APPENDIX - A

The system used for evacuating the chambers and filling gas is shown in fig. (A1). The spark chambers were enclosed in an iron box made of 5 mm thick sheet. The chambers as well as the box were evacuated simultaneously for 7-8 hours with the help of a rotary pump. The pressure in the chambers and the iron-box was watched constantly. At no time, during evacuation as well as filling, was the pressure difference allowed to exceed ~1 cm. This was very essential from the point of view of the safety of the spark chambers. This watch was very essential in the initial stages of evacuation because the rate of exhaustion was high. The Corning high-vacuum stop-cocks were used in the system. After the evacuation was over, the chambers and box were disconnected. The gas was allowed to flow in the chambers and, simultaneously, air was introduced in the box. Again, the pressure difference was not allowed to exceed ~1 cm. The gas was filled in the chambers at atmospheric pressure.

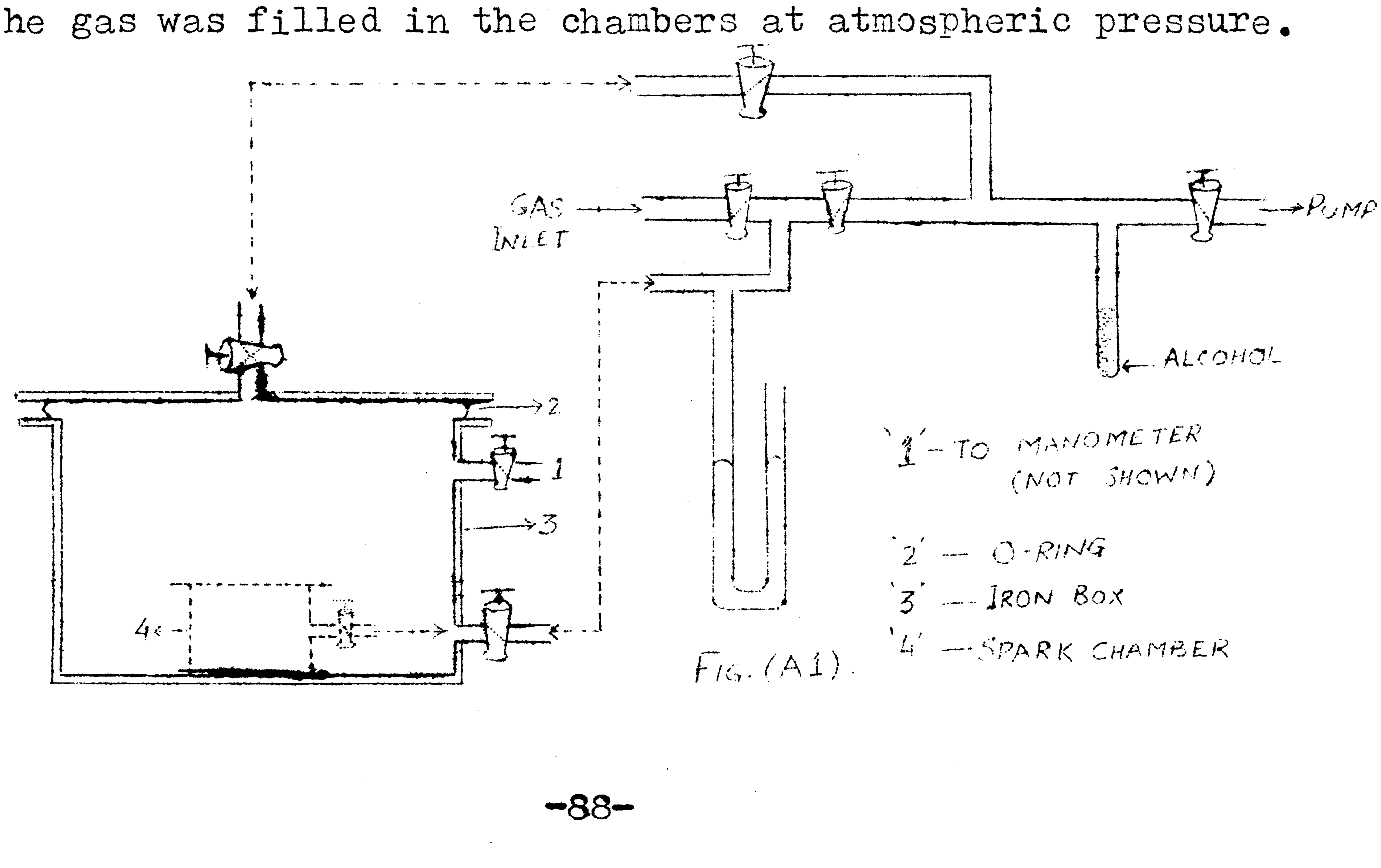
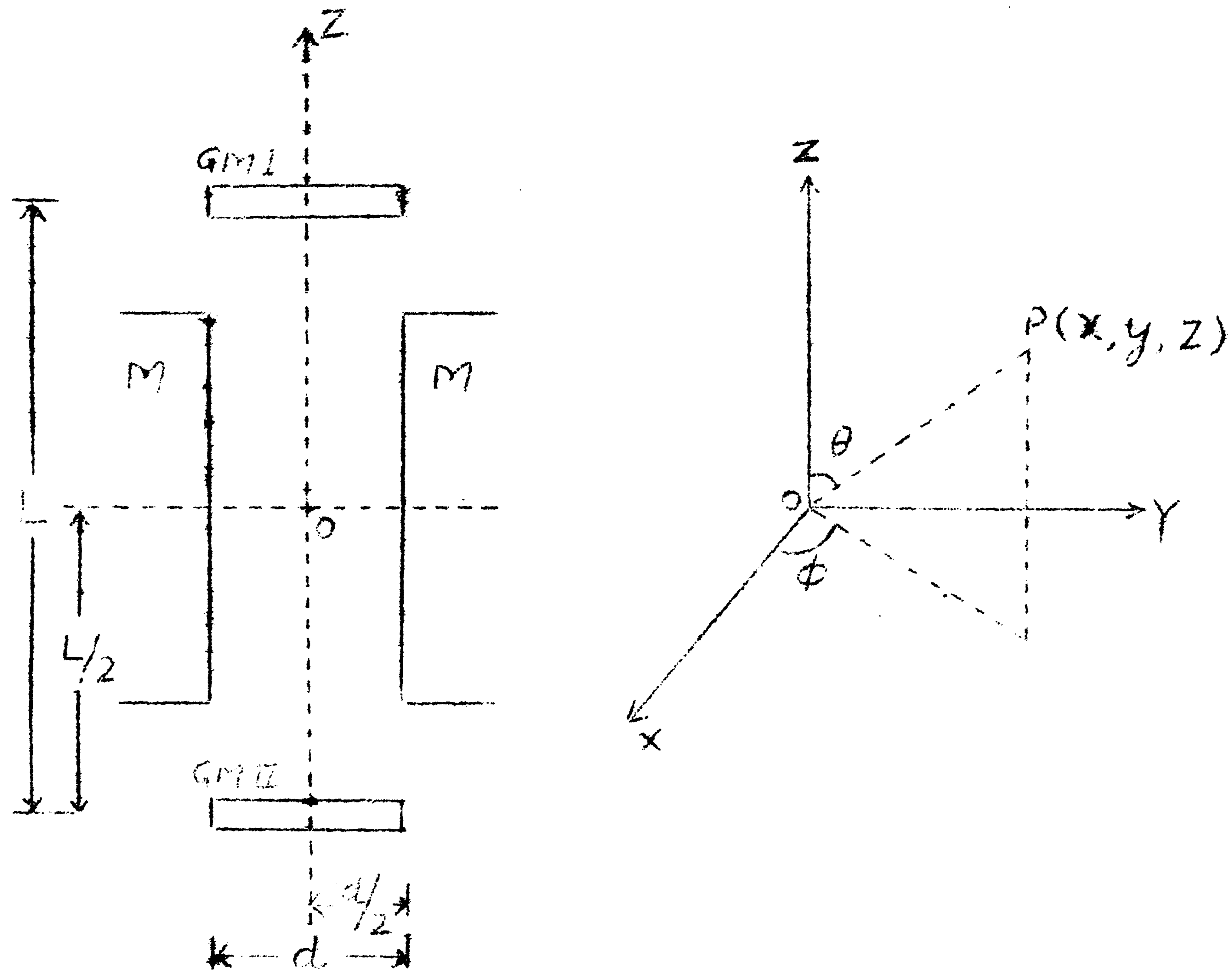


FIG. (A1).

APPENDIX- B

A simple Monte-Carlo simulation program was run for determining the acceptance function of the present spectrograph over the deflection region of interest. The procedure is explained below:

Consider the geometrical arrangement of the spectrograph, as shown in the adjacent figure.



The various lengths have been explained in the figure itself. The problem is the following: Suppose a particle impinges on the upper GM-counter anywhere between $-d/2$ to $+d/2$. What is the probability that after passing through the magnetic field whose strength is $\oint H.dl$, it is recorded by the lower counter anywhere between $-d/2$ to $+d/2$?. If it is recorded by the lower GM-counter, call it a 'success', if it is not, call it a 'failure'. Compute the 'successes' and 'failures' for different values of deflection.

There are two possible directions of the incident particle- it can come vertically downward or it can come anywhere between $\theta = 0$ to $\theta = 2\pi$, i.e., the initial direction is random over 2π. We will assume only the vertical incidence of the particle. We also assume that the distribution of cosmic-ray particles is isotropic over the geometry.

Suppose a point in the upper counter is represented by the cartesian coordinates (X,Y,Z) and a point in the lower counter is represented by (X',Y',Z'). We are, however, interested only in (X,Y) and (X',Y') coordinates.

We generate two random numbers, say r and r', corresponding to the coordinates (X,Y). Call the resultant coordinates as X_{ran} and Y_{ran}. Their limits are given by

$$X_{min} < X_{ran} < X_{max}$$

and $$Y_{min} < Y_{ran} < Y_{max}.$$

Now, according to the geometry of the telescope,

$$X_{min} = -d/2$$
$$X_{max} = +d/2$$
$$Y_{min} = -d/2$$
$$Y_{max} = +d/2$$

because the GM-counters are square in shape. The new coordinates will be given by

$$X_{ran} = r\,(X_{max} - X_{min}) + X_{min}$$

or

$$X_{ran} = rd - \frac{d}{2} \quad ;$$

similarly, $$Y_{ran} = r'd - \frac{d}{2} \quad .$$

The particle with coordinates (X_{ran}, Y_{ran}) passes through the magnetic field of length l, and assumes new coordinates (X_{new}, Y_{new}) in the lower counter. So, the problem is to find out whether (X_{new}, Y_{new}) falls between -d/2 to +d/2.

Polar spherical coordinates were used for obtaining (X,Y) in the lower counter. Two hundred muons were allowed to impinge on the upper counter and the 'success' and 'failures' were computed. The process was repeated for the entire deflection range of interest.