Electrolytic	50+32+32uF	350		A.6027
C20	Ceramic	330pF	500	10	C.304.AH/A330E
C22	Ceramic	15,000pF	500		C.301.BA/H15K
C23	Polyester	12,000pF	125	10	C.296.AC/A12K
C24	Polyester	8,200pF	125	10	C.296.AC/A8K2
C25	Trimmer	30pF			908/30E
C26	Electrolytic	125uF	25		C.426.AE/F125
C27	Polyester	0.22uF	400	10	C296 AC/220K

RESISTORS

(N.B.—Wattage is based upon an ambient temperature of 70°C.)

		Wattage	Permitted Tolerance %	
R1	1.0MΩ	¼	10	48.426.10/1M
R2	56,000Ω	½	10	48.426.10/56K
R4	1.0MΩ	5	5	E.003.AD/B1M
R5	0.22MΩ	5	5	E.003.AD/B220K
R6	0.47MΩ	¼	5	901/470K
R7	2,200Ω	¼	10	48.426.10/2K2
R9	2.2MΩ	¼	10	48.426.10/2M2
R10	3,300Ω	¼	5	48.426.02/3K3
R11	100Ω	¼	10	48.426.10/100E
R12	0.56MΩ	¼	10	48.426.10/560K
R13	0.22MΩ	¼	10	48.426.10/220K
R14	0.1MΩ	¼	5	901/100K
R15	0.27MΩ	¼	5	901/270K
R16	1.0MΩ	¼	5	901/1M
R17	10.0MΩ	¼	10	48.426.10/10M
R18	2.2MΩ	¼	10	48.426.10/2M2
R19	0.22MΩ	¼	10	48.426.10/220K
R20	0.1MΩ	¼	10	48.426.10/100K
R21	470Ω	¼	5	48.426.05/470E
R22	1.0MΩ	¼	10	48.426.10/1M
R23	1,000Ω	¼	10	48.426.10/1K
R24	560Ω	1	5	48.427.02/560E
R25	33,000Ω	¼	10	48.426.10/33K
R26	0.47MΩ	¼	10	48.426.10/470K
R27	2,200Ω	¼	10	48.426.10/2K2
R28	0.82MΩ	¼	10	48.426.10/820K
R30/31	Potentiometer 1.0M+1.0MΩ			B1.640.16
R32	10,000Ω	2	10	B8.305.08B/10K
R33	56,000Ω	¼	10	48.426.10/56K
R34	6,800Ω	¼	10	48.426.10/6K8
R35	0.33MΩ	¼	10	48.426.10/330K
R36	8,200Ω	¼	10	48.426.10/8K2
R50	10,000Ω	¼	10	48.426.10/10K
R51	0.12MΩ	¼	10	48.426.10/120K
R52	68,000Ω	¼	10	48.426.10/68K
R53	0.1MΩ	¼	10	48.426.10/100K
R54	0.39MΩ	¼	10	48.426.10/390K
R55	10,000Ω	¼	10	48.426.10/10K
R56	56,000Ω	¼	10	48.426.10/56K
R57	6.8MΩ	¼	10	48.426.10/6M8

Form 3634/RS422