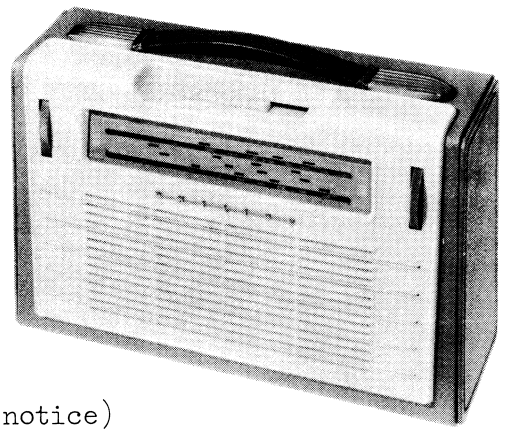
PHILIPS RADIOPLAYER
MODEL L3X73T-03



SPECIFICATIONS

(Subject to alteration without notice)

Tuning Range	.....	517 - 1630 Kc/s.
Intermediate Frequency	.....	455 Kc/s.
Power Supply:		
Dry Battery	.....	6V. Lantern - "Eveready" type 509 or "Diamond" type 3509
Battery Consumption	.....	13 mA. without signal 39 mA. for 50 mW output.

Knobs:

At left-hand: Volume control
At right-hand: Tuning control

Push Buttons:

From left to right -
1. Battery On-Off switch
2. Tone control switch
3. P.U. Switch
4. M.W.: 184-580 m (517 - 1630 kc/s)

Dimensions:

Length: $10\frac{1}{2}$"
Height: $7\frac{1}{2}$"
Depth: $3\frac{1}{2}$"

Weight:

Nett $4\frac{1}{2}$ lbs.
With Battery $5\frac{3}{4}$ lbs.

Loudspeaker:

Philips AD 3460 Z

Transistor and Germanium Diode Functions.

TR1 - OC44 Frequency converter.
TR2 - OC45 1st I.F. amplifier, and Pick-up pre-amplifier.
TR3 - OC45 2nd I.F. amplifier.
TR4 - OC71 1st audio amplifier.
TR5 - OC71 2nd audio amplifier.
TR6 - } 2OC72 Push Pull audio output.
TR7 - }
X1 - OA79 Detector and A.V.C.

* * *

Published by COMMONWEALTH SERVICE DEPARTMENT.

Philips Electrical Industries Pty. Ltd.

Sydney - Melbourne - Brisbane - Adelaide - Perth - Hobart

MARCH, 1958.

TO REMOVE CHASSIS FROM CABINET:

Open rear case cover by means of captive fastening screw, and place receiver face downwards on a suitable protective surface. Withdraw battery pack and unsolder speaker leads. (Black to speaker frame and grey to insulated solder tag). Remove the two chassis retaining screws together with the single screw which holds the audio sub-assembly. (Lower right-hand side of the cabinet). Carefully pull lower edge of chassis out and downwards so the push button assembly clears its aperture.

Re-insertion, is a reversal of the above method, however care should be taken that the dial cursor and push button assembly are not damaged in the process.

Before tightening the chassis retaining screws, ensure that the volume control and tuning rollers, together with the push-buttons operate freely.

DIAL CALIBRATION ADJUSTMENT:

If dial calibrations are incorrect by an equal amount of error over the band, the condition may be corrected by moving the cursor on the dial driving cord.

CIRCUIT ANALYSIS:

Analysis of circuit operation, stage by stage, is given to assist in service of this receiver.

R.F. STAGE:

Conversion to the intermediate frequency is accomplished by a self-oscillating mixing circuit. Shown in figure 1 is a simplified circuit for this stage.

Common base connection is used for oscillator transistor TR1. Necessary coupling between collector and emitter is given by the oscillator coil, (S5, S6, S7). D.C. supply to the collector is through resistor R4, decoupled by capacitor C11 and inductors S7 and S9. The base potential of TR1 is provided by the voltage divider circuit of resistors R1 and R2.

R1 is decoupled by C13. Correct matching of the emitter impedance to the oscillator coil is

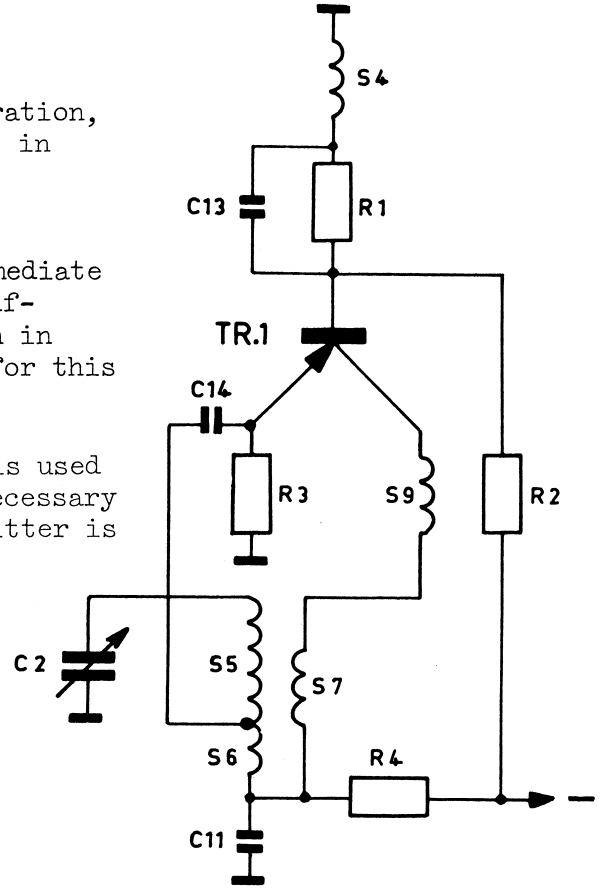


Fig.1

given through C14 to a tap on the coil. Matching of the ferroxcube antenna to the low impedance of the transistor is by means of the coupling windings S2 and S4. (Fig. 2)

Oscillator and incoming signal mixing occurs in transistor TR1. The required I.F. signal is obtained by the I.F. coil (S8, S9, S10, S11). (See figure 2.) Coil taps to transistor elements are used in both the I.F. stages to obtain the best I.F. impedance match.

I.F. STAGE:

Common emitter connection of the transistors is used for the remainder of the circuit. Improved amplification results from this configuration.

Two stages of I.F. amplification are provided by the transistors TR2 and TR3. D.C. supply to the collector of TR2 is through the decoupling filter R12, C10, C23 and the coil S13. Base potential is provided by the voltage divider circuit of R7 and R5, R6. R7 is decoupled by C17 and C18. Application of this potential to the base is through the low impedance coil S11. Temperature stability of the transistor is accomplished by this divider circuit, acting in conjunction with the emitter resistor R10. To prevent negative feedback of the intermediate frequency, R10 is by-passed by C5 and C20. Prevention of positive feed-back through the internal base to collector capacity is accomplished by a form of neutralizing circuit. Portion of the collector signal with reversed phase, is fed to the base by S14 and C19.

Transistor TR3 receives the amplified I.F. signal through the I.F. coil S12, S13, S14, S15, S16. Base potential of TR3 is by the voltage divider R13 and R14, decoupled by C24. Collector D.C. supply is through S18.

Emitter resistor R15, with by-pass C26, stabilises the operation of TR3. S19 and C25 provide neutralization for this stage.

Detection is accomplished by the germanium diode X1.

Detection provides two voltages; positive D.C. for AVC, as well as the AC audio signal. The AVC voltage is applied to the junction of R5 and R6. According to the signal strength received, the TR2 base becomes more or less negative. This AVC voltage is in opposition to the fixed bias voltage, thus the base potential and the transistor amplification, decreases with increasing signal.

When operating the receiver as a pick-up amplifier, transistor TR2 is made to serve as the preamplifier. Decoupling capacitors C17 and C18 are changed from earth to the pick-up terminals through R38 by the switch SK1. The audio signal reaches the base of TR2 through the low impedance winding S11.

Preamplifier output is developed across the collector resistance R12, as S13 presents a low impedance to audio frequencies.

Switch SK2 disconnects decoupling capacitors C10 and C23 from earth and applies the preamplifier output to the volume control. SK2 also stops operation of transistors TR1 and TR3 by interrupting their DC supply.

AUDIO STAGES:

The tone control switch operates in the collector circuit of TR4. In the high frequency position C39 is in parallel with R37 thus acting as a noise filter. In the treble cut position C39 is no longer in parallel with R37 as one end is now connected directly to earth to attenuate the high frequencies.

The audio signal derived either from the detector or the pick-up preamplifier, and is fed to TR4 base by R8 and C12. Stabilised transistor action is secured by the base bias voltage divider R18 and R34 and the emitter resistor R11 with its audio bypass C40. The DC supply to the collector is through R21.

Output of TR4 goes to TR5 base through the filter C39, R37 and the coupling capacitor C33. Bias stabilization is similar to TR4, that is:- base potential circuit R25 and R35 with R32 operating in conjunction with emitter transistor R26 and its by-pass capacitor C35. DC to the collector is through the primary of the driver transformer (S22). To prevent oscillation, an RC filter R27 and C36, is connected across this primary.

Negative feedback derived from the secondary of the output transformer, acts on the base of TR5. C37 in this feedback circuit provided phase correction for higher frequencies.

The centre tapped secondary of the driver transformer provides the correct phase for the push-pull output transistors TR6 and TR7. These transistors are operated with their emitters grounded and base potential is derived from a voltage divider circuit R28, R29 and R30. As the emitters are earthed, temperature compensation cannot be obtained from an emitter resistor. Instead an N.T.C. (negative temperature co-efficient) resistor R31 controls the base potential according to temperature and hence gives stability.

Resistor R33 and capacitor C38 provide an RC circuit designed to prevent oscillation in the output stage due to frequency changes varying the speaker loading.

ADJUSTMENT OF THE OUTPUT STAGE:

Class AB push-pull output stages are used in transistor circuits to provide economical power output. The transistors are so biased, that with no signal input there is a very small quiescent current. This feature

explains the economy of the circuit, relatively heavy current drain appears only when a large signal is applied. On application of signal the two transistors conduct alternatively. In the case of PNP transistors the one with the negative going signal conducts.

Now, if transistors were linear amplifiers they could be operated completely cut off with zero signal input. Unfortunately, this is not possible, for with a small initial increase in collector current severe distortion can occur.

This is overcome by applying a small bias current to the base of each transistor, input signals are superimposed on this bias current and good linearity results. The bias current is introduced to the transistor bases via the voltage divider R28 and R29 through the centre tap of the driver transformer. Adjustment of this bias is best carried out with a constant frequency audio input and oscilloscope displaying the output to the speaker. Bias current is then adjusted by varying R29 to obtain the best sine wave output.

If an oscilloscope is not available, an alternative but less accurate means of adjustment, is to connect a milliameter between the centre tap of S25 - S26 and negative 6V. as shown on the circuit diagram (fig. 2). The volume control is set to minimum position so that no signal is applied to the base of TR4. Now adjust R29 so that the milliameter indicates a current flow of 3.5mA.

ALIGNMENT PROCEDURE:

Volume control to maximum gain.
Local switch not depressed.
Voltmeter to loudspeaker terminals via transformer.
Screw I.F. transformer cores out. Modulate signals with 400 c/s. When operating on the RF stage, these signals should be inductively coupled to the ferroxcube antenna rod. Tuning point 1 is at the extreme left and tuning point 2 at the extreme right of the scale.

Adjust pointer to 1 with the gang at its minimum capacity. Should C19 and C25 be replaced, a 50pf trimmer is used for the purpose.

These trimmers must be adjusted before fitting to 22pf by means of a capacity bridge.

Alignment sequence is as depicted on the separate alignment chart.

REPLACING PARTS:

Most of the parts used in this receiver are of the miniature type. These parts together with transistors cannot be replaced without special precautions, as soldering can cause damage, through over heating. In order to prevent this damage, the heat must be conducted away. This should be done by holding, with a pair of pliers, the lead between the solder point and the component concerned. The larger mass of the pliers absorbs the surplus heat. Ideally, replacements in transistor receivers should be carried out with miniature tools, especially the soldering iron.

ALIGNMENT CHART

CIRCUIT SECTION	SIGNAL	POINTER	DAMP WITH 10 K OHM	TRIM FOR MAXIMUM OUTPUT VOLTAGE
I.F. Transformers	455 KC/S through 33000pf to base of TR3.	Point 1		S20, S21, S17, S18, S19.
	455 KC/S through 33000pf to base of TR2			S15, S16, S12, S13, S14.
	455 KC/S through 33000ohm to collector of TR1			S10, S8, S9.
R.F. and oscillator circuits.	512KC/S	Point 2	S3	S5, S6.
	550KC/S	Tune to Signal	Remove damping of S3	S1
	1630KC/S	Point 1	S3	C4
	1500KC/S	Tune to Signal	Remove damping of S3	C3
	Repeat procedure for R.F. and oscillator circuits.			

SPARE PARTS LIST

COILS

S1) S2) S3) S4)	Aerial Coil Assembly	A3 803 09
S5) S6) S7)	Oscillator Coil	A3 128 39
S8) S9) S10) S11)	1st I.F. Transformer	A3 128 40
C15) C16)	195 pF	Across S8 - 9 Across S10 - 11
S12) S13) S14) S15) S16)	2nd I.F. Transformer	A3 128 42
C21)	195 pF	Across S12,13,14.
C22)	195 pF	Across S15,16.
S17) S18) S19) S20) S21)	3rd I.F. Transformer	A3 128 41
C27)	195 pF	Across S17,18,19.
C28)	195 pF	Across S27,28.
S22) S23) S24)	Audio Coupling Transformer	A3 161 80
S25) S26) S27)	Audio Output Transformer	9 18/08

CONDENSERS

C1) C2)	Tuning Condenser		49 002 04
C3)	30	pF	
C4)	30	pF	
C7)	3000	pF	
C10	3,2	µF	9 09/E3,2
C11	47000	pF	
C12	3,2	µF	9 09/E3,2
C13	47000	pF	
C14	10000	pF	
C17	47000	pF	
C18	3,2	µF	9 09/E3,2
C19	50	pF	
C20	0,1	µF	C296 AA/A100K
C23	0,1	µF	C296 AA/A100K
C24	0,1	µF	C296 AA/A100K
C25	50	pF	
C26	0,1	µF	C296 AA/A100K
C30	2350	pF	
C31	100	µF	9 09/B100
C32	50	µF	9 09/B50
C33	3,2	µF	9 09/E3,2
C34	0,1	µF	C296 AA/A100K
C35	100	µF	9 09/B100
C36	1500	pF	
C38	0,1	µF	C296 AA/A100K
C39	47000	pF	
C40	100	µF	9 09/B100

SPARE PARTS LIST (Contd.)

RESISTORS

R1	2200	Ω	
R2	8200	Ω	
R3	2200	Ω	
R4	1000	Ω	
R5	10000	Ω	
R6	22000	Ω	
R7	0,15	MΩ	
R8	2200	Ω	
R10	680	Ω	
R11	1800	Ω	
R12	2200	Ω	
R13	3900	Ω	
R14	22000	Ω	
R15	560	Ω	
R16	220	Ω	
R17	12000	Ω	
R18	15000	Ω	
R19	390	Ω	
R20	1000	Ω	
R21	6800	Ω	
R22	16000	Ω)	B1 639 65
R23	4000	Ω)	Volume Control
R24	1500	Ω	
R25	22000	Ω	
R26	680	Ω	
R27	560	Ω	
R28	1000	Ω	
ø R29	2200	Ω	B8 300 43B/2K2
R30	82	Ω	
* R31	130	Ω	B8 320 01A/130E
R32	33000	Ω	
R33	330	Ω	
R34	82000	Ω	
R35	27000	Ω	
R37	4700	Ω	
R38	0,47	MΩ	

Note:

ø Bias Adjustment

* N.T.C.

MISCELLANEOUS SPARE PARTS

Description	Code Number
Cabinet	A3 005 63
Grill, Lid	P5 350 26/31
Grill, loudspeaker	A3 686 17
Handle	A3 755 90
Knob, volume control	P4 077 40/17
Knob, tuning	P4 077 41/17
Push button	A9 023 49
Push button unit	A3 768 48
Scale, dial	A3 925 17
Spring, coil can fixing - narrow ...	A3 652 75
Spring, coil can fixing - wide ...	A3 652 58
Spring, dial drive	89 312 10.3

IMPORTANT! In ordering spare parts, quote CODE NUMBER of part and MODEL NUMBER of Receiver. In claiming free replacement under GUARANTEE, return defective part PROMPTLY and quote MODEL and SERIAL NUMBER of Receiver and DATE OF PURCHASE.

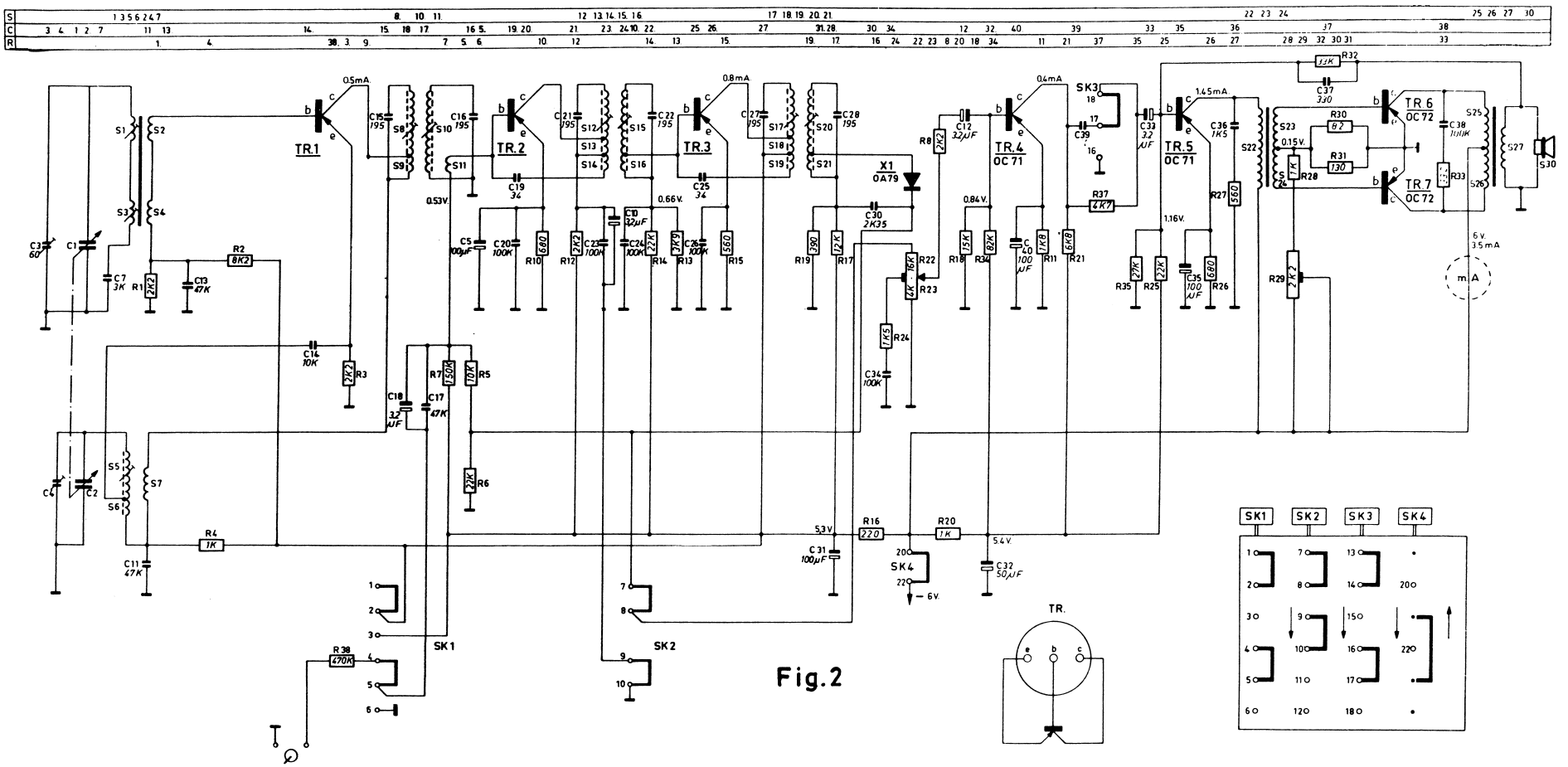

TR.1
TR.2
TR.3
TR.4
OC 71
TR.5
OC 71
TR.6
OC 72
TR.7
OC 72
X1
OA79
SK1
SK2
SK3
SK4
TR.
e
b
c
0.5mA
0.8mA
0.4mA
1.45mA.
0.53V.
0.66V.
0.84V.
1.16V.
0.15V.
5.3V
5.4V.
6V.
3.5mA
mA

Fig.2

S	D.	C.	B.	A.	22.	24. 23. 25. 26.	27.
C	11. 1. 7. 14. 6. 13. 2.	18. 17. 5. 20. 10. 19. 23. 31.	24. 26. 25. 30.	34. 32.. 40. 12. 35.	36.	39. 33.	37. 38.
R	3. 1. 4. 2. 38. 7. 9 5.	10. 12. 14. 13. 15.	6. 19. 17. 16. 8.	24. 11. 21. 18.	26. 27. 34. 20. 25. 35.	31. 30. 37. 29. 28.	32. 33.

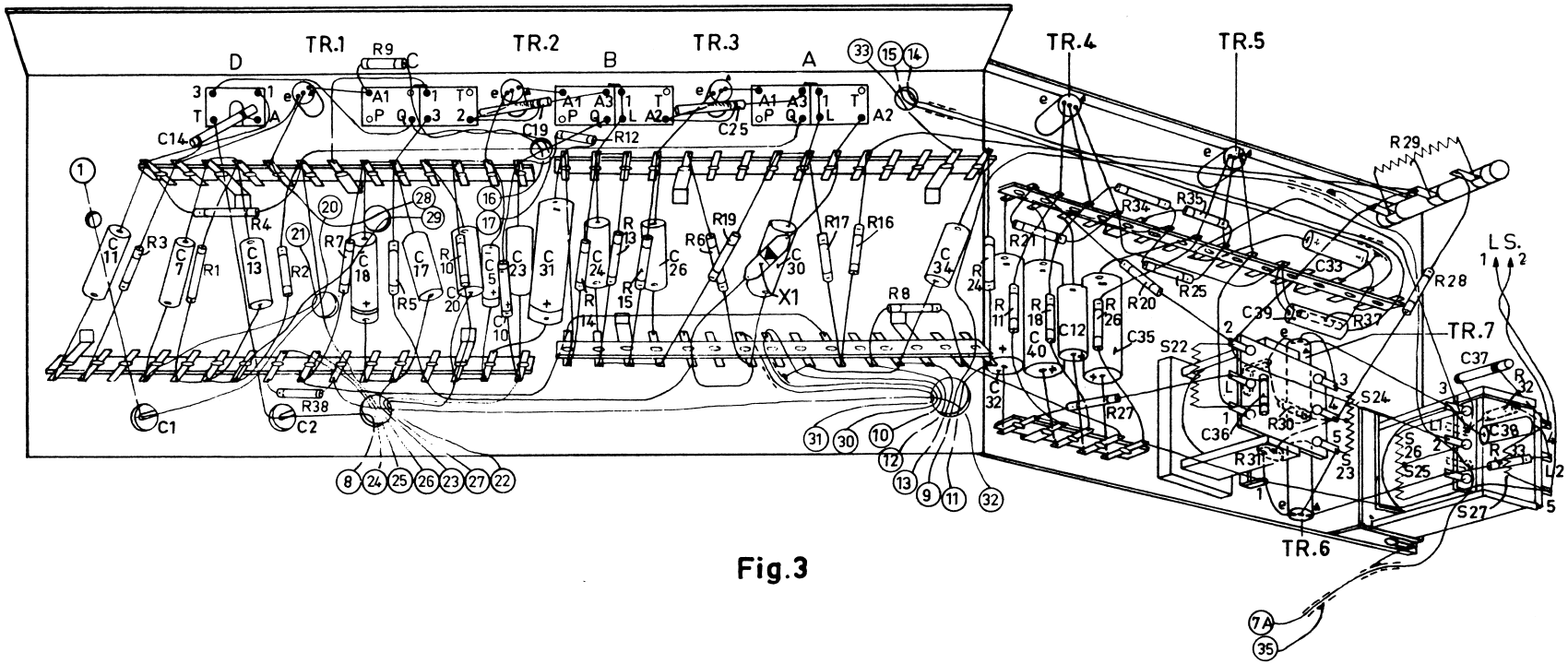
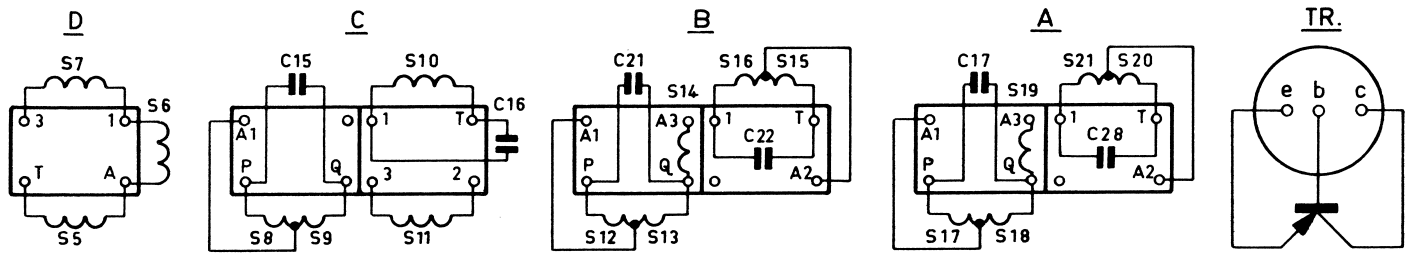


Fig.3



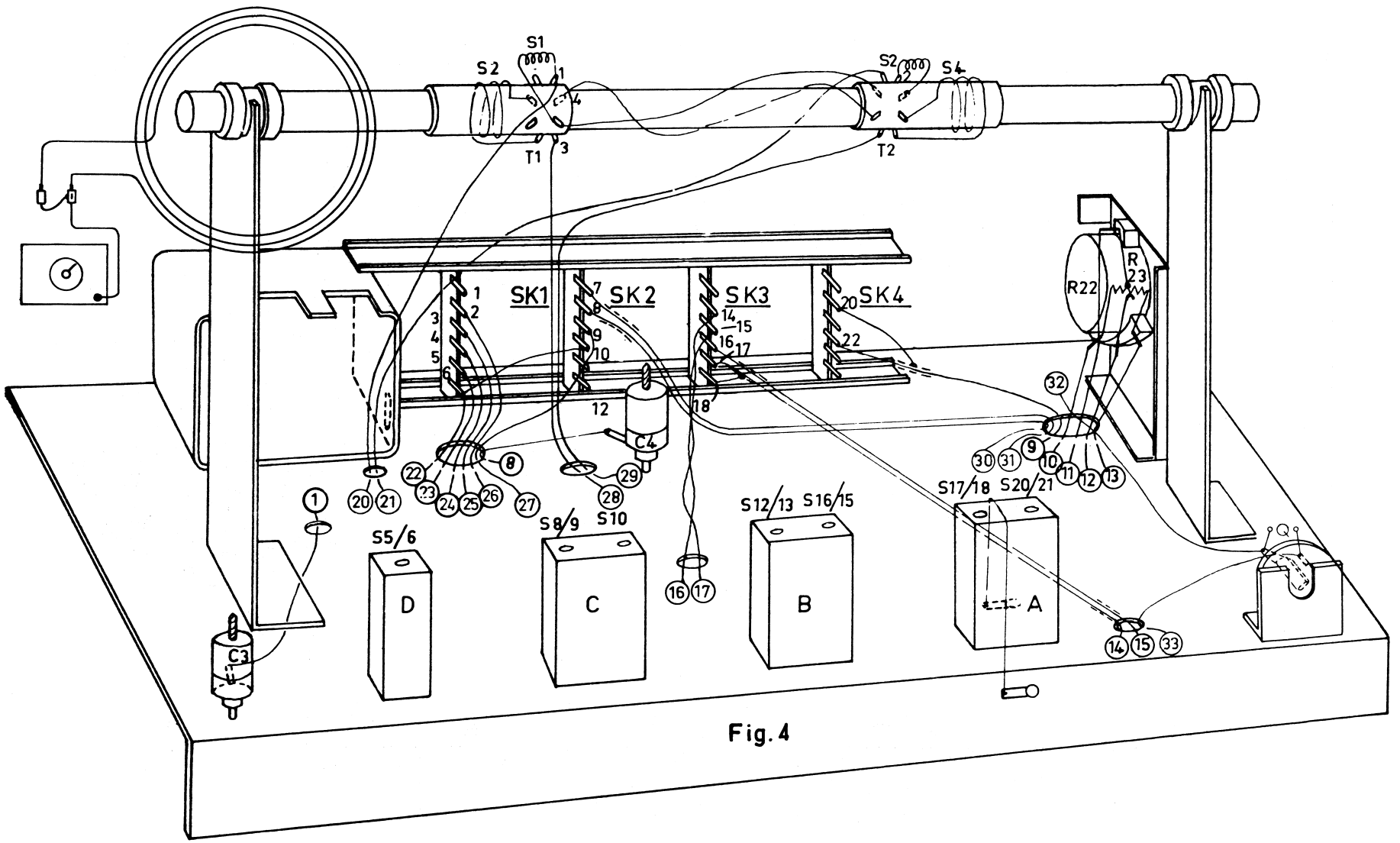

S1
S2
S2
S4
T1
T2
SK1
SK2
SK3
SK4
R22
R23
C4
C3
S5/6
S8/9
S10
S12/13
S16/15
S17/18
S20/21
D
C
B
A
Q

Fig. 4

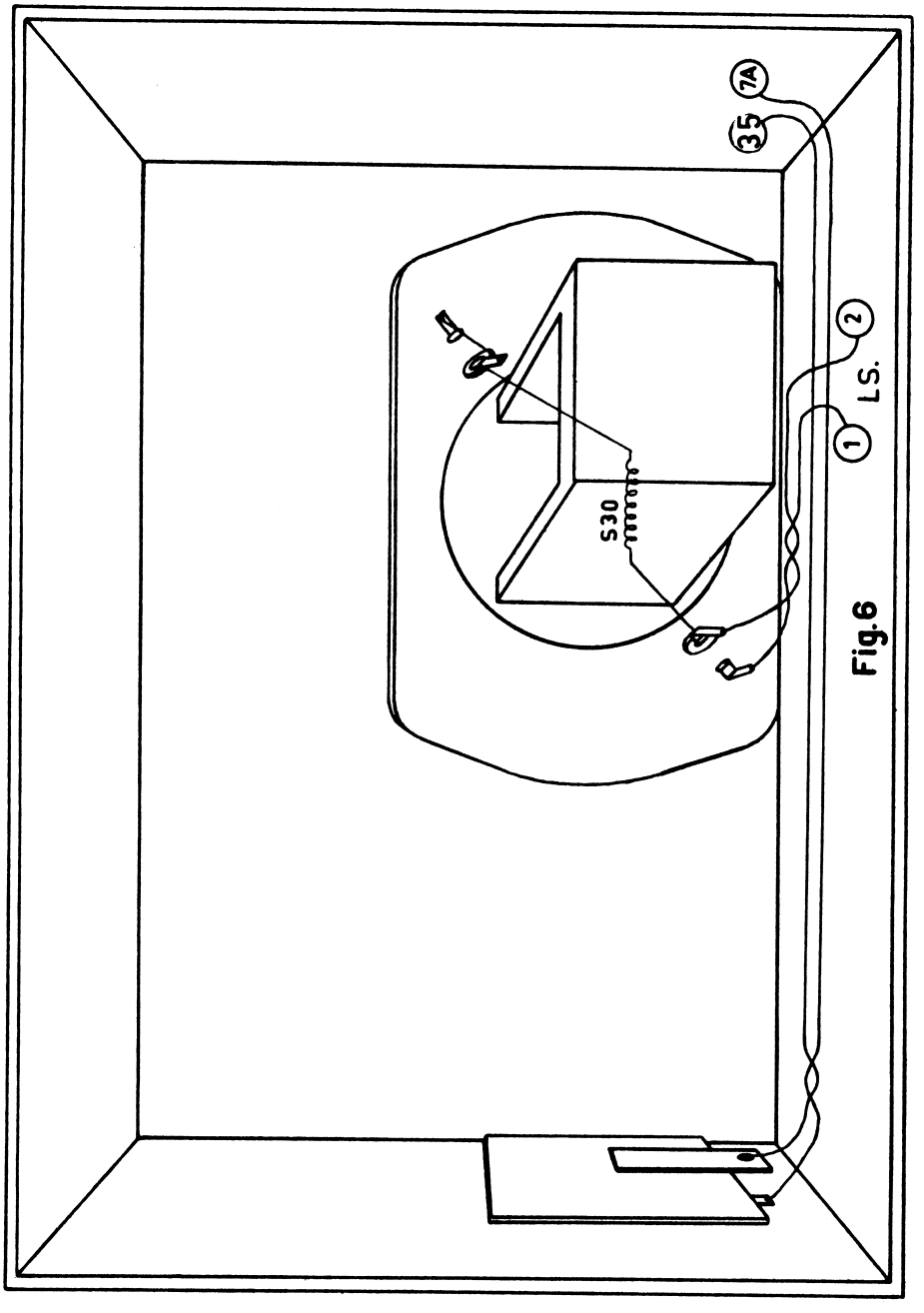


Fig.6

DIAL STRINGING GUIDE

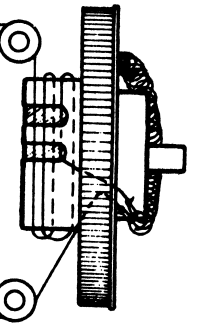


Fig.5