SONY®

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TAN-8250
Power Amplifier

New Circuit Operation

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POWER SUPPLY

One of the most unusual circuits is the power supply (Fig. 1), which provides semi-regulated voltage to the power output stage. This circuit is especially unusual in that regulation is provided only when the load on the power supply is heavy. For currents below .1 ampere, the load is supplied by half-wave rectifiers D340 and D341. These diodes conduct and charge filter capacitors C332 and C333 directly. However, when the current demand gets above 1 ampere, the output voltage falls to the trigger level that fires the SCRs. These operate from the full secondary winding of the power transformer. The big current pulse charges the filter capacitors, raising the output voltages above the trigger level. The sensing circuits, which include transistor Q331 and Q332, detect this increase and turn off the SCR for a few cycles until the load discharges the filter capacitors below the trigger level and process repeats.

The regulating circuit itself is essentially a standard closed-loop regulator adapted for an SCR pass element. Transistor Q331 is the error detector and amplifier for the positive supply. Its base monitors the DC output voltage via the RT331, R333, R334 voltage divider, and Q331 compares this output-voltage sample against the reference voltage applied to its emitter by zener diode D333. The collector-emitter impedance of Q331 and resistor R331 form a voltage divider whose output is pulsating DC that gates the SCR into conduction when the SCR cathode voltage falls below the predetermined level. Diode D332 disconnects the collector of Q331 when it is more negative than the cathode of the SCR to prevent reverse breakdown.

The negative regulator is similar, except that it uses the positive output voltage as a reference voltage, and has an additional transistor (Q333) to convert the circuit for negative output.

LAMP-CONTROL CIRCUIT

Transistors Q401 - Q403 (right side of Fig. 1) are arranged to provide a constant voltage to the pilot and meter lamps. This allows their intensity to remain constant regardless of the loading imposed on the power supply transformer.

Diodes D401 - D404 form a bridge rectifier that supplies the regulator transistors and the zener-diode reference source. The reference voltage supplied to the base of Q401 is set by RT401.

The lamp-control circuit, or more properly its rectifier, also serves another purpose. It acts as a loss-free voltage-dropping device between the main negative supply and the low-voltage negative regulator that supplies the input PC board. If a resistor were used, a lot of power would be wasted as heat.

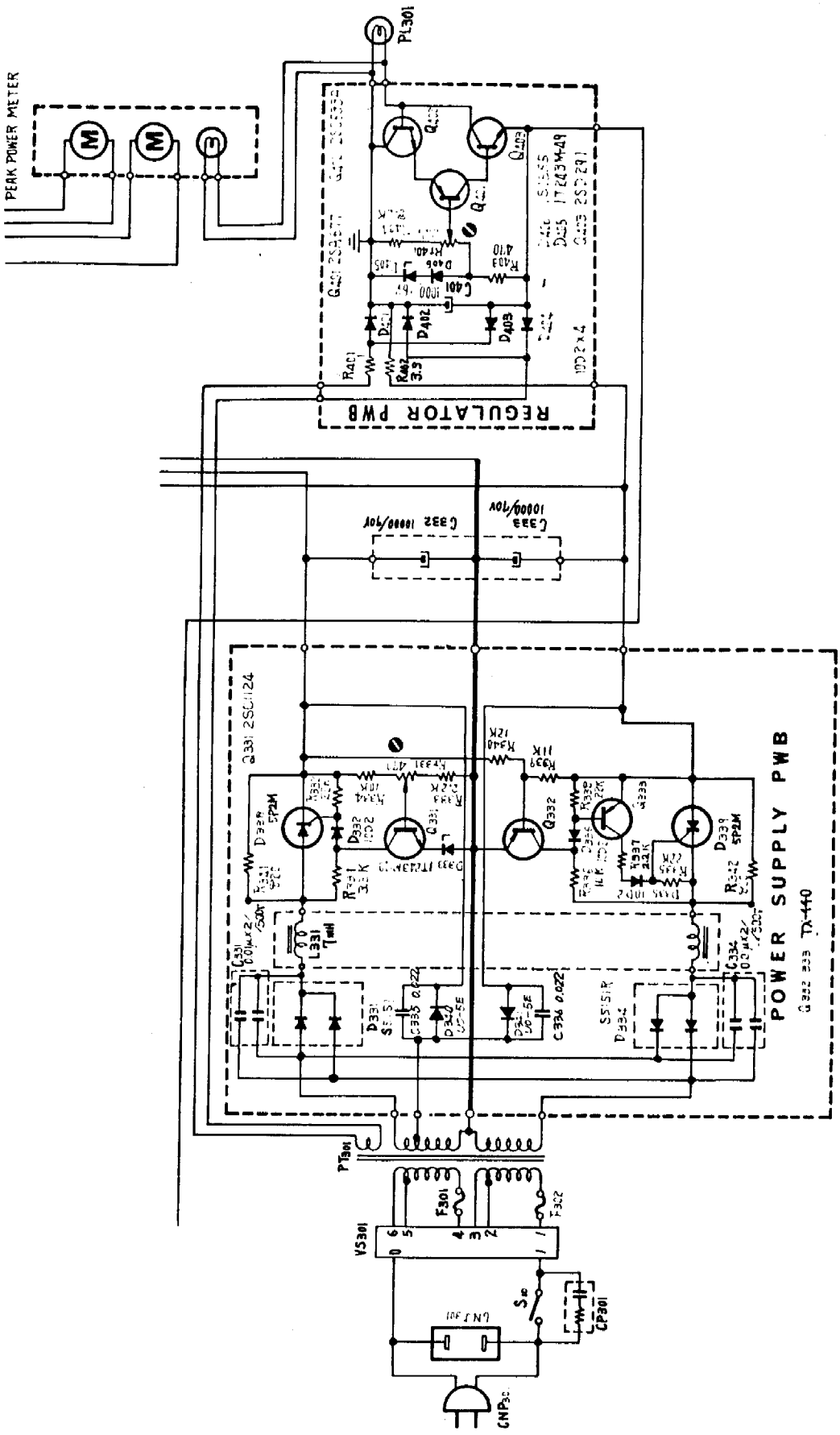

Fig. 1. Power supply.

POWER AMPLIFIER SECTION

The 8250 uses a pure complementary-symmetry power amplifier (Fig. 2). The output stage uses three parallel-connected NPN transistors, and three parallel-connected PNP transistors. The base-current requirement of this arrangement is enormous, so cascaded emitter-follower drivers are used.

In addition to the usual A and B speaker terminals, there is a group labelled DIRECT. These terminals are directly connected to the amplifier output point to provide very-high damping factor. The contact resistance of the speaker selector switch makes it difficult to achieve an extremely-high damping factor at the A or B terminals.

SPEAKER PROTECTION CIRCUIT

If DC appears on the power-amplifier output line, a simple protection circuit (left side of Fig. 2) initiates a series of events that blow all the power supply fuses a fraction of a second after the DC fault appears. To see what happens, let's assume that Q137 shorts and starts to drive the speaker line highly positive. The resulting current flow through R137 into the base of Q134 turns this transistor on, thereby clamping the cathode of D136 at around +1 volt. The increasing positive output line is also making the emitters of the PNP power transistors more positive. Since the anode voltage of D136 is clamped at 3 base-emitter voltage drops away from the voltage on the output line, it too is becoming more positive. When it becomes more positive than the cathode, it completes a low-resistance conducting path from the base of the PNP driver Q145 to ground. This causes an enormous increase in the collector current drawn by the PNP transistors, and blows the fuses.

The AC signal swings on the output line are prevented from operating this protection circuit by the filtering action of C133. This capacitor forms a low-pass filter in conjunction with R137 that does not pass signals above 7 Hz. The ground return for C133 is through transistor Q144. Though this transistor is connected to the muting circuit via R134, it is normally ON because it is a PNP transistor and the voltage at that point in the muting circuit is normally negative. Transistors Q131 - Q133, and Q140 - Q142 are the nucleus of another protection circuit for excessive drive and DC idling current. Its operation is nearly identical to that in the TA-8650.

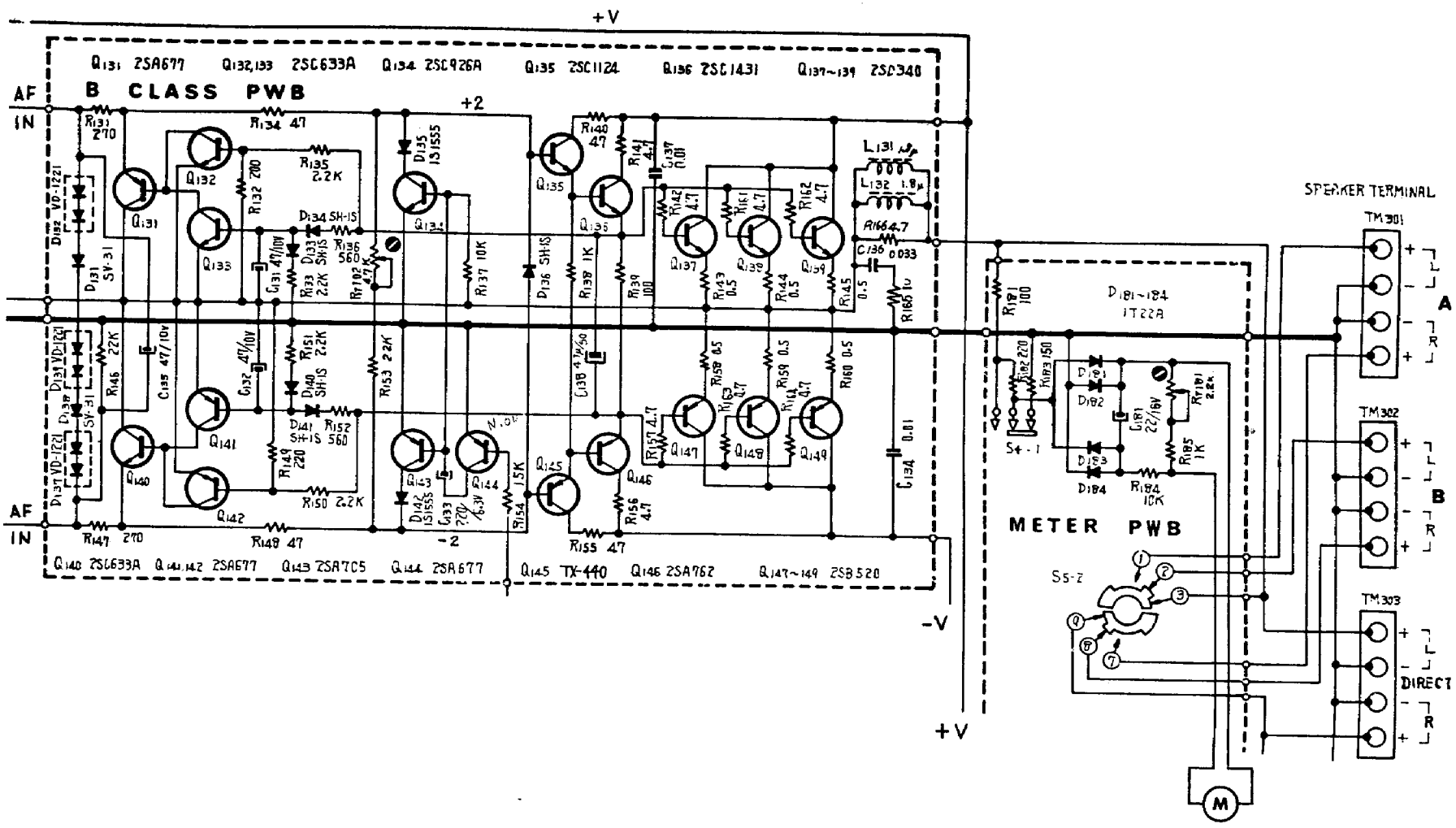

Fig. 2. Power output and protection circuitry.

INPUT AMPLIFIER

The input amplifier for the 8250 differs from that of the TA-8650's power amplifier mainly because of a few extra circuits and features. Refer to Fig. 3 during the following discussion.

B-Speaker Level Controls. An extra set of level controls is switched into the input circuit when the B set of speakers is selected by switch S5. The purpose of this is to permit equalizing the sound output from the A and B set of speakers during A/B comparisons. The higher-efficiency speakers are connected to the B terminal, and the extra level controls, RV102 and RV202, are adjusted to reduce the B speaker output to the same level as the A speakers.

Power Limiter. A series of push-button switches, S7 - S9, permit selecting either full-power operation, or limiting the power to 1/2, 1/4, or 1/8 of the maximum level. This is done very simply by limiting the absolute amplitude of the drive voltage at the junction of the input amplifier and power amplifier sections. These switches connect zener diodes across the signal lines.

The number of series-connected zener diodes used and the breakdown voltage of these diodes varies according the the power level selected. For instance, just diodes D303, D304, D307 and D308 are used for 1/8 power operation. As the maximum power level is increased, more zener diodes are added to the string. At full power the zener diode strings are disconnected entirely.

Diodes D202, D203, D102 and D103 serve two purposes, to isolate the two channels and to prevent the zener diodes from becoming forward biased by the signal.

Mono Operation. The two channels can be connected in parallel for monophonic operation with low-impedance loads (about 2 - 4 ohms), MODE selector switch S6 connects together the sliders of the level controls (RV101 and RV201), one set of signal lines at the junction between the input amplifier and power amplifier section, and the output buses.

For monophonic operation with high-impedance loads (8 - 16 ohms), the MODE selector sets up the amplifier for differential operation. The input to the right channel is grounded, and resistor R316 is connected from the output of the left channel to the inverting input of the right-channel's differential input amplifier. The speaker load must be manually connected between the +terminals of the left and right channels. This is essentially the same technique used in the SQR series receivers.

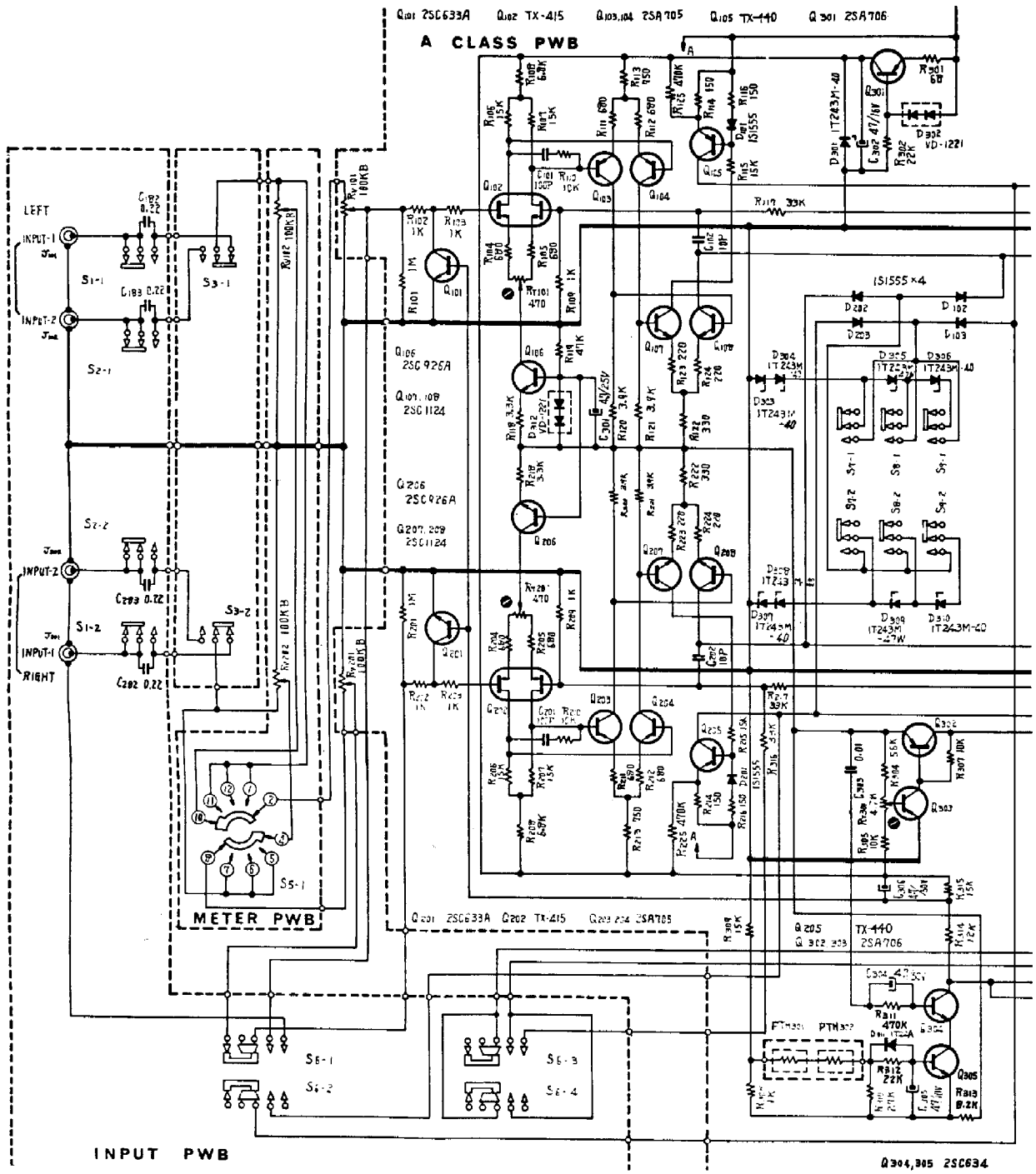

Fig. 3. Input amplifier.