5. Low Level Discriminator Using Tunnel Diode Bistable Circuit.

5.1 Circuit description and Theory of operation

Fig. 5.1 shows the diagram of a tunnel diode bistable circuit biased by a constant current source. The difference amplifier acts as a pulse former and pulse amplifier. The reset circuit is provided to reset the tunnel diode back to its normal state.

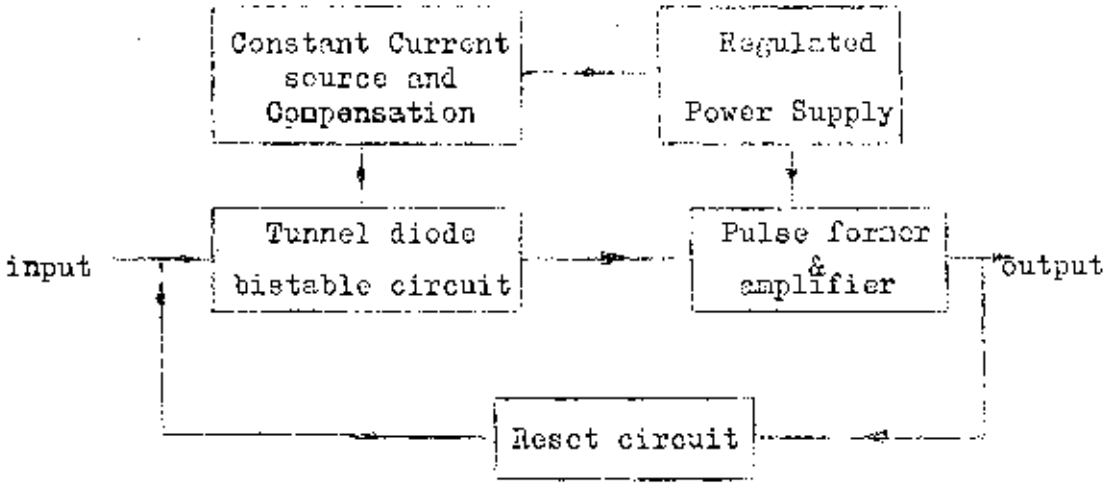

Fig. 5.1 Block diagram of the low level discriminator using tunnel diode bistable circuit.

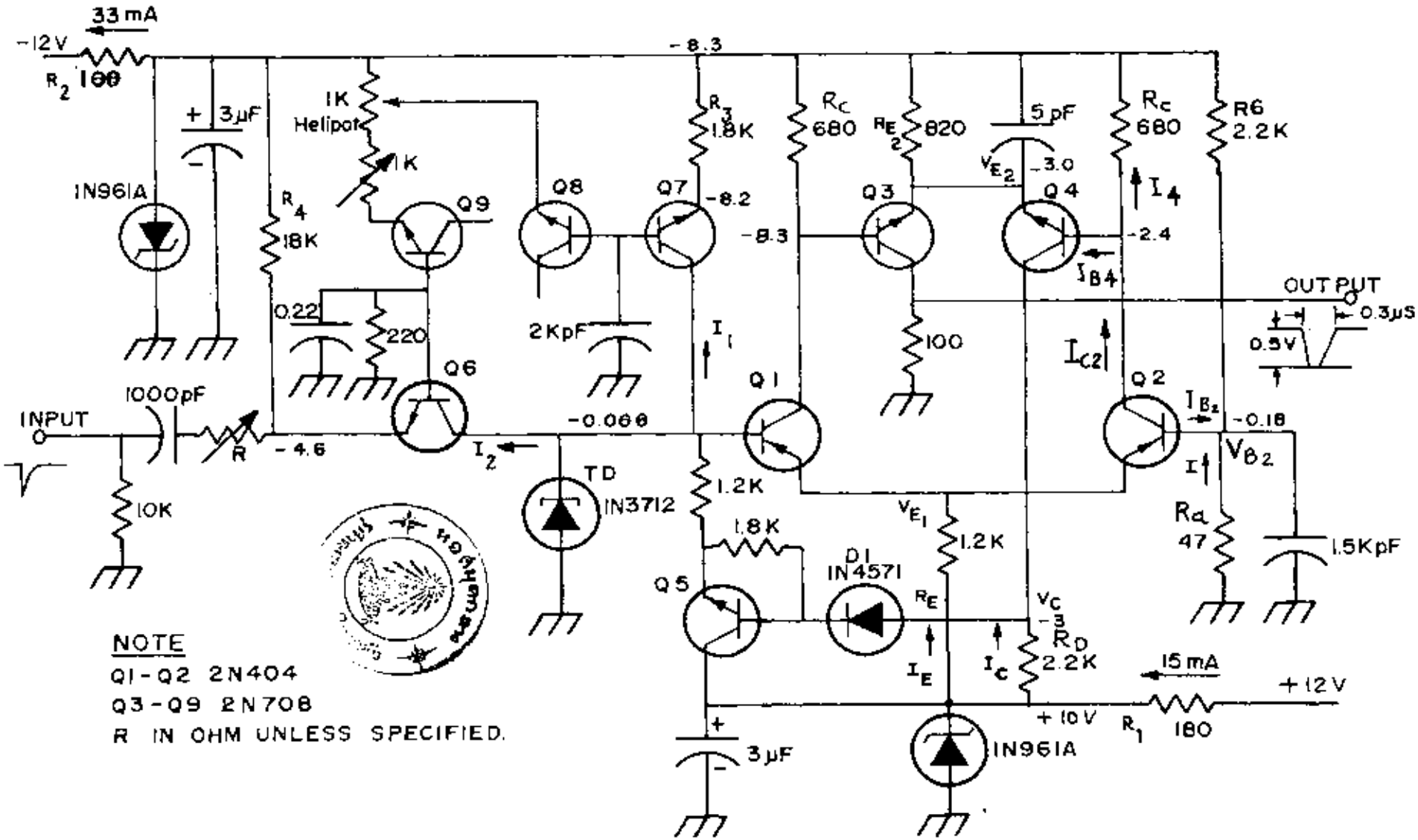

Fig.3.2 circuit diagram of the low level discriminator using tunnel diode bistable circuit.

Fig. 5.2 represents the schematic diagram of the circuit shown in Fig. 5.1. This circuit is sensitive to a negative input signal and the input is on the emitter junction of the transistor Q6. The collector has a high output resistance as required for fast switching of the tunnel diode TD and also isolates the input from switching transients. The threshold level is adjusted by means of a ten helicoidal potentiometer that supplies the bias current to the tunnel diode through the transistor Q7 which behaves as a high impedance source. The first difference amplifier (transistor Q1 and Q2) having a fixed threshold is used to amplify and send pulse to the second difference amplifier (transistor Q3 and Q4) which is used to store the d.- c level (output pulse width) and to send pulse to reset the tunnel diode through the transistor Q5. If a bipolar input is applied, the circuit doesn't require the reset circuit. The diode D1 is used to prevent charge store and spurious transients. A negative out-put pulse is taken out from the collector of the transistor Q3.

An input signal ——— across the resistor R produces a current high enough to trigger the tunnel diode to the other stable state usually to high voltage region causing the transistor Q1 to conduct and send pulse through the transister Q3 whose output is taken out from its collector. The signal from the collector of the transistor Q4 is delayed and sent ——— to reset the tunnel diode through the transistor Q5 to the original stable state.

This circuit is stabilized through the use of Zener diodes at both the positive and the negative power supplies. Temperature compensation is achieved through the use of the transistor Q8 and Q9.

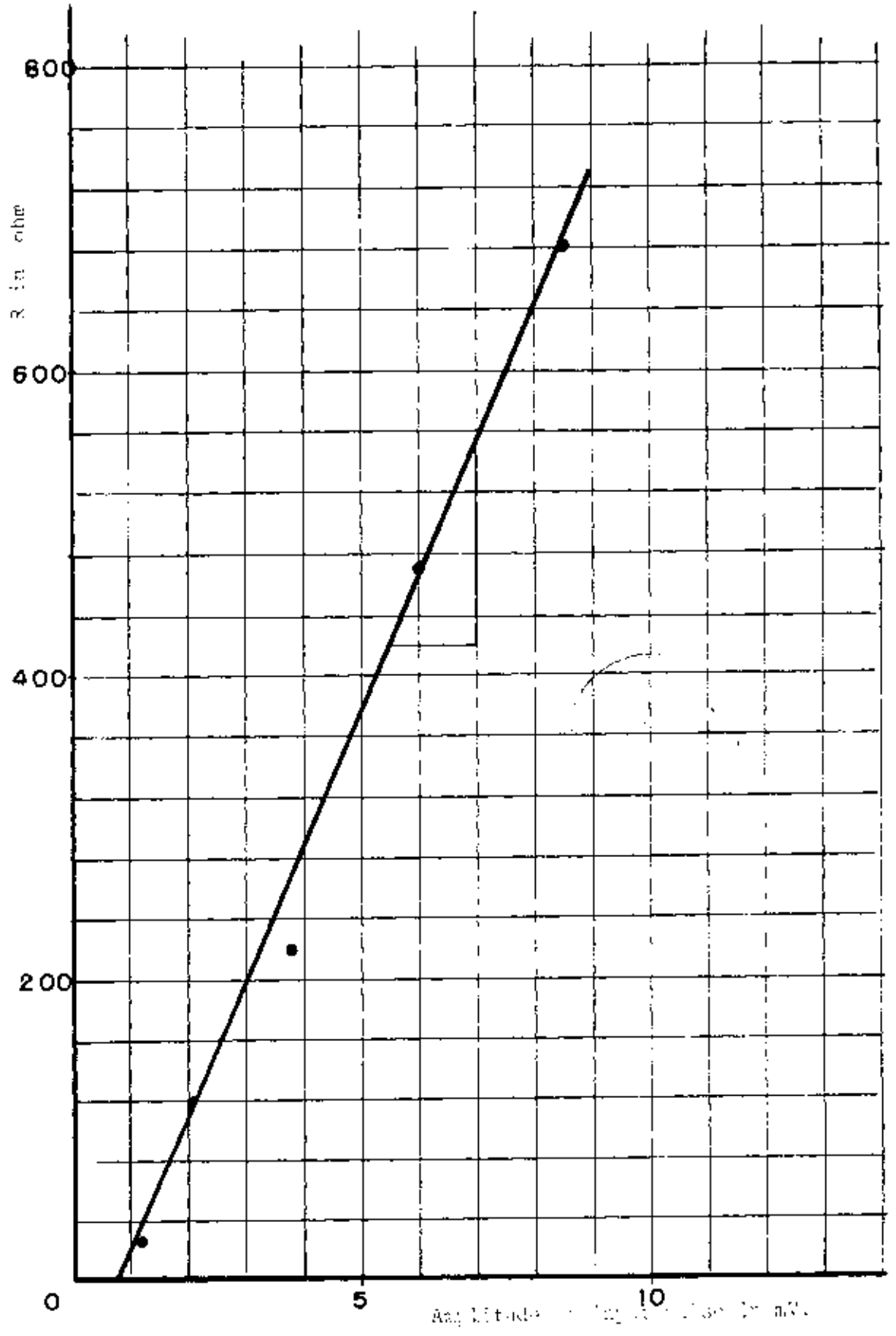

Fig.5.5 The linearity of the tunnel diode bistable discriminator.

5.2 Experimental results and linearity of the discriminator

The experimental result is obtained by supplying input signal from a mercury pulser to the circuit in Fig. 5.2, and by varying the resistance R and the input signal pulse. The result is shown in Fig. 5.3 and from this we obtain.

1. Current sensitivity = $\frac{1.2}{140}$ = 10.6 μa
2. The linearity is from 0 to 10 mv.
3. The deviation is ignored for this case.
4. The rise time is about 0.05 μsec, and the fall time is about 0.15 μsec. respectively.