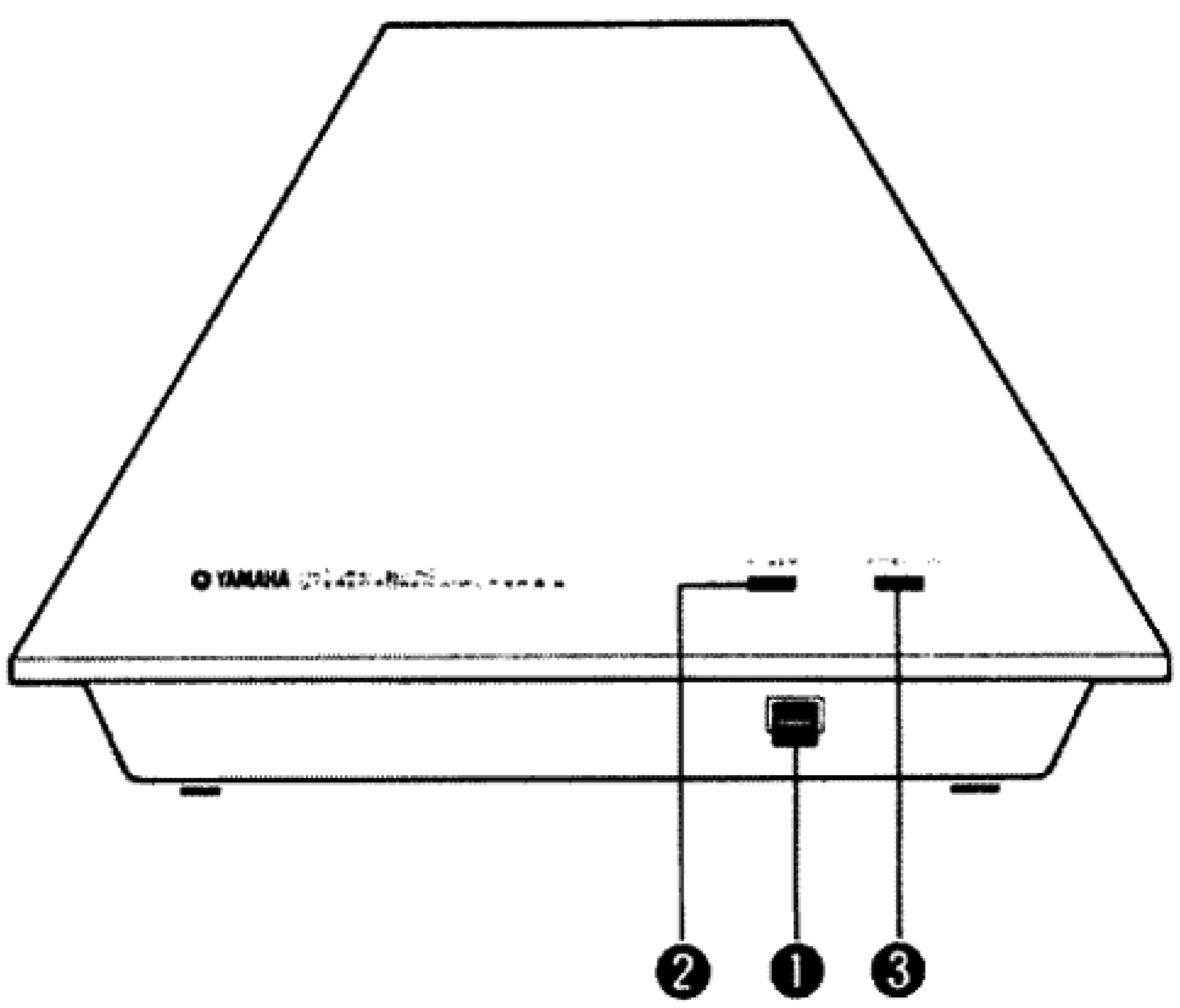
B-6

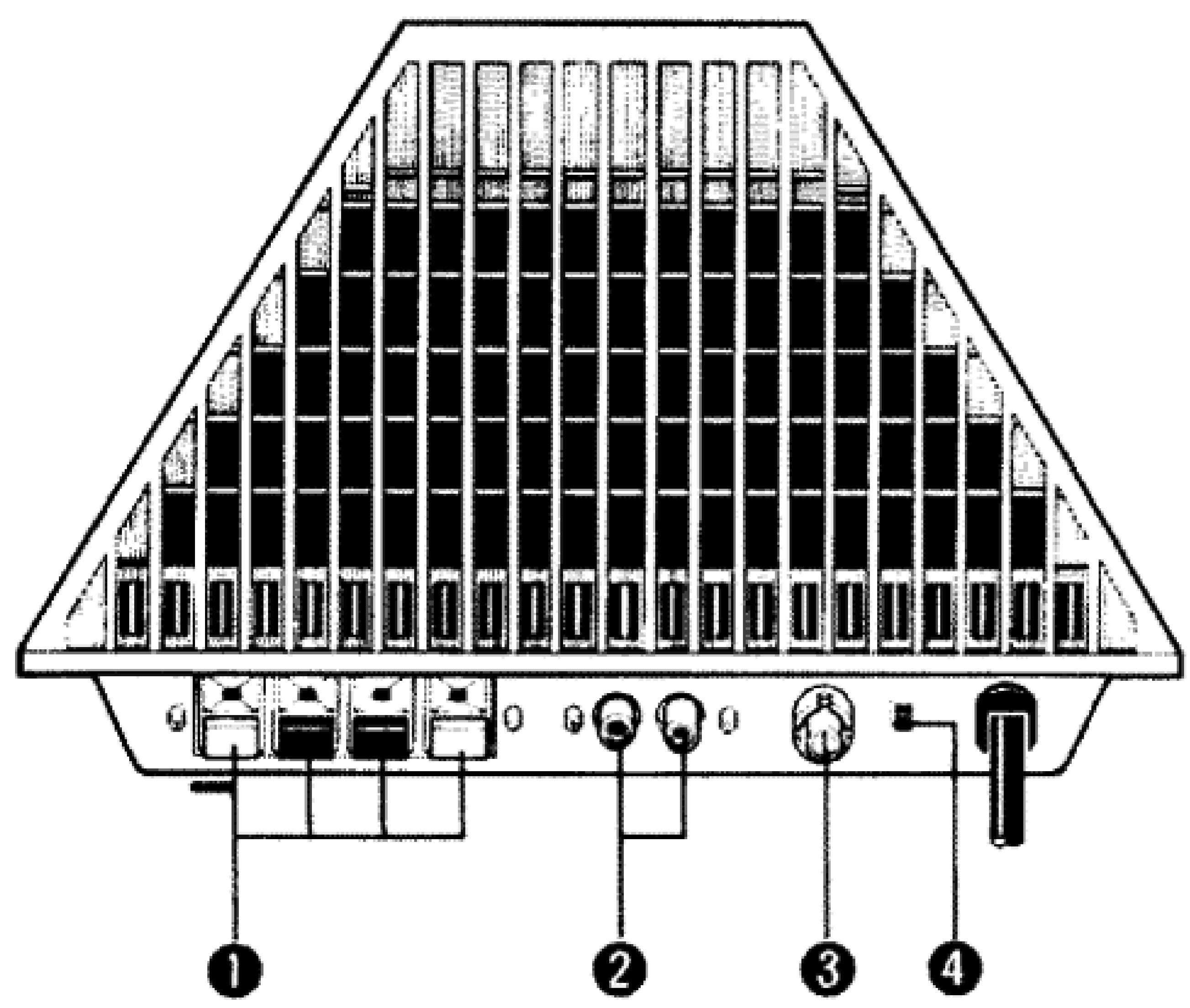
SERVICE MANUAL

■ FRONT VIEW



❶POWER SWITCH
❷POWER INDICATOR
❸PROTECTION INDICATOR

■ REAR VIEW



❶SPEAKER TERMINALS
❷INPUT TERMINALS
❸GROUND TERMINAL
❹SPEAKER SWITCH

B-6

■ CONTENTS

004416

SINCE 1887 YAMAHA
NIPPON GAKKI CO., LTD HAMAMATSU, JAPAN
'80. 9 1.8K K.T Printed in Japan

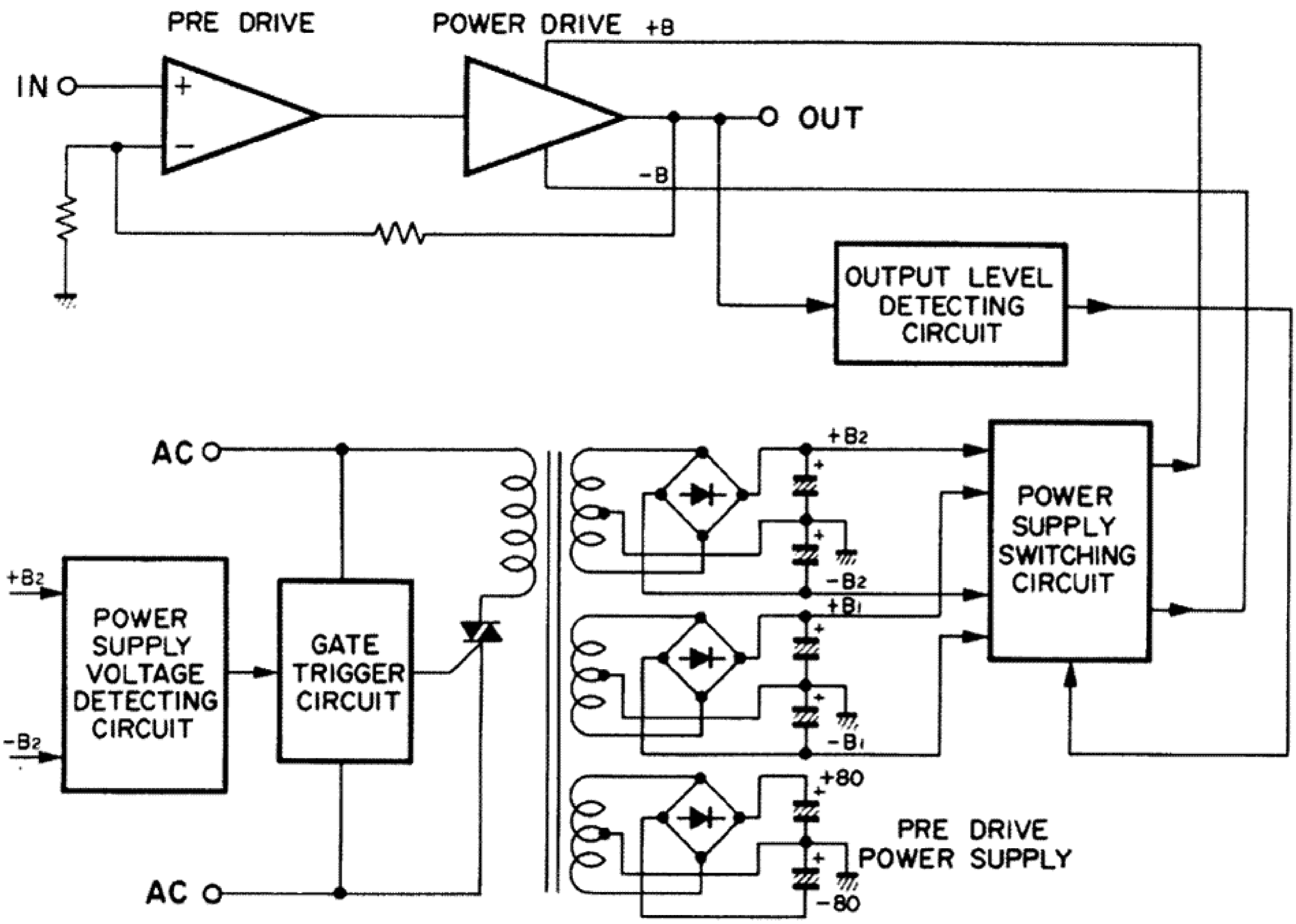
SPECIFICATIONS

Minimum rims Output Power	
(8Ω, 20 to 20,000Hz, T.H.D. 0.003%)	200W + 200W
Total Harmonic Distortion	
(8Ω, 100W, 20 to 20,000Hz)	Less than 0.03%
IM Distortion Ratio (50Hz · 7kHz = 4 : 1)	
(8Ω, 100W)	Less than 0.003%
Power Bandwidth	
(8Ω, 100W, 0.03% T.H.D.)	10Hz to 100kHz
Damping Factor	
(8Ω, 1kHz)	Better than 200
Frequency Response	
(8Ω)	DC to 100kHz $\pm^{0}_{0.5}$dB
Input Sensitivity/Impedance	
(8Ω, 200W, 1kHz)	1.41V/25kΩ
Signal-to-Noise Ratio (IHF A Network)	
(8Ω, input shorted)	127dB

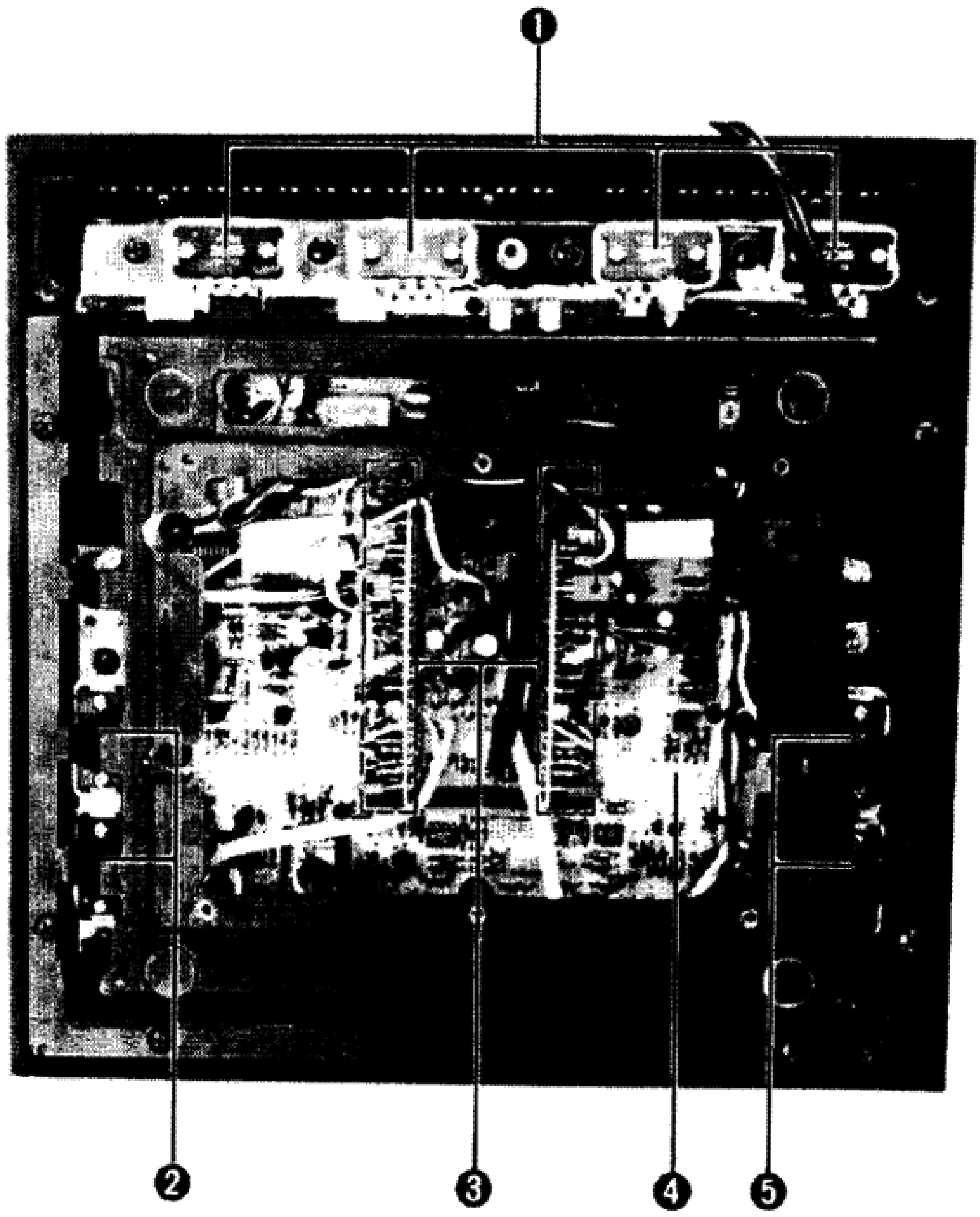
Channel Separation (1kHz, shorted)	
20Hz	95dB
1kHz	92dB
20kHz	72dB
Power Supply	
U.S.	120V, 60Hz
Northern Europe	220V, 50Hz
Power Consumption	
U.S.	200W (1% T.H.D., 1/10 output power)
Northern Europe	1200W (1% T.H.D.)
Dimensions (W x H x D)	290 x 176.5 x 290 mm (11-7/16" x 6-15/16" x 11-7/16")
Weight	
U.S.	9.0 kg (19 lbs. 13 oz.)
Northern Europe	9.2 kg (20 lbs. 4 oz.)

Specifications subject to change without notice.

BLOCK DIAGRAM



■INTERNAL VIEW

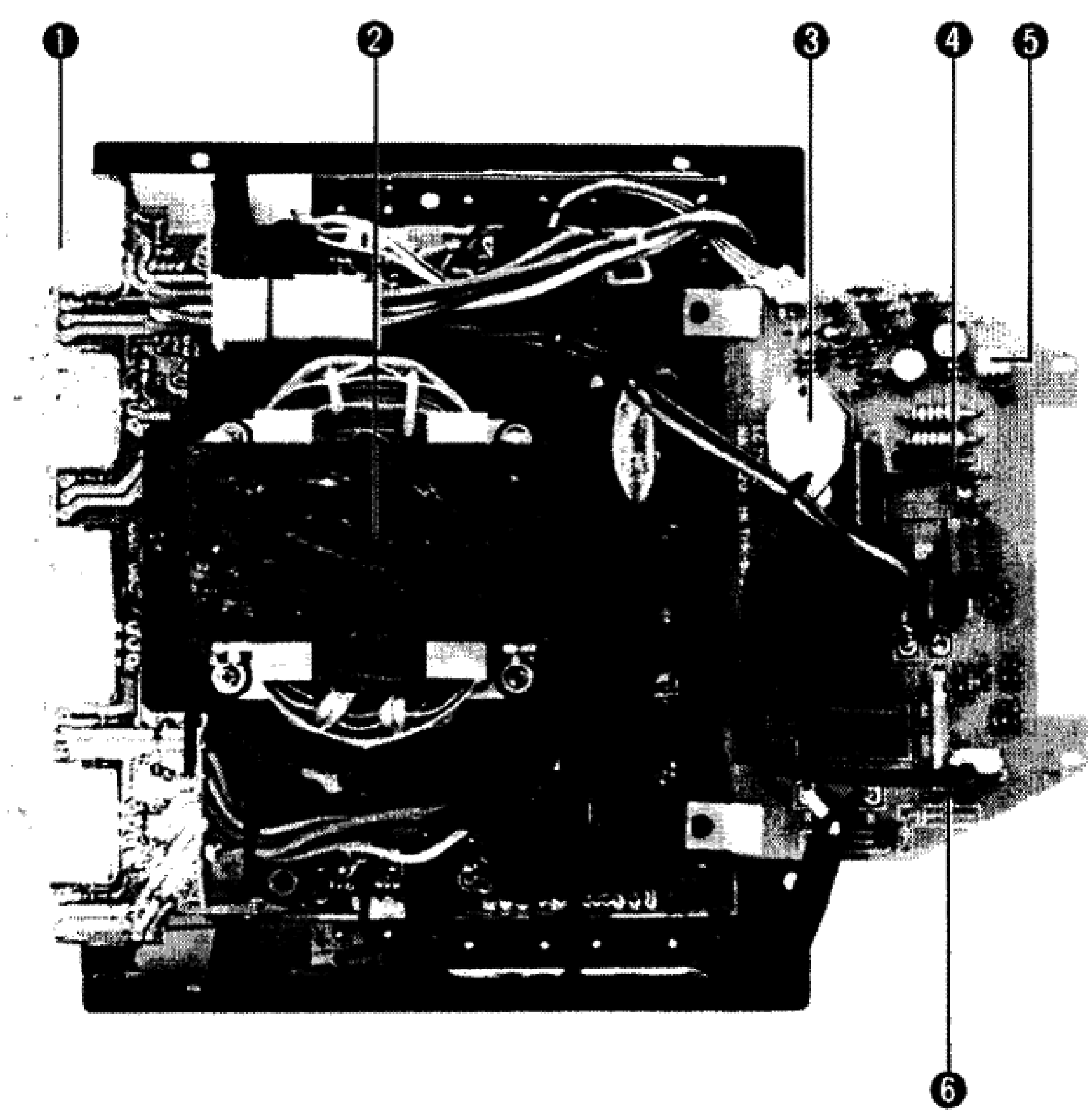


❶Power Transistor
2SA1095LBB
2SC2565LBB

❷ ❺Transistor (For Voltage selector)
2SA1095LBB
2SC2565LBB
2SB596 (O, Y)
2SD526LBB

❸Pri-drive C. Board (NA07519)

❹Main C. Board
(U.S. Model: NA07549)
(N. European Model: NA07518)



❶Radiator

❷Power Transformer
(U.S. Model: GA64010)
(N. European Model: GA64000)
(Japanese Model: GA63730)

❸ Triac AC16D1F-L (iH00102)

❹Triac SMOR5G42 (iH00090)

❺Photo coupler TLP508 (iK00028)

❻Power Supply C. Board
(U.S. Model: NA07556)
(N. European Model: NA07557)

DISASSEMBLY PROCEDURES

1. **Bottom cover removal**
   Remove the screws ① to ⑥ in Photo 1 and then the bottom cover can be removed.
   ① to ⑥ : Bind Head Tap-Tyte screw 4 x 8 (Black)

2. **Transistor cover removal**
   Remove the screws ⑦ to ⑨ in Photo 1 and then the transistor cover can be removed.
   ⑦ to ⑨ : Bind Head Tap-Tyte screw 4 x 8 (Black)

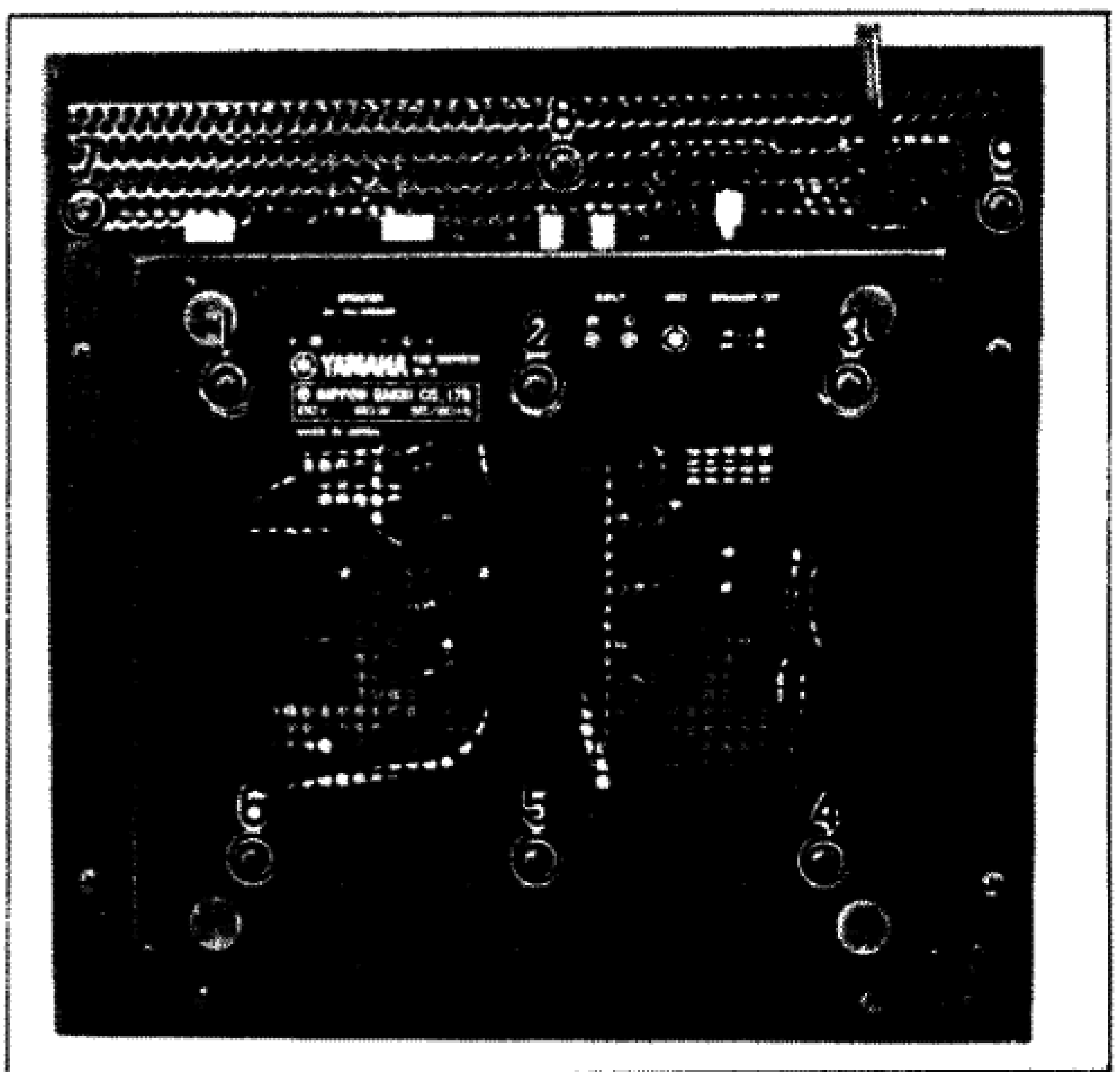


Photo 1

3. **Top case unit removal**
   Remove the screws ① to ⑭ in Photo 2 and then loosen the screws ⑮ to ⑱.
   *The screws ⑮ to ⑱ can not be removed because they are attacked with guide bushes.
   ① to ⑩ : Bind Head Tap-Tyte screw 4 x 8 (Black)
   ⑪ to ⑭ : B.W Head Tap-Tyte screw 4 x 8 (Black)
   *Make sure that you use the above screws.

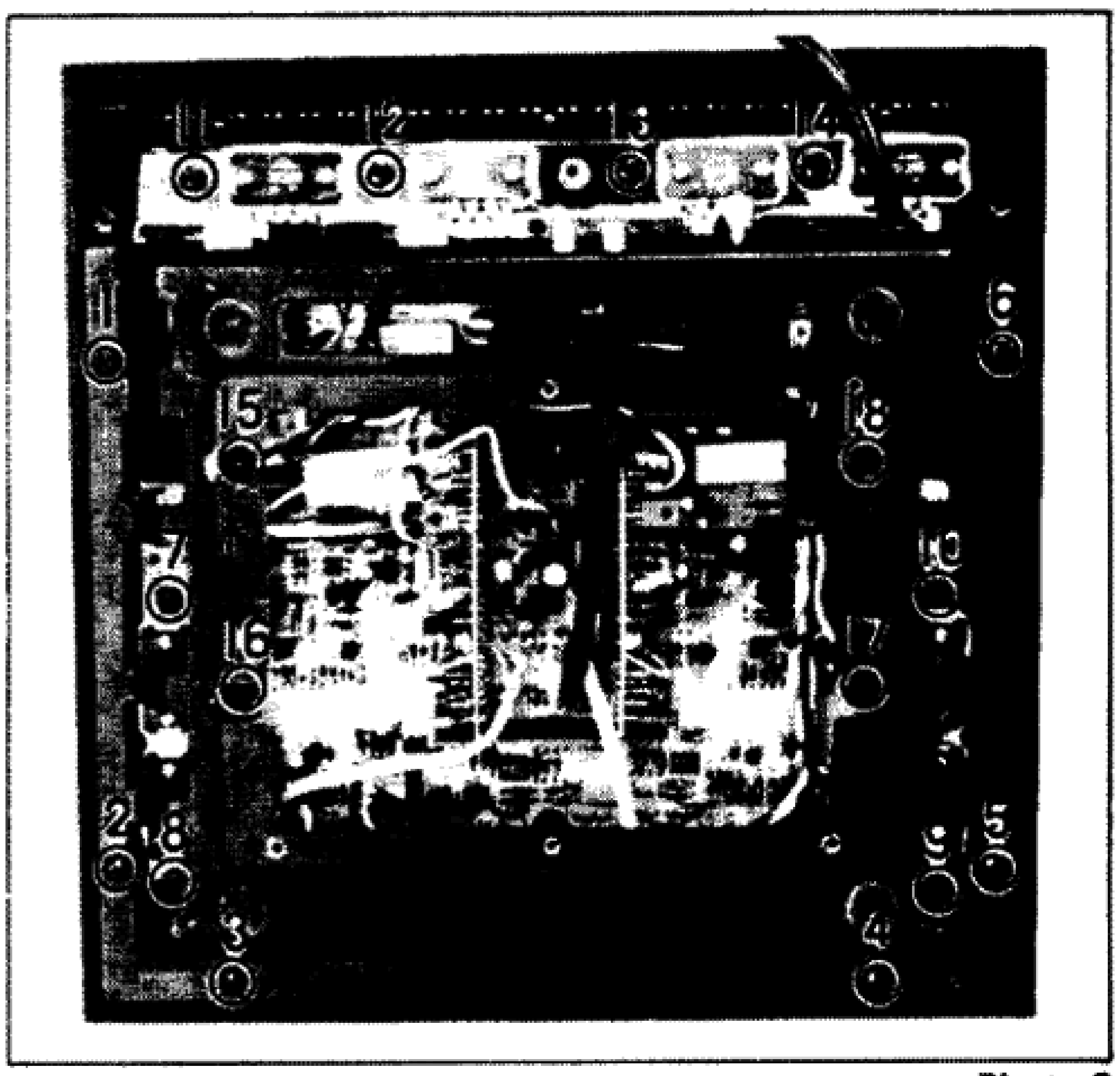


Photo 2

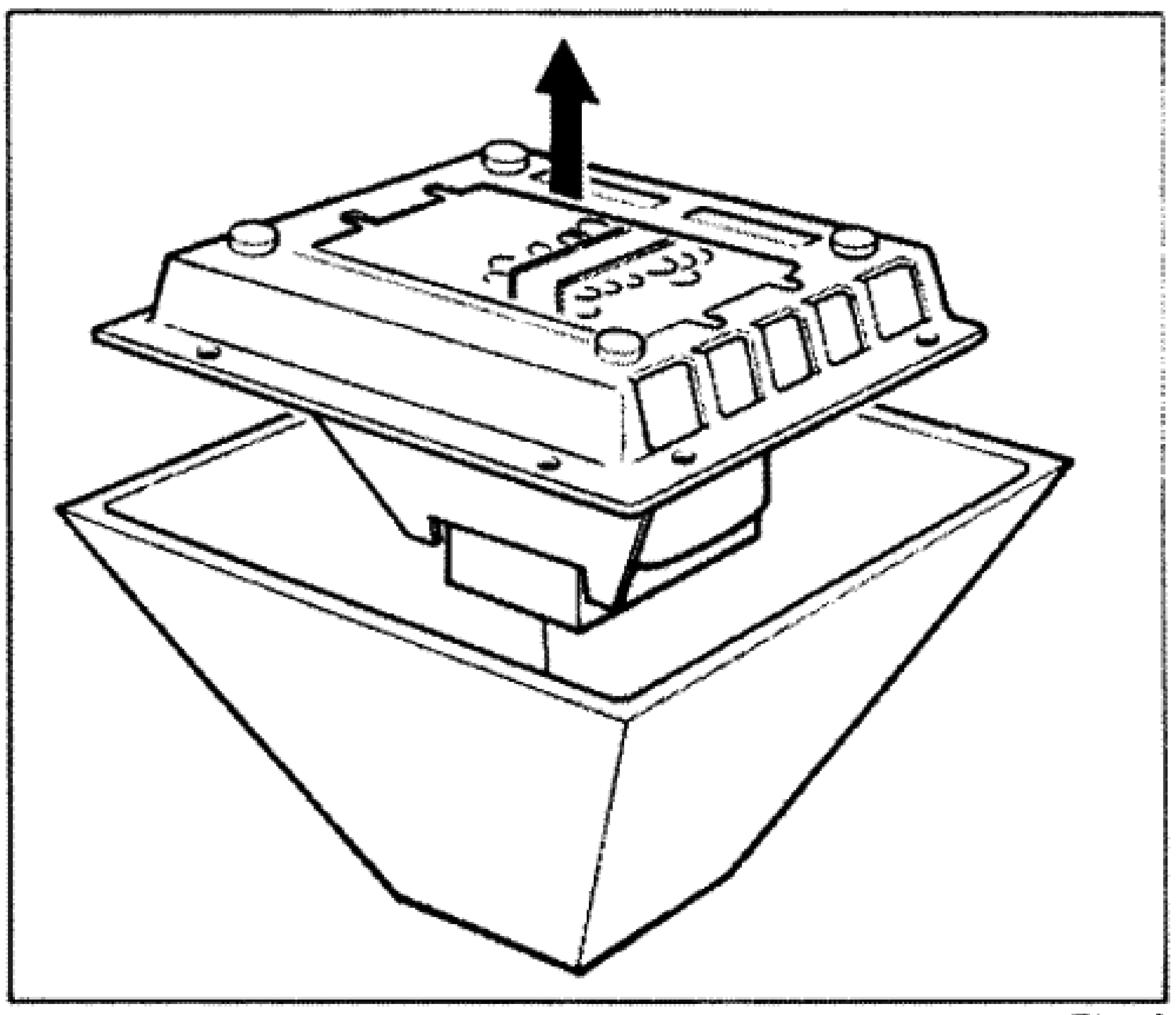


Fig. 1

4. **Power supply printed circuit board removal**
   Remove the screws ① to ④ in Photo 3 and then spread out the power supply printed circuit board in Photo 4. You can exchange the parts in power supply printed circuit board (ex. Triac).
   ①. ② : B.W Head Tap-Tyte screw 3 x 6 (Black)
   ③. ④ : Bind Head Tap-Tyte screw 3 x 8
   *Make sure that you use the toothed locked washer with the screw ①

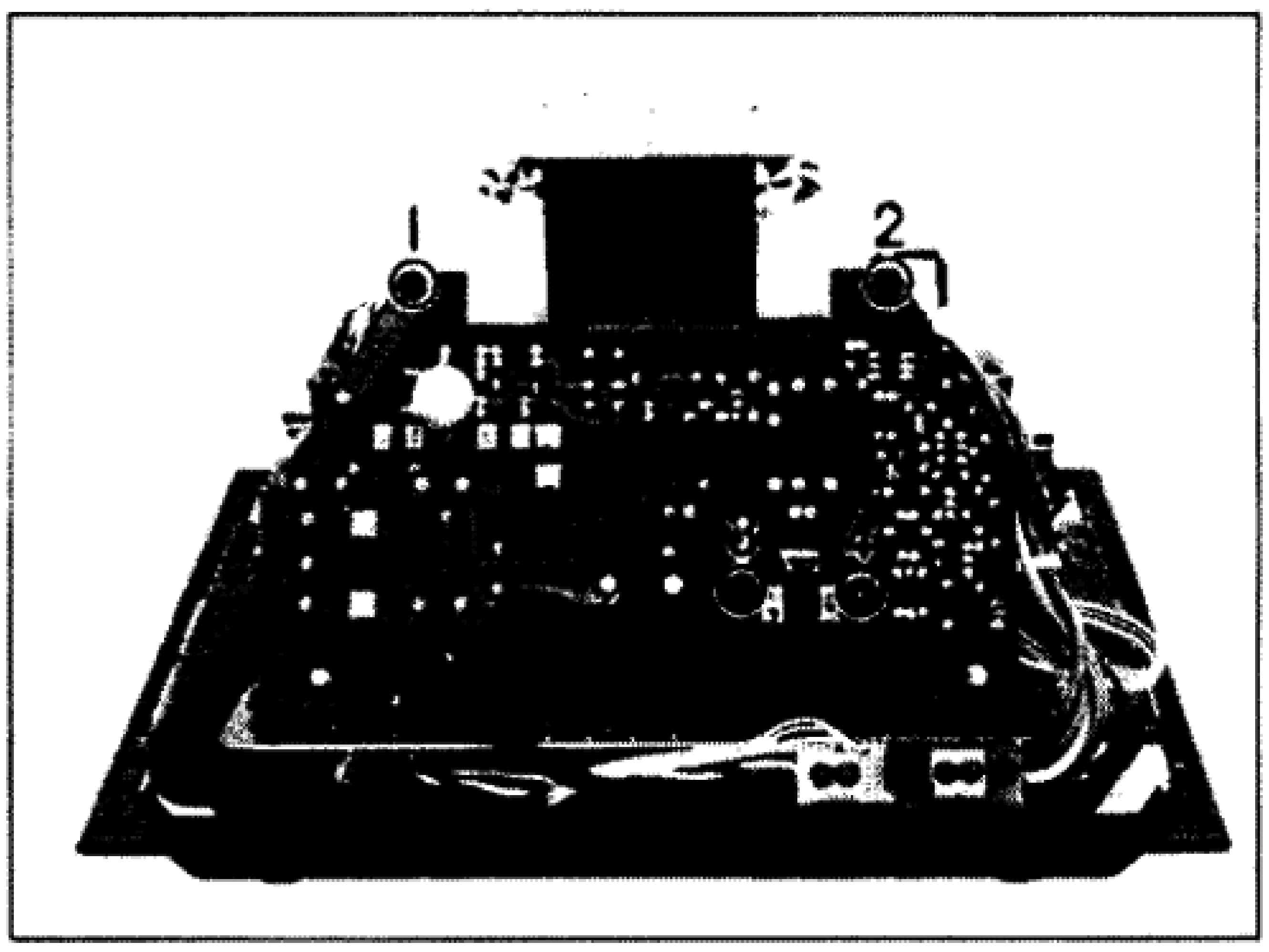


Photo 3

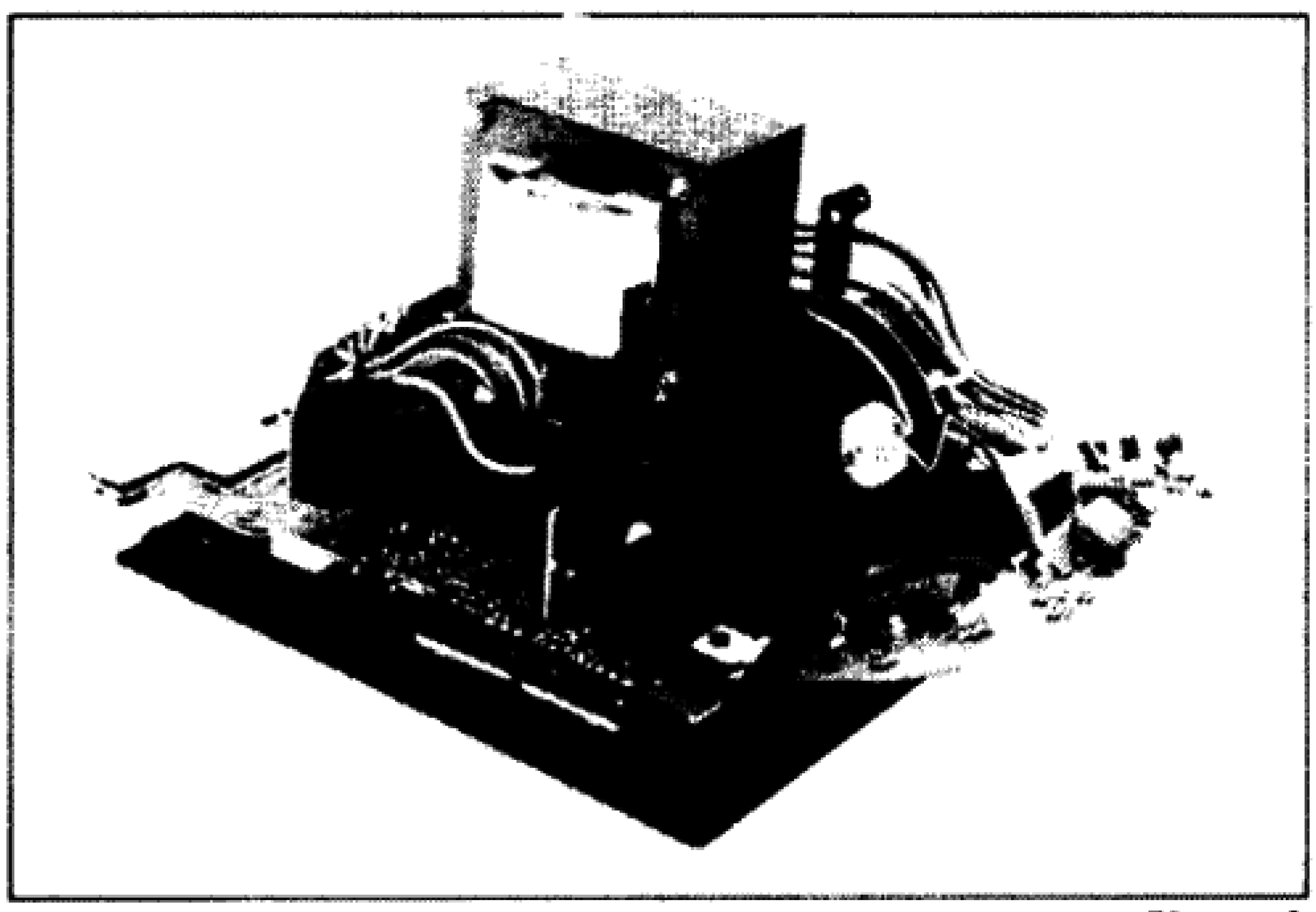


Photo 4

5. **Power supply unit removal**
   Remove the three connectors which are connected to power supply unit. Remove the screws ① to ③ in Photo 5 and then power supply unit can be removed from the bottom unit.
   ① to ③ : Bind Head Tap-Tyte screw 4 x 8 (Black)

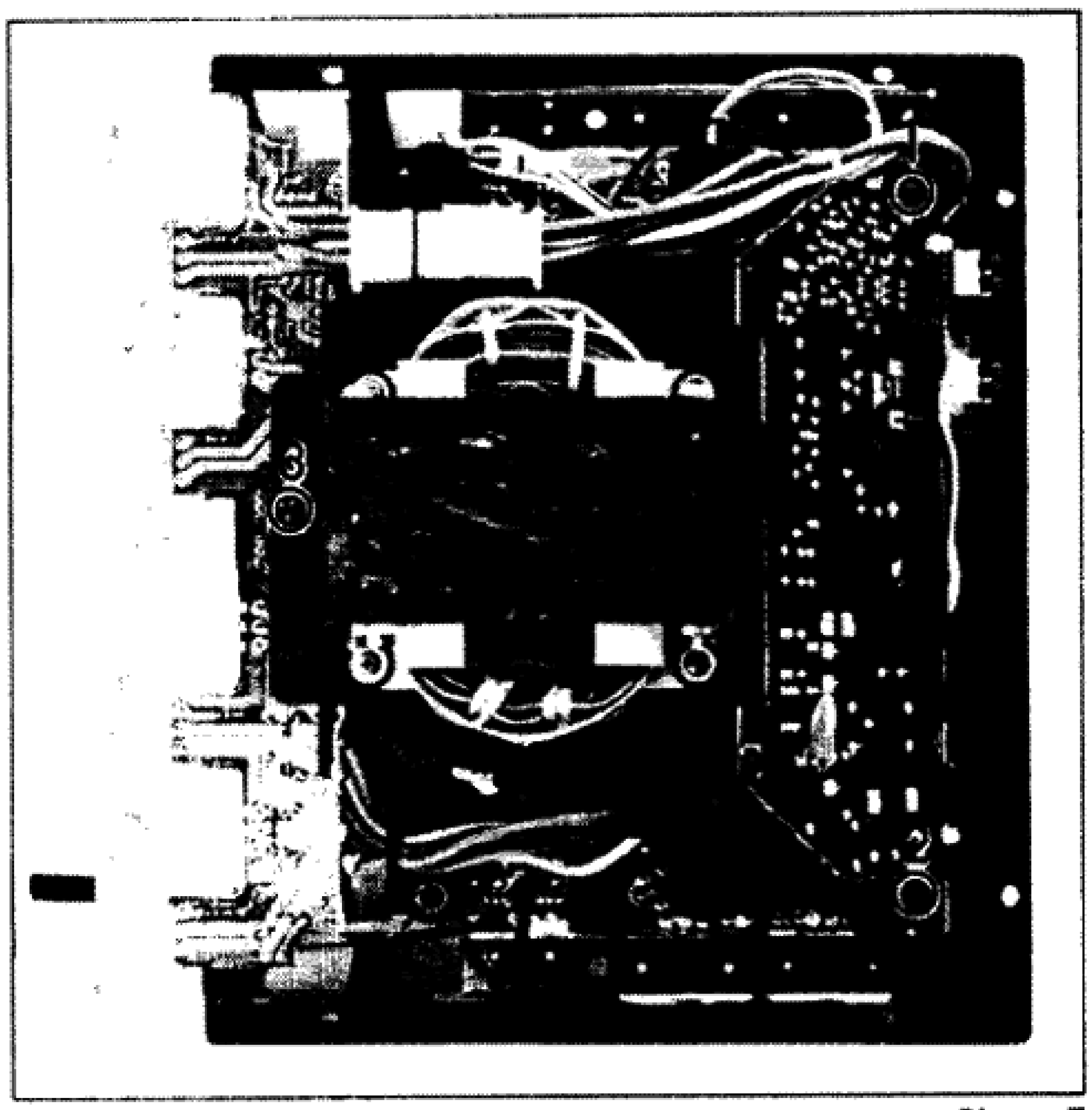


Photo 5

6. **Capacitor cover removal**
   Remove the screws ① to ④ in Photo 6 and then remove the capacitor cover.
   ① to ④ : Bind Head Tap-Tyte screw 3 x 8 (Black)

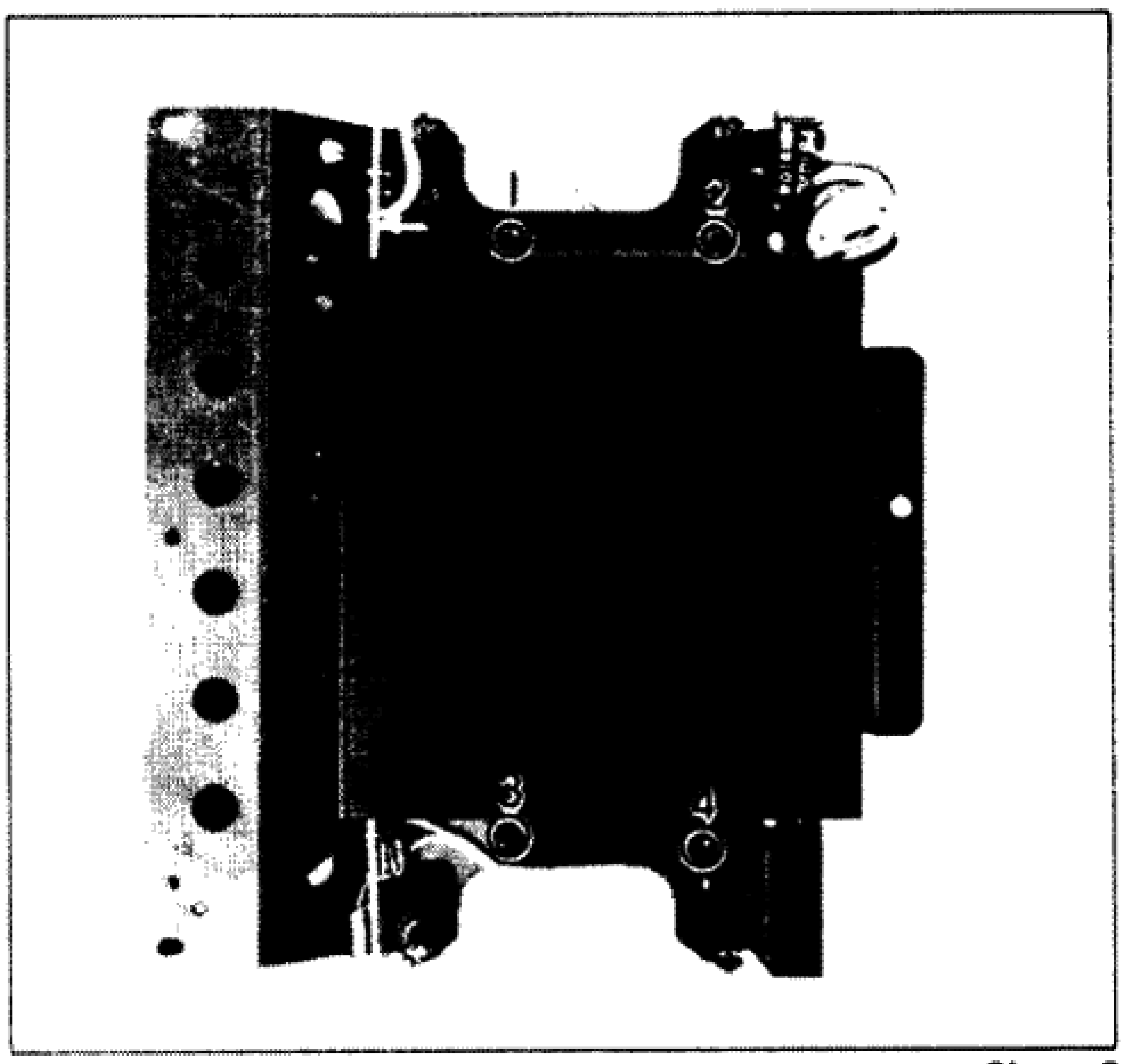


Photo 6

7. **Electrolytic capacitor printed circuit board removal**
   Remove the screws ① and ② in Photo 7 and remove the electrolytic capacitor printed circuit board.
   ①, ② : Bind Head Tap-Tyte screw 3 x 16 (Black)

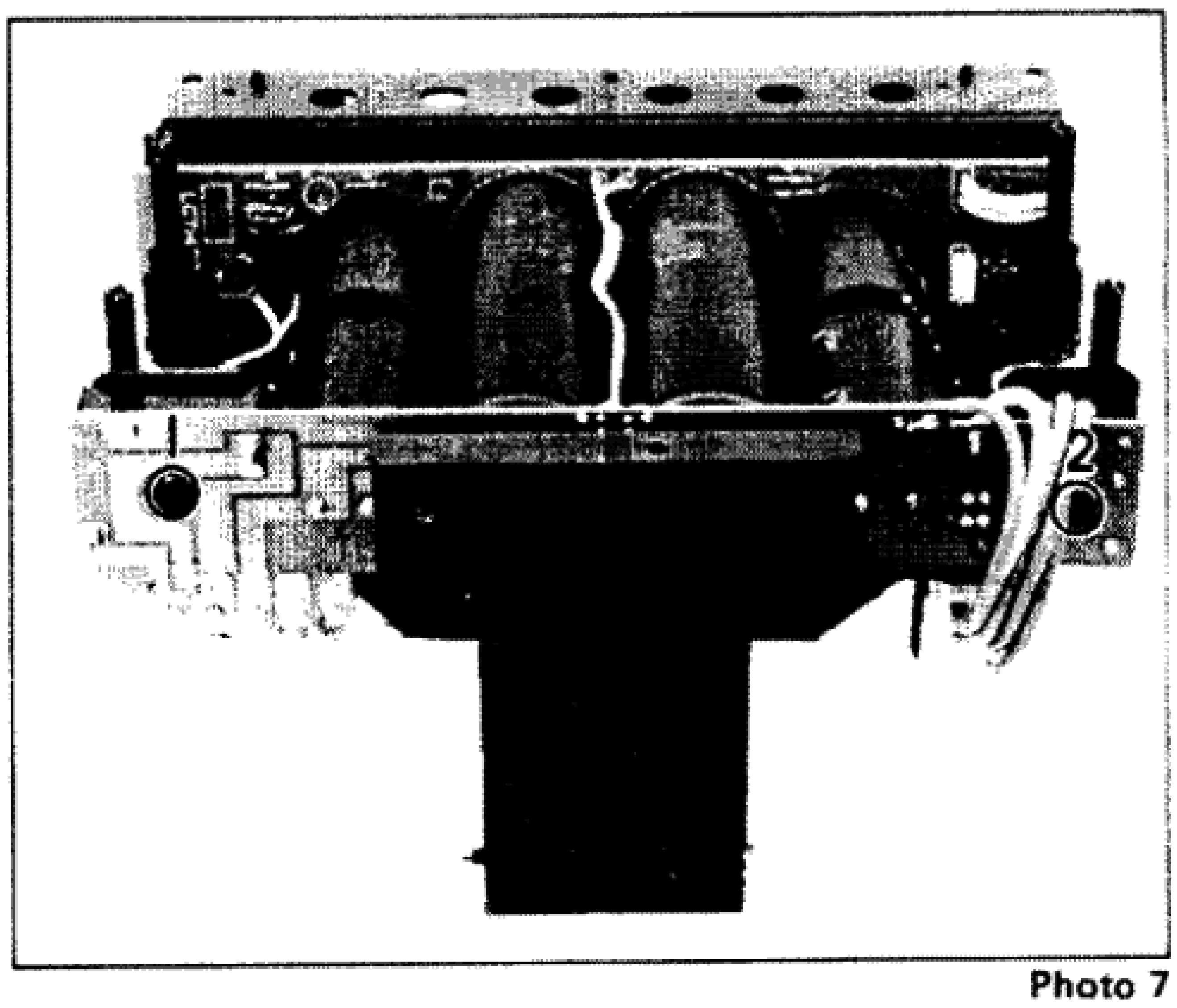


Photo 7

8. **Main printed circuit board removal**
   a. Remove the lead wires which are connected to the main printed circuit board.
      - Remove the speaker terminal. (2-screws)
      - Remove the LED Holder. (2-screws)
      - Remove the connector. (2-screws)
   b. Remove the screws ① to ⑥ in Photo 8 and then Remove the main printed circuit board.
   ① to ⑥ : Bind Head Tap-Tyte screw 4 x 8 (Black)
   *Make sure that you use the toothed locked washer with the screw ④

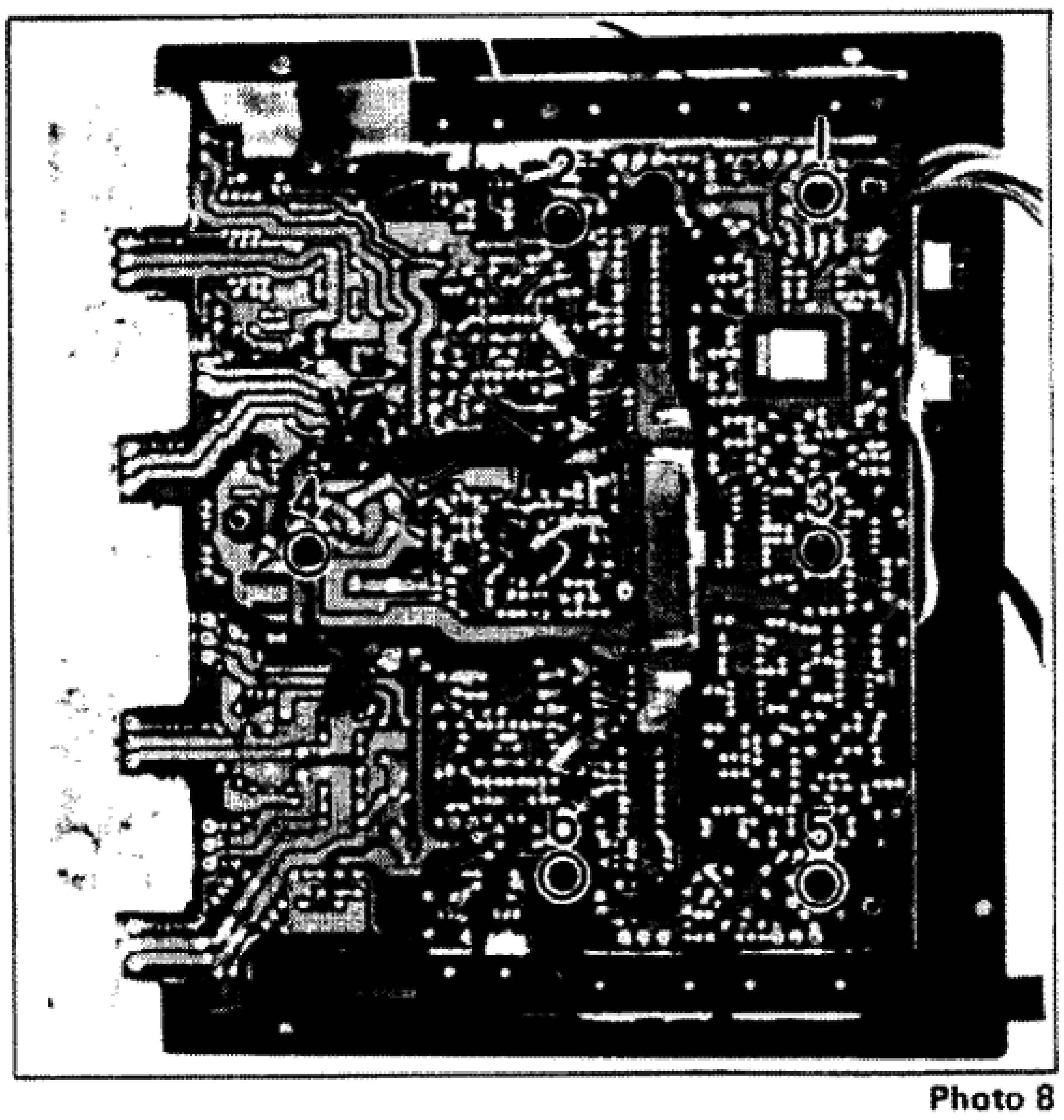


Photo 8

■CIRCUIT OPERATION

X POWER SUPPLY CIRCUIT OPERATION CONTROL CIRCUIT

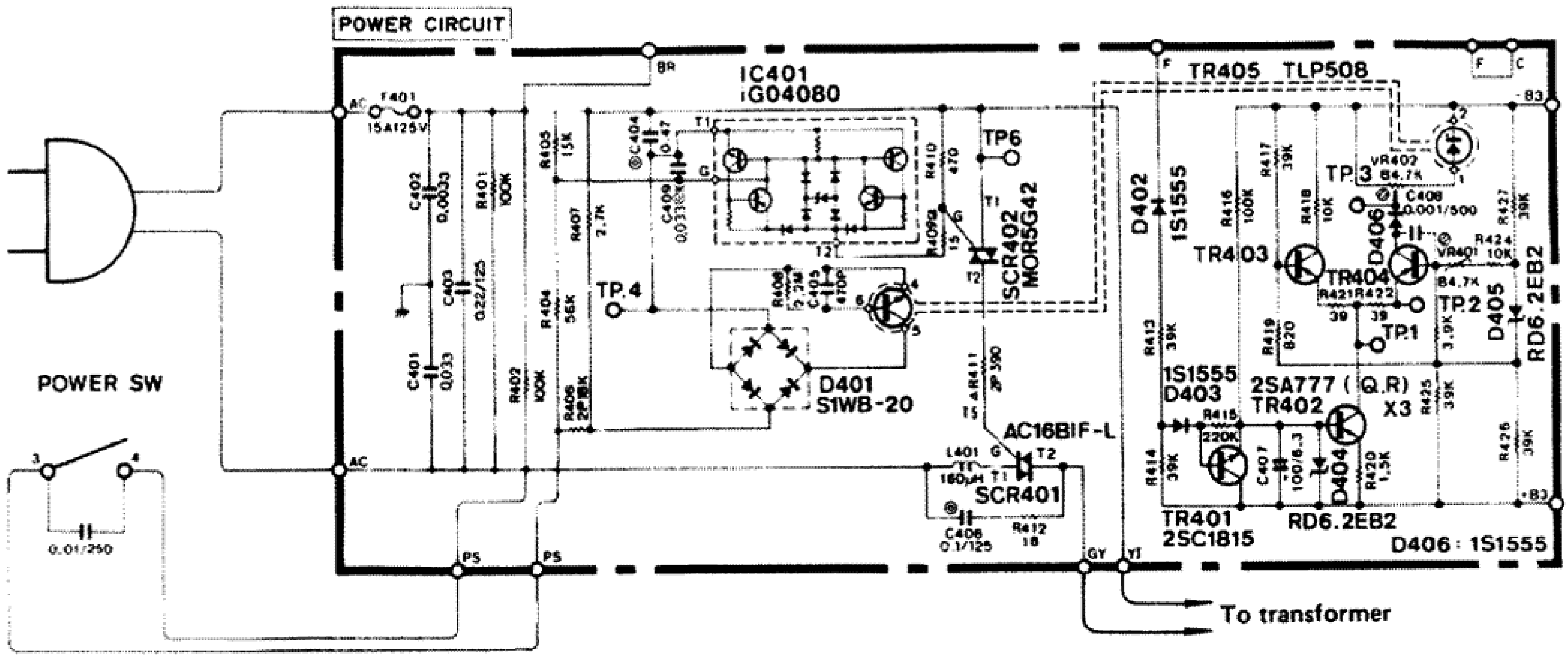


Fig. 1

X Power Supply Circuit Operation

The X power supply circuit is composed of a voltage variation detector circuit consisting of TR405 (Photo Coupler TLP508), TR402, TR403, TR404, D404, D405 and D406, and a control circuit consisting of IC401, IG04080, TR405 (TLP508), D401, SCR401 and SCR402.

IG04080

This is an IC with the function of triggering TRIAC.

Operation when $T_2 < T_1$

If a voltage higher than the combined forward-direction voltage of D_1 and D_4 (0.6 + 0.6V) and the zener voltage of ZD (7.5V) is applied (7.5 + 1.2 = 8.7V → about 9V), current flows to ZD. As this current becomes IB_2, TR_2 turns on, then TR_4 also turns on. Accordingly, a high current flows from T_1 to T_2.

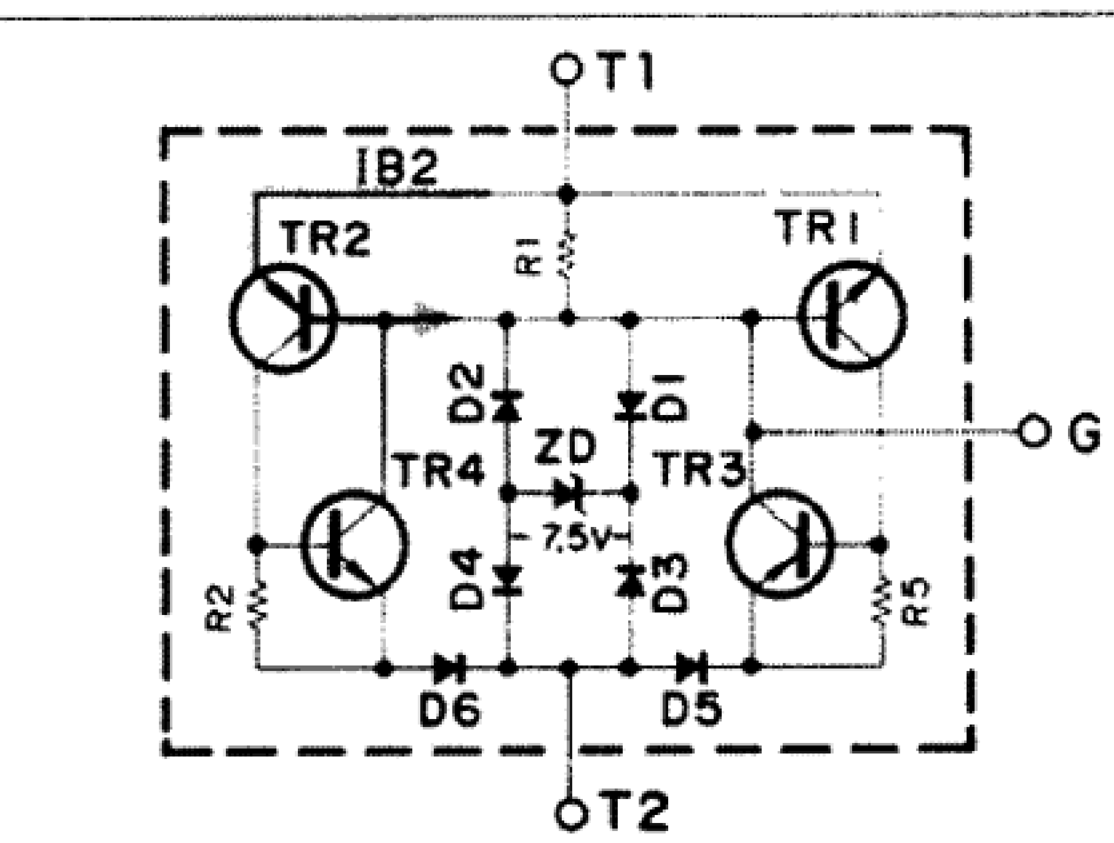


Fig. 2

Operation when $T_2 > T_1$

The same as above applies, but current flows in the order of: $D_3 \rightarrow ZD \rightarrow D_2 \rightarrow TR_1$. Then TR_1 and TR_2 turn on, and current flows from T_2 to T_1.

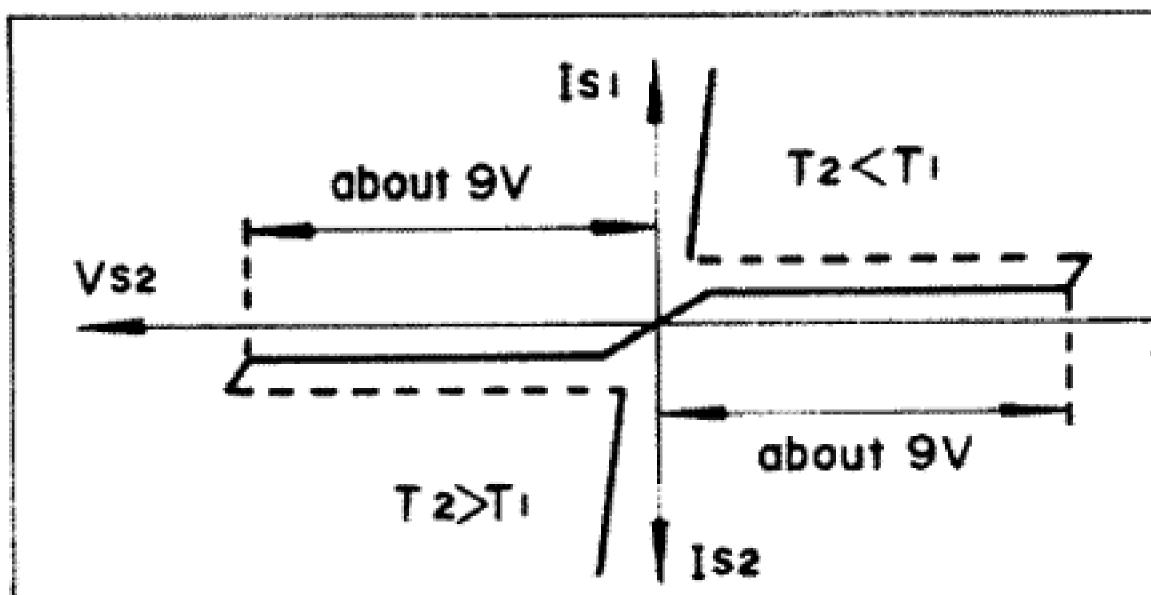


Fig. 3

POWER APPLICATION PHASE ANGLE CONTROL CIRCUIT AND CONSTANT-VOLTAGE OPERATION

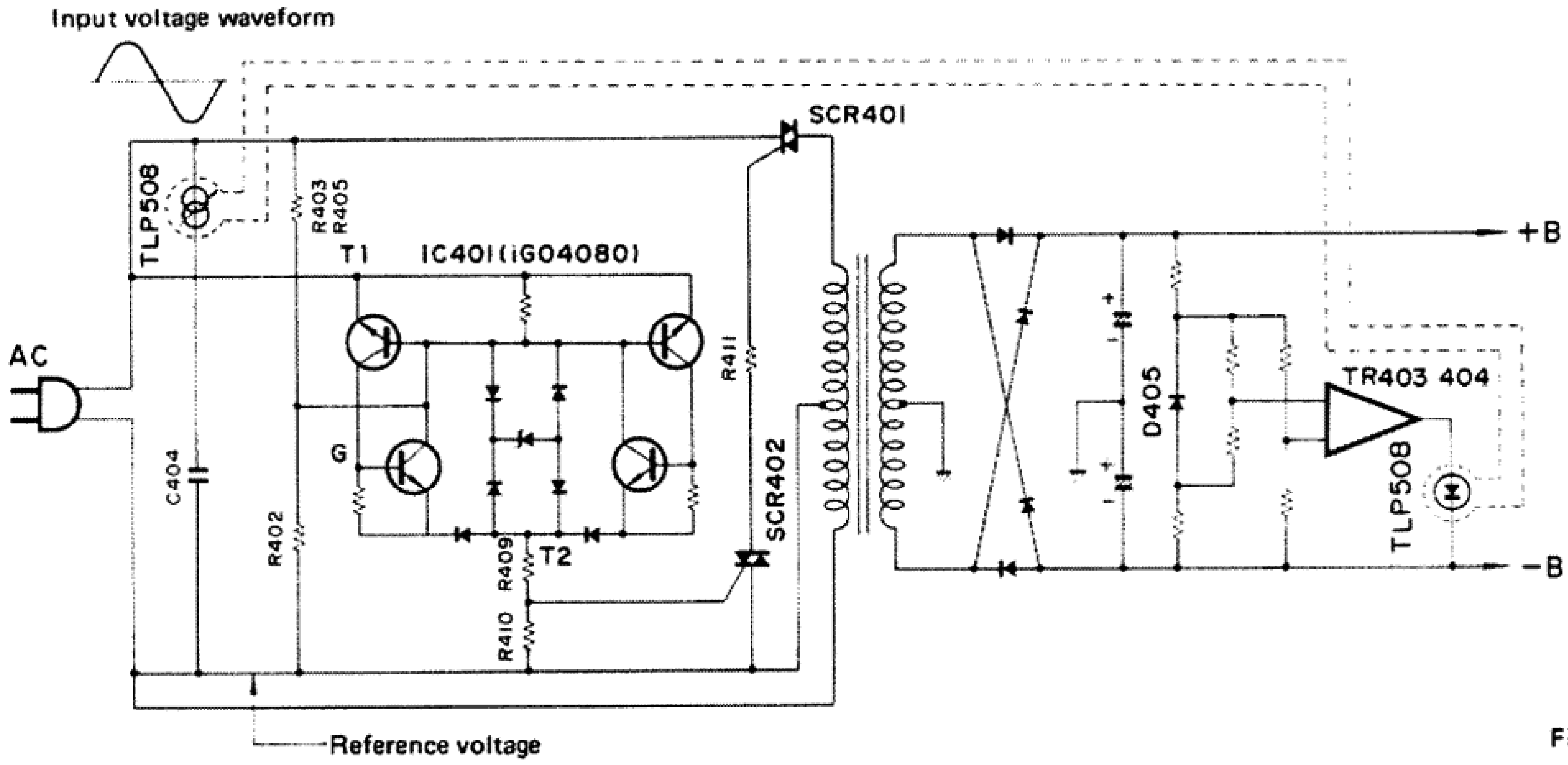


Fig. 4

The positive half-cycle of AC input is explained below: With the current from the constant-current source generated by a phototransistor of Photo Coupler TLP508, the voltage at both ends of C404 ($T_1 - T_2$ voltage) becomes higher over time as shown in Fig. 3. If it reaches about 9V, $T_1 - T_2$ turns on, and the electric energy stored in C404 passes, $T_1 \rightarrow T_2 \rightarrow$ R409 $\rightarrow$ R410, then discharges. At this time, the trigger operates and SCR402 switches on. Accordingly, SCR401 also switches on, and the voltage is applied to the transformer primary. If the current from the constant-current circuit with the phototransistor TLP508 is low, it will take a longer time to reach 9V. Thus the voltage applied to the transformer primary will be lower and the rectified voltage (±B) in the secondary will also be lower. On the other hand, if the current from the constant-current circuit is high, it will take a shorter time to reach 9V. As a result, the voltage applied to the transformer primary will be higher and the rectified voltage in the secondary (±B) will also be higher. Thus, by detecting the voltage variation of ±B of the secondary, and changing the current supplied to the LED of Photo Coupler 508 so as to change the light emitting quantity, the current of the phototransistor changes and the power application phase angle changes, thereby ensuring stability. If, for example, voltage ±B tends to rise, a voltage lower than the reference voltage obtained in zener diode D405 is input to terminal of the voltage variation detector circuit.

As a result, the current supplied to the LED of TLP508 decreases and it becomes dim. Accordingly, the current of the phototransistor decreases and it will take a longer time for TRIAC to turn on. Thus the voltage applied to the transformer primary will be lower and the rectified voltage of the secondary will also be lower. This means, that the amount by which ±B voltage tended to become higher, is detected and fed back so as to keep constant voltage. On the other hand, if ± voltage tends to become lower, the same sequence operates in reverse to maintain constant voltage.

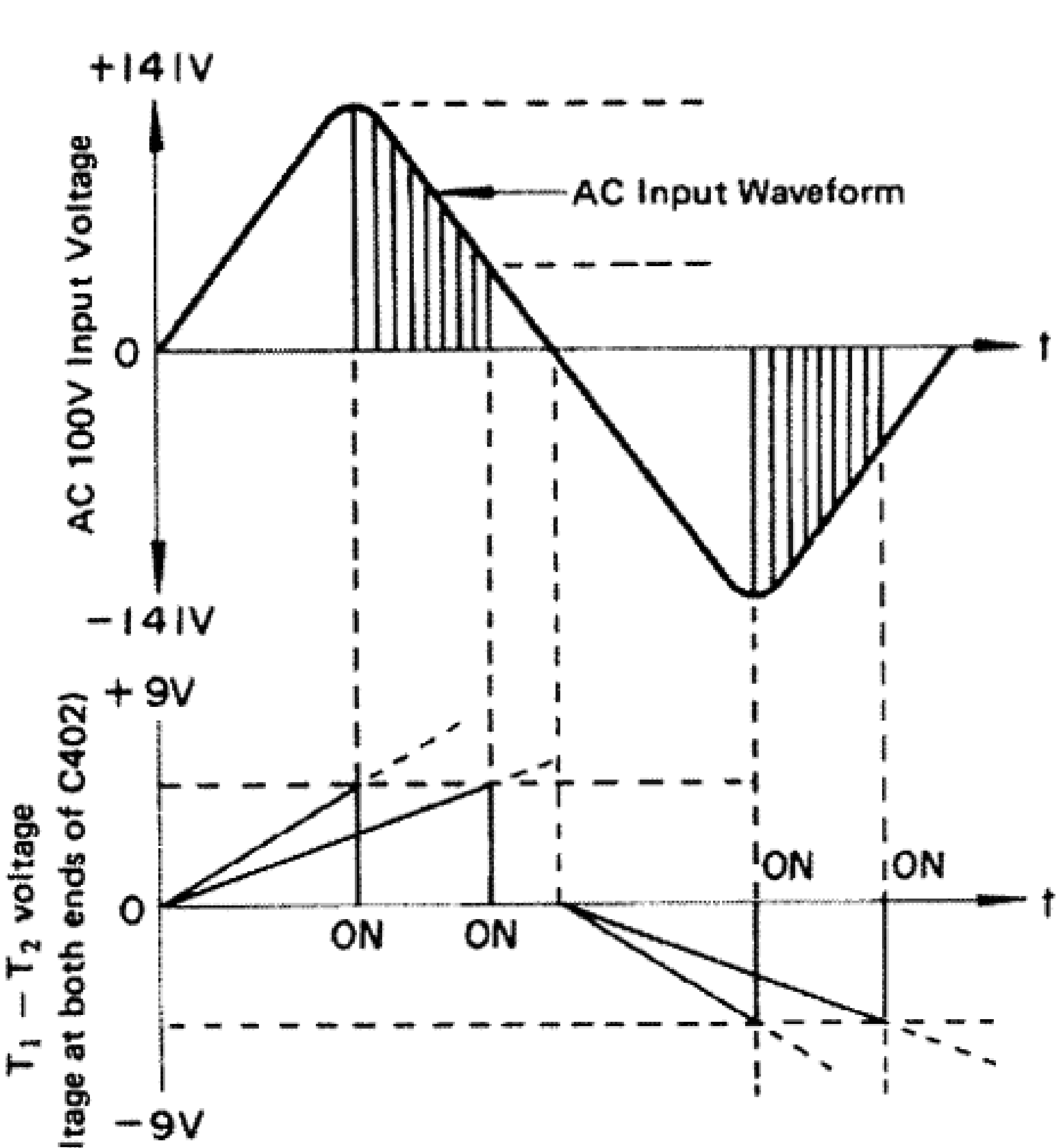


Fig. 5

THE OPERATION AT THE TIME OF ON-OFF OF POWER SW

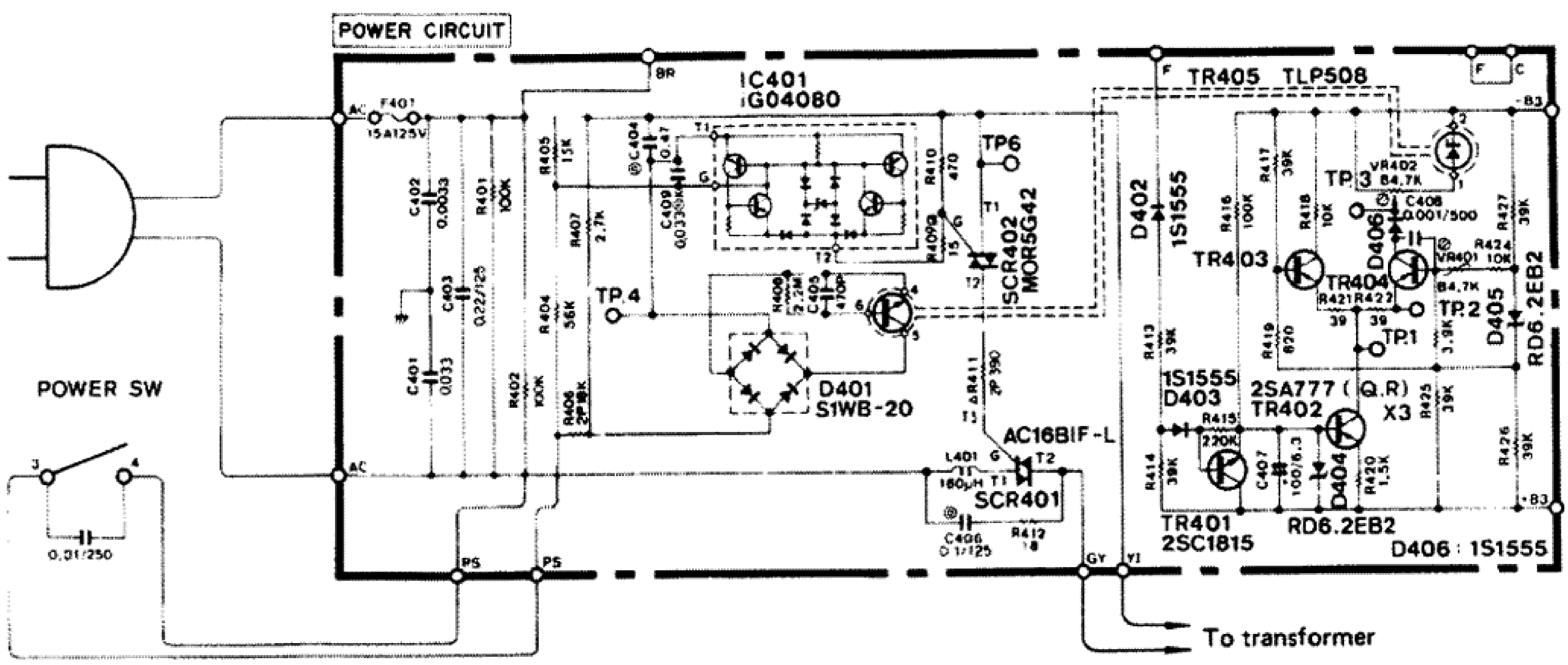


Fig. 6

In all cases mentioned above, the voltage variation detector circuit operates and, accordingly, the control circuit is activated. If the power SW is turned on, however, there is no ±B voltage. Therefore the voltage variation detector circuit does not operate and no current flows to the photo coupler. That is, as the control circuit of the primary is not activated either, there is no power supply.

This power circuit is provided with a start circuit to insure operation when the power SW is turned on. Resistors R404, and R405 connected to G circuit of IC401 (IG04080) provide this function. If the power SW is turned on, the AC input voltage passes R402 (100K), then from G terminal of IC401 to T_1 terminal and current flows to charge C404. Thus the voltage of T_1 terminal gradually increases. If it nears 9V, $T_1 - T_2$ of IC401 is connected, thereby switching on SCR402 and SCR401. At that time, a voltage of about 13V is supplied to the voltage variation detection circuit of the secondary to start operation.

And the start circuit operates quickly as the power voltage is low.

SOFT START CIRCUIT

Just after the power SW is turned on, the voltage variation detector circuit detects that the power voltage is very low. Then it is fed back to the primary control circuit via TLP508 so as to increase the power application phase angle.

However, if the phase angle increases abruptly, a very large rush current flows to TRIAC (SCR401).

To prevent this, a soft start circuit consisting of TR402, D404, C407 and R416 is provided so that the power application phase angle is increased gradually. Because this circuit gives a bias applied to TR402 with charge time of C407 and R416, the current flowing to TR402 gradually increases. Therefore, the current flowing to Photo Coupler TLP508 varies in the same way to increase the power application phase angle gradually.

VR401 is for adjustment of ±B, and VR402 for adjustment of the current flowing to TLP508.

■ADJUSTMENTS

AC line voltages under adjustments

Models	AC line voltage	Frequency
US	120V ± 10%	60 Hz
North European	220V ± 10%	50 Hz

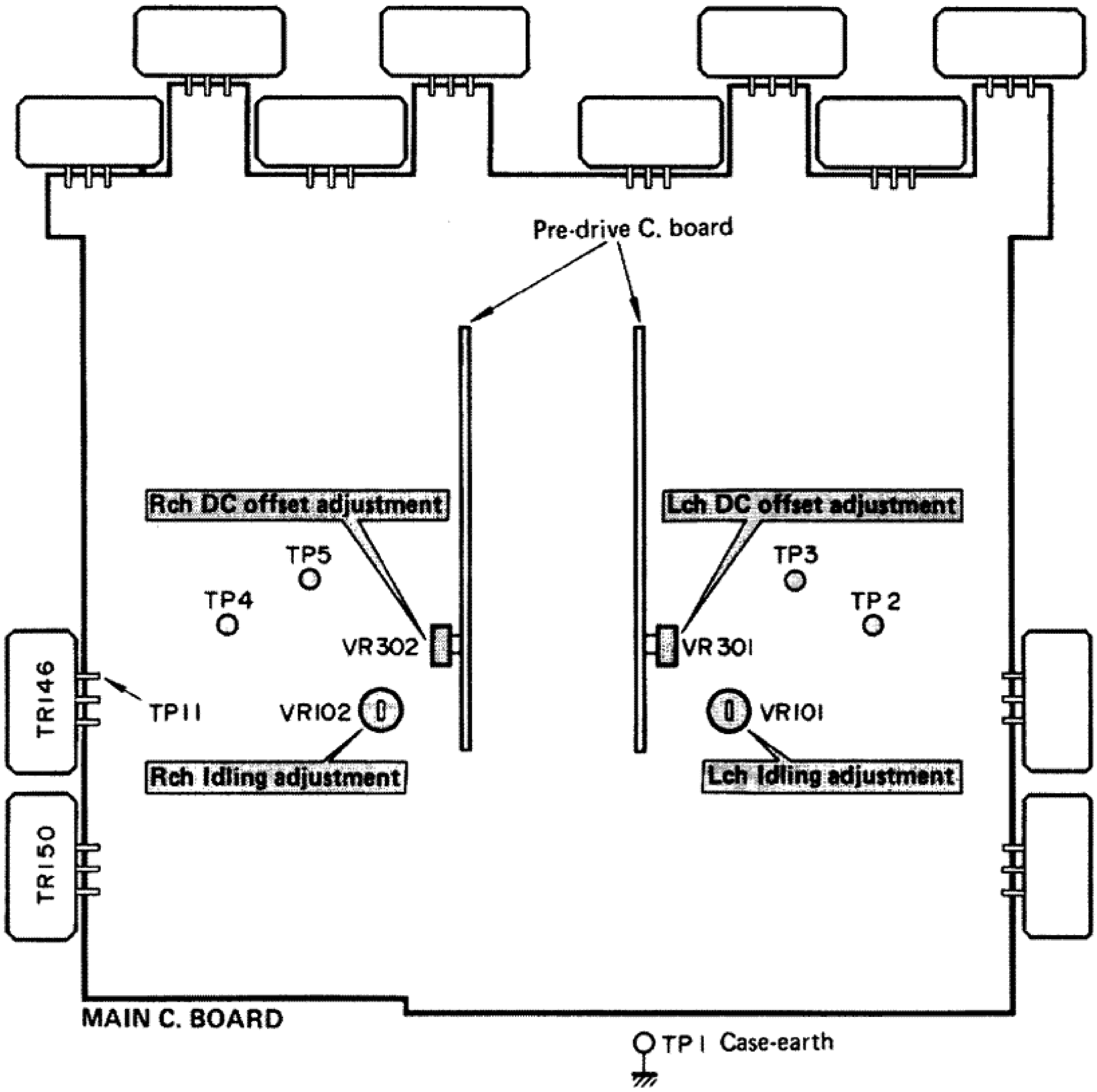
STEP	ADJUSTMENT ITEM	ADJUSTMENT	TEST POINT	RATING OR STANDARD	REMARKS
1	DC offset (Lch)	Pre-drive P.C. board VR301	Main P.C. board TP1 ~ TP2	0 ± 5 mV	After the power switch is ON, wait 3 minutes before adjustment.
2	DC offset (Rch)	Pre-drive P.C. board VR302	Main P.C. board TP1 ~ TP4	0 ± 5 mV	
3	Idling current (Lch)	Main P.C. board VR101	Main P.C. board TP2(+) ~ TP3 (–)	2.5 ± 0.5 mV	• No Load • Rotate VR101 and 102 to the left and after the power switch is ON, wait 5 minutes before adjustment. • Max 40mV under warming up.
4	Idling current (Rch)	Main P.C. board VR102	Main P.C. board TP4(+) ~ TP5(–)	2.5 ± 0.5 mV	
5	Power supply voltage	Power supply P.C. board VR401	Main P.C. board TP1(E) ~ TP11	76.0 ± 0.2 V	No Load
6	Photo coupler working point	Power supply P.C. board VR402	Power supply TP1 ~ TP2	60 ± 10 mV	Adjust the moment you adjust step 5.

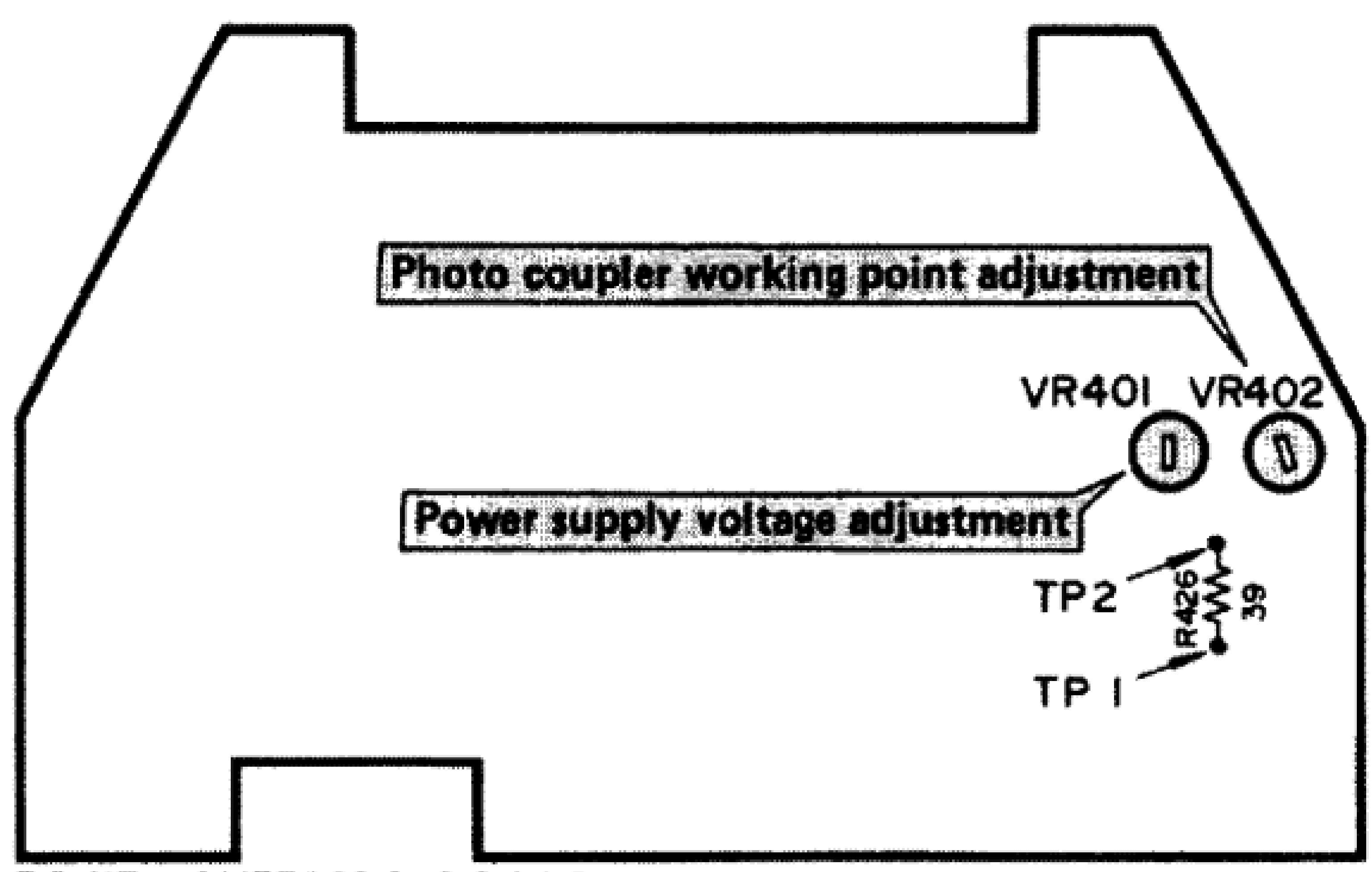
* *Adjust step 5 and 6 at the same time as you use the two digital multi-meters.*
* *Adjust step 6 only when exchanging the photo-coupler.*
* *Remove the Top case when adjusting but adjust in a short time when full power Drive is needed, because the top case unit is serves as a heat sink.*

- **Cautions (Power supply P.C. board adjustment)**

1) Be careful not to receive an electric shock because AC line voltage is feeded to power supply P.C. board directly.
2) Make sure that the voltage is checked between the check point and the standard point.
3) Make sure that you use the floating input type osciloscope for observing the waveform.
   By using body-earthed osciloscope the circuit may be shorted. As the AC line voltage is feeded to the body, do not touch it.
4) Observe the waveform across R411 (390Ω 2P) (U.S Model) R413 (390Ω 2P) (N. European Model) to check the triac.

I. Adjustment Test point

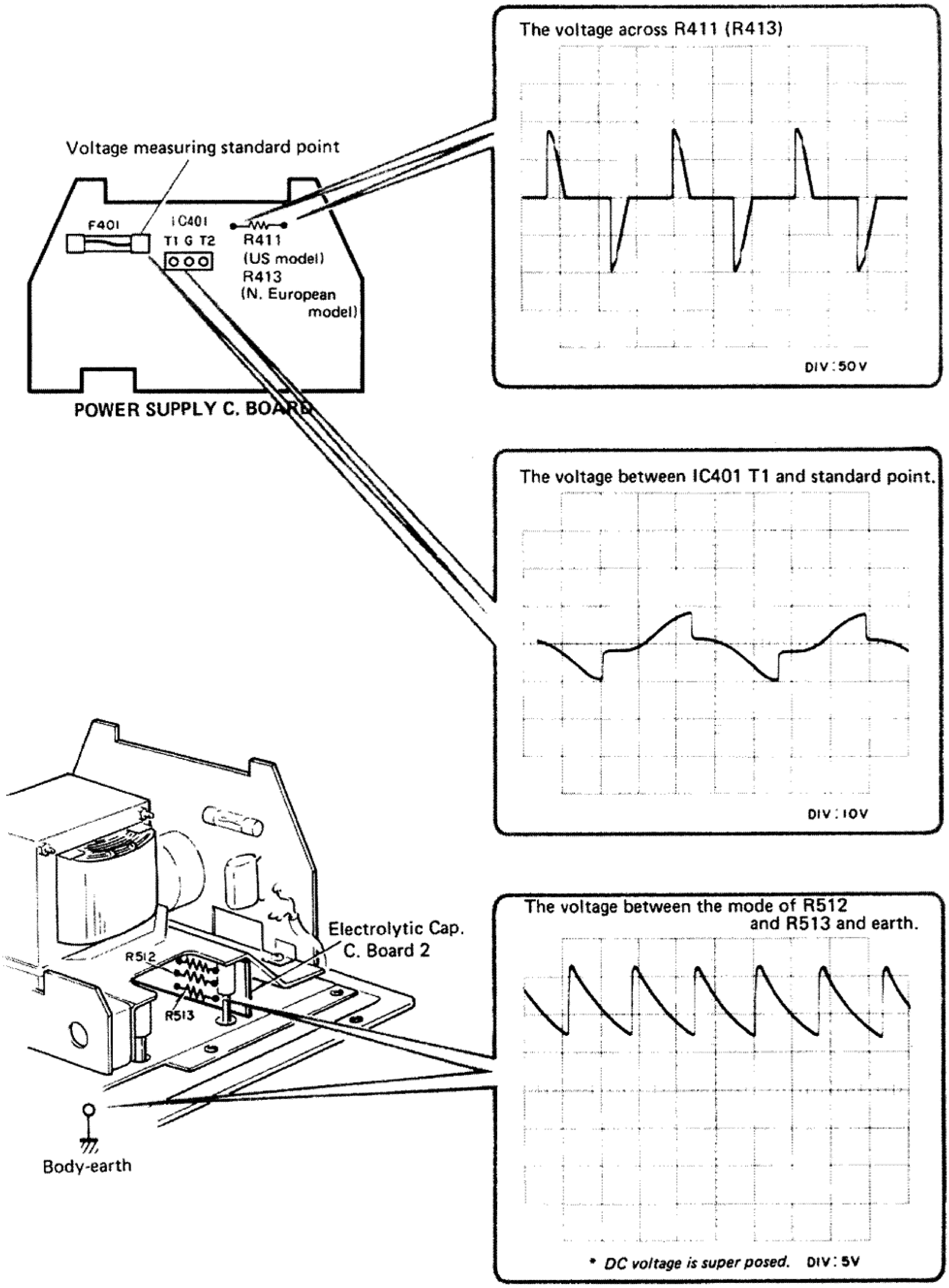




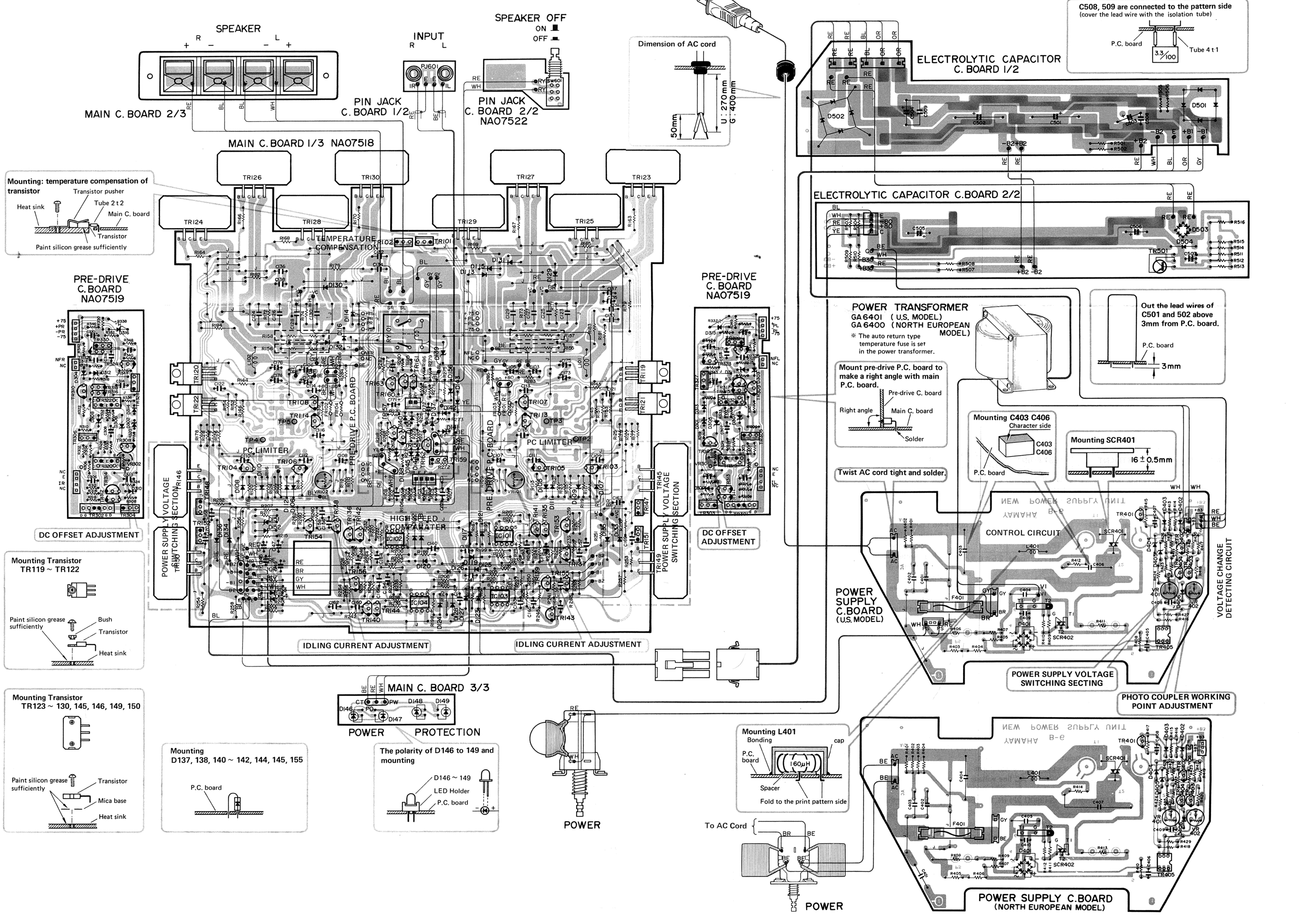
POWER SUPPLY C. BOARD
(print pattern side)

- *You can adjust easily to solder the lead wires (about 1cm) to TP1, and TP2.*
- *VR401 and 402 are able to adjust at print pattern side.*

II. Waveform Check point

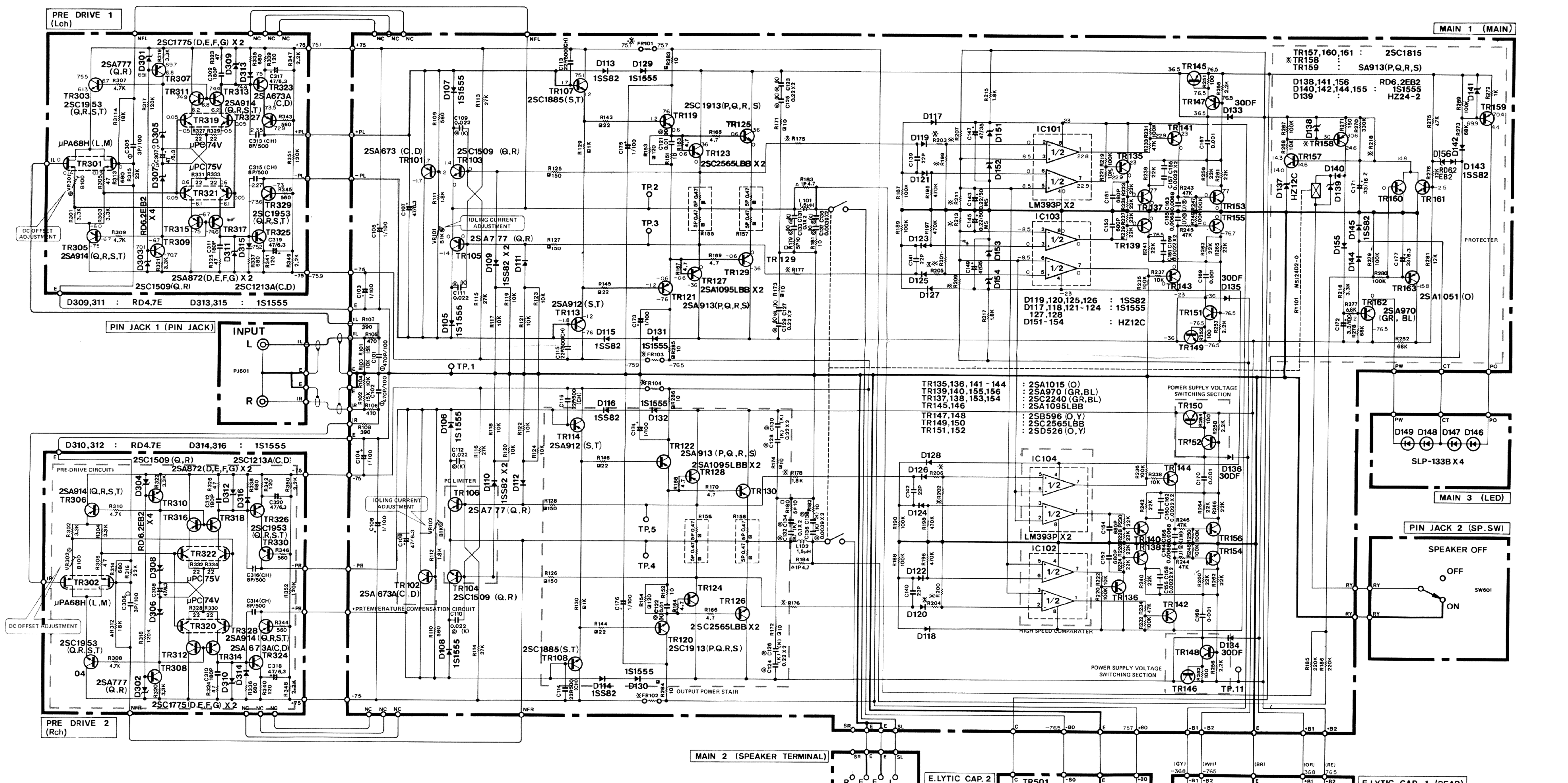


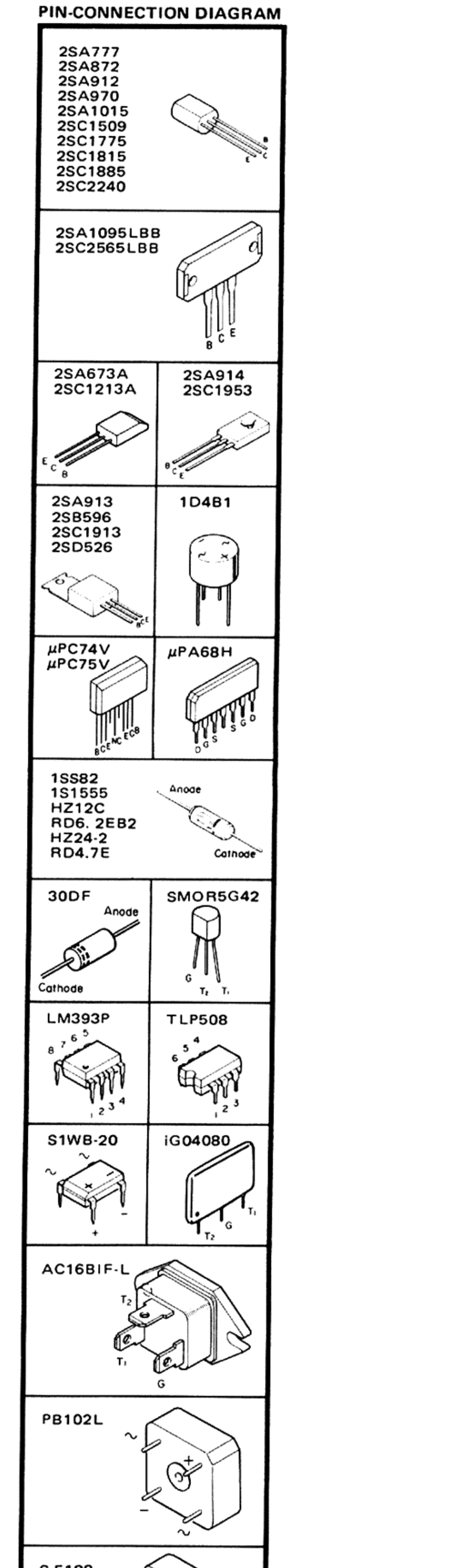
■WIRING



* Wiring Diagram is subject to change without notice.

■SCHEMATIC DIAGRAM





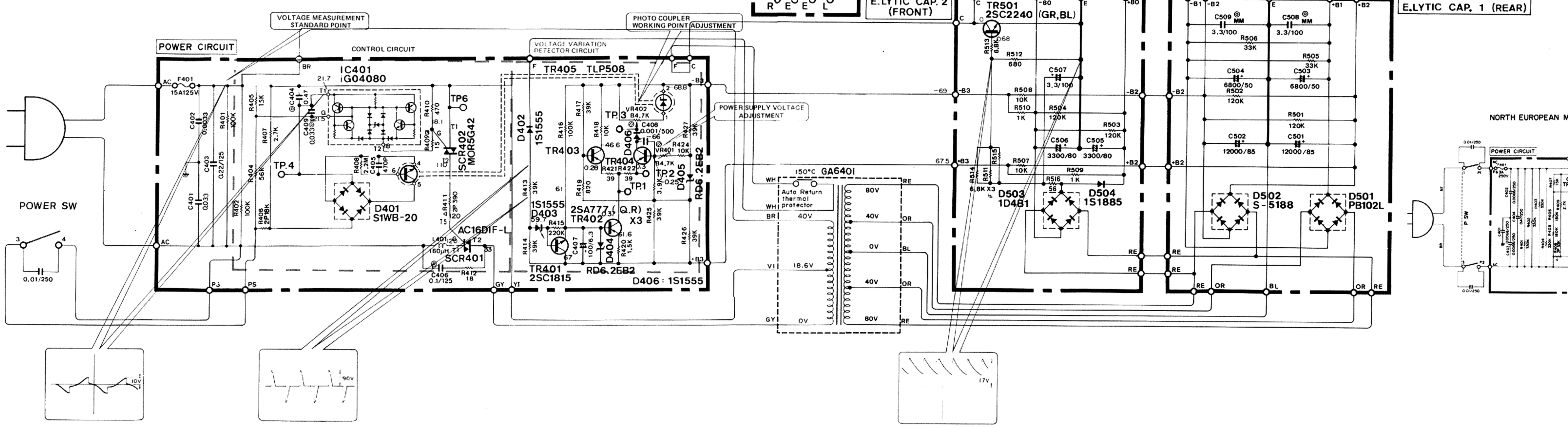
MODEL / PARTS NO.	J, G	U
R175 ~ 178	1.8kΩ	2.2kΩ
R199 ~ 202 211, 213	10kΩ	▲10kΩ
R203 ~ 206	22kΩ	▲24kΩ
R207, 209	33kΩ	33kΩ
FR101 ~ 104	110mA22	160mA10
R218	1MΩ	2.2MΩ
TR158	2SA777 (Q,R)	2SA814 (O,Y)

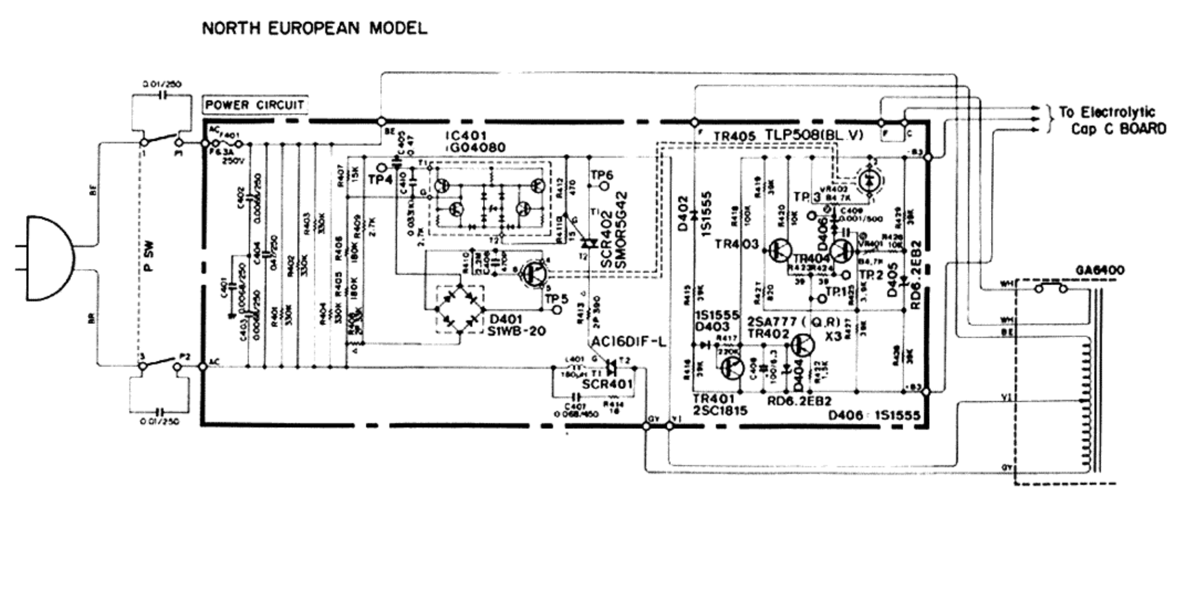
RESISTOR

REMARKS	PARTS
NO MARK	CARBON RESISTOR
⊘	SEMI VARIABLE RESISTOR
△	METAL OXIDE FILM RESISTOR
◘	FIRE PROOF CARBON RESISTOR
⊠	METAL PLATE RESISTOR
□	CEMENT MOLDED RESISTOR
▲	METALIZED FILM RESISTOR

CAPACITOR

REMARKS	PARTS
NO MARK	CERAMIC CAPACITOR
⦶	MICA CAPACITOR
◎	MYLAR CAPACITOR





1) Measure the voltage of power supply P. C. Board between test points and Voltage measurement standard point.
2) When observing the waveform of power supply P. C. Board, make sure that you don't touch the body of the oscilo-scope, because of receiving an electric shock and you don't have a body-earth.
3) Triac is active when you observe the waveform of R413 (2.2kΩ 3P) in the circuit.

- *The voltages are measured by the digital multimeter having internal resistance 1MΩ.*
- *Given above is the voltage measured with the U.S. model.*
- *Schematic Diagram is subject to change without.*