

# Service manual

## RECORDERS 9116A

00/02/43/75



The 9116A is a stereo cassette recorder with output amplifier, but without loudspeaker.

### TECHNICAL DATA

Mains voltage	: 110, 127, 220 and 240 V.
Mains frequencies	: 50, 60 Hz
Power consumption	: 25 W
Tape speed	: 4.75 cm/s (1 7/8 in/s) $\pm$ 2 %
Number of tracks	: 2 x 2 (stereo)
Track width	: 2 x 0.6 mm
Tape width	: 3.81 mm (in compact cassette)
Frequency response	: 80 - 10,000 Hz within 6 dB
Output power	: 2 x 4 W

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Subject to modification

4822 726 10722

Printed in the Netherlands



LIST OF MECHANICAL PARTS

1	Screw M2x5	4822 502 10679	78	Spring	4822 492 40416
2	Ring dia. 2.2	4822 532 10331	79	Brake pad	4822 466 40077
3	Clamping ring dia. 2.3	4822 530 70043	80	Torsion spring	4822 492 40117
4	Ring dia. 3.2	4822 532 10332	81	Plastic clamping ring	4822 532 50268
5	Screw M2.5x5	4822 502 10951	82	Roller	4822 528 80409
6	Clamping ring, dia. 2	4822 530 70114	83	Left-hand reel disc	4822 528 10227
7	Clamping ring, dia. 1.5	4822 530 70121	84	Tension spring	4822 492 30655
8	Screw M3x8	4822 502 10689	85	Screw	4822 500 10137
9	Clamping ring, dia. 4	4822 530 70124	86	Tension spring	4822 492 30777
10	Clamping ring, dia. 3	4822 530 70115	87	Ball	4822 520 40005
11	Clamping ring, dia. 1.5	4822 530 70174	88	Spring	4822 492 40378
12	Ring, dia. 2.8	4822 530 80081	89	Spring	4822 492 60344
13	Screw M3x5	4822 502 10058	90	Ring	4822 532 50265
14	Screw M2x12	4822 502 10682	91	Roller	4822 528 90081
15	Screw M2.5x8	4822 502 10672	91a	Switch SK5	4822 278 90008
16	Ring, dia. 2.5	4822 532 10215	92	Belt	4822 358 30152
17	Clamping ring, dia. 1.9	4822 530 70122	93	Spring	4822 492 30778
18	Clamping ring, dia. 4	4822 530 70116	93a	Bracket	4822 403 50591
19	Set screw M2.5x5	4822 535 80461	94	Spring	4822 492 60339
20	Clamping ring, dia. 3	4822 530 70123	95	Spring	4822 492 30251
21	Screw M2.5x5	4822 502 10889	96	Brake bracket	4822 403 10047
22	Clamping ring, dia. 2	4822 530 70114	97	Reel disc cap	4822 462 70107
51	Erase head K2	4822 249 40046	98	Right-hand reel disc	4822 528 10225
52	Spring	4822 492 30655	99	Pressure spring	4822 492 61534
53	Slide	4822 403 50584	100	Ring	4822 532 50648
54	Spring	4822 492 30251	101	Spindle of reel disc	4822 535 90062
55	Bracket	4822 403 10115	102	Collector	4822 310 20218
56	Tension spring	4822 492 30777	103	Capstan bearing bush	4822 520 30225
57	Tension spring	4822 492 30836	104	Ring	4822 530 70119
58	Push-button (record)	4822 410 20988	105	Spring	4822 492 60345
59	Push-button (rewind)	4822 410 20985	106	Pulley	4822 528 90173
60	Push-button (playback)	4822 410 20986	107	Wind bracket	4822 403 50576
61	Push-button (wind)	4822 410 20987	108	Wind friction clutch	4822 528 20022
62	Push-button (stop)	4822 410 21059	109	Spring	4822 492 60912
63	Compression spring	4822 492 50676	110	Plastic clamping ring	4822 532 50265
64	Leaf spring	4822 492 61314	111	Bracket with idler wheel	4822 403 20083
65	Ball	4822 520 40005	112	Switch bracket	4822 403 30089
65a	Bracket	4822 402 60321	113	Plastic clamping ring	4822 532 50265
66	Bush	4822 520 30226	114	Spring	4822 492 60345
67	Plastic washer	4822 532 50268	115	Ring	4822 532 50262
68	Pressure roller	4822 403 40039	116	Switch SK4	4822 278 90223
69	Record/playback head K1/K101	4822 249 10059	117	Drive wheel	4822 528 80147
70	Plastic ring	4822 532 50043	118	Ring	4822 532 50262
71	Bush	4822 532 10544	119	Ring	4822 532 50043
72	Compression spring	4822 492 50273	120	Belt	4822 358 30077
73	Compression spring	4822 492 50808	121	Flywheel	4822 528 10228
74	Bracket	4822 403 50586	122	Bearing plate	4822 520 10219
75	Bracket	4822 403 50431	123	Bearing bracket	4822 520 10292
76	Bracket	4822 403 50587	124	Counter	4822 349 50048
77	Bracket	4822 402 60322	125	Counter belt	4822 358 30148
			126	Motor	4822 361 20063

Required service tools

- Jig for perpendicular adjustment of capstan and adjustment of the height of the record/playback head 4822 402 60245
- Test cassette for azimuth alignment of the record/playback head and checking the tape speed 8945 600 11501
- Spring pressure gauge 3-55 g 4822 395 80029
- Spring pressure gauge 50-500 g 4822 395 80028
- Pliers for retaining rings (with a straight nose) 4822 395 40006
- Suction soldering iron (220 V) 4822 395 10018
- Suction soldering iron (110 V) 4822 395 10019

MAINTENANCE

After 500 working hours clean the recorder and lubricate the most important lubrication points.

Clean with alcohol or methylated spirit

- Erase head
- Record/playback head
- Cords
- Reel discs
- Idler wheels
- Capstan
- Pressure roller

Lubricating instruction

- Shell Alvania 2 (4822 390 20001)  
Is used for lubricating the ball bearings; for example, the ball bearings between the mounting plate and slide 53.
- Lubricant 10 (4822 390 10003)  
Is used for lubricating the contact surfaces; for example, brackets 505, 506, 502, 503, 107, 55.
- Tellus 33 (4822 390 10006)  
Is used for lubricating spindles and bearings; for example, spindles of reel discs, bearings of idler wheels, the capstan bearing.
- Silicone grease (4822 390 20011)  
Is used for greasing plastic components; for example, knob 203, slides 213 and 219, bracket 215.

LIST OF CABINET PARTS

Item	Description	Code number
200	Cabinet	4822 443 30211
201	Knob	4822 413 40491
202	Recording indicator	4822 347 10051
203	Push-button mains switch	4822 410 20984
204	Spring (mains switch)	4822 492 30651
205	Bottom	4822 443 30202
206	Screw M3x12	4822 502 10974
207	Cassette lid	4822 443 60339
208	Spring (cassette lid)	4822 492 30652
209	Dust cover	4822 460 20058
210	Knob (cassette lid/pause)	4822 410 20983
211	Screw	4822 502 30082
212	Wooden side-panel	4822 443 60345
213	Slide	4822 403 50486
214	Self-tapping screw	4822 502 30079
215	Locking bracket	4822 403 50485
216	Spring (locking bracket)	4822 492 30651
217	Lever	4822 403 50494
218	Spring (slide)	4822 492 30651
219	Slide (pause knob)	4822 466 90676
220	Screw	4822 502 30063
221	Foot	4822 462 40128

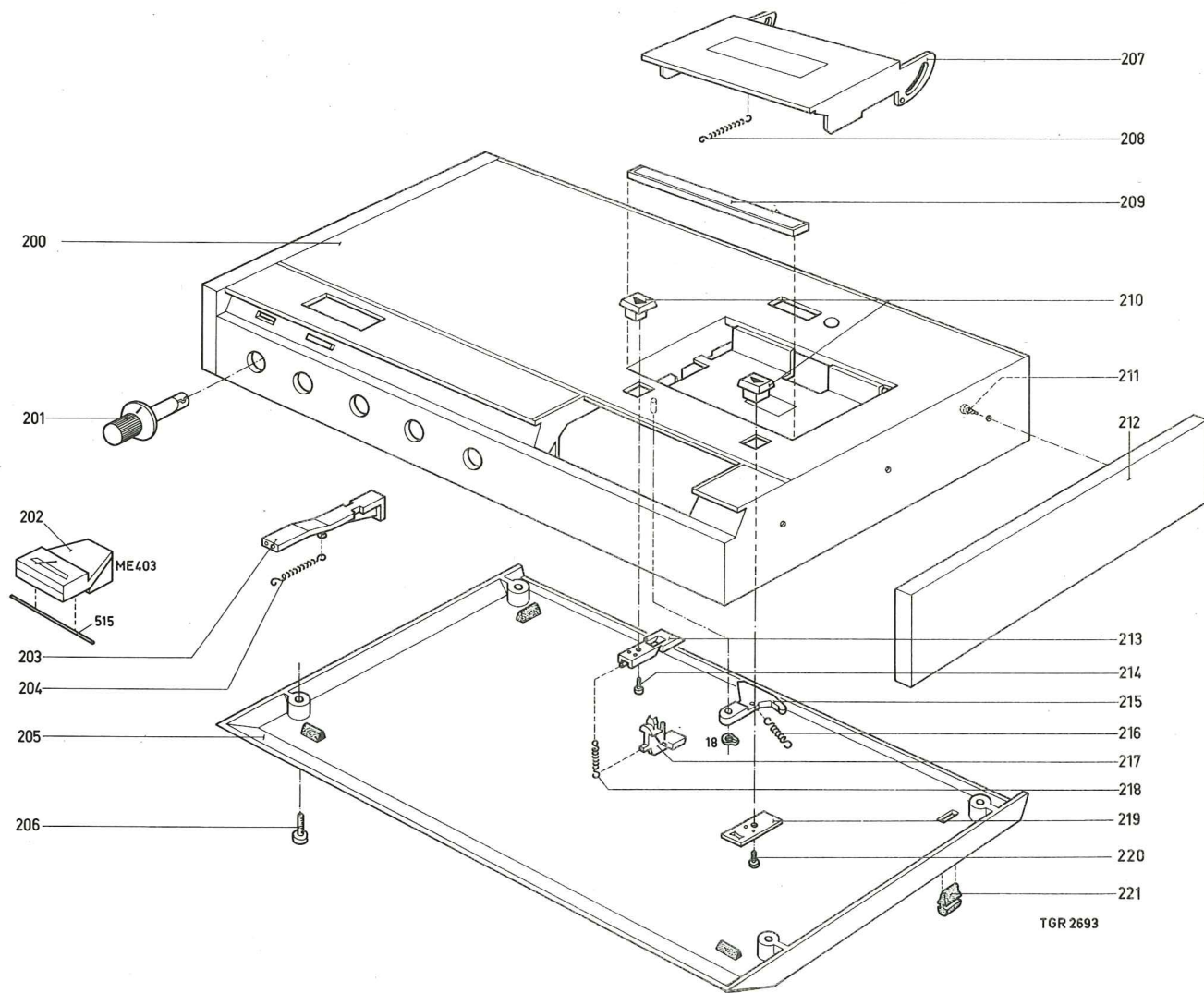


Fig. 2

## REPAIR HINTS

### Uncasing the recorder

- Remove the bottom by loosening the four screws 206.
- Remove the screws A, B, C, D, E, F and G (see Fig. 3).
- Remove the 5 control knobs.
- Remove the earth leads from motor bracket 512.
- Remove the tape deck and the p. c. board unit from the cabinet.

### Hinging out the p. c. board unit

When repairs need be carried out only on the two p. c. boards or on the mains transformer, it is only necessary to hinge out this unit.

- Remove the screws A, B, E, H and K (see Fig. 3).

Notes: 1. When hinging out the p. c. board unit, also remove screw E because this screw may damage the slide of SK1.

2. On recasing the recorder, be sure that the pause knob engages the appropriate tag on bracket 77a. Be also sure that the screws A, B, D and E have the required lengths (M3x6), because, if longer screws are used, the ornamental plate is damaged.
3. When reassembling, be sure that the cam on the slide of switch SK2 engages precisely the recess of bracket 514. Likewise the slide of switch SK1 must engage exactly the cam on bracket 74.
4. It is advisable to fit the control knobs to the spindles of the potentiometers prior to mounting the bottom. The p. c. board of the pre-amplifier can then be supported by hand.

### Replacing the drive belt 92

- Uncase the recorder.
- Remove the bracket of flywheel bearing 123.
- Replace belt 92.
- After replacement, readjust the bracket of the flywheel bearing. See "Mechanical adjustments and tests".

### Replacing flywheel 121 and winding friction clutch 108

- Uncase the recorder.
- Remove the bracket of flywheel bearing 123.
- Remove nylon clamping ring 110.

- Remove drive belt 92.
- Remove the flywheel and the winding friction clutch at the same time.

Notes: 1. When assembling, be sure that the cam on friction bracket 108 engages the hook of spindle 105.  
2. Readjust the bracket of the flywheel bearing after assembly. See "Mechanical adjustments and tests".

### Replacing right-hand reel disc 98

- Uncase the recorder.
- Remove cap 97.
- Remove the reel disc from the reel-disc spindle.

### Replacing the left-hand reel disc 83

- Uncase the recorder.
- Remove clamping ring 11, counter belt 125, counter belt pulley 106 and clamping ring 104.
- Remove the reel disc together with its spindle from the bearing.

### Replacing the push-buttons

- Uncase the recorder.
- Remove spring 63.

Note: When replacing the playback push-button, also remove the record and the rewind push-buttons. Straighten the bent part of bracket 76 (under the push-button).

- Remove the push-button with a tilting movement.

### Replacing collector 102

In the factory collector 102 is riveted onto the mounting-plate; the two rivet bushes also serve as terminals of the supply wires.

This method is less suitable for servicing. Therefore Central Service supplies a special collector to which already two bushes with an insulating ring have been riveted (code number 4822 310 20218). This collector should now be glued on the mounting-plate with e.g. a two-component adhesive 4822 390 30014.

The supply wires can then be soldered to the 2 rivet bushes in the normal manner.

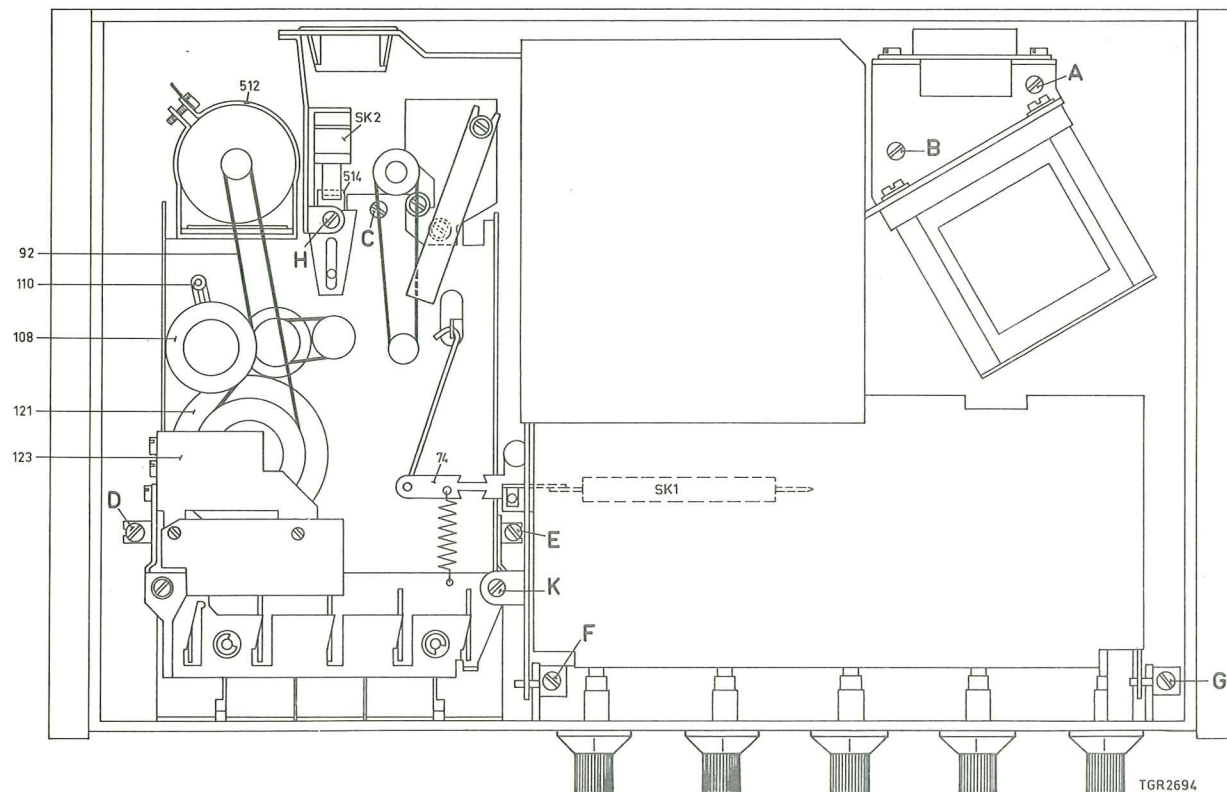


Fig. 3

MECHANICAL ADJUSTMENTS AND TESTS  
TAPE ADJUSTMENTS

Adjustment of the capstan (see Fig. 4)

For the adjustment a special jig (see A in Fig. 4) is required.

- Uncase the recorder.
- It is assumed that the record/playback head has been adjusted to the correct height. In this case the tape guides of the record/playback head and those of the erase head are in line.
- Set the recorder to position "Playback".
- Slide jig A over the capstan, while pressure roller 68 is pulled back. The jig must be slid over the capstan so far that it is in line with the tape guide of the erase head and the record/playback head.
- When the capstan is perpendicular with regard to the record/playback head and the erase head, the jig will slide exactly between the tape guides of the above-mentioned heads. If this is not the case (the capstan is not perpendicular), the capstan can be adjusted with screw 19 (see Fig. 4).

Note: For the construction of the capstan bearing see "New mechanical constructions".

Adjustment of record/playback head 69 (see Fig. 4)

a. Right-hand side

For this adjustment, too, the especial jig is used (see A in Fig. 4).

- Uncase the recorder.
- It is assumed that the capstan is in a perpendicular position.
- Set the recorder to position "Playback".
- Slide jig A over the capstan while pressure roller 68 is pulled back. The jig must be slid over the capstan so far that the capstan is precisely in line with the tape guides of the erase head and the record/playback head.
- If the record/playback head has been adjusted to the correct height, the jig will be slid exactly between the tape guides of the above-mentioned heads. If this is not the case (the record/playback head is too high or too low) the head may be adjusted with nut 66B. (After that, lockpoint nut 66A.)

b. Azimuth alignment

- Insert a test cassette (6300 Hz); code number 8945 600 11501.
- Connect a valve voltmeter to diode output BU1 between points 3 and 2.
- Set the recorder to position "Playback".
- Adjust the record/playback head with nut 66A so that a maximum output voltage is measured. (Make a note of this value.)
- Connect the valve voltmeter to points 5 and 2 of BU1.
- Measure the output voltage and adjust for maximum value with nut 66A. (Make a note of this value, too.)
- Adjust the record/playback head to the average of the two values referred to above so that the output voltages of the two channels are equally high. After that, lockpoint nut 66A.

Note: For the azimuth alignment the tape deck need not be uncased. Nut 66A is accessible after dust cover 209 has been removed.

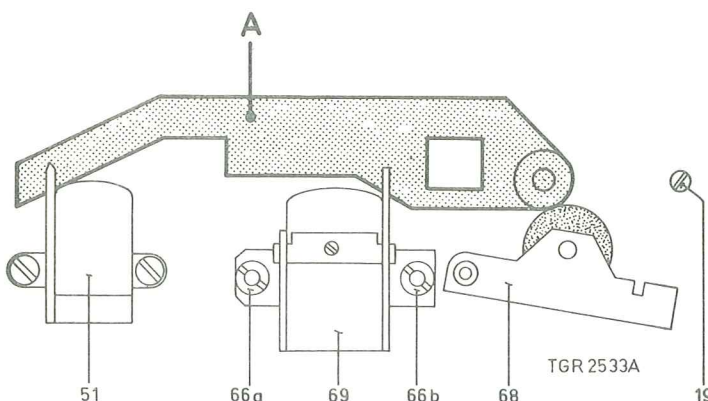


Fig. 4

Checking the pressure force of pressure roller 68 (see Fig. 5)

In position "Playback", the force required to lift the pressure roller just off the capstan is between 150 and 190 g. This force is adjusted when the torsion spring is hooked in another mounting hole.

In position "Playback", the clearance between the pressure roller lever and cam A must be at least 0.5 mm. This clearance is adjusted when cam A is bent.

Checking the friction clutch (see Fig. 5)

It may occur that the tape is not, or irregularly, wound. The tape which is driven by the capstan may consequently be damaged.

This fault may be caused by:

- a. Incorrect pressure force of the pulley on the friction clutch against the reel disc.  
The pressure force of the pulley against the reel disc should be 70-100 g (see Fig. 5). If this is not the case, spring 105 must be replaced.
- b. Insufficient winding friction  
This may be measured as follows:  
Open one cassette sideways so that the tape can be taken out (see the cassette in Fig. 15). See to it that only leader tape is wound on the reel at the opening.  
Make a loop in the leader tape which should be taken out of the cassette sideways. Hook a spring pressure gauge in the loop.  
Uncase the recorder. Put the automatic stop circuit out of operation by short-circuiting the collector and the emitter of TS472 (on the motor p.c. board).  
Place the mechanism free from the workbench. Place the cassette with the opening to the right in the recorder.  
Set the recorder to position "Playback". Move the spring pressure gauge slowly in the direction of the tape, pull and retard this movement gradually until the tape is stopped. Exactly at the moment the tape stops, the measured force must be 30-50 g. Pulling in opposite direction must be avoided because this will result in a considerable increase of the force.  
If the force measured is not between 30-50 g, the friction clutch is defective and must be replaced.
- c. Too much friction in the cassette  
When the values measured according to points a. and b. are correct, the poor reeling up of the tape is due to too much friction of the tape in the cassette. In this case the Teflon foils in the cassette must be replaced. (Code number of Teflon foil: 4822 466 90348)

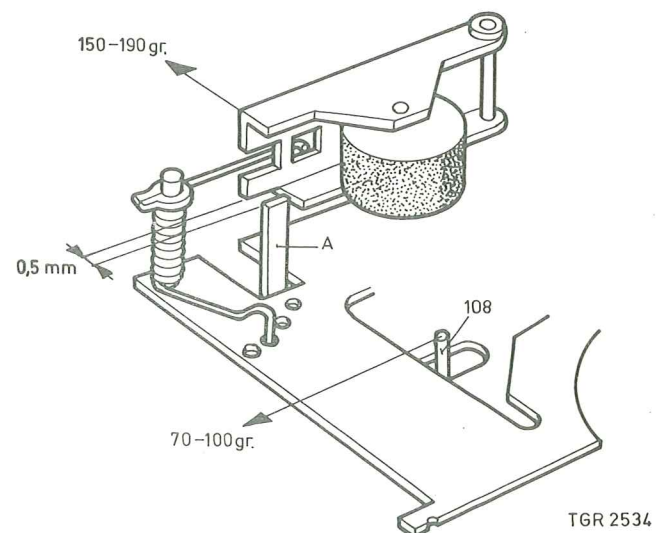


Fig. 5

Checking hold-down spring 99 (see Fig. 6)

The force with which the cassette is held down, should be between 200 and 300 g. This is measured with a spring pressure gauge (see Fig. 6).

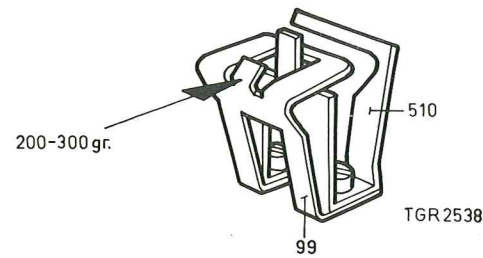


Fig. 6

CHECKING AND ADJUSTING THE DRIVE MECHANISM

Checking the rewind mechanism (see Fig. 7)

- The pressure force of idler wheel 111 against the reel discs should be 50 g in both winding positions.
- In position "Playback" the clearance between the flywheel and idler wheel 108 should be 1-2 mm. Adjust this clearance by bending tag E.
- In position "Rewind" the clearances A and B should be at least 0.2 mm. Adjust these clearances by bending tags F and G.
- In position "Wind" the clearances C and D should be at least 0.2 mm. Adjust these clearances by bending tags F and G.
- In the positions "Playback", "Wind" and "Rewind" the brake bracket must abut on the two stop tags on the mounting plate. The clearance between the reel discs and the brake pads should then be at least 0.3 mm.

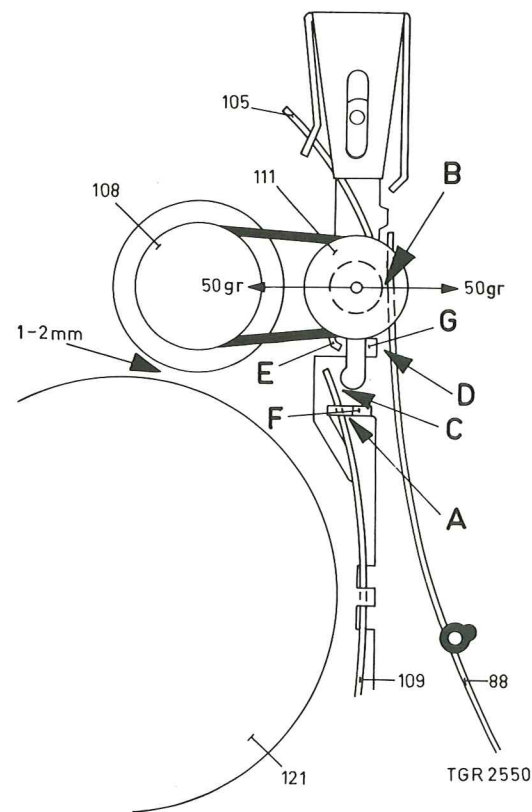


Fig. 7

Adjusting the flywheel (see Fig. 8)

- Place the recorder upside down.
- In this position the clearance between the underside of the capstan and the bearing plate should be 0.1 - 0.3 mm.
- Adjust this clearance by displacing bracket 123 with a screw-driver.

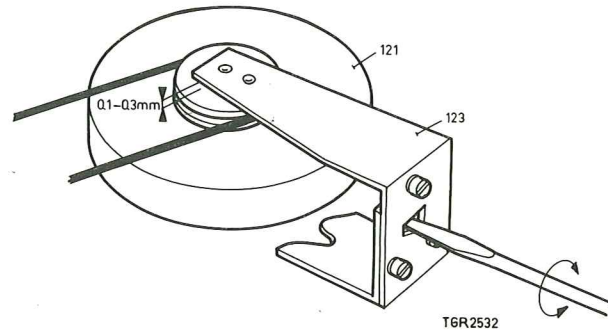


Fig. 8

Adjusting the motor

The height of the motor must be so adjusted that the motor pulley, the belt grooves of the flywheel and the friction clutch are flush.

ADJUSTMENTS OF THE SWITCHES

Switch SK1 (see Fig. 9)

- Remove the bottom.
- Depress the push-button "Record".
- Adjust the slide of switch SK1 so that the clearance between the first marking spot on the slide and the casing of the switch is 0 mm (see Fig. 9). (The marking spot is visible through a hole in the p.c. board.)
- Adjust this clearance by bending bracket 74 with e.g. a large retaining-ring pliers.

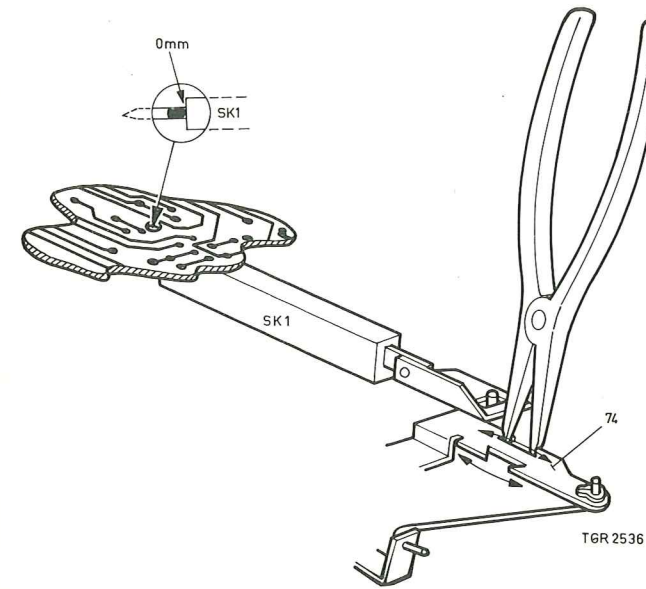


Fig. 9

Switch SK2 (see Fig. 10)

- Set the recorder to rest position (no button depressed). The clearance between the casing of the switch (front part) and the slide should be at least 0.1 mm (see Fig. 10).
- Set the recorder to position "Playback". The clearance between the casing of the switch (back part) and the slide should now also be at least 0.1 mm. Adjust this clearance by displacing the casing of the switch.

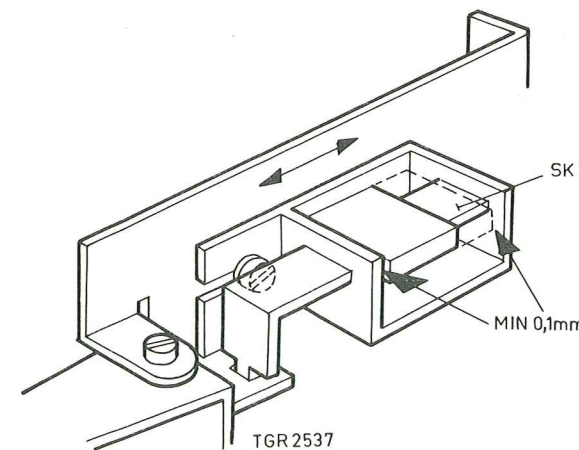


Fig. 10

NEW MECHANICAL CONSTRUCTIONS

Capstan bearing (see Fig. 11)

The capstan bearing is mounted on metal plate 516. This plate is resting on three distance pieces 517 which are riveted on main mounting plate 508. However, between the right-hand distance piece and plate 516 two additional rings A have been fitted. As a result, the capstan bearing is slightly tilted. When set screw 19 is tightened, the right-hand side of plate 516 is pressed down, and, consequently, the capstan bearing is positioned vertically.

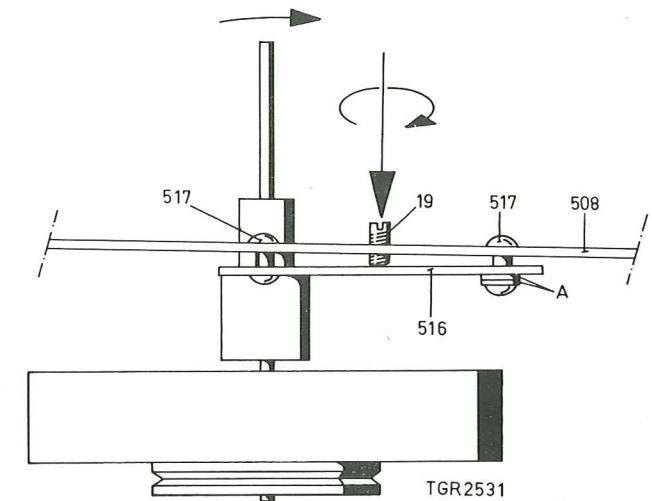


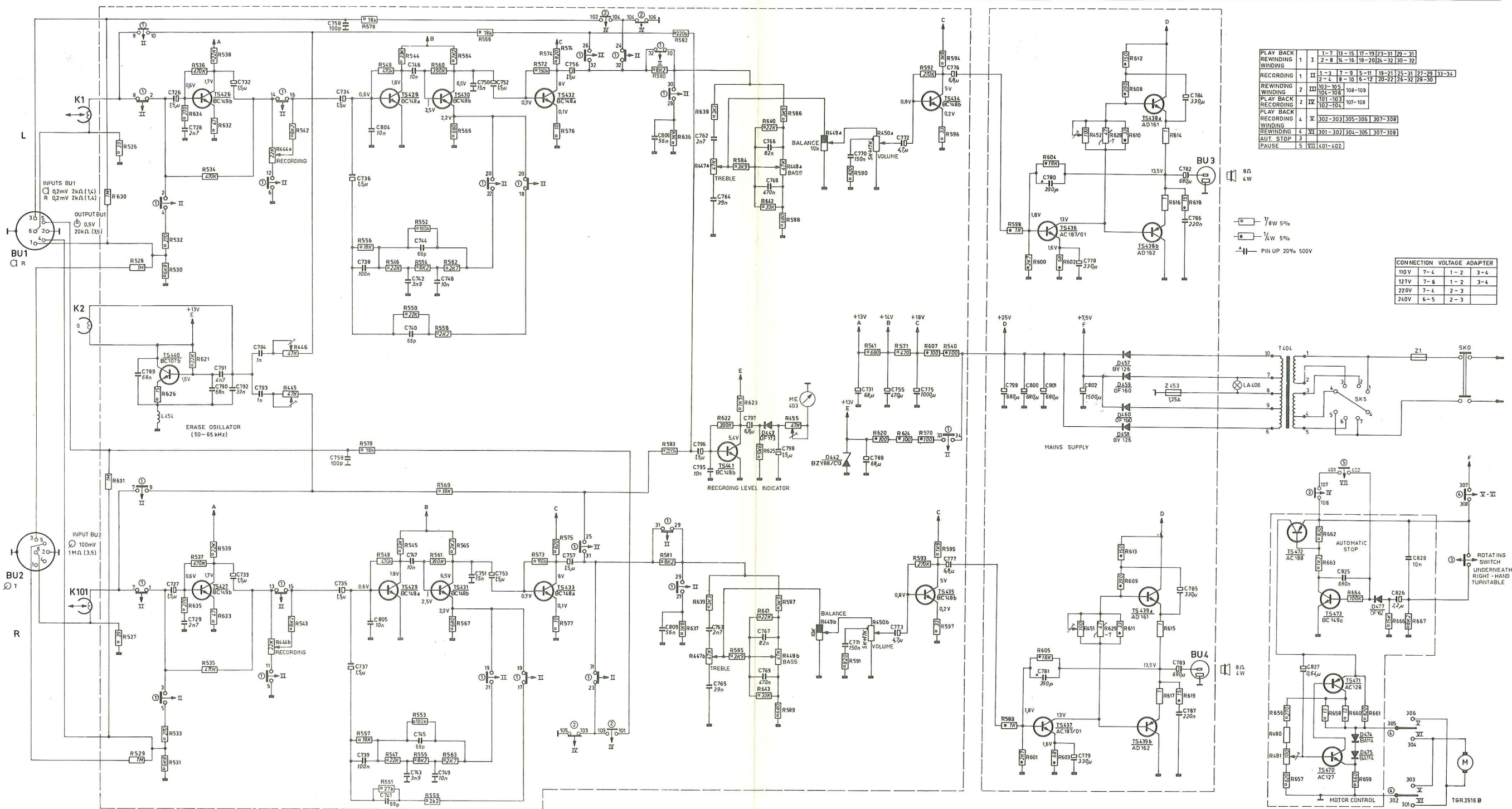
Fig. 11

Pause mechanism (see Figs. 1 and 16)

When the pause knob is pushed in the direction of the push-buttons, bracket 77a lifts pressure roller 68 off capstan 121. Besides, bracket 65a lifts friction clutch 108 off the right-hand reel disc. Bracket 65a also operates switch SK5. This switch short-circuits the automatic stop circuit. In this way the motor is prevented from stopping in position "Pause". Stop push-button 62 is provided with an additional bracket. This bracket causes the pause knob to return to its original position when the stop push-button is depressed.

To ensure that the motor will stop after winding or fast winding, a contact of SK2 is connected in series with SK5. These contacts (107 and 108) are closed only in positions "Record" and "Playback".

R:	630 526 528	532	534	536	532 538	444a 542 446	578 556 548 544 552 554	560 564 566 568	572 576	580 536 582	447a 638 622 584	625 640 588 448a	449a 590 541 450a 571	592 594 597 540	598 600 604 602	452 638 612 613	614 618	480 656 662 658 660 664 661 666 667				
C:	789	726 728	727 729	790 791	732	794 795	734 735 738 805	746 747 744 748	750 752	758 757	808 809	796 782 783 784 785	797 786 789 788 788	770 731 755 772 775 778	779 800 801 780 781	778 802 779	784 785 782 783 788 787	827 825 826 828				
MISC:	BU1 K1 K2 K101	L454 TS440	TS426 TS427	TS428 TS429	TS430 TS431	TS432 TS433	TS441	D443	ME403	D442	TS434 TS435	TS436 TS437	D458 D460	D457 D459	TS438a TS439a	TS439b TS439c	BU3 BU4	LA406	T404 TS472	TS473 TS471 TS470	D474 D475 D477	Z1 M



- The voltages indicated have been measured with a valve voltmeter with respect to chassis.
- De aangegeven spanningen zijn gemeten t. o. v. chassis met een buisvoltmeter.
- Les tensions indiquées sont mesurées à l'aide d'un voltmètre électronique par rapport au châssis.
- Die angegebenen Spannungen sind mit einem Röhrenvoltmeter gegen Chassis gemessen.
- Las tensiones indicadas fueron medidas con respecto al chassis, con un voltímetro electrónico.

Fig. 12



R	538 536 632 635 527 539 634 530 534 630 528 541 532 526 578 544 550 542 558 556 564 548 566 560 636 546 554 580 581 573 575 576 577 587 552 582 583 569 568 574 571 446	445	621 622 595 570 626 540 624 620 607 623 625	455	480 481 567 659 661 656 660 666 658
	663 635 537 529 531 535 533 631 444a 444b 579 545 549 551 565 639 638 567 561 559 557	507 637 447a 447b 555 563 553 577 586 587 584	585 643 448a 448b 641 642 588 589 596 593 597 594 592 449a 449b	591 590 450a 450b	663 662 667
C	616 614	612 604 608 543 598 610 452 618 602 600 619 451 611 603 601 599 609 613 605 615 617	755 796 794 793 791 792 790 798 795 788 797 798 775		664 827 828 825 826
MISC.	TS 426 SK1 TS 428 TS 430 TS 427 TS 429 TS 431 TS 432 TS 433 Z 453	D 460 D 459 TS 436 TS 437 D 458 D 457	S 454 TS 440 TS 441 D 443 D 442 TS 435 TS 434 TS 438a TS 438b ME 403 BU 3 BU 4 L 406 SK 5 SK 0 SK 4 Z 11 404 M	TS 471 TS 470 TS 473 D 474 D 475 D 477 TS 472	BU 1 BU 2 K 1 K 101 K 2 SK 3

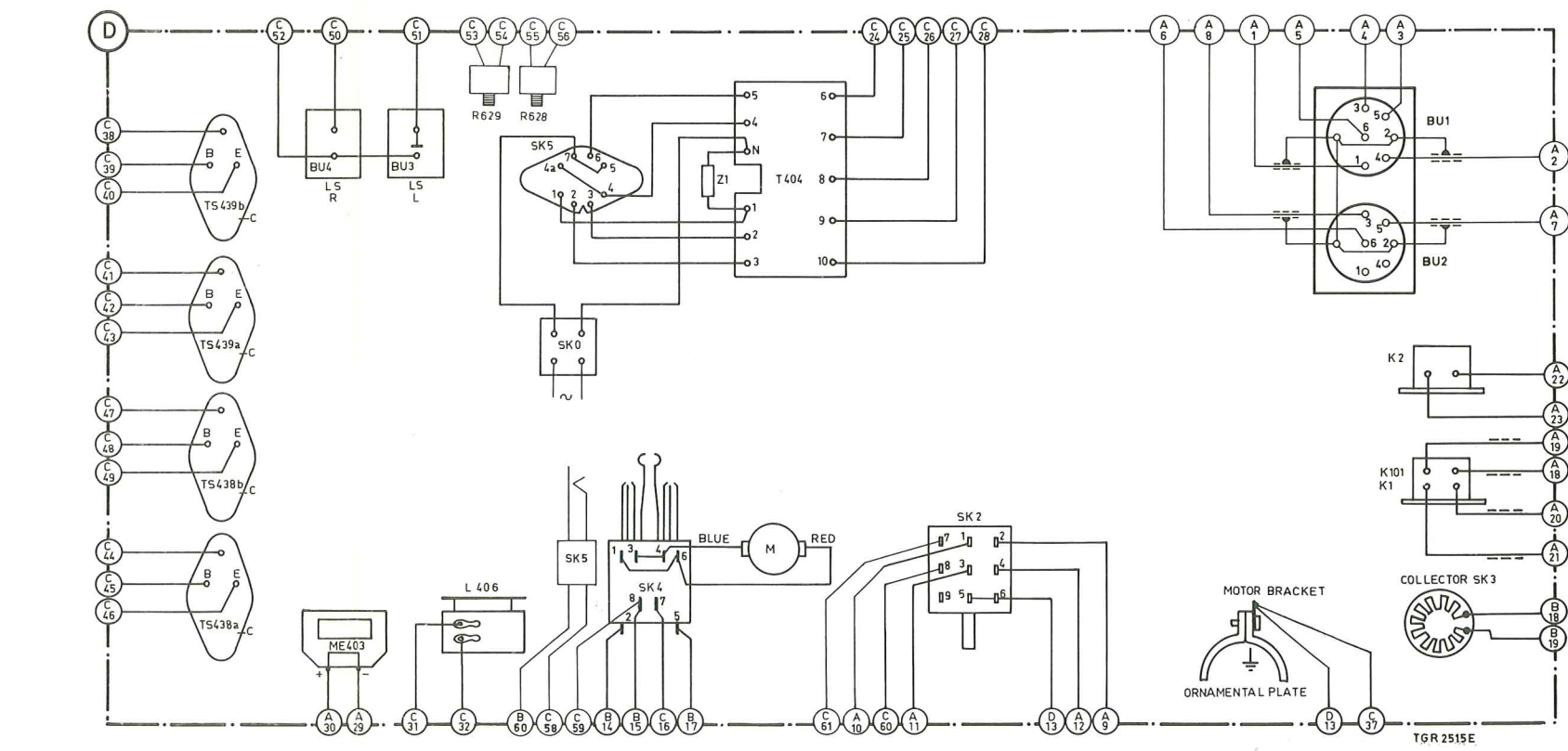
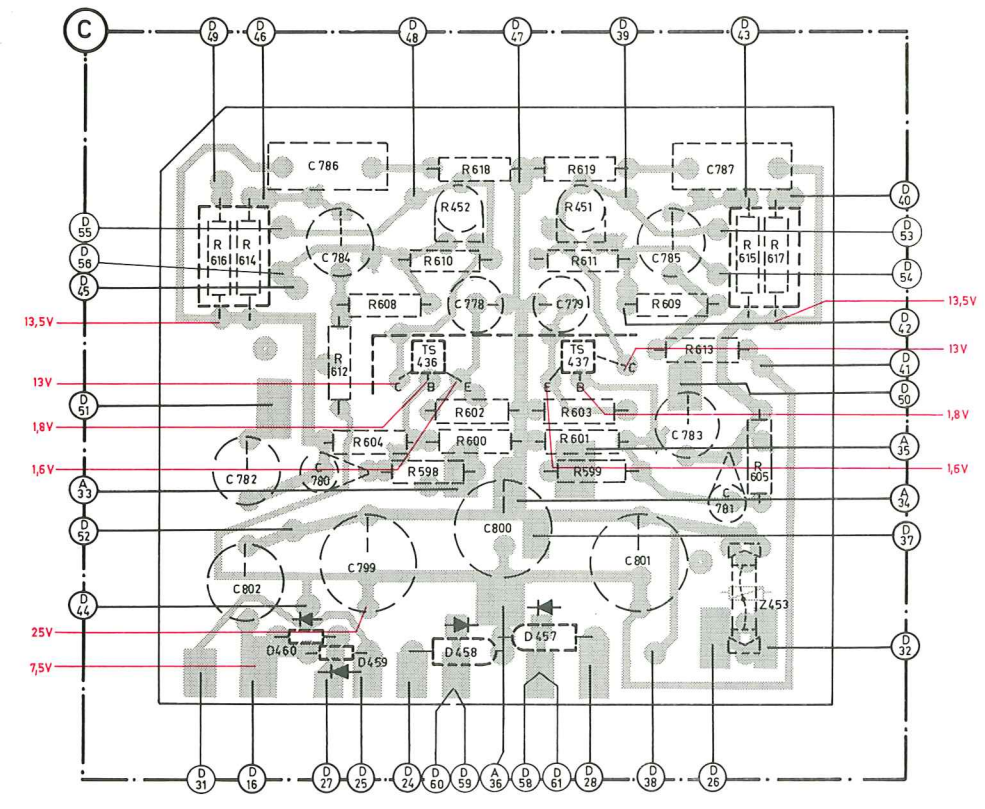
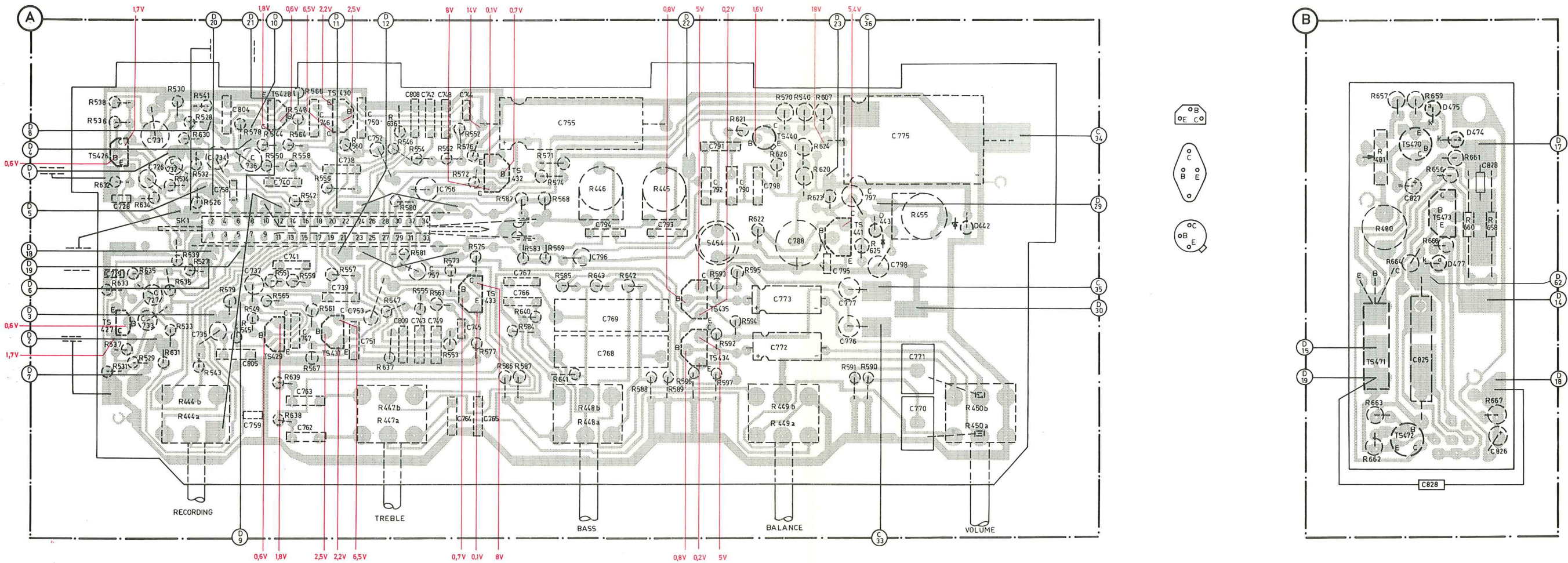


Fig. 13

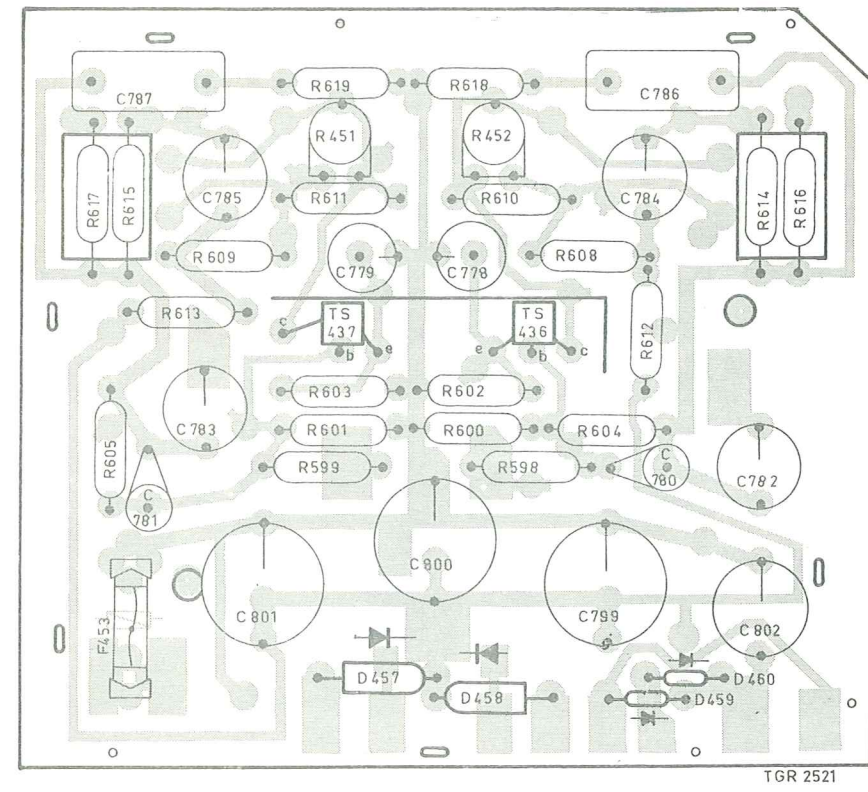
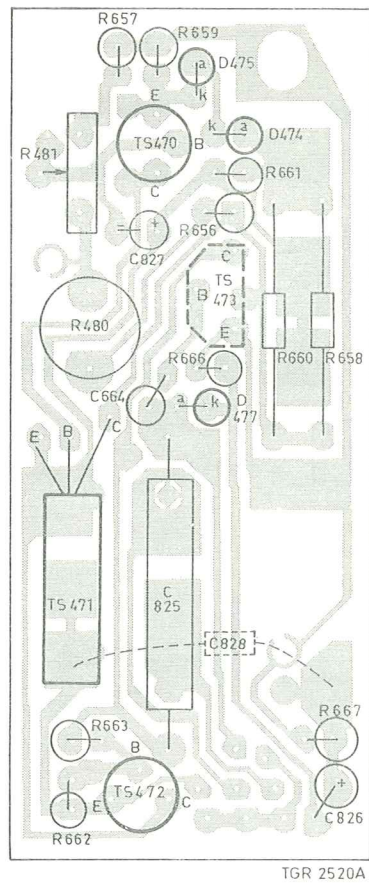
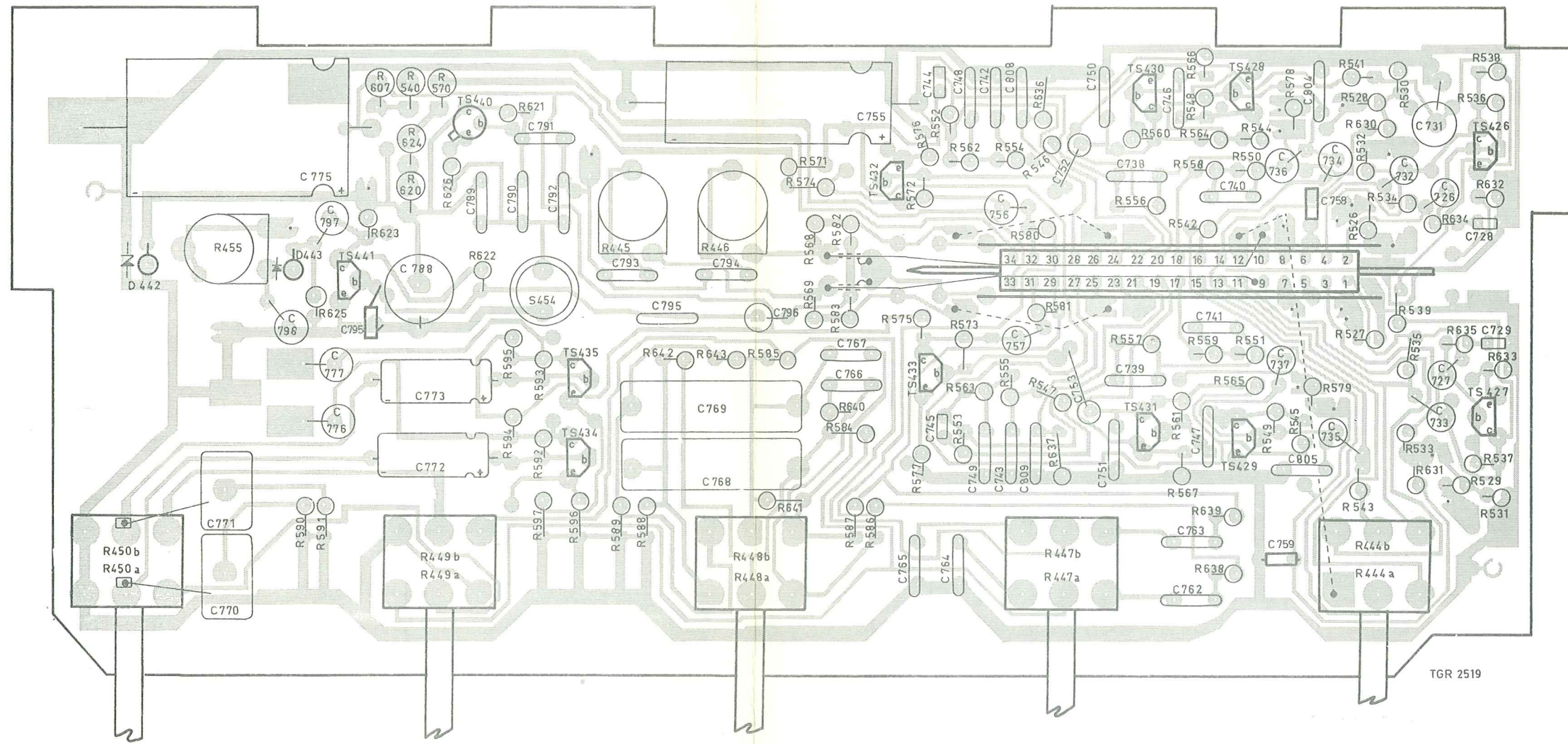


Fig. 14

LIST OF ELECTRICAL PARTS

Transistors

TS426	BC149B	4822 130 40313
TS427	BC149B	4822 130 40313
TS428	BC148A	4822 130 40317
TS429	BC148A	4822 130 40317
TS430	BC148B	4822 130 40318
TS431	BC148B	4822 130 40318
TS432	BC148A	4822 130 40317
TS433	BC148A	4822 130 40317
TS434	BC148B	4822 130 40318
TS435	BC148B	4822 130 40318
TS436	AC187/01	4822 130 40089
TS437	AC187/01	4822 130 40089
TS438(a, b)	AD161/AD162 (pair)	4822 130 40349
TS439(a, b)	AD161/AD162 (pair)	4822 130 40349
TS440	BC107B	4822 130 40357
TS441	BC148B	4822 130 40318
TS470	AC127	4822 130 40096
TS471	AC128	4822 130 40095
TS472	AC188	4822 130 40456
TS473	BC149C	4822 130 40216

Diodes

D442	BZY88/C13	4822 130 30401
D443	OF173	4822 130 30301
D457	BY126	4822 130 30192
D458	BY126	4822 130 30192
D459	OF160	4822 130 30313
D460	OF160	4822 130 30313
D474	BA114	4822 130 30189
D475	BA114	4822 130 30189
D477	OF162	4822 130 30266

Coils

S454	Erase-oscillator coil 2 mH	4822 157 50578
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Resistors

R444	Potentiometer 2x220 kΩ	4822 102 30144
R445	Trimming potentiometer 47 kΩ	4822 100 10079
R446	Trimming potentiometer 47 kΩ	4822 100 10079
R447	Potentiometer 2x47 kΩ	4822 102 30145
R448	Potentiometer 2x47 kΩ	4822 102 30145
R449	Potentiometer 2x10 kΩ	4822 102 30146
R450	Potentiometer 2x(5+17kΩ)	4822 102 30116
R455	Trimming pot. meter 47 kΩ	4822 100 10079
R528	1 MΩ, 1/8 W, 5 %	4822 111 30333
R529	1 MΩ, 1/8 W, 5 %	4822 111 30333
R534	470 kΩ, 1/8 W, 5 %	4822 111 30259
R535	470 kΩ, 1/8 W, 5 %	4822 111 30259
R536	470 kΩ, 1/8 W, 5 %	4822 111 30259
R537	470 kΩ, 1/8 W, 5 %	4822 111 30259
R540	100 Ω, 1/4 W, 10 %	4822 110 50081
R548	470 kΩ, 1/8 W, 5 %	4822 111 30259
R549	470 kΩ, 1/8 W, 5 %	4822 111 30259
R560	390 kΩ, 1/8 W, 5 %	4822 110 61176
R561	390 kΩ, 1/8 W, 5 %	4822 110 61176
R622	390 kΩ, 1/8 W, 5 %	4822 110 61176
R614	1 Ω, 1/4 W, 5 %	4822 111 30334
R615	1 Ω, 1/4 W, 5 %	4822 111 30334
R616	1 Ω, 1/4 W, 5 %	4822 111 30334
R617	1 Ω, 1/4 W, 5 %	4822 111 30334
R628	NTC 47 Ω, 0.6 W	4822 111 30057
R629	NTC 47 Ω, 0.6 W	4822 111 30057
R630	1 MΩ, 1/8 W, 5 %	4822 111 30333
R631	1 MΩ, 1/8 W, 5 %	4822 111 30333

Capacitors

C726	Electrol. cap. 1.5 μF, 63 V	4822 124 20342
C727	Electrol. cap. 1.5 μF, 63 V	4822 124 20342
C728	Ceram. cap. 2700 pF, 40 V	4822 122 30057
C729	Ceram. cap. 2700 pF, 40 V	4822 122 30057
C731	Electrol. cap. 68 μF, 16 V	4822 124 20376
C732	Electrol. cap. 1.5 μF, 63 V	4822 124 20342
C733		
C734		
C735		
C736		
C737		

C738	Pol. cap. 0.1 μF, 250 V	4822 121 40059
C739	Pol. cap. 0.1 μF, 250 V	4822 121 40059
C740	Pol. cap. 68 nF, 250 V	4822 121 40057
C741	Pol. cap. 68 nF, 250 V	4822 121 40057
C742	Pol. cap. 3.9 nF, 250 V	4822 121 40169
C743	Pol. cap. 3.9 nF, 250 V	4822 121 40169
C744	Ceram. cap. 68 pF, 40 V	4822 122 30023
C745	Ceram. cap. 68 pF, 40 V	4822 122 30023
C746	Pol. cap. 10 nF, 250 V	4822 121 40047
C747	Pol. cap. 10 nF, 250 V	4822 121 40047
C748	Pol. cap. 10 nF, 250 V	4822 121 40047
C749	Pol. cap. 10 nF, 250 V	4822 121 40047
C750	Pol. cap. 15 nF, 250 V	4822 121 40049
C751	Pol. cap. 15 nF, 250 V	4822 121 40049
C752	Electrol. cap. 1.5 μF, 63 V	4822 124 20342
C753	Electrol. cap. 1.5 μF, 63 V	4822 124 20342
C755	Electrol. cap. 470 μF, 25 V	4822 124 20406
C756	Electrol. cap. 1.5 μF, 63 V	4822 124 20342
C757	Electrol. cap. 1.5 μF, 63 V	4822 124 20342
C758	Ceram. cap. 100 pF, 40 V	4822 122 30021
C759	Ceram. cap. 100 pF, 40 V	4822 122 30021
C762	Pol. cap. 2700 pF, 250 V	4822 121 40271
C763	Pol. cap. 2700 pF, 250 V	4822 121 40271
C764	Pol. cap. 39 nF, 250 V	4822 121 40052
C765	Pol. cap. 39 nF, 250 V	4822 121 40052
C766	Pol. cap. 82 nF, 250 V	4822 121 40058
C767	Pol. cap. 82 nF, 250 V	4822 121 40058
C768	Pol. cap. 470 nF, 250 V	4822 121 40186
C769	Pol. cap. 470 nF, 250 V	4822 121 40186
C770	Pol. cap. 150 nF, 250 V	4822 121 40035
C771	Pol. cap. 150 nF, 250 V	4822 121 40035
C772	Electrol. cap. 4.7 μF, 63 V	4822 124 20346
C773	Electrol. cap. 4.7 μF, 63 V	4822 124 20346
C775	Electrol. cap. 1000 μF, 25 V	4822 124 20419
C776	Electrol. cap. 6.8 μF, 40 V	4822 124 20351
C777	Electrol. cap. 6.8 μF, 40 V	4822 124 20351
C778	Electrol. cap. 330 μF, 4 V	4822 124 20401
C779	Electrol. cap. 330 μF, 4 V	4822 124 20401
C782	Electrol. cap. 680 μF, 16 V	4822 124 20411
C783	Electrol. cap. 680 μF, 16 V	4822 124 20411
C784	Electrol. cap. 330 μF, 16 V	4822 124 20403
C785	Electrol. cap. 330 μF, 16 V	4822 124 20403
C786	Pol. cap. 0.22 μF, 250 V	4822 121 40079
C787	Pol. cap. 0.22 μF, 250 V	4822 121 40079
C788	Electrol. cap. 68 μF, 16 V	4822 124 20376
C789	Pol. cap. 68 nF, 250 V	4822 121 40057
C790	Pol. cap. 68 nF, 250 V	4822 121 40057
C791	Pol. cap. 4.7 nF, 250 V	4822 121 40168
C792	Pol. cap. 33 nF, 250 V	4822 121 40054
C793	Pol. cap. 1 nF, 250 V	4822 121 40269
C794	Pol. cap. 1 nF, 250 V	4822 121 40269
C795	Pol. cap. 10 nF, 250 V	4822 121 40047
C796	Electrol. cap. 1.5 μF, 63 V	4822 124 20342
C797	Electrol. cap. 6.8 μF, 40 V	4822 124 20351
C798	Electrol. cap. 1.5 μF, 63 V	4822 124 20342
C799	Electrol. cap. 680 μF, 16 V	4822 124 20411
C800	Electrol. cap. 680 μF, 16 V	4822 124 20411
C801	Electrol. cap. 680 μF, 16 V	4822 124 20411
C802	Electrol. cap. 1500 μF, 10 V	4822 124 20421
C804	Pol. cap. 10 nF, 250 V	4822 121 40047
C805	Pol. cap. 10 nF, 250 V	4822 121 40047
C808	Pol. cap. 56 nF, 250 V	4822 121 40056
C809	Pol. cap. 56 nF, 250 V	4822 121 40056
C825	Pol. cap. 0.68 μF, 250 V	4822 121 40268
C826	Electrol. cap. 2.2 μF, 40 V	4822 124 20344
C827	Electrol. cap. 0.64 μF, 64 V	4822 124 20092
C828	Cer. cap. 10 nF, 40 V	4822 122 30043
ME403	Recording indicator	4822 347 10051
T404	Mains transformer	4822 145 50049
L406	Pilot lamp 6 V, 45 mA	4822 134 40032
SK0	Mains switch	4822 276 10287
SK1	Slide switch	4822 277 30459
SK2	Playback switch	4822 276 10376
SK4	Motor switch	4822 278 90223
SK5	Voltage adapter	4822 272 10079
BU1, BU2	Socket	4822 267 20118
BU3, BU4	Socket for loudspeaker	4822 267 20123
Z1	Transformer inserting fuse	
	138 °C, 1.5 A	4822 252 20001
Z453	Glass fuse T 1.25 A	4822 253 30022
	Spring fixation Z453	4822 492 60063

## ELECTRICAL MEASUREMENTS AND ADJUSTMENTS

### Adjusting the output transistors

The quiescent current of output transistors TS438a, TS438b and TS439a, TS439b should be 6 mA  $\pm$  1 mA. At this value of the quiescent current, the voltage drop across the emitter resistors R614 - R617 is 6 mV  $\pm$  1 mV. This can be adjusted with trimming potentiometers R452 and R451.

### Adjustment of bias current

When adjusting the bias current, a compromise between the frequency range and the distortion must be made. If the bias current is too small, the result will be distortion. On the other hand, the high tones will be attenuated too much if the bias current is too large.

- Set the recorder to position "Record".
- The voltage on test points 6BU1 and 6BU2 should be between 7.5 - 25 mV. The value can be adjusted with trimming potentiometers R446 and R445.
- The bias current is mostly adjusted in a correct way if the voltage on the test points is about 17 mV.

### Checking the erase oscillator voltage

- Set the recorder to position "Record".
- The voltage across the erase head should be at least 15 V at a frequency ranging from 50 to 65 kHz.

### Adjusting the record indicator

- Set the recorder to position "Record".
- Switch off the oscillator by connecting the base of TS440 to earth.
- Interconnect PU inputs 3BU2 and 5BU2.
- Connect a tone generator (frequency 1000 Hz) to the inter-connected PU inputs.
- Adjust the output voltage of the tone generator so that the voltage on the test points (6BU1 and 6BU2) is 3.3 mV. If the gain factors of the two channels are unequal, the voltages on the two test points are, of course, also unequal. In this case the output voltage of the tone generator should be so adjusted that the average of the voltages on the two test points is 3.3 mV.
- Adjust with potentiometer R455 the pointer deflection of ME403 so that the pointer is positioned on the separation between the red and the white plane of the scale graduation.

### Checking the playback sensitivity (left-hand channel)

- Set the recorder to position "Playback".
- Terminate loudspeaker output BU3 with a resistor of 8  $\Omega$  - 1% - 4 W.
- Set the volume and tone controls to maximum.
- Turn the balance control fully anticlockwise.
- Connect a tone generator via a resistor of 39 k $\Omega$  - 1% to test point 6BU1 and apply a 15 mV signal (frequency 1000 Hz).
- On loudspeaker output BU3 there should be a voltage of 469 - 797 mV.

The playback sensitivity of the right-hand channel is checked in the same way. The load resistor is in this case connected to BU4 and the tone generator to 6BU2. The balance control is turned fully clockwise.

### Checking the line-output sensitivity (left-hand channel)

- Set the recorder to position "Playback".
- Connect a tone generator via a resistor of 39 k $\Omega$  - 1% to test point 6BU1, and apply a 15 mV signal (frequency 1000 Hz).
- On line output 3BU1 there should be a voltage of 30 - 50 mV.

The line output of the right-hand channel is checked in the same way. The tone generator is then connected to 6BU2, and the voltage is measured on line output 5BU1.

### Checking the recording sensitivity (left-hand channel)

- Set the recorder to position "Record".
- Connect a tone generator to PU input 3BU2, and apply a 56 mV signal (frequency 1000 Hz).
- On test point 6BU1 there should be a voltage of 2.5 - 4 V.

The recording sensitivity of the right-hand channel is checked in the same way. The tone generator is then connected to 5BU2, and the voltage is measured on test point 6BU2.

### Checking the automatic stop circuit

When the automatic stop circuit does not function properly, first check whether the electronic part or the rotating switch is defective, by measuring the voltage on junction C826, R667. On this test point there should be a voltage of 3-4 V. If this value is measured, the collector and the rotating switch are performing well; the fault must then be traced in the electronic part. Should the value measured differ from the above-mentioned value, the collector and the rotating switch must be checked and, if necessary, replaced.

### Checking the tape speed

The tape speed may be checked in two ways:

- a. with a test cassette on which every other 4.76 m a 800 Hz signal has been modulated; code number 8945 600 11501.
- b. with a stroboscope.

- a. Test cassette
  - Put a test cassette in the recorder.
  - Set the recorder to position "Playback".
  - Between two successive signals 98 - 102 seconds should elapse.
- b. Stroboscope
  - Remove one of the sides from the cassette. This is easily done with a knife and a file. The edges of the hole should be deburred. Through this hole the tape can be taken out.
  - Uncase the recorder.
  - Place a stroboscope next to the recorder, and adjust the stroboscope to the required height. Pass the tape along the stroboscope (see Fig. 15). The tape speed should be 4.75 cm/s  $\pm$  2%.

When the tape speed is too low, first check whether pressure roller, winding friction clutch, flywheel, etc. run too heavily. Then the speed can be adjusted with R481 on the motor control p.c. board.

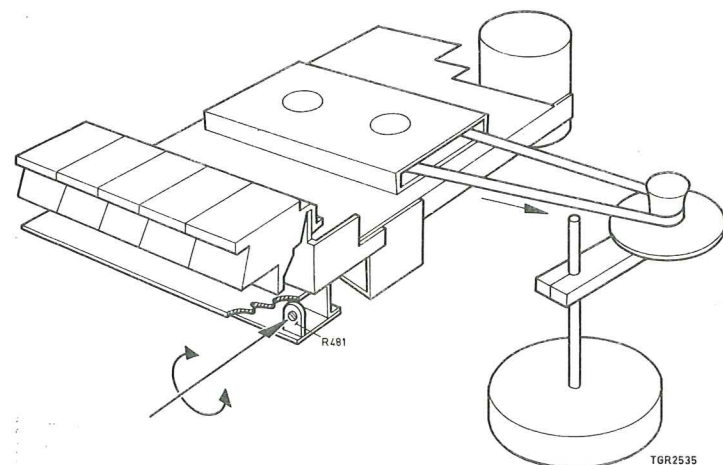


Fig. 15

Automatic stop circuit of the motor

The circuit consists of the rotating switch SK3, which is situated under the right-hand reel disc, and transistors TS472 and TS473. The motor-control circuit draws a current via this circuit. At the end of the tape TS472 is cut off; then no current is delivered to the motor-control circuit and, consequently, the motor stops.

When the recorder is switched to the positions "Playback", "Record", "Wind" and "Rewind", the contacts 307 and 308 of switch SK4 are closed; as a result, the emitter of TS472 is connected to supply point F. This positive voltage is also applied via R662, R663, C825 and R664, to the base of TS473. This transistor becomes conductive so that TS472 also becomes conductive. For the emitter voltage of TS472 will then be larger than the base voltage because the collector current of TS473 causes a voltage drop across R662. When TS472 is conducting, a current is delivered to the motor control circuit TS470, TS471, thus causing the motor to start.

If the motor must be kept running, it is necessary that TS473 should continue to conduct.

However, this is not possible via R662, R663, C825, and R664 because C825 is being charged.

TS473 will then no longer be able to draw a base current. To prevent this, C825 is charged with pulses in opposite direction (+ on the side of junction R664, C825).

This is done as follows: When the motor is running and there is a cassette in the recorder, the right-hand reel disc will rotate. Under this reel disc the rotating switch SK3 is fitted. This switch is opened and closed 24 times during each revolution of the reel disc.

On junction C826, R667 there is a square wave voltage. This voltage is also available on junction C826, R666, however, with the average value zero. During the positive period of the square wave voltage, D477 is conducting and C825 is each time charged positively. TS473 remains conductive because its base is kept positive.

Automatic stopping

At its end the tape will prevent the reel disc from rotating. SK3 then remains opened or closed depending on the position of the reel disc in regard to the collector.

- SK3 permanently closed. C826 will now charge itself practically to the collector voltage of TS472. However, C825 will no longer receive charge pulses via D477.

The result is that C825 will charge itself to the supply voltage (+ connected to junction R663/C825); subsequently, TS473 is cut off.

- SK3 permanently opened. C826 will fully discharge itself via resistors R666 and R667. In this situation, too, C825 will not receive charge pulses via D477. The result is that also in this case TS473 is cut off.

As can be seen from the above, TS473 is cut off at the end of the tape. TS472 is then cut off as well.

Then no current is delivered to motor-control p. c. board; consequently, the motor will be stopped.

For the function of SK2 and SK5 see NEW MECHANICAL CONSTRUCTIONS "Pause mechanism".

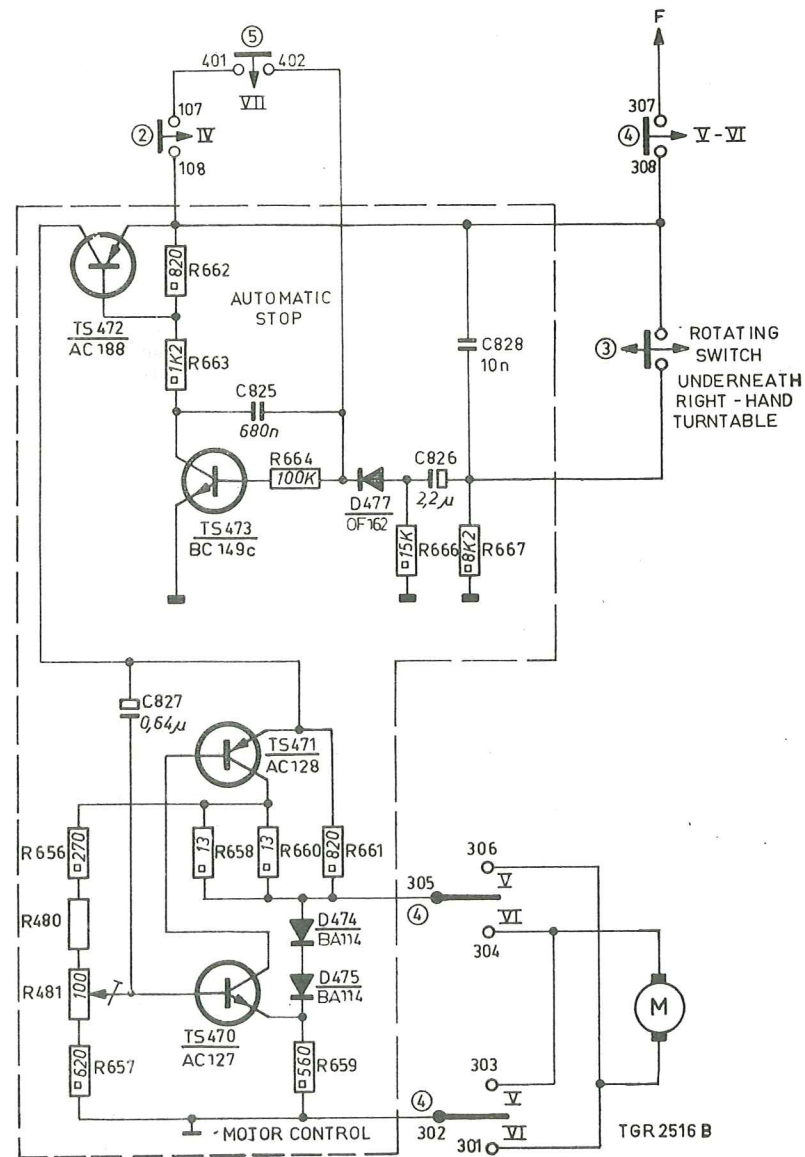


Fig. 16

Handwritten notes or markings in the top left corner.

Handwritten notes or markings in the middle left area.

