CHAPTER 5

CONCLUSION AND DISCUSSION

The portable scalers is a small size, light weight nuclear electronic instrument that still has circuits like other large radiation counting systems. These circuits are adjustable high voltage supply, discriminator amplifier, six decade counters presettable timer, ratemeter and low voltage supply. All of electronic parts in this counting system are seperated in several circuit boards for ease of maintenance. The power consumption is minimized by use of CMOS integrated circuits, multiplexing display and leading zero suppression technique. Most of the electronic components and mechanical parts are available locally. The portable scaler is designed in such a way that it is practically compatible with any scintillation and gas filled detectors through proper selection of the gain of amplifier, discriminator level setting and operating voltage.

The high voltage power supply can be adjusted in range of 200 to 2400 volts, indicated by front panel meter. The maximum loading current is 100 μA and ripple voltage is less than 20 mV. throughout the range.

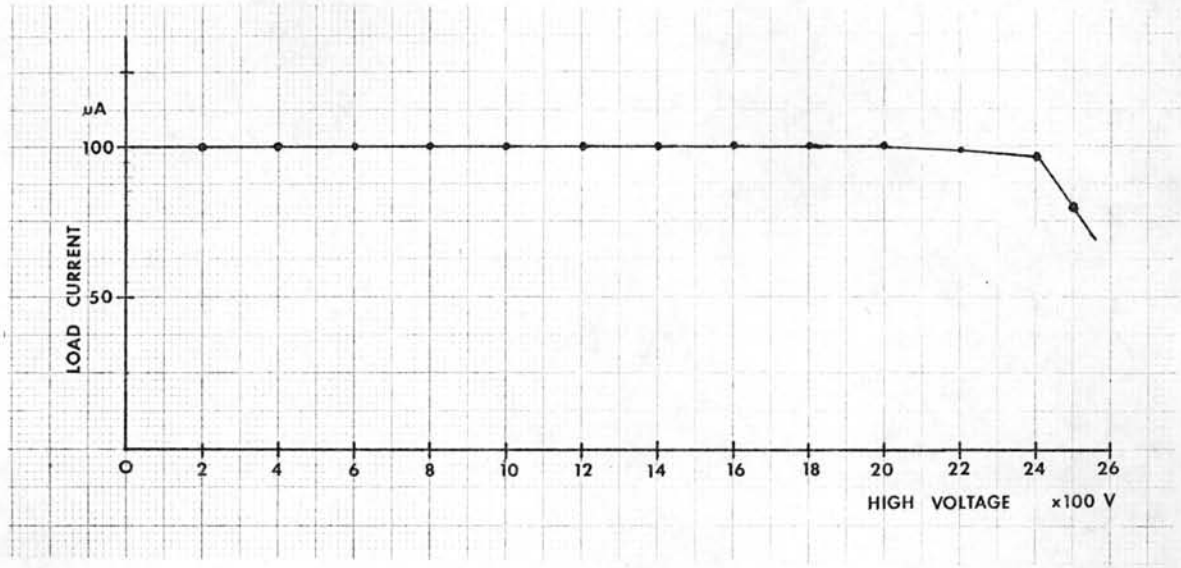

Fig. 5.1 Relation between high voltage and load current

The amplifier chain begins with charge sensitive input followed by ac coupling amplifiers and shaping circuits. Overall gain is selectable by an external switch x1 and x10 for voltage gain of 0.03 and 0.3 volt per millivolt. Shaping time constant of the output pulse is approximatly 50 μs. The discriminator level can be adjusted to eliminate unwanted signal in range of 0 to 2 volts by front panel control.

The six decade counters are BCD up/down counters using CMOS MM 74C192 with CD 4511 decoders and common cathode LED display. The 1.5 MHz counting speed of the counter is high enough for any radiation counting in field use. The counting time can be controlled either manually or by the timer in automatic mode of operation.

The presettable timer is provided for preset counting times from 1 to 90000 seconds. The precision of the preset time is derived from crystal controlled oscillator time base with frequency of 3.58 MH_z which is further divided by programmable divider CMOS MM 5369 EYR/N to 50 Hz, the working frequency of the timer.

The power consumed during operation is 3 W. maximum with 12 V. battery and 4.5 W. maximum at 220 V.ac line. The small size, light weight and compactness can be achieved by the proper selection of electronics components and the design of printed circuit boards.

There are some problems and difficulties arising during the development of this portable instrument. They can be summarized as follows :-

1. With special ICs some circuits could be designed easily. Owing to the unavailability of these components locally, the aforementioned circuits have to be developed with other simple electronic components thus making the circuits to look more clumsy and require more power consumption.

2. Due to lack of technical specifications of some electronic components, some parameters essential for the design of the circuits must be measured before using. The measurement is time consuming.

3. Difficulties arise in the high voltage circuit development, especially in the printed circuit design and installation, to avoid arcing between high voltage circuits and neighbouring components as well as breakdown in insulation. Moreover, proper high voltage components such as rectifiers and capacitors for filtering and coupling are not available locally.

4. Owing to compactness of the portable instrument difficulties in installation of several parts of the circuits boards to avoid cross coupling, noise interferences from high voltage oscillator as well as

proper grounding are common. Shielding and optimized orientation of these components are painstaking and time consuming.

5. For fine control of high voltage a ten-turns potentiomenter would be very helpful and is strongly recommended for future development.