# SERVICE MANUAL

## AKAI TAPE RECORDER

## MODEL X-355

ALSO APPLICABLE FOR MODEL X-355D

## TABLE OF CONTENTS

# I. SPECIFICATION

Style : Portable
Weight : 62.7 lbs. (28.5 kg)
Dimensions : 17-3/8"(H)×16"(W)×12-1/8"(D) (440(H)×407 (W) ×310 (D) m/m overall, case closed.
Power Supply : 100, 110, 117, 120, 125, 130, 140 / 200, 210, 217, 220, 225, 230, 240 V.A.C. (Interchangeable)
Recording System: In-line 4 track stereo, monaural recording by using Cross-field bias head.
Tape Speed : 2 speeds: 7-½ ips (19cm/s), 3-¾ ips. (9.5cm/s) by using adaptor 15 ips (38cm/s) available.
Tape Speed Deviation : Within ±0.5% at 7-½ ips.
Within ±1.0% at 3-¾ ips.
Wow and Flutter: Less than 0.08% R.M.S. at 7-½ ips. (at normal play)
Less than 0.12% R.M.S. at 7-½ ips. (at reverse play)
Less than 0.14% R.M.S. at 3-¾ ips. (at normal play)
Less than 0.15% R.M.S. at 3-¾ ips. (at reverse play)
Fast Forward and Rewind Time : 45 seconds for either operation using a 1,200 feet recording tape at 50 cycles. 36 seconds at 60 cycles.
Frequency Response: 30 to 24,000 cps ± 3 db at 7-½ ips.
30 to 18,000 cps ± 3 db at 3-¾ ips.
Signal to Noise Ratio: Better than 45 db at normal play (7-½ ips, 3-¾ ips).
Better than 43 db at reverse play (7-½ ips, 3-¾ ips).
Distortion (total harmonics) : Within 3% at 1,000 c/s 0 VU (line output)
Within 5% at 1,000 c/s 0 VU (speaker output at 10 watts (8 Ω))

OUTPUT
Pre-amplifier Output : 1,228 V (0 VU) at using 1,000 c/s 0 VU recorded tape. Impedance 1.5 kΩ.
Main Output (speaker output) : 20 watts at undistorted power output on each channel. Impedance 8 Ω.

INPUT
Line Input : More than 50 mV. Impedance 100 kΩ.
Microphone Input : More than 0.5 mV. Impedance 4 kΩ.
Cross-talk : Less than −80 db (Monaural)
Less than −45 db (Stereo)
Erase Ratio : Less than −70 db for all tracks.
Insulation Resistance : More than 10 MΩ
Insulation Durability : 1,000 V.AC. for more than one minute duration.
Monitor System (in recording) : With record output button at "IN":
Can be monitored the program being recorded by using
- built-in speaker
- stereo headphone
- external speakers
- crystal receiver

With playback output button at "IN":
Can be monitored the recorded signals from the playback head by using
- built-in speaker
- stereo headphone
- external speakers
- crystal receiver

Main Motor : Condenser starting, hysteresis synchronous 2 speeds (4-8 pole) motor.
Condenser capacity 3 μF (50 c/s)
2.5 μF (60 c/s)
More than 1/100 HP
Power factor 70%
Revolution 1,500-750 R.P.M. (50 c/s)
1,800-900 R.P.M. (60 c/s)
Torque Motor : Condenser starting induction motor.
Condenser capacity 3 μF
More than 1/100 HP
Power factor 70%
Revolution 1,450 R.P.M. (50 c/s)
1,740 R.P.M. (60 c/s)

Heads
Recording Head: Inline 4 track stereo and monaural.
Impedance: 135 Ω at 1,000 c/s
Gap: 4 microns
Playback Head : Inline 4 track stereo and monaural.
Impedance: 1,000 Ω at 1,000 c/s
Gap: 2 microns
Erase Head : Inline 4 track stereo.
Impedance: 750 Ω at 90kc.
Gap: 0.2 mm
Cross-Field Bias Head: Inline 4 track stereo.
Impedance: 750 Ω at 90kc.
Gap: 0.2 mm
Record Level Indicator : Vertical indication model "A" VU meter.
Internal Speakers: 6-½" round wide range dynamic speaker.
Impedance: 8Ω
Nominal power input: 4W
Maximum power input: 6W
Frequency response: 50-10,000 ±10db.
Transistor Used : 2SB443Ⓐ× 4, 2SB75Ⓕ × 2, 2SB75Ⓑ ×10 } Pre-amplifier
2SB75Ⓐ ×2, 2SB370AⒶ×2, 2SB338Ⓐ ×4 } Main amplifier
2SB370AⒷ×2 Oscillator
Selenium Used : SPN-01×2 Bridged selenium rectifier
12C-2×1 Center top selenium rectifier
Siliconc Diode Used : SE-05a×1
SL-150×1
SW05-a×1
Reels Used : With adaptor, reels up to 10-½" can be used.

# II. MEASURING METHOD

## TAPE SPEED DEVIATION

1. Method involving use of pre-recorded tape.
   Playback on the tape recorder to be tested tape pre-recorded at 1,000 cps ±0.1% for measuring tape speed deviation. Connect the appropriate output to a frequency counter meter in order to measure the tape speed deviation from the resulting deviation of the measured frequency.
2. Method involving use of timing tape (designed for tape speed measurement).
   This method utilizes a timing tape marked at intervals of 7-½". The running time of the tape over 60 marked section is measured in order to calculate the deviation of the tape speed. In application of this method, however, it should be borne in mind that should the timing tape stretch or contract, measurement error is inevitable, so that it is necessary to measure the total length of the tape in advance.

## WOW AND FLUTTER

Playback the 3,000 cps pre-recorded tape whose wow and flutter level is guaranteed to be smaller than 0.07% for measurement by means of a wow meter. It is also possible for a 3,000 cps sine wave to be recorded and played for measurement by means of the wow meter. In this case, however, the wow meter indicates a value as much as twice the value given in the specifications on the first page.

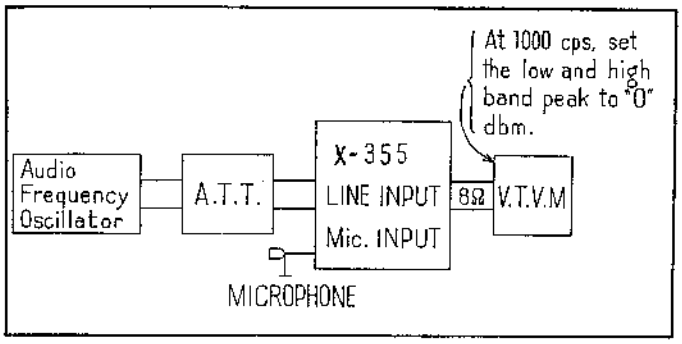
## FREQUENCY RESPONSE

RECORD:

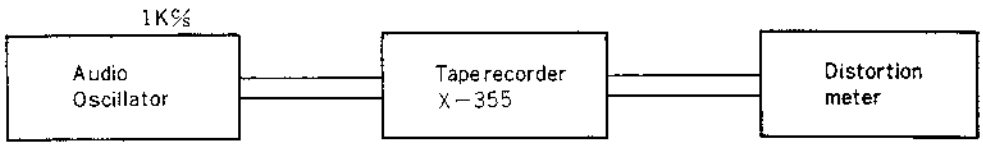
1) Give a sine wave of 1,000 c/s to the Line Input of the recorder to be tested through an attenuator from an audio frequency generator.
2) Push the "Record Output Button" and adjust the line input volume so that the VU meter needle indicates "0" VU.
3) Under the condition described in (2), lower the input level 16 db by means of the attenuator.
4) Connect a microphone to the Microphone Input.
5) Start recording. Control the microphone input level and the spot frequency in the range of 30 cps to 25,000 cps from the audio frequency generator and record by talking.
   ★ Remarks: After announcing the frequency of each point, the microphone volume should immediately be rotated back to minimum.

PLAYBACK:

6) Place the "Record Output Button" in the OUT position and push the "Playback Button"
7) Set the Equalizer Switch on 7-½" or 3-¾" position.
8) Set the Tone Switch on "Flat" position.
9) Terminate "External Speaker Output" of the recorder with 8 Ω resistor and connect a Vacuum Tube Volt Meter (V.T.V.M with milli volts scale).
10) Playback the tape previously recorded.
11) Adjust the output level to "0" dbm at "1,000 c/s" as indicated on the V.T.V.M. by adjusting the loudness volume.
12) Playback the recorded spot frequencies with the conditions in (11); make a memo of output level and plot the value on a graph.



## TOTAL HARMONIC DISTORTION FACTOR




Connect the measuring instrument as shown above, and record the 1,000 cps sine wave at "0" VU. Playback the resultant signal and measure the overall distortion factor. Measure the noise level of the tape recorder with the tape removed; connect the audio oscillator directly to the distortion meter for measurement of the distortion factor of the oscillator.

The required distortion factor may be obtained from the results of the above measurement by the following formula:

$$d_0 = d - d_1 - d_2$$

where, $d_0$ = Required
$d$ = Overall distortion factor
$d_1$ = Noise level
$d_2$ = Distortion factor of the oscillator

(Note: New tape of particularly good quality should be used for measurement of the distortion factor).

## SIGNAL TO NOISE RATIO

Set the Tone Switch on "Flat" position and playback a tape containing a 1,000 cps sine wave recorded at "0" VU level on a standard recorder. Connect an 8 Ω resistor to the output terminals of the recorder and measure its output. Then remove the tape and measure the noise level under the same conditions. Convert into decibels each of the measured values.

## POWER OUTPUT

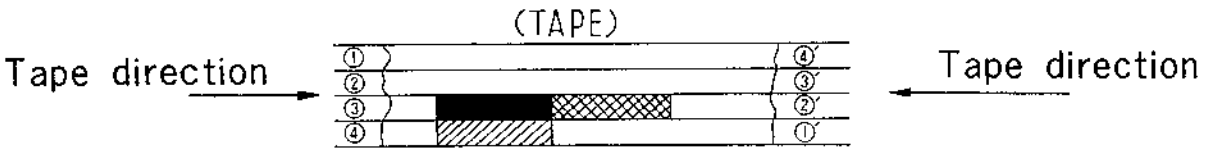
Playback a tape containing a sine wave of 1,000 cps recorded at 0 VU on a standard recorder. Measure the voltage at the output of the recorder to be tested when terminated with 8 Ω.

Then use the following formula:

$$P = \frac{E^2}{R}$$

$P$ = Desired output (W)
$E$ = Measured voltage (R.M.S.)
$R$ = 8 Ω

## CROSS TALK (Cross talk between the tracks)



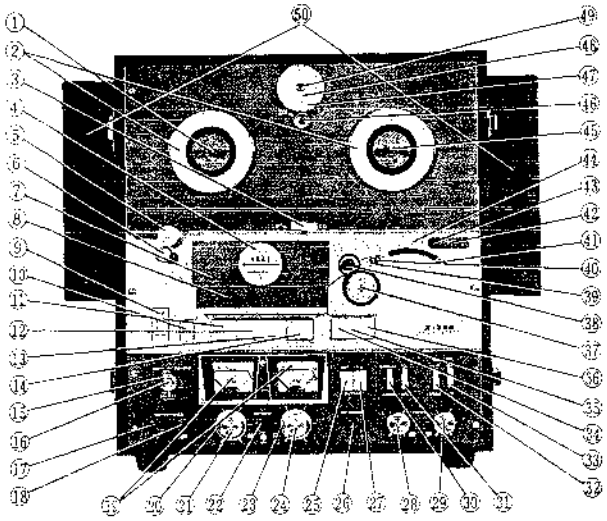

As shown in the figure, first record a 1,000 cps sine wave on track No. 3 at +3 VU level. Next, remove the 1,000 cps input signal and record under a non-input condition.

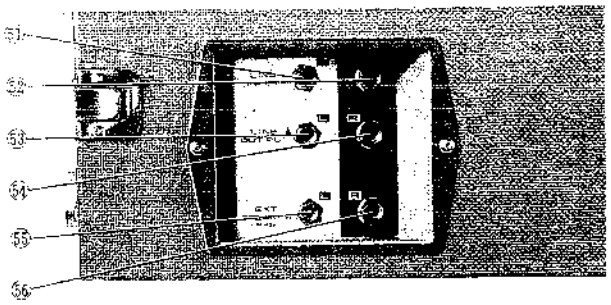
Then, playback the tape on track No. 3 and No. 1 (reversed condition of tape) through the 1,000 cps B.P.F. (Band Pass Filter, Sensitivity....1 : 1) and obtain a ratio between the two from the following formula.

$$C = 20 \log \frac{E_0}{E_2 - E_1} \text{(db)}$$

$C$ = Desired cross talk ratio (db)
$E_0$ = 1,000 cps signal output level
$E_2$ = 1,000 cps cross talk output level
$E_1$ = No-input signal record level

# III. CONTROL LOCATION

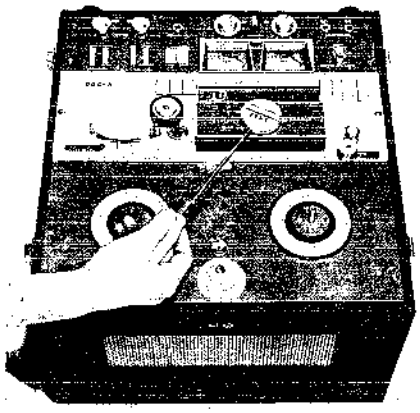




① Supply Reel Shaft
② Guard Circle
③ Speed Change Switch
④ Track Selector Knob
⑤ Tape Guide
⑥ Tape Guide Roller
⑦ Head Cover, A
⑧ Head Cover, B
⑨ Remote Control Socket
⑩ Power Button
⑪ Stop Button
⑫ Rewind Button
⑬ Play Button
⑭ Fast-Forward Button
⑮ Record Safety Lock
⑯ Record Safety Button
⑰ Microphone Jack (Left)
⑱ Microphone Jack (Right)
⑲ VU Meter
⑳ Line Volume Control (Left)
㉑ Microphone Volume Control (Left)
㉒ Recording Lamp
㉓ Line Volume Control (Right)
㉔ Microphone Volume Control (Right)
㉕ Record Output Button
㉖ Stereo Headphone Jack
㉗ Playback Output Button
㉘ Volume Control (Left)
㉙ Volume Control (Right)
㉚ Function Switch
㉛ Equalizer Switch
㉜ Tone Switch
㉝ Speaker ON/OFF Switch
㉞ Repeat Button
㉟ Reverse Button
㊱ Shut-Off Button
㊲ Pinch Wheel
㊳ Capstan Shaft
㊴ Auto. Reverse Pin (L)
㊵ Auto. Reverse Pin (R)
㊶ Tension Arm
㊷ Index Counter
㊸ Reset Button
㊹ Tape Holder
㊺ Take-up Reel Shaft
㊻ Dial Off Button
㊼ Auto. Tape Count Meter
㊽ Set Dial
㊾ Manual Reverse Button
㊿ Reflector
(51) Line Input Jack (Left)
(52) Line Input Jack (Right)
(53) Line Output Jack (Left)
(54) Line Output Jack (Right)
(55) Ext. Speaker Jack (Left)
(56) Ext. Speaker Jack (Right)

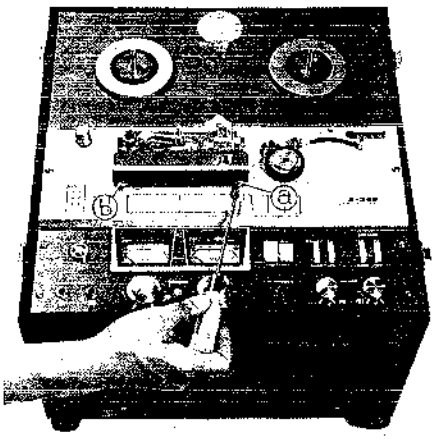
# IV. PROCEDURE FOR REMOVAL

(1) Loosen the RETAINING SCREW of TRACK SELECTOR KNOB by using a Phillips-headed screw driver (3 millimeters in diameter) and remove the TRACK SELECTOR KNOB by hand.

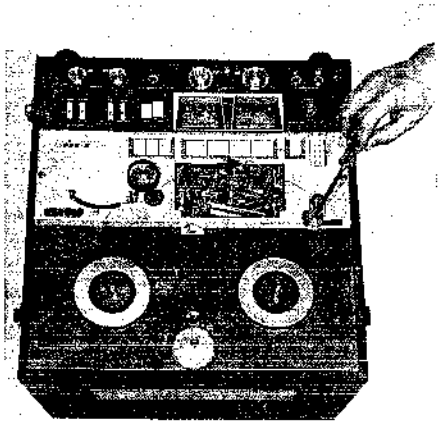


(2) Loosen the RETAINING SCREWS (marked (a) and (b)) of the HEAD COVER (A) by using the same screw driver and remove the HEAD COVER (A) by hand.

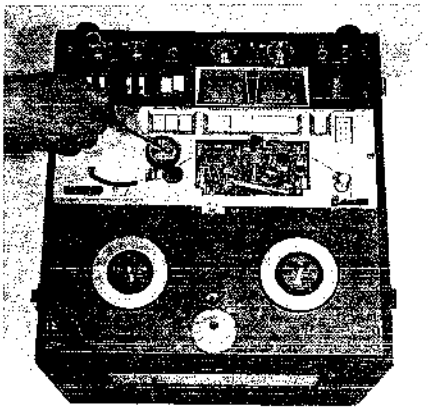

(3) Loosen the RETAINING SCREWS (marked (a) and (b)) of the HEAD COVER (B) and remove the HEAD COVER (B) in the same manner.



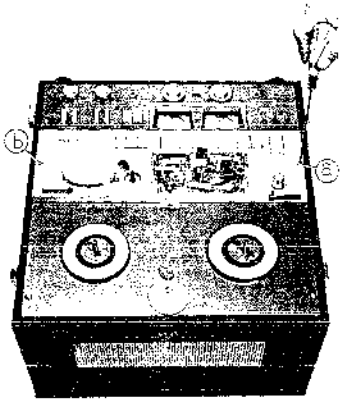

(4) Loosen the RETAINING SCREW of the TAPE GUIDE by using a larger (4 millimeters in diameter) Phillips-headed screw driver and remove the TAPE GUIDE by hand.



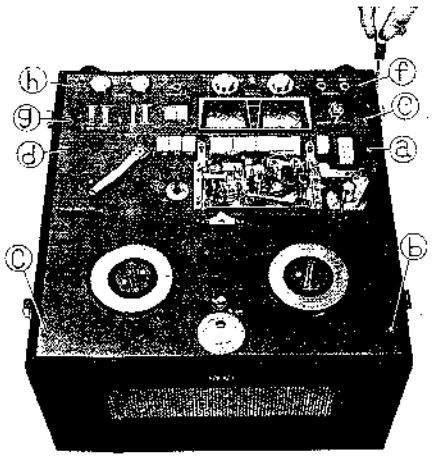
(5) Loosen the RETAINING SCREW of the PINCH WHEEL by using the same screw driver and remove the PINCH WHEEL by hand.



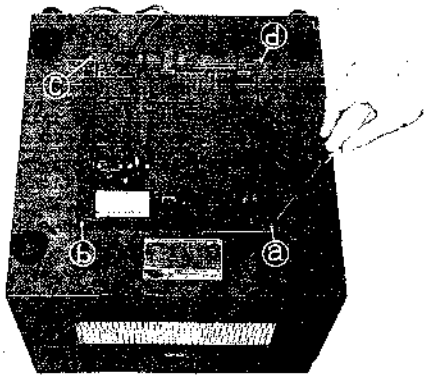
(6) Loosen the RETAINING SCREWS (marked (a) and (b)) of the FRONT PANEL by using the same screw driver and remove the FRONT PANEL by hand. In this case, set the SHAFT of the TAPE GUIDE on the left of the FRONT PANEL.



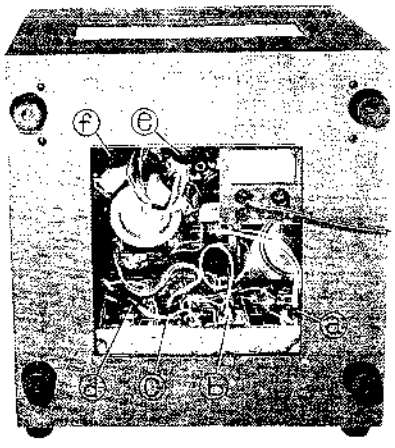

(7) Loosen the SCREWS marked from (a) to (h) by using the same screw driver.



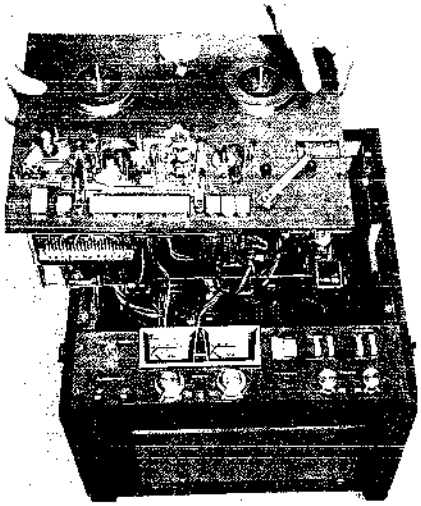

(8) Loosen the RETAINING SCREWS (marked from (a) to (d)) of the VENTILATOR by using the same screw driver and remove the VENTILATOR by hand.



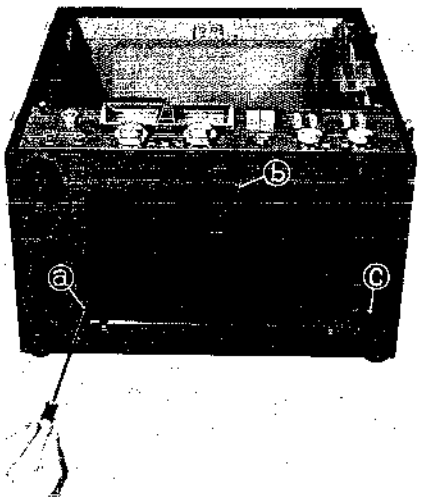

(9) Remove the PLUGS marked (a) to (f) carefully by hand.



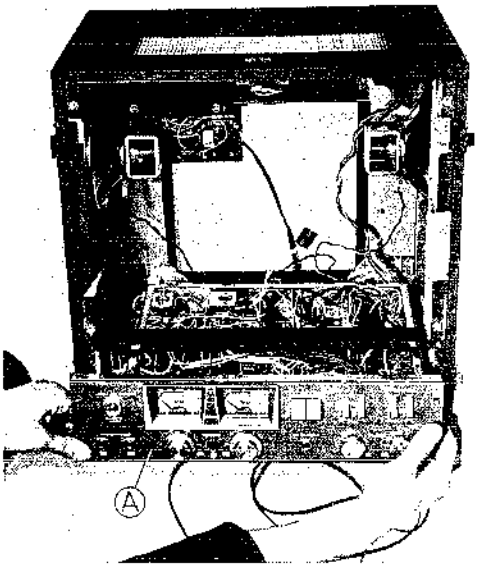
(10) Remove the TAPE TRANSPORT MECHANISM ASSEMBLY (M) by slowly lifting it from the case as shown in picture.



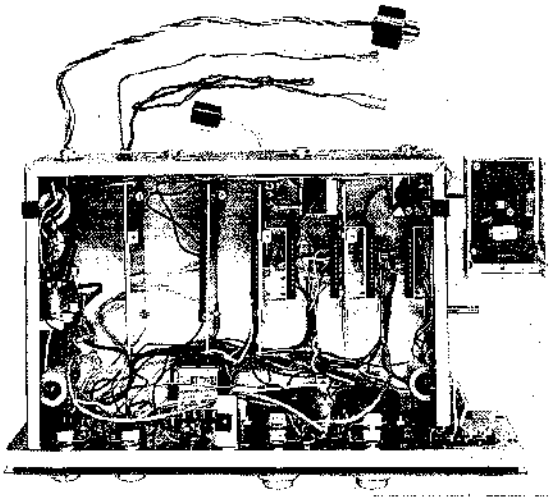
(11) Loosen the RETAINING SCREWS (marked (a) to (c)) of the AMPLIFIER SHEATHING by using the same screw driver.

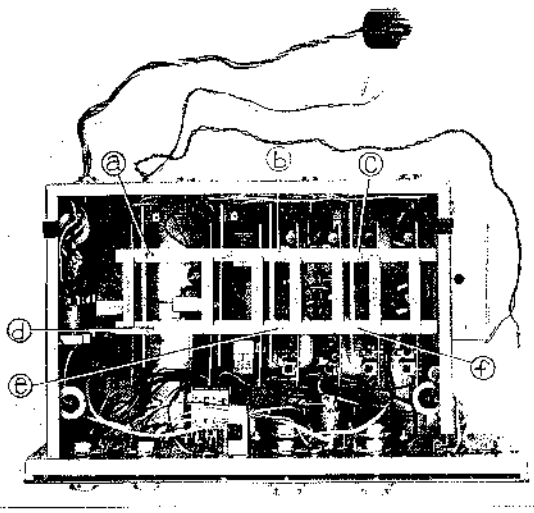



(12) Disconnect the SPEAKER TIPS (marked (a) to (b)) and remove the AMPLIFIER ASSEMBLY (A) from the case by hand.




(13), (14) Loosen the RETAINING SCREWS (marked from (a) to (f)) by using a smaller (4millimeters in diameter) Phillips-faded screw driver and remove the CARDS of MAIN AMPLIFIER, PLAYBACK, RECORD and RELAY BLOCK by hand.

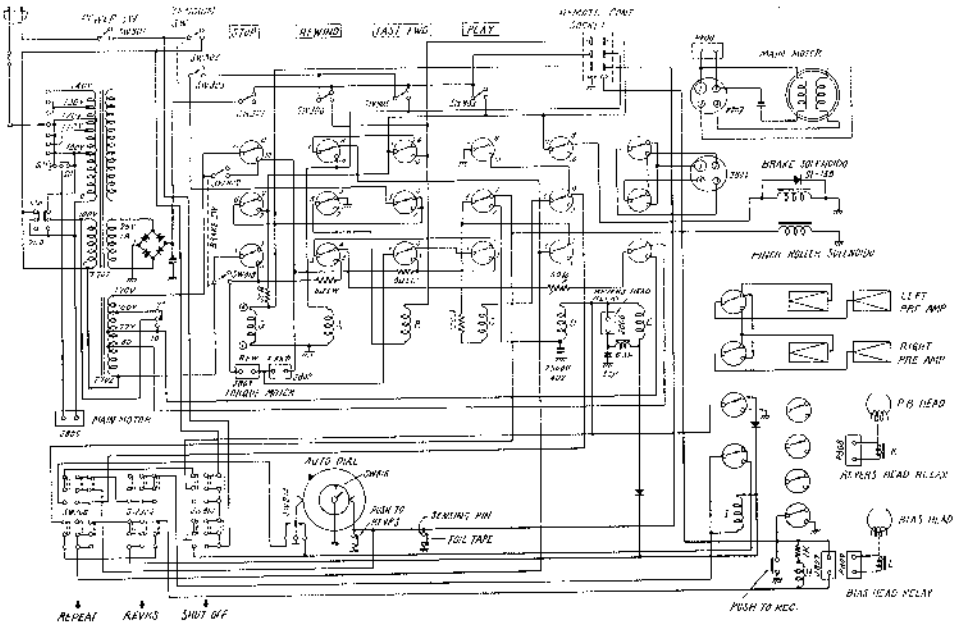




# V. TRANSPORT MECHANISM

Fig. 1 illustrates the basic circuit arrangement of the transport mechanism which is a modification of the schematic diagram attached to the Operator's Manual and which gives better understanding of the functions and operation of the tape transport.

**FIG. 1**




## 1. STOP

Load a tape and set the recorder to play condition. Put the power switch (SW801) to the ON position. Current flows as indicated by red line in Fig. 2 and the main motor starts and the VU meter lamp lights. In this state of tape transport, no relay or no solenoid coil is operated.

## 2. PLAY

As the play button is depressed under the STOP condition, the relay control current flows through the play button micro switch (SW804) as indicated by red dotted line in Fig. 3 and the relay G is energized and locked by contact 6-2. The relay G thus locked continues to be energized even with the finger released from the play button. The current flow is shown in red line. The current flows through contacts 7-10 and 5-3 of the relay G and into two torque motors. The center taps of these motors are connected through the contacts of the relays A, B, C and E to the 40V terminal of the power transformer (T702). The tape is thus given proper tension.

At the same time, the current flows into the brake solenoid and pinch wheel solenoid so that the brake band is let free and the pinch wheel is pressed against the capstan thereby causing the tape to travel at constant rate of speed.

While in tape travel, the stop button may be depressed and the stop micro switch (SW807) put in OFF position, so that the relay control current is discontinued and the relay G unlocked, bringing the transport mechanism to a stop.

As the tape is fully wound onto the take-up reel and the tension arm dropped, the tension switch (SW803) turns into OFF position, thereby the transport mechanism is reverted to a stop.

## 3. FAST FORWARD

Depressing now the fast forward button under the STOP condition causes the relay control current to flow through the micro switch (SW805) as shown by red dotted line in Fig. 4 thereby switching the relay A into ON position. As the relay A is thus locked, the relay control current flows along the red line in Fig. 4 until the relay G and brake solenoid become energized to release the brakes. 120 volts are applied across 8 Ω 5W resistor to the fast forward motor as shown in Fig. 5, whereupon the fast forward motion of the tape is effected. This resistor is intended to prevent transient pulse generated when switching the relay contacts.

FIG. 2

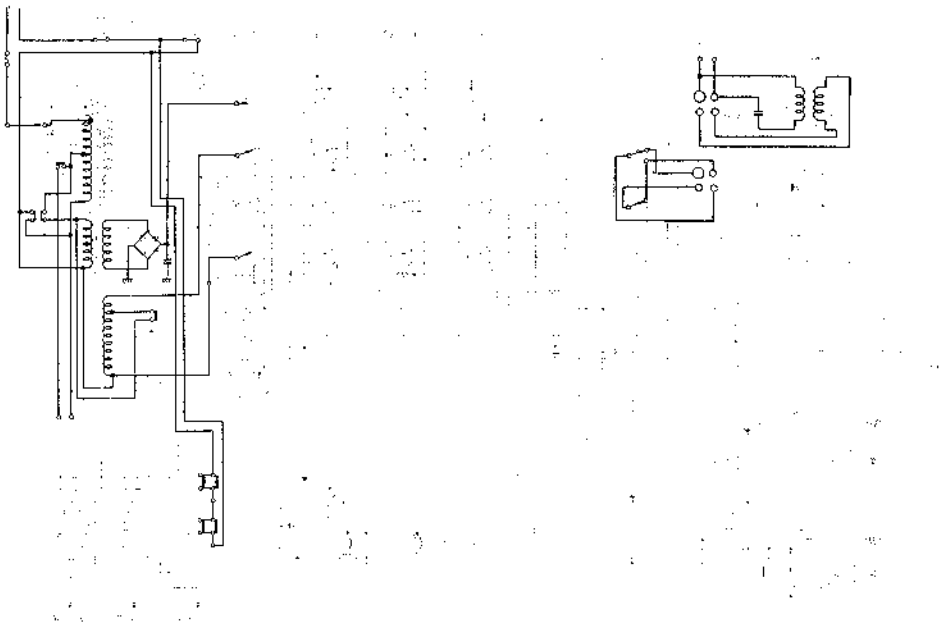


FIG. 3

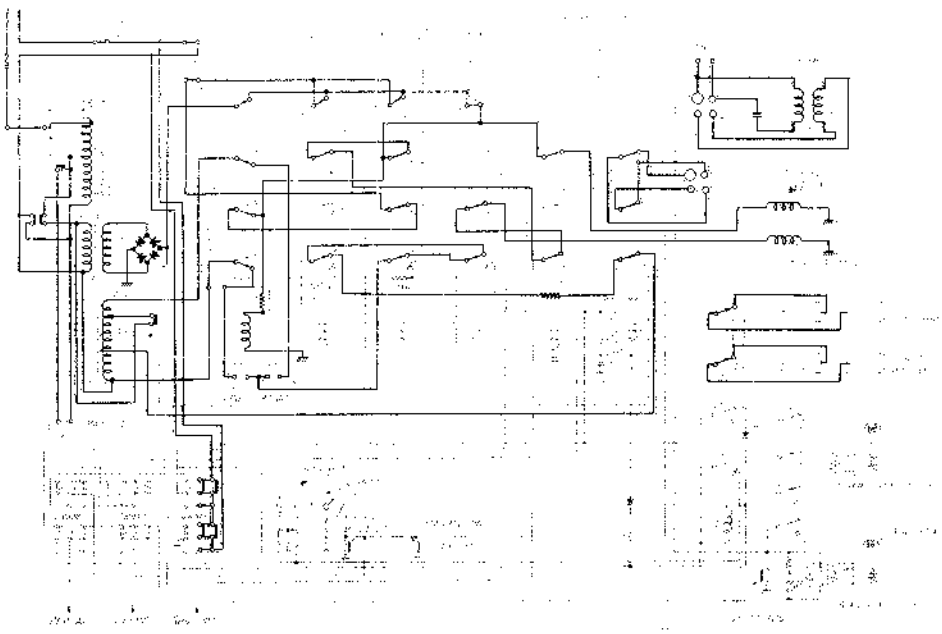


FIG. 4

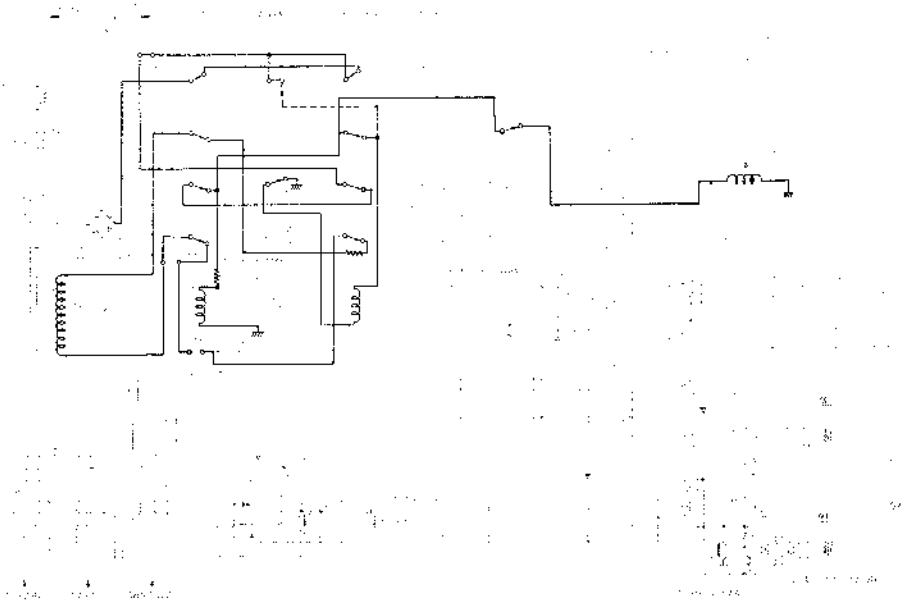
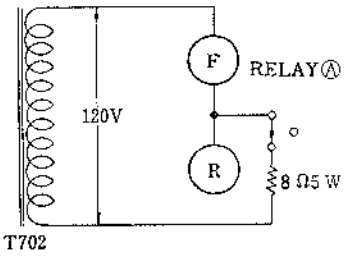


FIG. 5




F : Fast forward motor
R : Rewind motor

## 4. REWIND

Depressing the rewind button under the STOP condition causes the current to flow through the micro switch (SW806) as indicated by red dotted line in Fig. 6 so that the relay B is energized and locked by contact 7-10. The relay control current now flows as indicated by red line in Fig. 6 so that the relay G is energized and the brakes released, whereupon the rewind motor is supplied with 120 volts through 8 Ω 5W resistor as shown in Fig. 7. The rewind mode of operation thus takes place.

FIG. 6

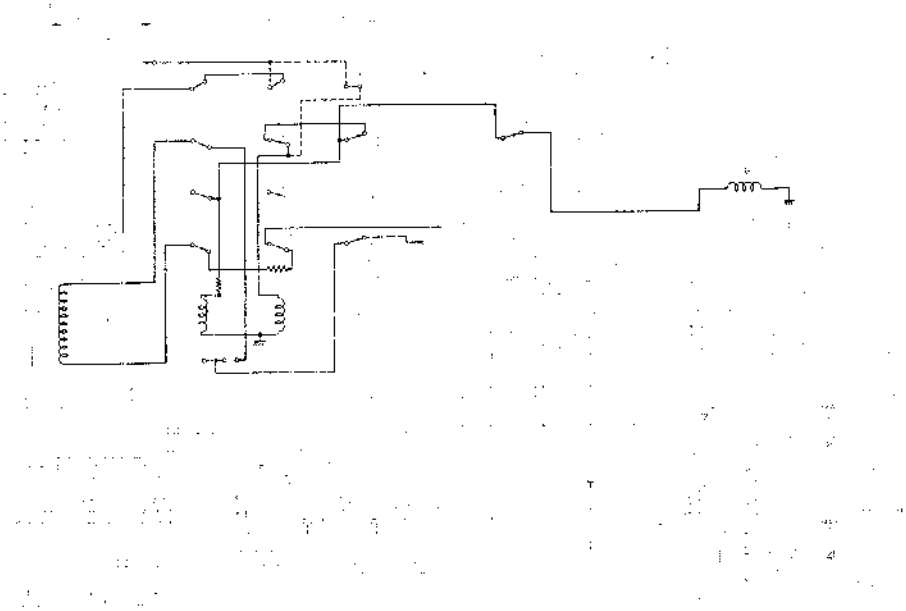
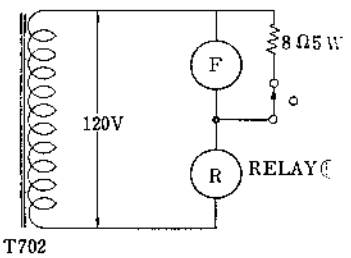


FIG. 7




F : Fast forward motor
R : Rewind motor

## REPEAT

### a) REPEAT PLAY

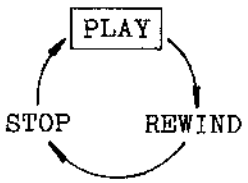
To establish the repeat play mode of operation of the tape recorder, the repeat button on the front panel should be first depressed thereby to put the repeat switch (SW808) in red-line position as shown in Fig. 8.

At a starting end of the tape, the automatic tape counter meter dial B should be calibrated by bringing its zero point in registry with the arrow point of the dial-off button dial C, then set the set dial to its arrow pointing any desired area of the tape·····near the terminating end or any portion of the tape desired for repeated play, as illustrated in Fig. 9. Exact tape length in this case varies with the type of tape used; therefore, it is advisable to check how far the zero point of the dial B has advanced when the tape is fully taken up by fast forward and set the arrow of the dial A at that point.

Now, press the play button so that the relay control current flows as indicated by red line in Fig. 8, thus establishing the play mode of operation already described in Paragraph 2.

The dial B turns in the direction of the dotted line in Fig. 9 arrow as the tape advances.

FIG. 8



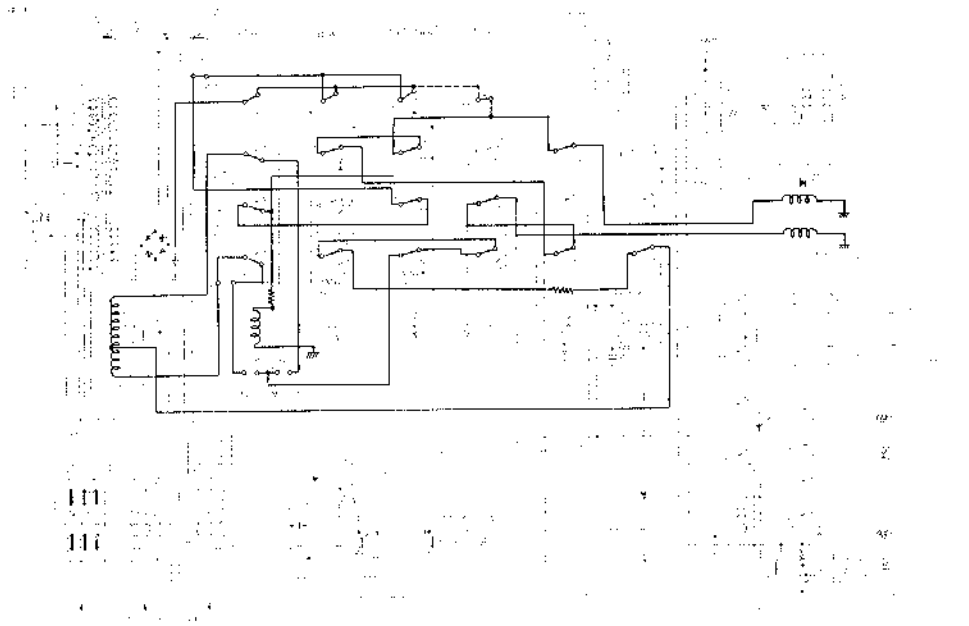
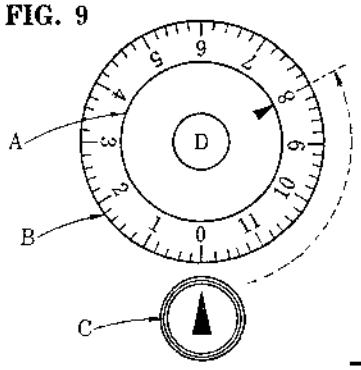



FIG. 9




### b) REPEAT REWIND

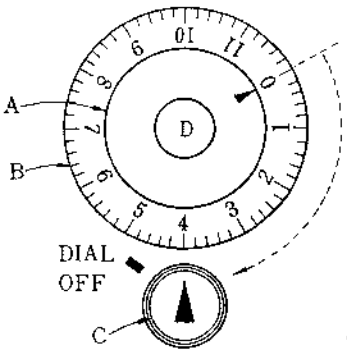
The dial B, in repeat play, continues to turn counter clockwise until its "0" point comes in registry with the arrow of the dial A as shown in Fig. 11. Then, the automatic dial switch (SW816) in Fig. 10 is put in ON position and the relay control current flows in the manner shown by red line in Fig. 10 so that the relay C and relay G are energized thereby to effect the automatic rewind operation. Subsequently, the "0" point of the dial B rotates in the direction of the dotted line arrow as shown in Fig. 11 and the automatic dial switch (SW816) is put in OFF position. However, inasmuch as the relays C and G are respectively locked by contacts 7-10 and 6-2, the rewind mode of tape motion continues while the capacitor C812 (2500 $\mu$F) is charged with 35 volts through the contact 6-2 of relay C.

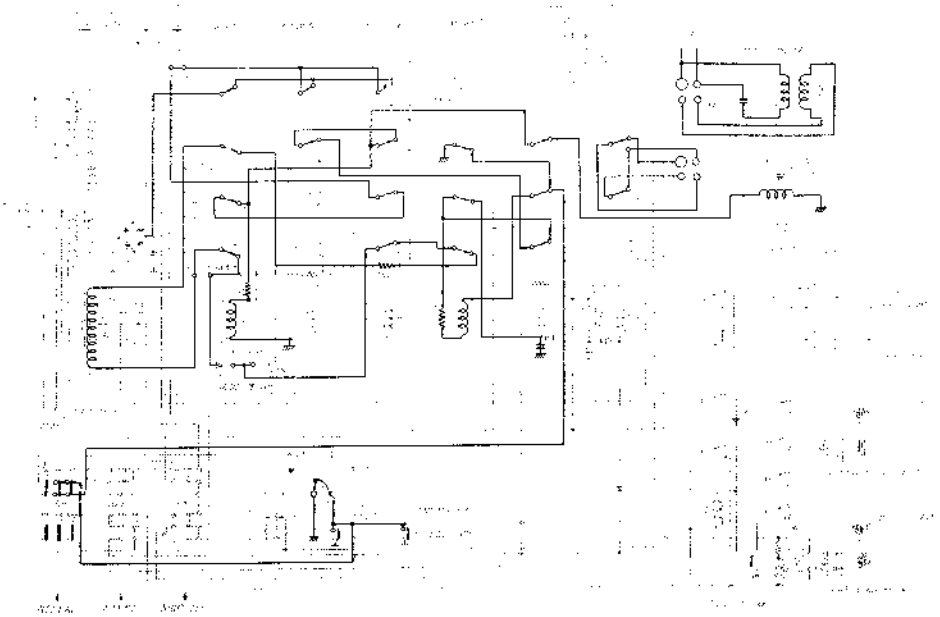
When the manual reverse button (shown at D in Fig. 9) is depressed any time during the repeat mode of operation, the automatic mode of rewind operation takes place just in the same manner as it would be with the switch (SW816) put in ON position.

With a tape more than 2400 feet long, the dial-off button may be set in DIAL-OFF position and the dial B stopped, whereupon the tape may be attached at the terminating end with a foil tape for contact with the sensing pin. That foil tape causes the transport mechanism to switch on automatic rewind.

FIG. 10


FIG. 11



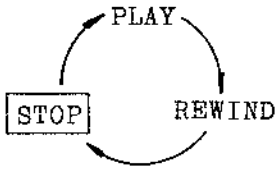



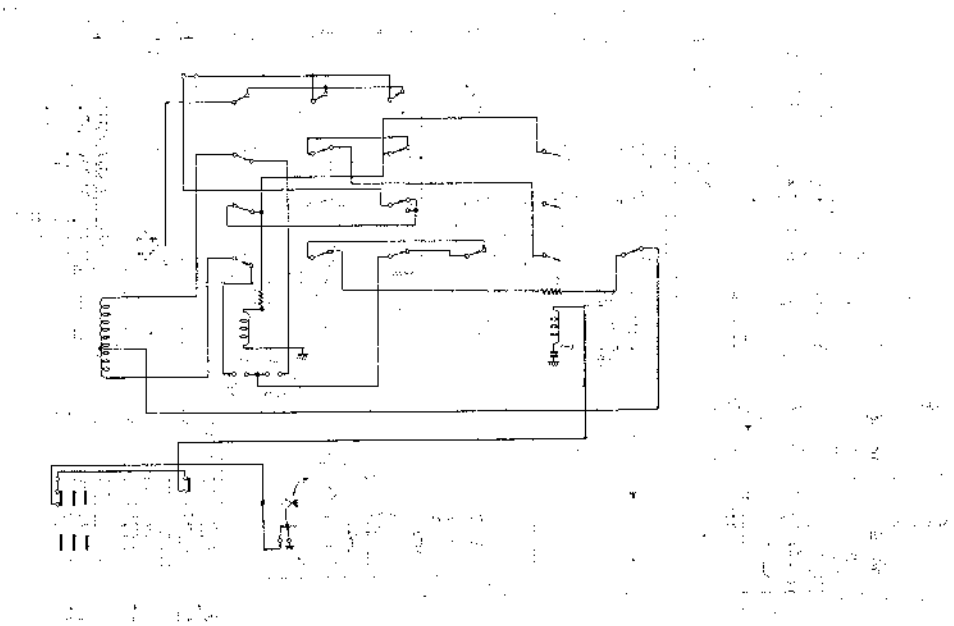
### c) REPEAT CYCLE STOP

While the machine is in the repeat rewind mode operation with the dial B kept in the dotted line direction as shown at Fig. 11, the "0" point of the dial B is at the same position with the arrow point of the dial C so that the switch (SW814) is put in ON position by convexity of the dial B. Consequently, the 35 volt potential established in the capacitor during repeat rewind is discharged through the relay D coil and the contacts of the switches (SW808, 810 and 814). This discharge current causes the relay D to be energized so that the current flow through the brake solenoid and pinch wheel solenoid is discontinued the and then the tape stops.

It takes 3 to 4 seconds to discharge the capacitor C812, while the tape is held to a stop. As the capacitor C812 is completely discharged, the relay D automatically becomes de-energized and the transport resumes the repeat play mode of operation to begin reproduction of the tape. The operation of the machine just described repeats itself as long as the hand is off the stop button.

FIG. 12



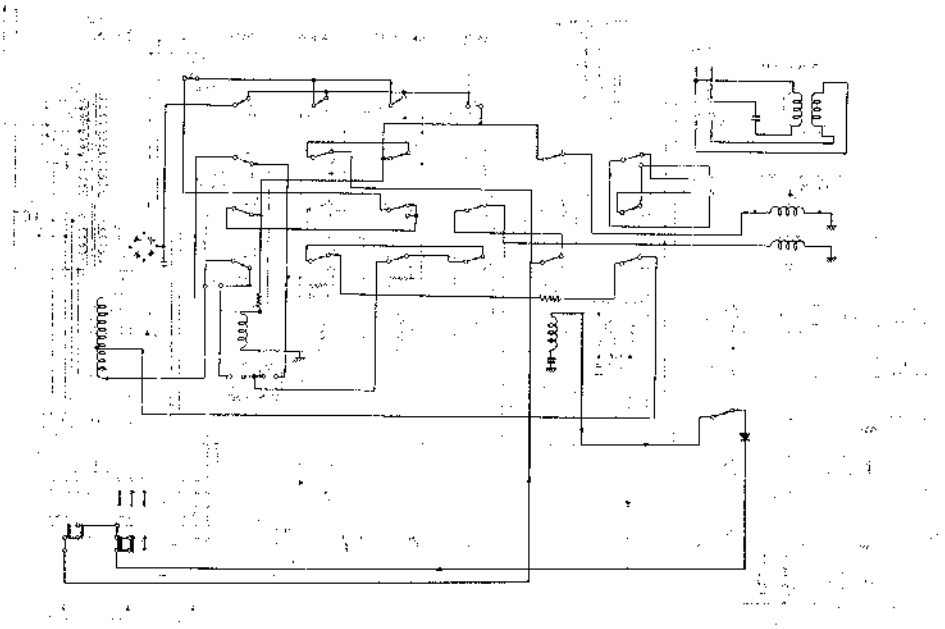



## 6. REVERSE

### a) REVERSE CYCLE "NORMAL PLAY"

To establish a reverse play mode of operation, the reverse button on the front panel is depressed so that the reverse switch (SW809) is put in the red line position as shown in Fig. 13. In just the same manner as with the repeat play mode of operation, the "0" point of the dial B in Fig. 9 is brought in registry with the arrow marking on the dial C at an initial turn of tape roll, while the arrow of the dial A is set to a terminating end of tape or to any desired point on tape for reverse play. With the play button depressed in this manner, the relay control current flows in a manner indicated by red line in Fig. 13. However, at the instant of depressing the play button there flows a charge current through the coil of relay D into the capacitor C812 (2500 $\mu$F) as shown by black line in Fig. 13, so that the relay D is energized for about 2 or 3 seconds blocking the flow of current through the brake solenoid and the pinch wheel solenoid. So, with the play button depressed, a few seconds must be anticipated until the charge current to the capacitor diminishes, before the relay D is de-energized to begin normal play of the tape.

**FIG .13**

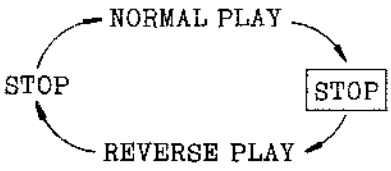


### b) REVERSE CYCLE "NORMAL PLAY——→STOP"

The "0" point of the dial B rotates in the direction of the dotted line arrow in Fig. 9 according to the tape advance, and comes in registry with the arrow on the dial A, whereupon the automatic dial switch (SW816) is put in ON position and the relay I energized thereby discharging the capacitor C812 through the contact of relay I. The discharge current from the capacitor flows through the coil of relay D. The relay D thereby energized for a few seconds blocks the flow of current through the brake solenoid and the pinch wheel solenoid so that the machine is held to a stop.

The tape may be stopped for 3 or 4 seconds any time during normal play according to Paragraph. 5 by either when the manual reverse button is pressed or when the foil tape on the record tape contacts the sensing pin, just in the same manner as the switch (SW816) put in ON position. At which time, the current flows through the contact of relay I and the coil of relay E. As the relay E is thereby energized and the contacts 7-10 and 6-2 are closed in, the main motor starts to reverse.

FIG. 14



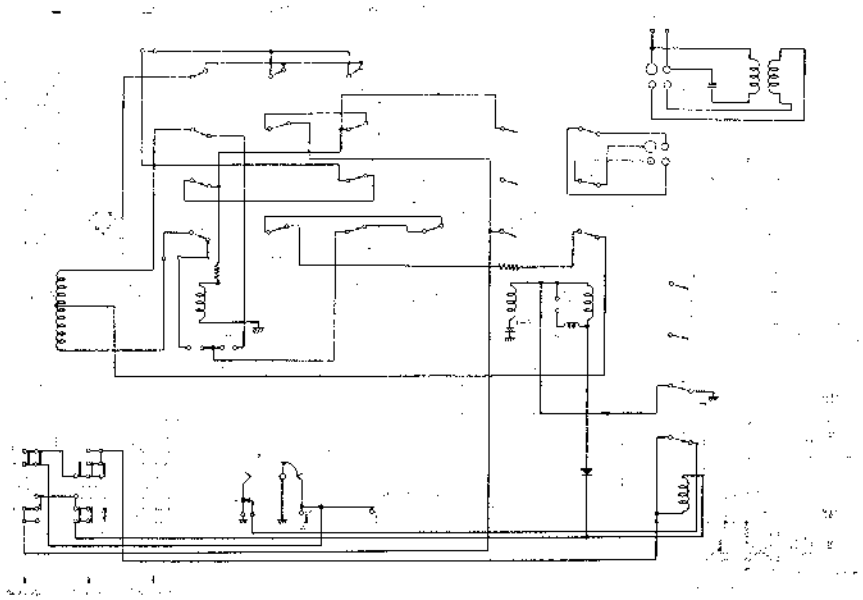
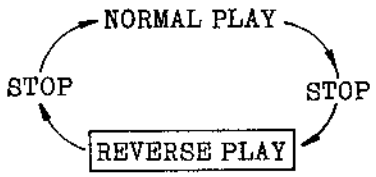
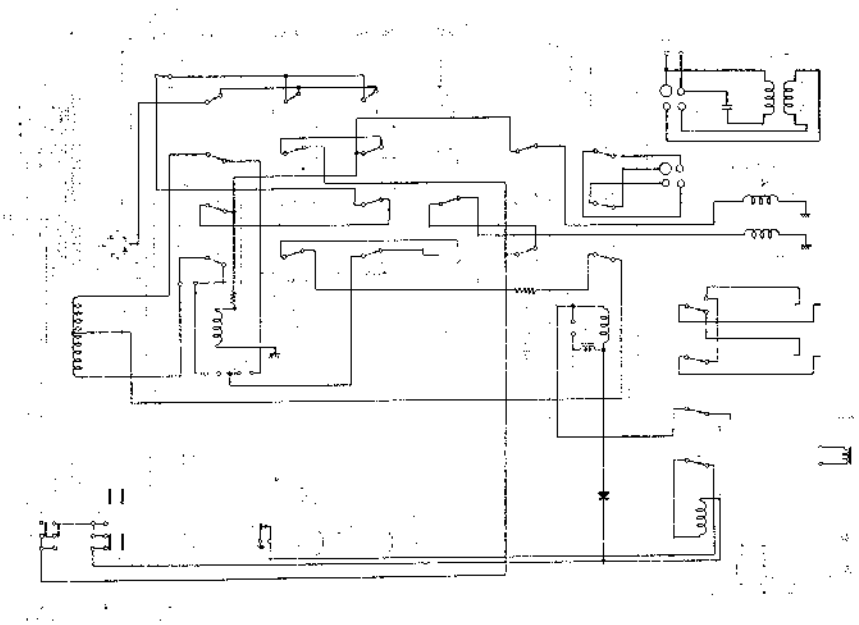



FIG. 15

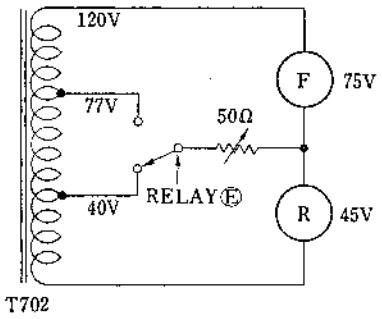


**c) REVERSE CYCLE "REVERSE PLAY"**

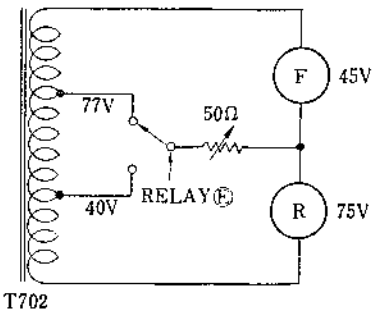
With the machine held to a stop in the manner described, as the charge current diminishes with charging of the capacitor C812, the relay D becomes de-energized so that the current flows through the brake solenoid and the pinch wheel solenoid. Consequently, the tape begins reverse motion as the main motor has already reversed, thus establishing a reverse play mode of operation. The current simultaneously flows into the reverse head relay coil connected parallel with the coil of relay E, so that the playback head is lowered to reproduce the 2 and 4 tracks of the tape. The left and right pre-amplifiers may be switched over by the relay I so that the recorded signal on the left channel is reproduced without fail from the line output designated at this channel. For reverse play, tension in the tape may be adjusted by changing the voltage impressed on the torque motor in the manner illustrated in Figs. 16 and 17.

FIG. 16




Normal Play

FIG. 17




Reverse Play

F : Fast Forward Motor

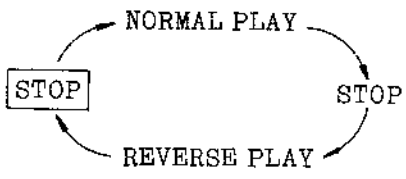
R : Rewind Motor

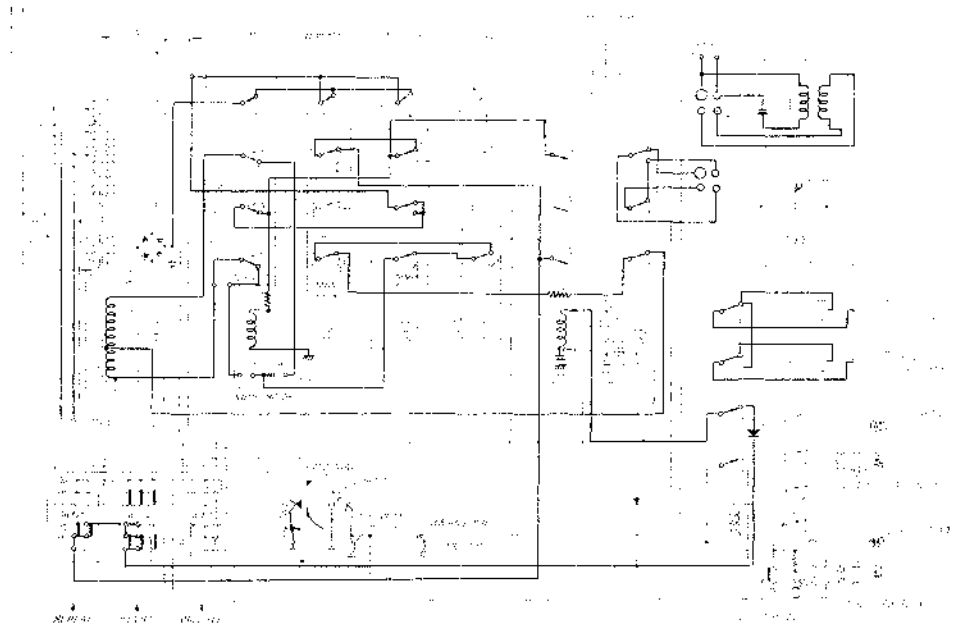
**d) REPEAT CYCLE "REVERSE PLAY——→STOP"**

With the tape advancement on reverse playback, the automatic tape counter meter dial B rotates in the direction of the dotted line arrow as shown in Fig. 11. As the "0" point on the dial B comes at the arrow point on the dial C, the contact of dial switch (SW814) is raised by the convexity of the dial B as illustrated in Fig. 18, and the contacts Y-Z are de-energized, hence, the relay I is de-energized as the charge current for the capacitor C812 flows through the coil of relay D as shown by red line in Fig. 18. The relay D energized prevents the current from flowing through the brake solenoid and the pinch wheel solenoid thereby holding the machine to a stop. De-energization of the relay I stops the flow of current through the relay E and coil of the reverse head relay, so that the main motor is switched back to forward rotation and the voltage applied to the torque motor switched to normal play. The preamplifiers resume a normal play mode of performance. In this manner, the relay D continues to be energized (for about 3 to 4/seconds) until the charge current of the capacitor C812 is finally diminished. As the relay D is again de-energized, the tape begins to travel in the normal play fashion.

Thus, the tape transport in the reverse cycle mode of operation repeats the sequence of Normal Play——→Reverse Play——→Stop.

FIG. 18



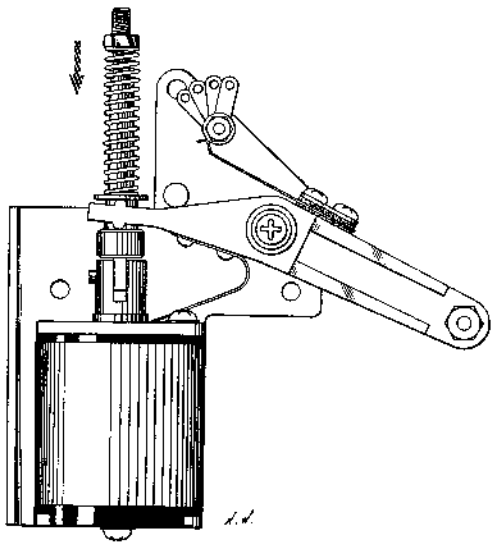
# VI. MECHANISM ADJUSTMENT

## 1. ADJUSTMENT OF PINCH WHEEL

The proper pressure is applied to the pinch wheel by plunger action and spring tension.

The proper pressure to be applied to the capstan is between 1400-1500 grams and pressure above or below that range may cause wow and flutter. The pressure adjustment is made by turning an adjusting screw as shown by Fig. 19, where the direction of the arrow indicates increasing pressure and the other direction indicates decreasing pressure.

FIG. 19



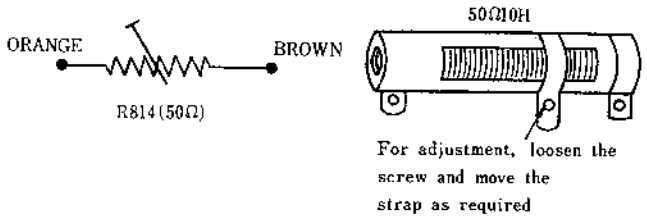
## ADJUSTMENT OF TAKE-UP MOTOR

The take-up motor is a condenser (3$\mu$F) start 4-pole induction motor having optimum torque between 130 and 145 grams ranging when loaded with standard 7″ reel in "normal play". (as determined with tape wound on 5″ reel to a roll diameter of 60 mm using a bar gauge). The motor is run in this manner to insure that the tape is wound at a constant speed. The voltage supplied to the take-up motor during this operation may range from 75 to 80 V. A. C.

The optimum to torque (viz. optimum back tension) in the "reverse play" mode of operation ranges from 40 to 50 grams with a feed voltage of about 40 to 45 V. A. C., approximately. The optimum torque when loaded with 10″ reel in "normal play" is set at 210-220 grams, with a feed voltage ranging from 85 to 95 V. A. C., while in "reverse play" the torque is set at 70-80 grams with a feed voltage ranging from 55 to 65 V. A. C.

The torque can be adjusted by controlling the resistor R814 (50 Ω) as shown in Fig. 20. Since this resistor is adapted for varying the voltage fed midway between the take-up motor and the supply motor, increasing the value of the resistor increases the torque of the supply motor and conversely reduces the torque of the take-up motor. With this in mind, adjustment of the torque should be made with use of a wow meter so as to set the torque to a level where wow and flutter are held to a minimum.

FIG. 20




## 3. ADJUSTMENT OF SUPPLY MOTOR

The supply motor is, like the take-up motor, a condenser (3 $\mu$F) start 4-pole induction motor.

a) Its optimum torque when loaded with the 7″ reel in "normal play" is set between 40 and 50 grams (as measured by a bar gauge with tape wound on 5″ reel to a roll diameter of 60 mm). The voltage fed to the supply motor is in the range between 40 and 45 V. A. C.

The torque in "reverse play" is optimum in the range of 130 to 145 grams with the feed voltage between 75 and 80 V. A. C.

b) The torque optimum for the loading of 10″ reel in "normal play" is in the range from 70 to 80 grams (with the feed voltage ranging from 55 to 65 V.A.C.), while in the "reverse play" the optimum torque is in the range between 230 and 235 grams (with the feed voltage ranging from 85 to 95 V. A. C.).

The optimum torque is adjusted in the same manner as in the case of the take-up motor.

## 4. ADJUSTMENT OF HEADS

Adjustment of heads requires high-precision workmanship and for this reason re-adjustment of the heads, after delivery of tape-recorders, should be avoided without attention of the skilled engineer. In case, however, the head requires replacement, this should be done in accordance with the following procedures.

(A) Mounting and positioning of heads (See Fig. 21)

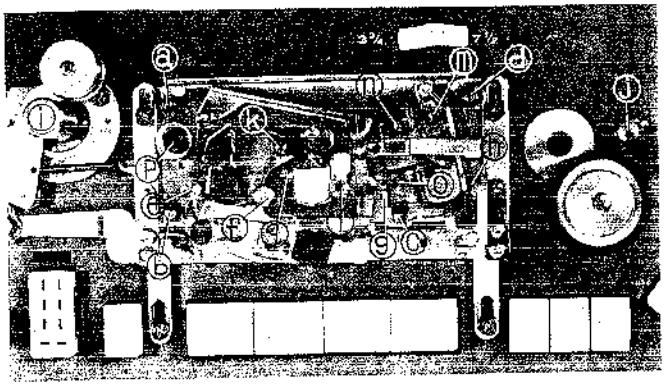
i) Fix the head while loosening the control nuts ⓐ, ⓑ, ⓒ and ⓓ, and set the tape in motion for "normal play".

ii) Adjust the position of the tape, using the inclination control nuts ⓐ through ⓓ so that the tape passes the centers of the tape guides ⓔ, ⓕ, ⓖ and ⓗ, respectively.

iii) Now, set the machine in the "reverse play" mode of operation. Use the inclination control nuts ⓐ through ⓓ and also the level regulating screw ⓘ and adjust the position of the tape contacting the periphery of the impedance roller ⓘ so that the tape will assume the same position as in "normal play".

iv) To be sure that the adjustments have been properly accomplished, check the heads once again with respect to ii) and iii).
(Note that incomplete adjustment may lead to sluggish displacement of the cross-field bias head.)

FIG. 21



B: Adjustment of head level

* In "normal play" mode

a: Adjust the erase head so as to be positioned about 0.15 mm above the upper edge of the tape by turning the level control screw ⑥.

b: Adjust the position of the record head by turning the level control screw ⑦ so that the upper edge of the tape is aligned with the top edge of the CH-1 core.

c: Adjust the position of the playback head with the level control screw ⑩ so that the upper edge of the tape is brought into register with the top edge of the CH-1 core, in just the same manner as in the adjustment of the record head.

* In "reverse play" mode

a: Adjust the playback head by turning the level control screw ⑩ so that the lower edge of the tape is located at the same level with the bottom edge of the CH-2 core.

* Note: Check the tape to head contact alignment both in horizontal and vertical directions.

C: Adjustment of playback head alignment

Playback an Ampex Alignment tape 3000 c/s at the tape speed of 3-3/4" in "normal play" mode. Set the head at a point at which maximum output is obtained by turning the alignment control screw ⑨.

Apply this test in "reverse play" also and see if the differences of output levels between the two modes of tape operation are in excess of 1 dB. If so, this should be reduced to less than 1 dB by turning the alignment control screw ⑨.

D: Adjustment of recording bias voltage

Set the machine in "record" mode of operation. Set VTVM between the lead wire red in colour of the bias voltage control coil ⑭ and ground. Adjust the terminal voltages to read 40 V. A.C. by vertically moving the control screw in the coil ⑭.

Preferably, a driver of non-conductive nature, for example, a driver made of a plastic material, should be used for this purpose. An ordinary metal driver, upon insertion into the coil ⑭, alters the value of $\mu$ resulting in correct bias voltage readings.

E: Adjustment of record head alignment

Set a blank tape in motion at the tape speed of 7-1/2". Record 10,000 c/s sine waves at about -10 VU. Adjust the record angle control screw ⑪ to obtain maximum reproduce output.

* After the foregoing adjustments, the amplifiers should also be adjusted in accordance with the section of "Amplifire Adjustment" except for the main amplifier.

## 5. ADJUSTMENT OF BRAKE

In order to protect the tape from being damaged when the machine comes to a "STOP", the voltages fed to both the supply motor and the take-up motor are cut off from the relays, and each brake felt is simultaneously pressed against each motor pulley to stop the rotation of the motors. Adjust the brake, by turning the brake regulating screws ⑱ and ⑲ while the machine is in its "STOP" mode as shown in Fig. 22, so that slipping tension between the left and the right motor pulleys and the brake felt is maintained between 200 and 250 grams. Read the value with a bar gauge, using a tape wound on 5" reels to a roll diameter of 60 mm.

FIG. 22

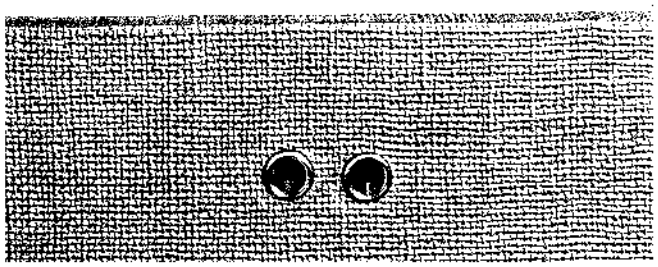
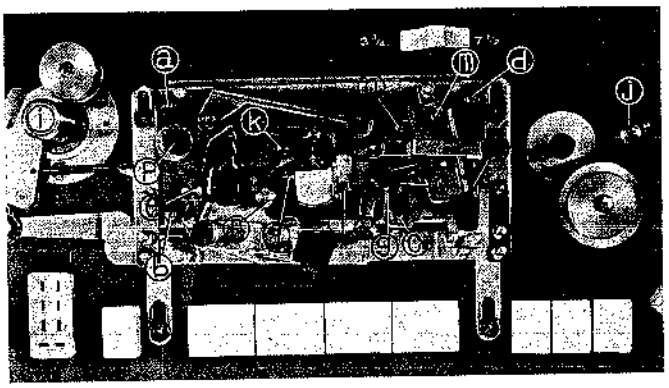


**FIG. 21**




(B) Adjustment of head level

* In "normal play" mode

a) Adjust the erase head so as to be positioned about 0.15 mm above the upper edge of the tape by turning the level control screw ⓚ.

b) Adjust the position of the record head by turning the level control screw ① so that the upper edge of the tape is aligned with the top edge of the CH-1 core.

c) Adjust the position of the playback head with the level control screw ⓜ so that the upper edge of the tape is brought into register with the top edge of the CH-1 core, in just the same manner as in the adjustment of the record head.

* In "reverse play" mode

a) Adjust the playback head by turning the level control screw ⓝ so that the lower edge of the tape is located at the same level with the botton edge of the CH-2 core.

* Note: Check the tape to head contact alignment both in horizointal and vertical directions.

(C) Adjustment of playback head alignment

Playback an Ampex Alignment tape (8000 c/s) at the tape speed of 3-3/4″ in "normal play" mode. Set the head at a point at which maximum output is obtained by turning the alignment control screw ⓞ.

Apply this test in "reverse play" also and see if the differences of output levels between the two modes of tape operation are in excess of 1 dB. If so, this should be reduced to less than 1 dB by turning the alignment control screw ⓞ.

(D) Adjustment of recording bias voltage

Set the machine in "record" mode of operation. Set VTVM between the lead wire (red in colour) of the bias voltage control coil ⓟ and ground. Adjust the terminal voltages to read 40 V. A. C. by vertically moving the control screw in the coil ⓟ.

(Preferably, a driver of non-conductive nature, for example, a driver mode of a plastic material, should be used for this purpose. An ordinary metal driver, upon insertion into the coil ⓟ, alters the value of $\mu$, resulting in correct bias voltage readings.)

(E) Adjustment of record head alignment

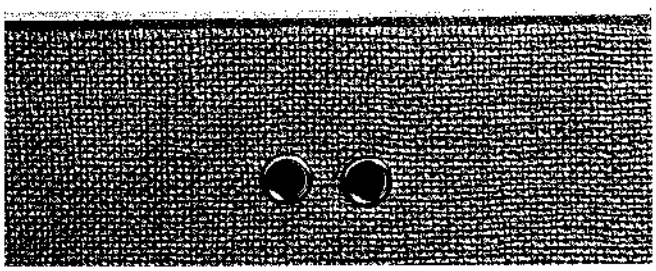
Set a blank tape in motion at the tape speed of 7-1/2″. Record 10,000 c/s sine waves at about -10 VU. Adjust the record angle control screw ⑨ to obtain maximum reproduce output.

* After the foregoing adjustments, the amplifiers should also be adjusted in accordance with the section of "Amplifire Adjustment" (except for the main amplifier).

## 5. ADJUSTMENT OF BRAKE

In order to protect the tape from being damaged when the machine comes to a "STOP", the voltages fed to both the supply motor and the take-up motor are cut off from the relays, and each brake felt is simultaneously pressed against each motor pulley to stop the rotation of the motors. Adjust the brake, by turning the brake regulating screws ⓐ and ⓑ while the machine is in its "STOP" mode as shown in Fig. 22, so that slipping tension between the left and the right motor pulleys and the brake felt is maintained between 200 and 250 grams. (Read the value with a bar gauge, using a tape wound on 5″ reels to a roll diameter of 60 mm.)

**FIG. 22**



## 6. ADJUSTMENT OF PINCH WHEEL MUTE SWITCH

The switch is gang-operated with the pinch wheel for constructing a voice circuit only under PLAY conditions. Accordingly, improper adjustment of the switch contacts may result in reproduction failure or troublesome noise during fast rewind.

Adjust the switch contact position so that the contact is OFF when the pinch wheel is in contact with the capstan, and ON when the pinch wheel is not operated.

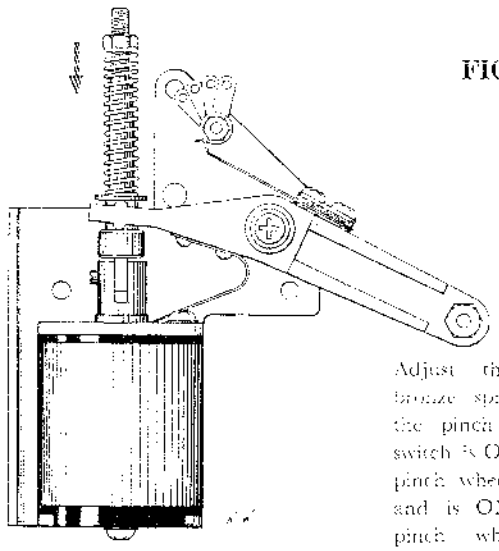


FIG. 23

Adjust this phosphor bronze spring so that the pinch wheel mute switch is OFF when the pinch wheel is operated and is ON when the pinch wheel is not operated.

## 7. ADJUSTMENT OF TENSION SWITCH

This tension switch is operative interlockingly with the tension arm in such fashion that only when the arm is located between ① and ② as shown in Fig. 24, the switches SW-802 and SW-803 are tripped into "ON" position thereby actuating the relays. Therefore, loosen the fastening screws ⓐ and ⓑ of the switches (SW-802 and SW-803) and displace them with fingers to adjust them so that only when the tension arm is located between ① and ②, the lever ⓒ will press the button SW-802 and conversely, the button SW-903 will emerge.

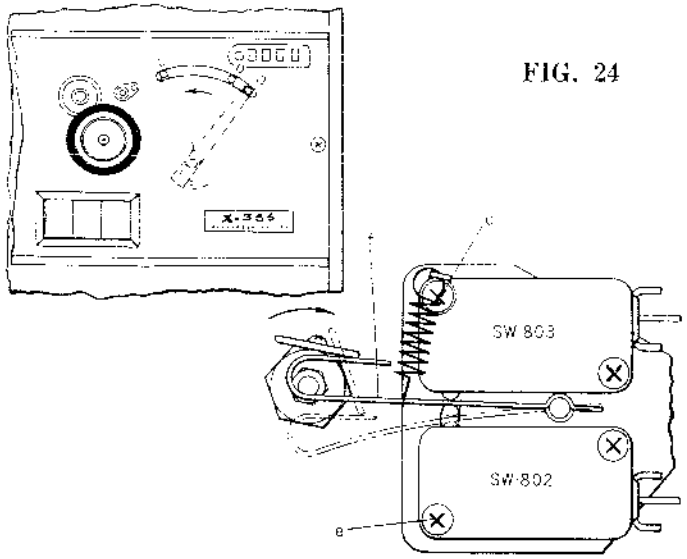


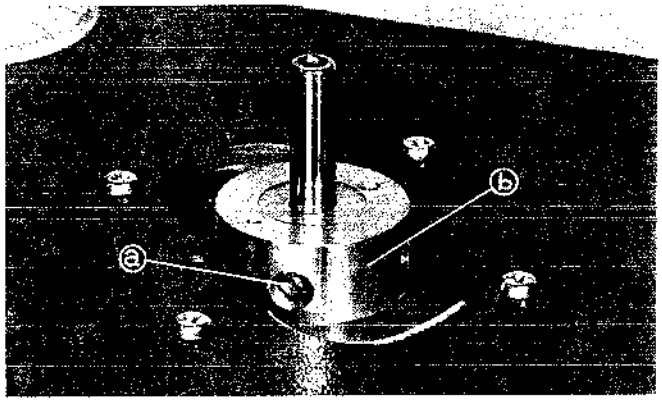

FIG. 24

## 8. ADJUSTMENT OF REEL BASE HEIGHT

When the reel base height is improper, the tape rubs against the reel causing tape wear on one edge or even broken tape.

Loosen the height adjustment screws (two used) of the motor pulley and align the reel center with the tape center by moving the motor pulley 'b' manually. Tighten the adjustment screws. See Fig. 25.

FIG. 25



## 6. ADJUSTMENT OF PINCH WHEEL MUTE SWITCH

The switch is gang-operated with the pinch wheel for constructing a voice circuit only under PLAY conditions. Accordingly, improper adjustment of the switch contacts may result in reproduction failure or troublesome noise during fast rewind.

Adjust the switch contact position so that the contact is OFF when the pinch wheel is in contact with the capstan, and ON when the pinch wheel is not operated.

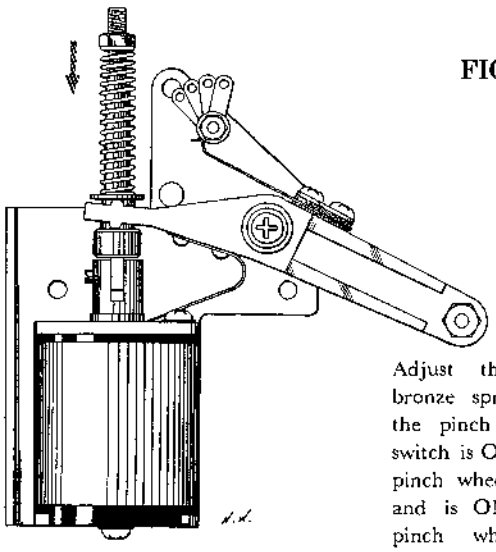


FIG. 23

Adjust this phosphor bronze spring so that the pinch wheel mute switch is OFF when the pinch wheel is operated and is ON when the pinch wheel is not operated.

## 7. ADJUSTMENT OF TENSION SWITCH

This tension switch is operative interlockingly with the tension arm in such fashion that only when the arm is located between ⓑ and ⓒ as shown in Fig. 24, the switches SW-802 and SW-803 are tripped into "ON" position thereby actuating the relays. Therefore, loosen the fastening screws ⓓ and ⓔ of the switches (SW-802 and SW-803) and displace them with fingers to adjust them so that only when the tension arm is located between ⓑ and ⓒ, the lever ⓕ will press the button SW-802 and conversely, the button SW-903 will emerge.

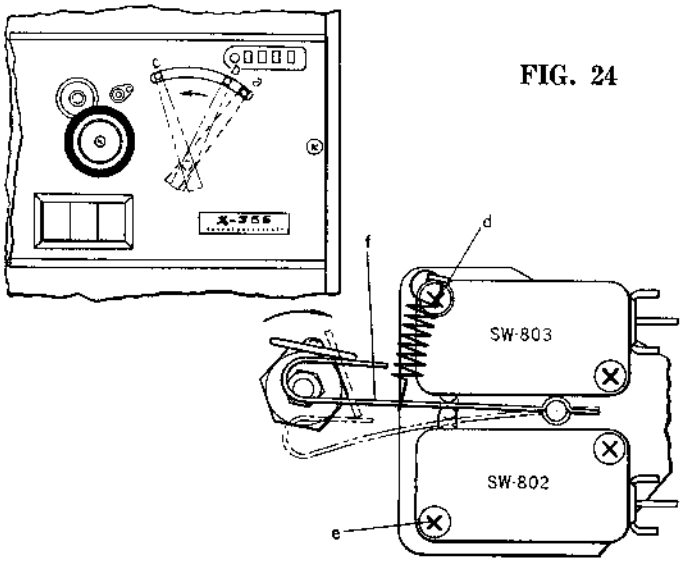


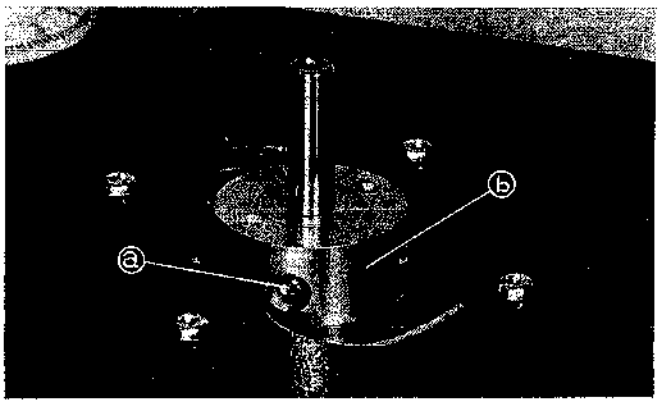

FIG. 24

## 8. ADJUSTMENT OF REEL BASE HEIGHT

When the reel base height is improper, the tape rubs against the reel causing tape wear on one edge or even broken tape.

Loosen the height adjustment screws (a)···(two used) of the motor pulley and align the reel center with the tape center by moving the motor pulley (b) manually. Tighten the adjustment screws. (See Fig. 25.)

FIG. 25

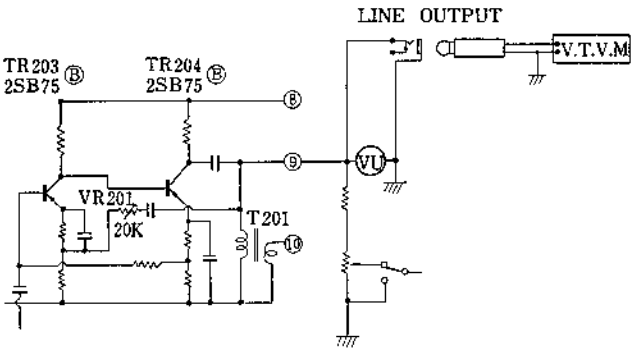


# VII. AMPLIFIER ADJUSTMENT

### 1) ADJUSTMENT OF PLAYBACK OUTPUT LEVEL (PRE-AMPLIFIER)

a) Connect VTVM (use one with Milli-Volt scale) to line output as shown in Fig. 26.
b) Playback an Ampex 250 c/s test tape (7.5″/s). Adjust VR201 (semi-fixed resistor, 20 kΩ) so that the Line Output Level of Channel 2 indicates 1.228 V. At this point, the VU meter should indicate 0 VU ± 0.5 VU.
c) Then, adjust the Line Output Level of Channel 1 in the same manner as followed in the adjustment of the level of CH-2. This adjustment should be done, however, while pushing the playback head downwards by about 0.5 mm with fingers after setting the Head Selector either to the 3-2 monaural position or to the stereo position. Compare both Line Output Levels after adjustment. By reading the 355 VU meter, the level of CH-1 will be about 0.5 to 1 dB lower than that of CH-2.

**FIG. 26**




### 2) ADJUSTMENT OF RECORDING EQUALIZATION CHARACTERISTICS

a) Set a testing blank tape (SCOTCH-111) on the machine.
b) Set Equalizer Switch in the 7-1/2″ position.
c) Supply 1,000 c/s sine wave of the Audio Frequency Oscillator to the Line Input of the X-355 through the Attenuator (ATT).
d) Set the X-355 in "record" mode. Set the tape into motion at the tape speed of 7-1/2″, and set the Playback Output Button in "IN" position (thereby placing the machine in the playback monitoring for recording).
e) Operate the Line Volume and the ATT to adjust the input level so that the level of the Line Output reads about 200 mV (−16 dB).
f) After this adjustment, shift the signal frequency of Audio Frequency Oscillator to 10,000 c/s. Operate the resistor VR-102 (500 Ω (B) semi-fixed resistor) to adjust the Line Output Level of X-355 so as to assume the same value as that in 1,000 c/s (approximately 200 mV).

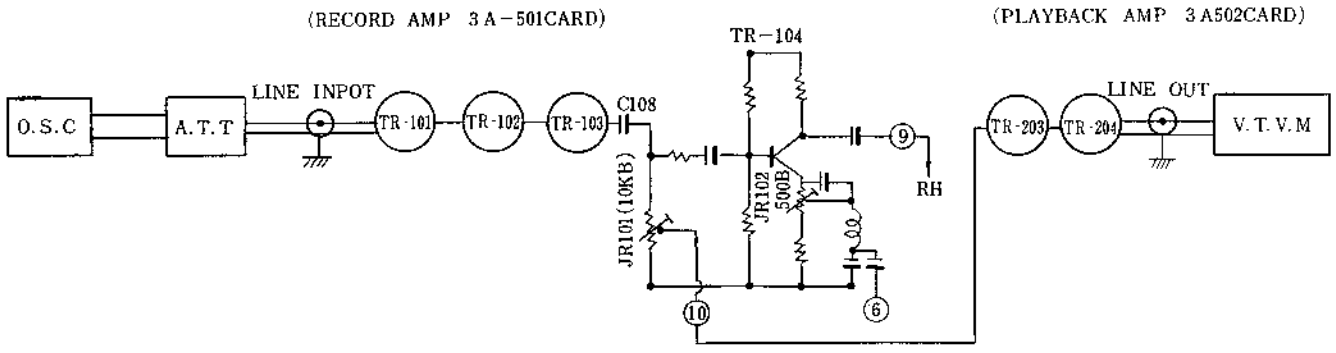
"Check":
In the (f) state, shift the signal frequency of Audio Frequency Oscillator to 18,000 c/s, and it will be noted that the Line Output Level of the X-355 is set at −6 dB or lower, as compared with the level at 1,000 c/s. Furthermore, when Equalizer Switch has been shifted to 3-3/4″ with the tape running at the speed of 3-3/4″, the Line Output Levels for 1,000 c/s and 10,000 c/s will be equal.
In the event that the equalization characteristics should deviate from the above standards after proper adjustments, such deviation may be due to mal-adjusted heads, and hence the heads should be readjusted according to the instructions on the Adjustment of Heads.

### 3) ADJUSTMENT OF RECORDING INPUT LEVEL

a) Connect VTVM to Line Output.
b) Supply 1,000 c/s sine wave of Audio Frequency Oscillator to the Line Input of the X-355.
c) Set a testing blank tape (SCOTCH-111) on the machine. Set the X-355 in "record" mode, and set the tape in motion at the speed of 7-1/2″.
d) Set the Playback Output Button in "IN" position.
e) Manipulate the Line Volume (10 kΩ A) to adjust the Recording Input Level so that the indicator voltage of VTVM connected to Line Output reads 1.228 V.
f) In the state of (e), re-set the Playback Output Button. Then, set the Record Output Button in "IN" position and operate VR-101 (10 kΩ B) so that the indicator of the VU meter of the X-355 will point at the volume unit of "0".

* If this later adjustment has been correctly accomplished, the VU meter should indicate the same value also when the operation of the output button is shifted from the Record Output Button to the Playback Output Button.

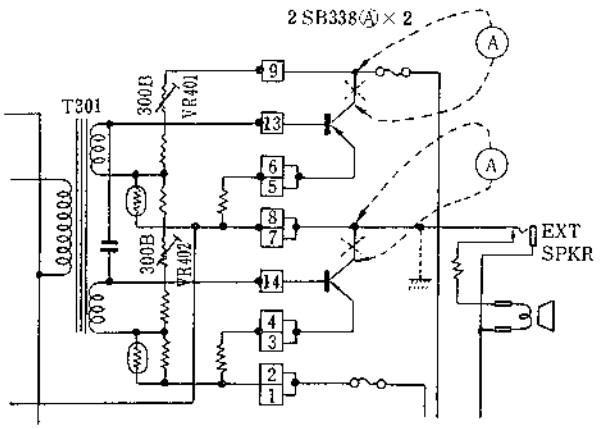
**FIG. 27**



4) **ADJUSTMENT OF D.C. BIAS FOR POWER TRANSISTORS (2SB338 (A))**

Set the ammeter as shown in Fig. 28. Operate VR-401 and VR-402 so that the amperage at absence of signal will be 50 mA.

**FIG. 28**

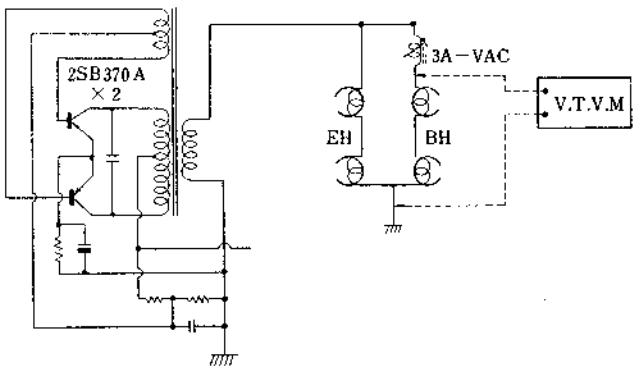



(Adjustment will be facilitated by the insertion of a short-circuited plug into the External Speaker Jack.)

5) **ADJUSTMENT OF RECORDING BIAS VOLTAGE**

This has been already described under the paragraph entitled, "Adjustment of Heads". Note that VTVM is set as shown in Fig. 29, and XL (reactance) of the Recording Bias Control Coil 3A-VAC is adjusted to accomplish this purpose.

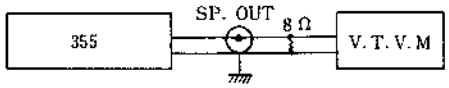
**FIG. 29**




6) **S/N ADJUSTMENT**

Playback a standard 250 cps (or 1,000 cps) sine wave tape recorded on a standard tape recorder (the tone switch should be set in the Flat Position). Connect VTVM (mV scale type) with 8Ω resistor to the Speaker Output Jack and adjust the loudness volume until the VTVM indicates "0" dB. Then, remove the standard tape. Measure noise level under the same conditions and adjust by bending the shield metal located opposite to the playback head to read a lower noise point on the meter.

**FIG. 30**



# VIII. MAINTENANCE

All moving parts have been lubricated before packing. After every 1500~2000 hours operation, lubrication is required for the following items. The grade of oil chosen should be good quality sewing machine oil.

The antodial gear portions should be lubricated with a small amount of high quality grease.

The surfaces of the erase, record, bias and playback heads, the tape guide roller, the capstan and the pinch wheel often become contaminated.

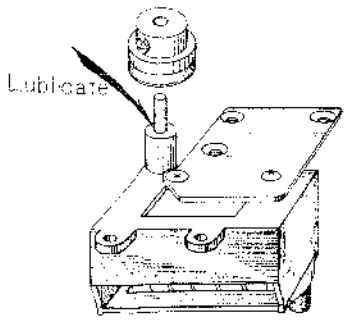
These surfaces should be cleaned from time to time with a soft cloth (gauze, etc.) dipped in alcohol or chlorothene-nil.

Extreme care should be taken in order not to allow the adherence of oil or grease on the drive belt, as this may cause slipping. Should oil or grease stick to the drive belt, clean with a soft cloth soaked in a cleaning solvent such as alcohol. In this case, other items in contact with the belt must also be cleaned.

For lubrication, refer to Fig. 31.

## LUBRICATION POINTS

| | |
|---|---|
| Main motor | replace two bearings |
| Left and right motors | replace a bearing |
| Capstan shaft | 2 drops |
| Impedance roller shaft | 2 drops |
| Pinch wheel shaft | 2 drops |
| Selector | 1 drop |



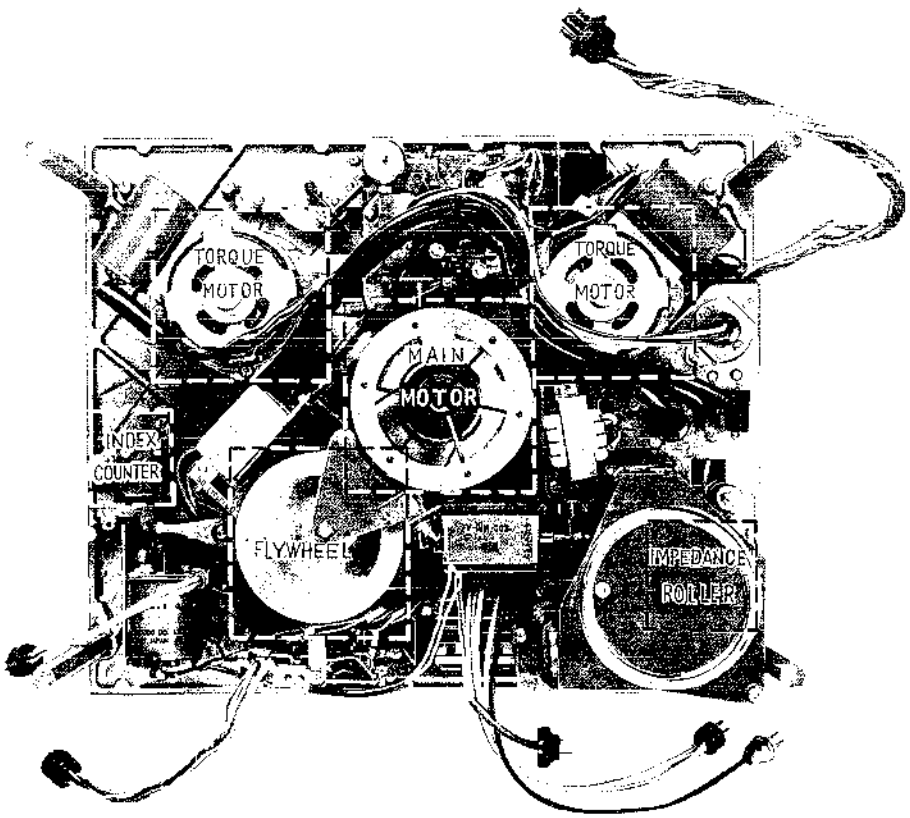




FIG. 31

# VIII. MAINTENANCE

All moving parts have been lubricated before packing. After every 1500~2000 hours operation, lubrication is required for the following items. The grade of oil chosen should be good quality sewing machine oil.

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The surfaces of the erase, record, bias and playback heads, the tape guide roller, the capstan and the pinch wheel often become contaminated.

These surfaces should be cleaned from time to time with a soft cloth (gauze, etc.) dipped in alcohol or chlorothenenil.

Extreme care should be taken in order not to allow the adherence of oil or grease on the drive belt, as this may cause slipping. Should oil or grease stick to the drive belt, clean with a soft cloth soaked in a cleaning solvent such as alcohol. In this case, other items in contact with the belt must also be cleaned.

For lubrication, refer to Fig. 31.

### LUBRICATION POINTS

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| Main motor | replace two bearings |
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| Pinch wheel shaft | 2 drops |
| Selector | 1 drop |

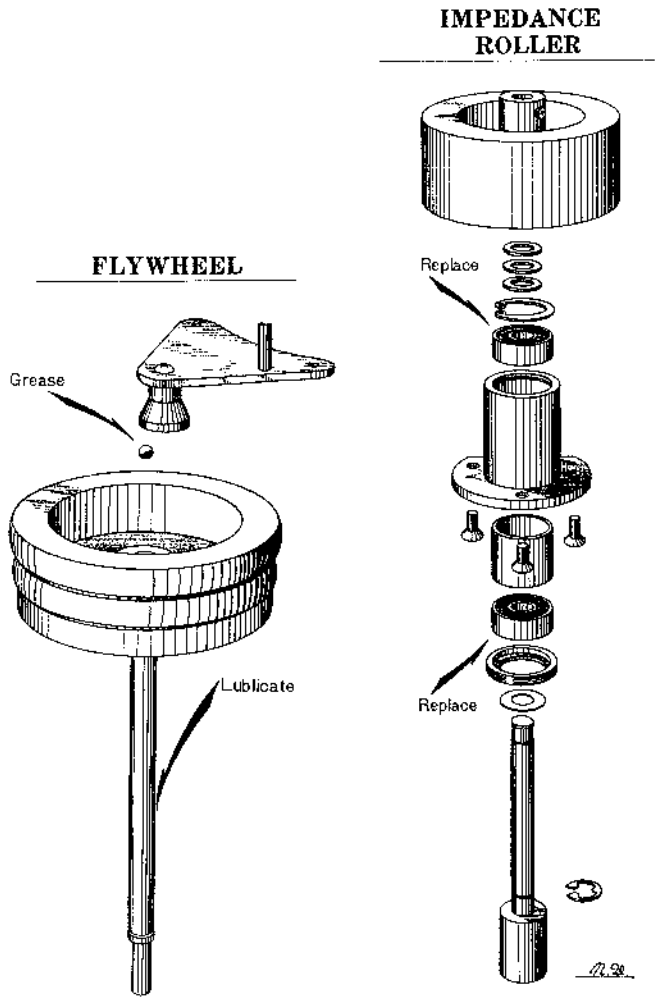
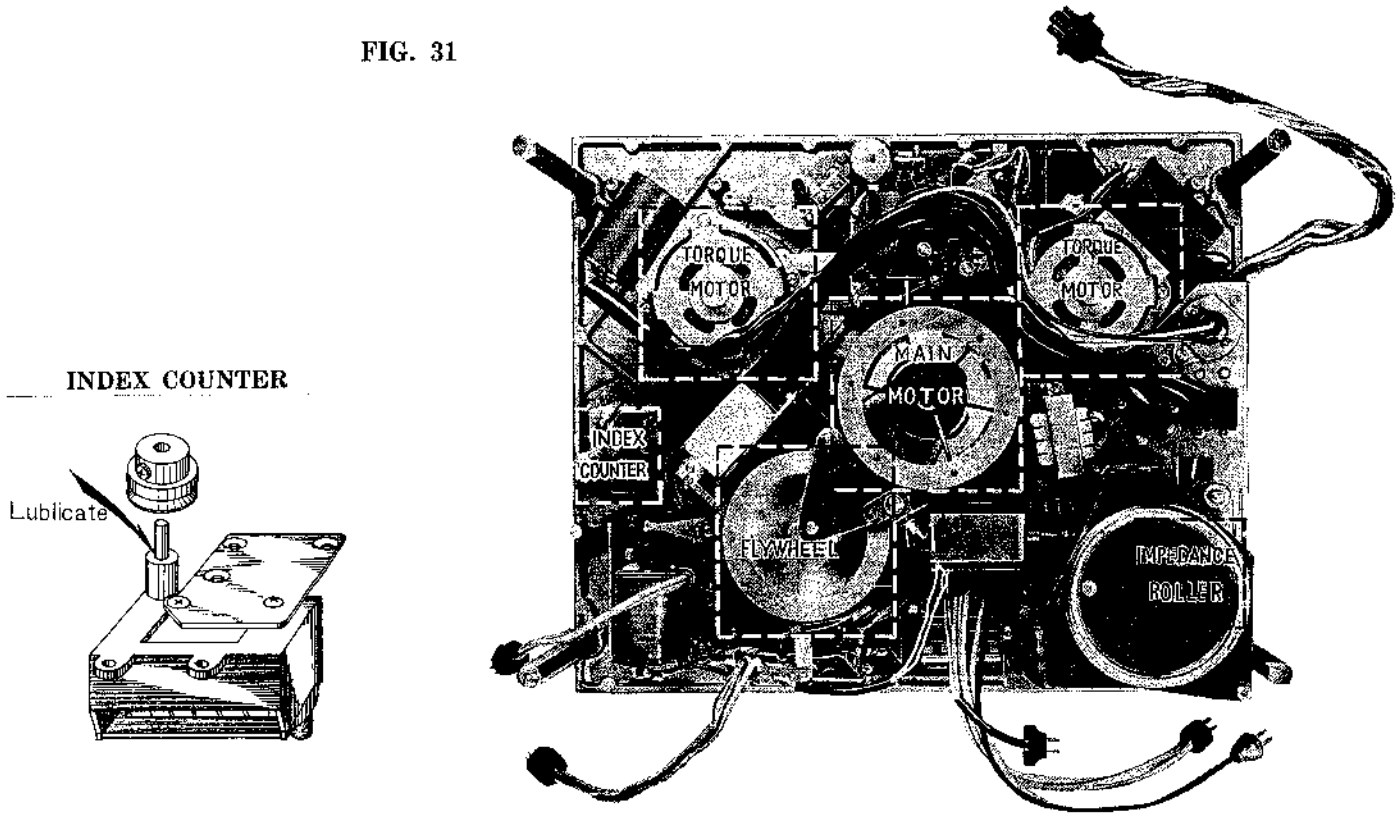
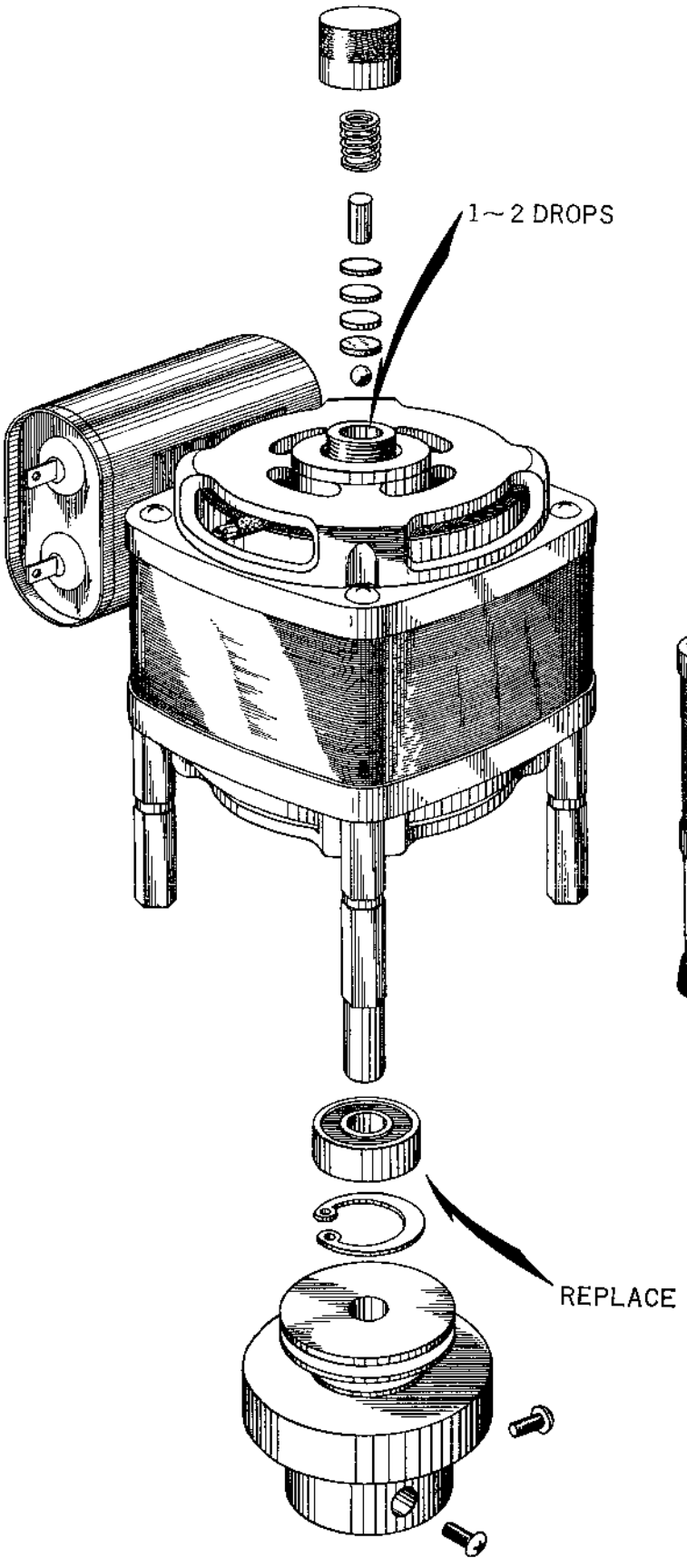


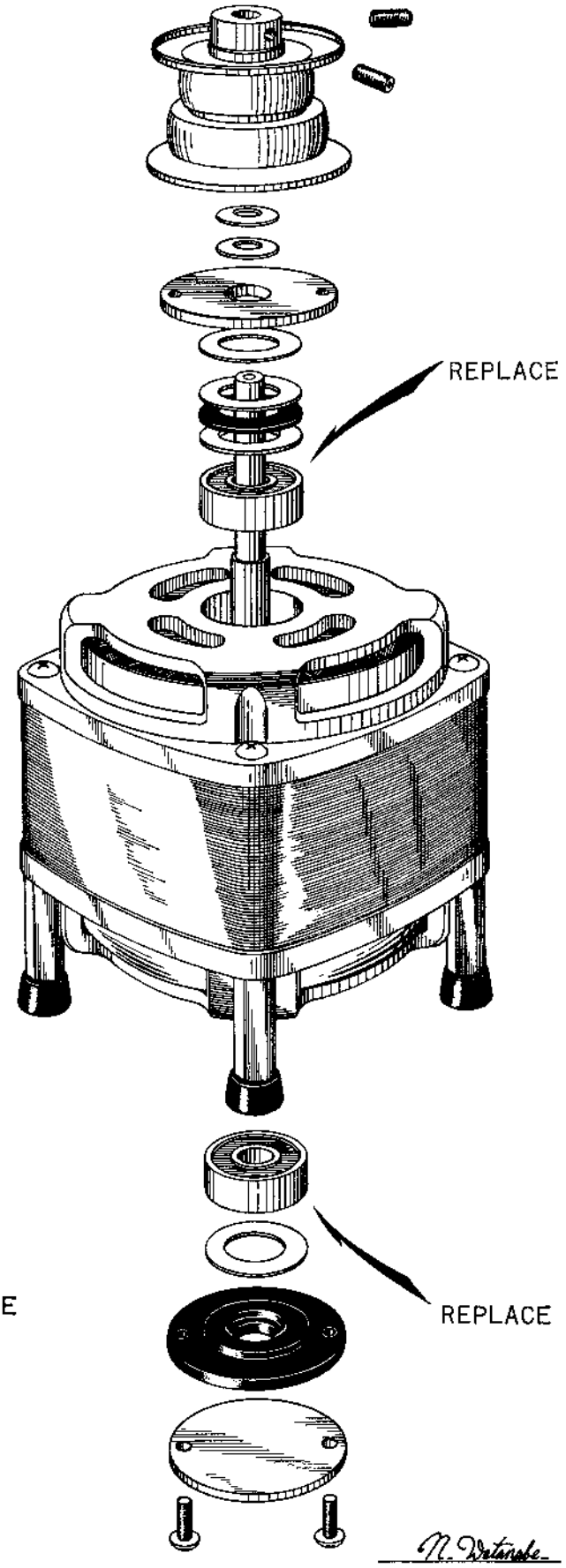

FIG. 31



TORQUE MOTOR




MAIN MOTOR




M. Watanabe

# IX. REPLACEMENT PARTS TABLE

| Parts No. | Nomenclature |
|---|---|

## MECHANISM

### MAIN MOTOR BLOCK

| | |
|---|---|
| 01-001 | Main Motor Comp. |
| 002 | Motor Chassis, Main Motor |
| 003a | Motor Pulley |
| 003b | Screw, without Head |
| 004a | Motor Fan |
| 004b | Ring, Motor Fan |
| 004c | Screw |
| 005 | External Shield Plate, Motor |
| 006a | Flywheel Comp. |
| 006b | 4 mm Ball Bearing |
| 006c | Thrust Metal |
| 007 | Main Metal Case |
| 008 | Plate, Main Shaft |
| 009 | Prop A, Flywheel |
| 010a | Plate, Flywheel |
| 010b | Belt Change Lever |
| 010c | Screw |
| 010d | Prop, Belt Change Lever |
| 010e | Screw |
| 011 | Drive Belt |
| 012a | Speed Change Lever Comp. |
| 012b | Spring F, Lever |
| 012c | Screw |
| 013 | 18P Slide Switch (FS-601N) |
| 014a | 6P Slide Switch, Cycle Change (FS-201NB) |
| 014b | Name Plate, Cycle Change |
| 014c | Screw |
| 014d | Washer |
| 015 | MP Condenser |
| 016 | Resistor 1/4P 10K ohms |
| 017 | 2P Plug |
| 018 | 4P Plug (T Type) |

### WIND MOTOR BLOCK

| | |
|---|---|
| 02-001 | Wind Motor Comp. |
| 002 | Rewind Motor Comp. |
| 003 | 2P Plug |
| 004 | MP Condenser 4$\mu$ 300 VAC |
| 005 | Supply Pulley |
| 006 | Take-up Pulley |

### HEAD BLOCK

| | |
|---|---|
| 03-001 | Head Assembly Comp. |
| 03-002 | Erase Head Comp. |
| 002a | Shift Table, Erase Head |
| 002b | Metal, Up-Down Table |
| 002c | $\mu$ Spring |
| 002d | Plate, Erase Head |
| 002e | Pin, Cam |
| 003 | Recording Head Comp. |
| 003a | LP Angle Table |
| 003b | LP Table |
| 003c | Height Adjusting Plate A, Recording Head |
| 003d | Height Adjusting Plate B, Recording Head |
| 003e | Angle Screw, Recording Head |
| 003f | Screw, Up-Down Recording Head |
| 004 | Bias Head Comp. |
| 004a | Shift Table, Bias Head |
| 004b | Metal, Field Table |
| 004c | Side Plate, Bias Head |
| 004d | Lever, Bias Head |
| 004e | Connecting Plate |
| 004f | (-) Screw 2.3×4.5 |
| 005 | Playback Head |
| 005a | Shift Table, Playback Head |
| 005b | Shaft, Up-Down Playback Head |
| 005c | Reverse Spring |
| 005d | 3 mm closed Nut |
| 005e | Angle Table, Playback Head |
| 005f | Shift Metal, Playback Head |
| 005g | Angle Screw, Playback Head |
| 005h | Height Adjusting Plate, Playback Head |
| 005i | Angle Adjusting Spring |
| 005j | Up-Down Lever, Playback Head |
| 005k | Spring, Head Plunger |
| 005l | 3 mm Nut |
| 005m | Prop, Playback Head Shift |
| 005n | Spring, Playback Head Shift |
| 006a | Table, Head |
| 006b | Stopper |
| 007a | 4T Tape Guide, B |
| 007b | Tape Guide, A |
| 007c | Micron Guide, A |
| 007d | Micron Guide, B |
| 008 | Hum Bucking Coil |
| 009 | Tape Guide Comp. |
| 009a | Screw |
| 009b | Z Guide, A |
| 009c | Washer A, Tape Guide |
| 009d | Washer B, Tape Guide |
| 009e | Bearing |
| 009f | Z Guide, B |
| 009g | Z Arm |
| 009h | Spring, Z |
| 009i | Z Lever, A |
| 009j | Z Metal |
| 010 | Slider Lever, E |
| 011a | Slider Lever, D |
| 011b | Stop Spring, B |
| 012 | Screw, Amplifier Lever |
| 013 | Slider Lever |
| 014a | Shifter Lever, C |
| 014b | Shifter Pin |
| 015 | Shield Plate, Head |
| 016 | Switch Table |
| 017 | 4T Cam |
| 018 | Shaft, Head Wheel |
| 019 | Head Gear, C |
| 020 | Head Gear, A |
| 021 | Shield Plate, H Switch |
| 022 | Rotary Switch |
| 023 | Shield Plate |
| 024 | Plunger A (SDC-M10A) Comp. |
| 024a | Plunger A |
| 024b | Shift Joint, Playback Head |
| 025 | Plunger B (SDC-M10B) Comp. |
| 025a | Plunger B |
| 025b | P Joint, Bias Head |
| 026a | Pull Shaft, Bias Head |
| 026b | Pull Metal, B |
| 026c | Pull Lever |
| 026d | Spring, DA |
| 027 | 2P Plug |
| 028 | 4P Plug |
| 029 | 4P Plug (T Type) |

### HEAD COVER BLOCK

| | |
|---|---|
| 04-001 | Head Wheel |
| 002 | 3A Cover, A |
| 003a | 3A Cover, B |
| 003b | Screw 4×12 |

### PUSH BUTTON BLOCK

| | |
|---|---|
| 05-001 | Main Push Button |
| 002 | Spring, Mechanism Push Button |
| 003 | Guide, Push Button |
| 004 | Prop, Push Button |
| 005a | Chassis, Switch |
| 005b | Rubber Bush |
| 006a | Micro Switch |
| 006b | Plate A, Micro Switch |
| 006c | Plate B, Micro Switch |
| 006d | Collar, Micro Switch |
| 006e | Shaft, Micro Switch |
| 006f | Washer Pin |
| 007 | Push Button, Power Switch |
| 008 | Power Switch |

| Parts No. | Nomenclature |
|---|---|
| 05-009 | Push Button, Automatic Switch |
| 010 | 3AF Block Comp. |
| 010a | 3AF Print plate |
| 010b | Auto. Chassis |
| 010c | 2P Socket (B Type) |
| 010d | Tip Jack |
| 010e | Tip Plug |
| 010f | 8P Plug |
| 011 | 8P Johnson Socket, for Remote Control Comp. |
| 012 | Silcon Diode SW-05a |

## RELAY BLOCK

| | |
|---|---|
| 06-001 | Relay Printed Plate Block Comp. |
| 002 | Relay Printed Plate |
| 002a | 22 Multi Jack |
| 002b | 11P Socket (O Type) |
| 002c | 2P Socket (B Type) |
| 002d | 4P Socket (B Type) |
| 003a | MP Condenser 0.5$\mu$ 350 VDC (220 VAC) |
| 003b | MP Condenser 0.1$\mu$ 350 VDC (220 VAC) |
| 003c | MP Condenser 0.5$\mu$ 150 VDC |
| 003d | MP Condenser 0.1$\mu$ 150 VDC |
| 003e | Oil Condenser 0.02$\mu$ 400 VDC |
| 003f | Electrolytic Condenser 50$\mu$ 50V |
| 003g | Wired Resistor 5L 8 ohms J |
| 003h | Resistor 1P 100 ohms J |
| 003i | Resistor 1/4P 50 ohms K |
| 004 | Lug Type Condenser 2500$\mu$ 40V |
| 005 | 9P Plug |
| 006 | P Printed Plate Chassis Comp. |
| 006a | Table, P Socket |
| 006b | Choke Transformer, Reverse Plunger (0.3H 0.1A) |
| 006c | Base, P Chassis |
| 007 | Resistor 50 ohms 10H |
| 008a | 55 Prop. |
| 008b | 55 Prop. (Hexagonal) |
| 009 | 69 Prop. |
| 010 | Side Plate, P Chassis |
| 011 | Relay Switch DC 24V |
| 012 | Relay Support Plate, B |
| 013 | Print Plug |
| 014 | 6P Plug |

## BRAKE BLOCK

| | |
|---|---|
| 07-001 | Brake Relay Table Comp. |
| 002 | Brake Connect Plate Comp. |
| 003a | Brake Band |
| 003b | Switch Angle, A |
| 003c | Switch Angle, B |
| 004a | Spring, Brake |
| 004b | Spring Holder, A |
| 004c | Spring Holder, B |
| 005a | Brake Adjusting Screw |
| 005b | Brake Adjusting Spring |
| 006a | Brake Lever Comp. |
| 006b | Shaft, Brake Lever |
| 007a | Brake Plunger |
| 007b | Relay York |
| 007c | Connecting Screw |
| 007d | Table, Micro Switch |
| 007e | Micro Switch |
| 008 | 4P Plug (T Type) |
| 009 | Tip Connector Jack |

## REPEATER BLOCK

| | |
|---|---|
| 08-001a | Dial Button |
| 001b | Spring, Repeater Knob |
| 001c | Repeater Knob, B |
| 001d | Repeater Dial |
| 001e | Spring, Clamp |
| 001f | Spur Gear |
| 001g | Dial Stop Plate |
| 001h | Repeater Switch |
| 001i | Switch Angle, A |
| 002a | Repeater Change Knob |
| 002b | Escutcheon, Repeater Change Knob |
| 002c | Change Lever |
| 002d | Angle, Change Lever |
| 002e | Shaft |
| 003 | Timer Chassis Comp. |
| 004a | Insulator Spacer |
| 004b | Insulator Table, Switch |
| 004c | Switch Plate, B |
| 005a | Repeater Gear |
| 005b | Washer |
| 005c | Pressure Spring |
| 005d | Clank Gear |
| 005e | Screw, without Head |
| 006a | Metal Fitting, Shaft |
| 006b | Repeater Gear |
| 006c | Spur Gear |
| 007a | Repeater Worm with Shaft |
| 007b | Washer |
| 007c | Timer Pulley |
| 007d | Timer Belt |
| 008a | Angle, UZ Socket |
| 008b | UZ Socket |
| 008c | Condenser Q-AK1 |
| 008d | Tip Connector Jack |

## TENSION ARM BLOCK

| | |
|---|---|
| 09-001 | Tension Arm Comp. |
| 001a | Guide Pin, Tension Arm |
| 001b | Metal, Tension Lever |
| 001c | Nut, Tension Lever |
| 001d | Cushion, Tension Arm |
| 004a | Lever, Micro Switch |
| 004b | Spring, Micro Switch |
| 005 | Micro Switch |
| 006 | Table, Cut-off Micro Switch |

## IMPEDANCE BLOCK

| | |
|---|---|
| 10-001 | Z Roller |
| 002 | Screw, Z Bearing |
| 003 | Bearing 608VUC2E |
| 004 | Z Case |
| 005 | Bearing Collar |
| 006 | Pin |
| 007 | Impedance Wheel |

## PINCH WHEEL BLOCK

| | |
|---|---|
| 11-001a | (+) Screw Flat Mould 4 x 12 |
| 001b | Cap, Pinch Wheel |
| 001c | Pinch Wheel |
| 001d | Shaft, Pinch Wheel |
| 002 | Base B, Pinch Wheel |
| 003 | Shaft, Pinch Wheel Arm |
| 004a | Arm, Pinch Wheel |
| 004b | Spring, Pinch Wheel |
| 005 | Relay Comp. |
| 005a | Relay York |
| 005b | Plunger |
| 005c | Tip Connector Plug |
| 006a | Pinch Wheel Pull Bar Comp. |
| 006b | Washer |
| 006c | Pressure Spring, Pinch Wheel |
| 006d | Nut |
| 006e | Stop Pin B, Pinch Wheel |
| 007a | Short Switch B |
| 007b | Prop B, Short Switch |
| 007c | 4P Plug |

## COUNTER BLOCK

| | |
|---|---|
| 12-001 | Counter Four Digit Comp. |
| 002 | Plate, Counter |
| 003a | Pulley, Counter |
| 003b | Screw |
| 004 | Belt, Counter |

## POWER BLOCK

| | |
|---|---|
| 13-001 | Power Chassis |
| 002 | Power Transformer |
| 003 | Auto. Transformer, Motor |
| 004 | Rectifier SPN-01 |

| Parts No. | Nomenclature |
|---|---|
| 13–005 | Rectifier 12C–2 |
| 006 | US Socket, TV–318 |
| 007 | 9P Mould Socket, Black |
| 008a | 6P Slide Switch ESS–22C–NB, Cycle Change |
| 008b | Name Plate, Cycle Change |
| 009 | 3P Lug Plate |
| 010 | 2P Lug Plate |
| 011a | Lug Type Condenser 500$\mu$ 50V |
| 011b | Tubular Type Condenser 500$\mu$ 50V |
| 012a | Wired Resistor 1.5L 0.2 ohms K |
| 012b | Wired Resistor 2L 120 ohms K |
| 012c | Wired Resistor 2L 100 ohms K |
| 012d | Wired Resistor 5L 105 ohms K |
| 013 | 12 mm Rubber Bush |
| 014 | Power Connector Plate |
| 015 | Power Selector Knob |
| 016 | Power Change Socket |
| 017 | Hexangular Prop, Selector |
| 018 | 6P Slide Switch ESS-22C–NC, Power Change |
| 019 | Prop, Switch |
| 020 | Hexangular Prop, Selector |
| 021 | Arm, Power Selector |
| 022a | Plate, Power Selector |
| 022b | 3 mm Closed Nut |
| 023 | 6P Slide Switch ESS-22C-NB, Reel Size |
| 024 | 3A Fiber |
| 025a | Fuse Post |
| 025b | Fuse, 3A |
| 026 | Cord Support |
| 027 | AC Cord |
| 028 | Rubber Bush, AC Cord |

### PANEL BLOCK

| | |
|---|---|
| 14–001 | Mechanism Panel |
| 001a | (+) Screw Truss 4×4 |
| 001b | Washer |
| 001c | Prop, Mechanism Panel |
| 002 | Mechanism Frame |
| 002a | (+) Screw Truss 4×25 |
| 003a | Reel Holder |
| 003b | Screw Flat 3×8 |
| 003c | Rubber, Reel Table |
| 003d | Plate, Reel Table |
| 003e | Spring, Reel Table |
| 14–003f | Screw |
| 003g | Reel Table Ring |
| 004 | Speed Change Knob, B |
| 005a | Screw, without Head |
| 005b | R Guide |
| 005c | Prop, R Guide |
| 005d | Cover, R Pin |
| 005e | R Pin |
| 005f | Insulator Ring |
| 006 | Dust Cover, Capstan Shaft |

### CASE BLOCK

| | |
|---|---|
| 15–001 | Case Comp. |
| 001a | Case |
| 002a | 3A Ventilator |
| 002b | (+) Screw Truss 3×6 |
| 003 | Cord Holder |
| 004 | Sound Mirror |
| 005a | Amplifier Base Panel, Case |
| 005b | Catch, Amplifier Base Panel |
| 006a | Rubber Foot |
| 006b | (+) Screw Truss 4×20 |
| 007a | Escutcheon |
| 007b | (+) Screw Truss 3×8 |
| 008 | Speaker Russ Plate |
| 009 | Speaker 6DJ1 |
| 010 | Russ Plate, A |
| 011 | Patent Name Plate |
| 012 | Support Angle, Case |
| 013 | Catch |
| 014 | Hinge |

## AMPLIFIER

### AMPLIFIER CHASSIS BLOCK

| | |
|---|---|
| 16–001 | Amplifier Chassis, A |
| 002 | Amplifiier Chassis, B |
| 003 | 27 Prop |
| 004a | Holder A, Muliti Jack |
| 004b | 10P Multi Jack |
| 005a | Hoder B, Multi Jack |
| 005b | 18P Multi Jack |
| 006a | Supporter, Printed Plate |
| 006b | Holder, Printed Plate Supporter |
| 007a | 4P Jack |
| 007b | Table, 4P Jack |
| 008a | 4P Socket |
| 008b | Holder, 4P Socket |
| 16–009a | 2–pole E Jack |
| 009b | Name Plate, Jack |
| 010 | 4P Connector Socket |
| 011 | US Plug |
| 012 | Tip, Speaker |
| 013 | Small Rubber |
| 014 | Speed Nut |
| 015a | 2P Fuse Holder |
| 015b | Fuse, 1A |
| 016a | 3P Lug Plate, Small |
| 016b | 3P Lug Plate, 31 L1 |
| 016c | 4P Lug Plate, 41 L2 |
| 016d | 4P Lug Plate, 42 L1 |
| 016e | 5P Lug Plate, Small |
| 017 | Transistor 2SB 338(A) or 2SB 471 |
| 018a | Tubular Type Electrolytic Condenser 500$\mu$ F 25V |
| 018b | Tubular Type Electrolytic Condenser 200$\mu$ F 25V |
| 018c | Tubular Type Electrolytic Condenser 1000$\mu$ F 25V |
| 019a | Resistor 1/4P 47 ohms K |
| 019b | Resistor 1/4P 220 ohms J |
| 019c | Resistor 1/4P 820 ohms |
| 019d | Resistor 1/4P 6.8K ohms K |
| 019e | Resistor 1/4P 10K ohms K |
| 019f | Resistor 1/4P 100K ohms |
| 019g | Wired Resistor 3WL 8 ohms K |

### AMPLIFIER FRAME BLOCK

| | |
|---|---|
| 17–001 | Amplifier Frame |
| 002 | Support Angle, Amplifier Frame |
| 003a | Prop A, Amplifier Panel |
| 003b | Prop B, Amplifier Panel |
| 004a | Prop A, Switch |
| 004b | Prop B, Switch |
| 005 | VU Meter (VH-30) |
| 006 | Spring, VU Meter |
| 007a | Pilot Lamp, Swan Type |
| 007b | Lamp Socket |
| 008a | Recording Button |
| 008b | Lever, Recording Lock |
| 009a | 2-pole E Jack (MIC Input) |
| 009b | Holder, Jack |
| 010a | 3-pole E Jack (Headphone Input) |
| 010b | Holder, Jack |
| 011a | Seasaw Switch (Function Switch, Tone Switch, Speaker ON/OFF Switch) |
| 011b | Seasaw Switch (Equalizer Switch) |

| Parts No. | Nomenclature |
|---|---|
| 17-012 | Push Button Switch (Equalizer Switch) |
| 013a | 3P Lug Plate, Small |
| 013b | 5P Lug Plate, Small |
| 014a | Variable Resistor, Duplex |
| 014b | Variable Resistor |
| 015a | Resistor 1/4P 10K ohms |
| 015b | Resistor 1/4P 39K ohms |
| 016 | Tubular Type Oil Condenser 0.02 (M) 400WV |

## AMPLIFIER CARD BLOCK
## RECORD CARD

| | |
|---|---|
| 18-001 | Record Card Comp. |
| 002 | Printed Plate, Record Card |
| 003 | Holder, Record Card |
| 004a | Transistor 2SB 443 (A) |
| 004b | Transistor 2SB 75 (B) |
| 005a | Tubular Type Electrolytic Condenser 30$\mu$ F 3V |
| 005b | Tubular Type Electrolytic Condenser 100$\mu$ F 3V |
| 005c | Tubular Type Electrolytic Condenser 100$\mu$ F 6V |
| 005d | Tubular Type Electrolytic Condenser 10$\mu$ F 10V |
| 005e | Tubular Type Electrolytic Condenser 100$\mu$ F 10V |
| 005f | Tubular Type Electrolytic Condenser 10$\mu$ F 25V |
| 005g | Mylar Condenser 0.033$\mu$ F 50V K |
| 005h | Mylar Condenser 0.047$\mu$ F 50V K |
| 005i | Mylar Condenser 0.1$\mu$ F 50V K |
| 006a | Resistor 1/4P 100 ohms K |
| 006b | Resistor 1/4P 220 ohms J |
| 006c | Resistor 1/4P 300 ohms J |
| 006d | Resistor 1/4P 560 ohms J |
| 006e | Resistor 1/4P 1.2K ohms J |
| 006f | Resistor 1/4P 1.5K ohms J |
| 006g | Resistor 1/4P 3K ohms K |
| 006h | Resistor 1/4P 3.3K ohms K |
| 006i | Resistor 1/4P 10K ohms K |
| 006j | Resistor 1/4P 10K ohms J |
| 006k | Resistor 1/4P 15K ohms J |
| 006l | Resistor 1/4P 22K ohms J |
| 006m | Resistor 1/4P 100K ohms J |
| 007a | Half Fixed Resistor 500 ohms (B) |
| 007b | Half Fixed Resistor 10K ohms (B) |
| 008 | Peaking Coil 300$\mu$ H |
| 009 | Screw, (+) 2.3×5 |
| 010 | 2.3 mm Nut |

## PLAYBACK CARD

| | |
|---|---|
| 19-001 | Playback Card Comp. |
| 002 | Printed Plate, Playback Card |
| 003 | Holder, Playback Card |
| 004a | Transistor 2SB 443 (A) |
| 004b | Transistor 2SB 75 (B) |
| 004c | Transistor 2SB 75 (F) |
| 005a | Tubular Type Electrolytic Condenser 30$\mu$ F 3V |
| 005b | Tubular Type Electrolytic Condenser 100$\mu$ F 3V |
| 005c | Tubular Type Electrolytic Condenser 100$\mu$ F 6V |
| 005d | Tubular Type Electrolytic Condenser 10$\mu$ F 10V |
| 005e | Tubular Type Electrolytic Condenser 100$\mu$ F 10V |
| 005f | Tubular Type Electrolytic Condenser 10$\mu$ F 25V |
| 005g | Tubular Type Electrolytic Condenser 50$\mu$ F 25V |
| 005h | Mylar Condenser 0.01$\mu$ F 50V J |
| 005i | Mylar Condenser 0.22$\mu$ F 35V K |
| 006a | Resistor 1/4P 100 ohms K |
| 006b | Resistor 1/4P 220 ohms J |
| 006c | Resistor 1/4P 270 ohms J |
| 006d | Resistor 1/4P 300 ohms J |
| 006e | Resistor 1/4P 560 ohms J |
| 006f | Resistor 1/4P 1.5K ohms J |
| 006g | Resistor 1/4P 1.8K ohms K |
| 006h | Resistor 1/4P 2.2K ohms K |
| 006i | Resistor 1/4P 3K ohms K |
| 006j | Resistor 1/4P 3.3K ohms K |
| 006k | Resistor 1/4P 4.7K ohms J |
| 006l | Resistor 1/4P 6.8K ohms K |
| 006m | Resistor 1/4P 10K ohms K |
| 006n | Resistor 1/4P 10K ohms J |
| 006o | Resistor 1/4P 15K ohms J |
| 006p | Resistor 1/4P 100K ohms J |
| 007 | Half Fixed Resistor 20K ohms (B) |
| 008 | Headphone Transformer 7K ohms : 8 ohms |
| 009 | Screw, (+) 2.3×5 |
| 010 | 2.3 mm Nut |

## RELAY CARD

| | |
|---|---|
| 20-001 | Relay Card Comp. |
| 002 | Printed Plate A, Relay Card |
| 003 | Printed Plate B, Relay Card |
| 004 | Silicon Diode SE-05a |
| 005 | Tubular Type Electrolytic Condenser 200$\mu$ F 25V |
| 006a | Resistor 1/4P 220 ohms J |
| 006b | Resistor 1/4P 1K ohms K |
| 007 | Compound Body 120 ohms+0.1$\mu$ F 250V |
| 008a | Relay FBV153b |
| 008b | Socket |
| 008c | Metal Holder |
| 009 | 9P Socket, Printed Plate |
| 010 | Angle, Relay |
| 011 | Holder, Reloy Card |
| 012 | Screw, (+) 2.3×5 |
| 013 | 2.3 mm Nut |

## MAIN AMPLIFIER CARD

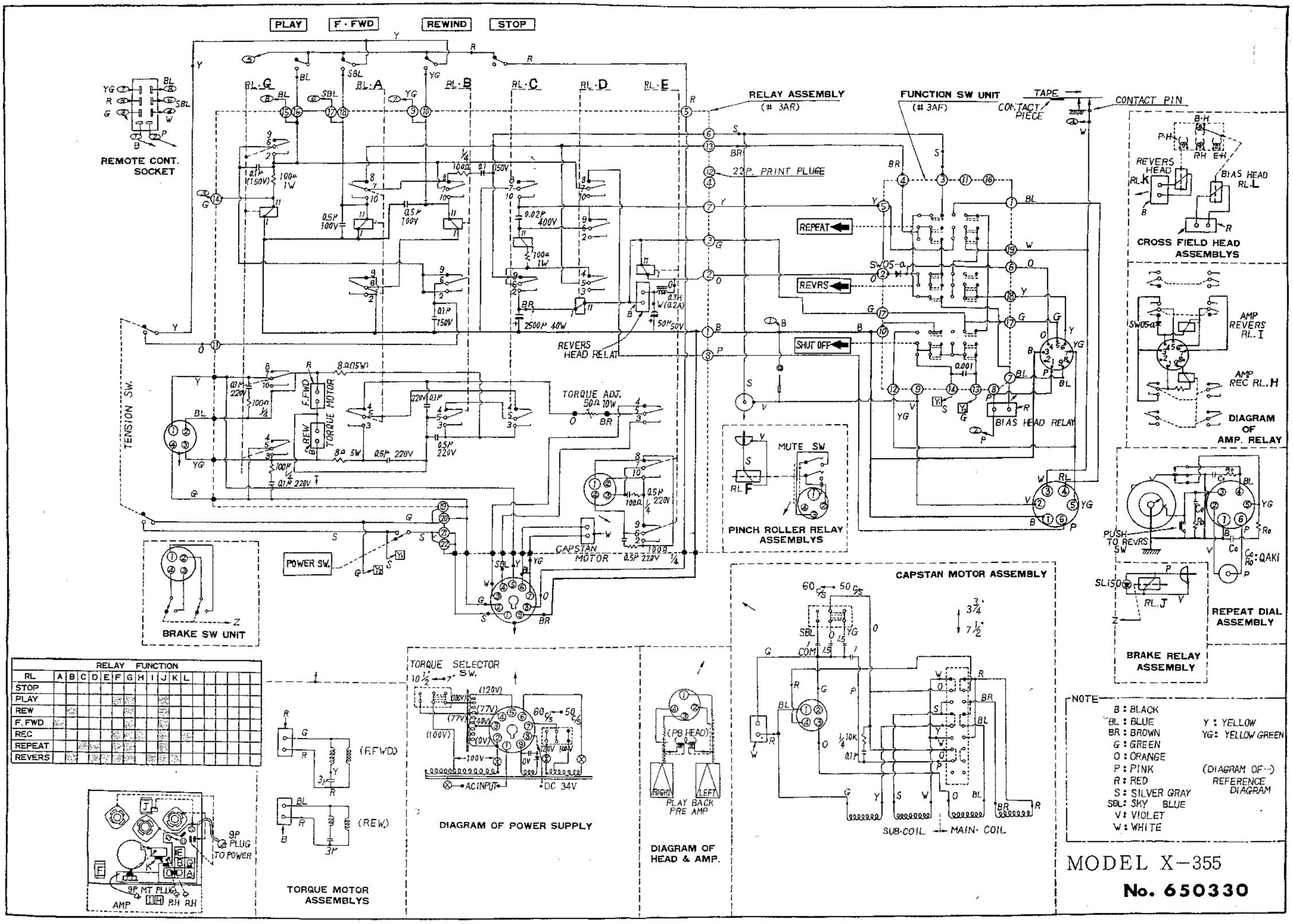
| | |
|---|---|
| 21-001 | Main amplifier Card comp. |
| 002 | Printed Plate, Main Amplifier Card |
| 003 | Radiative Plate |
| 004 | Radiative Plate, Transistor |
| 005 | Holder, Printed Plate |
| 006a | Tubular Type Electrolytic Condenser 500$\mu$ F 3V |
| 006b | Tubular Type Electrolytic Condenser 10$\mu$ F 6V |
| 006c | Tubular Type Electrolytic Condenser 500$\mu$ F 6V |
| 006d | Tubular Type Electrolytic Condenser 50$\mu$ F 10V |
| 006e | Mylar Condenser 0.015$\mu$ F 50V K |
| 006f | Mylar Condenser 0.022$\mu$ F 50V K |
| 006g | Mylar Condenser 330P 35WV K |
| 007a | Resistor 1/4P 12 ohms K |
| 007b | Resistor 1/4P 150 ohms K |
| 007c | Resistor 1/4P 150 ohms J |
| 007d | Resistor 1/4P 470 ohms J |
| 007e | Resistor 1/4P 1K ohms J |
| 007f | Resistor 1/4P 1.2K ohms J |
| 007g | Resistor 1/4P 3.3K ohms K |
| 007h | Resistor 1/4P 5.6K ohms J |
| 007i | Resistor 1/4P 30K ohms J |
| 007j | Resistor 1/4P 15K ohms J |
| 007k | Resistor 1/4P 100K ohms K |
| 007l | Resistor 1/2P 680 ohms K |
| 008 | Wired Resistor 3/4WL 0.5 ohms K |
| 009 | Half Fixed Resistor 300 ohms (B) |
| 010 | Driver Transformer N-35-2052 |
| 011a | Transistor 2SB 75 (A) |
| 011b | Transistor 2SB 370A (A) |
| 012 | Thermister 13D27 |
| 013 | Screw, (+) 2.3×5 |
| 014 | 2.3mm Nut |

## OSCILLATOR CARD

| | |
|---|---|
| 22-001 | Oscillator Card Comp. |
| 002 | Printed Plate, Oscillator Card |
| 003 | Chassis, Oscillator |
| 004 | Prop A, Switch |
| 005 | Radiative Plate |
| 006 | Transistor 2SB 370A (B) |
| 007a | Tubular Type Electrolytic Condenser 100$\mu$ F 6V |
| 007b | Oil Condenser 0.01$\mu$ F 400WV |
| 008a | Resistor 1W 36 ohms J |
| 008b | Resistor 1/4P 20K ohms J |
| 008c | Resistor 1/4P 3K ohms J |
| 009 | Oscillator Coil |
| 010 | Plastic condenser 0.06$\mu$ F 400WV |
| 011 | Screw, (+) 3×12 |
| 012 | M3 Nut |
| 013 | Screw, (+) 3×8 |
| 014 | Screw, (+) 3×5 |
| 015 | M3 Nut |

## AMPLIFIER PANEL BLOCK

| | |
|---|---|
| 23-001 | Amplifier Panel |
| 002 | Escutcheon, VU Meter |
| 003 | Escutcheon B, Recording Lamp |
| 004 | Escutcheon, Recording Button |
| 005a | Knob A, Amplifier |
| 005b | Knob B, Amplifier |
| 006 | Push Button (P.B/REC. OUTPUT) |



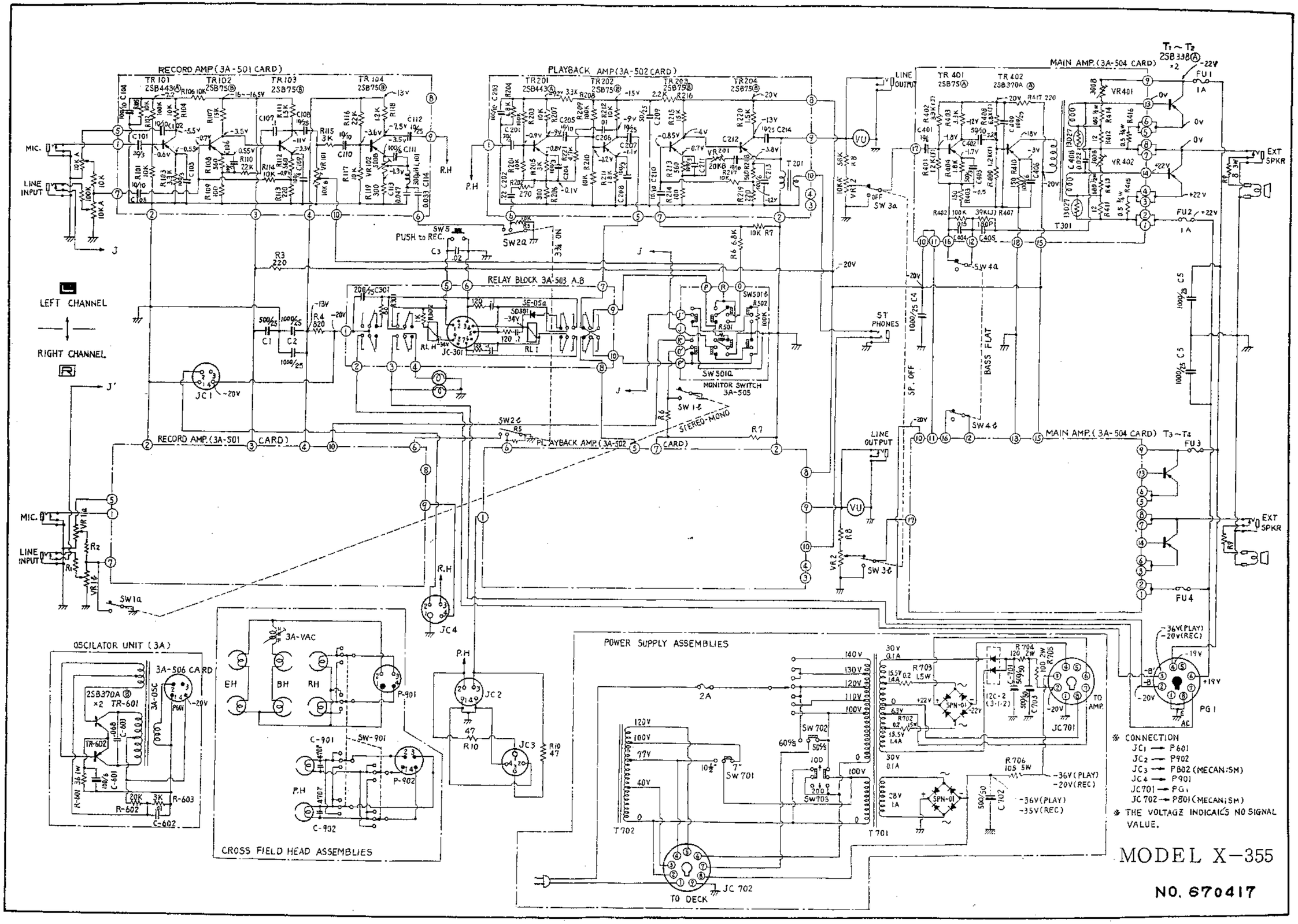

| RELAY FUNCTION | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RL | A | B | C | D | E | F | G | H | I | J | K | L | | | | | |
| STOP | | | | | | | | | | | | | | | | | |
| PLAY | | | | | | | | | | | | | | | | | |
| REW | | | | | | | | | | | | | | | | | |
| F. FWD | | | | | | | | | | | | | | | | | |
| REC | | | | | | | | | | | | | | | | | |
| REPEAT | | | | | | | | | | | | | | | | | |
| REVERS | | | | | | | | | | | | | | | | | |

NOTE

| | |
|---|---|
| B : BLACK | Y : YELLOW |
| BL : BLUE | YG : YELLOW GREEN |
| BR : BROWN | |
| G : GREEN | |
| O : ORANGE | |
| P : PINK | (DIAGRAM OF··) REFERENCE DIAGRAM |
| R : RED | |
| S : SILVER GRAY | |
| SBL : SKY BLUE | |
| V : VIOLET | |
| W : WHITE | |

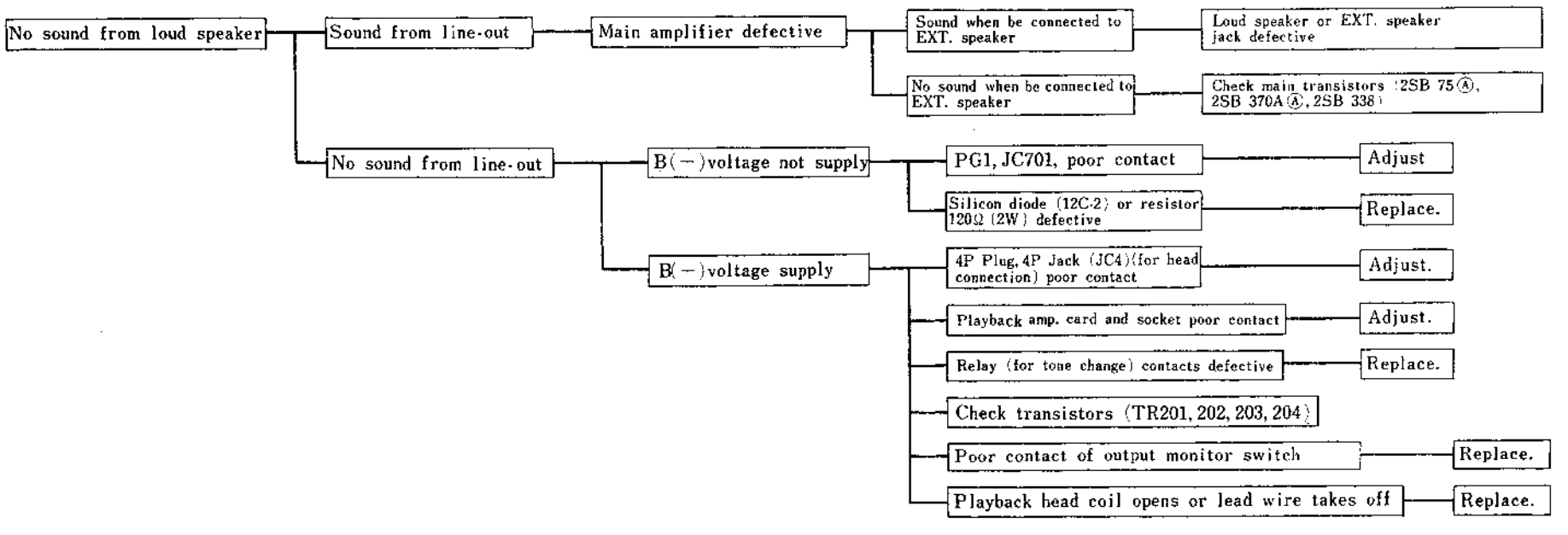
MODEL X-355

**No. 650330**

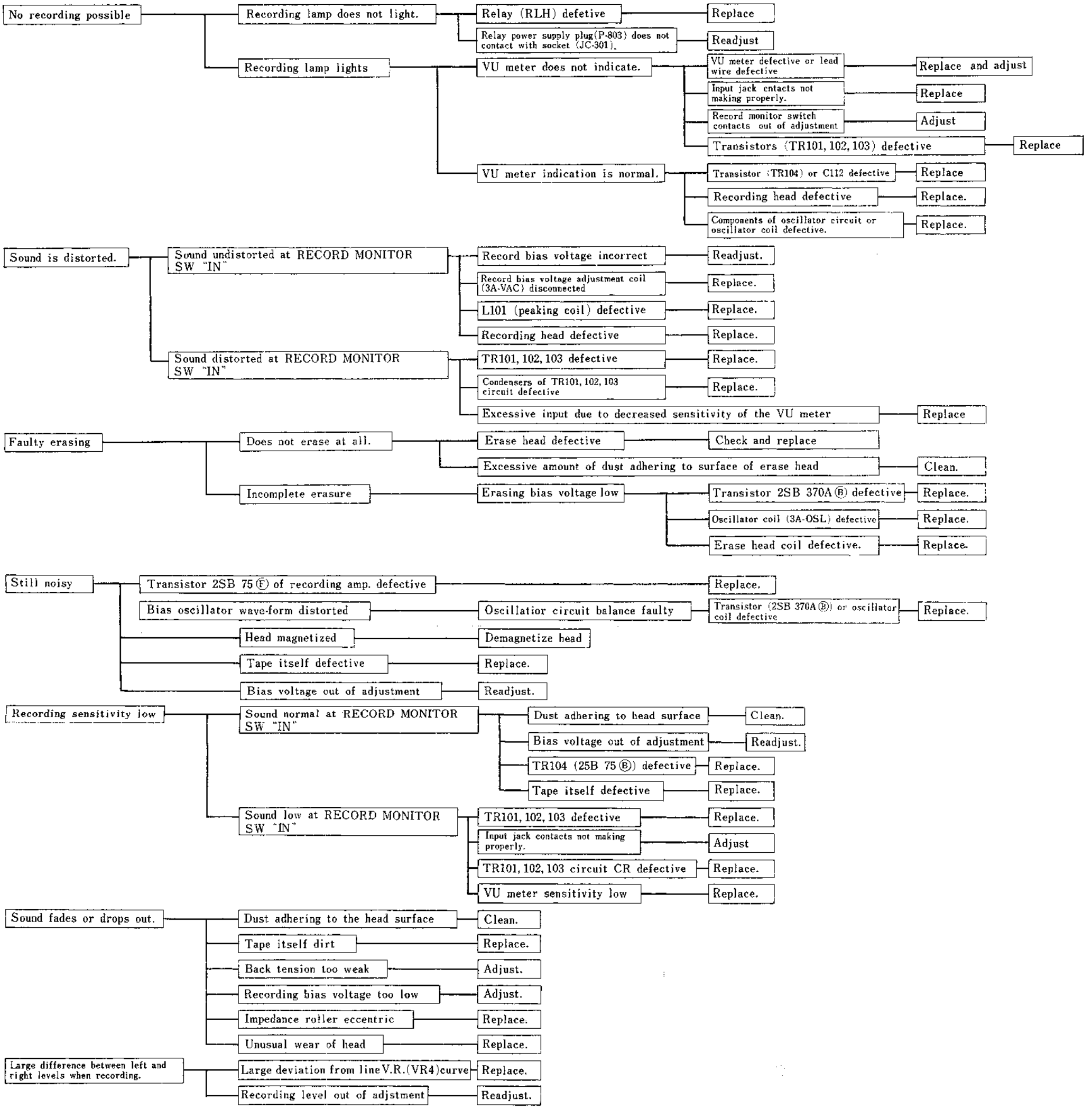

RECORD AMP.(3A-501 CARD)
PLAYBACK AMP.(3A-502 CARD)
MAIN AMP.(3A-504 CARD)
RELAY BLOCK 3A-503 A.B
MONITOR SWITCH 3A-505
LEFT CHANNEL
RIGHT CHANNEL
MIC.
LINE INPUT
LINE OUTPUT
EXT SPKR
ST PHONES
SP. OFF
BASS FLAT
STEREO-MONO
PUSH to REC.
OSCILATOR UNIT (3A)
CROSS FIELD HEAD ASSEMBLIES
POWER SUPPLY ASSEMBLIES
TO DECK
TO AMP.
※ CONNECTION
JC1 → P601
JC2 → P902
JC3 → P802 (MECAN:SM)
JC4 → P901
JC701 → PG1
JC702 → P801 (MECAN:SM)
※ THE VOLTAGE INDICAICS NO SIGNAL VALUE.
MODEL X-355
NO. 670417

# XI. TROUBLE SHOOTING CHART

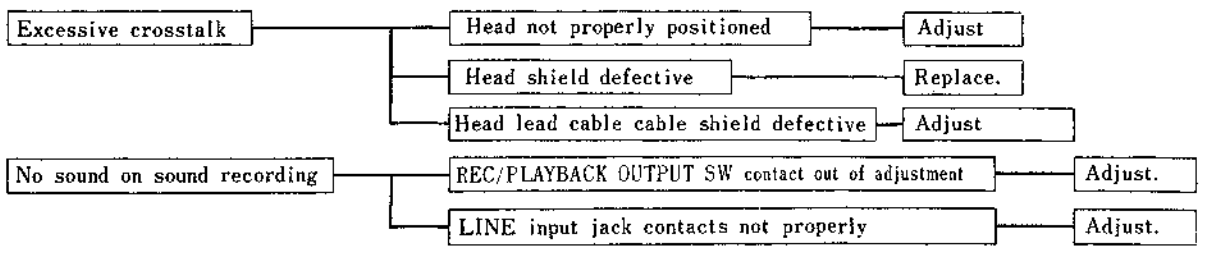
## TROUBLE WITH PLAYBACK SYSTEM (AMPLIFIER)



# RECORDING SYSTEM TROUBLES (AMPLIFIER)




# TROUBLE IN BOTH RECORDING AND PLAYBACK (AMPLIFIER)

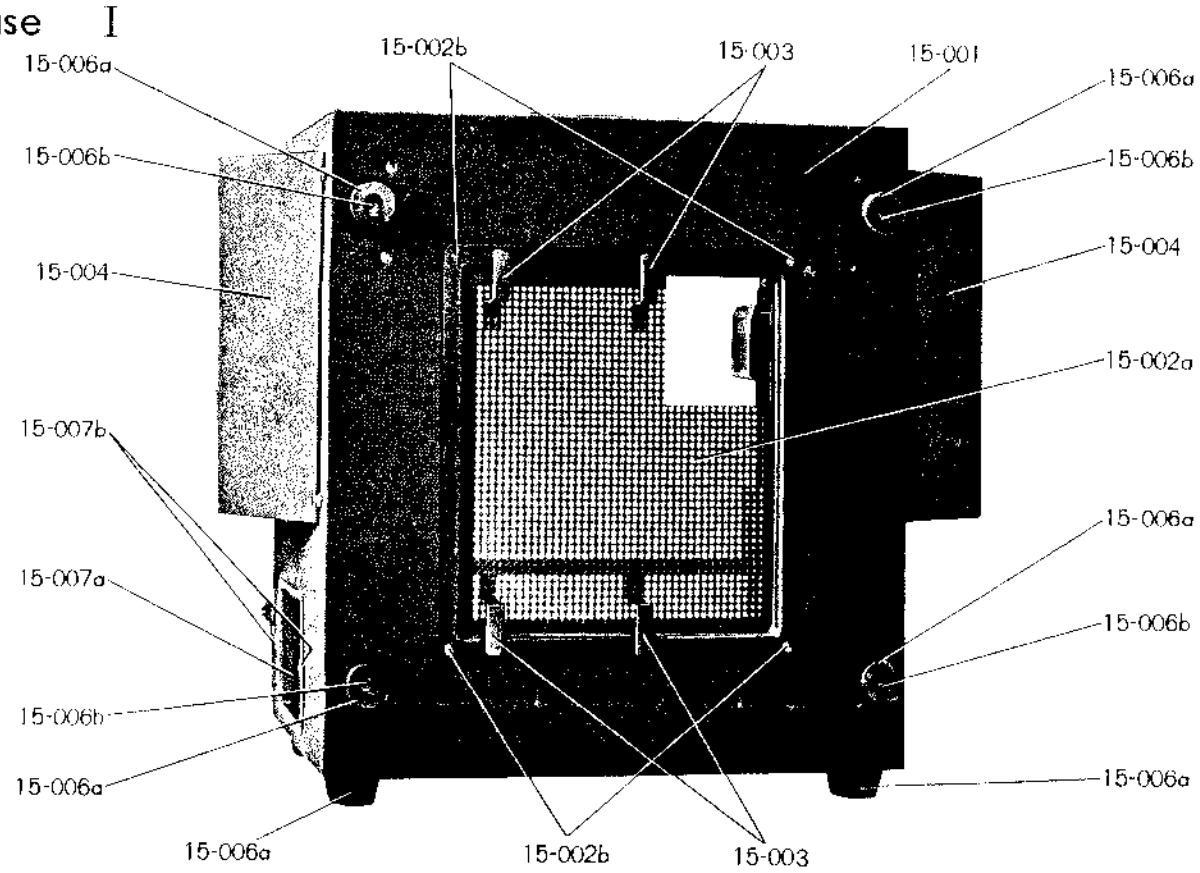


# TROUBLES WITH TAPE TRANSPORT MECHANISM.

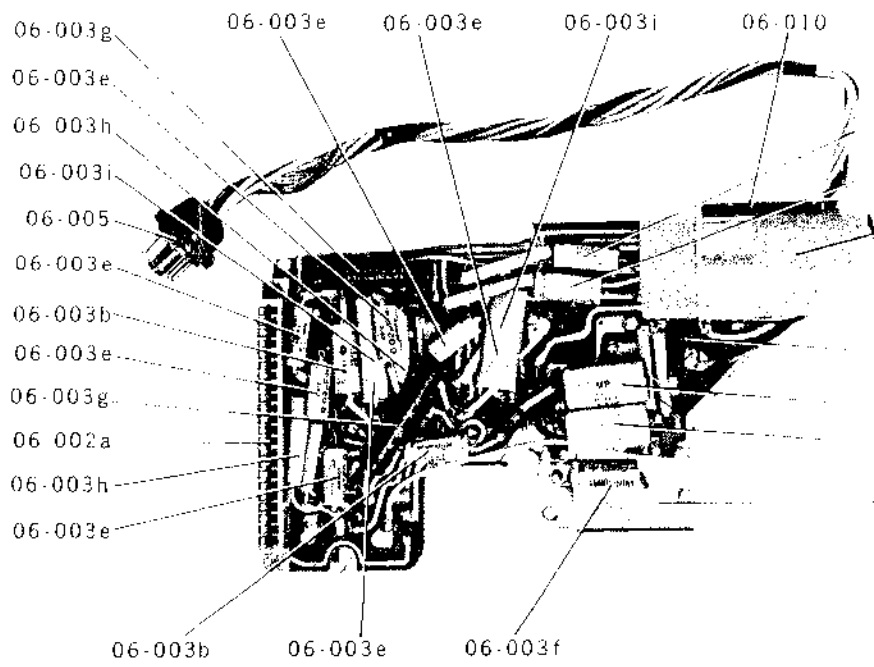
| | | | |
|---|---|---|---|
| Capstan does not rotate. | Pilot lamp (VU meter lamp) does not light. | Fuse blown | Replace. |
| | | Power switch defective | Replace. |
| | | Power transformer defective. | Replace. |
| | | Power supply socket defective. | Replace. |
| | | Power cord defective | Replace. |
| | Pilot lamp lights. | Shut off S.W. contacts defective | Replace. |
| | | Defective transport | Driving belt not in proper position — Reposition belt |
| | | | Motor-pulley slipping — Tighten set-screw |
| | | | Oil on motor-pulley or flywheel — Wipe off oil |
| | | Main motor block defective | Field coil open — Replace. |
| | | | Starting condenser defective — Replace. |
| | | | Metal seizure — Replace. |
| No movement in "PLAY" | Function lamp does not light. | Tension switch contacts defective | Replace. |
| | | "PLAY" switch (SW9) contacts out of adjustment | Readjust. |
| | | Relay G defective | Replace. |
| | Function lamp lights. | Brake solenoid defective | Replace. |
| | | Pinch wheel solenoid defective | Replace. |
| | "PLAY" does not operate properly. | Motor-pulley slipping | Tighten screw clamp. |
| | | Oil on driving belt | Wipe off oil. |
| | | Motor torque weak | Replace. |
| Tension arm falls in "PLAY" position | Fast FWD motor defective | | Replace. |
| | Brake arm balance out of adjustment | | Readjust. |
| | Fast FWD motor socket not making good contact | | Adjust. |
| Does not "Rewind." | Function lamp does not light. | Tension S.W. contacts out of adjustment | Adjust. |
| | | Rewind S.W. (SW806) contacts out of adjustment | Adjust. |
| | | Relay B, relay G defective | Replace. |
| | Function lamp lights. | Rewind motor defective | Replace. |
| | | Rewind motor socket not making good contact | Adjust. |
| Does not "Fast FWD" | Function lamp not light. | Tension SW not making good contact | Adjust. |
| | | Fast FWD switch (SW805) not making good contact | Adjust. |
| | | Relay A, relay G defective | Replace. |
| | Function lamp lights. | Fast FWD motor defective | Replace. |
| | | Fast FWD motor socket not making good contact | Adjust. |
| Does not "REVERSE PLAY" | Trouble in AUTO DIAL operation only | Auto dial contacts out of adjustment | Readjust. |
| | Does not operate even when MANUAL REVERSE BUTTON is pushed | Reverse SW contacts out of adjustment | Readjust. |
| | | Relay E, relay I defective | Replace. |
| | | S.W. 809 not making good contact | Adjust. |
| | | C812 faulty | Replace. |
| Will not "STOP | Brake solenoid disconnected or lead cable off-positioned. | | Check and change |
| | Brake adjustment screw out of adjustment | | Readjust. |
| No "REPEAT" operation | Trouble in AUTO DIAL operation only | Auto dial contacts out of adjustment | Readjust. |
| | No movement even when pushing the MANUAL REVERSE BUTTON | Relay C defective | Replace. |
| | | Repeat SW (SW808) not making good contact | Adjust. |
| Wow, flutter excessive | Impedance roller eccentric or needs oiling | | Replace or lubricate |
| | Flywheel eccentric or needs oiling | | Replace or lubricate. |
| | Excessive back tension | | Supply and take-up motor terminal voltage ajustment |
| | Main motor torque weak | | Replace. |
| Tape speed too slow | Main motor block defective | Metal seizure | Replace. |
| | | Starting condenser faulty | Replace. |
| | Defective transport mechanism | Motor-pulley slipping | Tighten screw |
| | | Driving belt tension or oil adherence | Replace. |
| | Fluctuation of power supply voltage or frequency | Power supply voltage or frequency too low. | Check voltage, frequency |
| Will not NORMAL PLAY when REVERSE BUTTON is pushed | Instrument is set for 60% when it is used on 50% | Set drive belt in 50% position | |
| | SW814 lead cable or REVERSE SW809 grounded | | Readjust. |
| Auto SHUT-OFF does not work. | Tension switch (SW802) remains on. | | Adjust. |
| No take up of tape during REVERSE PLAY | Relay E defective | | Replace. |
| REVERSE PLAY provides sound improperly | Head solenoid disconnected | | Replace.. |
| | Upper and lower head selector lever catches | | Adjustment |
| Squeaky noise heard when transporting tape. | Dust adherig to head surface | | Clean |
| | Tape is statically charged. | | Replace tape. |
| | Tape is very old. | | Replace tape. |
| | Excessive back tension | | Adjust. |
| | Tape coating defective | | Replace tape. |
| Trpe is worn from rubbing on the reel | Left or right motor pulley height out of adjustment | | Adjust. |

# EXPLODED VIEW OF COMPONENT PARTS

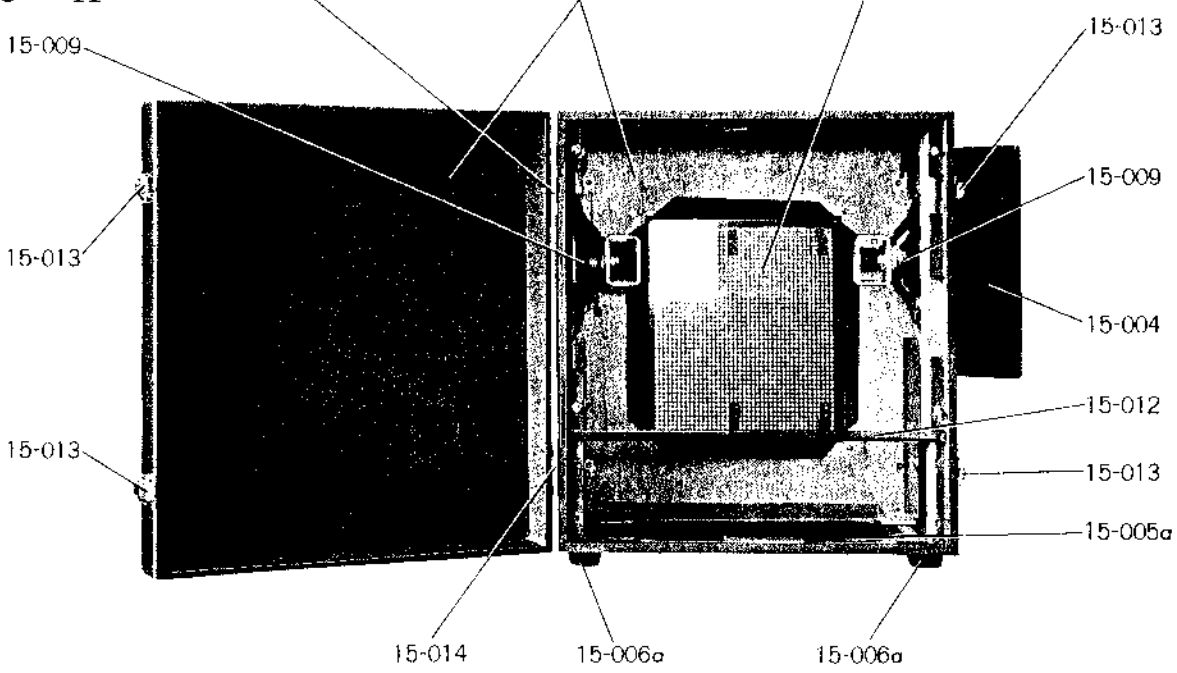
## Case I



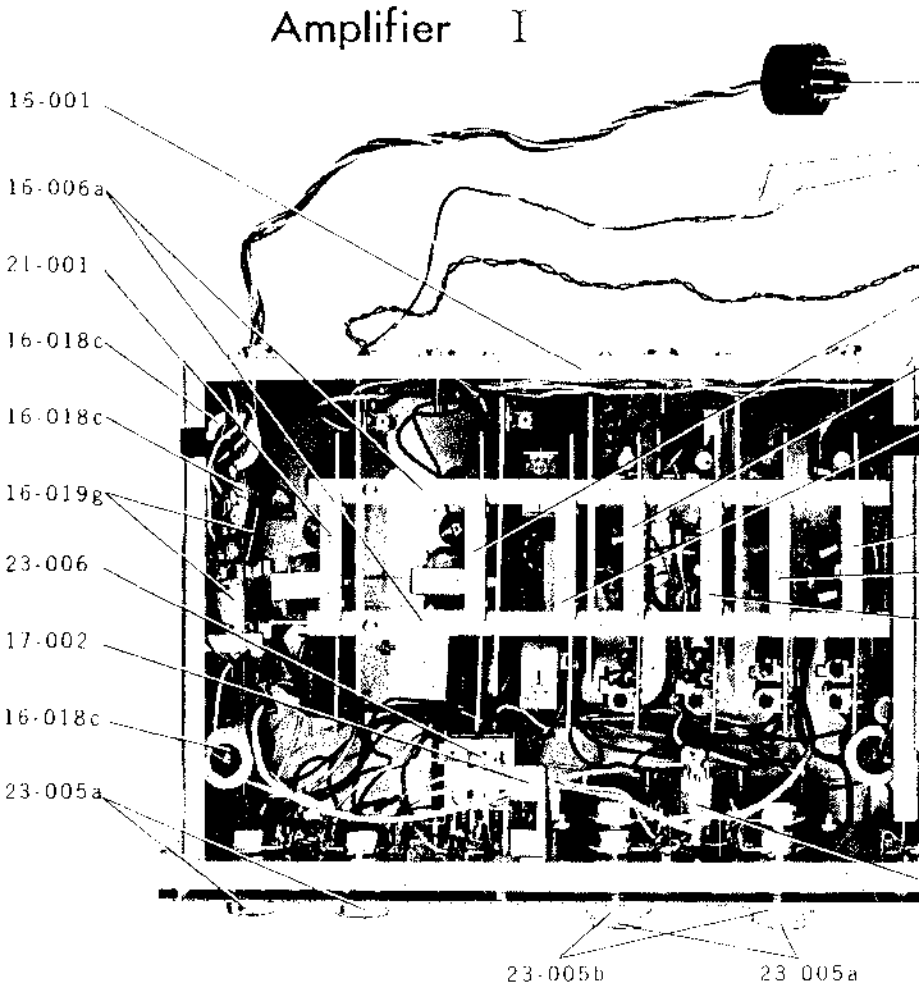

## Mechanism Relay Block



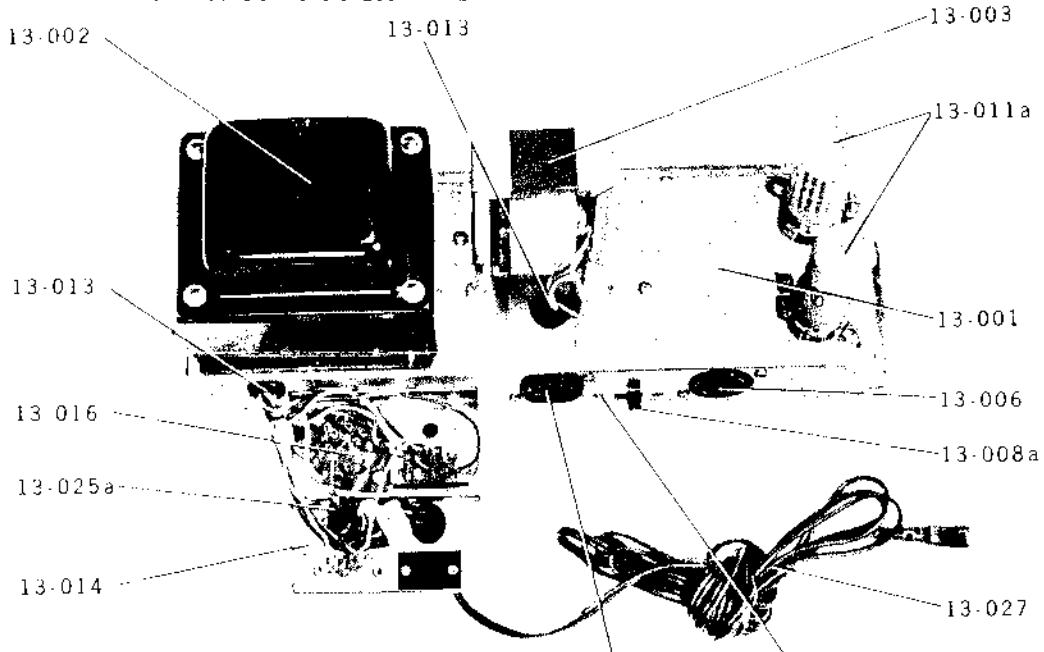

## Case II



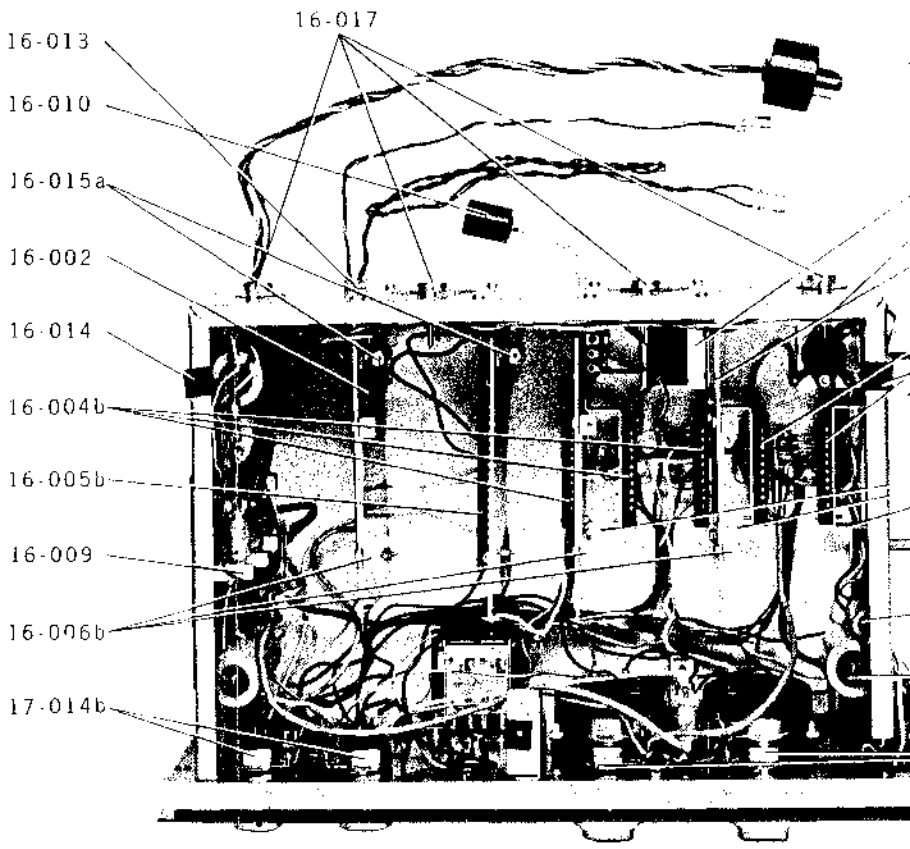

## Amplifier I



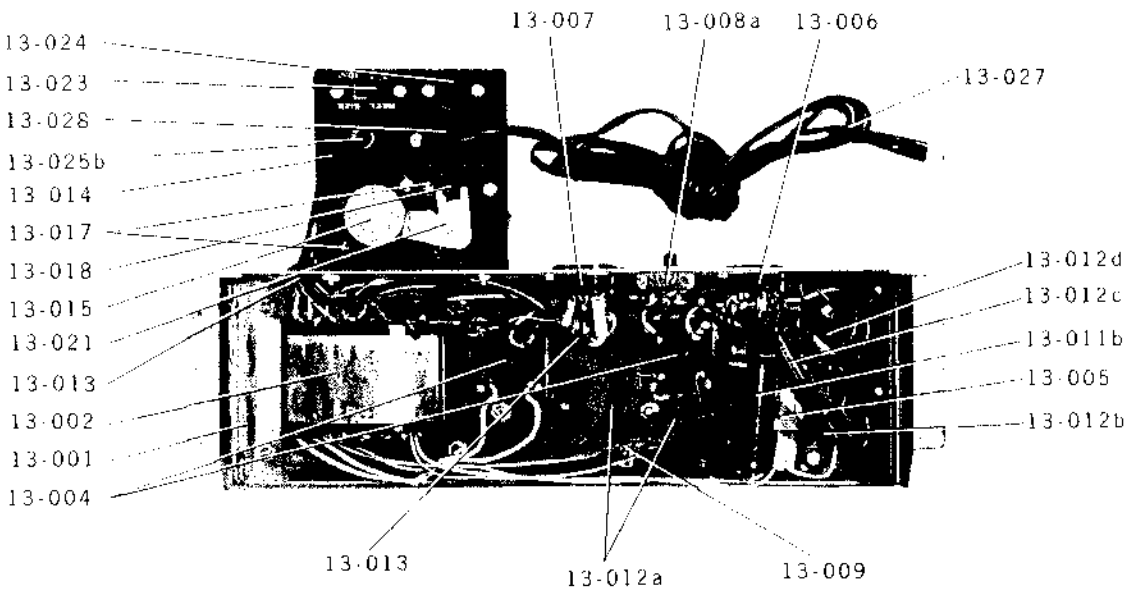

## Mechanism Power Block I



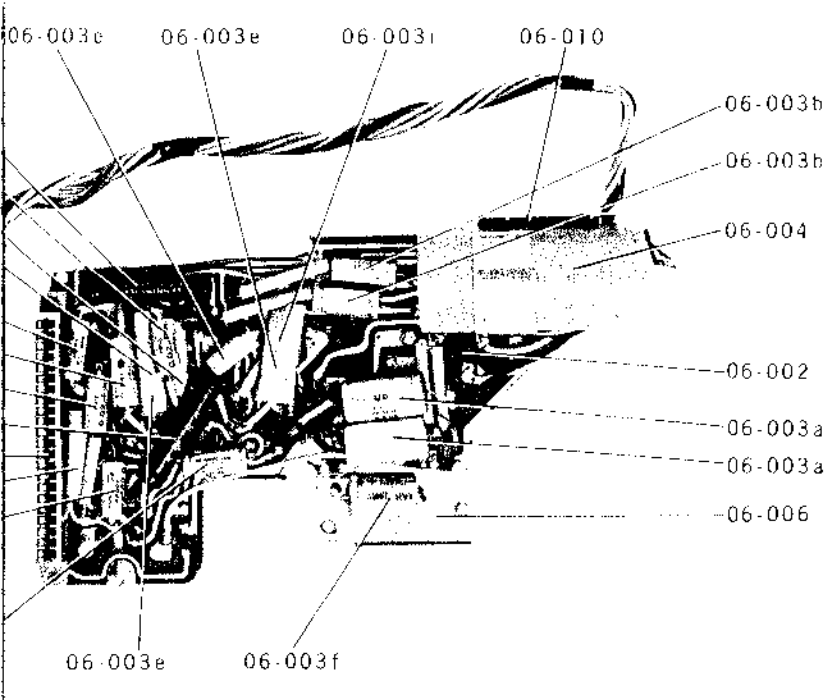

## Amplifier II



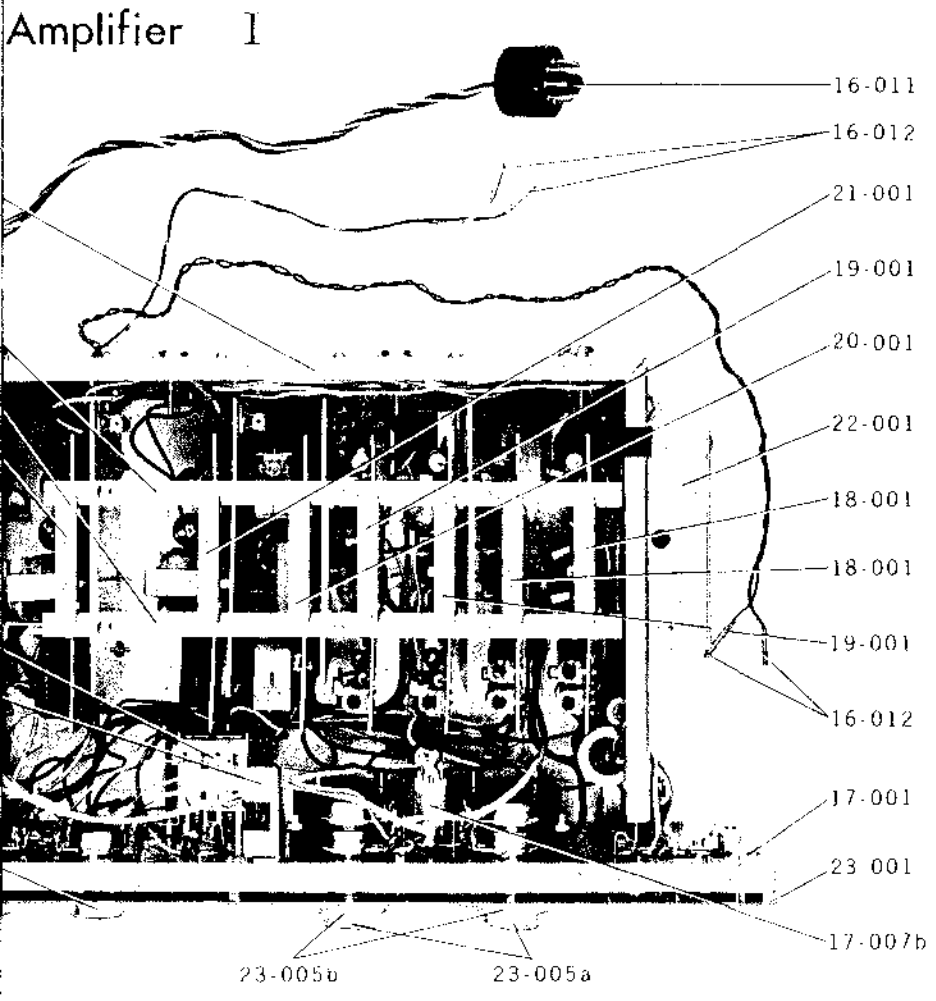

## Mechanism Power Block II



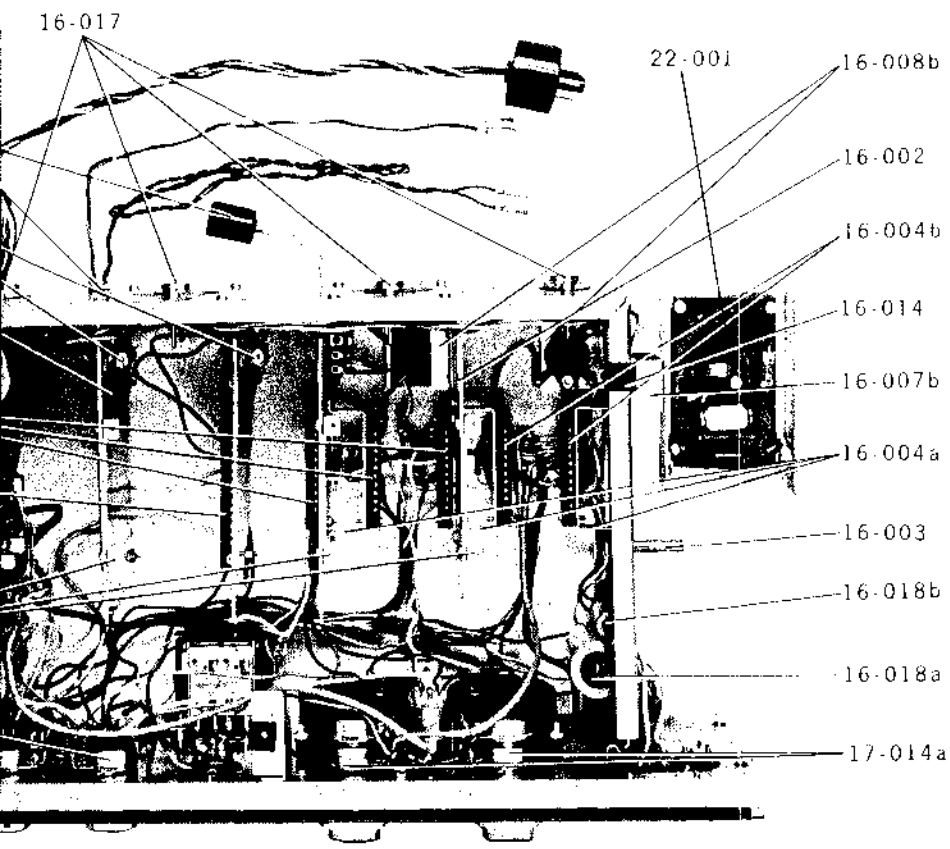
## Mechanism Relay Block



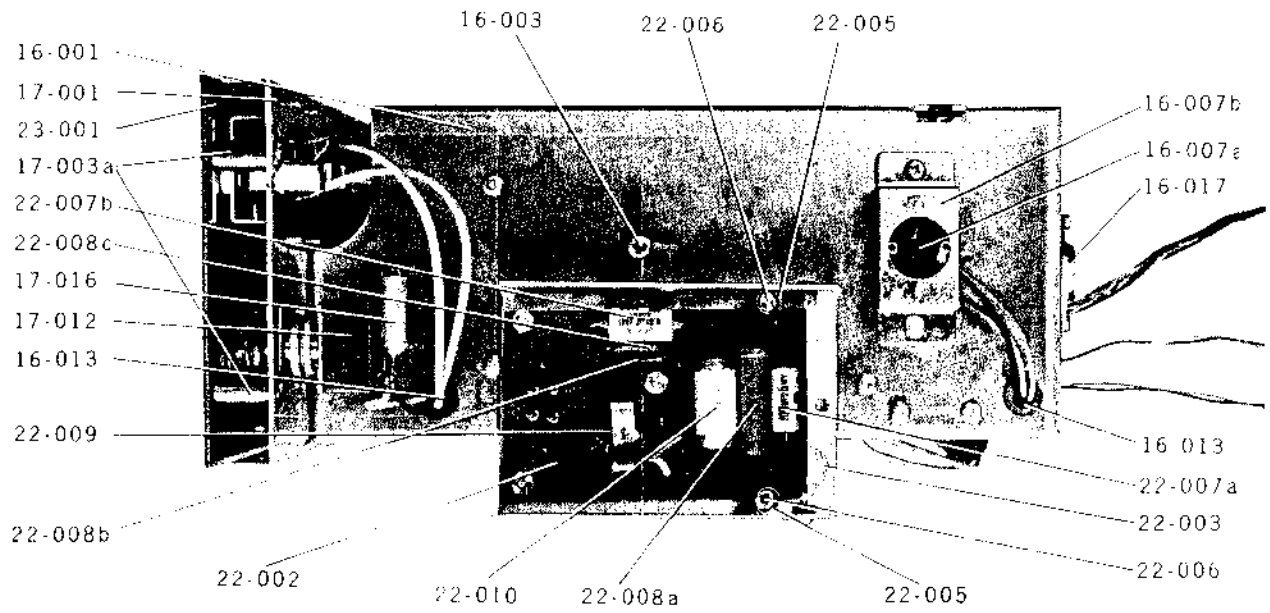

## Amplifier I




## Amplifier II

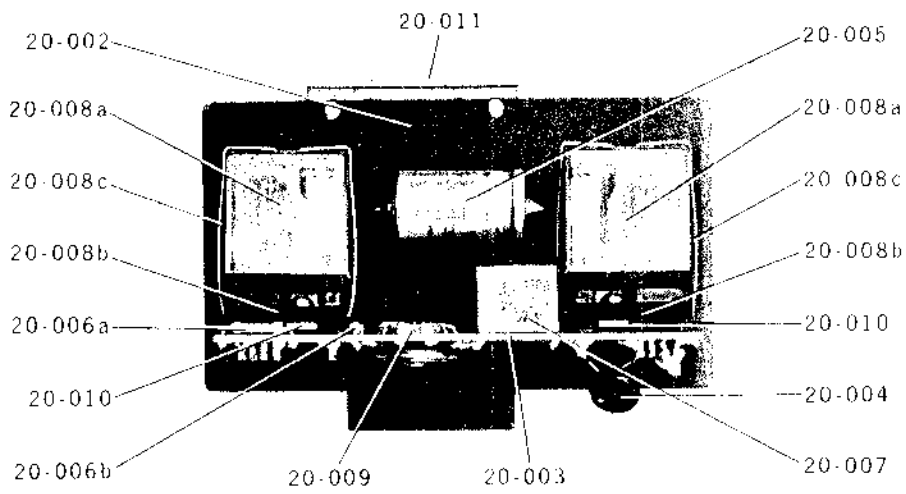



## Amplifier III

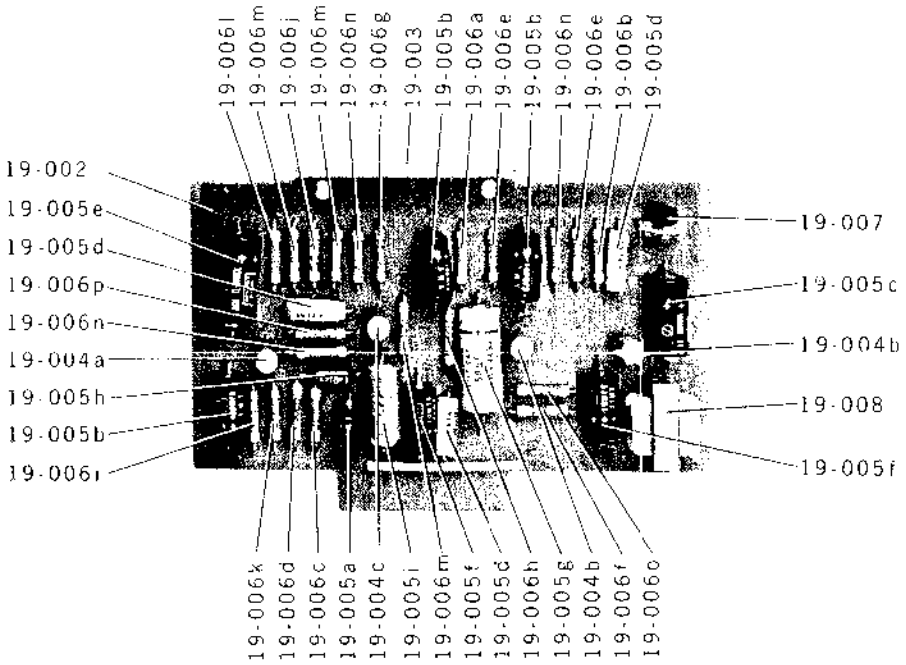



## Amplifier IV

RELAY BLOCK

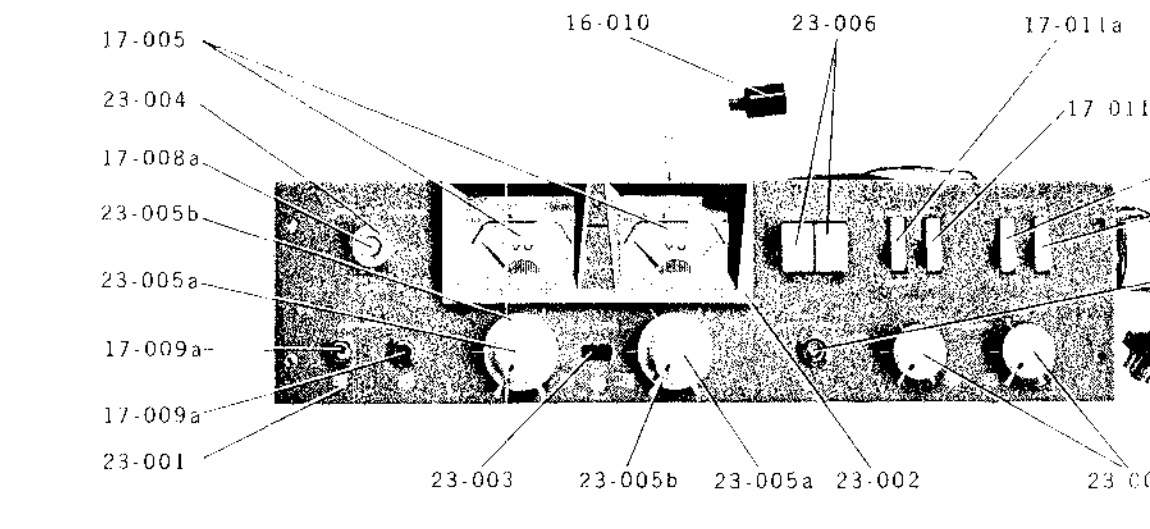



PLAYBACK

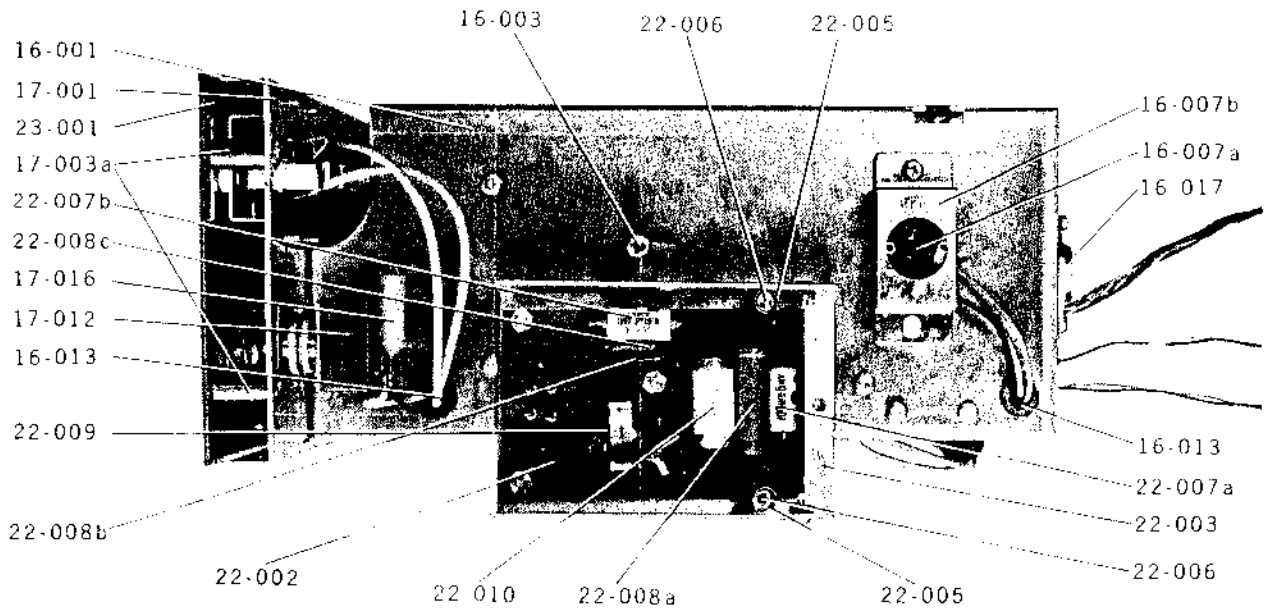




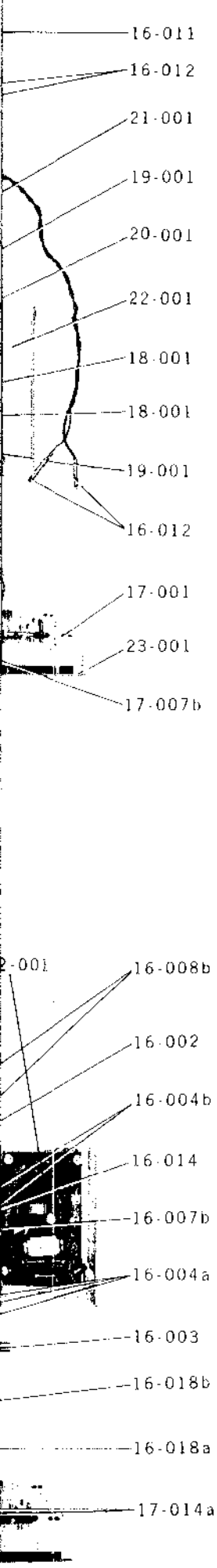
## Amplifier V



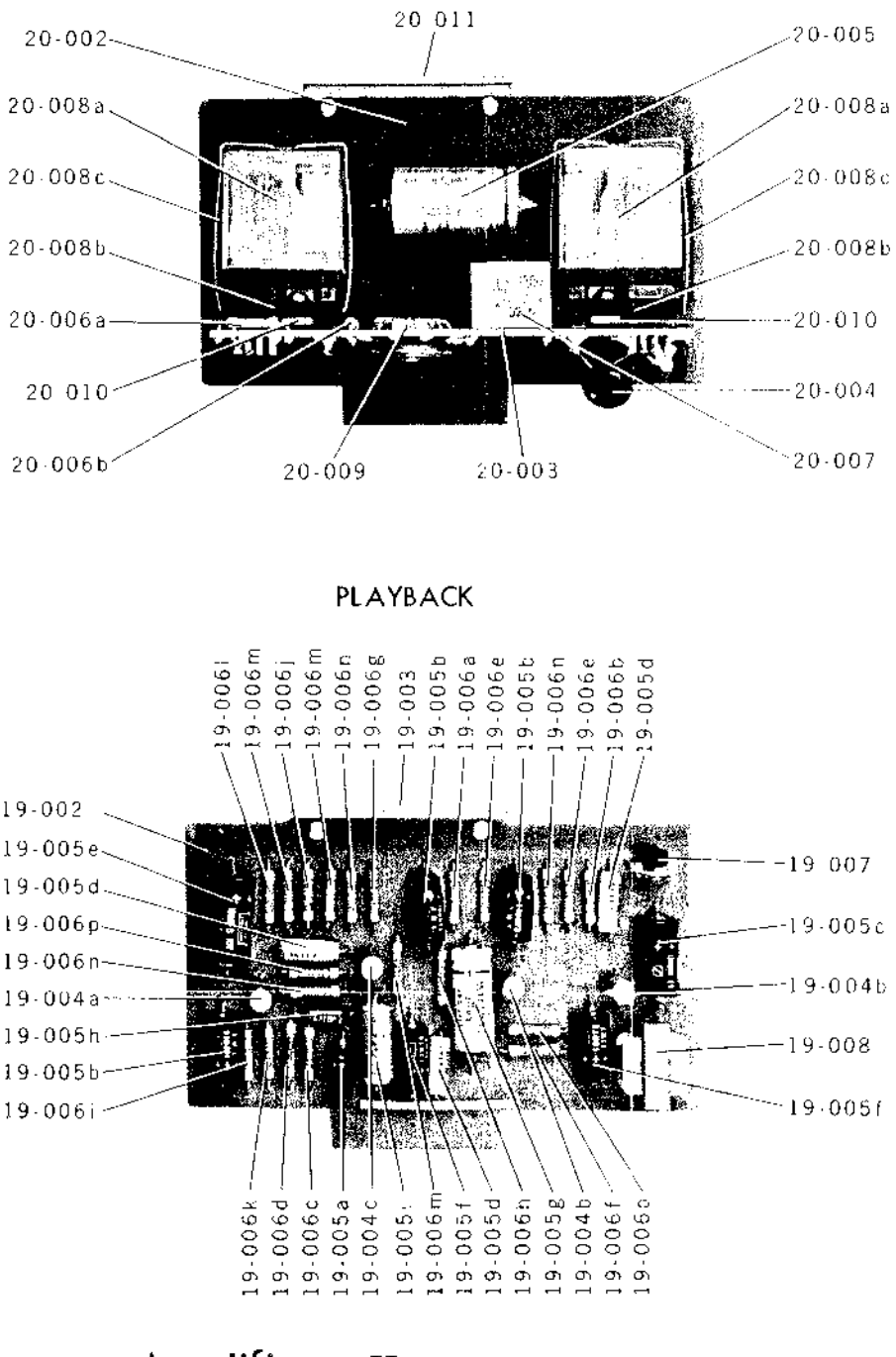
## Amplifier III



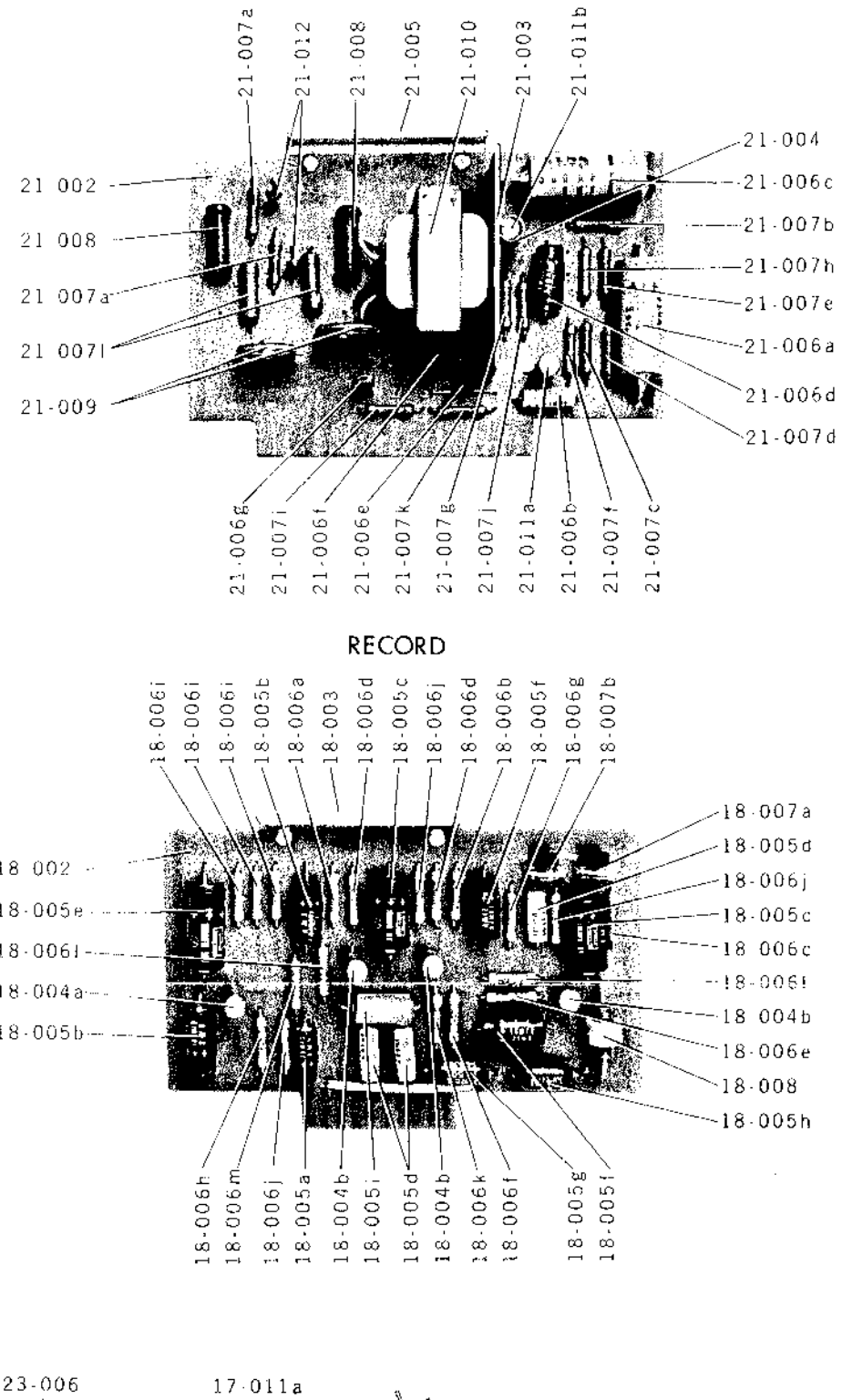

## Amplifier IV




### RELAY BLOCK




### MAIN AMP. BLOCK



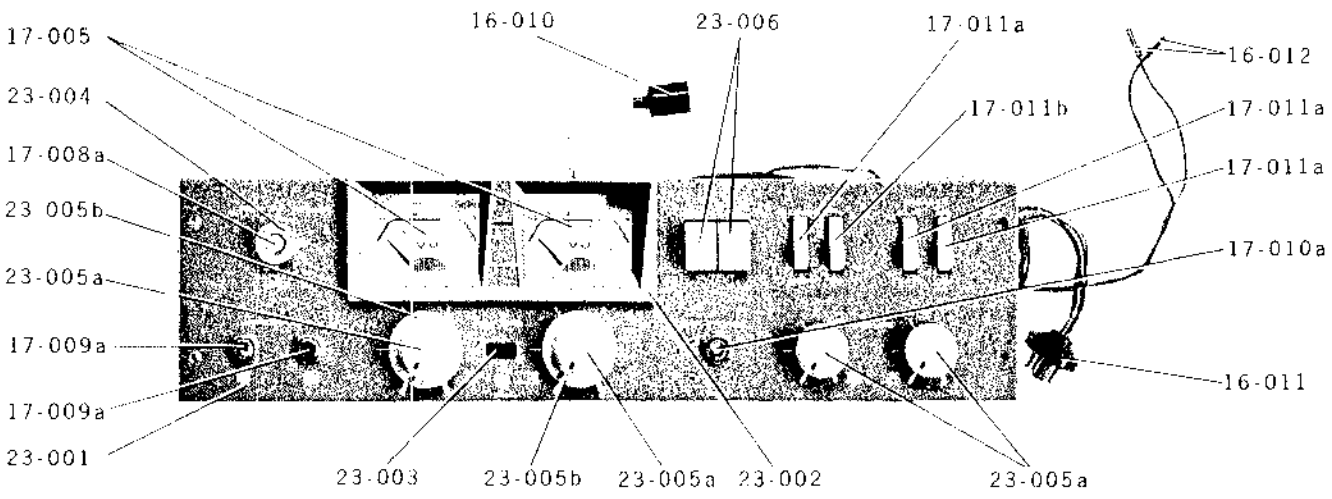

### PLAYBACK

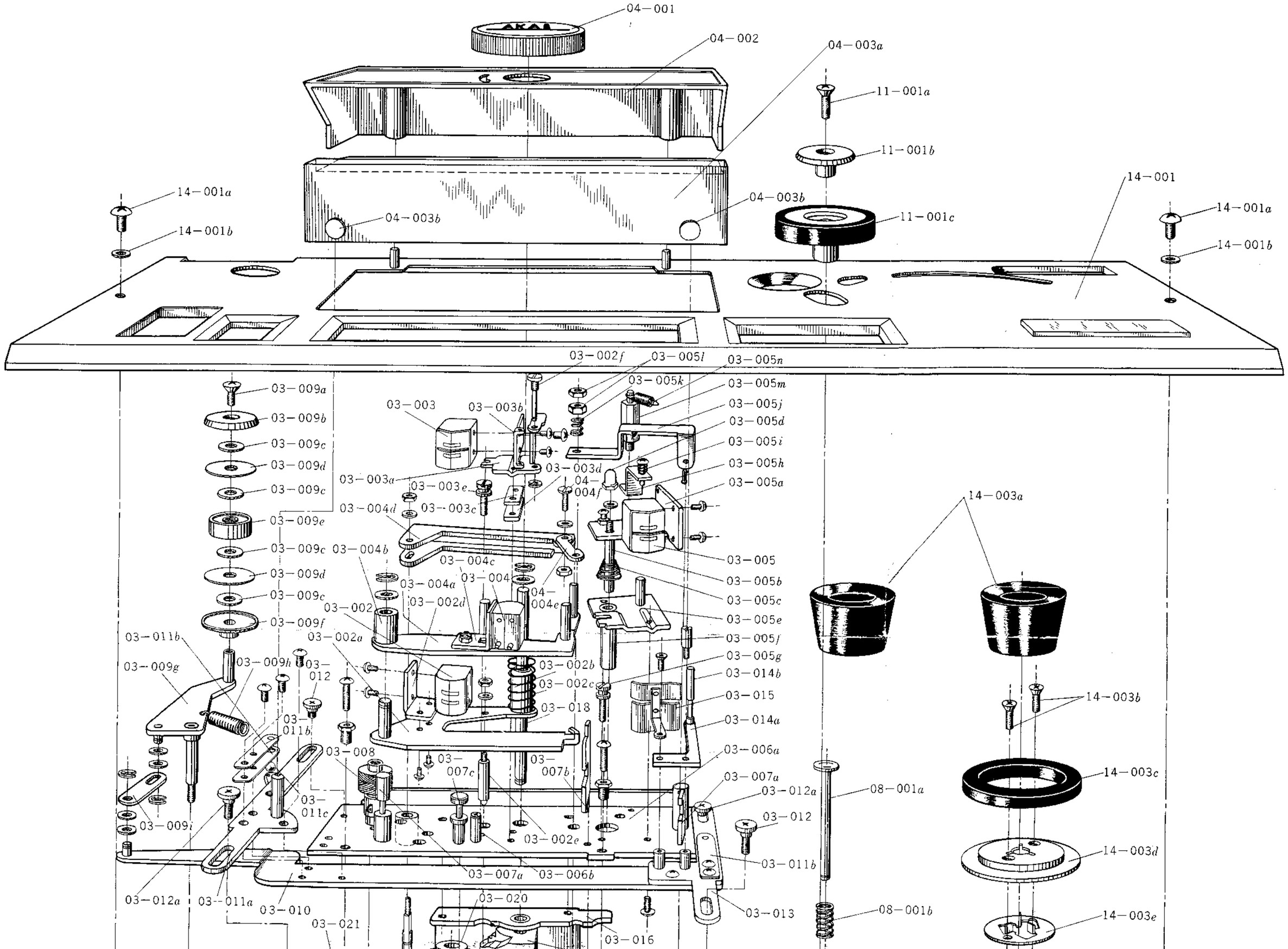



### RECORD




## Amplifier V

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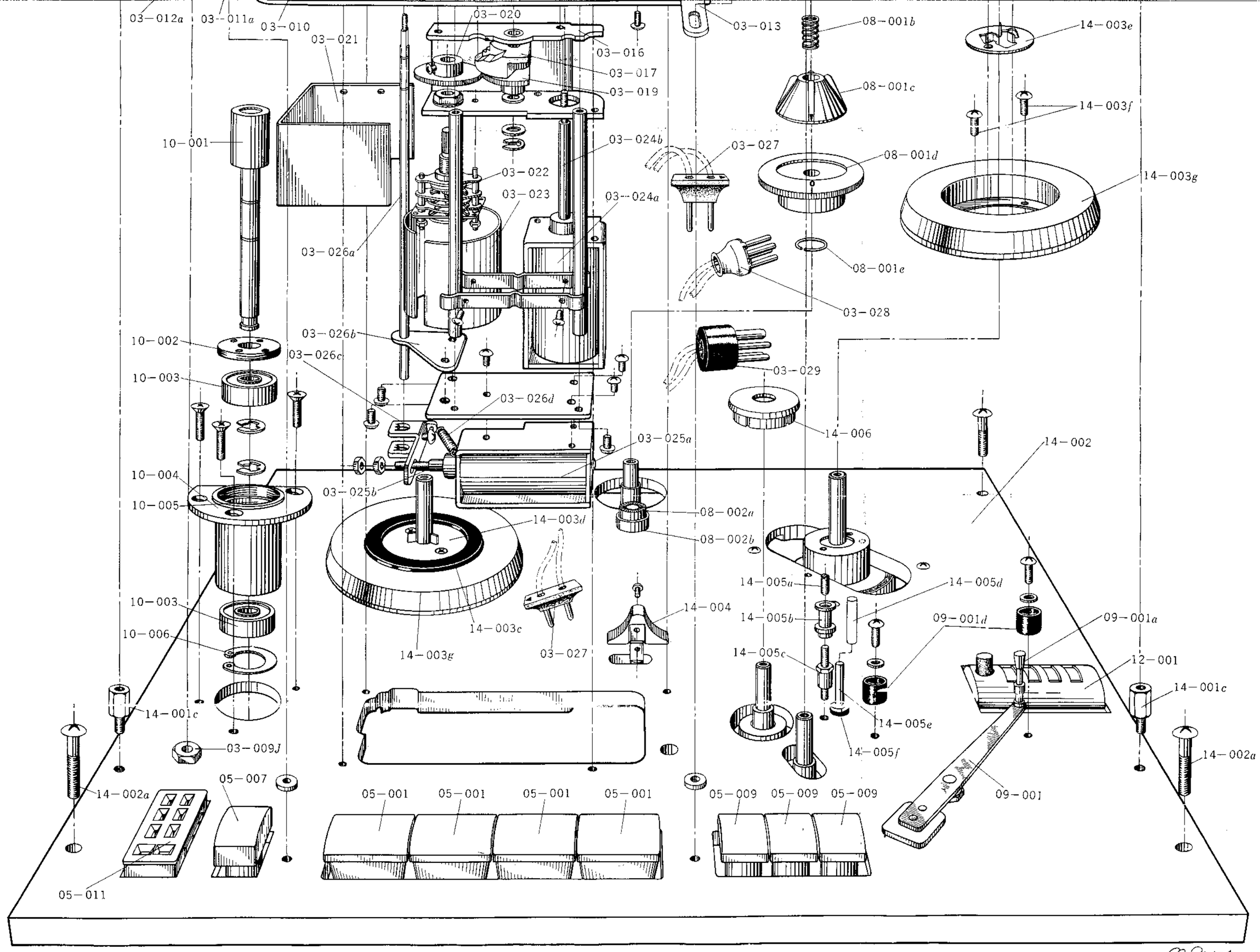
04—002
04—003a
11—001a
11—001b
11—001c
04—003b
14—001
14—001a
14—001b
03—002f
03—005l
03—005n
03—005k
03—005m
03—005j
03—005d
03—005i
03—005h
03—005a
03—005
03—005b
03—005c
03—005e
03—005f
03—005g
03—014b
03—015
03—014a
03—006a
03—007a
03—012a
03—012
03—011b
03—013
03—016
03—009a
03—009b
03—009c
03—009d
03—009e
03—009f
03—009g
03—009h
03—009i
03—011b
03—012
03—008
03—011c
03—011a
03—010
03—021
03—020
03—007c
03—007b
03—002e
03—007a
03—006b
03—012a
03—003
03—003b
03—003d
03—003a
03—003e
03—003c
04—004f
03—004d
03—004b
03—004c
03—004
03—004a
04—004e
03—002d
03—002
03—002a
03—002b
03—002c
03—018
14—003a
14—003b
14—003c
14—003d
14—003e
08—001a
08—001b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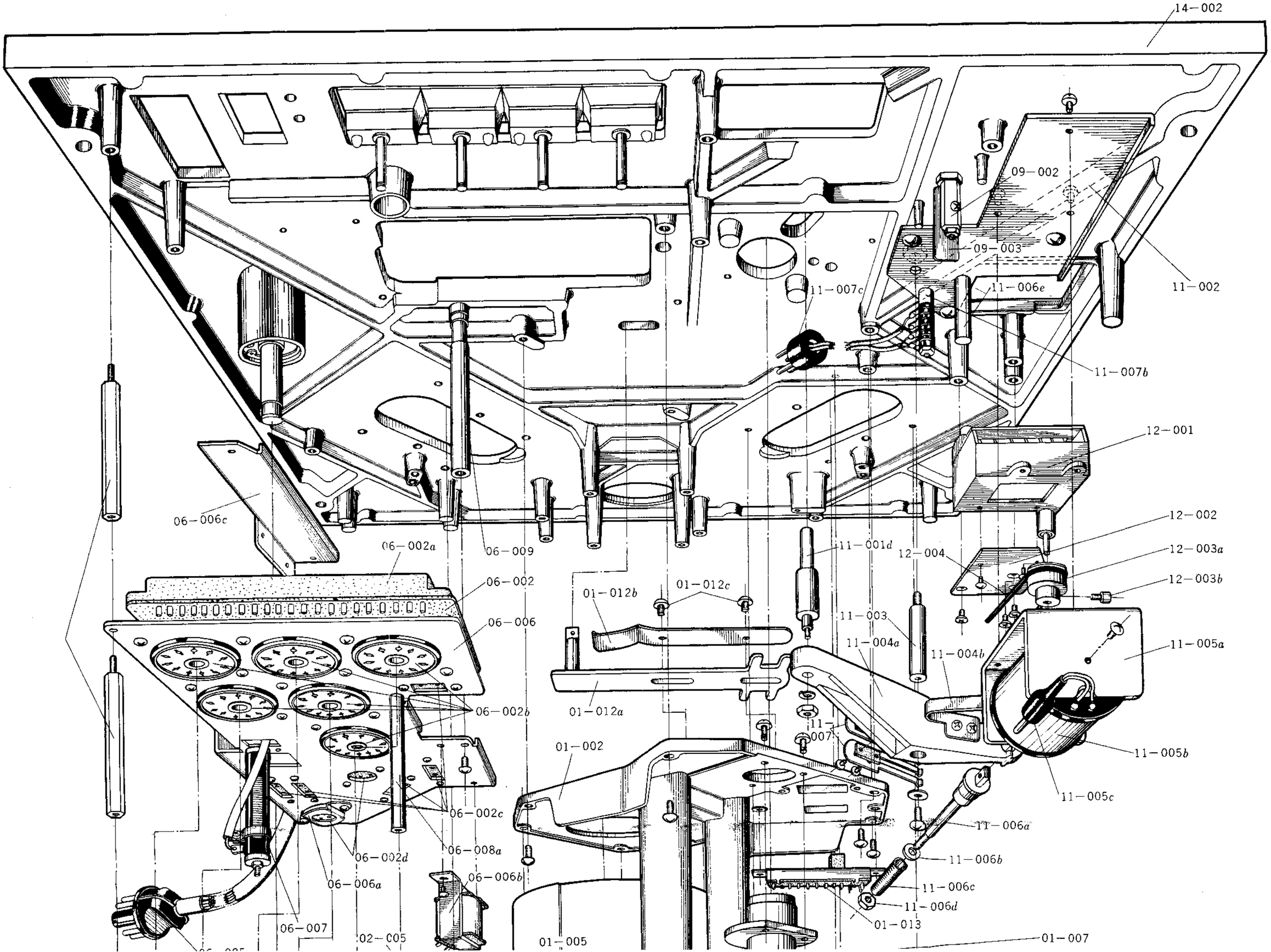
03—011a
03—010
03—021
03—020
03—016
03—017
03—019
03—013
08—001b
14—003e
08—001c
14—003f
10—001
03—024b
03—027
08—001d
14—003g
03—022
03—023
03—024a
03—026a
08—001e
03—028
10—002
03—026b
03—026c
03—029
10—003
03—026d
14—006
03—025a
14—002
10—004
10—005
03—025b
08—002a
08—002b
14—003d
14—005a
14—005d
10—003
14—004
14—005b
09—001d
09—001a
10—006
14—003c
14—003g
03—027
14—005c
12—001
14—001c
14—005e
14—001c
03—009J
14—005f
14—002a
09—001
05—007
05—001
05—001
05—001
05—001
05—009
05—009
05—009
05—011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09—003
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11—006e
11—007b
12—001
06—006c
06—002a
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06—006
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06—002d
06—008a
06—006b
06—006a
06—007
02—005
01—005
01—012b
01—012c
01—012a
01—002
11—001d
12—004
12—002
12—003a
12—003b
11—003
11—004a
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11—005a
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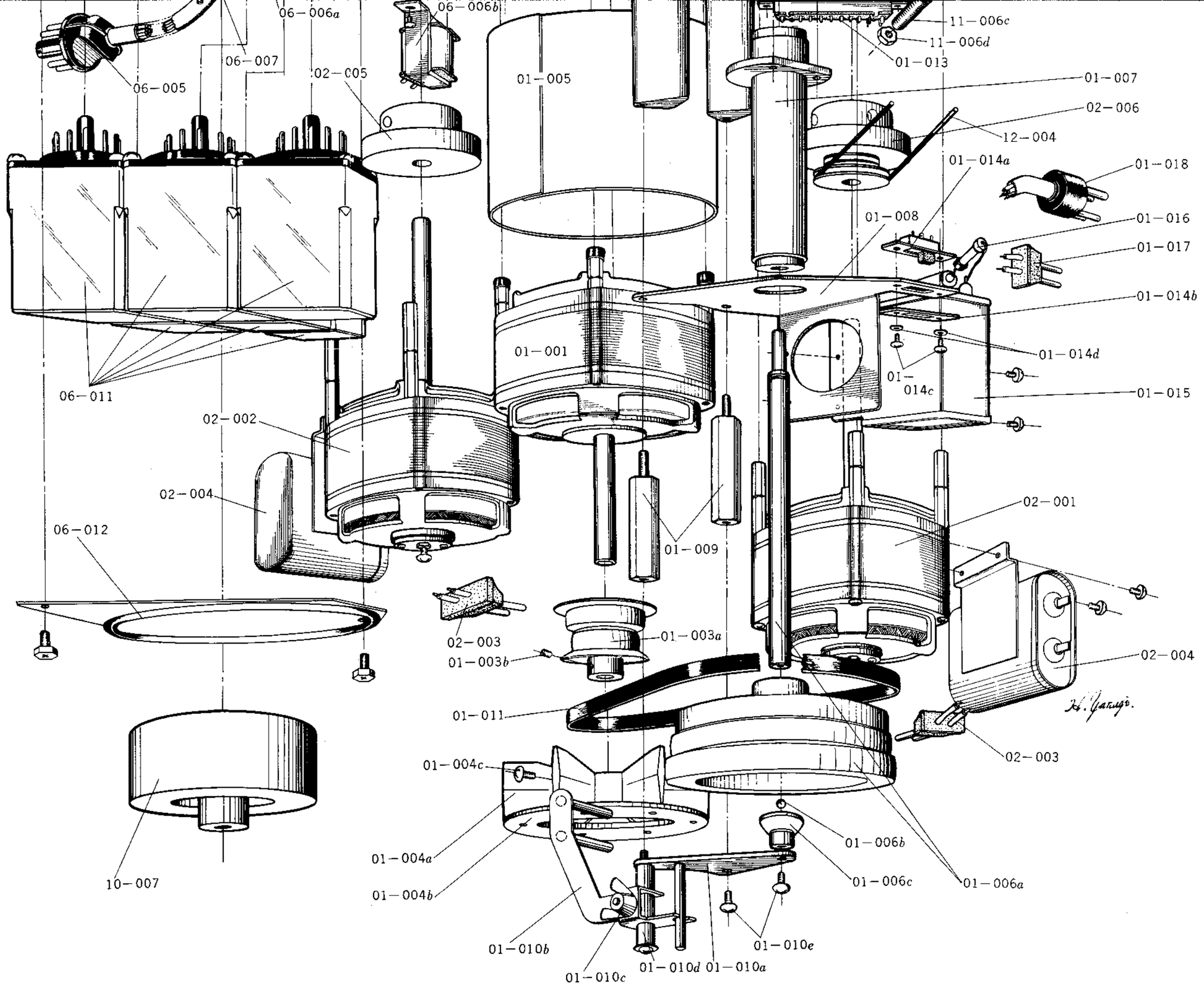
11—005c
11—007
11—006a
11—006b
11—006c
11—006d
01—013
01—007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06–006b
11–006c
11–006d
01–013
06–005
06–007
02–005
01–005
01–007
02–006
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01–014a
01–018
01–008
01–016
01–017
01–014b
01–001
01–014d
01–014c
01–015
06–011
02–002
02–004
06–012
01–009
02–001
02–004
02–003
01–003a
01–003b
01–011
02–003
01–004c
01–004a
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01–006c
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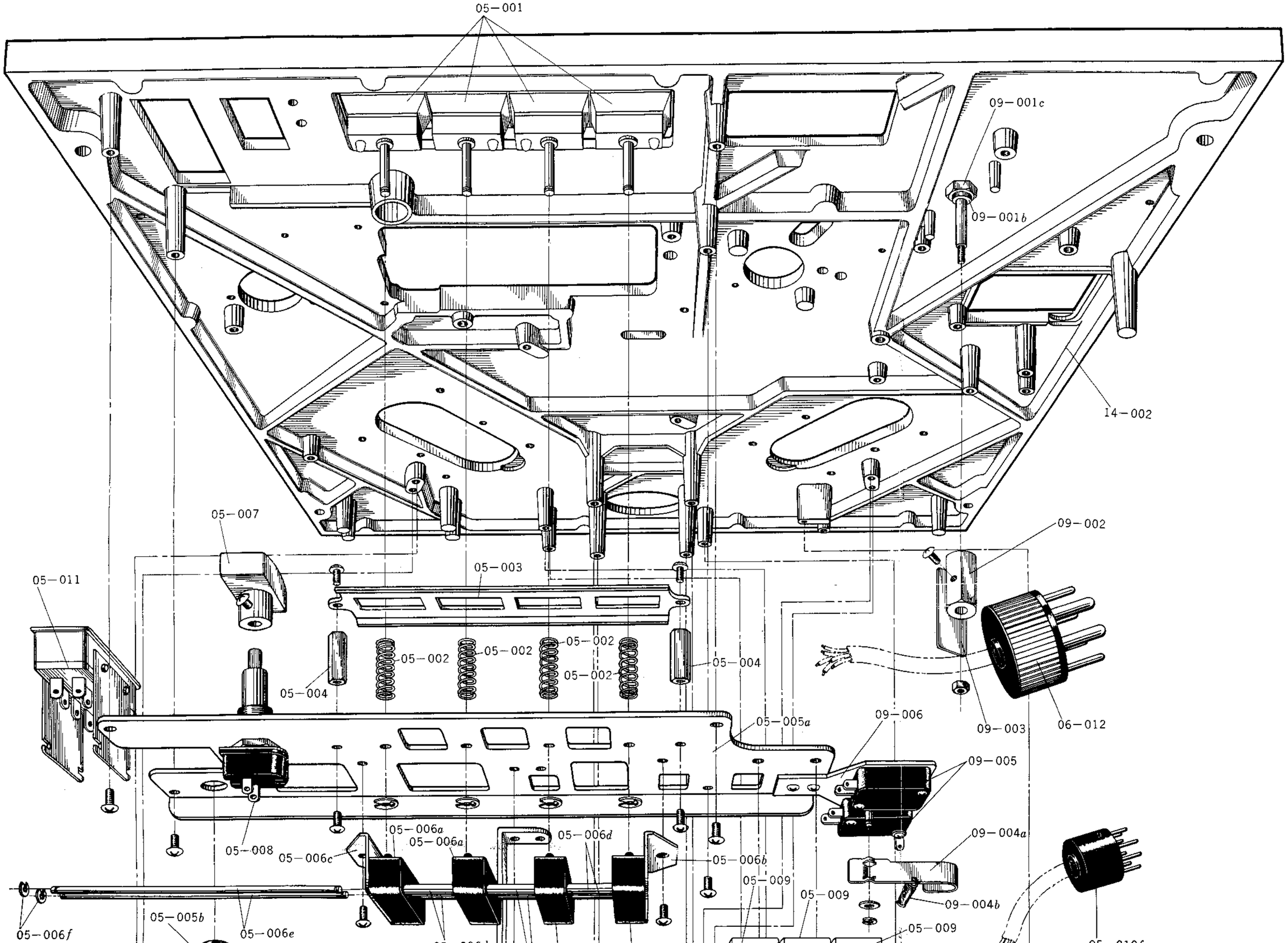
01–010d
01–010a
01–010e
10–007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09–001b
14–002
05–007
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05–002
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09–002
09–003
06–012
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05–006a
05–006a
05–006d
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05–008
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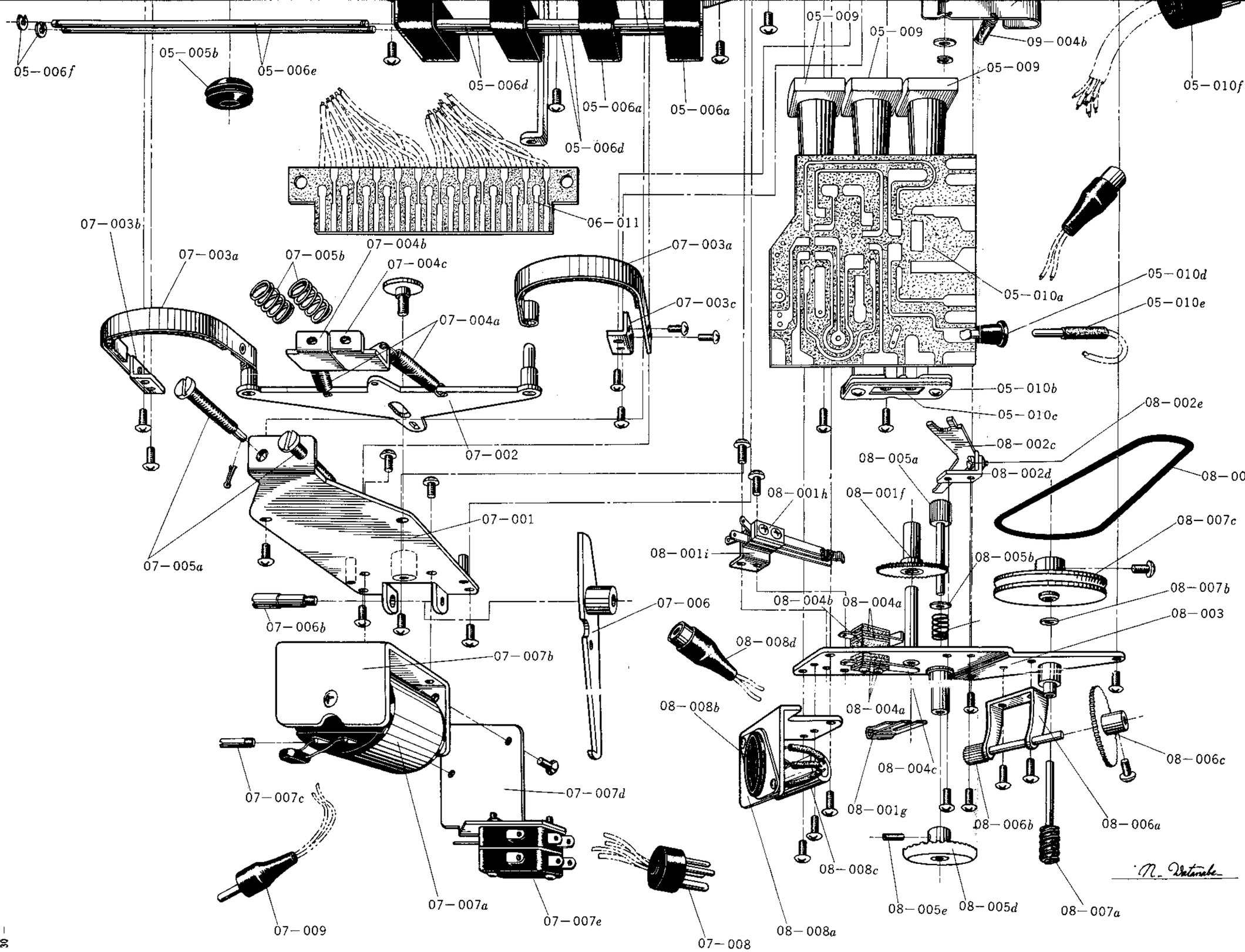
05–009
05–009
09–004a
09–004b
05–009
05–006f
05–005b
05–006e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05—006d
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08—002e
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05—010b
05—010c
05—010a
05—010d
05—010e
05—010f
09—004b
05—009
05—009
05—009

## XIII. CONNECTING DIAGRAM