CHAPTER III

EXPERIMENTAL EQUIPMENT AND PROCEDURE

3.1. Transparent Electroconductive Coatings on Glass.[7,8]

The 3×1" glass plates were coated with tin oxide (SnO_2) films were optically transparent and electrically conducting. The technique consisted of spraying a solution of one and a half parts of stannic chloride (fuming) and one part of water on to a glass surface at the temperature between 550°c and 650°c so that a layer of stannic oxide was formed. Prior to coating, the glass plates were cleaned with cleaning solution (0.6 mg. potassium dichromate in 20 ml. sulfuric acid concentrate) and then washed with distilled water. For the coating process, the glass plates were heated in an oven to 600°c , then quickly removed from the oven and sprayed with the coating solution for not more than 4 seconds. It is then replaced in the 600°c oven and heated for 1 to 2 minutes and taken out and sprayed again. For four times of spraying and reheating, the conductivity of SnO_2 films will be in the range of 100 to 1000 $\Omega^{-1}cm^{-1}$. The spraying and reheating may be repeated as necessary to produce desired electrical conductivity. Highest quality coatings, however were obtained when the heating and spraying times were kept as short as possible. The glass with thinner coatings and lower conductivity had better light transmittance, however, there was some loss in ability to withstand high temperature baking. Coated glass baked at 500°c for periods of 3 or 4 hours showed no significant change in electrical resistance.

The coated glass plates were used as the transparent electrodes in electroluminescent cells.

3.2. Construction of Electroluminescent Cell.

Zinc sulfide phosphor, grade EP1 of British manufacture, was mixed with a commercial epoxy resin in a proportion of 1:1 by volume, and the resin was then cured. The phosphor- epoxy mixture was placed between the coated glass plates. The glass plates, arranged with the conducting layers facing inward, were crossed to allow electrical connection to be made to the conducting layers. A thin sheet of waxed paper was inserted between phosphor layer and one of the electrodes to act as an insulating layer which would resist dielectric breakdown. Pressure was applied to the glass plates so that a phosphor layer approximately 6 mils thick[9] was obtained before complete polymerization of the epoxy resin occured. Electrical connections were clamped directly to the conducting layers.

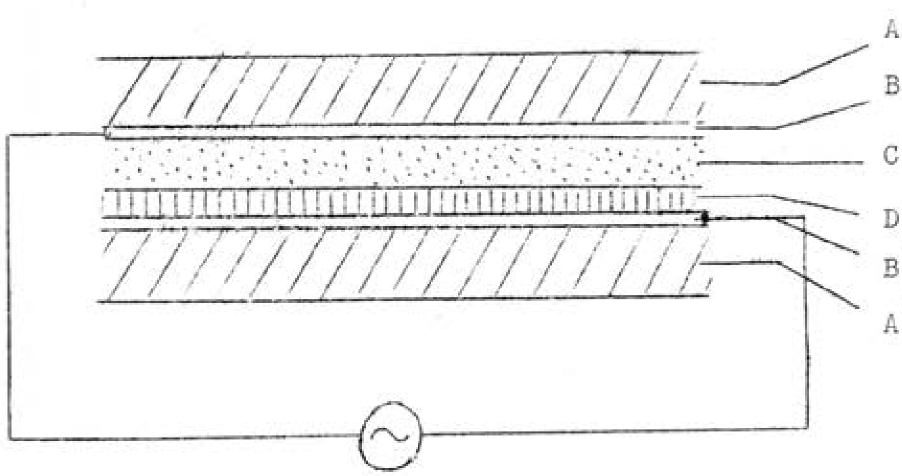

Fig 3.1 Schematic View of Electroluminescent Cell.

A., A'. Glass, B, B'. SnO_2 conducting film,

C. Phosphor suspended in cured epoxyresin,

D. A thin sheet of waxed paper.

3.3. Brightness Measurement.

A block diagram of the complete measuring system is shown in Fig.3.2. and the apparatus is as shown in Fig.3.3.

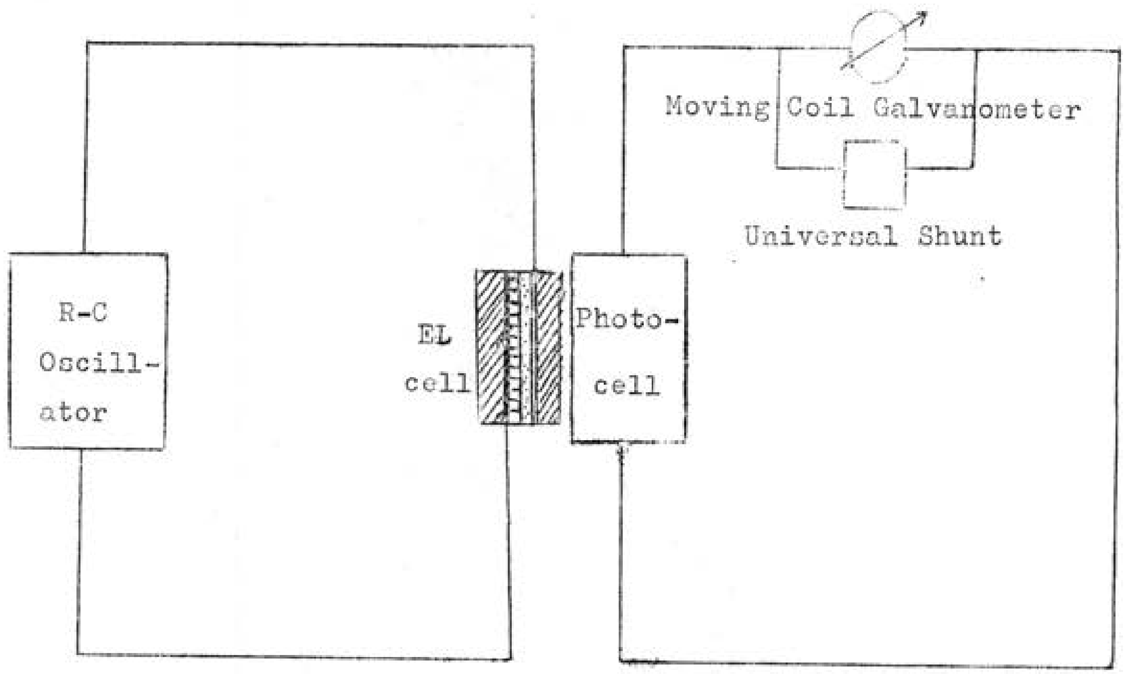

Fig. 3.2. Block Diagram of the Measuring System.

The output of an R - C oscillator was used as the source of A.C. voltage. The current produced by the photocell was measured by a moving coil galvanometer. The deflections of the galvanometer were the indication of the light output.

The electroluminescent phosphor layer was faced to the photosensitive surface of the photocell. When an alternating voltage from R - C oscillator was applied to the electroluminescent electrodes. An alternating electric field was set up across the phosphor layer and it caused the phosphor to emit light. The illumination supplied by the electroluminescent cell produced the current output from the photocell.

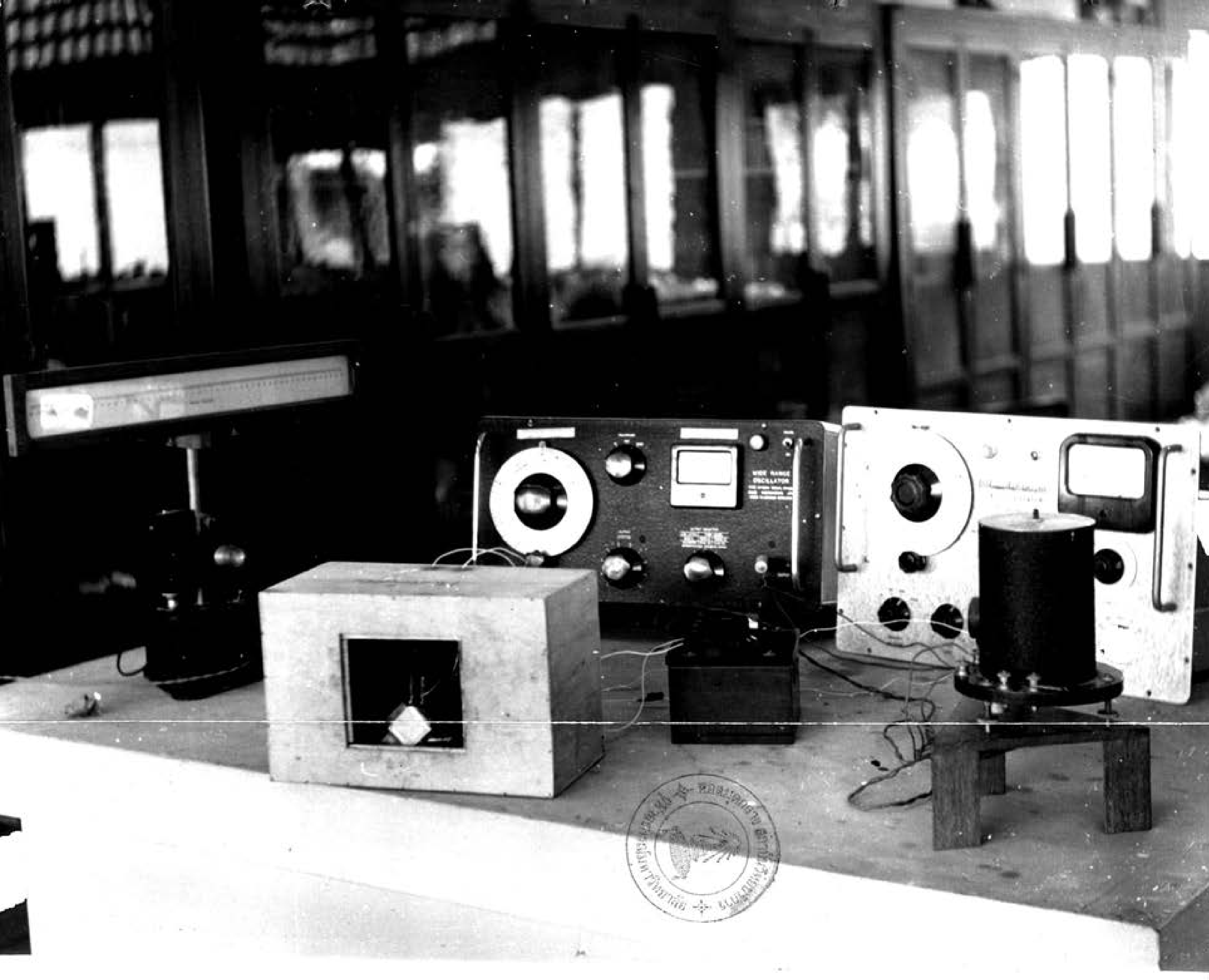

Fig. 3.3 The Apparatus

In the over-all response of an electroluminescent cell-photocell combination; the actual brightness B is related to the current I in the case of a photocell operated at some fixed bias voltage.[9] The photocell may be regarded as having a linear response in the light - level range used in the experiments; thus,

$$I = kB$$

when k is a constant. At a fixed frequency, however, there is a direct correspondence between I and B.

The current produced by the photocell was measured by the moving coil golvanometer, the values of currents could be read in term of deflection on a scale. The brightness of the electroluminescent cell was determined when the external illumination was excluded by placing the electroluminescent cell and the photocell in a light - tight box.

3.4. Experimental Procedure.

The apparatus was arranged as shown in Fig. 3.2. Various parts could be listed as follow:

(1) R - C oscillator was the Type A 1302, manufactured by Associated Electronic Engineers Ltd. England. Frequencies and voltages could cover the range from 20 to 20,000 c.p.s. and 0 to 250 volts respectively.

(2) The photocell was the Model 856, Weston Photonic Photoelectric cell.

(3) The moving coil galvanometer was the Model 2302/121, Onwood London.

(4) Universal shunt was the Ser. No.185487 Leeds & Northrup Co. Scientific Instruments Philadelphia, U.S.A.

(5) The electroluminescent cell was constructed as described.

The brightness produced (correspondence to the deffection) by the electroluminescent cell was measured in two different ways:

(a) For each constant voltage, frequencies were varied from 100 to 20,000 c.p.s. The results from cells No. I,II,III and IV were shown in Tables 4 - 1, 4 - 2,,4 - 3 and 4 - 4.

(b) At fixed frequencies, the voltages were varied from 0 to 250 volts. The results from cell No. I and II were shown in Tables 4 - 5 and 4 - 6.