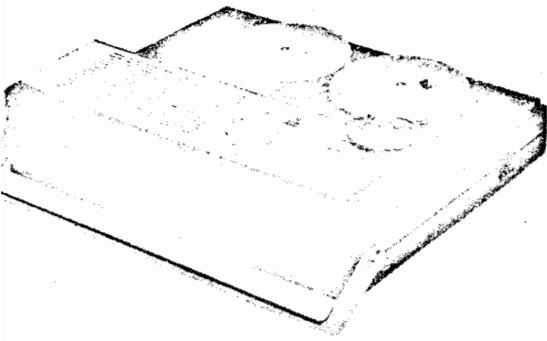


Danger
HIGH VOLTAGE



HITACHI
Hitachi, Ltd. Tokyo Japan



HITACHI TAPE RECORDER

MODEL TRQ-330

SERVICE MANUAL

No.106 (Supplement) 1966

SPECIFICATIONS

ELECTRICAL CHARACTERISTICS.

Power Consumption.	Less than 1.8 W (Audio output 200 mW)
Current Consumption.	Less than 150 mA (Playing condition, without signal)
Biasing System.	AC Bias.
Bias Oscillation Frequency.	35 ± 7 kc/s.
Bias Current.	0.8 - 1.0 mA.
Erasing System.	DC Erasing.
Erasing Current.	3 - 5 mA.
Power Source.	DC 9 V battery (UM-2 × 6 or 6 "C" cells) or Hitachi AC adaptor A-90A or 90E.
Overall S/N.	More than 35 dB.
Monitor Output.	250 ± 50 mV/8 Ohm. Maximum 800 mW. 10% distortion 200 mW.
Input Impedance.	Microphone Jack. . . 2 k-ohm (Approx.) Radio Input Jack. . . 200 k-ohm (Approx.)
Output Impedance.	8 Ohms.

Rewinding Time.
Fast Forwarding Time.
Operating System.
Driving System.

Within 2 minutes } (3" 50 micron tape.)
Within 4 minutes }
One knob control.
Capstan drive.

COMPONENTS USED.

Transistors.
Diodes and Varistors.
Motor.
Loudspeaker.
Microphone.

2SB73, 2SB75 and 2SB77X5.
1N34A and HV16.
DC Micro-motor with governor.
4" × 2.3/4" Oval permanent magnet type.
Dynamic microphone with remote control switch.

MISCELLANEOUS SPECIFICATIONS.

System.
Dimensions.

Monaural dual track.
Width : 10.1/4"
Height : 2.5/8"
Depth : 8.5/8"
5 lbs. (Without batteries)

Weight.

MECHANICAL CHARACTERISTICS.

Tape Speed.	3.3/4" per second ± 3%. 1.7/8" per second ± 3%.
Maximum Performance Time.	20 minutes at 3.3/4" (Hitachi 3" 50 micron tape.) 40 minutes at 1.7/8"

ACCESSORIES

Dynamic microphone.	1.
1/4" Magnetic Recording Tape. (50 micron)	1.
1/4" Empty Reel for Tape.	1.
Splicing Tape.	1.
Microphone Case.	1.

DESCRIPTIONS

1. Dry Cell Operated

Because it is operated simply by dry-cells, you can enjoy anywhere and anytime regardless of indoor or outdoor.

2. Level Matic Device

For the excessive impulseic input, it works remarkably, resulting distortionless recording.

3. All Transistor System

Electrical circuit start its operation instantaneously and simultaneously with tape driving mechanisms.

4. Micromotor

High quality micromotor providing gover-

nor presents steady constant running of tape for long time.

5. Monitoring

Output jack may be used as monitor output jack, also at the time of recording.

6. Tape Speed

Two speeds are available by means of capstan collar changing.

7. Earphone for Private Listening and Monitoring.

8. Operation with Power Mains Available

By means of AC adaptor, you can enjoy with "power mains" voltage.

CIRCUIT EXPLANATION

Those devices, such as micro-phone and magnetic recording head, connected to the first stage usually change their impedance with frequency. At the time of recording, either micro-phone or radio-set output may be connected, while in case of play-back, magnetic recording head will be connected.

In case of Radio Input

R1 and R2 are connected in series and they work as voltage divider as illustrated in Fig. 1.

In case of Micro-phone Input

R2 (2.2 k-ohm) is connected in series with

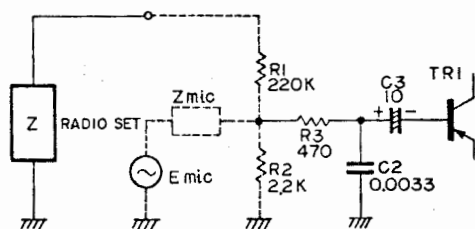


Fig. 1

FIRST AND SECOND STAGE

Impedance matching of the input circuit with external devices such as microphone, radio-set and magnetic recording head are taken into consideration as were described above. Matching between input circuit and transistor input impedance is, however, not obtained exactly, because of the satisfactory gain of the succeeding amplifiers, this amount of matching loss is acceptable. See Fig. 3.

A circuit with R,C is depicted in Fig. 4---that is R,C filter circuit and the function of it is to lead radio broadcast signal to the ground. At the places where the field strength is strong, RF signals caught at microphone (being an inductive device, it may work as an antenna in some case) will be detected by emitter-base diode and be converted into audio signal to bring music or speech being broadcasted.

micro-phone to regulate audio current against impedance change caused with difference of frequency.

In case of Play-back

As the magnetic recording head itself is simply an inductive device, impedance increases in proportion to frequency to be reproduced. To keep the input voltage for TR1 as constant as possible, a considerably big resistor R4 (39 k-ohm) is employed as current regulator. That is, as illustrated in Fig. 2, R4 and R5 are connected in series with changing head impedance Z_o.

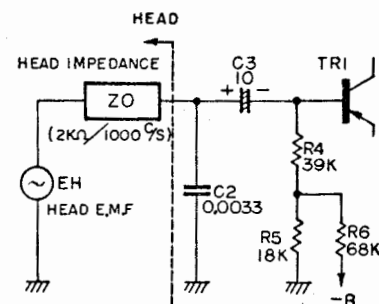


Fig. 2

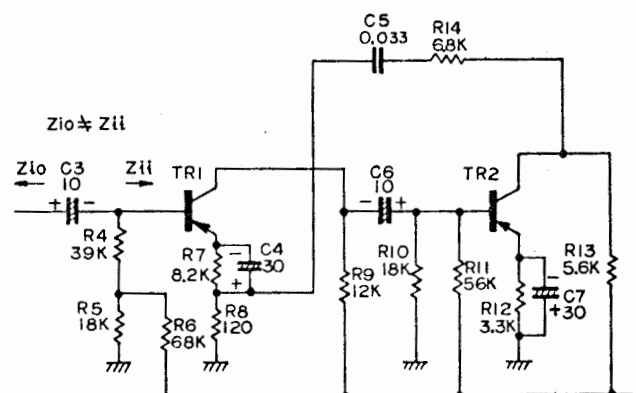


Fig. 3

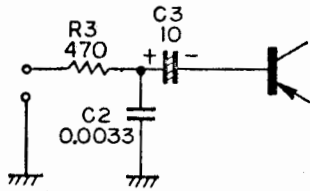


Fig. 4

R₈ (120 ohm) is current feedback resistor and R₇ (8.2 k-ohm) is emitter stabilizer resistor which is completely by-passed with C₄ (30 μF). Negative feedback voltage from collector of next stage is fed to R₈ (120 ohm) which has low frequency emphasis effect because, the higher the frequency the more the negative feedback.

THIRD STAGE

Current feedback is obtained by R₁₈ (27 ohm). In addition to current feedback of this particular stage, another Negative Feedback (NF) takes place from the secondary winding of output transformer. The frequency characteristic of the NF is flat in this case. (The NF of the first stage

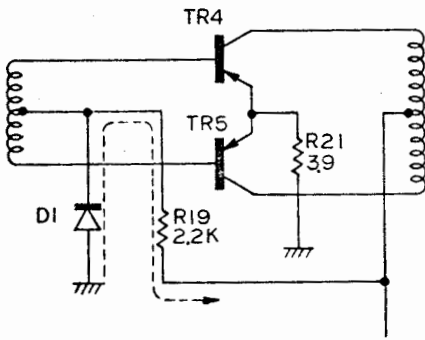


Fig. 5

LEVELMATIC CIRCUIT

The voltage across terminals ① and ② on primary winding of T₂, after being blocked the DC, appears again across R₂₀ (2.2 k-ohm). If there be no R₂₀, the whole circuit operate as clamper and left side of C₁₁ will simply be kept at a negative potential and no satisfactory levelmatic operation will be expected.

The signal voltage, appearing across R₂₀, is rectified by D₂ and is filtered out with C₁₂, R₂₆

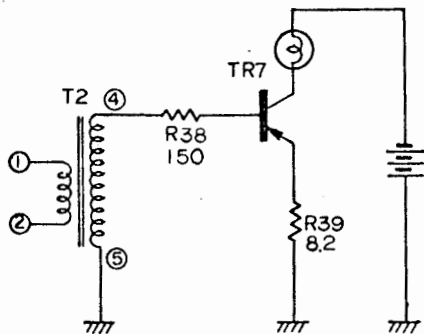
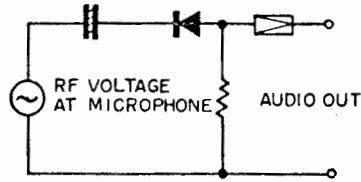


Fig. 7



was not flat, rather it had the low frequency boosted.) C₂₅ (0.0047 μF) is employed to ground the bias oscillation component which is brought from output transformer through R₂₄ to amplifier TR₃

POWER OUTPUT AMPLIFIER STAGE

DC current shown by dotted line in Fig. 5 flows through varistor D₁ and because of its forward impedance, it brings the voltage drop across it as is indicated. The voltage drop across D₁ is utilized as the base bias of TR_{4, 5} to compensate the fluctuations of amplification caused by temperature changes. Emitter resistor R₂₁ (3.9 ohm) also is employed to stabilize this stage against temperature fluctuation.

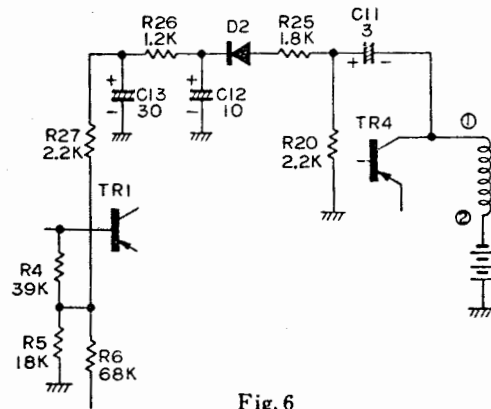


Fig. 6

and C₁₃ to obtain the positive control voltage, which is fed to the base of the first stage, reducing the gain of TR₁ circuit Fig. 6.

LEVEL INDICATOR LAMP CIRCUIT

At the time of recording, collector current of TR₇ is controlled by signal voltage drawn from secondary of T₂ to the base electrode and consequently, the luminance of light inserted as a collector load is varied.

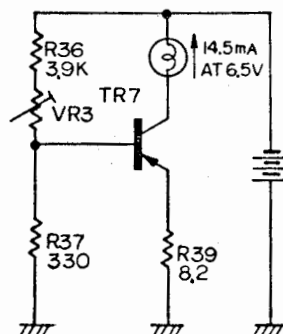


Fig. 7

MODEL TRQ-330 SERVICE MANUAL

In case of playing back, regardless of signal intensity; the lamp indicates simply battery voltage. R36, VR3 and R37 are constituting a voltage divider to give suitable base bias voltage---VR3 is adjustable.

Adjustment of VR3 is done so as to get 14.5 mA collector current at 6.5 V battery voltage.

BIAS OSCILLATOR CIRCUIT

Oscillator itself is a simple Hartley configuration. R31, R32 constitute a voltage divider to present proper base bias voltage. R34 is emitter stabilizer resistor which is bypassed by C23. C22 is DC blocking coupling capacitor. R33 attenuates the feed back voltage to get a purer oscillation waveform.

Oscillation frequency of 35 ± 7 kc is determined by C21 and effective inductance of secondary of T3.

RC circuit of C20, R29 and R30 is to boost up the high-frequencies at the time of recording.

ERASING: Erasing head is connected to the power source, through series resistor of R35(820 ohm). Erasing current should be 3 to 5 mA, that is, voltage across R35 should be within 2.5 V and 4.1 V. If you had changed any components in erasing circuit, check that the erasing current is more than 3 mA (2.6 V across R35) for a battery voltage of 6.5 V.

MOTOR NOISE ELIMINATOR CIRCUIT: CHm is attached to the motor which will suppress the pulse-noises caused by the governor and the commutator. Another choke coil CH1, together with C17 and C18, is employed to suppress motor noise further more, lest it should be brought to the rest of the electrical circuit.

LEVER SWITCH SW₂ (MUTING SWITCH): If the electrical circuit is left "on" at the time of re-

winding and fast-forwarding, hissing sound will come out of the loudspeaker. Also there will be an unnecessary drain on the battery. It is switching the dc power voltage for mechanical circuit and electrical circuit respectively according to the necessity.

EXPLANATION OF MECHANISM

There are three mechanism-conditions in TRQ-330, those are;

Play-back and Recording Condition. (Steady Speed Condition.)

Fast Forwarding Condition.

Rewinding Condition.

1) PLAY-BACK AND RECORDING CONDITION.

As is in play-back and recording condition; magnetic recording tape should run at a constant speed. The take-up reel and sender reel have to wind-up or release the tape without any sag or excessive tension.

In TRQ-330, a speed controlled micromotor is coupled to the capstan rim, which also functions as fly-wheel, and onto this capstan collar, a pressure roller made of rubber is coming into contact to let the tape run constantly.

Upper ring and bottom ring of take-up reel base are friction coupled, i.e., the bottom ring is driven compulsory with an idler which is coupled to capstan rim. Rotation of bottom ring is coupled to the upper ring with proper friction provided with a spring and felt cushion. Usually, at the time of play-back & recording condition, upper ring is always slipping to present proper tension to magnetic recording tape.

COMPONENTS	CONDITIONS
MOTOR	RUNNING
CAPSTAN	RUNNING
PRESSURE ROLLER	PRESSED TO CAPSTAN COLLAR
IDLER	COME INTO CONTACT
TAKE-UP REEL BASE	RUNNING (UPPER-RING SLIPPING)
SENDER REEL BASE	FREE (BRAKE OFF)
SOURCE SWITCH	ON
LEVER SWITCH S ₂	ON (Electronics circuit operates with mechanism.)
PAD	PRESSED TOWARD HEADS

Table 1. Explanation of mechanism condition at play-back and recording condition.

2) FAST FORWARDING CONDITION

In this state, slipping of friction coupling take-up

reel base is eliminated with an additional external coupler idler, while pressure roller and pad assembly are parted from their operating conditions. At the same time, DC power for electronics circuit is cut by means of muting switch S₂ to eliminate hissing sound and battery drain.

MODEL TRQ-330 SERVICE MANUAL

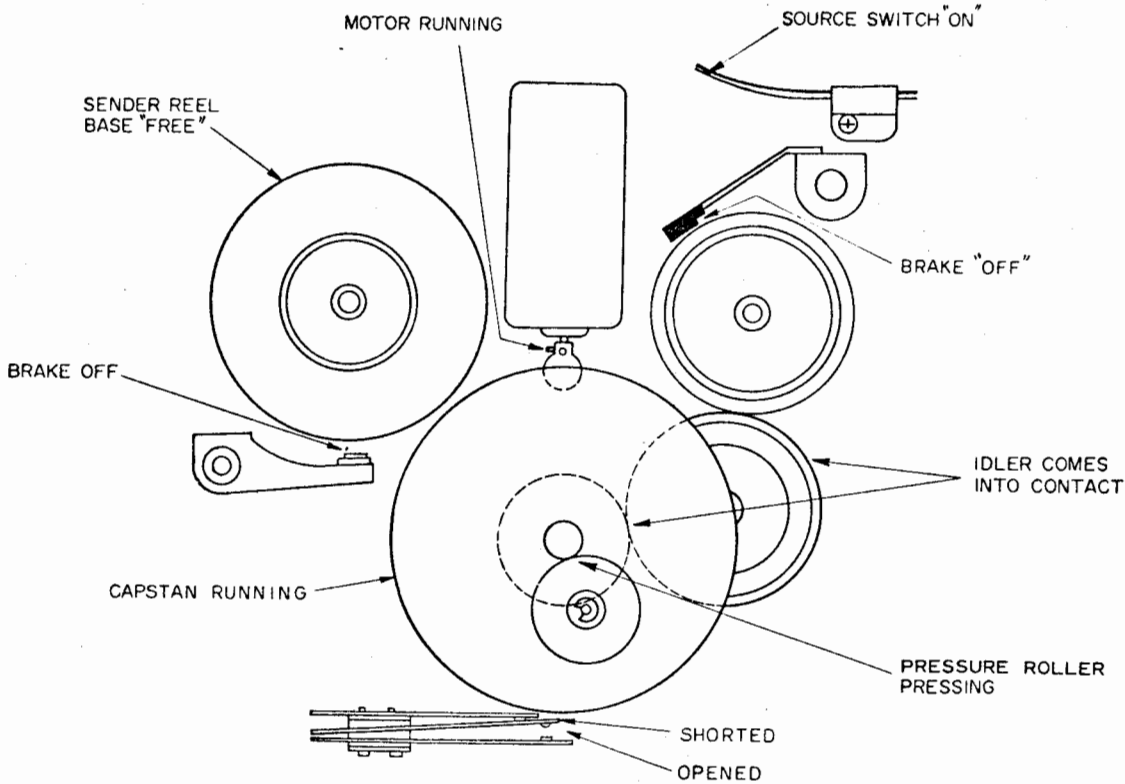


Fig. 8

COMPONENTS	CONDITIONS
MOTOR	RUNNING
CAPSTAN	RUNNING
PRESSURE ROLLER	DETOUCHED FROM CAPSTAN
IDLER	COME INTO CONTACT
TAKE-UP REEL BASE	COMPULSORY COUPLED (WITHOUT ANY SLIPPING)
FAST FORWARD RING	COME INTO CONTACT
SENDER REEL BASE	FREE (BRAKE OFF)
SOURCE SWITCH	ON
LEVER SWITCH	OFF (Electronics circuit does not operate)
PAD	DETOUCHED FROM HEADS

Table 2. Explanation of mechanism condition at Fast Forwarding Condition.

3) REWINDING CONDITION

At the time of rewinding, sender reel base should rotate clockwise in full speed and take-up reel be

in free. To obtain this, sender reel base itself is shifted toward capstan. Consequently, sender reel base is made to run compulsory only at the time of rewinding and in all other conditions, it is quite free except for stopping condition when it is braked.

COMPONENTS	CONDITIONS
MOTOR	RUNNING
CAPSTAN	RUNNING
TAKE-UP REEL BASE	FREE (BRAKE OFF)
SENDER REEL BASE	CLOCKWISE ROTATION IN FULL SPEED
LEVER SWITCH S ₂	OFF (Electronics circuit does not operate)
PRESSURE ROLLER	DETOUCHED
IDLER	DETOUCHED
PAD ASSEMBLY	DETOUCHED

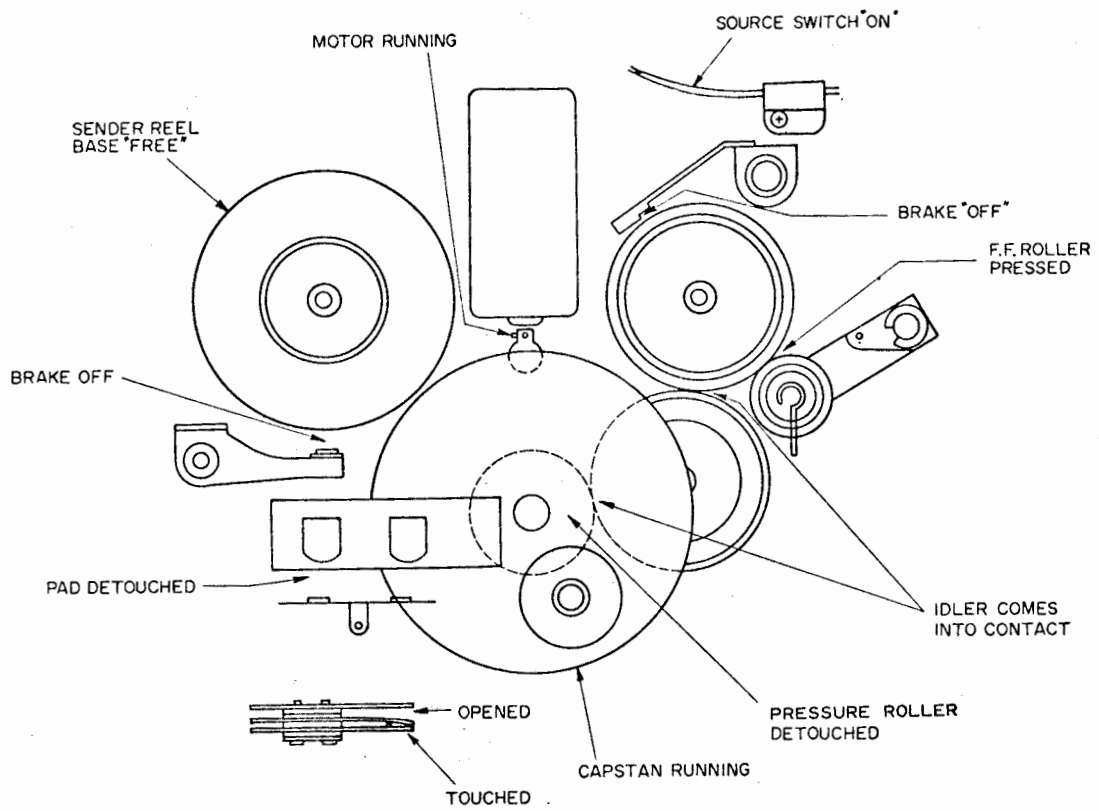


Fig. 9

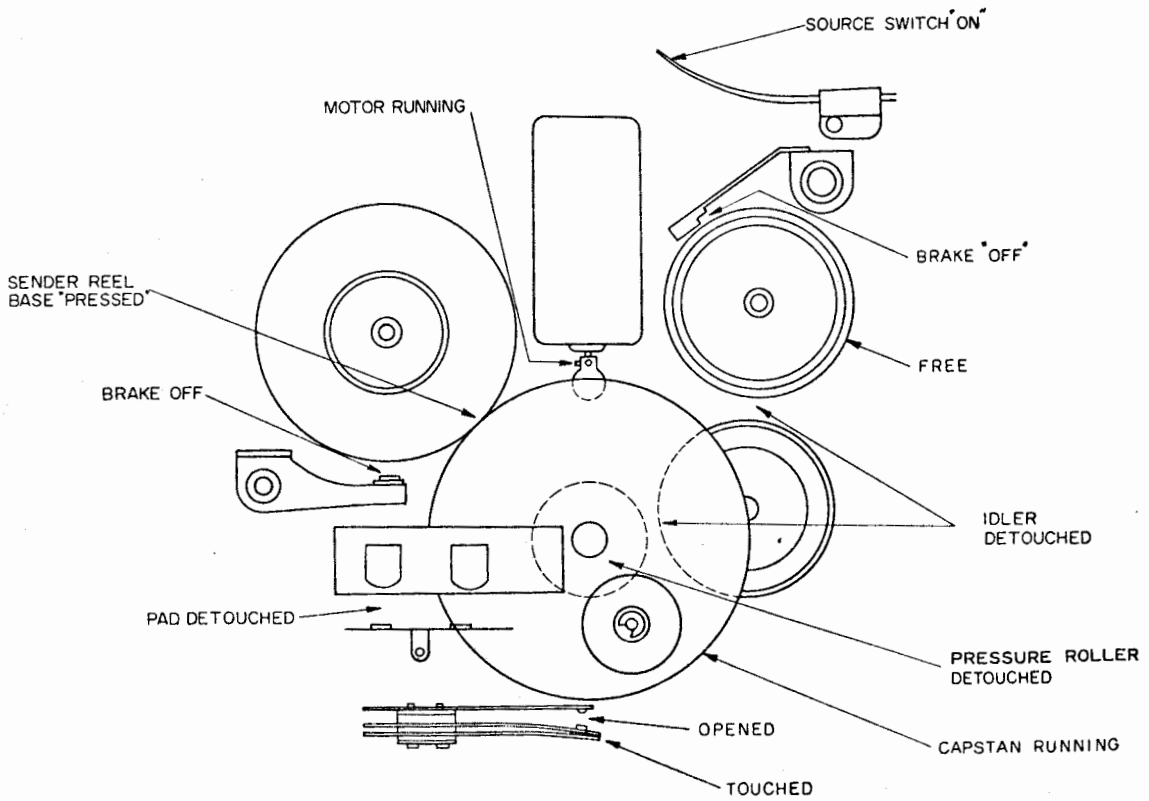


Fig. 10

Different from other Home Electrical Appliances, the Tape-recorder has special difficulties in its adjustment and checking of mechanical components. At each time after having finished a service, check the following items and if those values were not satisfying the specified value, adjust them according to the values listed in the attached table.

1. ADJUSTMENT

1-1. ADJUSTMENT OF MECHANISM

The torque of the motor employed in TRQ-330 is more than twice that of the torque necessary for the mechanism. It means that there is ample

1-1-a. PRESSURE ROLLER

Pull the shaft of pressure roller, along the direction connecting capstan shaft and pressure roller shaft, until the loaded tape cease to travel. The reading is defined as pressure-roller pressure and it must

be as follows :

Tape Speed	Pressure
3-3/4"/sec	290-400 grams
1-7/8"/sec	260-360 grams

1-1-b. MOTOR PRESSURE

At the playback condition, measure the pressure of motor toward capstan rim as is shown in photograph. The reading of pressure gauge at the moment when the capstan rim was just to stop is defined as motor pressure. Notice the point where the gauge is pressed on; it is at the bearing.

The value should be within: 100-170 grams.

1-1-c. PAD PRESSURE

As the pad is pressing magnetic recording tape at right angles, excessive pressure may disturb the travel of the tape at a constant speed. Especially in such cases like any friction contact point were slipping, adjustment of pad-pressure is of important together with prevention of the slipping itself.

Values measured as shown in photograph should be: 20-40 grams.

1-1-d. TAKE-UP FORCE

Wind a string along inner wall of a 3" vacant reel and hold a tension gauge perpendicular to the string.

Reading of take-up force should be within: 15-25 grams.

If the value were not within the specified limits, disassemble the take-up reel base and adjust the pitch and stroke of spring to obtain the proper.

torque, but still the adjustment of each pressure contact portion should be carefully carried out to their specified values. If these values were not adjusted properly, it may cause unstable rotation, and running of the tape under such conditions may reduce the life time of the mechanism itself.

Adjustment points are as follows :

- Pressure Roller
- Motor Pressure
- Pad Pressure
- Take-up force

In addition to those adjustment, checking of re-winding operation is inevitable.



Fig. 11

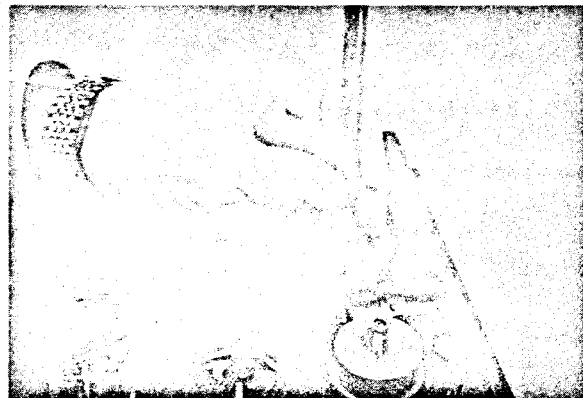


Fig. 12

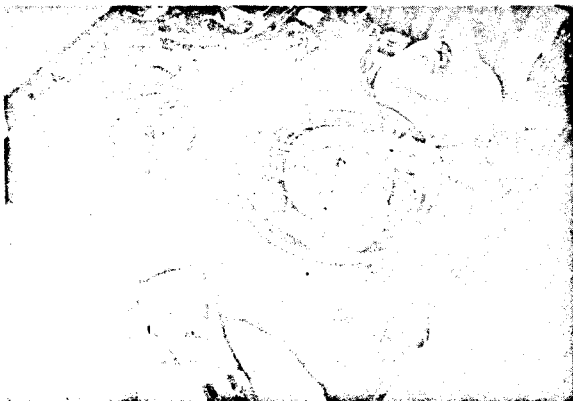


Fig. 14

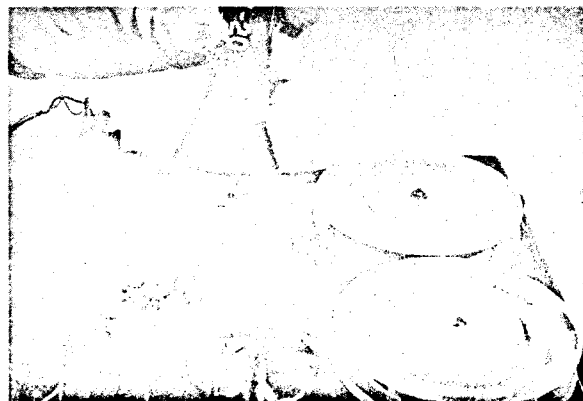


Fig. 13

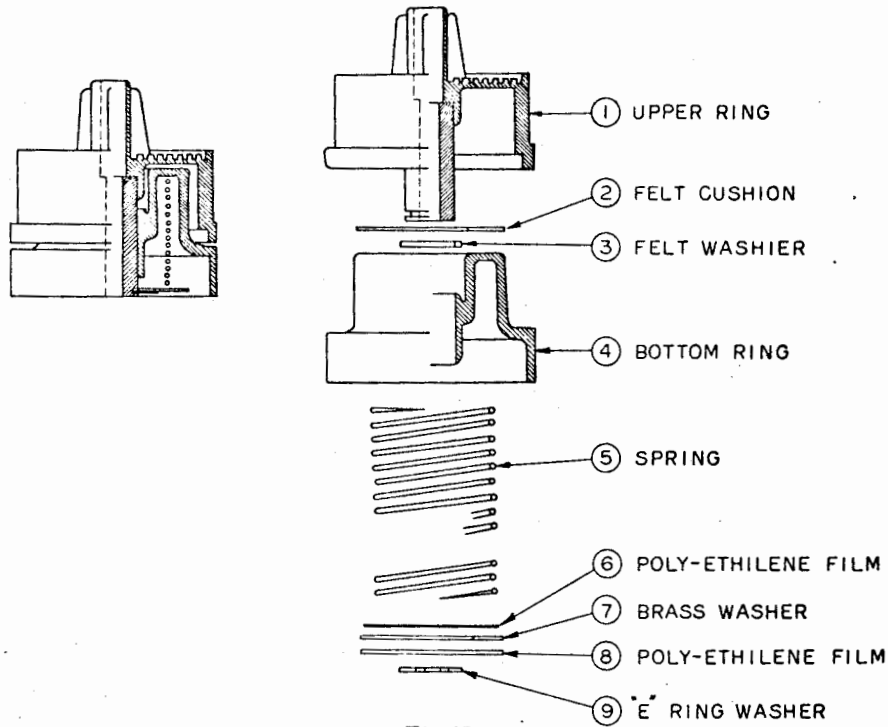


Fig. 15

ITEMS	VALUES	METHODS
PRESSURE ROLLER PRESSURE	290-400 g at 3-3/4"/s 260-360 g at 1-7/8"/s	See photograph Fig. 11
MOTOR PRESSURE	100-170 g	See photograph Fig. 12
PAD PRESSURE	20-40 g at center of pad ass'y	See photograph Fig. 13
WIND-UP FORCE	15-25 g	See photograph Fig. 14
BIAS CURRENT (RECORDING)	0.8 - 1.0 mA	Measure with series resistor of about 10 ohms.
ERASING CURRENT (D.C.)	3 - 5 mA	See page 4
BATTERY INDICATOR (LAMP)	14.5 mA at 6.5 V battery	See page 4

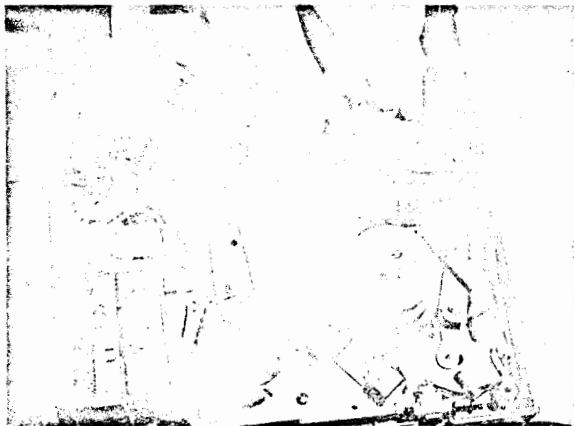


Fig. 16

CHECKING OF REWINDING FORCE

At the time when rewinding reel base were compelled to stop rotation, motor also should nearly be ceased rotation. Rotation of motor even under such condition means slipping between capstan rim and motor pulley.

MODEL TRQ-330 SERVICE MANUAL

1-2. ADJUSTMENT OF ELECTRICAL CIRCUIT

1-2-a. ADJUSTMENT OF BIAS CURRENT

Recording bias current is adjusted under condition of "Recording", that is, after having pressed the recording button, rotate the selector switch to "Play". Then, take a lead wire connected to recording head and insert a series resistor of about 10 ohm, connect a Vacuum Tube Voltmeter (VTVM) across the series resistor. Voltage obtained must be within 8 to 10 mV. This adjustment is carried out by rotating VR₂ (500 ohm).

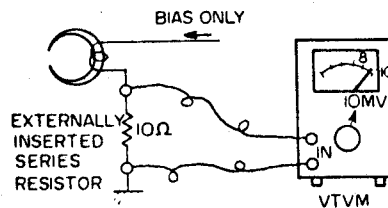


Fig. 17

1-2-b. ADJUSTMENT OF ERASING CURRENT

DC saturation erasing is employed in TRQ-330. Necessary dc current to obtain satisfactory erasing is 3 to 5 mA. Measurement of this current also should be done as measurement of bias current.

1-2-c. ADJUSTMENT OF LUMINANCE OF BATTERY INDICATOR

The level Indicator lamp operate as Battery Life Indicator at the time of play-back. For the battery voltage of 6.5 V, collector current of TR₇ should be adjusted to 14.5 mA by means of VR₃ (5 k-ohm).

LUBRICATION

the lubricant, Hitachi recommend following two materials, that is;

Motor Oil of SAE #30 or its equivalent as lubricant for rotating portion such as bearing of idler, pressure roller and capstan.

Grease of NLGI grade #2 (Lithium Soap Base Grease) for sliding portion or other lubrication points such as selector knob and slide plates.

(L).....Pan-motor oil No.30

(G).....Grease

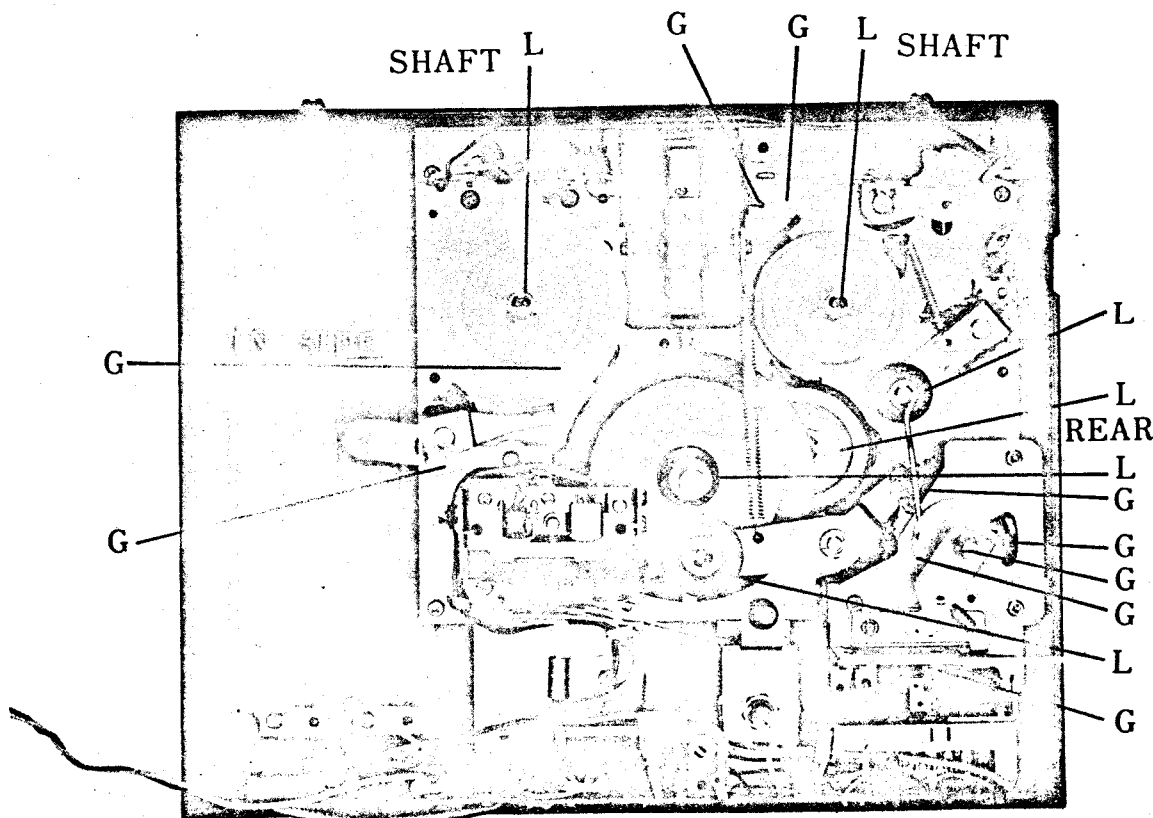
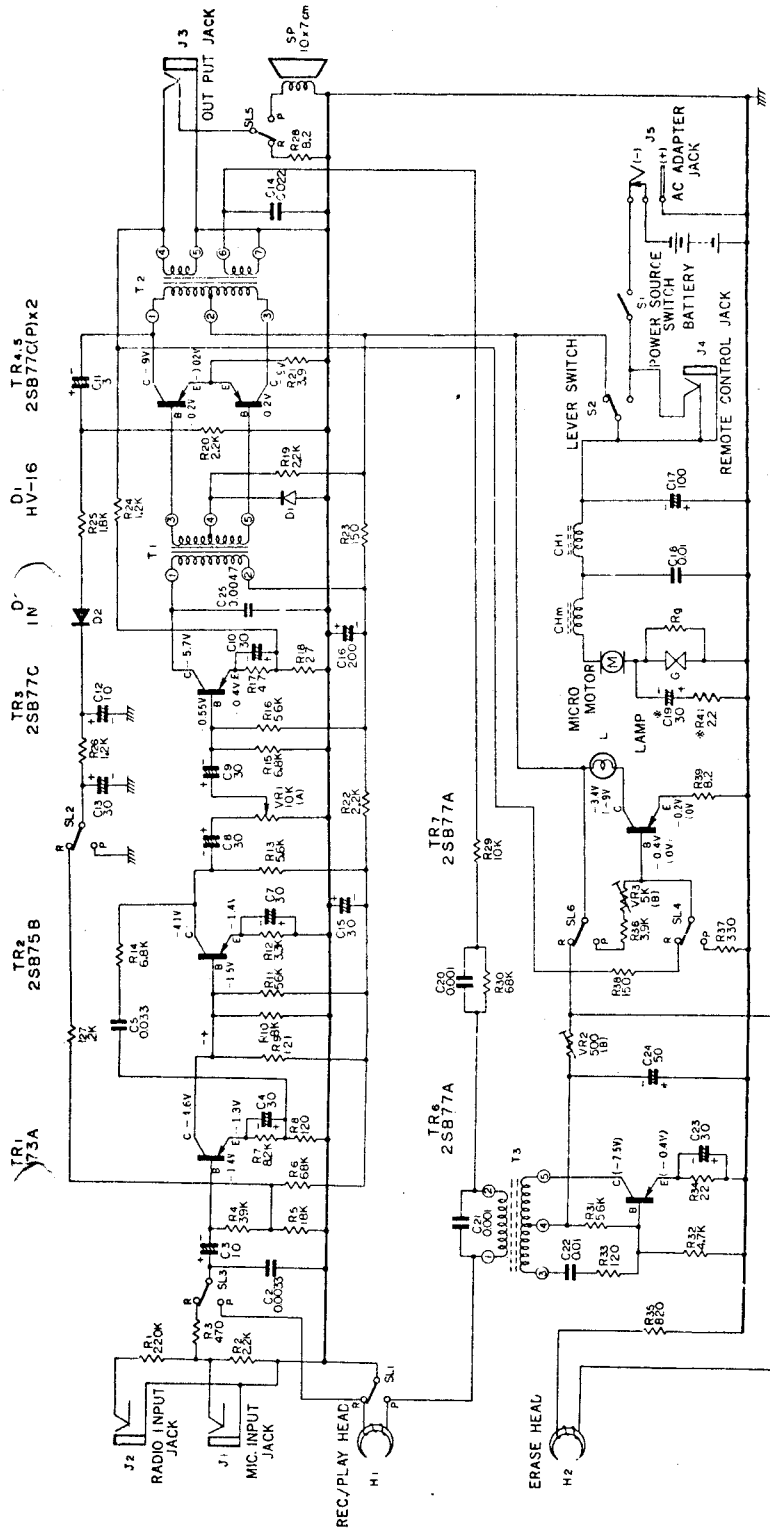


Fig. 18

MODEL TRQ-330 SERVICE MANUAL

CIRCUIT DIAGRAM



Head Office: 4, 1-chome, Marunouchi Chiyoda-ku, Tokyo
 Tel. Tokyo (212) 1111 (80 lines)
 Cable Address: "HITACHY" TOKYO
 Codes: All Codes Used

Printed in Japan