OPERATION MANUAL FOR FUNCTION GENERATOR MODEL 454

Kikusui Electronics Corp.

On Power Supply Source, it is requested to replace the related places in the instruction manual with the following items.

(Please apply the item of √ mark.)

☐ Power Supply Voltage: to _____ V AC

☐ Line Fuse: to _____ A

☐ Power Cable: to 3-core cable (See Fig. 1 for the colors.)

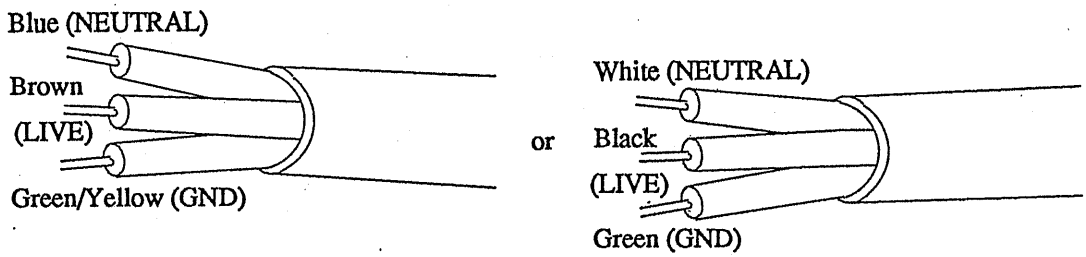


Fig. 1

Please be advised beforehand that the above matter may cause some alteration against explanation or circuit diagram in the instruction manual.

* AC Plug: In case of Line Voltage 125V AC or more, AC Plug is in principle taken off and delivered , in view of the safety.
(AC Plug on 3-core cable is taken off in regardless of input voltages.)
To connect the AC Plug to the AC power cord, connect the respective pins of the AC Plug to the respective core-wires (LIVE, NEUTRAL, and GND) of the AC power cord by referring to the color codes shown in Fig. 1.

Before using the instrument, it is requested to fix a suitable plug for the voltage used.

Table of contents

---

1. Outline

The Kikushi Electronics Type Function Generator Model 454 is an ultra-low frequency oscillator for generation of sinusoidal wave, triangular wave and square wave ranging from 0.005Hz - 100KHz by dividing them to 7 ranges of the decimal system.

The Model 454 has been designed and manufactured to be compact and light. Transistors have been adopted for the circuits of the generator.

The frequency characteristics of oscillating output voltage are essentially flat in principle. No transient phenomenon develops when the waveform or range is changed over and the generator starts oscillating a given waveform. Besides, the function generator can be made to start oscillating sinusoidal wave and triangular one from almost 0 V and square waveform from (+) electric potential optionally by handling the start switch located at the panel. Accordingly, the Function Generator Model 454 is very convenient when it is used for measurement is made at ultra-low frequency.

The Function Generator Model 454 can be used in a wide application field i.e. measurement of reduction characteristics of the feed-back amplifier, test of the servomechanism of automatic controllers, purpose of the function generator for analog computers and signalling source for oscillating driver. It is ideal for various kinds of measurements and tests.

2. Specification

o Power	100V 50/60 Hz	Approx. 24VA
o Dimensions	190(W) x 140(H) x 250(D)	
(Largest part)	190(W) x 155(H) x 300(D)	
o Weight		Approx. 4.3Kg
o Accessories	Operation Manual..... 1	
	Test table..... 1	
	Terminal adaptor 941 B Type..... 1	
o Oscillated frequency	0.005Hz - 100KHz	
Range	x0.01, x0.1, x1, x10, x100, x 1K, x10K	
Dial scale	Equally-divided 0.5 - 10	
Precision	2% + (±0.05 of dial scale)	
Stability	±0.5% or below against a ± fluctuation of power voltage	
o Output	Sinusoidal wave, triangular wave and square wave	
Max. output voltage (at load resistance 600Ω)		15Vp-p or above
Min. load resistance		300Ωor above
Frequency characteristics	Against 1000Hz	±0.3dB or below
Distortion factor (sinusoidal wave)	20Hz - 20KHz	1% or below
	20KHz- 100KHz	3% or below
Output impedance		150 or below
Stability	±0.5% or below against a ± 10% fluctuation of power voltage	
Voltage interdeviation		5% or below
Square wave output voltage (50Ωterminal, output release)		1Vp-p or above
Building-up time (at 50Ω end)		70 μ sec or below
Sag overshoot (")		5% or below

Synchronous output	-10 V peak or above
Pulse width	5 μ sec or below

3. Operation procedure

3-1. Description for panel surface (Refer to Fig.3-1.)

(1) POWER

Push the push type power switch and the power is turned at a locking state. The push button is illuminated and it starts working.

(2) FUNCTION

When the change-over knob for output waveform is operated, ∩ (sinusoidal wave), ∧ (triangular wave) and ⊓ (square wave) are generated. Simultaneously with changing-over, a given stable waveform can be utilized at once. No change takes place at the output voltage by waveform. The time corelations of respective output waveforms are as follows. That is, the sinusoidal wave and triangular waveform are in-phase and the square wave, is delayed at 90° than the preceding 2 waveforms.

(3) FREQ. CONT.

This knob is located at the central part of the panel and for varying frequency continuously. When it is turned clockwise, the frequency will increase.

(4) FREQ. FINE
↘ CAL'D

This knob is for fine adjustment of frequency and has a variable range of approx. 10%. When it is turned clockwise, the frequency will increase. The dial scale

has been calibrated at the position CAL'D.

(5) RANGE

This is a change-over switch for frequency ranges. The frequency of output waveform corresponds to the value calculated by multiplying the dial value by 0.01Hz ..... 10KHz.

The output voltage has nothing to do with the frequency and is almost fixed. Simultaneously with changing-over, a newly-set output is available.

(6) OUTPUT

This is a knob for varying output voltage for sinusoidal wave, triangular wave and square wave.

When this knob is turned clockwise from 0, output voltage will increase. Output voltage larger than 15Vp-p is produced at a load of 600Ω.

The output terminal is the UHF type receptacle located under the knob. The metal terminal is connected electrically with the periphery of the receptacle and GND of the circuit.

The GND terminal is floated from the case in D.C.

(7) OUTPUT

This is a knob for varying the output voltage of square wave. When it is turned clockwise from 0, the output will be increased.

The UHF type receptacle is the square wave output terminal for output impedance 50Ω.

When the output is opened, voltage larger than 1 Vp-p is available.

(8) START

This is a black push switch. With the START push switch pushed, oscillation is stopped. When the START push switch is released, oscillation will start.

The start levels and slopes of the respective waveforms are as mentioned hereunder at the time of starting oscillating.

o SINUSOIDAL WAVE

From almost OV to (+)

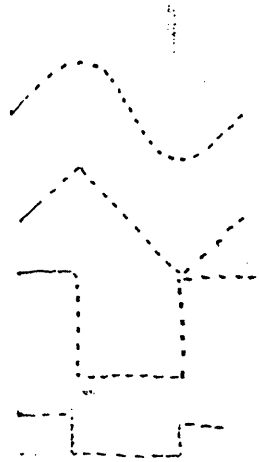
o TRIANGULAR WAVE

From almost OV to (+)

o SQUARE WAVE

From (+) output voltage

From output voltage of square wave (50)(-)



3-2. Description for back panel (Refer to Fig.3-2)

(9) Synchronous output terminal

This is a UHF receptacle output terminal and the -10V peak output voltage synchronizing the positive max. point of sinusoidal wave and triangular wave, the building down point of square wave and the positive building-up point of square wave (50Ω terminal) is available.

Synchronous pulse

Sinusoidal wave

Triangular wave

Square wave

Square wave (50Ω terminal)

(10) GND Terminal

This GND TERMINAL is connected with the GND of the circuit as in the case of the metal terminal located at the front panel.

(11) FUSE

This is a fuse holder used for AC power.

(12) Power cord

This is connected with AC 100V 50/60 Hz.

FIG.3-1 ARRANGEMENT AT PANEL SURFACE

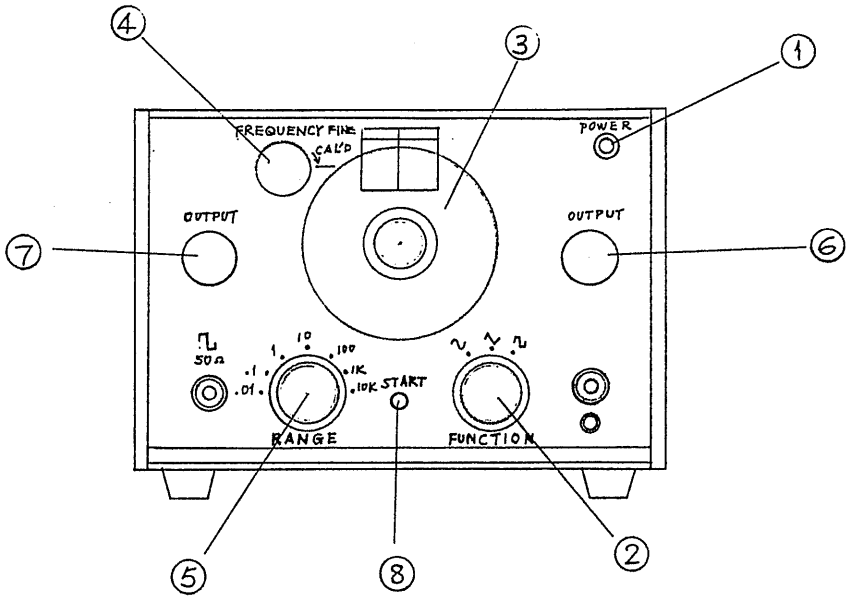
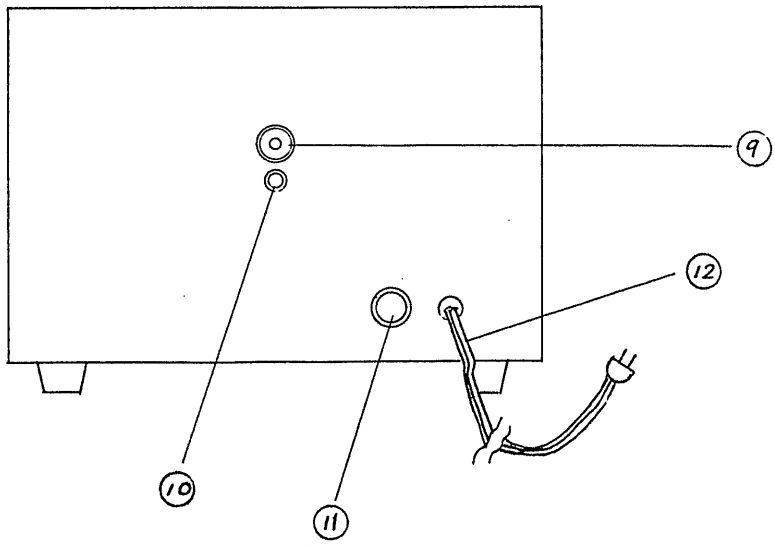


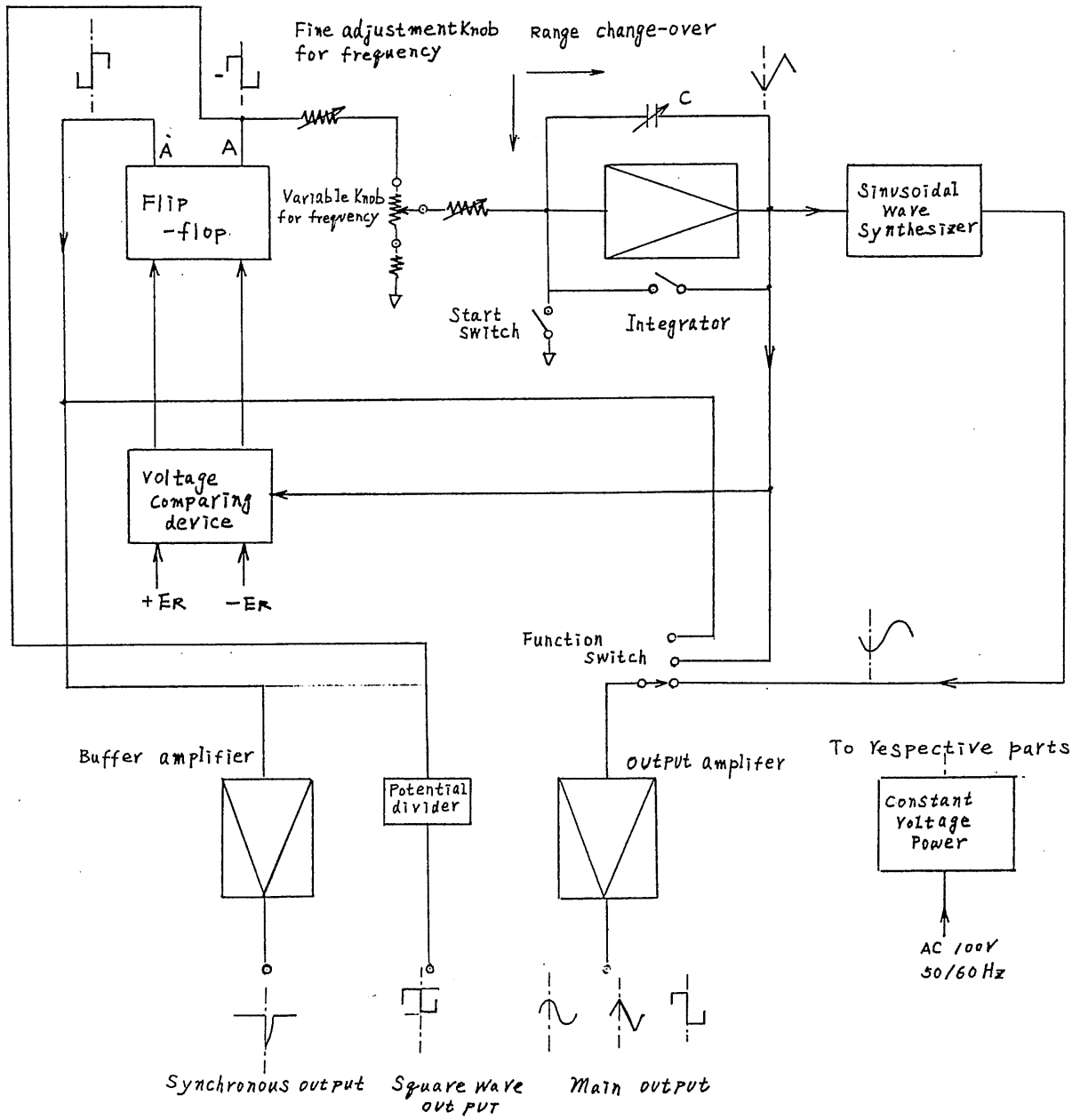
FIG.3-2 ARRANGEMENT AT PANEL BACK



4. Principle

Fig.4-1 shows a block diagram for the working principle of the Function Generator Model 454.

FIG.4-1 BLOCK DIAGRAM FOR FUNCTION GENERATOR MODEL 454



The principle of the oscillator is quite different from that for Vienna bridge type or Swartuzer type RC oscillators which are adopted widely. The flip flop, integrator and voltage comparing device constitute a closed circuit. It is a kind of relaxation oscillator and works as follows.

If the output A of the flip flop which is inversed to positive or negative is assumed to be negative in Fig.4-1, the output is divided by the potentiometer for varying frequency and then added to the integrator.

The integrator consists of a high gain DC amplifier and it is fed back negative to the input from output to condenser for integration of input voltage. As the input voltage is negative in this case, the storage output will rise gradually at a specified inclination according to volume of input voltage and constant at the time of integration as against time.

The storage output voltage enters the voltage comparing device and is compared with the pre-set reference value +ER. When they are equal, a trigger pulse will be generated, resulting in inversion of flip flop.

Owing to the inversing working of the flip flop, the output voltage A of the flip flop will be positive voltage. At the same time, it is integrated in the same way and its output voltage will drop.

When the dropping voltage reaches -ER, a trigger pulse will be generated by the comparing device, resulting in inversing the flip flop to its orginal state.

The repetition of the aforementioned working results in continuanace of oscillating state.

Accordingly, oscillated frequency can be varied by the following procedure. That is, the ranges are changed over by condenser C and resistor R and the volume of storage voltage is changed by potentiometer.

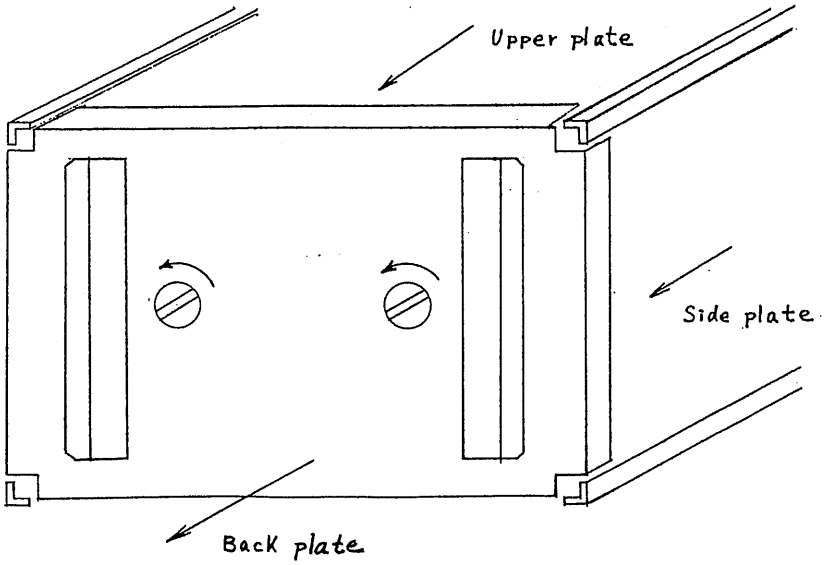
Then, the triangular wave is sined by the sinusoidal synthesizer employing diodes, and its amplitude is adjusted together with the triangular wave of the integrator output and the square wave produced by flip flop. Then, it is amplified by output amplifier to be an output voltage.

5. Maintenance

5-1. Inspection of inside

Turn the 2 set screws shown in Fig.5-1 with a coin counterclockwise and remove the back plate. Then, pull out the both side plates, upper plate and bottom plate slowly in the arrow direction for interior inspection.

FIG.5-1



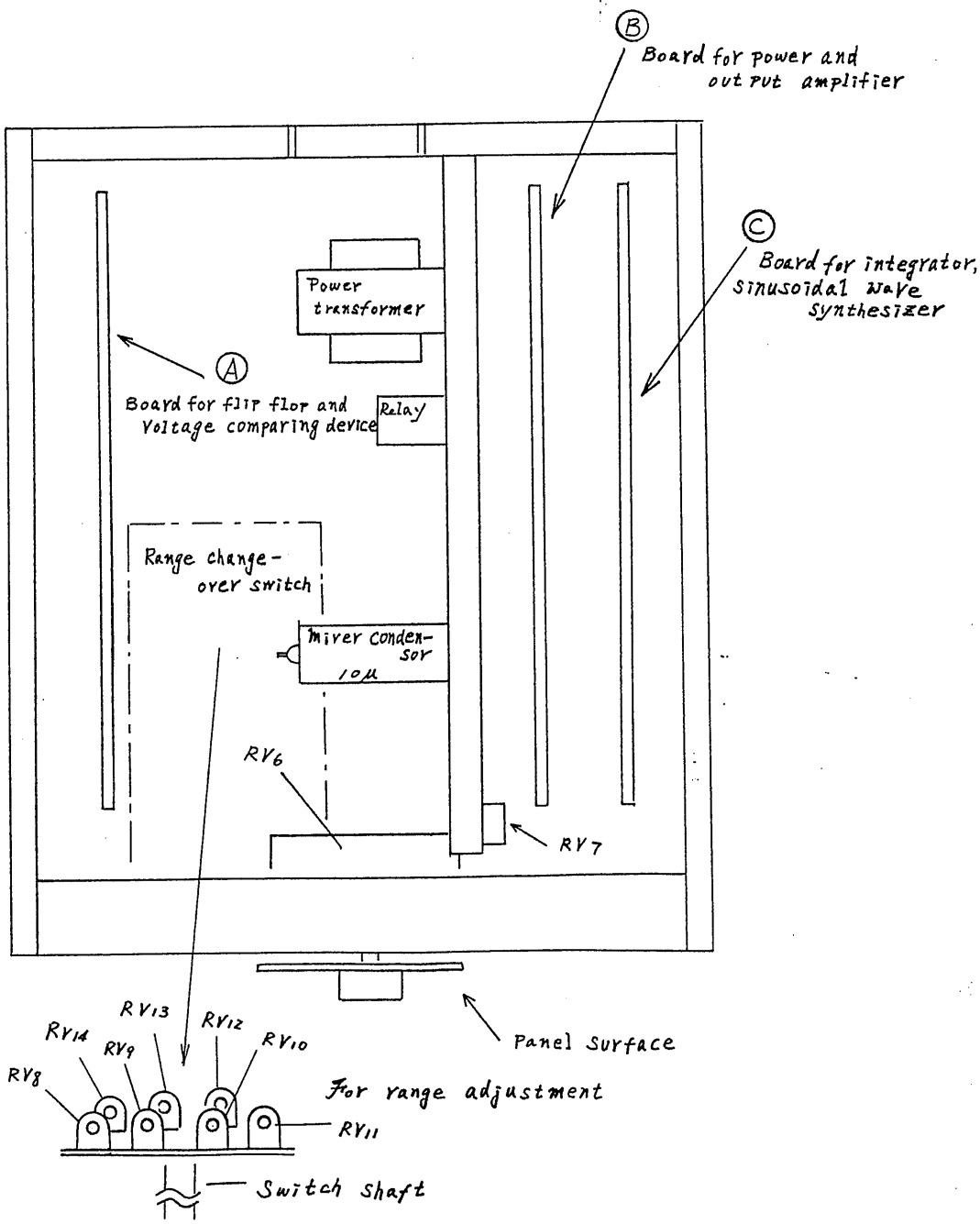
(CAUTION)

Pay your attention to the following point. That is, if the handle is held and the panel front is inclined with the unlocked back plate, the frame will be removed.

5-2. Arrangement

Fig.5-2 and Fig.5-3 show the arrangement of main parts of the function generator.

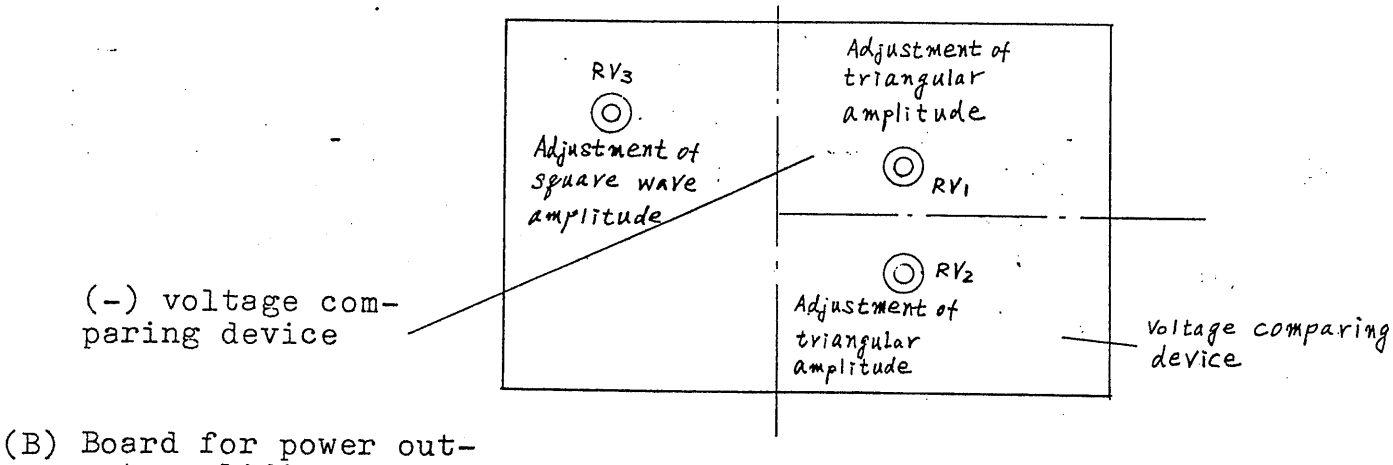
FIG.5-2 ARRANGEMENT OF PARTS



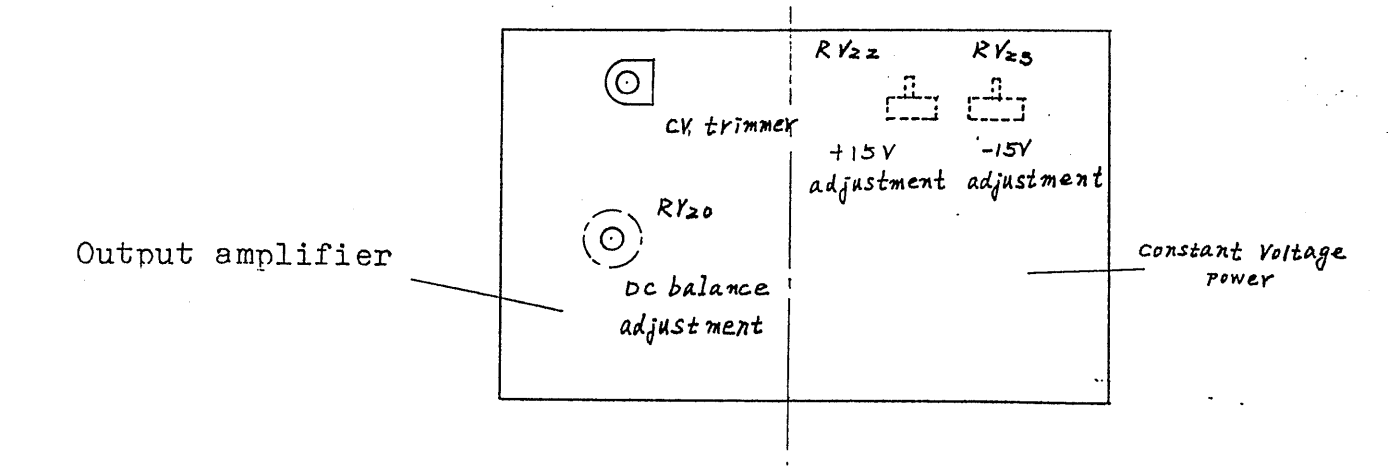
NOTE: The following are the illustrations facing the print surface.

FIG.53- ARRANGEMENT OF BOARDS

(A) Board for flip flop, voltage comparing device



(B) Board for power output amplifier



(C) Board for integrator, sinusoidal wave synthesizer