JVC

SERVICE MANUAL

MODEL TT-101

QUARTZ-LOCKED TURNTABLE

No. 2391
JAN. 1977

Contents

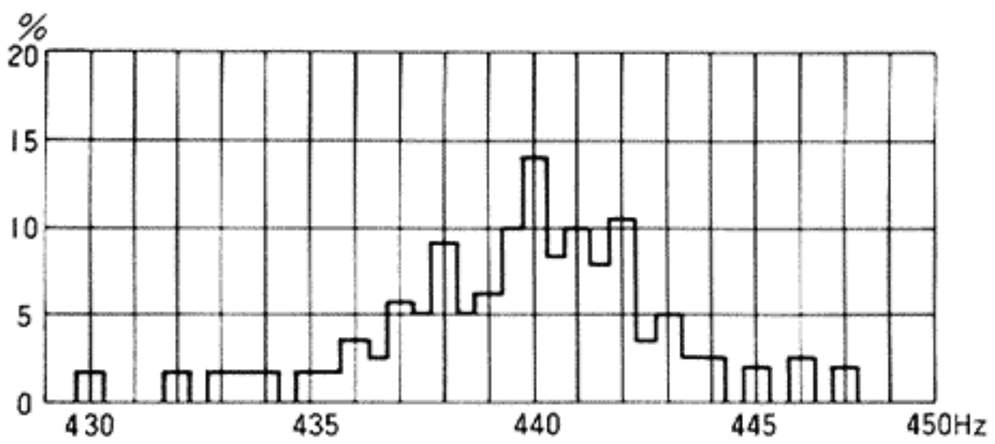
1. Specifications

Motor	: Coreless DC servomotor
Drive system	: Direct drive
Speeds	: 33-1/3 and 45 rpm
Speed detection	: Integrated frequency generator
Servo system	: Quartz-locked positive and negative servo control
Pitch control	: ±6Hz (reference: 440Hz)
Starting time	: Within 0.6 sec. (60°)
Wow and flutter	: Within 0.02% (WRMS)
S/N	: 65dB (IEC-B), 75dB (DIN-B)
Starting torque	: 1.2kg/cm
Speed deviation	: Within 0.002%
Load characteristics	: 0% (with a 120g total tracking force)
Drift	: 0.0004%H
Power characteristics	: 0% (±10V)
Temperature characteristics	: 0.00003%/°C
Turntable platter	: 31cm aluminium diecast
Quick stop time	: Within 1 sec.
Power supply	: 120V AC
Power consumption	: 16W (50/60Hz)
Dimensions	: 15cm(H) x 35.8cm(W) x 35.8cm(D)
Weight	: 10kg (net)

2. Features

- **Quartz-locked turntable**
  The oscillating frequency of an oscillator circuit using crystal quartz is accurate and stable, as suggested by the fact that quartz is used in clocks and watches. The quartz-locked turntable utilizes this accurate oscillating frequency to control the speed of the turntable. In both accuracy and stability, quartz-locked speed control is far superior to the conventional servo systems.
- **Coreless DC servomotor**
  DC servomotor, in general, consume less power and produce higher torque than AC servomotors. But a disadvantage with DC servomotors is irregular rotation. This is because the stator is devided into several cores with coils wound thereon, forming several gaps which cause irregular torque in combination with the rotor. One way to avoid this irregular rotation is to use a turntable which rotates with a high-inertia flywheel effect. Another way is to modify the waveform of the current which is supplied to the coils.
  But the TT-101 adopted the coreless stator to substantially avoid such irregular rotation problems. To avoid the deterioration of efficiency, a new structure was developed employing dual rotor magnets with the stator coil placed between them.
  As a result of the new design, improved turntable specifications are obtained – S/N ratio: 65dB and wow and flutter: 0.02%(WRMS).
- **1Hz pitch control**
  The pitch, "A′" is standardized at 440Hz according to international standards, and is the standard for all western musical instruments. In other words, the tuning of all instruments of the orchestra is based on this pitch. But in reality, the basic tuning pitch of each orchestra differs due to the instrumentation and individual characteristics of each orchestra, as well as the personality of the conductor. The diagram shows such differences by orchestra. Most of the pitches range within ±6Hz of 440Hz. To reproduce these subtly different pitches, a quality turntable with highly accurate rotation is required. Another important requirement is the possibility of minute speed adjustment. If the speed of a turntable could be adjusted to the individual pitch used by an orchestra while at the same time remaining controlled by a quartz-locked servo system, the benefits of flexibility and precision would be significant from a musicological viewpoint. For this reason the TT-101 is equipped with built-in speed-control facilities which can adjust the pitch in 1Hz steps within a range of ±6Hz of 440Hz. The difference of pitches between master tape recorders and disc record cutting machines has been intentionally ignored before but now the speed of a record can be adjusted to match the original pitch of the orchestra, even if the master was recorded differently from the original performance. For example, a performance of the NHK Symphony Orchestra on one record can be adjusted to match the pitch of the same performance on a record by the London Symphony Orchestra, for the enjoyment of a critical comparison.
  The "A′" key of a piano in your home is usually tuned to 440Hz. When you practice the piano while playing back a record, you can adjust the pitch of the record, to be in perfect tune with your piano.
- **Digital speed indication**
  The TT-101 designed to be one of the highest quality consumer grade turntables, incorporates a four figure digital counter (the circuit capacity is to five fugures) to indicate the speed clearly and accurately. Because the TT-101 has a built-in measurement apparatus, it can be used by professionals in broadcast or recording studios, where utmost reliability is required.
  Increasing the frequency from the frequency generator for the speed detection by 1,000 times makes the count time shorter and the count more effective. To measure the speed accurately, at least 1.8 seconds, which is the time required for one revolution of the turntable, is needed. The TT-101 count time is 2 seconds.
- **Start characteristic and speed indication**
  The TT-101 has an excellent start characteristic. After having pushed one of the start buttons (33-1/3 or 45 speed changeover button) it takes 0.6 seconds (33-1/3 rpm), to reach standard speed. But digital indication appears 3.5 seconds after the start, for in order to indicate the rotation speed accurately, the count is delayed until after the start button is pushed and 2 seconds have passed. A RUN/HOLD switch for checking the speed is provided under the turntable. Put this switch in the RUN position, and the counter indicates from 0 to 33.33 (or from 0 to 45.00) continuously and repeatedly. When it is in HOLD, the counter indicates a fixed figure.
- **Positive and negative servo control**
  Factors which disturb the servomotor such as wear of the rotating parts, increased load or voltage drop, usually act to slow down the turntable speed. To cope with this, the conventional servomotor increases the drive current to the drive circuit to accelerate the motor. However, to correct excess acceleration due to increased voltage or servo overshooting, it only switches off the drive current. This results in poor response because of the inertia of the rotating parts. The new positive and negative servo control is capable of correcting the speed in both directions. This also makes it possible to bring the speed instantly to a steady state when it is switched from 45 rpm to 33-1/3 rpm.
- **Quick stop**
  With most turntables, it takes some time before the turntable stops completely after the stop button has been pressed, owing to inertia in the rotating parts. This makes changing records rather inconvenient. To solve this problem, the TT-101 is equipped with a quick stop device. When the stop button is pressed, an electronic brake produces a reverse-current in the drive circuit and instantly stops the rotation with reverse motor torque.

- **Integrated frequency generator**
  A frequency generator for speed detection is an integral part of the motor. To detect the speed, a disc rotor has 180 grooves cut in its circumference and a doughnut-shaped magnet is attached to this disc rotor. Therefore, 180 magnetic fluxes are formed around this magnetic component, under which a stator coil for detection is printed on a doughnut-shaped circuit board. When the motor is rotating, 180 pulses per revolution are available from this circuit board.
- **Toroidal wound transformer**
  The TT-101 is equipped with a toroidal wound transformer which is ten times more efficient than the EI core transformer. It is less vibrant, and has less flux leakage, so the S/N ratio has been greatly improved.

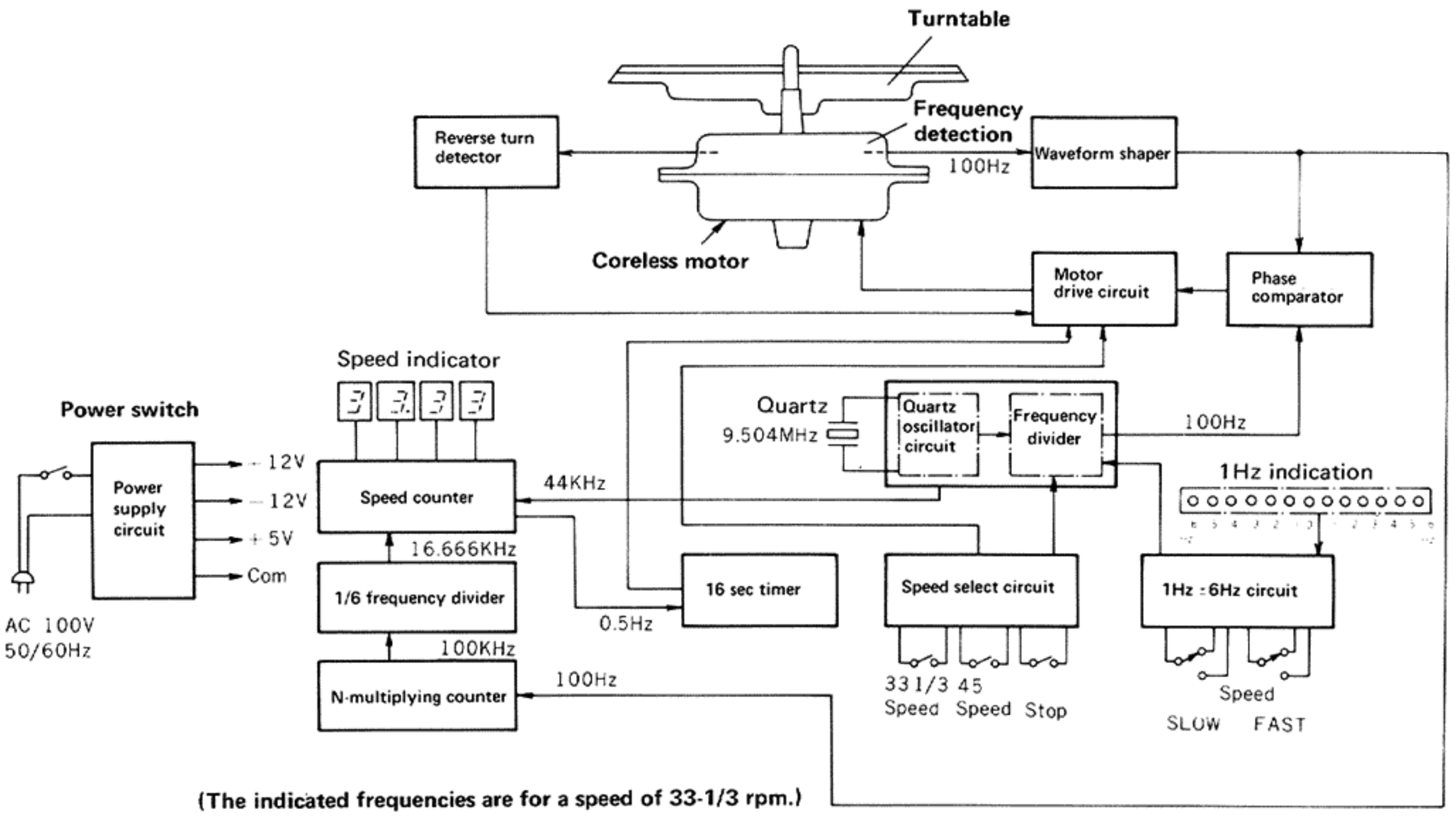


Concert tuning pitches

Fig. 1

3. New Technical Information

3-(1) Block Diagram



(The indicated frequencies are for a speed of 33-1/3 rpm.)

Fig. 2

3-(2) Crystal Oscillation Frequency Divider and 1Hz Indication

1. C. MOS LSIT SC3042 consists of the elements shown in the block diagram of Figure 2.

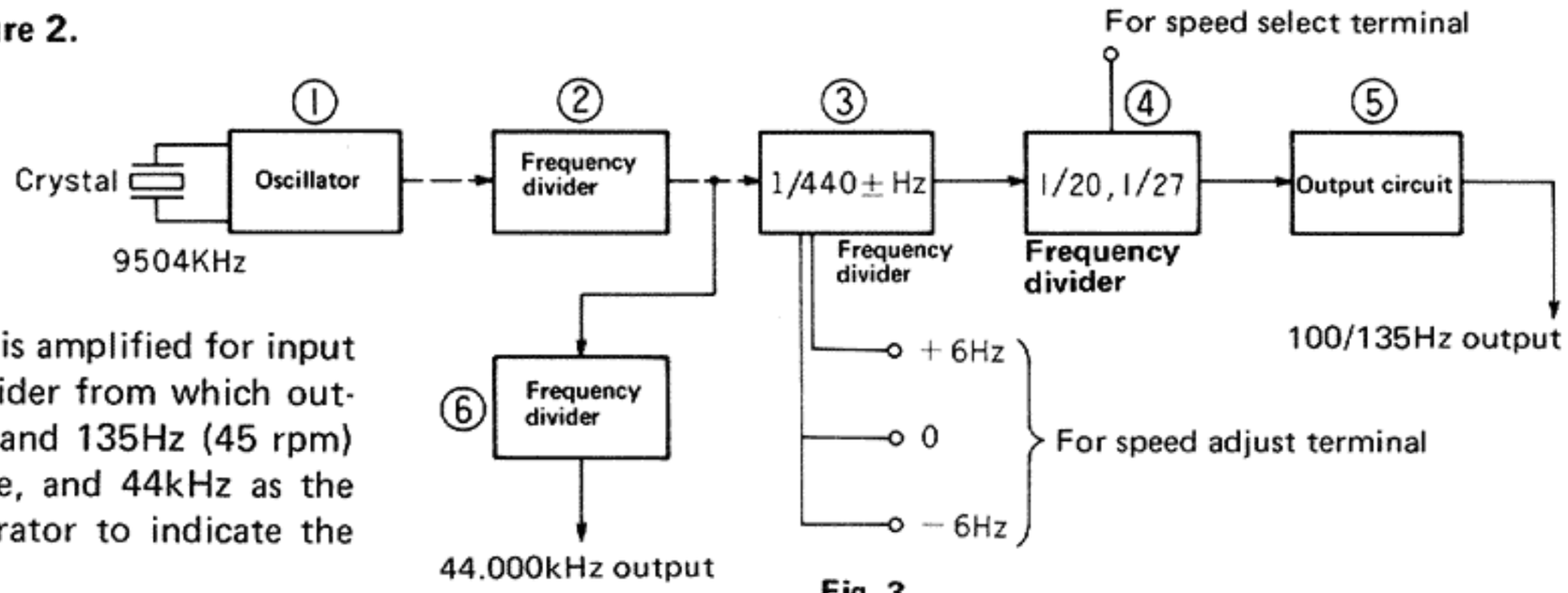


Fig. 3

a. The crystal oscillator output is amplified for input to the built-in frequency divider from which outputs of 100Hz (33-1/3 rpm) and 135Hz (45 rpm) for the quartz-lock turntable, and 44kHz as the input to the time base generator to indicate the rated rpm.
b. Selection terminals on frequency dividers 1/20 and 1/27 are connected to Vcc or Vss to permit output circuit 6 to produce minus pulses required in rpm selection.
c. The grounded speed adjustment terminals permit adjustment in 1Hz increments within the 1/436 – 1/446 frequency devision ratio.
d. The divided frequency for the counter is not adjustable and is obtained by demultiplying 9504kHz, then further demultiplying the result in succeeding steps to obtain the time base.
The pin-connections are shown in Figure 4.

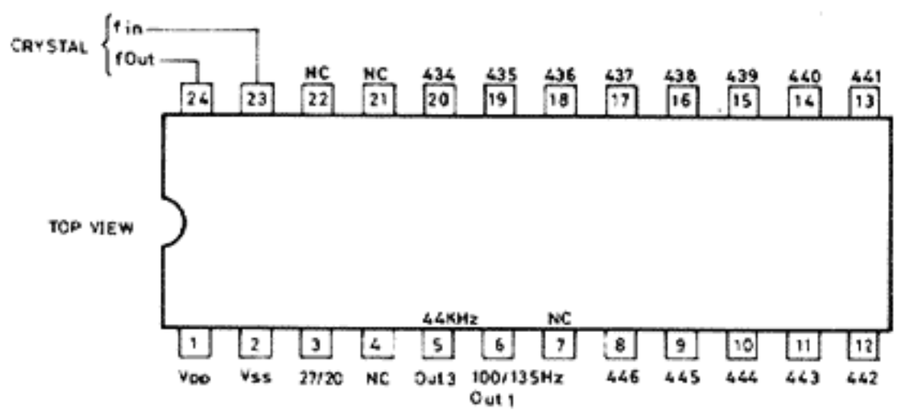


Fig. 4

8	1/446
9	1/445
10	1/454
11	1/443
12	1/442
13	1/441
14	1/440
15	1/439
16	1/438
17	1/437
18	1/436
19	1/435
20	1/434

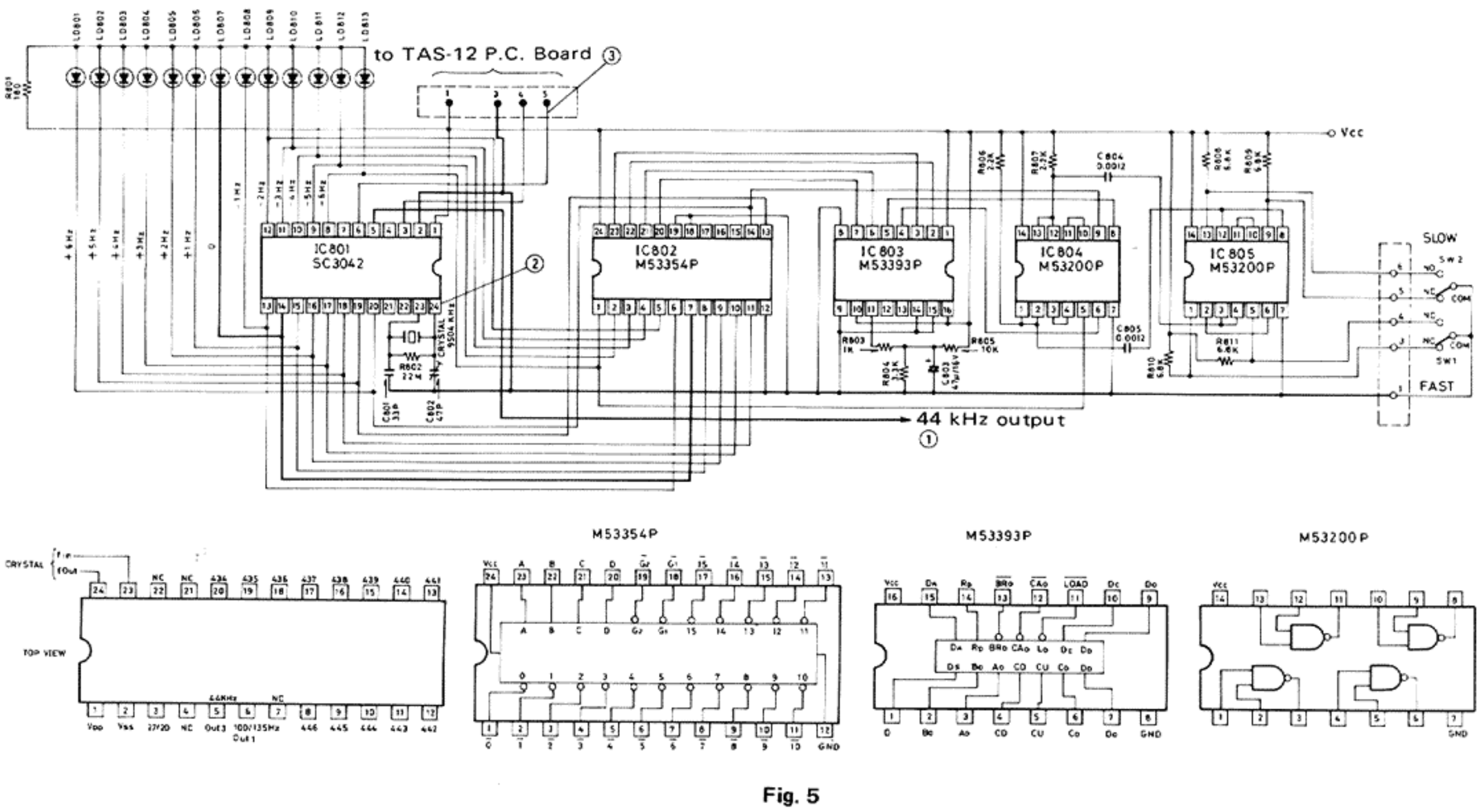


Fig. 5

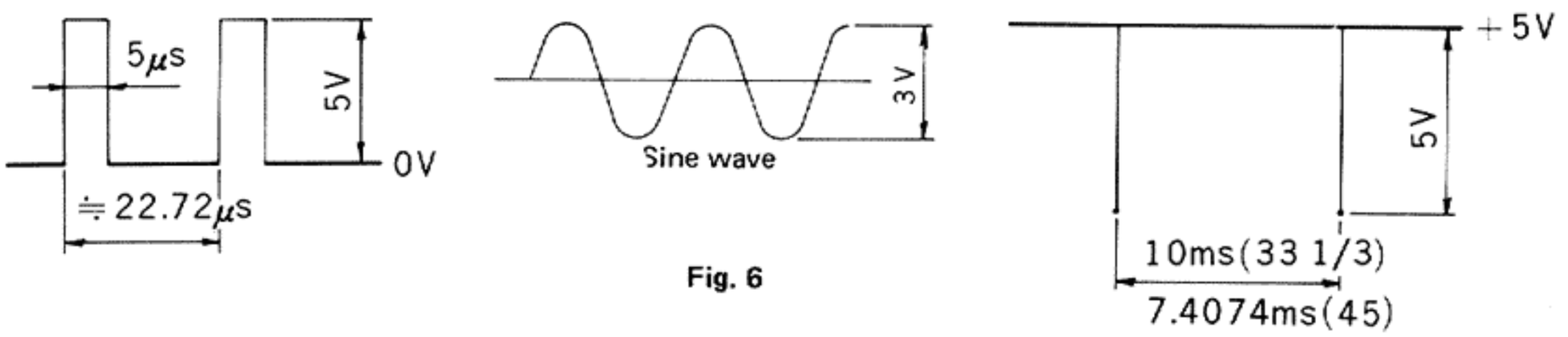
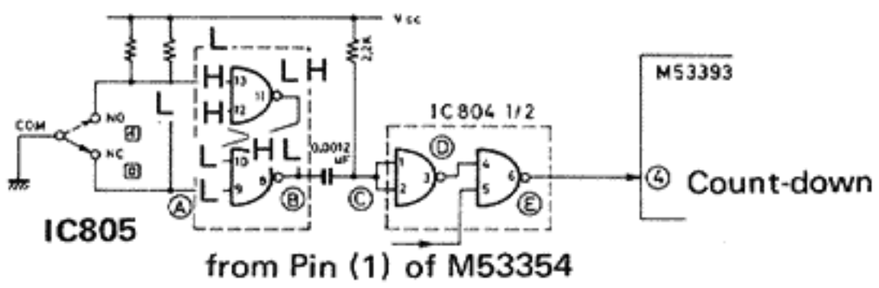


Fig. 6

2. Indicator section

A. Circuit operation

a. This section encodes and decodes the ±6Hz adjustment, which results in a maximum ±6Hz deviation from the basic 1/440 demultiplication of a pulse input to permit indication by the indicator lamp. Push buttons are provided to cause two pulse generation circuits to generate SLOW and FAST pulses. Figure 4 shows the SLOW pulse generation circuit in which the output of IC805, consisting of two NAND circuits is latched to the first input pulse, thus holding it stable to succeeding noise generated by push-operation. Depression of the button yields an increment of deviation and releasing it enables the deviation to be set at that level. In addition, another pair of NAND circuits in IC804 receives a −6Hz clamp signal input from Pin (1) of M53354 to prevent pulse inputs also created by the push-button switch operation from producing outputs causing the deviation to proceed beyond −6Hz.



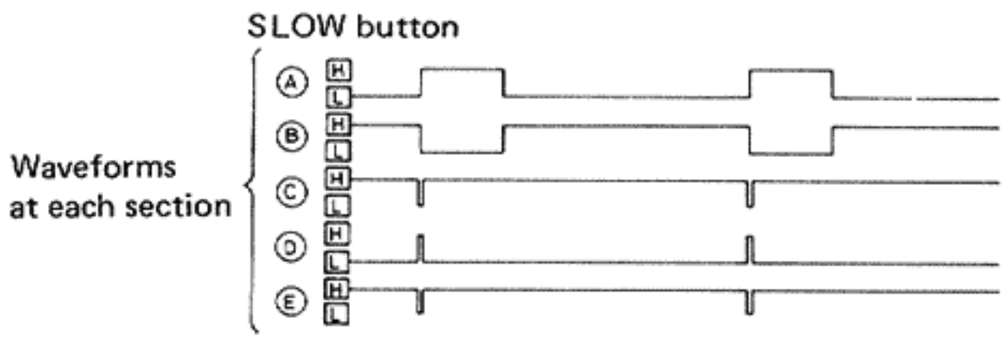


Fig. 7

b. The FAST pulse generation circuit is identical to the SLOW circuit descrived in the above except for the pin connection.

c. A SLOW or FAST pulse is generated when the pushbutton is depressed. However, holding the button depressed will not produce additional pulses. Succeeding pulses are generated only when the IC805 is reverse-latched by redepressing the button.

d. The NAND gate in IC804 and IC805 (physical No. M53200) has the input/output relationships shown in Figure 8. As is seen, when one of the two inputs is Low, the output is always High regardless of the High/Low states of the other input, thus making Low inputs predominant over High inputs.

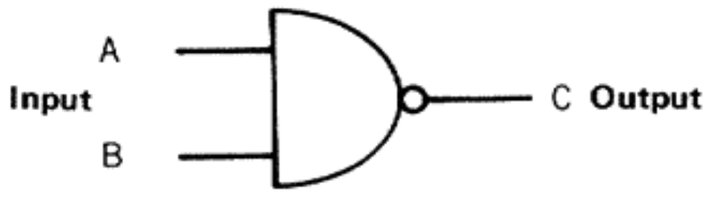


Fig. 8

Input		Output
A	B	C
L	L	H
L	H	H
H	L	H
H	H	L

The NAND gate shown above is the basis for all other T.T.L IC's, and should be carefully studied and remembered.

B. Up-down counter

Adjustment can be set at the desired level by inputting accumulative SLOW or FAST pulses to hexadecimal counter M53393. The counter acting as an ordinary flip-flop IC has the capability of adding or subtracting the number of pulses depending on whether the inputs are count-up pulses or countdown pulses.

Pin (4) M53393 is for count-down inputs and Pin (5) is for count-up inputs.

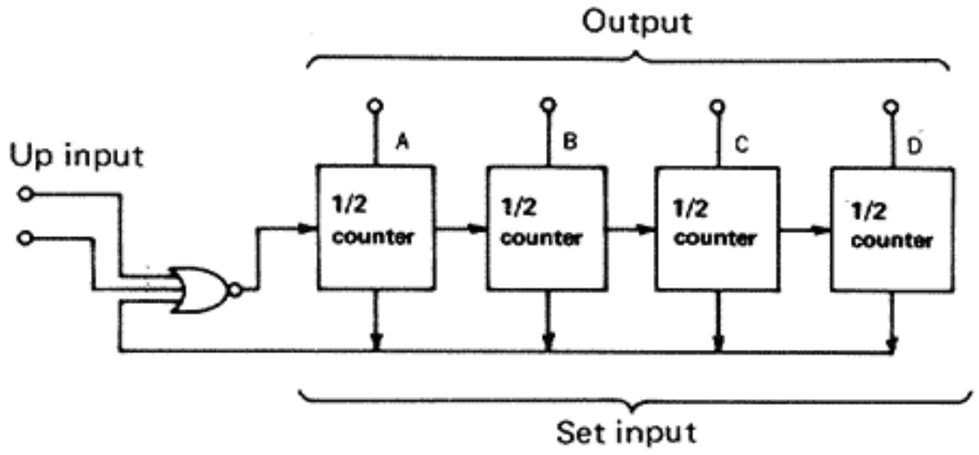


Fig. 9

M53393 consists of four 1/2 counters having the capacity of counting a number within the range of 0 through 15, but is actually clamped by its input circuit within a range of 0 through 13.

If the set terminal of M53393 has been initialized, contents of the set input counter are output from terminals A, B, C and D.

Initializing M53393 is performed by grounding Pin (11). This permits use of the turntable, only when the power switch is turned on. The shape of the initialization signal is determined by the CR combination as shown in Figure 10.

When the power switch is turned on, the voltage between the ends of C803 (47μF/16V) becomes zero thus making Pin (11) Low and setting the initial value into the counter. The charge current to C803 through R805 (10kΩ) then makes it High again thus disabling the initial set signal.

C. Indicator

IC802 M53394 is a 16-line decoder which decodes parallel input data of Binary Code Decimal outputs from M53393 to one of the 16 indicator outputs.

That is, a signal representing one of numbers 0 through 13 decoded from BCD makes a specific output terminal Low to light a corresponding light emitting diode and also for other purposes.

This equipment utilizes Low level outputs from IC802 as indicator signals for the SC3042 1Hz counter, while at the same time performing both deviation indication and varying the ratio of frequency division.

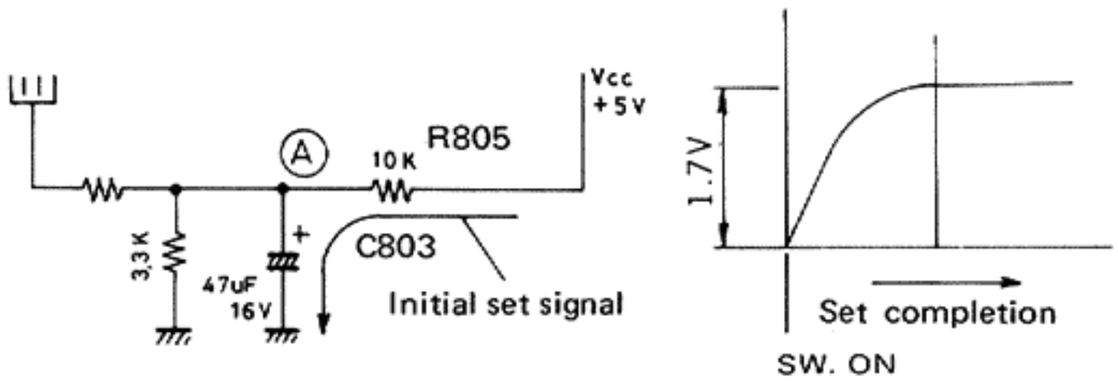


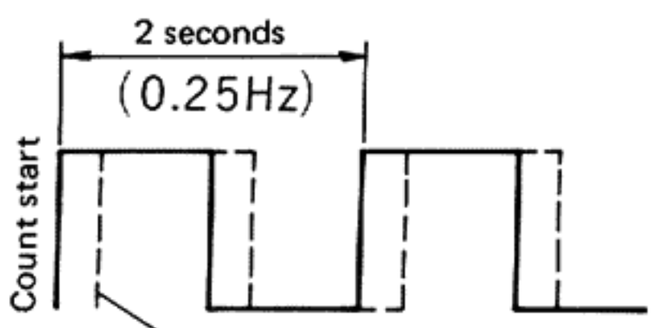
Fig. 10

3-(3) Time Base Generator Circuit

a. The time base generator circuit generates 0.5Hz and 0.25Hz signals by frequency-dividing the 44kHz signal from IC801 (SC4042) through the count down process.

b. Count-down is accomplished by amplifying the output from SC3042 through buffer X801, and passing it to M53293 for 1/11 division. Though the IC was originally intended for dividing its input to 1/16, feed-back to X802 and X803 of the input to the counter causes Pin (2) and Pin (3) to be reset (if both Pins are High level, the contents of the counter become zero by the falling portion of the 11th input pulse, thus making the counter restart counting there). Since this circuit performs feed-back, the signal waveforms vary depending on the section from which they are obtained (refer to Figure 12).
Three IC's, IC807, IC808 and IC809 are 1/10 decade counters each consisting of a 1/2 counter and a 1/5 counter thus yielding a total 1/1000 demultiplication. The M53293 of IC810 divides the 4Hz output from IC809 into 1/8 or 0.5Hz which is used as the basis of the reset signal. Further, the 4Hz output is also divided into 1/2 or 0.25Hz for use as the time base for counting the frequency of an external source input.

c. Reset
To determine the count-start point, all IC's from IC807 through IC810 are reset at one time to produce the 0.25Hz timing shown in Figure 11.



Unless reset is provided, start points become unstable thus entailing varying indication internals and incorrect readings.

Fig. 11

d. Waveform at each section
To observe the process of frequency count down, utilize a dual beam or dual trace oscilloscope. A single beam oscilloscope may also be employed, and confirmation obtained by a frequency counter.

e. Waveform

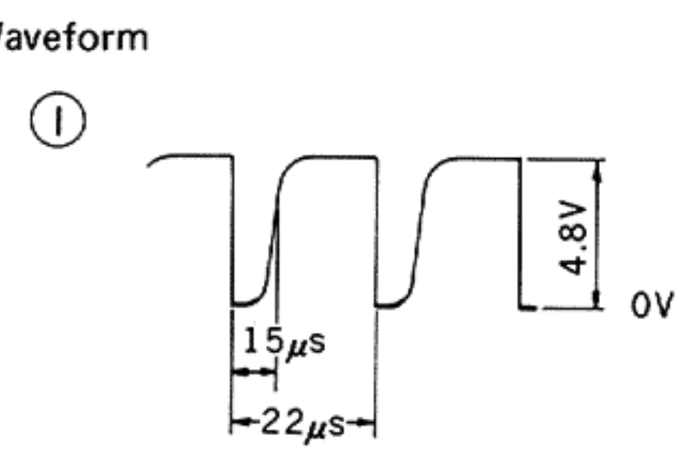
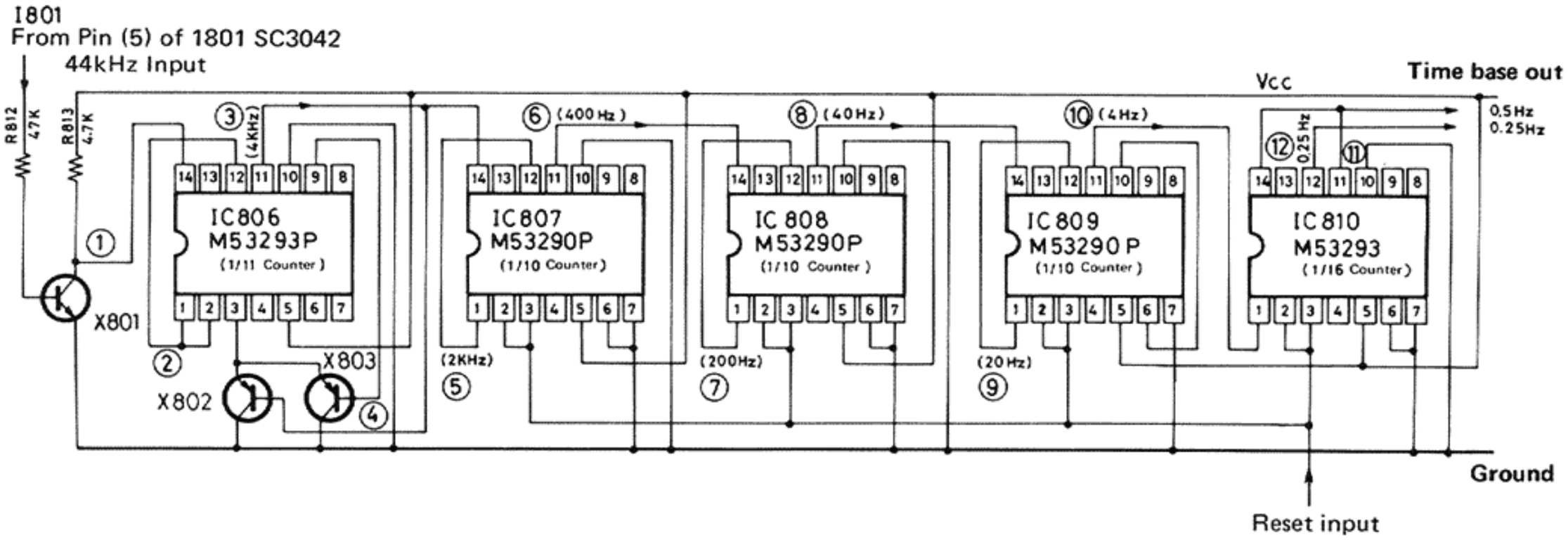
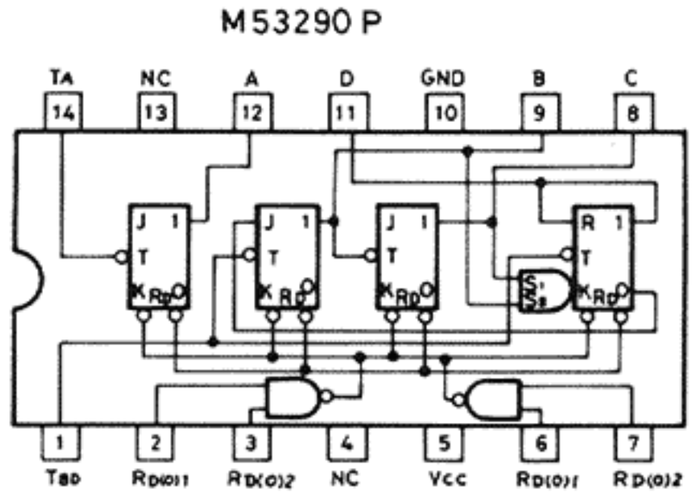


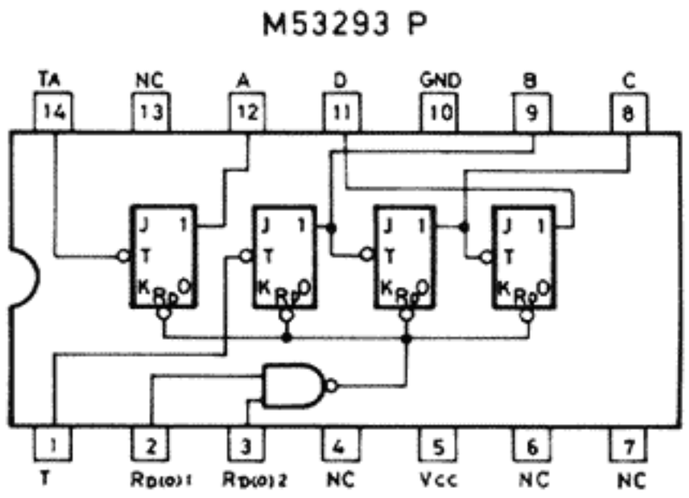
Fig. 12

f. Time base generator circuit





Decode Counter



4-Bit Binary Counter

Fig. 13

3-(4) Count Circuit

Count Set Circuit

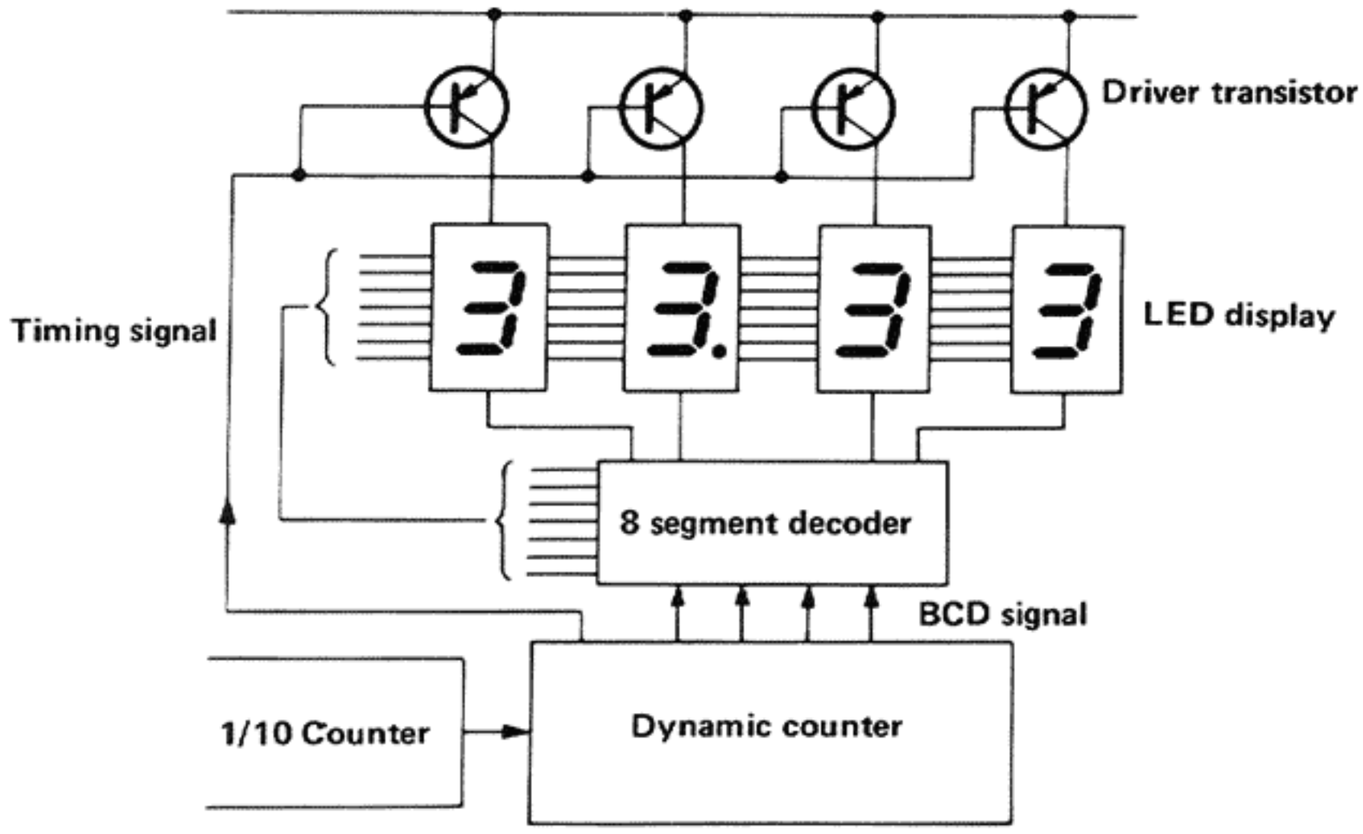


Fig. 14

Timing Chart of Count Circuit

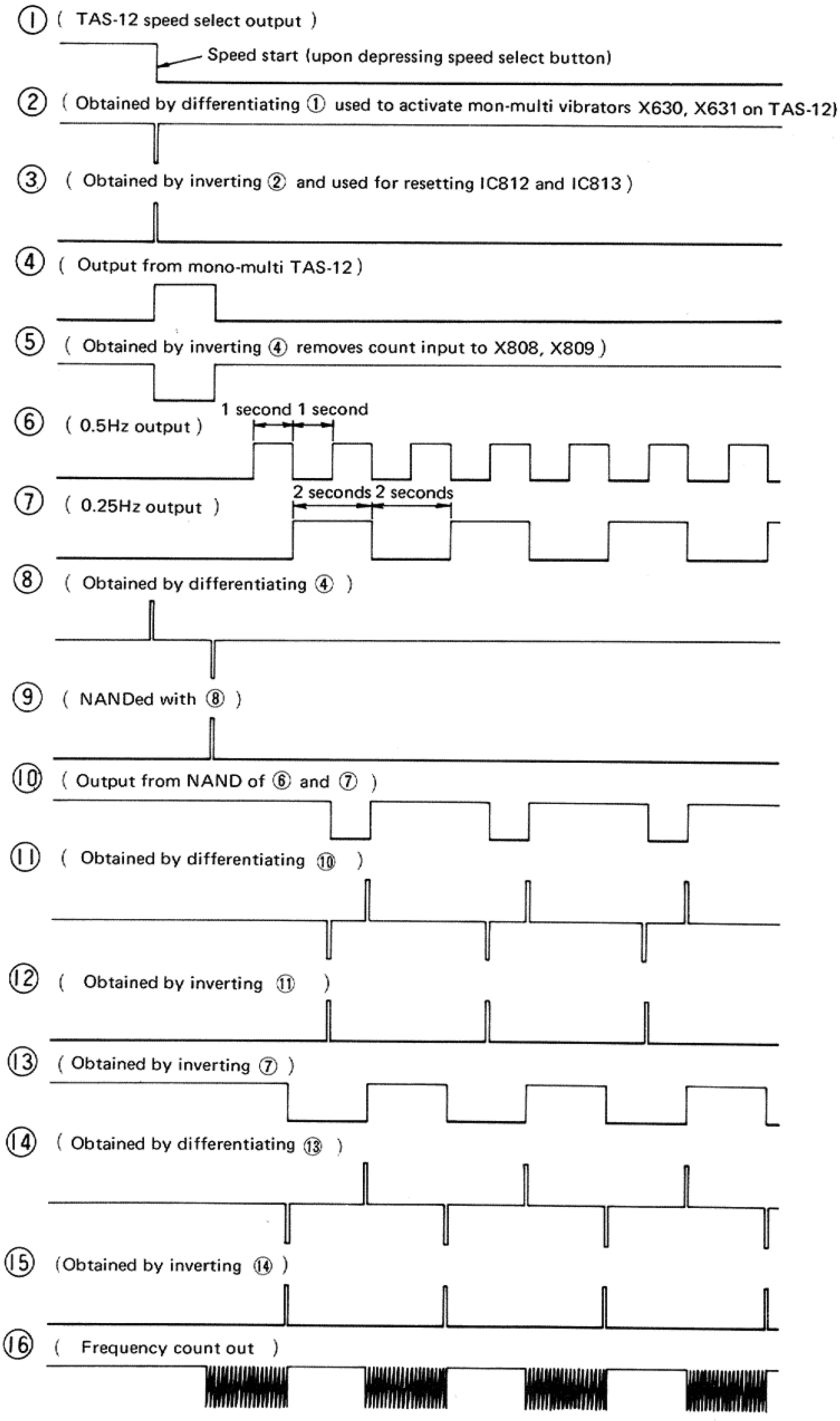


Fig. 15

Count Circuit

1. **The count circuit displays the frequency of the input from an external source based on the time base generated by the Time Base generator (See Figure 15).**

A. Count set circuit

This circuit creates two square waves of 0.25Hz and 0.5Hz as reset and latch signal respectively.

(1) Reset signal

- The reset signal is used to determine count-start points of the 1/10 Counter and 1/1000 Dynamic Counter and to zero the counters. Counter reset timing is generated by waveforms ⑥, ⑦, ⑩, ⑪ and ⑫ in Figure 15.
- Waveforms ⑥ and ⑦ are input to the NAND gate to produce short-duration minus pulses ⑩ which are differentiated to produce plus and minus spikes ⑪. The spikes are then forced to enter the gate and become plus spikes ⑫. The reset signal is triggered by the last all-plus spike. Figure 16 shows the circuit creating the reset signal.

(2) Latch signal

The latch signal causes the BCD contents of the Dynamic Counter to be output to the indicator circuit. There are two methods of transferring BCD contents. If SW3 is set to the Hold side, the latch signal pulse causes the contents to be transferred in the multiplexing mode, whereas if the switch is set to the Run side, latch pulses are not generated and the contents are transferred in the burst mode. At present, most counters employ the Hold type. The latch signal used with the Hold type is obtained through waveforms ⑬, ⑭ and ⑮ in Figure 15.

Waveform ⑬, which inverts the 0.25Hz time base, is differentiated to become ⑭ of plus and minus spikes. ⑭ passes through an inverter to become the latch signal ⑮ of all plus spikes. A latch signal pulse is generated each time frequency counting is completed as shown by ⑯.

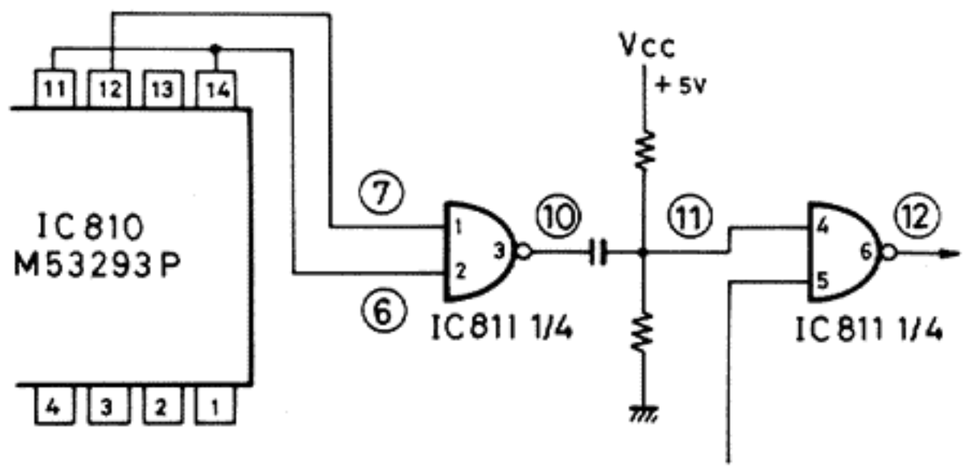


Fig. 16

Block diagram

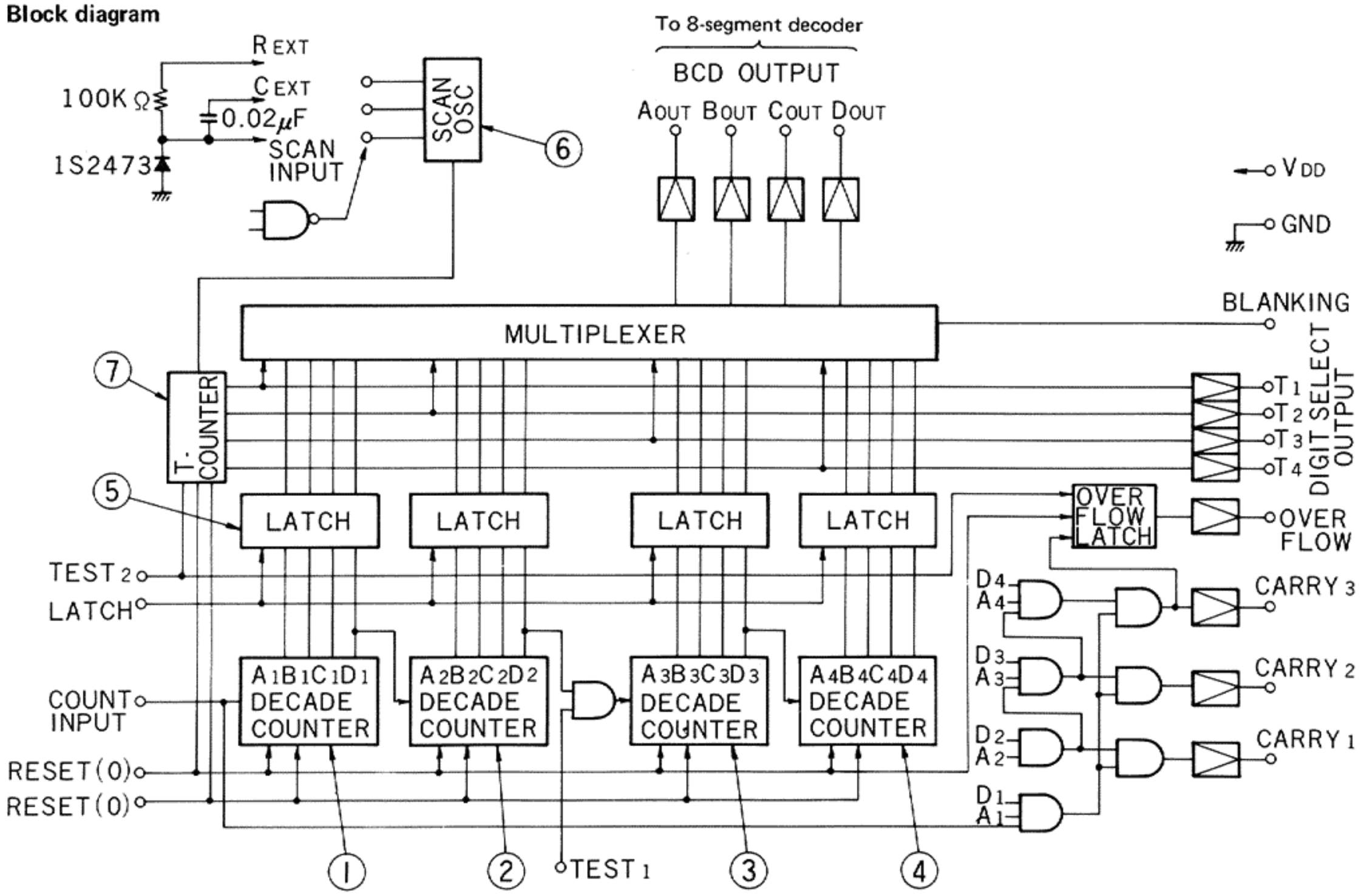


Fig. 17

B. Dynamic Counter IC813 (TC5001), shown in Figure 15, is a C. Mos LSI which has numerous functions and elements. The device forms a 4-digit indication counter housed in a 24-Pin ceramic package, and consists of ① to ④ 1/10 Decade Counters serially connected to each other. When a frequency is input to the Count Input, each of the four Decade Counters produces a pulse from terminal D every 10th period of the input frequency. This results in the last Decade Counter producing a frequency of $(1/10)^4 = 1/10000$ from the input frequency.
The output from each Decade Counter is input to one of the four "Latches" ⑤ in Figure 17, ANDed with a plus latch pulse input, then output to the Multiplexer as shown in Figure 18 (from Ⓐ to Ⓑ).

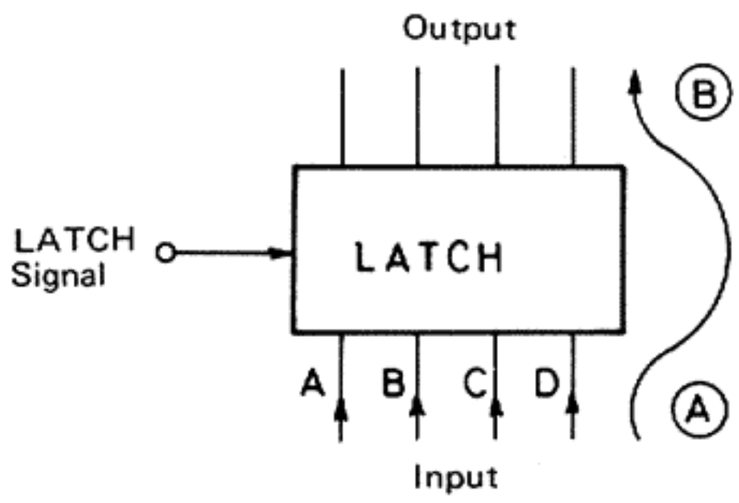


Fig. 18

If the latch signal is High or plus, the Latch Circuit passes the BCD outputs from the Decade Counters without latching them. SCAN OSC ⑥ in Figure 17 is a 2kHz basic oscillator which permits the BCD outputs from the Dynamic Counter to be indicated in sequence. This causes T. Counter ⑦ in Figure 17 to produce T1 through T4 square wave Digit Select Outputs (see TC5001 Timing Chart) to drive Decade Counter respective outputs in the proper sequence.

C. Round-off Counter
A drawback of any digital counter is that the last digit indication is apt to fluctuate. To eliminate this, the 4-digit Dynamic Counter uses 5 Decade Counters, one of which is used to count but not indicate the least significant digit. For example, in the case of 33-1/3 rpm, the indication will be as shown in Figure 19.

The last digit would fluctuate like to 2 or 4.

Fig. 19

Timing chart

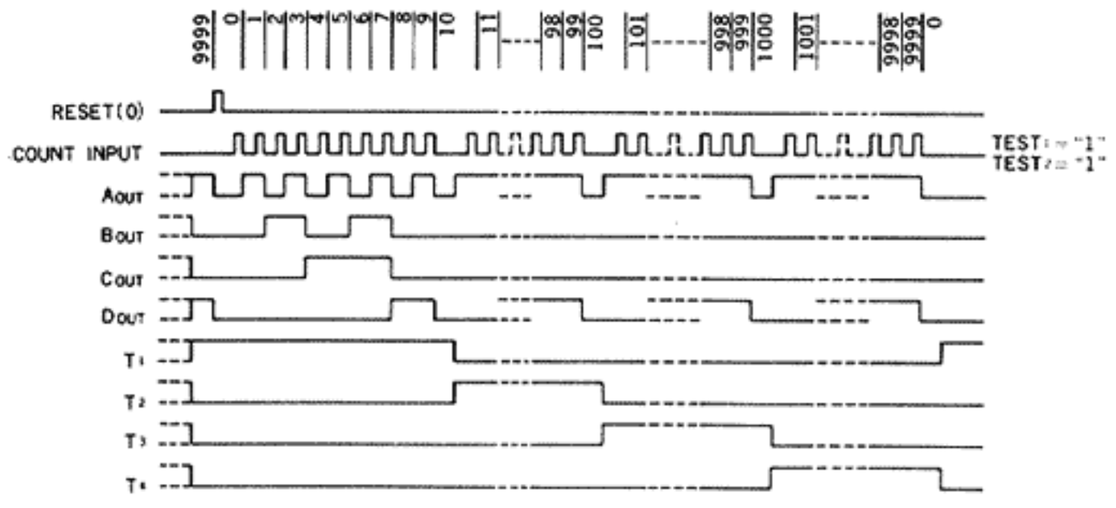
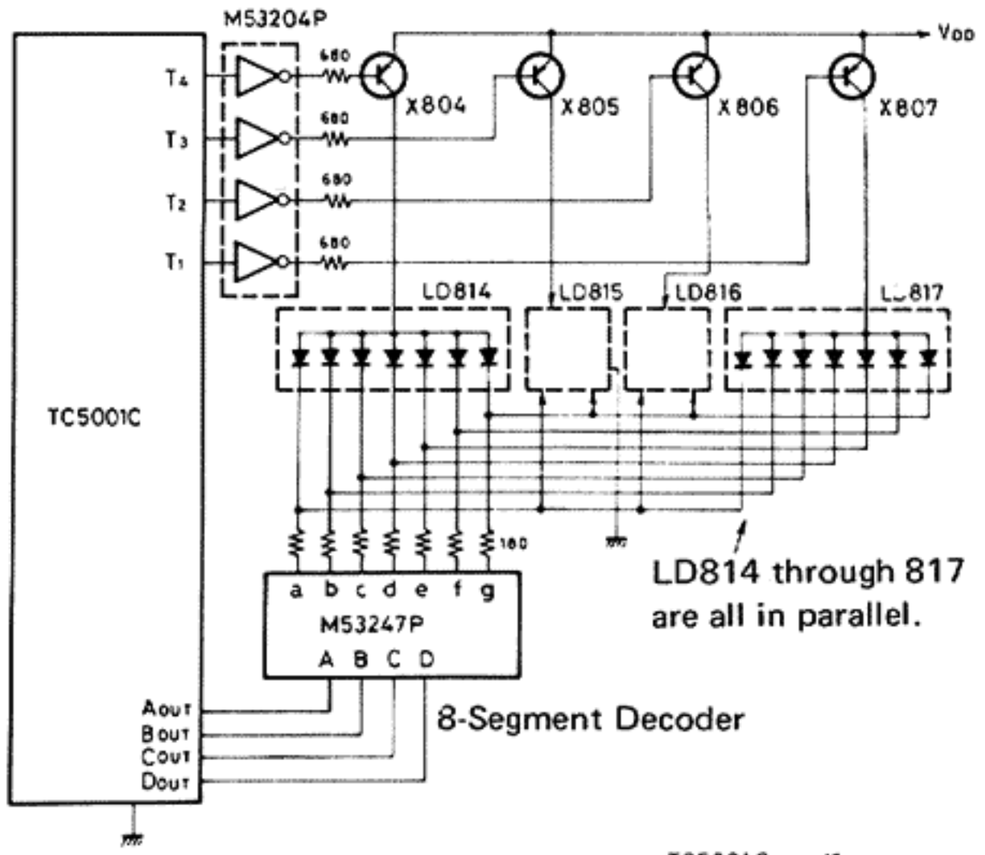


Fig. 20

Indicator lamp drive circuit



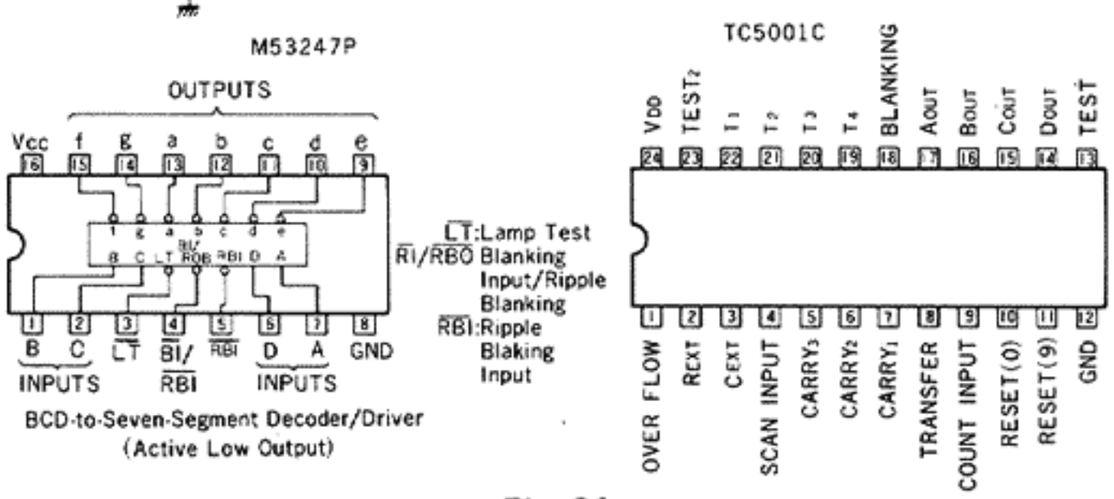


Fig. 21

D. 8-Segment Decoder
IC M53247P decodes BCD outputs from the Dynamic Counter into decimal number digits for indication on 8-segment L.E.D. indicator lamps.
The BCD signals are combinations of High (+5 V) and Low (0 V) levels which can not be used for direct indication. This problem is resolved by the IC logic which decodes the combinations of BCD signals into one of digits 0 through 9.

E. Driver
The L.E.D. display comprises four digits each consisting of 8 diodes. Each of the four 8-segment lamps is sequencially selected and illuminated by turning on the Driver Transistors which are sequencially triggered by timing pulses.

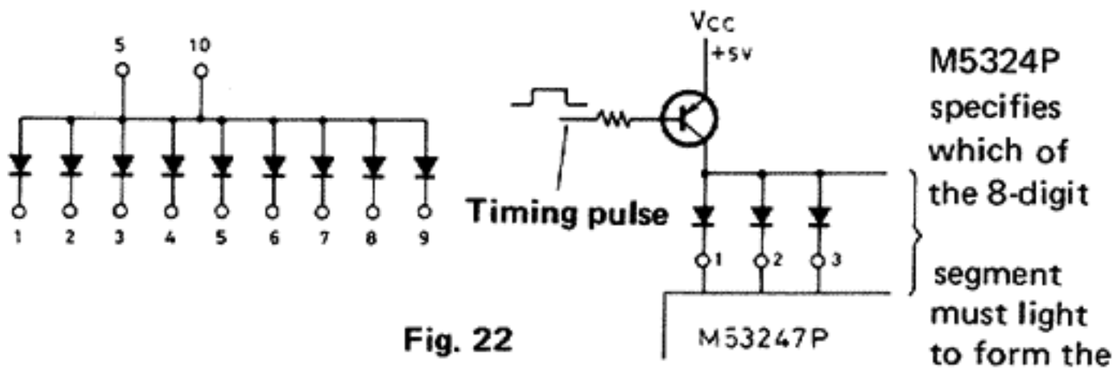


Fig. 22

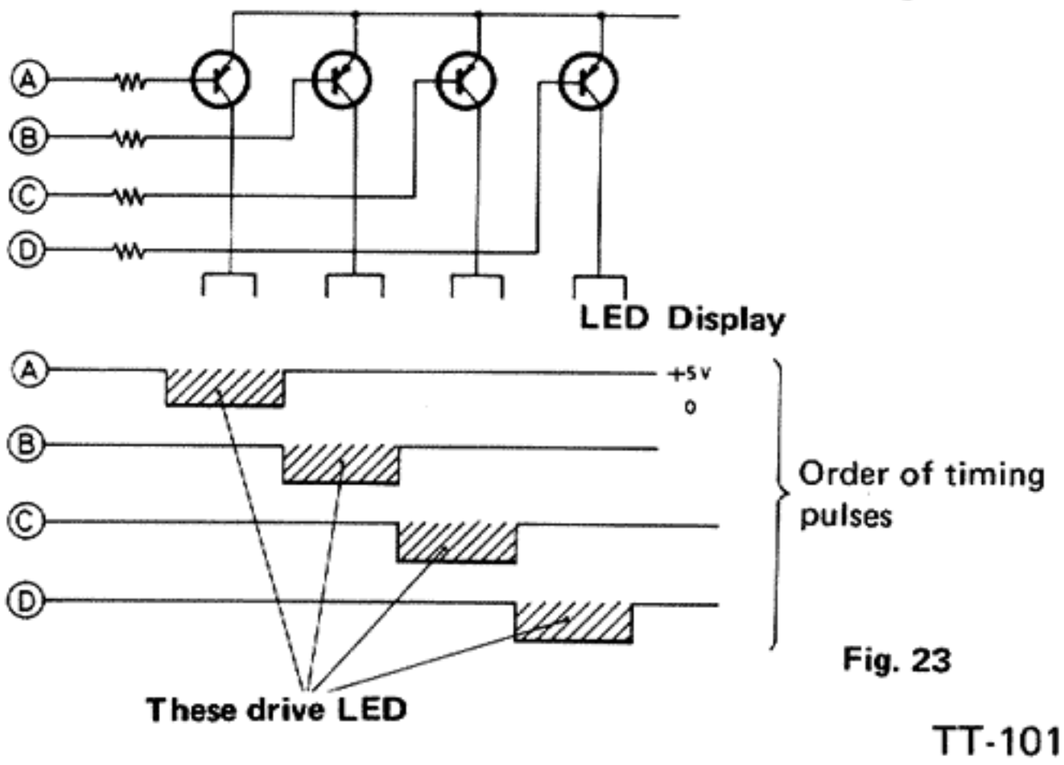


Fig. 23

TT-101
No. 2391

2. Prevention of error indication and miscount

Care has been given the Count Circuit to eliminate errors which may occur during the interval from application of power and depressing the speed select button to indicating the frequency, as follows.

A. At speed start

The output ① in Figure 15, produced by a flip-flop in the Speed Select section, is differentiated to produce a spike in High-to-Low transition, and used to drive the monostable multivibrator, consisting of X630 and X631, which makes the collector of X633 High for about 1.4 seconds (as shown by ④, thus causing the Count Set circuit to stop counting the time base frequency. At the same time, the minus spike is inverted and used to reset IC812 (M53290P) and IC813 (TC5001C), thus making the contents of both ICs, zeros or empty.

Further, to prevent frequencies from being input to the counters during the 1.4 second interval from the start, signal ⑤ obtained by inverting ④ is input to Pin 10 of IC801 thereby attaining completely fail-safe operation.

B. "Zero" indication at start time

At speed start, the counters do not have inputs thus contain zero contents. Then 1.4 seconds after start, the status is indicated by the LED indication lamps utilizing the latch signal ⑨ in Figure 15.

C. 2-second count time

The frequency generated by revolution of the turntable through the F-G coil is 100Hz at 33-1/3 rpm or 135Hz at 45 rpm, which is too slow for the counters to actually perform counting. Therefore, the frequency is multiplied by 1000 to yield a count time of 2 seconds. The time required for one revolution of the turntable is 1.8 seconds at 33-1/3 rpm. Though the time of each revolution deviates due to various reasons, indication is stabilized by continuous counting, i.c. for more than 1.8 seconds and averaging the results. It is desirable for counters to accuracy count as quickly as possible. However, counting too fast will result in reflecting the revolution deviations on the indication, thus causing indicator fluctuate which tends to confuse and/or make the observer uneasy. This is the reason the count time frequency is not multiplied by the N-time counter.

3-(5) Reverse Turn Detection

(1) Necessity for reverse turn detection

The reverse turn detection circuit serves to restore forward turns, as soon as possible, after an external reverse turn force is applied to the turntable. In the past, this purpose was served by conventional servo motors which were employed to react after revolution had reached the rated speed of 33-1/3 or 45 rpm. This method, however, was inconvenient.

(2) Detection

Detection is performed by the reverse turn detection magnet attached to the rotor by a bracket, and the fixed hole element.

The detection signal waveform is generated utilizing magnet polarities and pulse generation phases of the hole element. In the case of normal (clockwise) movement, the N polarity of the magnet first passes the hole element and produces the waveform shown in the upper part of Figure 24.

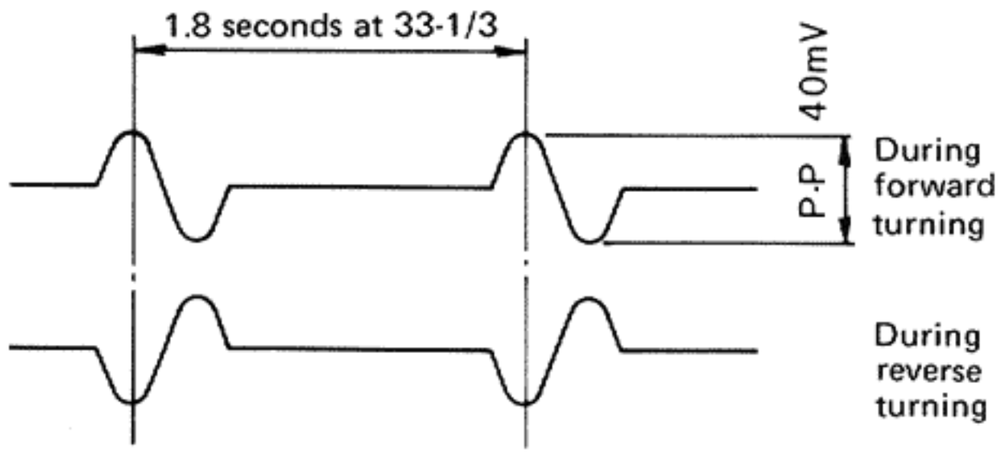


Fig. 24

This waveform on X603 of the positive feed-back flip-flop consisting of X603 and X604, while the collector of X603 is grounded. The state remains unchanged despite the succeeding arrival of like type waveforms. If a reverse turn force is applied to a turntable which is turning forward, such as pressing with the finger, the S polarity of the magnet first passes the hole element and produces a waveform such as that shown in the lower part of Figure 24. This causes a negative pulse to be applied to the base of X601 to reverse the state of the flip-flop.

When revolving normally, the base of X608 is Low and X608 is cut off. Whereas in reverse, X608 is turned and the collector is grounded. Grounding the collector activates the emitter of X663 in the Phase Comparison section to produce the drive force necessary to restore the forward movement.

Reverse Turn Detection

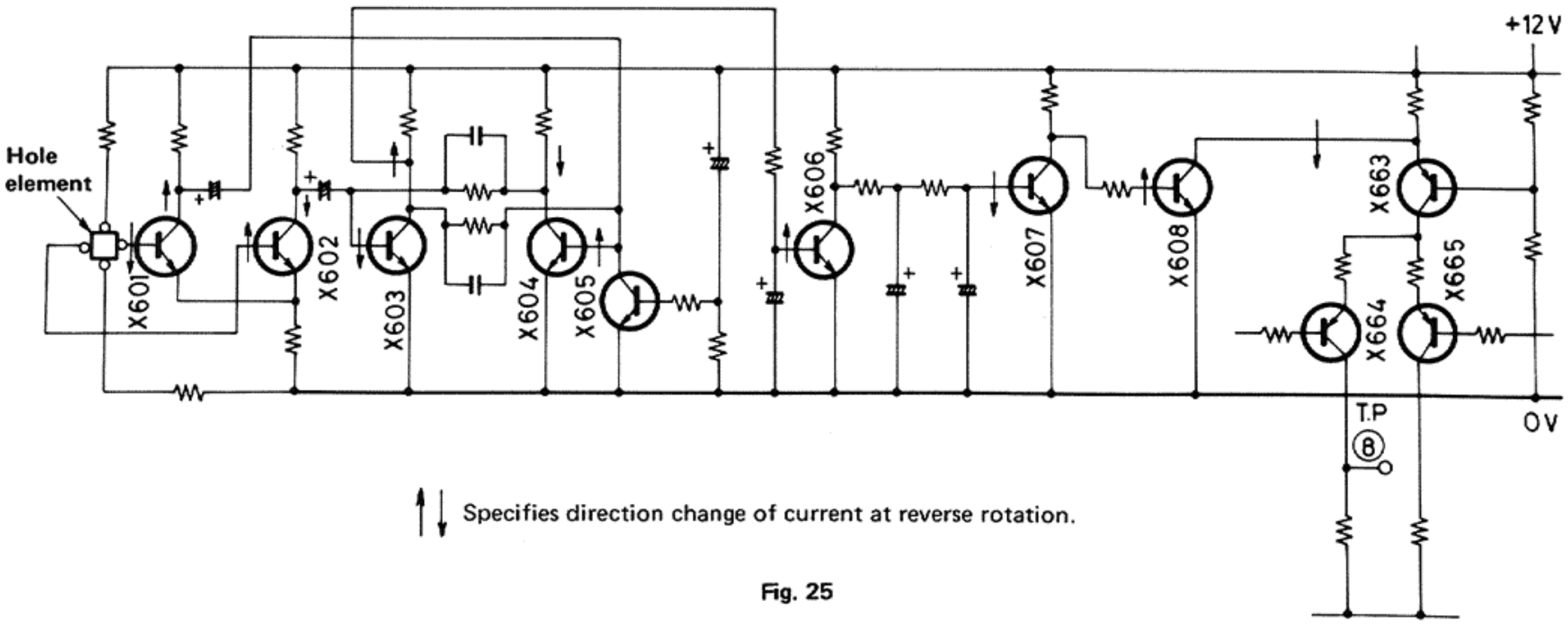
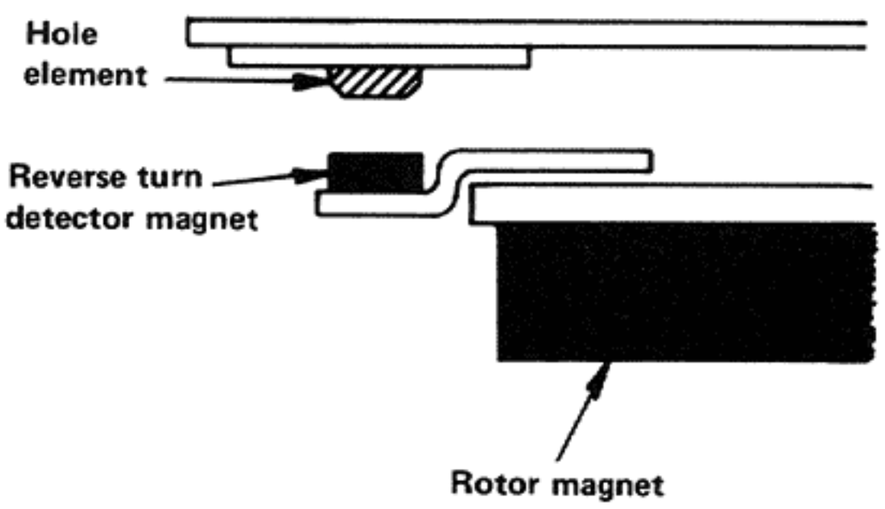


Fig. 25

-12 V

Reverse turn detector magnet mounting drawing



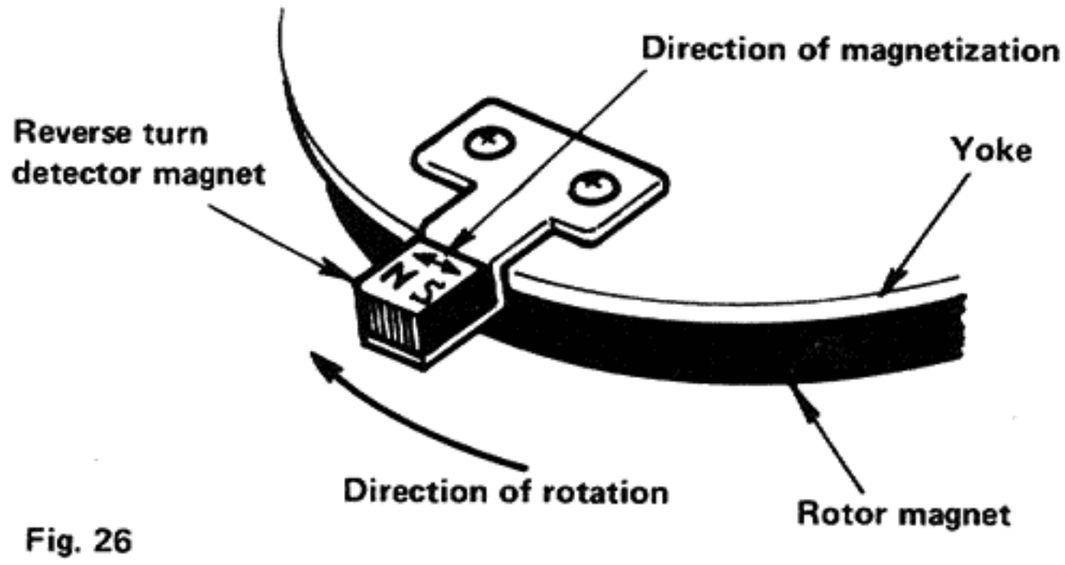


Fig. 26

3-(6) N-time Counter

The N-time counter utilizing P.L.L. multiplies the frequency of the input from the F-G coil without changing its phase.

1. Block diagram

Figure 27 shows block diagram of the N-time counter.

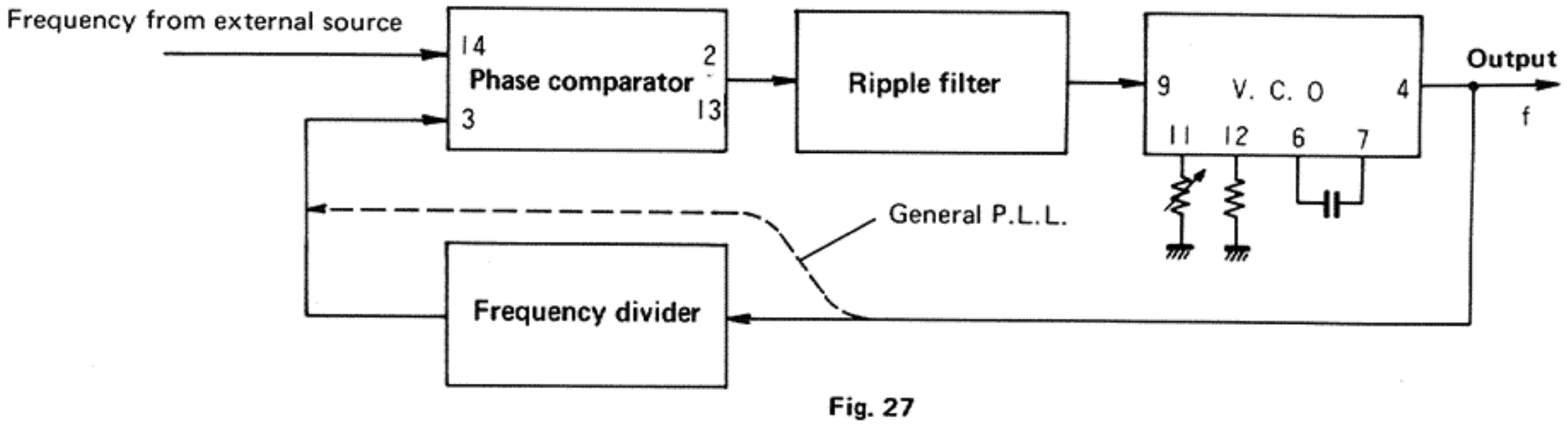


Fig. 27

2. Operation

The phase comparator compares the phase of external frequency A with that of feed-back frequency A′. If a phase deviation is detected, a phase comparison output such as that shown in Figure 28 is produced. This output consists of sharp square pulses, which must be flattened by the ripple filter before being input to the VCO. The VCO (Voltage Control Oscillator) is capable of varying the oscillation frequency, according to the input voltage, over the range from Fmin to Fmax which is 2 times Fmin. fo is determined by R684, VR685 and C630, and is selectable within this range. The oscillating frequency from VCO is converted into an impedance value by buffer X653 for input to the frequency divider. The same is also sent to the gate of the frequency counter. Frequency divider IC606 (M53292P) divides 100kHz (at 33-1/3) into 1/6 to obtain an output of 16.666kHz. The frequency counter, on the other hand, divides 100kHz into 1/1000 utilizing three decade counters. The output from IC603 is made identical to the input frequency 100Hz.

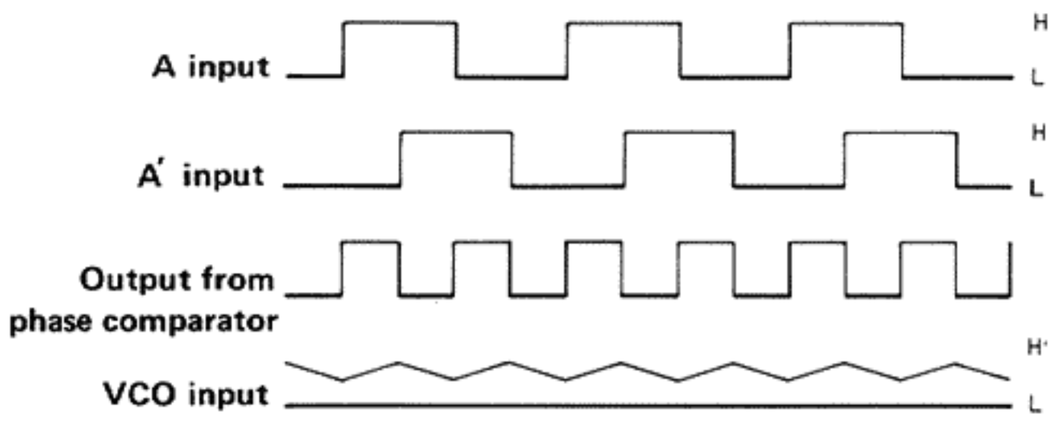


Fig. 28

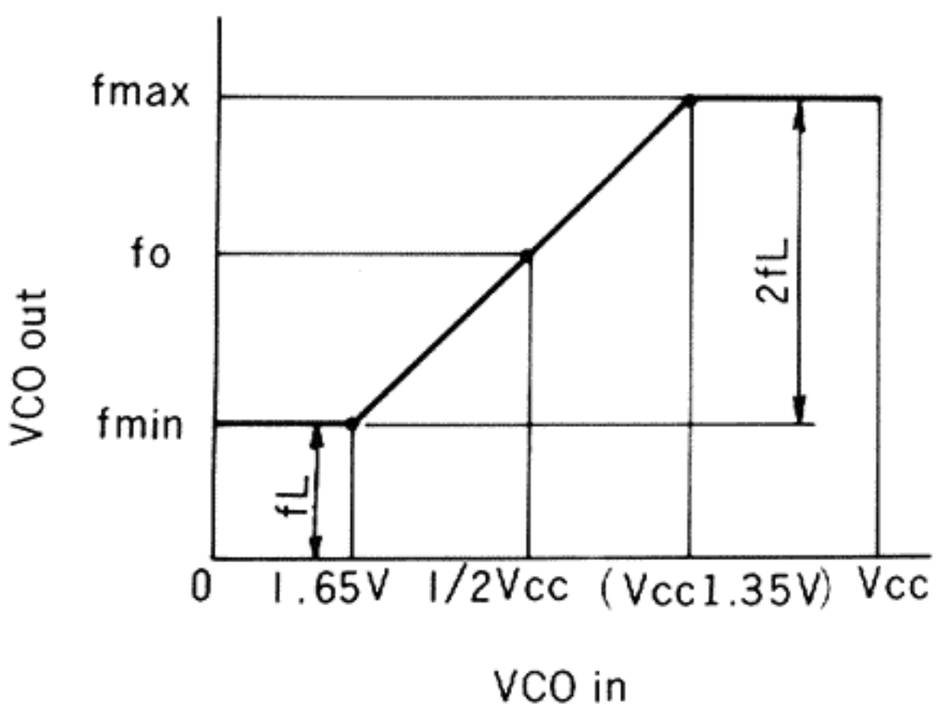


Fig. 29

3. Frequency lock circuit

The frequency lock circuit locks the output at a frequency within the Fmin through Fmax range of approximately 2 x Fmin. Since stability exists outside of the range, locking at these ranges is easily attained.
For 100Hz at 33-1/3 rpm, Fmin is set to 80Hz, and for 135Hz at 45 rpm, Fmax is set to 155Hz, thus providing ample coverage.

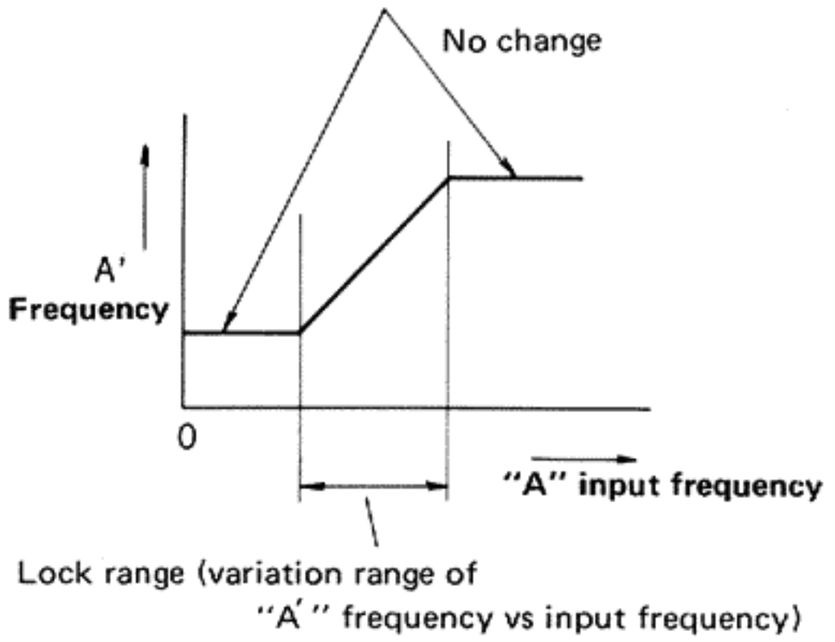
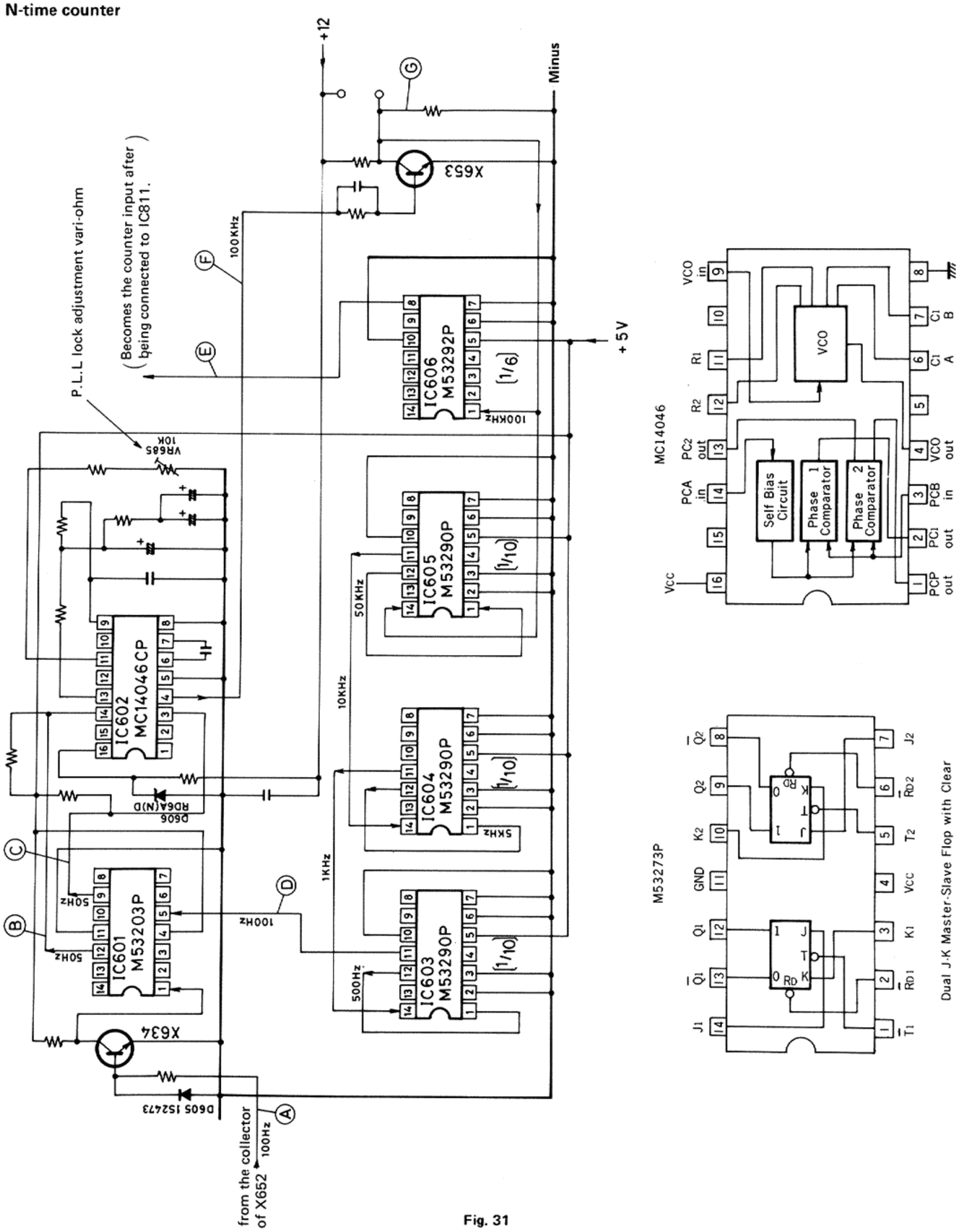


Fig. 30

N-time counter



Dual J-K Master-Slave Flop with Clear

Fig. 31

Equivalent circuit of M53292P (for reference)

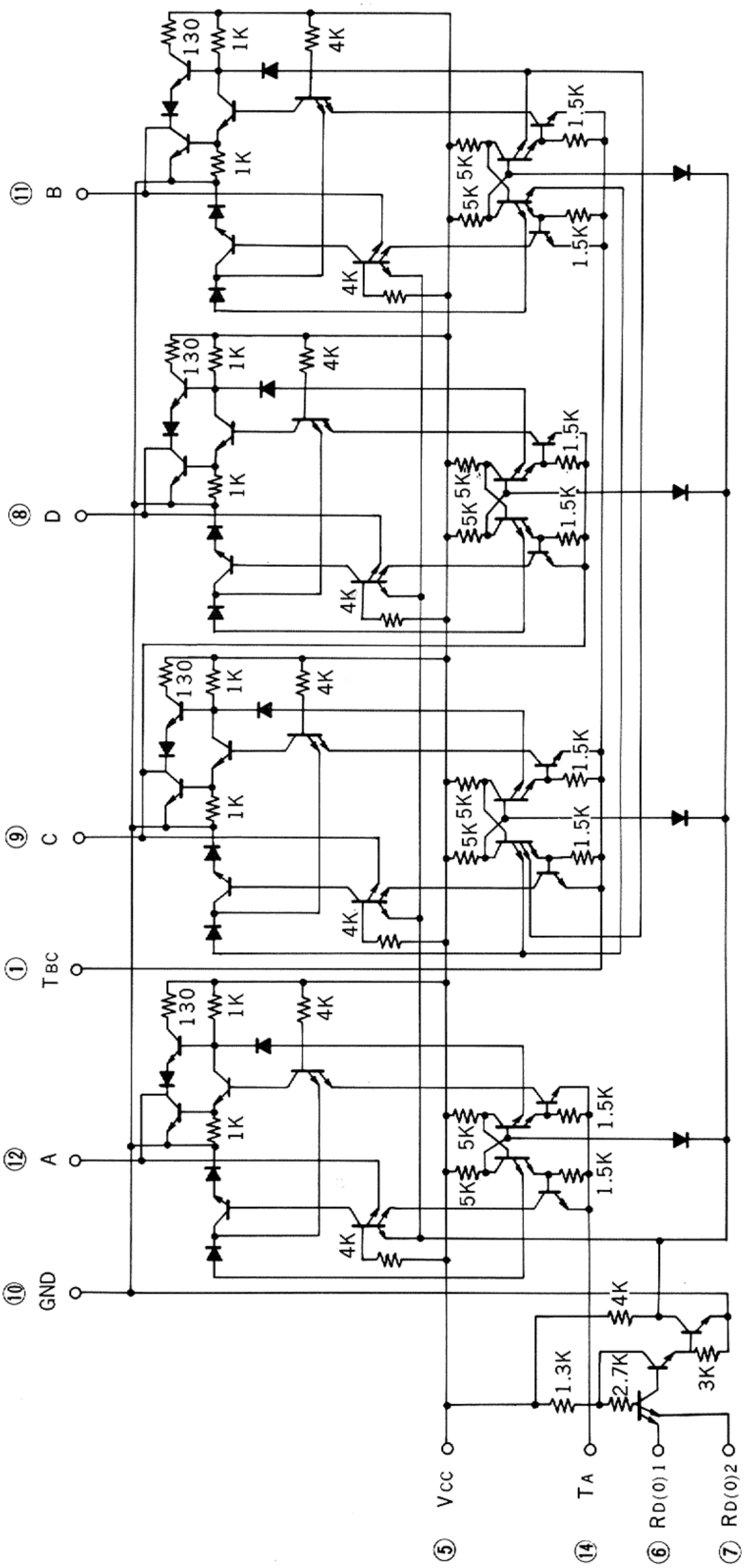


Fig. 32

3-(7) Timer

The timer enables the motor to stop automatically within 16 seconds after the turntable is forcibly locked, like with the hand, to prevent the motor from overheating.

1. **Current detection**
   As shown in Figure 34, a 10-ohm resistor is inserted in the emitter common to power transistors X684 and X686 which are serially connected to the motor-drive coil. During the start interval or when the turntable is forcibly locked, approximately 3V is applied to the resistor whereas when turning at a normal speed, the transistor current is quickly reduced, thus lowering the voltage to between 0.2 and 0.3V. The current through the power transistors is detected by utilizing the difference between the above voltages. This timer starts functioning when the voltage exceeds 1.5V.
2. **Set/reset**
   When employing a record cleaner which causes intermittent locking of the turntable or when the turntable is stopped for less than 16 seconds, the turntable may be made to automatically restart by resetting Pins 2 and 3 of IC607 to High level.

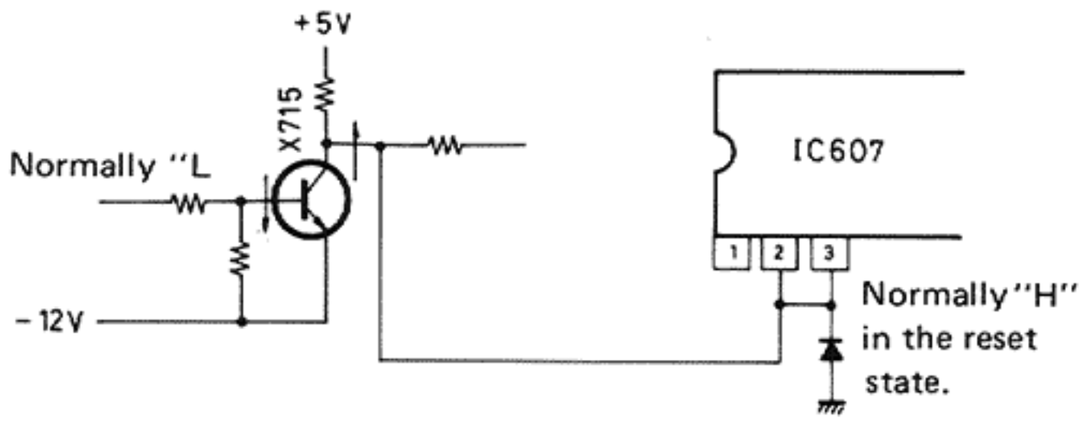


Fig. 33

3. **Timer operation**
   When a 0.5Hz input is applied from TDC-7 to D631, the resulting output from IC607 becomes 1/8 of the frequency thus permitting Pin 8 to turn from Low to High upon arrival of the 8th pulse, which is sent to the base of X610 to activate the stop circuit and turn off the speed select circuit.

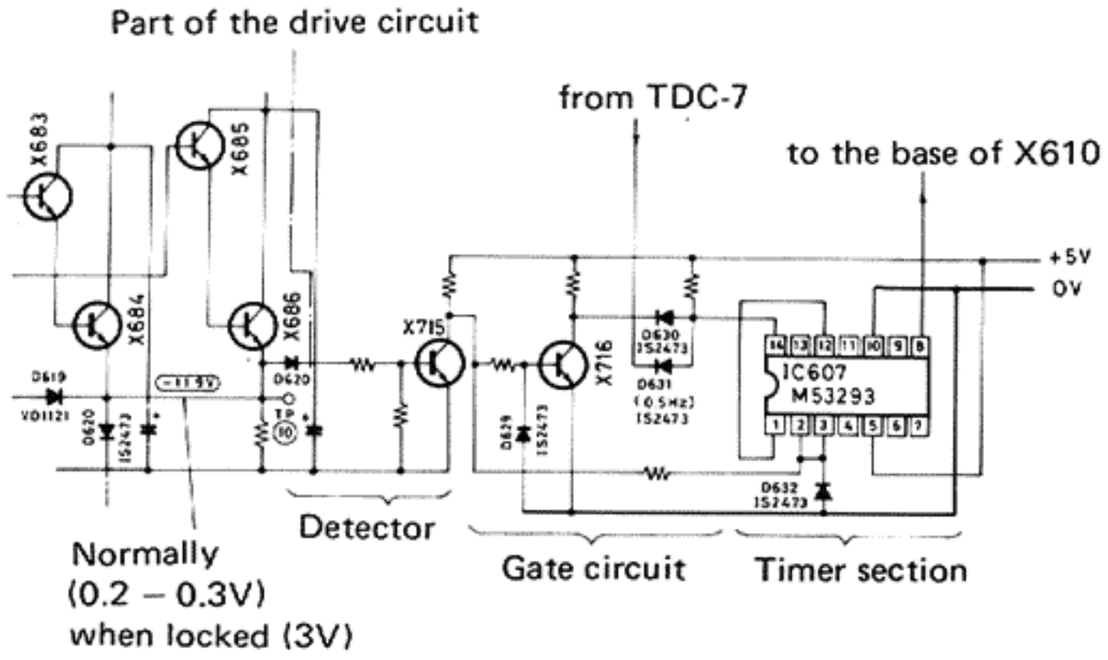


Fig. 34

3-(8) FM Demodulator and Phase Comparator

1. **FM demodulator**
   A 100Hz (33-1/3 rpm) or 135Hz (45 rpm) output of approximately 0.5mV from the speed detector is amplified by X641 through X652 into a 24V square wave as shown by Ⓐ in Figure 36. The square wave is differentiated to obtain pulses as shown by Ⓒ. If each Ⓒ positive pulse is input to the base of X658 the collector of which is connected to the power supply charged C640 (0.1μF), X658 starts to conduct and the collector voltage becomes 0V. After the disappearance of the pulse, the capacitor is again charged through R736 and VR735. This process is repeated to generate a sawtooth waveform as shown by Ⓓ in Figure 36 from the collector of X658. Conversely, X655 is supplied negative to produce pulses with polarities opposite to Ⓑ pulses. The pulse output causes X659 to conduct, and a sample-hold-ripple DC (Ⓔ in Figure 36) to be obtained from the FET X660 source.
2. **Phase comparator**
   A 100Hz (33-1/3 rpm) output from IC SC3042 is applied in the waveform shown by Ⓖ in Figure 36 to X669 of this new phase comparator. The output from X669 is differentiated for input through X668 to X667 as a sample hold input. The sawtooth waveform Ⓓ is applied to the source of X667. Since the input Ⓖ from the quartz cristal has a constant frequency. A decrease in the sawtooth waveform will result in ladder step voltage rises as shown by Ⓙ.
   A stabilized DC Ⓔ is ultimately obtained from the differential amplifier consisting of X664 and X665. This produces a voltage between the ends of R750 (22kΩ) to ensure a constant revolution speed.

FM demodulator and phase comparator

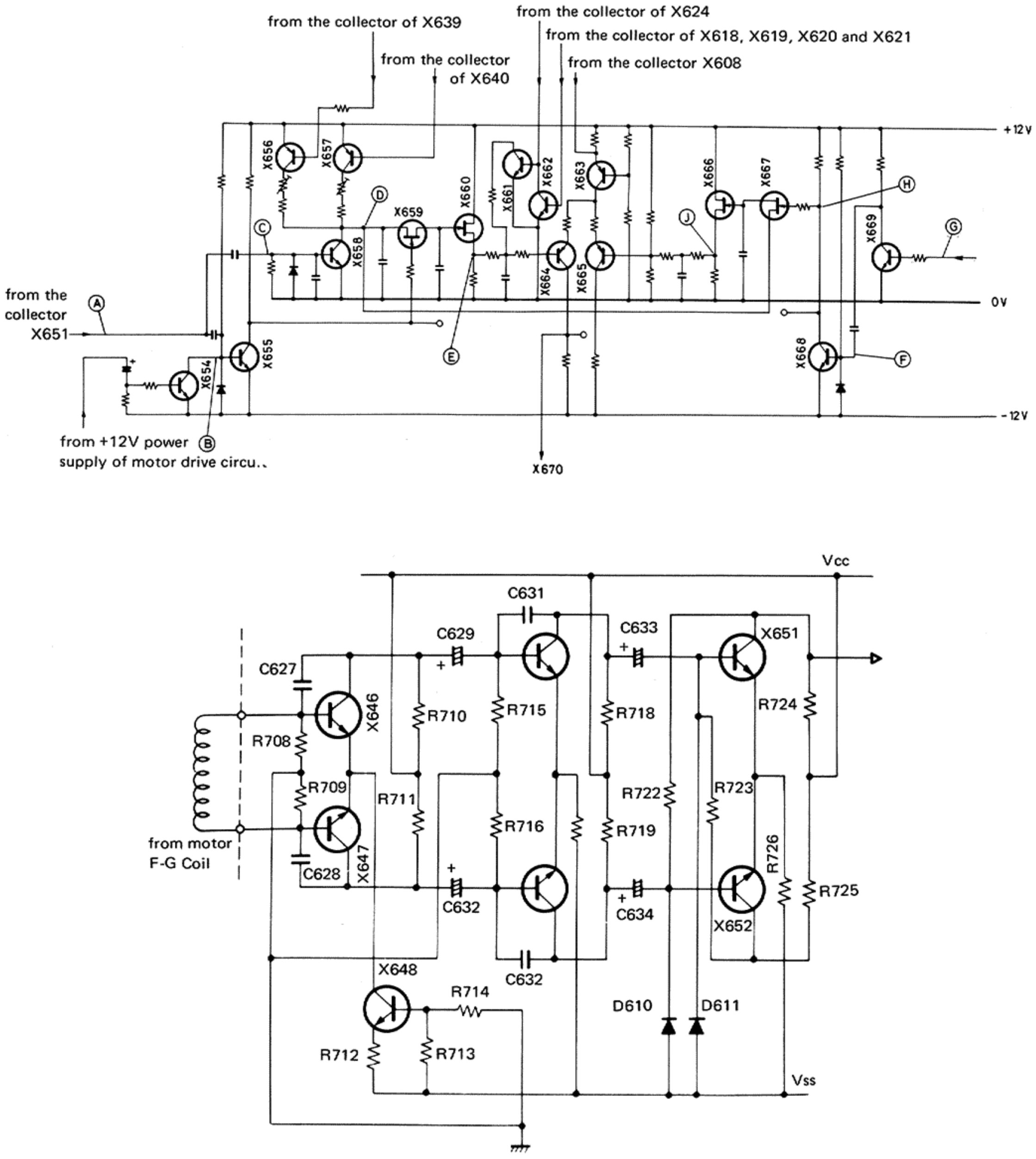
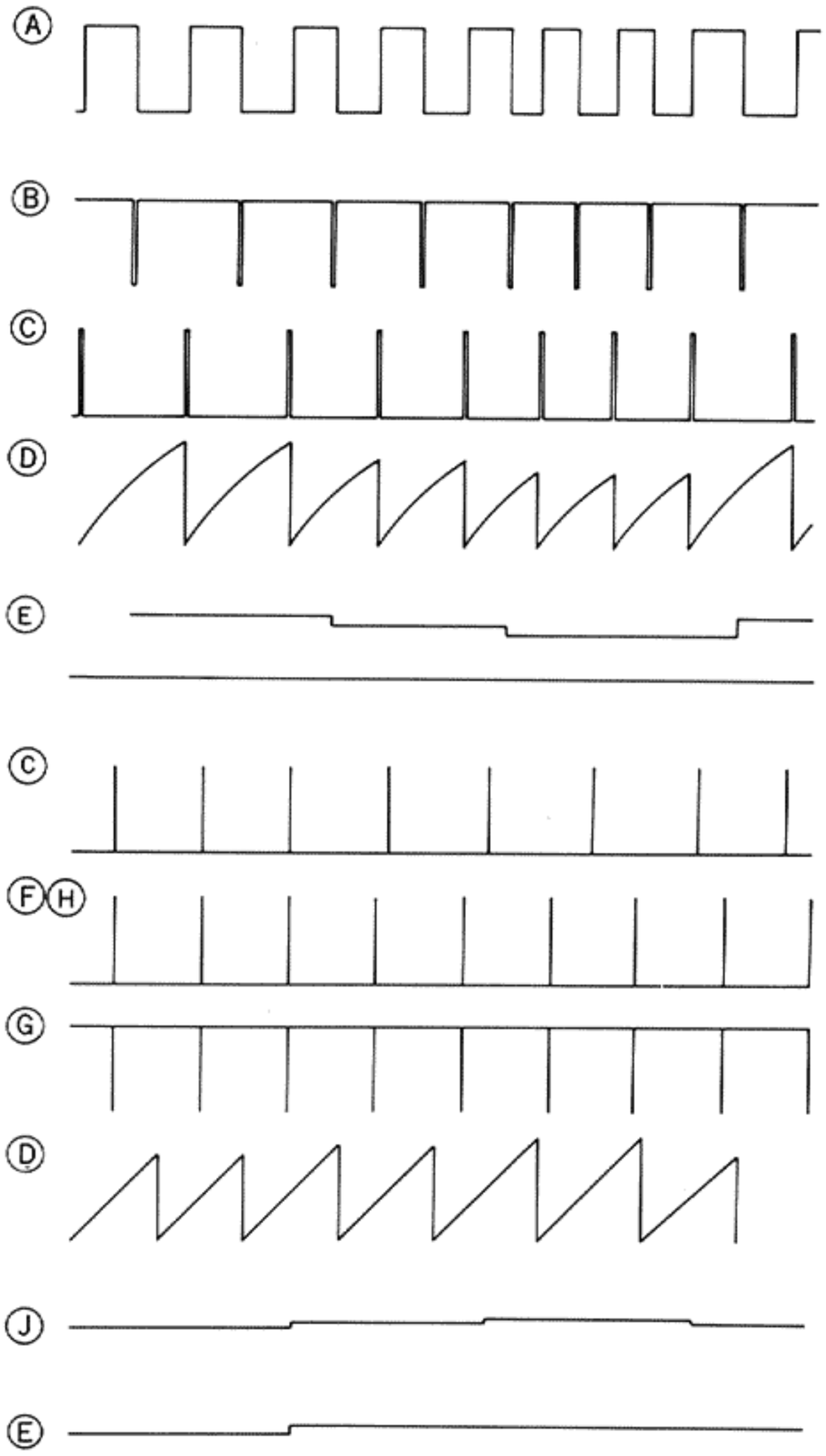
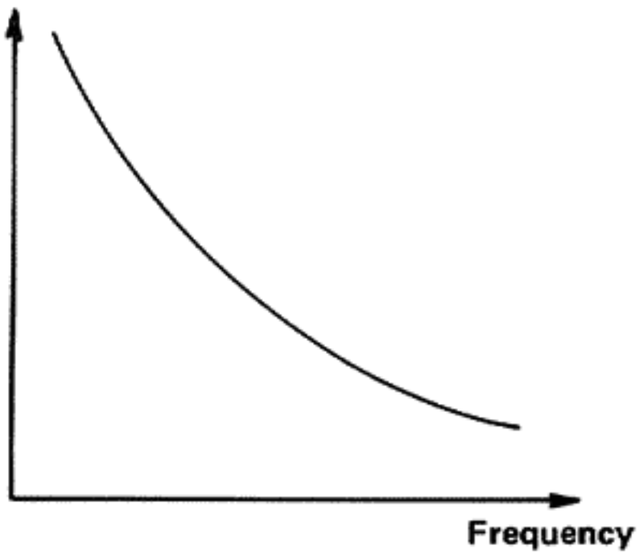


Fig. 35

FM demodulator section in encoder



Output voltage of (E)



If pulses of Ⓐ are demodulated, voltages/frequencies shown in the left are obtained.

Fig. 36

3-(9) Drive Start Circuit

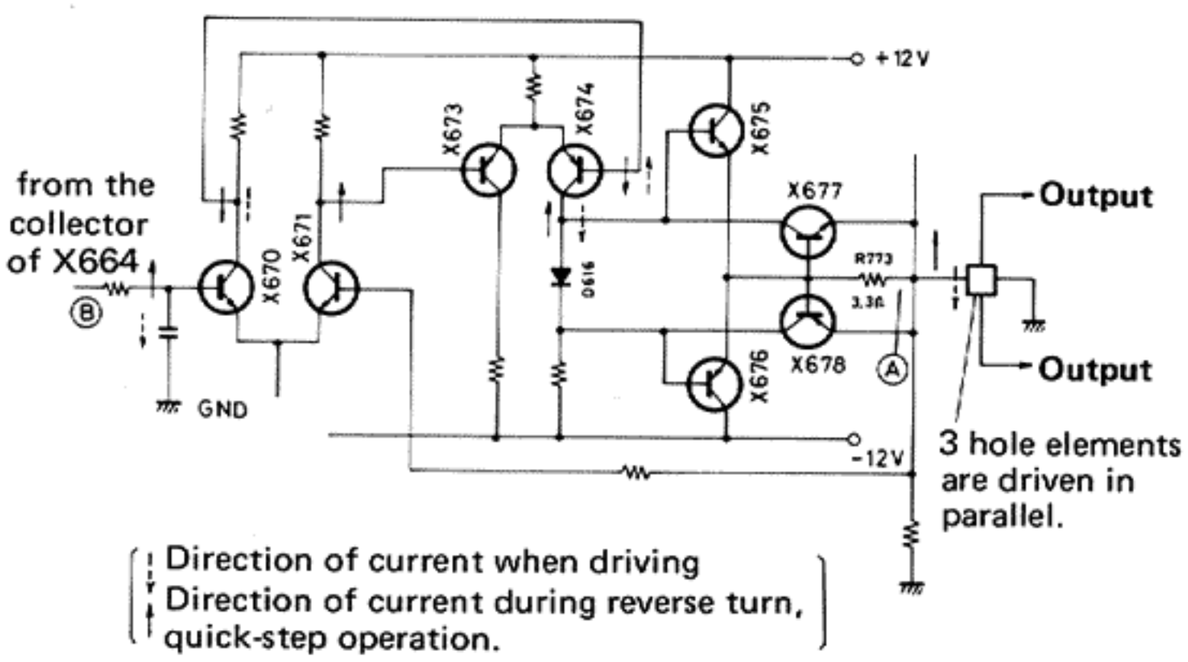


Fig. 37

This circuit DC-amplifies the output from the phase comparator and provies current to the hole element.
The voltage polarity changes at both Ⓐ and Ⓑ points are identical, therefore an identical, amplified version of the output from X664 is obtained from output point Ⓑ. X667 and X678 protect the hole element from damage due to an excess current. If an excess current flows in X667 and X678, the collectors and emitters of both transistors are short-circuited, and the output is terminated at the last stage.

3-(10) Motor Power Switch

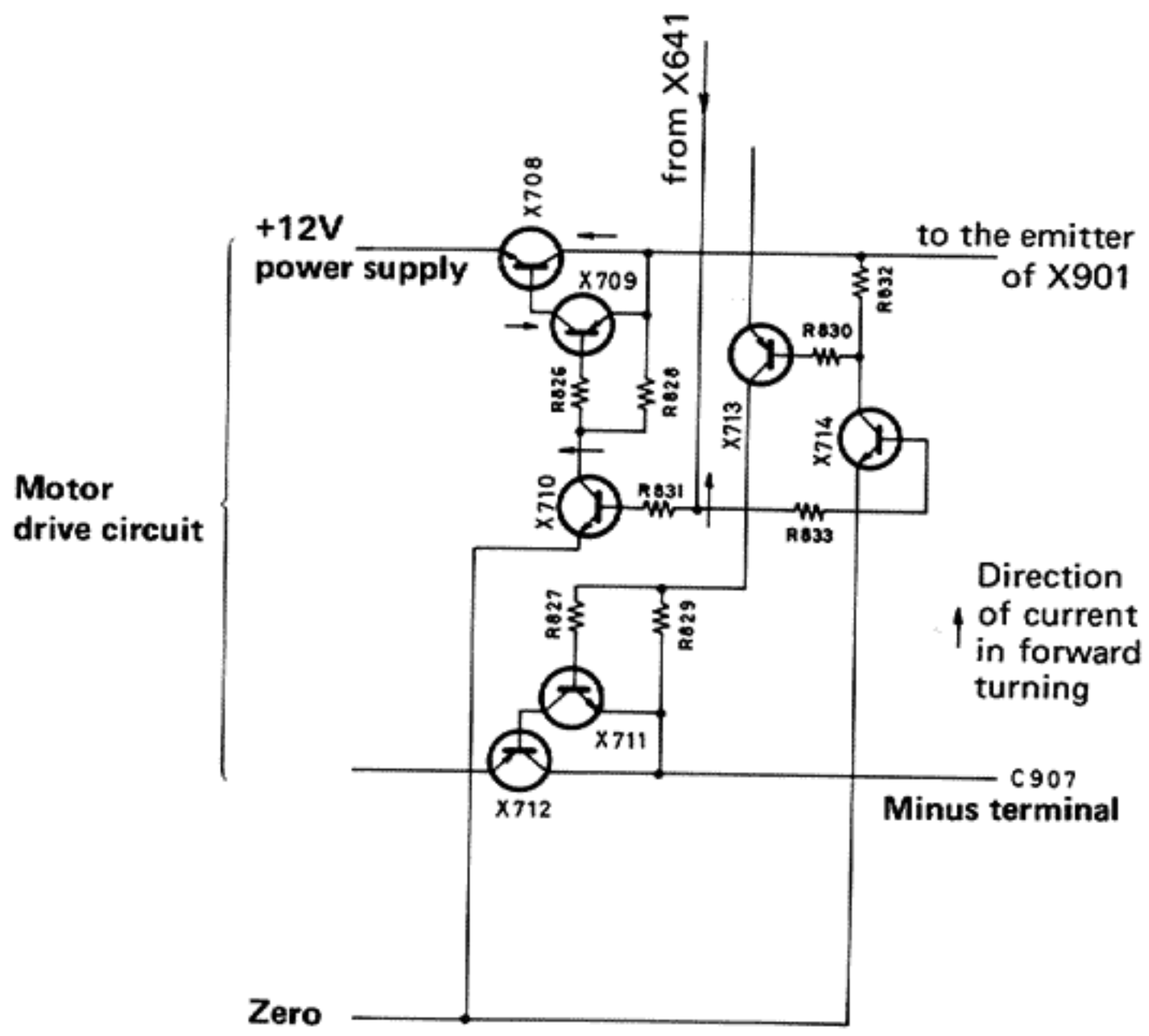


Fig. 38

The electronic motor power switch in the motor drive circuit causes the collector of X641 High to turn on X708 and X712, if the turntable is rotating at 33-1/3 or 45 rpm, thus transferring the power supply circuit voltage to the motor. The turntable is stopped by changing the collector of X641 Low, thus cutting off the current supply to the motor drive circuit.

3-(11) Speed Selection Circuit

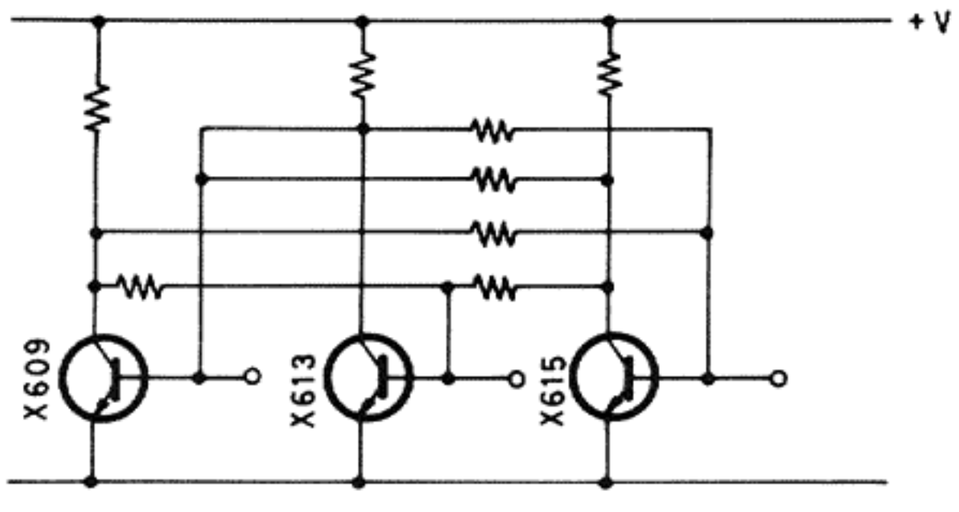


Fig. 39

The basic speed selection circuit is as shown in Figure 39. If one of the transistors X609, X613 and X615 is in the OFF state, the other two are in the ON state. For example, if the collector of X609 is +V, currents flow to the base of X613 and X615, thus causing them to conduct and their collectors to obtain the same level as VCES.
However, unless the circuit is modified slightly, it is impossible to foresee which of the three transistors will go OFF first immediately after applying power, since this is dependent upon dispersion of transistor characteristics and the PCB pattern layout.
Therefore, an additional transistor is inserted into the base of, for instance X609, to make it the first to go OFF immediately after turning the power switch on. As shown in Figure 40, immediately after the switch is turned on a current flows through C610 to the base of X611 to turn it on. This cuts off the current to the base of X609 and turns it off.

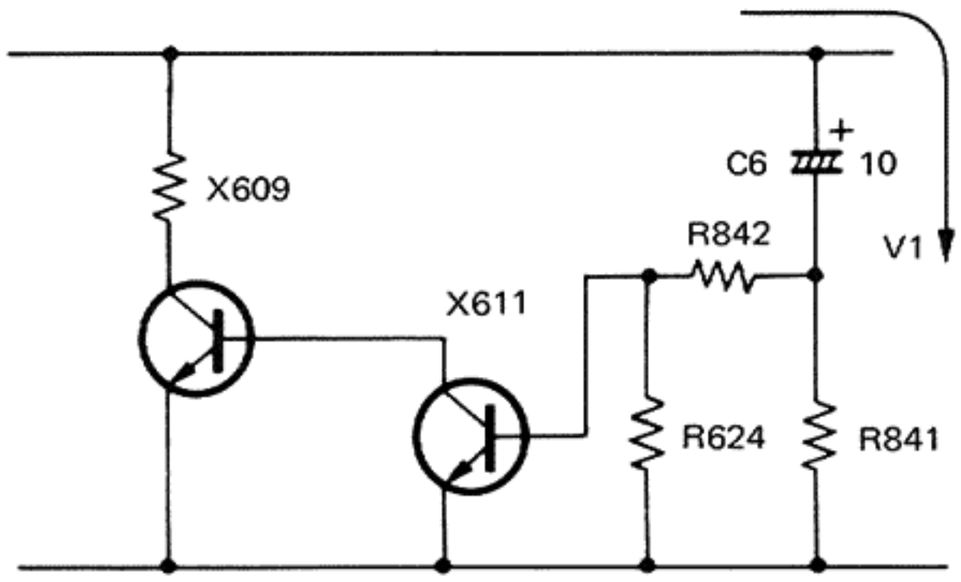


Fig. 40

The above action results in a high X609 collector voltage which causes current to flow to the base of X613 and X615 to turn them on. This state produces zero rpm of a speed select off condition.

4. Disassembly

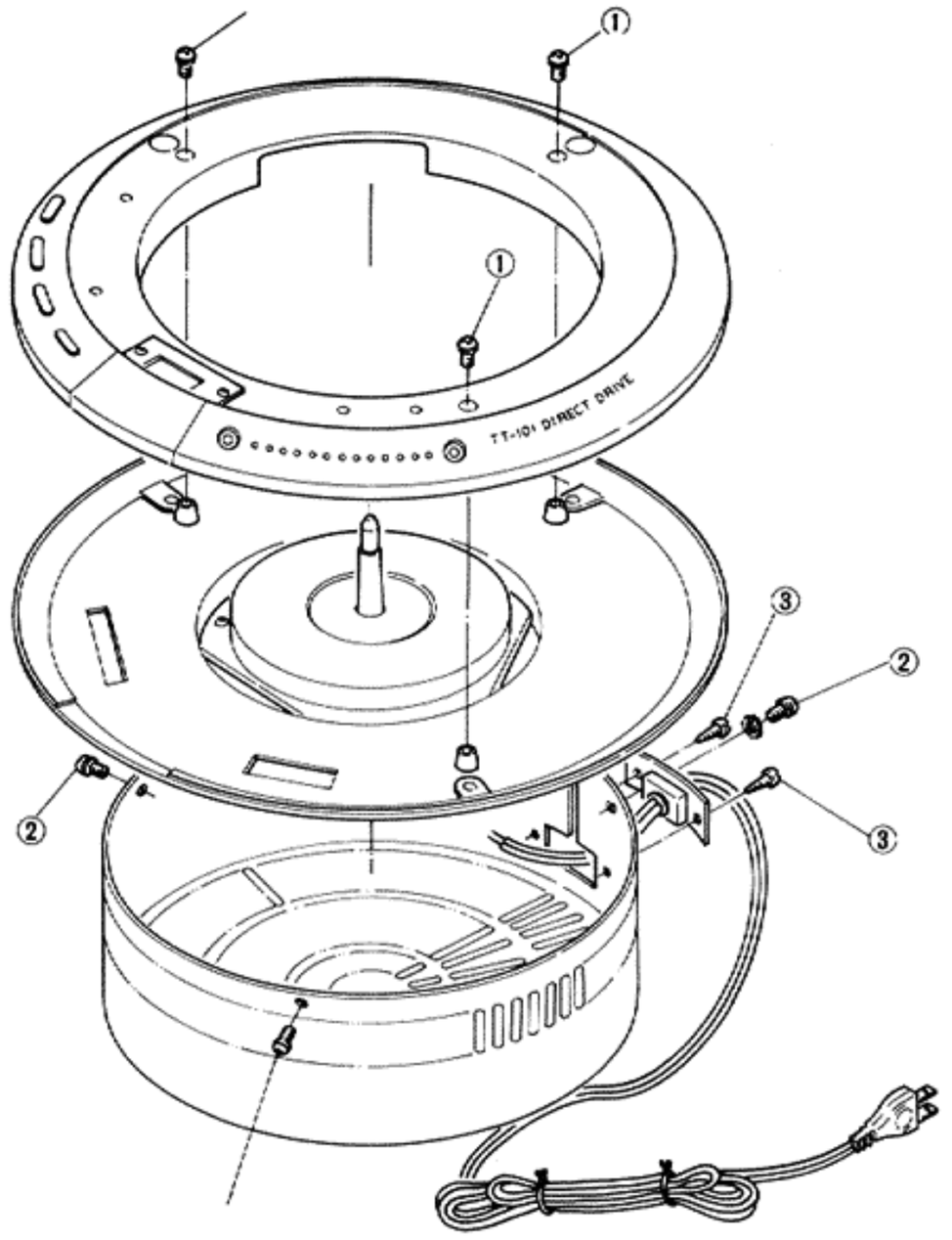


Fig. 41

(1) Remove the three screws ① and the control panel lifts off.
(2) Remove the three screws ② and two screws ③, then remove the cover.

5. Adjustment Procedures

Special precautions

- Power on/off
  Do not turn the power on until all required connections between circuits have been completed. Do not insert or remote plugs while the power is on.
- Handling of C. MOS
  C. MOS IC801, IC813 and IC602 are very sensitive. Therefore, care should be exercised to prevent contact with other components in replacement, or current leaks may result. Maintain the same voltage level for all elements.

5-(1) Adjustment of TPS-41B Power Supply P.C.Board

A. +12V adjustment
Supply the rated voltage of AC 100V 50/60Hz to the primary, then adjust VR905 until the voltage between the 1st and 3rd terminals of S⑥ on TPS-41 is +12 ±0.2V. (note: the 1st terminal is the positive side)

B. −12V adjustment
Adjust VR909 until the voltage between the 3rd and 6th terminals of S ⑥ is +12 ±0.2V. (note: the 3rd terminal is the positive side)

C. +5V adjustment
Adjust VR912 until the voltage between the 5th and 3rd terminals of S ⑥ is +5 ±0.2V. Insert a 10k-ohm load resistor between the terminals. (note: the 5th terminal is the positive side)

5-(2) Motor Adjustment (TAS-12B)

A. 2.2Hz adjustment

- Remove the quartz lock. (Extract J1 jack from the TDC-7 digital PCB.)
  Insert a 680-ohm resistor and a 220μF ±20% capacitor into TP ⑧ after starting the motor. (see Figure 42)

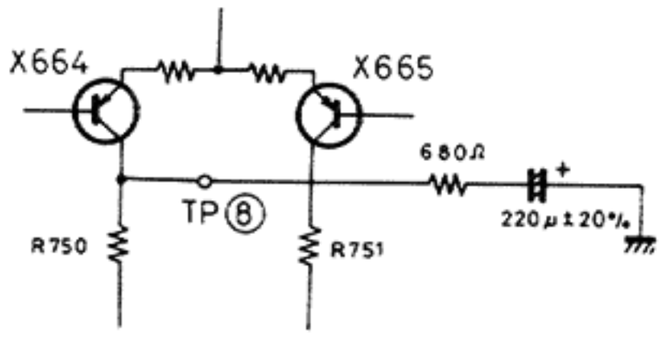


Fig. 42

- Start the adjustment approximately 2 minutes after power on and motor start. Connect the probe of an oscilloscope (storage type) to TP ⑩ and set the vertical scale to the 20mV/div of 50mV/div scale in the DC coupling mode. Adjust VR779 to obtain optimum waveform display.

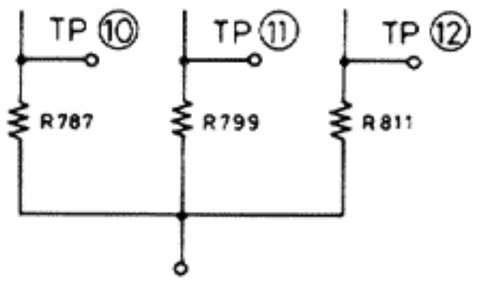


Fig. 43

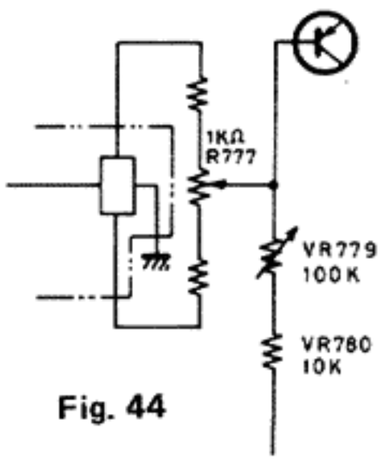


Fig. 44

- Adjust VR777 to re-shape the waveform shown in Figure 45 to that shown in Figure 46. Next, re-adjust VR779 to give 20mV ±10% to the waveform. It may be necessary to repeat adjustments of VR777 and VR779. (This is due to the 2.2Hz W.F. measurement.)
- The above is also performed on TP ⑪ (VR789, VR791) and TP ⑫ (VR801, VR803). Exercise care since these adjustments may cause TP ⑩ to go out of adjustment and necessitate repeat adjustments of TP ⑩ through TP ⑫

Fig. 45

Fig. 46

B. Drive gain adjustment
Utilizing the gain of TP ⑫ as the adjustment criterion, adjust the gains of TP ⑩ and TP ⑪. For TP ⑩, adjust VR784 (1k ohm) to make the heights of "A" and "B" in Figure 48 equal to those of TP ⑫ in Figure 47. At this time, heightening either "A" or "B" will result in a circuit characteristic lowering of the other. For TP ⑪, adjust VR796 to obtain the same result. Lock adjustment may necessitate repeating the 2.2Hz adjustment. (If "B" exceeds 100mV, the motor is defective.)

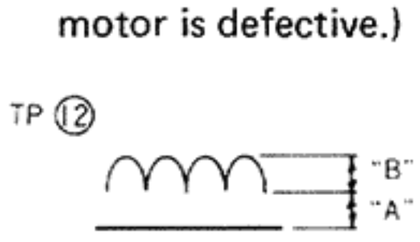


Fig. 47

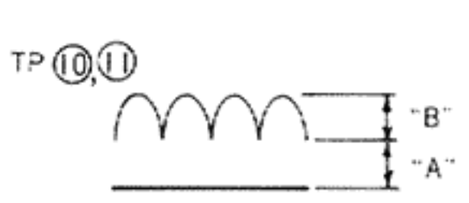


Fig. 48

C. Lock adjustment

- Remove the 670-ohm resistor and 200μF capacitor from TP ⑧.
  In this state, adjust coarse adjusters VR735 and VR739 to obtain rotation of approximately 33-1/3 and 45 rpm. Connect the probes of a dual beam/trace oscilloscope (2 msec/div) to TP (7) and TP ⑨ then externally trigger the scope with signals from TP ⑨. Staying within the −6Hz (min) quartz lock frequency range, adjust VR735 and VR739 until the deviation of each pulse at TP ⑦ is within ± 0.2 msec as shown in Figure 49.

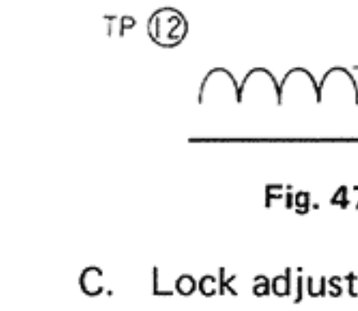


Fig. 49

D. Quick stop adjustment
- With the turntable mounting two 30-cm LP records rotaing at 33-1/3 rpm, depress the stop button, then adjust VR647 until the turntable stops without any reverse movement.
- Set the turntable to 45 rpm and mount a 30-cm LP record (approx. 200g), then adjust in the same manner using VR646.
- Confirm that the turntable without a record and running at 33-1/3 or 45 rpm is stopped by the quick stop after slight forward movement.

5-(3) N-time Counter Adjustment

Connect the output leads from a low frequency oscillator to the 6th and 7th terminals of P ⑨. Connect the probe of an oscilloscope to TP ②, then abserve the waveform.

A. Set the oscillator frequency to 85Hz and adjust VR685 until the waveform displayed on the scope is stable.

B. Then, increase the oscillator frequency which confirming that it causes the lock frequency from the oscillator on the PCB to vary accordingly.

Note: When performing this adjustment, disconnect P ⓪ from the motor.

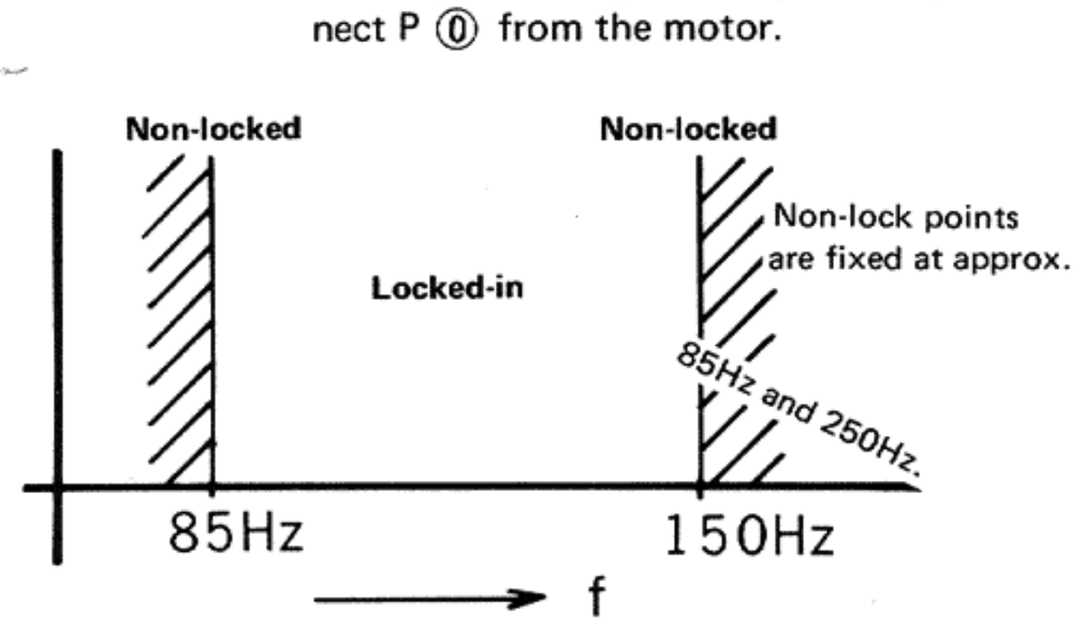


Fig. 50

5-(4) TDC-7 Oscillation Frequency Adjustment

Connect a frequency counter with 7 or more digit reading to TP ⑨ and set the 1Hz control to the "0" point at 33-1/3 rpm, then turn trimmer 50pF of C802 on TDC-7 to adjust the frequency to 100.0000 ±0.0001Hz.

5-(5) Rotation Adjustment

A. Reason for adjusting rotation

This equipment employing the quartz-lock servo method ensures constant rotation of the turntable at either 33.33 or 45.00 rpm. However, a 1Hz pitch control is provided for the following reason.

At present, the frequency of standard tone "A′" is specified as 440Hz and is the basic tone in all musical instruments and music, thus providing the basis for tuning of an orchestra etc.

In spite of this, depending on the characteristic of an orchestra or objectivity of the conductor, the basic frequency often deviates from 440Hz within the range of ±6Hz. On the other hand, the "A′" tones in home use pianos are all tuned at 440Hz. Therefore, when practicing on a piano with accompaniment from a record of a performance of the above type of orchestra, pitch control is required. Pitch control also permits comparison of a recorded orchestration with another of the same music but in different tune, thus providing new enjoyment through listening to the difference in musical philosophy of different orchestras.

B. RPM indication

Since a 4-digit digital counter to indicate turntable rpm is provided, precise monitoring of the revolving speed of the quartz-lock turntable can be performed at any time.

After the power switch is turned on and the rpm selection button is set to either 33-1/3 or 45, the unit reaches to the rated speed within a superb 0.6 seconds, and 1.5 seconds after the rpm selection button is set, the digital counter ensures correct indications by counting 2 additional seconds before starting to display the rpm. Therefore, it takes a total of 3 seconds after the start for the counter to start providing an indication. The counter counts down to the 3rd digit to the right of the decimal point and the least significant 3rd digit is rounded off for indication. However, due to a characteristic of the circuit, if the 3rd digit to the right of the decimal point is either "0" or "9", the indication may be somewhat different from that shown on the table in Figure 51.

C. Fine adjust RPM indication

If fine rpm adjustment is performed, the digital indication will become as shown on the following table.

Speed \ Pitch	+6 Hz	+5	+4	+3	+2	+1	0	−1	−2	−3	−4	−5	−6 Hz
33	33.79	33.71	33.64	33.56	33.48	33.41	33.33	33.25	33.18	33.10	33.03	32.96	32.88
45	45.62	45.51	45.41	45.30	45.20	45.10	45.00	44.89	44.79	44.69	44.59	44.49	44.39

Fig. 51

6. Connection Diagram

6-(1) Ground Connection

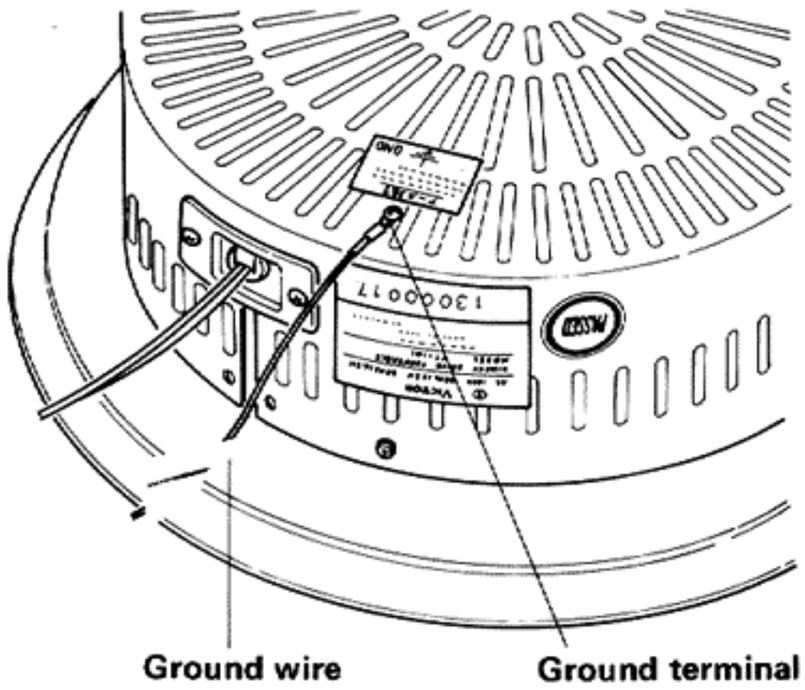


Fig. 52

- Connect the ground terminal on the unit and the ground terminal on the amplifier.
- Connect the attached accessory ground wire to the ground terminal on the unit.
- Connect the other end of the ground wire to the ground terminal on the amplifier.

6-(2) P.C.Board Ass'y Connection

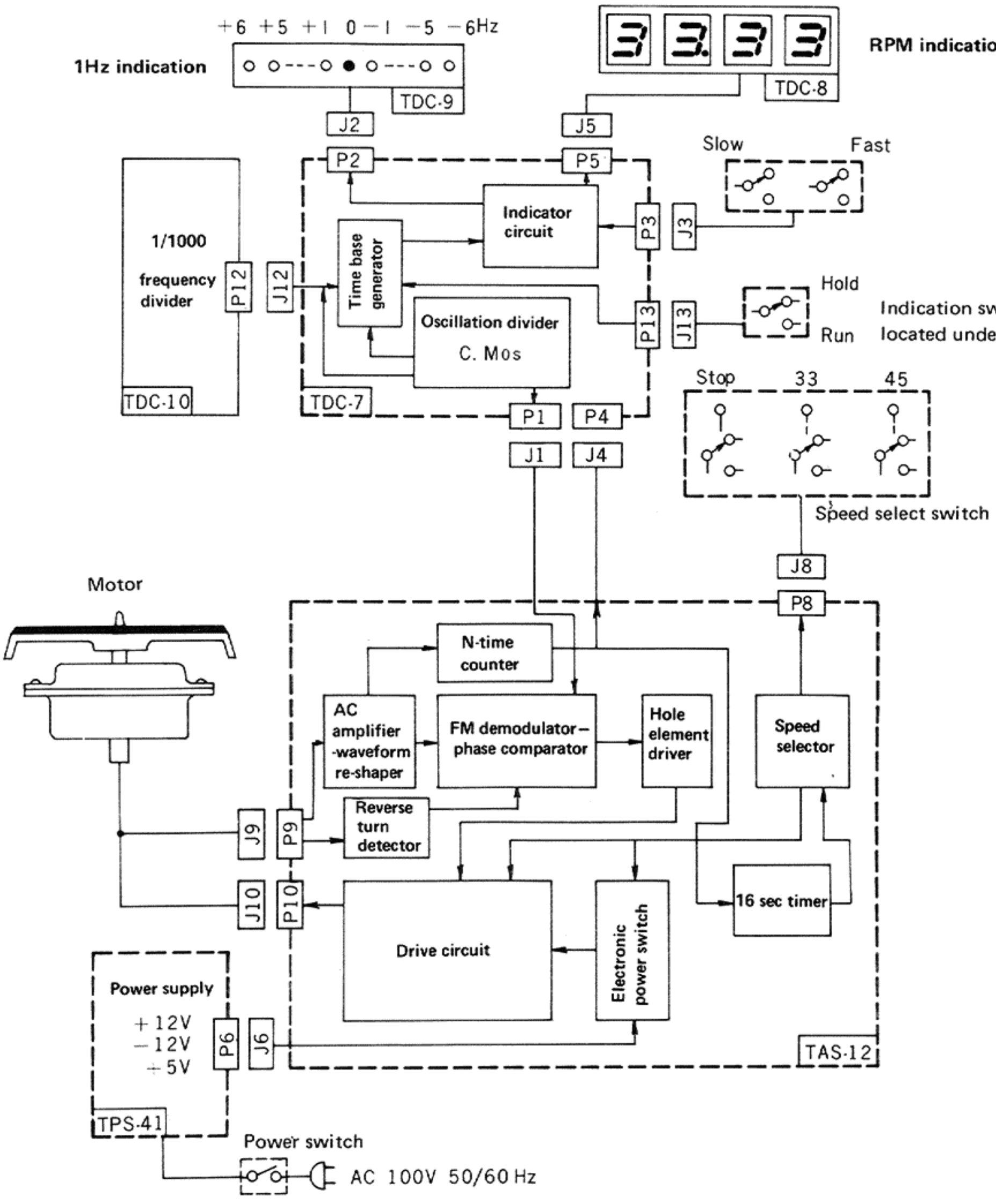


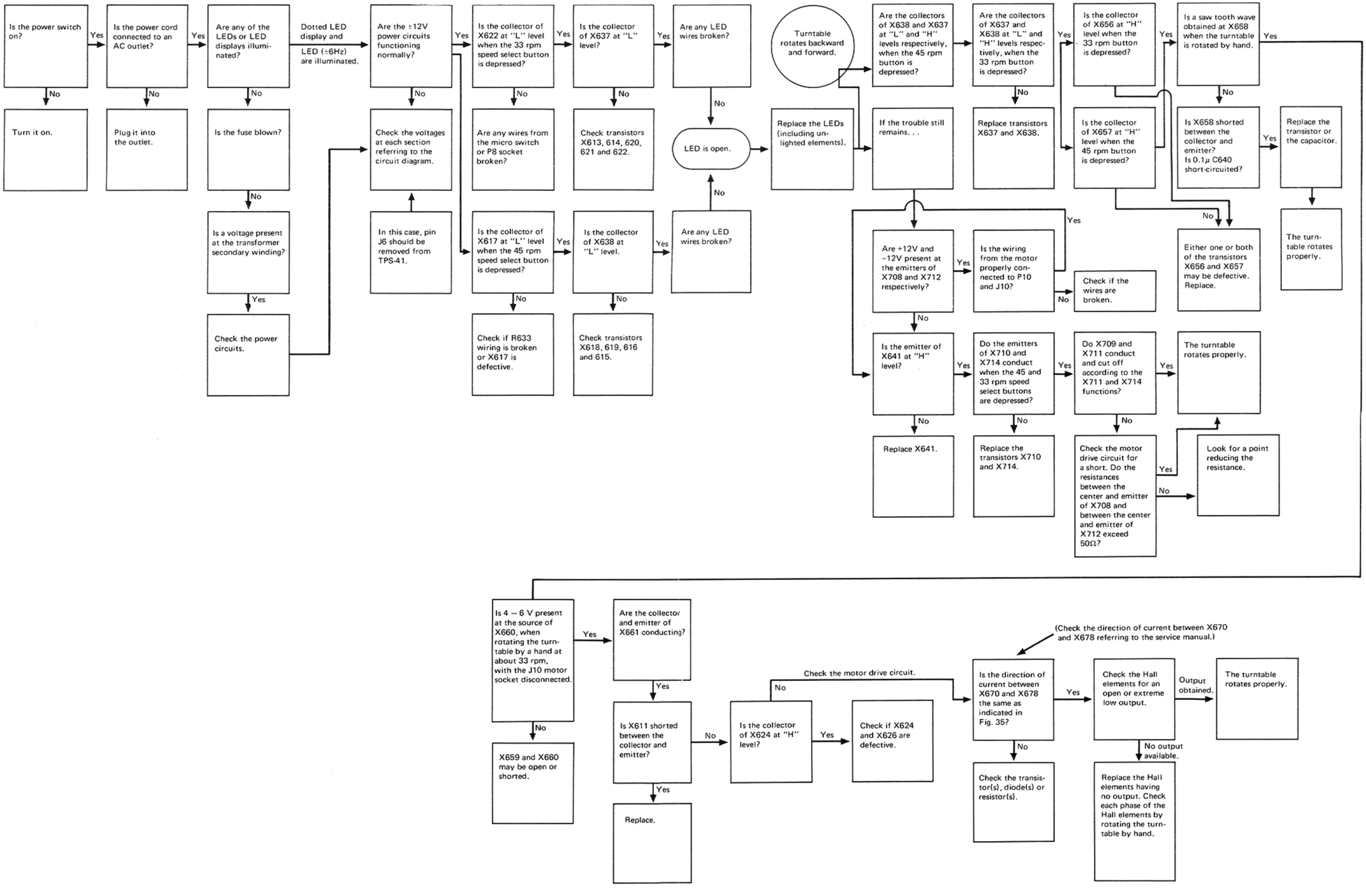
Fig. 53

7. Lubrication

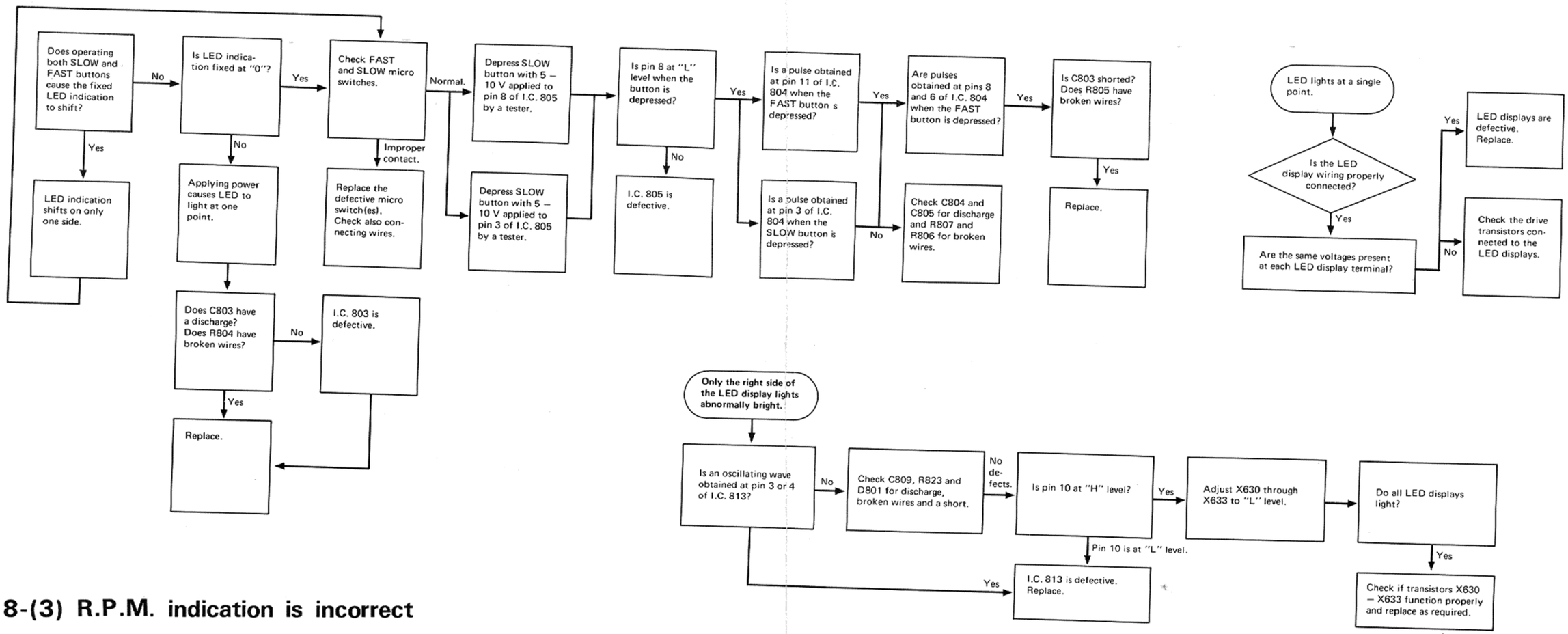
The direct drive motor used in the unit does not require lubrication.

8. Troubleshootings

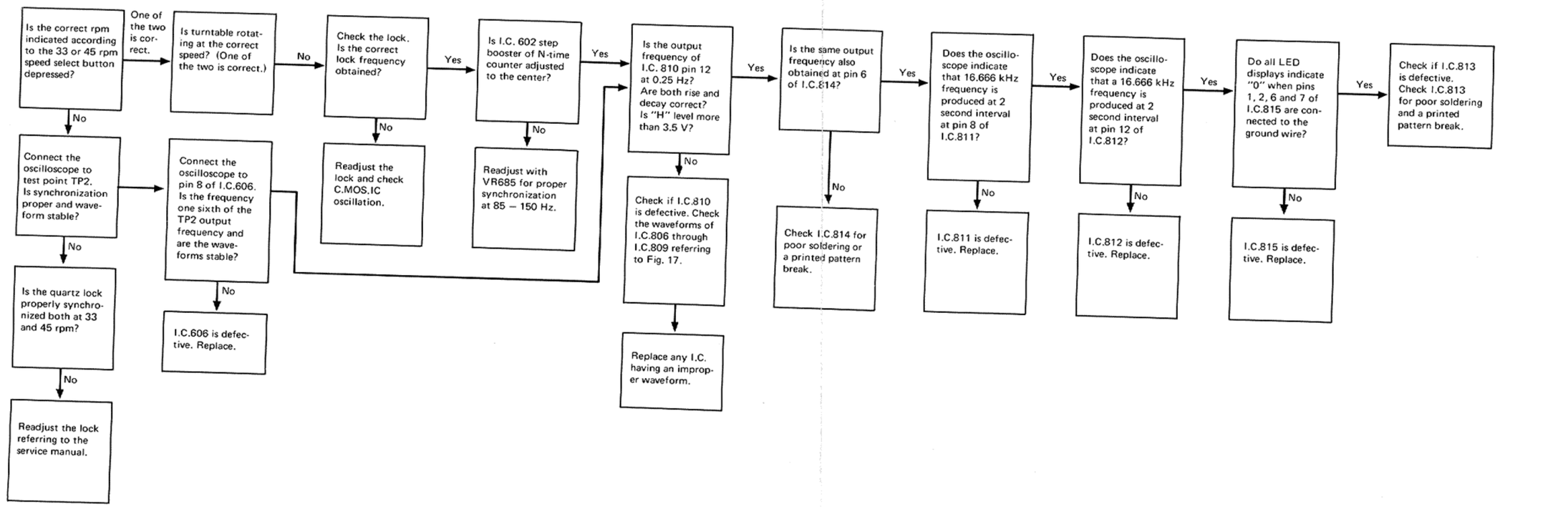
8-(1) Turntable does not rotate



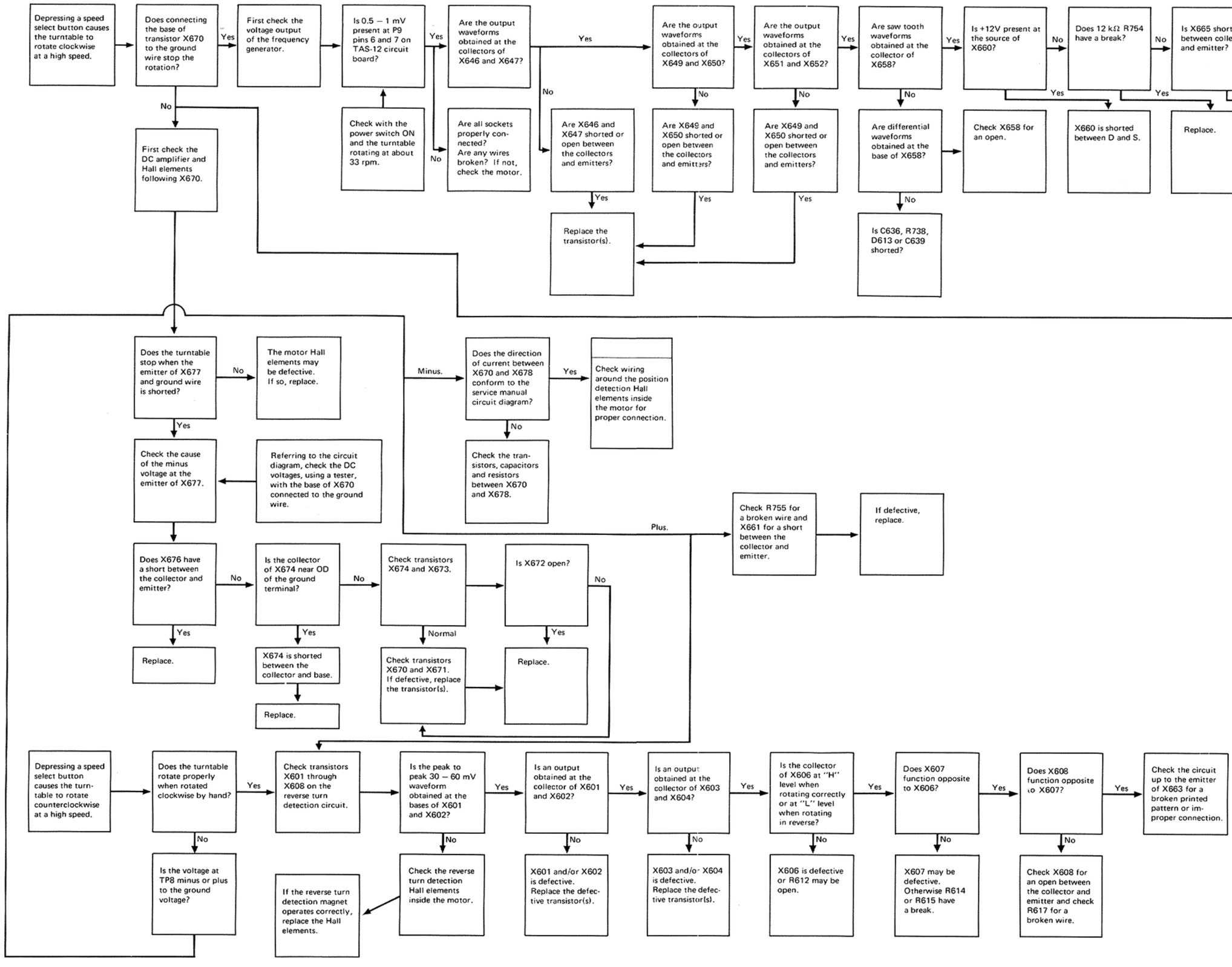
8-(2) The 1Hz step LED indication is fixed at one point and cannot be controlled



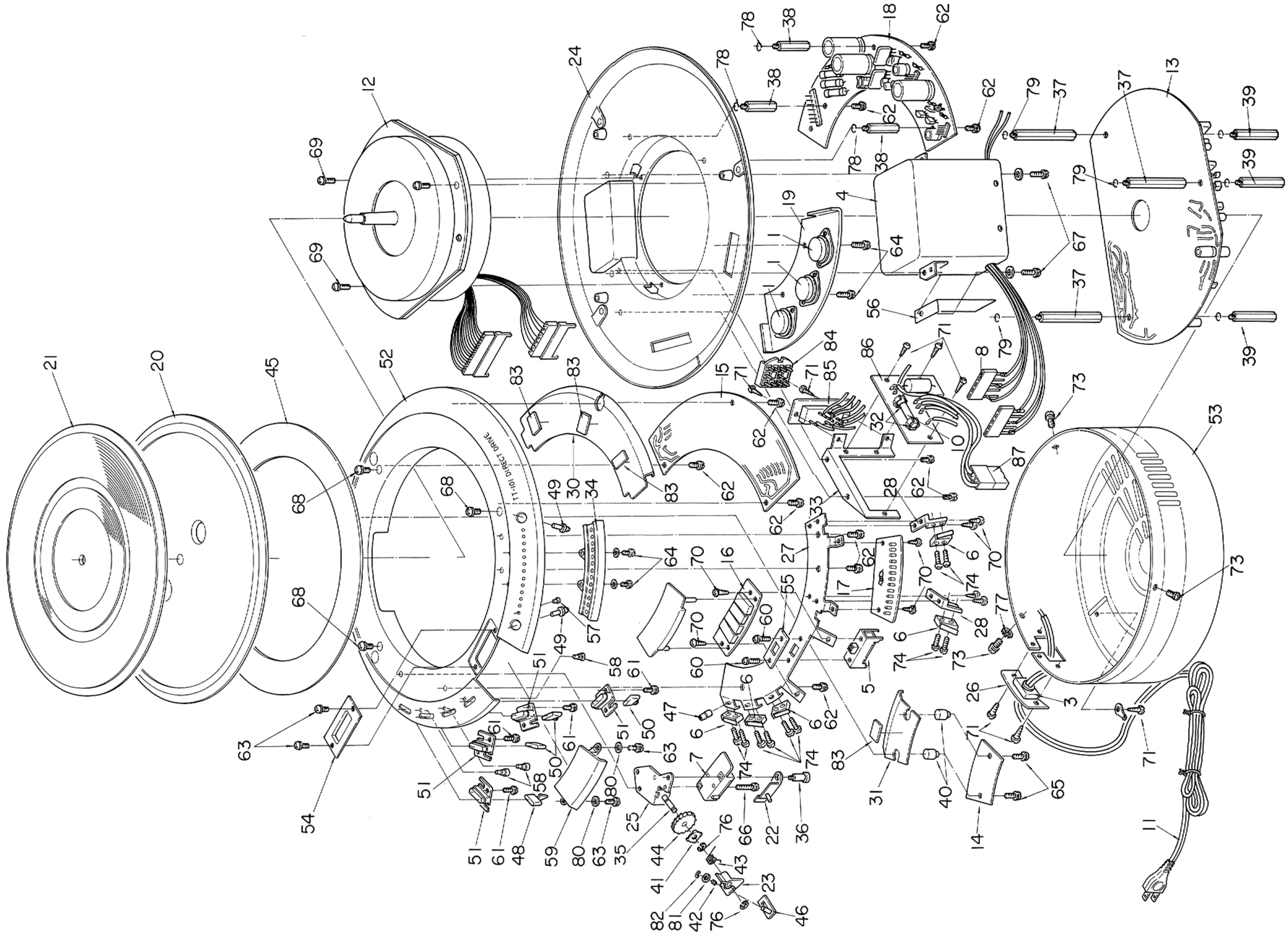
8-(3) R.P.M. indication is incorrect



8-(4) Turntable rotates at high speed



9. Exploded Views and Part Numbers

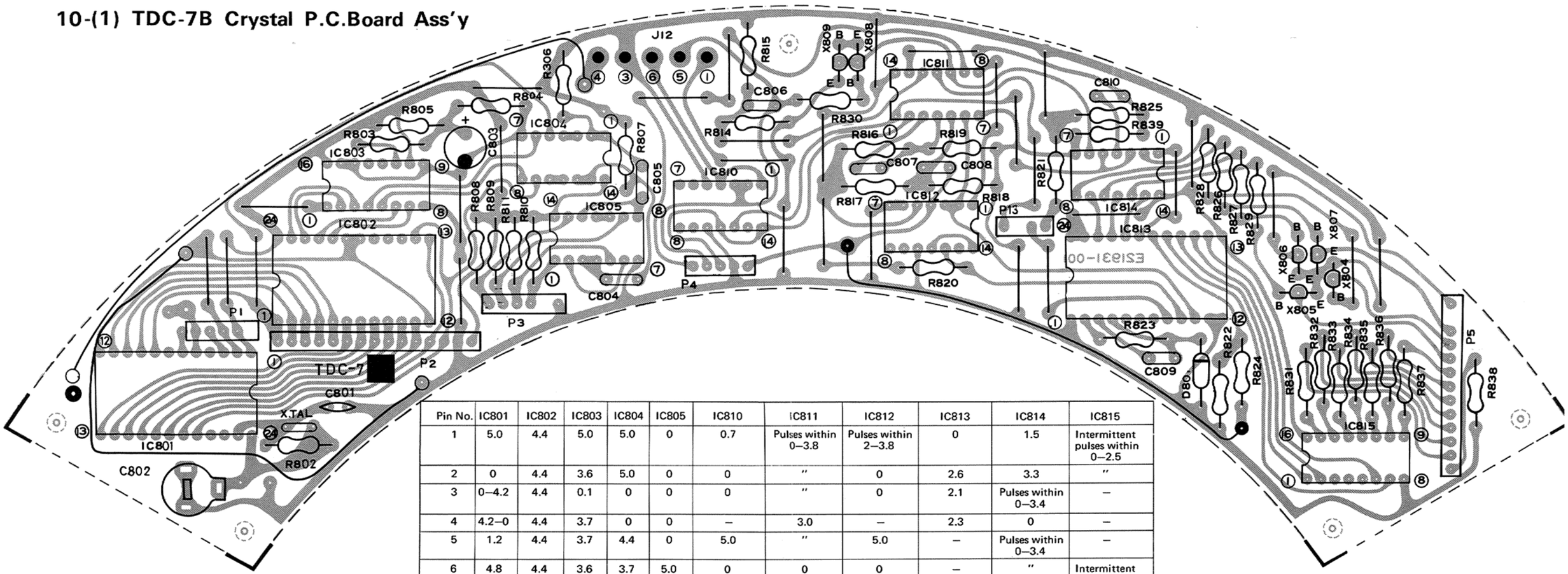


No.	Part Number	Part Name	Rating		Description	Maker
			Pc	fT		
1	2SC1030(C)	Silicon transistor	50W	10MHz	X901, 902, 905	Hitachi
3	Refer to Table 1	Cord stopper			See page 54	
4	E03617-6C	Power transformer				
5	QSS4224-002	Slide switch				
6	QMS1S01-014	Micro switch				
7		"				
8	E03565-580	5 pins socket			J7	
10	Refer to Table 1	Fuse			See page 54	
11	Refer to Table 1	Power cord			"	
12	M926	Direct drive motor				
13	TAS-12B	Servo control P.C. Board ass'y				
14	TDC-10B	Frequency divider P.C. Board ass'y				
15	TDC-7B	Crystal P.C. Board ass'y				
16	TDC-8B	LED speed counter P.C. Board ass'y				
17	TDC-9B	LED indication P.C. Board ass'y				
18	TPS-41B	Power supply P.C. Board ass'y				
19	E34211-001	Heat sink				
20	E21891-002	Platter				
21	E21890-004	Platter mat				
22	E60241-001	Switch lever ass'y				
23	E60248-001	Lever				
24	E10021-001	Motor board				
25	E60239-001	Base ass'y				
26	E34197-001	Bracket				
27	E34203-001	"				
28	E60274-001	Switch bracket				
29	E60277-001	Bracket				
30	E34339-001	Shield plate ass'y				
31	E60829-001	Shield plate				
32						
33	E61564-001	C.B. holder				
34	E60283-001	Eye holder				
35	E60243-001	Shaft				
36	E60244-001	Lever shaft				
37	E60278-001	Stud (A)				
38	E60279-001	Stud (B)				
39	E60280-001	Stud (C)				
40	E60802-001	Spacer				
41	E60246-001	Spring				
42	E60252-001	"				
43	E60253-001	"				
44	E60245-001	Cam				
45	E34194-001	Rubber sheet				
46	E60249-001	Key ass'y				
47	E60698-001	L.E.D. support				
48	E60254-001	Switch knob				
49	E60275-001	Push knob (A)				
50	E60276-001	Push knob (B)				
51	E60728-001	Knob base				
52	E10020-003	Control panel				

No.	Part Number	Part Name	Rating	Description	Maker
53	E21896-002	Cover			
54	E60691-001	Switch cover			
55	E60692-001	Switch plate			
56	E61563-001	Insulator			
57	E60281-001	Eye (A)			
58	E60282-001	Eye (B)			
59	E60238-001	Window			
60	LPSP2605M	Screw			
61	LPSP3005NS	"			
62	LPSP3006ZS	"			
63	LPSP3008NS	"			
64	LPSP3008ZS	"			
65	LPSP3010ZS	"			
66	Refer to Table 1	"		See page 54	
67	LPSP4008MS	"			
68	LPSP4008ZS	"			
69	LPSP4012NS	"			
70	SBSB3006Z	Tapping screw			
71	SBSB3008N	"			
72	SBSB3008Z	"			
73	SDSP3006NS	Screw			
74	SPSP2010Z	"			
75	SPSP3008NS	"			
76	REE3000	Washer			
77	WBS3000N	"			
78	WLS3000N	Lock washer			
79	WLS4000N	"			
80	WNS3000N	Washer			
81	WNS3000Z	"			
82	REE2000X	E ring			
83	E60837-001	Rubber sheet			
84	E03676-001	V.S. plug			
85	E03676-002	V.S. socket			
86	Refer to Table 1	AC fuse P.C. Board ass'y		See page 54	

10. Printed Circuit Board Ass'y Part Numbers and Parts List

10-(1) TDC-7B Crystal P.C.Board Ass'y



Pin No.	IC801	IC802	IC803	IC804	IC805	IC810	IC811	IC812	IC813	IC814	IC815
1	5.0	4.4	5.0	5.0	0	0.7	Pulses within 0–3.8	Pulses within 2–3.8	0	1.5	Intermittent pulses within 0–2.5
2	0	4.4	3.6	5.0	0	0	"	0	2.6	3.3	"
3	0–4.2	4.4	0.1	0	0	0	"	0	2.1	Pulses within 0–3.4	–
4	4.2–0	4.4	3.7	0	0	–	3.0	–	2.3	0	–
5	1.2	4.4	3.7	4.4	0	5.0	"	5.0	–	Pulses within 0–3.4	–
6	4.8	4.4	3.6	3.7	5.0	0	0	0	–	"	Intermittent pulses within 0–2.5
7	–	0.2	0.1	0	0	0	0	0	–	0	0
8	4.4	4.4	0	3.7	0	–	Pulses within 0.8–2	–	0	3.2	Intermittent pulses within 0.1–3.8
9	4.4	4.4	0	4.4	0	–	1.8	–	Pulses within 0–2.5	1.5	"
10	4.4	4.4	5.0	0	0	0	3.8	0	0	3.2	"
11	4.4	4.4	1.6	0	0	Pulses withim 3–3.8	0	Pulses within 0–0.1	0	1.5	"
12	4.4	0	–	5.0	0	"	3.0	Pulses within 0–2.5	0	3.2	"
13	4.4	4.4	–	5.0	5.0	–	"	–	5.0	1.5	"
14	0.2	4.4	0	5.0	5.0	Pulses withim 0–3.8	5.0	Pulses within 0–0.1	Pulses within 0–2.5 as indicated	5.0	5.0
15	4.4	–	0								
16	4.4	–	5.0								
17	4.4	–									
18	4.4	0							0		
19	4.4	0							1.5		
20	4.4	0.1–3.6							1.5		
21	–	0.1–3.6							1.5		
22	–	0.1–3.6							1.5		
23	1.6	0.1–3.6							5.0		
24	2.0	5							5.0		

Transistors in TDC-7 oscillator C.B. assembly

	C	B	E
X808	3.8	0.1	0.05
X809	3.8	0.05	0
X804	2.2	4	5
X805	2.2	4	5
X806	2.2	4	5
X807	2.2	4	5

10-(1) TDC-7B Crystal P.C.Board Ass'y

Transistors

Item No.	Part Number	Rating		Description	Maker
		Pc	fT		
X804~X807	2SA628A(E)	200mW	150MHz	Silicon	Mitsubishi
X808~X809	2SC711A(E, F)	〃	〃	〃	〃

Integrated Circuits

Item No.	Part Number	Rating	Description	Maker
IC801	SC3042	50mW	C. MOS I.C.	Nihon Precision
IC802	M53354P		I.C.	Mitsubishi
IC803	M53393P	155mW	〃	〃
IC804~IC805	M53200		〃	〃
IC810	M53293		〃	〃
IC811	M53200		〃	〃
IC812	M53290P		〃	〃
IC813	TC5001C		C. MOS I.C.	Toshiba
IC814	M53204P		I.C.	Mitsubishi
IC815	M53247P		〃	〃

Diode

Item No.	Part Number	Rating	Description	Maker
D801	1S2473		Silicon	Toyo-Dengu

Capacitors

Item No.	Part Number	Rating		Description
C801	QCT05UJ-330	33pF	50V	
C802	QAT3001-006	47pF		
C803	QEW41CA-476	47μF	16V	Electrolytic
C804~C805	QFM41HK-122	0.0012μF	50V	Mylar
C806	QFM41HK-102	0.001μF	〃	〃
C807~C810	QFM41HK-223	0.022μF	〃	〃

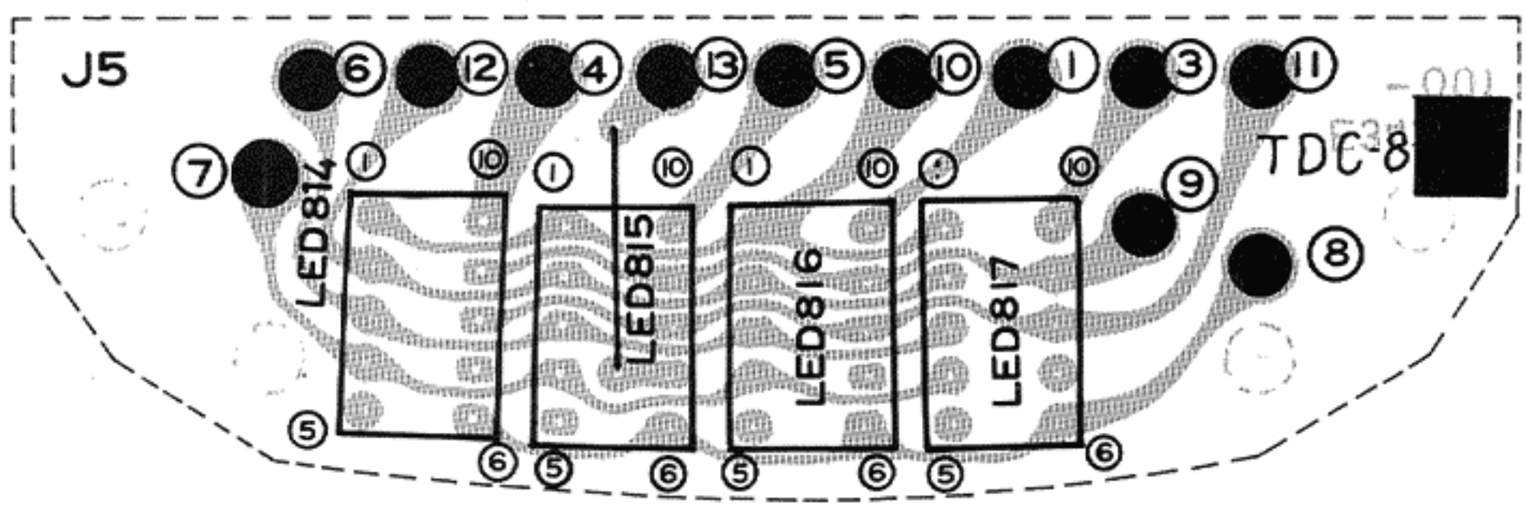
Resistors

Item No.	Part Number	Rating		Description
R802	QRD141J-225	2.2MΩ	1/4W	Carbon
R803	QRD141J-102	1kΩ	〃	〃
R804	QRD141J-332	3.3kΩ	〃	〃
R805	QRD141J-103	10kΩ	〃	〃
R806~R807	QRD141J-222	2.2kΩ	〃	〃
R808~R811	QRD141J-682	6.8kΩ	〃	〃
R814	QRD141J-152	1.5kΩ	〃	〃
R815~R817	QRD141J-102	1kΩ	〃	〃
R818~R819	QRD141J-152	1.5kΩ	〃	〃
R820	QRD141J-562	5.6kΩ	〃	〃
R821	QRD141J-153	15kΩ	〃	〃
R822	QRD141J-473	47kΩ	〃	〃
R823	QRD141J-104	100kΩ	〃	〃
R824	QRD141J-473	47kΩ	〃	〃
R825	QRD141J-102	1kΩ	〃	〃
R826~R829	QRD141J-681	680Ω	〃	〃
R830	QRD141J-562	5.6kΩ	〃	〃
R831~R838	QRD141J-181	180Ω	〃	〃
R839	QRD141J-152	1.5kΩ	〃	〃

Others

Item No.	Part Number	Rating	Description
	E04300-001	9.504MHz	Crystal
	E46687-001		Tab
P1	E03686-0058		5 pins plug
P2	E03686-015B		15 pins plug
P3	E03686-006B		6 pins plug
P4	E03686-005B		5 pins plug
P5	E03686-013B		13 pins plug
J12	E03681-0601		Socket wire
	E21931-002		Printed wiring board

10-(2) TDC-8B LED Speed Counter P.C.Board Ass'y



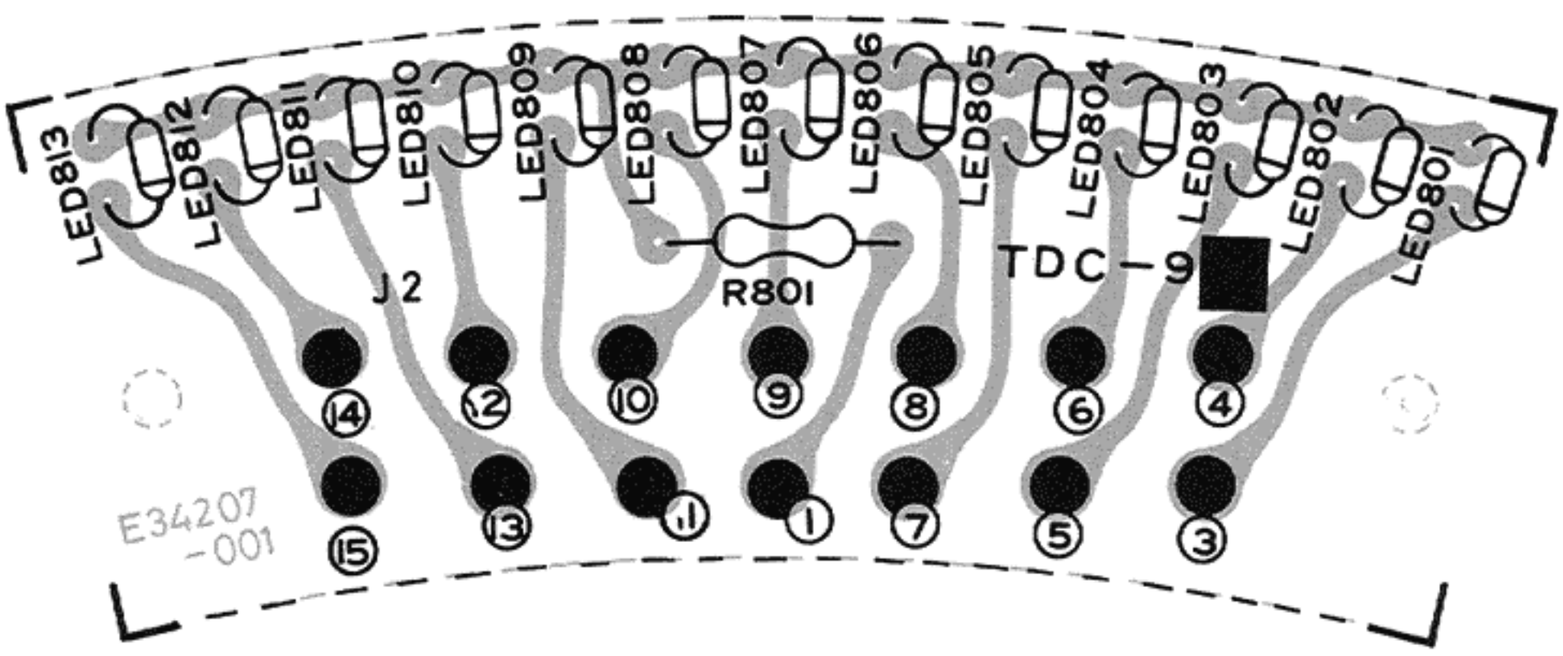
Diode

Item No.	Part Number	Rating	Description	Maker
	TLR313		LED	Toshiba

Others

Item No.	Part Number	Rating	Description
	E34206-002		Printed wiring board
	E34204-001		Screen
	E46687-001		Tab

10-(3) TDC-9B LED Indication P.C.Board Ass'y



Diode

Item No.	Part Number	Rating	Description	Maker
	LN23SR		L.E.D.	Matsushita-Denki

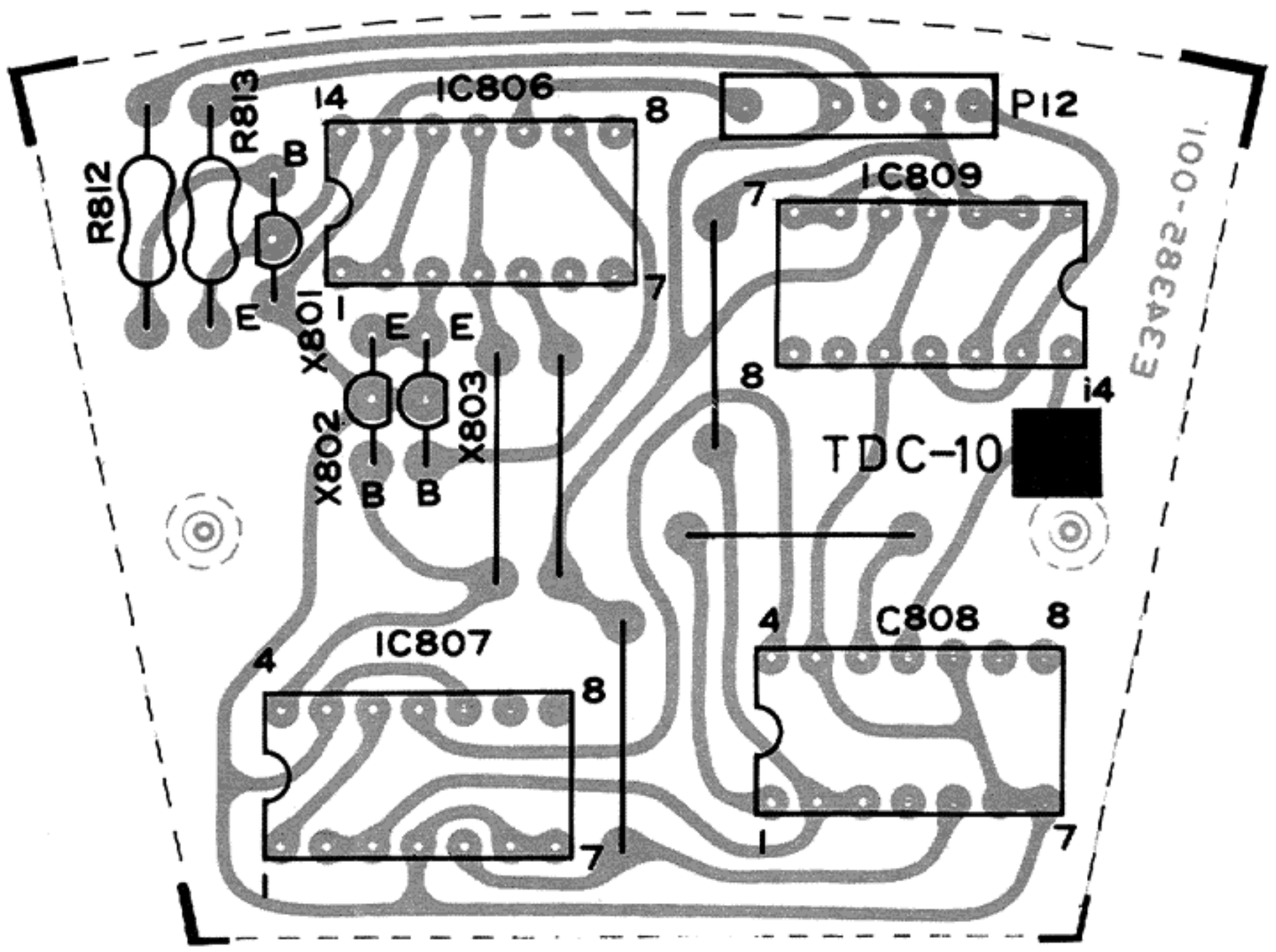
Resistor

Item No.	Part Number	Rating		Description
	QRD141J-181	180Ω	1/4W	Carbon

Others

Item No.	Part Number	Rating	Description
	E34207-002 E46687-001		Printed wiring board Tab

10-(4) TDC-10B Frequency Divider P.C.Board Ass'y



	C	B	E
X801	3.3	0.2	0
X802	0	1.1	0.05
X803	0	1.6	0.05

Transistors

Item No.	Part Number	Rating		Description	Maker
		Pc	fT		
X801	2SC711A(E. F)	200mW	150MHz	Silicon	Mitsubishi
X802~803	2SA628A(E)	〃	〃	〃	〃

Integrated Circuits

Item No.	Part Number	Rating	Description
IC806	M53293P		I.C.
IC807~IC809	M53290P		〃

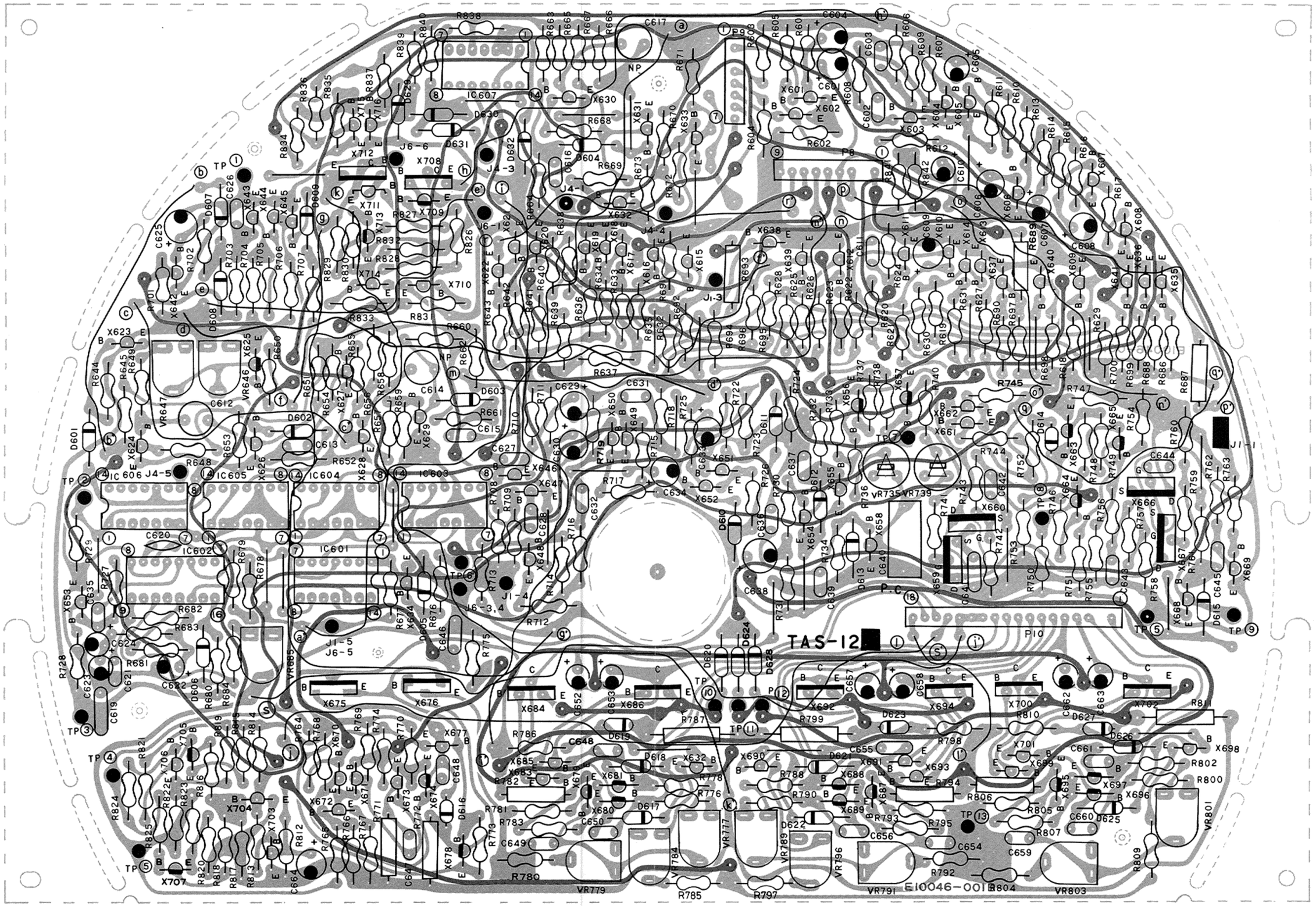
Resistors

Item No.	Part Number	Rating		Description
R812	QRD141J-473	47kΩ	1/4W	Carbon
R813	QRD141J-472	4.7kΩ	1/4W	〃

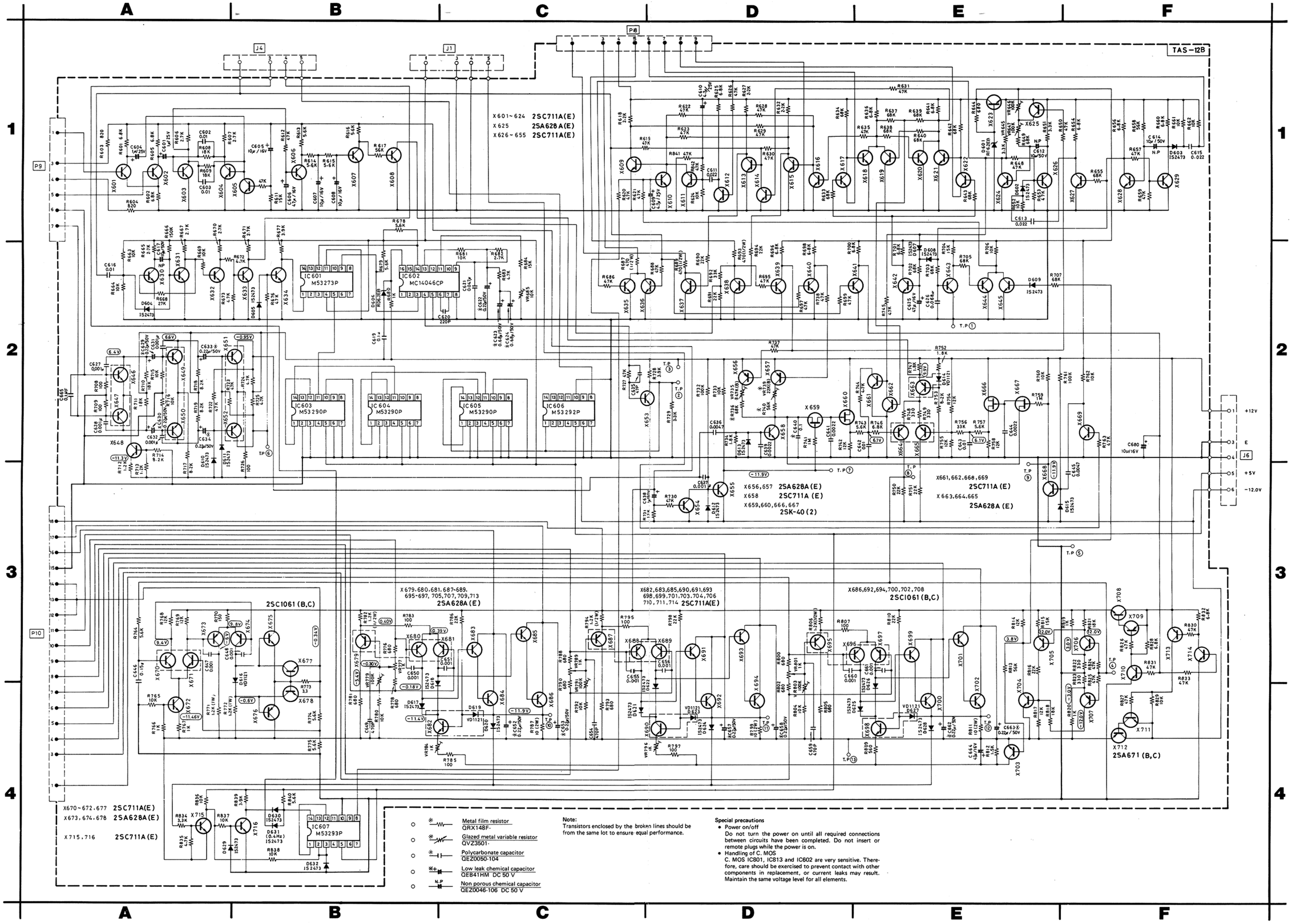
Others

Item No.	Part Number	Rating	Description
	E34385-002		Printed wiring board
	E03686-006B		6 pins plug

10-(5) TAS-12B Servo Control P.C.Board Ass'y



TAS-12B Schematic Diagram



Voltage chart (Measured with a tester having an input impedance of more than 100kΩ.)

33-1/3 rpm reverse turn detection parts

	C	B	E	Remarks
X601	9.3	6	5.4	
X602	9.3	6	5.4	
X604	12	0.1	0	Clockwise normal revolution
X604	0.1	0.6	0	Counterclockwise revolution
X603	0.1	0.6	0	Clockwise normal revolution
X603	12	0.1	0	Counterclockwise revolution
X605	0.6	0	0	
X606	12	0	0	
X607	0.1	0.6	0	
X608	9.9	0.1	0	

Transistors in blocking circuit

	C	B	E
X630	12	0.6	0
X631	0.1	0.1	0
X632	11.9	0.1	0
X633	0.1	0.6	0

N times counter TR's

	C	B	E
X634	0.5	−0.8	0
X653	0.5	−0.2	0

Transisotrs in TAS-12 C.B. ass'y speed select section

	OFF			33 rpm			45 rpm		
	C	B	E	C	B	E	C	B	E
X609	10.8	0.6	0	0.1	0.6	0	0.1	0.6	0
X610	0	0.05	0	0	0.05	0	0	0.05	0
X611	0.6	0	0	0.6	0	0	0.6	0	0
X612	12	0.1	0	12	0.1	0	12	0.1	0
X613	0.1	0.6	0	11.8	0.1	0	0.1	0.6	0
X614	0.6	0.1	0	0.1	0.6	0	0.1	0.6	0
X615	0.1	0.6	0	0.1	0.6	0	0.1	0.6	0
X616	0.6	0.1	0	0.6	0.1	0	0.1	0.6	0
X617	0.6	12	11	0.6	12	11	0.6	12	11
X618	0	0	0	0	0	0	0	0	0
X619	0	0	0	0	0	0	0	0	0
X620	0	0.1	0	0	0	0	0	0	0
X621	0.1	0.6	0	0	0	0	0	0.1	0
X622	0.6	12	11	0.6	12	11	0.6	12	11
X623	12	6.1	5.4	12	6.1	5.4	12	6.1	5.4
X624	0.1	0.6	0	0.1	0.6	0	0.1	0.6	0
X625	8.0	12	5.4	5.1	4.8	5.4		12	5.4
X626	5.4	0.1	0	5.4	0.1	0	5.4	0.1	0
X627	5.4	0.1	0	5.4	0.1	0	5.4	0.1	0
X628	0.1	0.6	0	0.1	0.6	0	0.1	0.6	0
X629	5.4	0.1	0	5.4	0.1	0	5.4	0.1	0
X635	0.1	0.1	0	11.8	0.1	0	11.8	0.1	0
X636	0.1	0.6	0	11.8	0.1	0	11.8	0.1	0
X637	11.8	0.1	0	0.1	0.6	0	11.8	0.1	0
X638	11.8	0.1	0	11.8	0.1	0	0.1	0.6	0
X639	0.1	0.6	0	0.1	0.6	0	12	0.1	0
X640	0.1	0.6	0	12	0.1	0	0.1	0.6	0
X641	0.1	0.6	0	9	0.1	0	9	0.1	0
X642	12	0.1	0	12	0.1	0	12	0.1	0
X643	12	0.1	0	12	0.1	0	12	0.1	0
X644	0.1	0.6	0	0.1	0.6	0	0.1	0.6	0

Note: The voltages listed above were measured at a stable revolution or stopped stage and are not transient voltages.

AC amplification waveform shaper transistors

	C	B	E
X646	6.4	0	-0.6
X647	6.4	0	-0.6
X649	6.6	0	-0.6
X650	6.6	0	-0.6
X651	-0.95	0.8	-12
X652	-0.95	0.8	-12

Transistors in phase comparator

	C	B	E	Remarks
X654	-11.4	-11.4	-12	
X655	-11.9	-11.4	-12	
X656	11.7	11.4	12	33-1/3 rpm
X656	5	11.8	12	45 rpm
X657	5	11.8	12	33-1/3 rpm
X657	11.7	11.4	12	45 rpm
X658	5	0	0	
X661	6.1	0.3	0	
X662	0.3	0.6	0	
X663	6.4	9.3	9.9	
X664	0.17	6.1	6.4	
X665	-0.17	6.1	6.4	
X668	-11.9	-11.4	-12	
X669	0.2	0.6	0	

Phase comparator FET

	D	G	S
X659	6	-11.9	5
X660	12	6	6.1
X660	12	6	6.1
X667	6	-11.9	6

Note: Voltage in column G is 120V.

Transistor DC Amp.

	C	B	E
X670	9.4	-0.17	-0.7
X671	9.4	-0.17	-0.7
X672	-10.9	-0.7	-11.5
X673	-6	-5.4	9.8
X674	-6	-5.4	9.8
X675	12	0.3	-0.34
X676	-12	-0.6	-0.34
X677	0.3	-0.3	-0.34
X678	-0.6	-0.3	-0.34

Transistors in timer section

			C	B	E
X679	X687	X695	-5.4	-0.3	0.4
X680	X688	X696	10.8	-0.3	0.39
X681	X689	X697	10.8	-0.3	0.39
X682	X690	X698	-11.4	-11.3	-11.9
X683	X691	X699	11.8	-10.8	-11.3
X685	X693	X701	11.8	-10.8	-11.3
X684	X692	X700	11.8	-11.3	-11.9
X696	X694	X702	11.8	-11.3	-11.9
X703	—	—		-11.4	-12

Transistors in interior power switch and gain switch section

	C	B	E
X704	3.8	-12	-12
X705	-12	12	12
X706	12	3.6	3.0
X707	-12	-3.6	-3.0
X708	12	11.4	12
X709	11.4	10.8	12
X710	0.3	0.6	0
X711	-11.4	-11.4	-12
X712	-12	-11.4	-12
X713	11.8	11.4	12
X714	0.1	0.6	0

Transistor in drive section

	C	B	E
X715	5	0	-12
X716	0.1	0.6	0

IC's on TAS-12 C.B. ass'y

Pin No.	IC601	IC602	IC603	IC604	IC605	IC607
1	2.6	—	1.8	1.8	1.8	0
2	—	—	0	0	0	0.6
3	—	5.0	0	0	0	0.6
4	5.0	3.1	—	—	—	—
5	0.8	0	5.0	5.0	5.0	5.0
6	—	1.1	0	0	0	—
7	—	1.1	0	0	0	—
8	2.0	0	—	—	—	0.1
9	2.6	2.2	—	—	—	—
10	0	—	0	0	0	0
11	0	4.1	0.1	0.1	0.1	—
12	0.6	—	1.8	1.8	1.8	—
13	—	4.1	—	—	—	—
14	—	2.6	1.1	1.1	1.1	—
15		6.4				
16		6.4				

Note: At 33-1/3 rpm

TAS-12B Servo Control P.C.Board Ass'y Parts List.

Transistors

Item No.	Part Number	Rating		Description	Maker
		Pc	fT		
X601~C624	2SC711A(E)	200mW	150MHz	Silicon	Mitsubishi
X625	2SA628A(E)	〃	〃	〃	〃
X626~X655	2SC711A(E)	〃	〃	〃	〃
X656~X657	2SA628A(E)	〃	〃	〃	〃
X658	2SC711A(E)	〃	〃	〃	〃
X659~X660	2SK40-2	100mW		F.E.T.	Hitachi
X661~X662	2SC711A(E)	200mW	150MHz	Silicon	Mitsubishi
X663~X665	2SA628A(E)	〃	〃	〃	〃
X666~X667	2SK40-2	100mW		F.E.T.	Hitachi
X668~X672	2SC711A(E)	200mW	150MHz	Silicon	Mitsubishi
X673~X674	2SA628A(E)	〃	〃	〃	〃
X675	2SC1061(B, C)	25W	6MHz	〃	Hitachi
X676	2SA671A(B, C)	〃	8MHz	〃	〃
X677	2SC711A(E)	200mW	150MHz	〃	Mitsubishi
X678~X681	2SA628A(E)	〃	〃	〃	〃
X682~X683	2SC711A(E)	〃	〃	〃	〃
X684	2SC1061(B, C)	25W	6MHz	〃	Hitachi
X685	2SC711A(E)	200mW	150MHz	〃	Mitsubishi
X686	2SC1061(B, C)	25W	6MHz	〃	Hitachi
X687~X689	2SA628A(E)	200mW	150MHz	〃	Mitsubishi
X690~X691	2SC711A(E)	〃	〃	〃	〃
X692	2SC1061(B, C)	25W	6MHz	〃	Hitachi
X693	2SC711A(E)	200mW	150MHz	〃	Mitsubishi
X694	2SC1061(B, C)	25W	6MHz	〃	Hitachi
X695~X697	2SA628A(E)	200mW	150MHz	〃	Mitsubishi
X698~X699	2SC711A(E)	〃	〃	〃	〃
X700	2SC1061(B, C)	25W	6MHz	〃	Hitachi
X701	2SC711A(E)	200mW	150MHz	〃	Mitsubishi
X702	2SC1061(B, C)	25W	6MHz	〃	Hitachi
X703~X704	2SC711A(E)	200mW	150MHz	〃	Mitsubishi
X705	2SA628A(E)	〃	〃	〃	〃
X706	2SC711A(E)	〃	〃	〃	〃
X707	2SA628A(E)	〃	〃	〃	〃
X708	2SC1061(B, C)	25W	6MHz	〃	Hitachi
X709	2SA628A(E)	200mW	150MHz	〃	Mitsubishi
X710~X711	2SC711A(E)	〃	〃	〃	〃
X712	2SA671(B, C)	25W	8MHz	〃	Hitachi
X713	2SA628A(E)	200mW	150MHz	〃	Mitsubishi
X714~X716	2SC711A(E)	〃	〃	〃	〃

Integrated Circuits

Item No.	Part Number	Rating	Description	Maker
IC601	M53273P	80mW	I.C.	Mitsubishi
IC602	MC14046CP	50mW	〃	Motorola
IC603~IC605	M3290P	155mW	〃	Mitsubishi
IC606	M53292P	〃	〃	〃
IC607	M53293P	〃	〃	〃

Diodes

Item No.	Part Number	Description	Maker
D601	RD6.2EB	Zener	Nihon-Denki
D602~D605	1S2473	Silicon	Toyo-Dengu
D606	RD6.2EB	Zener	Nihon-Denki
D607~D613	1S2473	Silicon	Toyo-Dengu
D614	VD1121	Varistor	Nihon-Denki
D615	1S2473	Silicon	Toyo-Dengu
D616	VD1121	Varistor	Nihon-Denki
D617~D618	1S2473	Silicon	Toyo-Dengu
D619	VD1121	Varistor	Nihon-Denki
D620~D622	1S2473	Silicon	Toyo-Dengu
D623	VD1121	Varistor	Nihon-Denki
D624~D626	1S2473	Silicon	Toyo-Dengu
D627	VD1121	Varistor	Nihon-Denki
D628~D632	1S2473	Silicon	Toyo-Dengu

Capacitors

Item No.	Part Number	Rating		Description
C601	QEW41HA-105	1μF	50V	Electrolytic
C602~C603	QFM41HK-103	0.01μF	〃	Mylar
C604	QEW41HA-105	1μF	〃	Electrolytic
C605	QEW41CA-106	10μF	16V	〃
C606	QEW41CA-476	47μF	〃	〃
C607~C608	QEW41CA-106	10μF	〃	〃
C609~C610	QEW41EA-475	4.7μF	25V	〃
C611	QFM41HK-223	0.022μF	50V	Mylar
C612	QEZ0046-106	10μF	〃	Electrolytic
C613	QFM41HK-223	0.022μF	〃	Mylar
C614	QEZ0046-106	10μF	〃	Electrolytic
C615	QFM41HK-223	0.022μF	〃	Mylar
C616	QFM41HK-103	0.01μF	〃	〃
C617	QEZ0046-106	10μF	〃	Electrolytic
C619	QFM41HK-104	0.1μF	〃	Mylar
C620	QCS11HJ-221	220pF	〃	Ceramic
C621	QFM41HK-473	0.047μF	〃	Mylar
C622	QEB41HM-224	0.22μF	〃	Electrolytic
C623~C624	QEB41HM-684	0.68μF	〃	〃
C625	QEW41CA-476	47μF	16V	〃
C626	QFM41HK-683	0.068μF	50V	Mylar
C627~C628	QFM41HK-102	0.001μF	〃	〃
C629~C630	QEB41HM-224	0.22μF	〃	Electrolytic
C631~C632	QFM41HK-102	0.001μF	〃	Mylar
C633~C634	QEB41HM-224	0.22μF	〃	Electrolytic
C635	QSC11HJ-470	47pF	〃	Ceramic
C636	QFM41HK-472	0.0047μF	〃	Mylar
C637	QFM41HK-102	0.001μF	〃	〃
C638	QEW41HA-105	1μF	〃	Electrolytic
C639	QFM41HK-222	0.0022μF	〃	Mylar

Capacitors

Item No.	Part Number	Rating		Description
C640	QFZ0050-104	0.1μF	100V	P.C.
C641	QFM41HK-222	0.0022μF	50V	Mylar
C642~C643	QFM41HK-103	0.01μF	"	"
C644	QFM41HK-222	0.0022μF	"	"
C645	QFM41HK-472	0.0047μF	"	"
C646	QFM41HK-154	0.15μF	"	"
C647~C648	QFM41HK-102	0.001μF	"	"
C649	QCS11HJ-471	470pF	"	Ceramic
C650~C651	QFM41HK-102	0.001μF	"	Mylar
C652~C653	QEB41HM-224	0.22μF	"	Electrolytic
C654	QCS11HJ-471	470pF	"	Ceramic
C655~C656	QFM41HK-102	0.001μF	"	Mylar
C657~C658	QEB41HM-224	0.22μF	"	Electrolytic
C659	QCS11HJ-471	470pF	"	Ceramic
C660~C661	QFM41HK-102	0.001μF	"	Mylar
C662~C663	QEB41HM-224	0.22μF	"	Electrolytic
C664	QEW41CA-476	47μF	16V	"
C665	QFM41HK-104	0.1μF	50V	Mylar
C680	QEW41CA-106	10μF	16V	Electrolytic

Resistors

Item No.	Part Number	Rating		Description
R601~R602	QRD141J-682	6.8kΩ	1/4W	Carbon
R603~R604	QRD141J-821	820Ω	"	"
R605	QRD141J-682	6.8kΩ	"	"
R606~R607	QRD141J-272	2.7kΩ	"	"
R608~R609	QRD141J-183	18kΩ	"	"
R610	QRD141J-473	47kΩ	"	"
R611	QRD141J-153	15kΩ	"	"
R612	QRD141J-473	47kΩ	"	"
R613~R616	QRD141J-562	5.6kΩ	"	"
R617	QRD141J-563	56kΩ	"	"
R618	QRD141J-222	2.2kΩ	"	"
R619~R623	QRD141J-473	47kΩ	"	"
R624	QRD141J-103	10kΩ	"	"
R625	QRD141J-682	6.8kΩ	"	"
R626	QRD141J-473	47kΩ	"	"
R627	QRD141J-222	2.2kΩ	"	"
R628~R631	QRD141J-473	47kΩ	"	"
R632	QRD141J-222	2.2kΩ	"	"
R633~R634	QRD141J-683	68kΩ	"	"
R635	QRD141J-473	47kΩ	"	"
R636	QRD141J-682	6.8kΩ	"	"
R637~R640	QRD141J-683	68kΩ	"	"
R641	QRD141J-682	6.8kΩ	"	"
R642~R643	QRD141J-683	68kΩ	"	"
R644	QRD141J-681	680Ω	"	"
R645	QRD141J-332	3.3kΩ	"	"
R648	QRD141J-473	47kΩ	"	"
R649	QRD141J-683	68kΩ	"	"
R650	QRD141J-473	47kΩ	"	"
R651	QRD141J-332	3.3kΩ	"	"

Resistors

Item No.	Part Number	Rating		Description
R652	QRD141J-103	10kΩ	1/4W	Carbon
R653	QRD141J-473	47kΩ	"	"
R654	QRD141J-682	6.8kΩ	"	"
R655	QRD141J-683	68kΩ	"	"
R656	QRD141J-682	6.8kΩ	"	"
R657	QRD141J-473	47kΩ	"	"
R658	QRD141J-563	56kΩ	"	"
R659	QRD141J-473	47kΩ	"	"
R660	QRD141J-682	6.8kΩ	"	"
R661~R664	QRD141J-103	10kΩ	"	"
R665	QRD141J-272	2.7kΩ	"	"
R666	QRD141J-154	150kΩ	"	"
R667	QRD141J-272	2.7kΩ	"	"
R668	QRD141J-273	27kΩ	"	"
R669	QRD141J-103	10kΩ	"	"
R670~R671	QRD141J-272	2.7kΩ	"	"
R672~R673	QRD141J-472	4.7kΩ	"	"
R676	QRD141J-473	47kΩ	"	"
R677	QRD141J-392	3.9kΩ	"	"
R678~R679	QRD141J-562	5.6kΩ	"	"
R680	QRD141J-102	1kΩ	"	"
R681	QRD141J-103	10kΩ	"	"
R682	QRD141J-272	2.7kΩ	"	"
R683	QRD141J-472	4.7kΩ	"	"
R684	QRD141J-153	15kΩ	"	"
R686	QRD141J-473	47kΩ	"	"
R687	QRD126J-471	470Ω	"	"
R688	QRD141J-473	47kΩ	"	"
R689	QRD126J-471	470Ω	1/2W	Uninflammable carbon
R690~R691	QRD141J-223	22kΩ	1/4W	Carbon
R692	QRD141J-333	33kΩ	1/4W	Carbon
R693	QRD126J-471	470Ω	1/2W	Uninflammable carbon
R694	QRD141J-223	22kΩ	1/4W	Carbon
R695	QRD141J-473	47kΩ	"	"
R696	QRD141J-682	6.8kΩ	"	"
R697	QRD141J-473	47kΩ	"	"
R698	QRD141J-682	6.8kΩ	"	"
R699	QRD141J-473	47kΩ	"	"
R700~R701	QRD141J-682	6.8kΩ	"	"
R702~R703	QRD141J-683	68kΩ	"	"
R704	QRD141J-153	15kΩ	"	"
R705	QRD141J-683	68kΩ	"	"
R706	QRD141J-103	10kΩ	"	"
R707	QRD141J-683	68kΩ	"	"
R708~R709	QRD141J-101	100Ω	"	"
R710~R711	QRD141J-183	18kΩ	"	"
R712~R713	QRD141J-122	1.2kΩ	"	"
R714	QRD141J-822	8.2kΩ	"	"
R715~R716	QRD141J-103	10kΩ	"	"
R717~R719	QRD141J-822	8.2kΩ	"	"
R722~R723	QRD141J-473	47kΩ	"	"
R724~R725	QRD141J-472	4.7kΩ	"	"
R726	QRD141J-101	100Ω	"	"
R727	QRD141J-473	47kΩ	"	"
R728	QRD141J-392	3.9kΩ	"	"

Resistors

Item No.	Part Number	Rating		Description
R729	QRD141J-332	3.3kΩ	1/4W	Carbon
R730	QRD141J-473	47kΩ	〃	〃
R731	QRD141J-123	12kΩ	〃	〃
R732	QRD141J-104	100kΩ	〃	〃
R733	QRD141J-103	10kΩ	〃	〃
R734	QRD141J-182	1.8kΩ	〃	〃
R736	QRX148F-6802	68kΩ	1/2W	Metal film
R737~R738	QRD141J-473	47kΩ	1/4W	Carbon
R740	QRX148F-5602	56kΩ	1/2W	Metal film
R741	QRD141J-105	1MΩ	1/4W	Carbon
R742	QRD141J-123	12kΩ	〃	〃
R743	QRD141J-562	5.6kΩ	〃	〃
R744	QRD141J-472	4.7kΩ	〃	〃
R745	QRD141J-473	47kΩ	〃	〃
R746	QRD141J-682	6.8kΩ	〃	〃
R747	QRD141J-182	1.8kΩ	〃	〃
R748~R749	QRD141J-331	330Ω	〃	〃
R750~R751	QRD141J-223	22kΩ	〃	〃
R752	QRD141J-182	1.8kΩ	〃	〃
R753	QRD141J-822	8.2kΩ	〃	〃
R754~R755	QRD141J-123	12kΩ	1/4W	Carbon
R756	QRD141J-333	33kΩ	〃	〃
R757	QRD141J-562	5.6kΩ	〃	〃
R758	QRD141J-123	12kΩ	〃	〃
R759	QRD141J-105	1MΩ	〃	〃
R760	QRD141J-103	10kΩ	〃	〃
R761	QRD141J-104	100kΩ	〃	〃
R762	QRD141J-103	10kΩ	〃	〃
R763	QRD141J-473	47kΩ	〃	〃
R764	QRD141J-562	5.6kΩ	〃	〃
R765	QRD141J-103	10kΩ	〃	〃
R766~R767	QRD141J-102	1kΩ	〃	〃
R768~R769	QRD141J-123	12kΩ	〃	〃
R770	QRD141J-151	150Ω	〃	〃
R771~R772	QRG017J-122	1.2kΩ	1W	Oxide metal
R773	QRD141J-3R3	3.3Ω	1/4W	Carbon
R774~R775	QRD141J-562	5.6kΩ	〃	〃
R776	QRD141J-681	680Ω	〃	〃
R778	QRD141J-681	〃	〃	〃
R780	QRD141J-103	10kΩ	〃	〃
R781	QRD141J-681	680Ω	1/4W	Carbon
R782	QRD126J-122	1.2kΩ	1/2W	Uninflammable carbon
R783	QRD141J-101	100Ω	1/4W	Carbon
R785	QRD141J-101	〃	〃	〃
R786	QRD141J-223	22kΩ	〃	〃
R787	QRX026J-100	10Ω	2W	Uninflammable M.F.
R788	QRD141J-681	680Ω	1/4W	Carbon
R790	QRD141J-681	〃	〃	〃
R792	QRD141J-103	10kΩ	〃	〃
R793	QRD141J-681	680Ω	〃	〃
R794	QRD126J-122	1.2kΩ	1/2W	Uninflammable carbon
R795	QRD141J-101	100Ω	1/4W	Carbon
R797	QRD141J-101	〃	〃	〃
R798	QRD141J-223	22kΩ	〃	〃
R799	QRX026J-100	10Ω	1/2W	Uninflammable M.F.

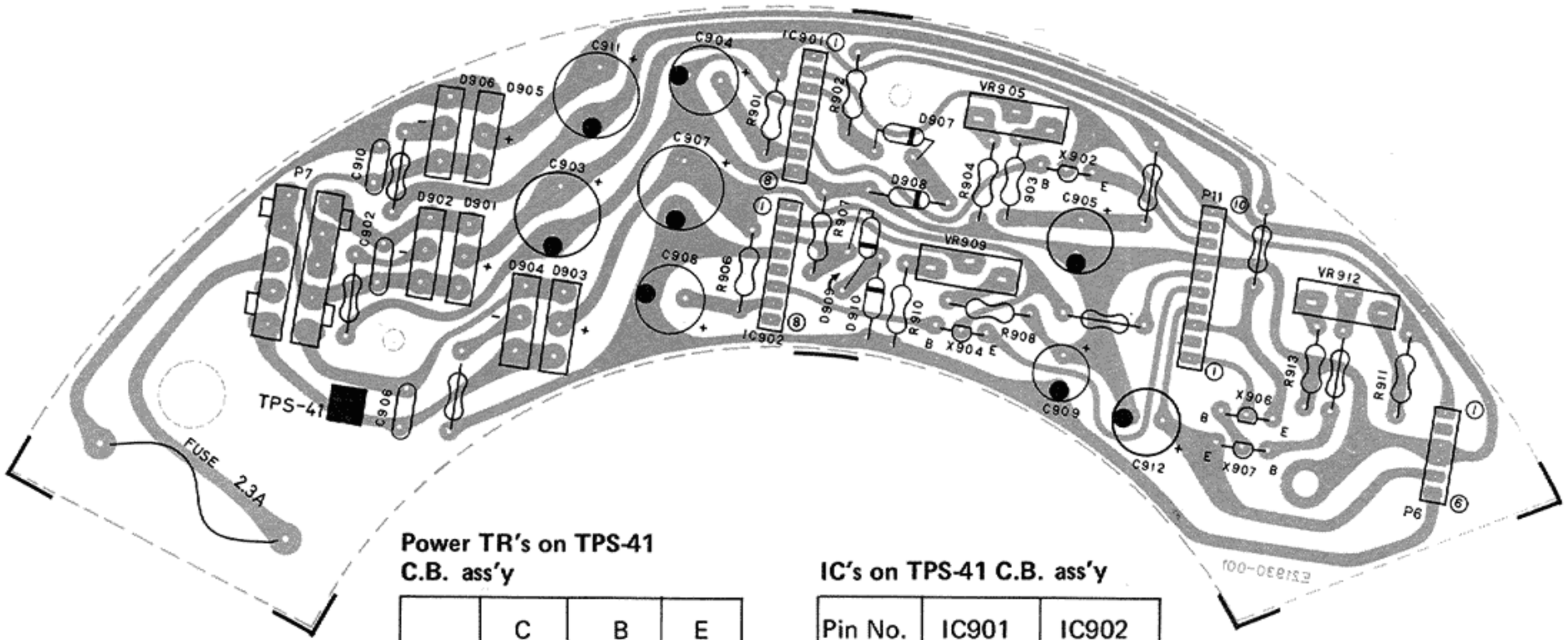
Resistors

Item No.	Part Number	Rating		Description
R800	QRD141J-681	680Ω	1/4W	Carbon
R802	QRD141J-681	〃	〃	〃
R804	QRD141J-103	10kΩ	〃	〃
R805	QRD141J-681	680Ω	〃	〃
R806	QRD126J-122	1.2kΩ	1/2W	Uninflammable carbon
R807	QRD141J-101	100Ω	1/4W	Carbon
R809	QRD141J-561	560Ω	〃	〃
R810	QRD141J-223	22kΩ	〃	〃
R811	QRX026J-100	10Ω	2W	Uninflammable M.F.
R812	QRD141J-152	1.5kΩ	1/4W	Carbon
R813	QRD141J-563	56kΩ	〃	〃
R814	QRD141J-123	12kΩ	〃	〃
R815	QRD141J-153	15kΩ	〃	〃
R816	QRD141J-223	22kΩ	〃	〃
R817	QRD141J-123	12kΩ	〃	〃
R818	QRD141J-183	18kΩ	〃	〃
R819~R820	QRD141J-102	1kΩ	〃	〃
R821	QRD141J-183	18kΩ	〃	〃
R822~R823	QRD141J-331	330Ω	〃	〃
R824~R827	QRD141J-473	47kΩ	〃	〃
R828	QRD141J-682	6.8kΩ	〃	〃
R829	QRD141J-103	10kΩ	〃	〃
R830~R831	QRD141J-473	47kΩ	〃	〃
R832	QRD141J-682	6.8kΩ	〃	〃
R833	QRD141J-473	47kΩ	〃	〃
R834	QRD141J-332	3.2kΩ	〃	〃
R835	QRD141J-472	4.7kΩ	〃	〃
R836~R838	QRD141J-103	10kΩ	〃	〃
R839	QRD141J-392	3.9kΩ	〃	〃
R840	QRD141J-562	5.6kΩ	〃	〃
R841~R842	QRD141J-473	47kΩ	〃	〃
R646	QVP8AOB-015	100kΩ		Variable (carbon)
R685	QVP8AOB-014	10kΩ		〃
R735	QVZ3501-473	43kΩ		Variable (metal film)
R739	QVZ3501-223	22kΩ		〃
R777	QVP8AOB-013	1kΩ		Variable (carbon)
R779	QVP8AOB-015	100kΩ		〃
R784	QVP8AOB-013	1kΩ		〃
R789	QVP8AOB-013	〃		〃
R791	QVP8AOB-015	100kΩ		〃
R796	QVP8AOB-013	1kΩ		〃
R801	QVP8AOB-013	〃		〃
R803	QVP8AOB-015	100kΩ		〃

Others

Item No.	Part Number	Rating	Description
	E60686-001		Heat sink
	A41096		Tab
	E43727-002		〃
P9	E03686-007A		7 pins plug
P8	E03686-009A		9 pins plug
P10	E03686-018A		18 pins plug
J1	E03681-0503		Socket wire
J4	E03681-0504		〃
J6	E03681-0602		〃
	E33754-002		Tie band
	E10046-002		Printed wiring board

10-(6) TPS-41B Power Supply P.C.Board Ass'y



Power TR's on TPS-41 C.B. ass'y

	C	B	E
X901	20.5	12.6	12
X902	20.5	13.2	12.6
X903	-8.5	-0.6	0
X904	-8.5	-1.2	-0.6
X905	10	5.6	5
X906	5.6	9.4	10
X907	9.4	5.6	5

Note: Voltage and rise time at normal speed changes slightly.

IC's on TPS-41 C.B. ass'y

Pin No.	IC901	IC902
1	—	—
2	6.6	-5.4
3	6.6	-5.4
4	0	-12
5	—	—
6	11.8	-1.2
7	19.0	-1.5

Note: At normal speed.

Transistors

Item No.	Part Number	Rating		Description	Maker
		Pc	fT		
X902	2SD438(D, E)	750mW	100MHz	Silicon	Sanyo-Denki
X904	2SD438(D, E)	"	"	"	"
X906	2SA628(E)	200mW	150MHz	"	Mitsubishi
X907	2SC711A(E)	"	"	"	"

Integrated Circuits

Item No.	Part Number	Rating	Description	Maker
IC901~IC902	M51802L	50mW	I.C.	Mitsubishi

Diodes

Item No.	Part Number	Rating	Description	Maker
D901	ESAB02-02C		Silicon	Fuji-Denki
D902	ESAB02-02N		"	"
D903	ESAB02-02C		"	"
D904	ESAB02-02N		"	"
D905	ESAB02-02C		"	"
D906	ESAB02-02N		"	"
D907	VD1121		Varistor	Nihon-Denki
D908	RD6.2EB		Zener	"
D909	VD1121		Varistor	"
D910	RD6.2EB		Zener	"

Capacitors

Item No.	Part Number	Rating		Description
C902	QFM41HK-223	0.022μF	50V	Mylar
C903	QEW41EA-228	2200μF	25V	Electrolytic
C904	QEW41EA-227	220μF	"	"
C905	QEW41CA-107	100μF	16V	"
C906	QFM41HK-223	0.022μF	50V	Mylar
C907	QEW41EA-228	2200μF	25V	Electrolytic
C908	QEW41EA-227	220μF	"	"
C909	QEW41CA-107	100μF	16V	"
C910	QFM41HK-223	0.022μF	50V	Mylar
C911	QEW41EA-228	2200μF	25V	Electrolytic
C912	QEW41CA-107	100μF	16V	"

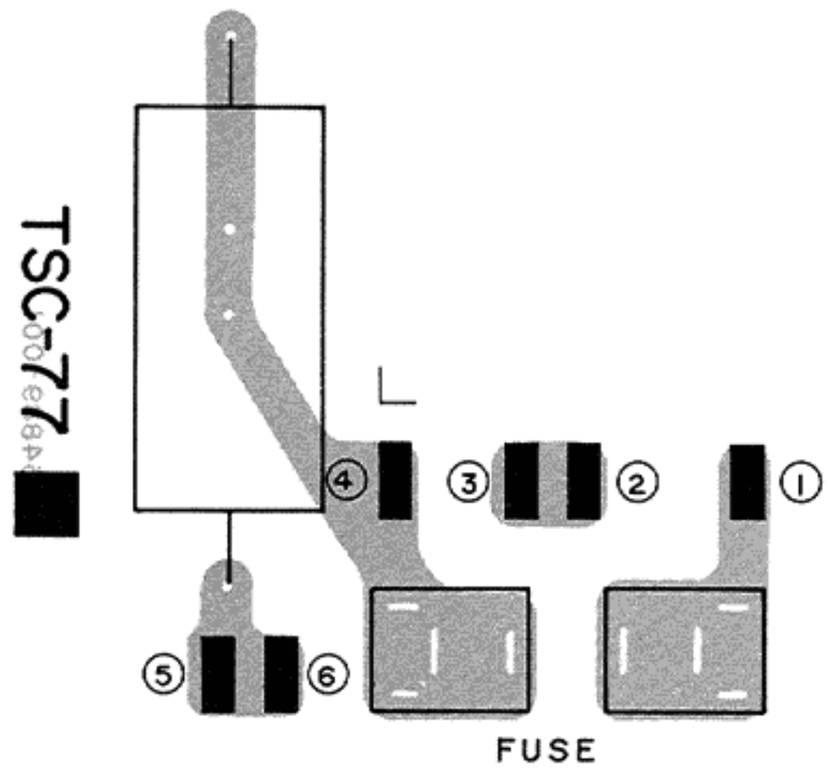
Resistors

Item No.	Part Number	Rating		Description
R901	QRD141J-331	330Ω	1/4W	Carbon
R902	QRD141J-102	1kΩ	"	"
R903	QRD141J-182	1.8kΩ	"	"
R904	QRD141J-222	2.2kΩ	"	"
R905	QVP2AOB-052	500Ω		Variable (carbon)
R906	QRD141J-331	330Ω	1/4W	Carbon
R907	QRD141J-102	1kΩ	"	"
R908	QRD141J-182	1.8kΩ	"	"
R909	QVP2AOB-052	500Ω		Variable (carbon)
R910	QRD141J-222	2.2kΩ	1/4W	Carbon
R911	QRD141J-272	2.7kΩ	"	"
R912	QVP2AOB-052	500Ω		Variable (carbon)
R913	QRD141J-222	2.2kΩ	1/4W	Carbon

Others

Item No.	Part Number	Rating	Description	Maker
P6	E03686-006A		6 pins plug	
P7	E03628-5		5 pins plug	
P11	E03686-010A		10 pins plug	
	E21930-002		Printed wiring board	

10-(7) TSC-77 AC Fuse P.C.Board Ass'y



TSC-77A (For U.S.A.)

Capacitor

Item No.	Part Number	Rating		Description
	QFH72BM-473	0.047μF	125V	Capacitor

Others

Item No.	Part Number	Rating	Description
	E34889-001 E40130 E45524-001		Printed wiring board Tab Fuse clip

TSC-77B (For PACEX and Other Countries)

Capacitor

Item No.	Part Number	Rating		Description
	QFH53AM-473M	0.047μF	450V	Capacitor

Others

Item No.	Part Number	Rating	Description
	E34889-001 E40130 E45524-001		Printed wiring board Tab Fuse clip

TSC-77C (For U.K. and Australia)

Capacitor

Item No.	Part Number	Rating		Description
	QFZ9007-473	0.047μF	450V	Cap

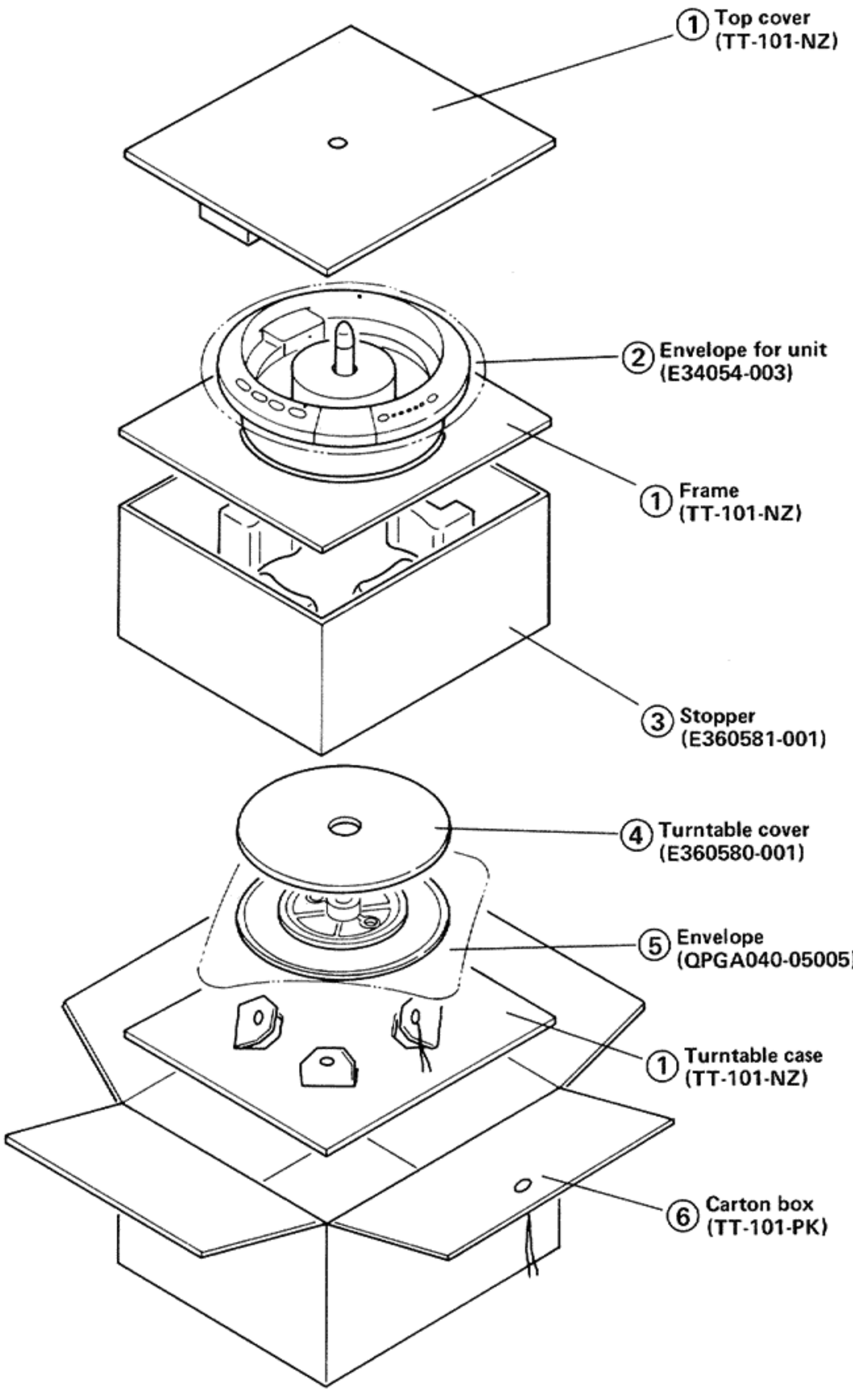
Others

Item No.	Part Number	Rating	Description
	E34889-001 E40130 E48965-002		Printed wiring board Tab Fuse clip

11. Accessories List

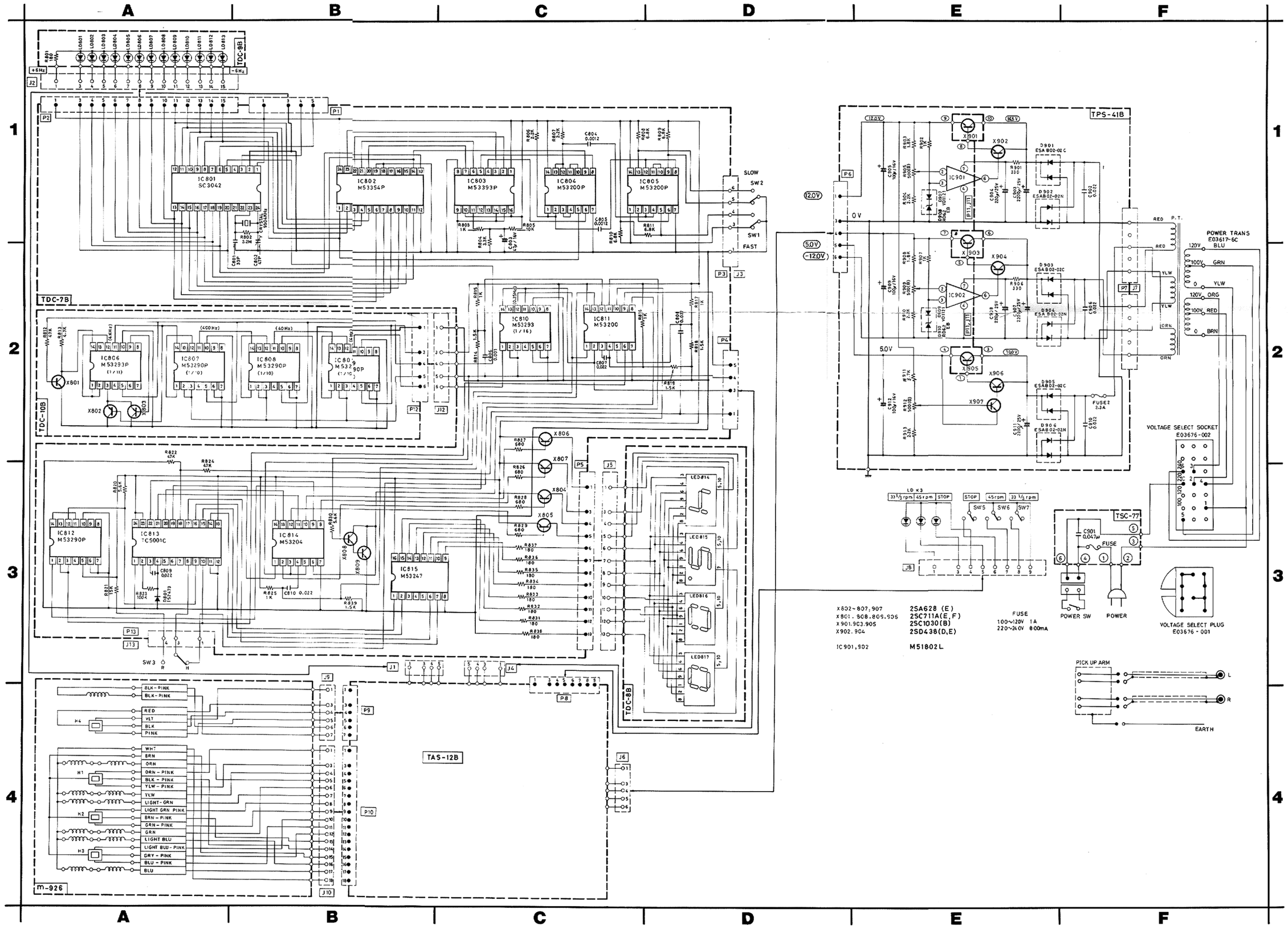
Parts Number	Parts Name	Remarks	Q'ty
E60259-002	Overhang indicator		1
SPSP6075Z	Screw		3
NTS6000Z	Nut		3
WNS6000Z	Washer		3
E22295-001	Dimension digram		1
E61315-001	EP adapter		1
Refer to Table 2 on page 54	Instruction book		1
QPGA010-01503	Envelope	(For fixing screws)	1
QPGA010-01503	"	(For EP adapter)	1
E64207-001	"	(For accessories)	1
Refer to Table 2 on page 54	Warranty card		1

12. Packing Materials and Part Numbers



Item No.	Parts Number	Description
2	E34054-003	Nylon cover
5	QPGA040-05005	Envelope
6	TT-101-PK	Packing
1	TT-101-NZ	Frame set

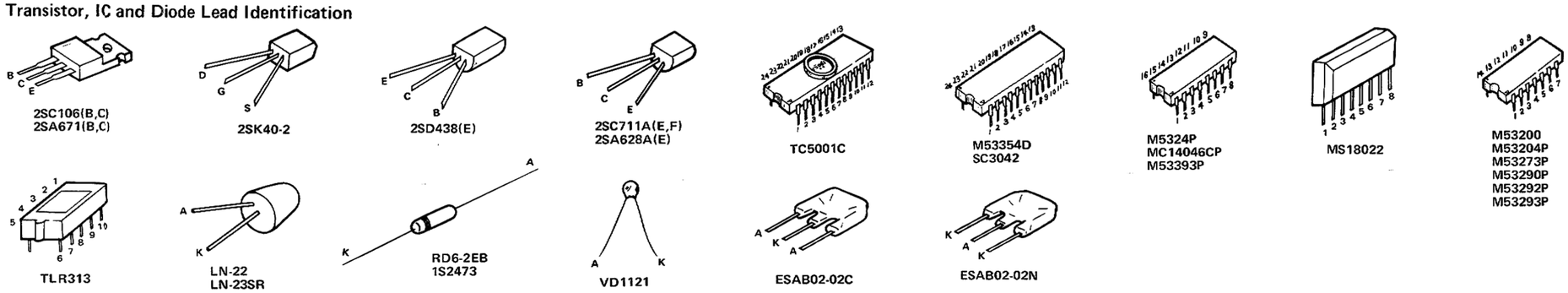
13. TT-101 Schematic Diagram



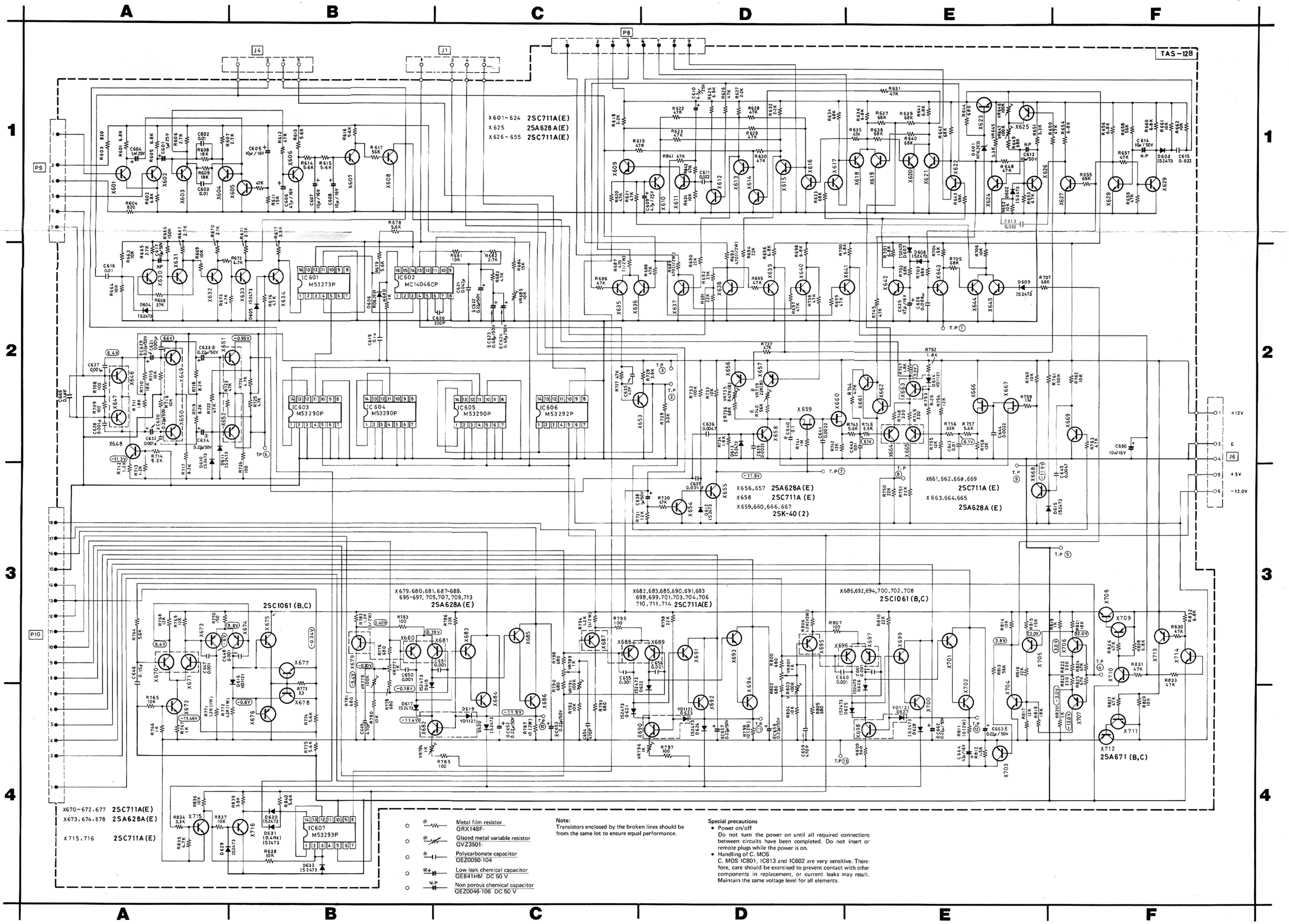
Circuit Board Ass'y Locations

C.B. Ass'y	Description	Page
TDC-7B	Crystal P.C. Board Ass'y	31
TDC-8B	LED Speed Counter P.C. Board Ass'y	34
TDC-9B	LED Indication P.C. Board Ass'y	35
TDC-10B	Frequency Divider P.C. Board Ass'y	36
TAS-12B	Servo Control P.C. Board Ass'y	37
TPS-41B	Power Supply P.C. Board Ass'y	47
TSC-77	AC Fuse P.C. Board Ass'y	49

Transistor, IC and Diode Lead Identification



TAS-12B Schematic Diagram



Metal film resistor QRX148F-

Glazed metal variable resistor QVZ3501-

Polycarbonate capacitor QEZ0050-104

Low leak chemical capacitor QEB41HM DC 50 V

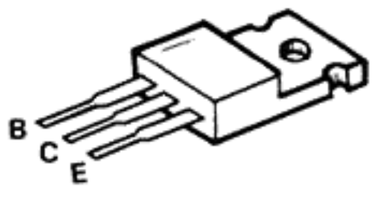
Non porous chemical capacitor QEZ0046-106 DC 50 V

Note:
Transistors enclosed by the broken lines should be from the same lot to ensure equal performance.

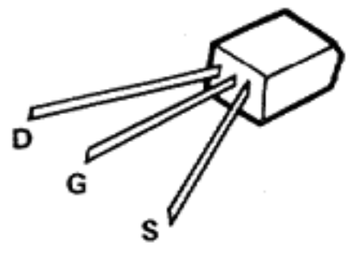
Special precautions

- Power on/off
  Do not turn the power on until all required connections between circuits have been completed. Do not insert or remote plugs while the power is on.
- Handling of C. MOS
  C. MOS IC801, IC813 and IC602 are very sensitive. Therefore, care should be exercised to prevent contact with other components in replacement, or current leaks may result. Maintain the same voltage level for all elements.

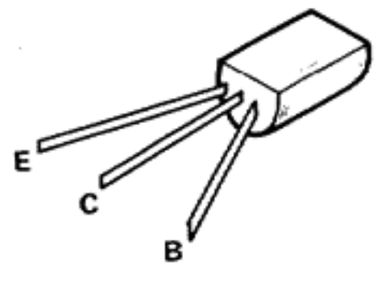
14. Transistor, Diode and I.C. Lead Identification



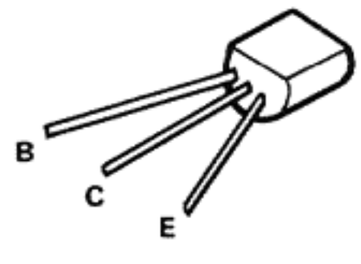
2SC1061(B,C)
2SA671(B,C)



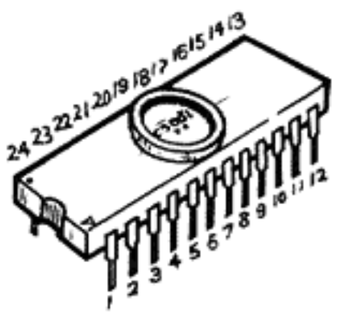
2SK40-2



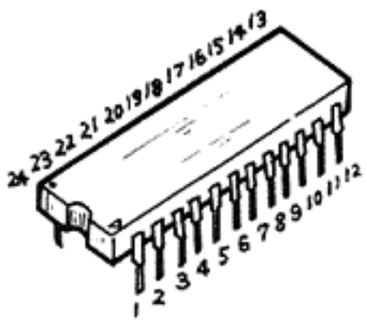
2SD438(E)



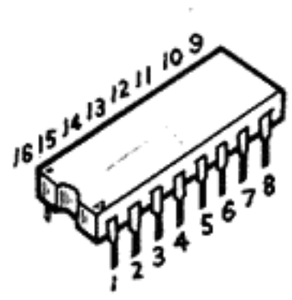
2SC711A(E,F)
2SA628A(E)



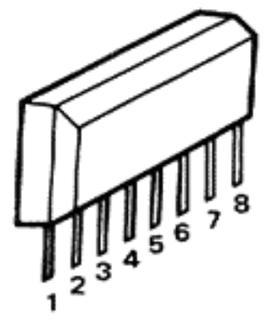
TC5001C



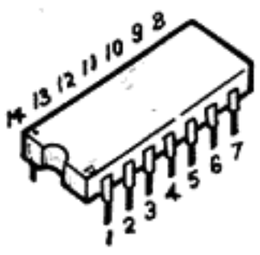
M53354D
SC3042



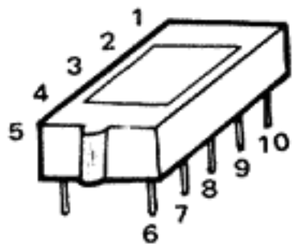
M53247P
MC14046CP
M53393P



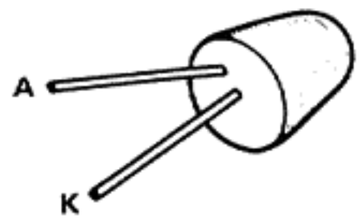
MS18022



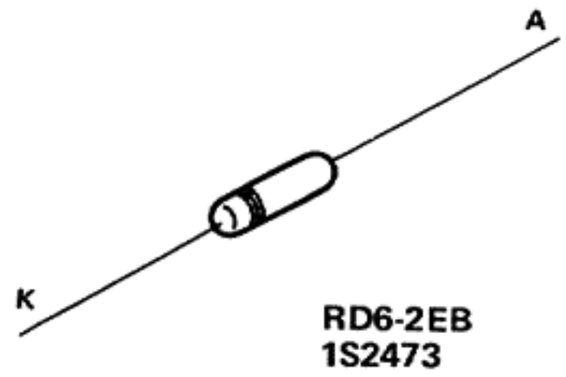
M53200
M53204P
M53273P
M53290P
M53292P
M53293P



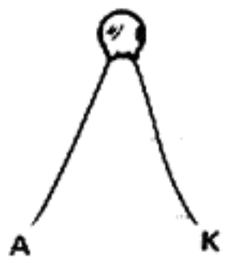
TLR313



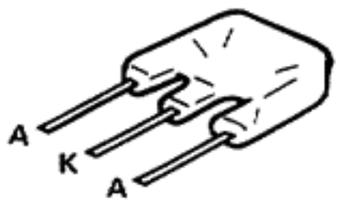
LN-22
LN-23SR



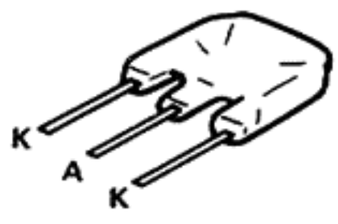
RD6-2EB
1S2473



VD1121



ESAB02-02C



ESAB02-02N

15. Parts List with Specified Numers for Designated Areas

Table 1

Item No.	Parts Name	For U.S.A.	For Europe	For U.K. and Australia	For PACEX and Other Countries
3	Cord Stopper	QHS3876-162	QHS3876-162	QHS3876-162	QHS3876-162
10	Fuse	QMF61U1-1RO	QMF51A2-R80	QMF51A2-R80	QMF61U1-1RO (For AC 100 V & AC 120 V) QMF61U2-R80 (For AC 220 V & AC 240 V)
11	Power Cord	QMP1200-244	E03544-001 QMP3800-240 (Switzerland)	QMP9017-007 (U.K.) QMP2500-200 (Australia)	QMP1200-244
86	Circuit Board Ass'y	TSC-77A	TSC-77C	TSC-77C	TSC-77B

Table 2

Item No.	Parts Name	U.S.A.	Europe	U.K. and Australia	PACEX and Other Countries
	Instruction	E30580-567A	E30580-567A E30580-568A E30580-569A	E30580-567A	E30580-567A
	Warranty Card	BT20020C	Not enclosed	BT20013 (U.K.) BT20029 (Australia)	BT20014

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