by three pads of 1/4 inch thick rubber under the leveling screws. The entire unit rested on a piece of 3/4 inch thick steel plate supported by a heavy 2' x 2' table. The latter was insulated from the floor by a piece of sponge rubber 1 inch thick and one yard square. These precautions were necessary to eliminate the sensitivity of the system to vibrations in the floor caused by normal building activity.

The primary galvanometer, G, was a Leeds and Northrup type HS unit with a voltage sensitivity of 1.8×10^{-7} volts/mm for 1 meter path length. The optical path length in the galvanometer amplifier was about .3 meter so the sensitivity of the primary system is approximately 60×10^{-8} volts input/mm deflection at the photocells. The sensitivity of the entire system, as measured by using a voltage divider to give an input of 10^{-7} volts and noting the secondary galvanometer deflection, is approximately 10^{-8} volts/mm. The gain of the system is approximately 60. The secondary galvanometer was a Leeds and Northrup 2430G.

The detection system could have been made more sensitive by improving the optical system. Galvanometer amplifiers have been made with gains of 2000-3000 [4]. Such gain is difficult to use, because of attendant drift, and negative feedback is often used to reduce the gain and increase the stability. The sensitivity we achieved using a simple optical system without negative feedback was adequate and no improvements were made. We considered the galvanometer amplifier preferable to commercially available chopper amplifiers, which had a noise level of .03 microvolt and were moderately expensive.

The magnet was of laboratory design, with 7 inch pole pieces and a 2 inch gap. The power supply was unregulated, using selenium rectifiers in a bridge circuit. The maximum field available was 8750 gauss. The magnet was calibrated by proton resonance, but the field was set by adjusting the current measured by a Weston Model 430 1/4 percent accuracy ammeter.

The compensator is a loop of wire with an enclosed area of about one square inch mounted on a formica rod and placed in the magnetic field. The coil can be rotated so that the enclosed flux varies. Small variations in magnetic field, caused by current fluctuations, induce varying voltages in the loop formed by the Hall leads and the sample. The compensator coil, connected in series with the Hall leads, is rotated until the voltage induced in it exactly cancels that induced in the sample loop and the drift disappears. The magnitude of the field fluctuations, as measured using a search coil and the galvanometer amplifier, was about 4 gauss at a field of 3700 gauss.

These field variations of approximately .1 percent would not cause measurable variations in the Hall voltage. On the other hand, the voltages induced in the Hall loop are quite measurable; they are of the order of .1 microvolt. The compensator eliminated the effect of the field fluctuations without actually regulating the power supply. Slow, steady drifts of magnetic field can change the Hall voltage but can be detected by monitoring the magnet current.

4. Spurious voltages.

Low level Hall voltage measurements are made difficult by thermoelectric and thermomagnetic effects which can produce spurious voltages. Fortunately, most of these effects were not of concern to us, as long as they did not change in the time required to take a reading. The voltage measured by the potentiometer is

$$V = V_R + V_H + V(H) + V(H^2) + V_S\,, \tag{II-2}$$

where

V_R - voltage due to the IR drop between Hall probes

V_H - Hall voltage

$V(H)$ - all other voltages linear in H

$V(H^2)$ - all voltages quadratic in H

V_S - spurious voltages which are independent of H

Calling the voltage produced with the field in one direction V_1 and that with the field reversed V_2 we have

$$|V_1 - V_2| = |2V_H + 2V(H)| \tag{II-3}$$