CHAPTER V

RESULTS

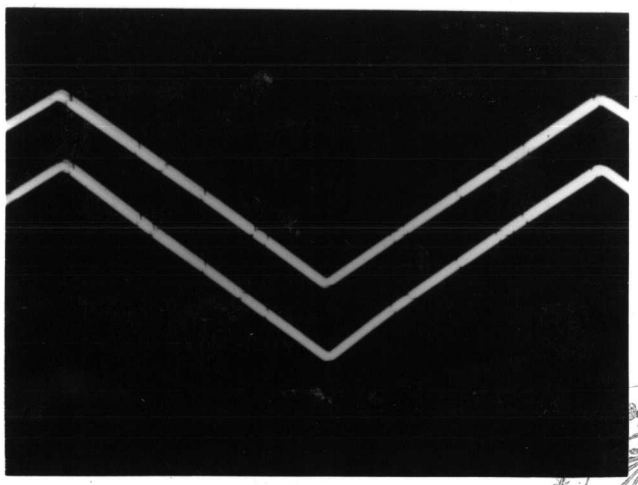
The triangular reference signal, the velocity pick-up signal and the error signal used in the experimental run are shown in Fig. 5.1. The error signal voltage was about 0.15 % of the reference signal voltage (both measured peak-to-peak). The gamma-ray spectrum of the Mössbauer source, obtained by using the arrangement of path 1 of Fig. 4.3, is shown in Fig. 5.2 (a). Only the two peaks of the 6.5 KeV x-rays and the 14.41 KeV Mössbauer gamma rays appeared. To reduce the x-rays intensity, the aluminum foil (29.95 mg/cm^2) was placed between the source and the detector. The resulting gamma-ray spectrum is shown in Fig. 5.3. Fig. 5.4 is the energy calibration curve of the system which gives a resolution of 30 % at 14.41 KeV. Fig. 5.5 and 5.6 are the Mössbauer spectra of a natural iron and $CoFe_2O_4$ absorbers respectively.

The folded data for the Mössbauer spectrum of a natural iron absorber is plotted in Fig. 5.7. Using the method described in chapter IV, the velocity calibration was calculated to be 0.0407 mm/sec-channel, with a systematic deviation of 0.0002 mm/sec-channel. The maximum velocity was then ± 10.4192 mm/sec. After the folding procedure had been applied to the spectrum of $CoFe_2O_4$, the Mössbauer spectrum of Fig. 5.6 (b) is plotted in Fig. 5.8. Using the equation (Sauer and Reynik, 1968)

$$H = 30960\ (V_6 - V_1)$$

where V_1 and V_6 are the Doppler velocities of the first and the sixth peaks in millimeters per second, and H is the hyperfine field at the iron nucleus in oersteds, the hyperfine field at the iron nucleus of the $CoFe_2O_4$ compound was found to be 510.3 ± 17.1 KOe, which agrees with the value quoted by Petitt and Forester (1971).

(a)



(b)

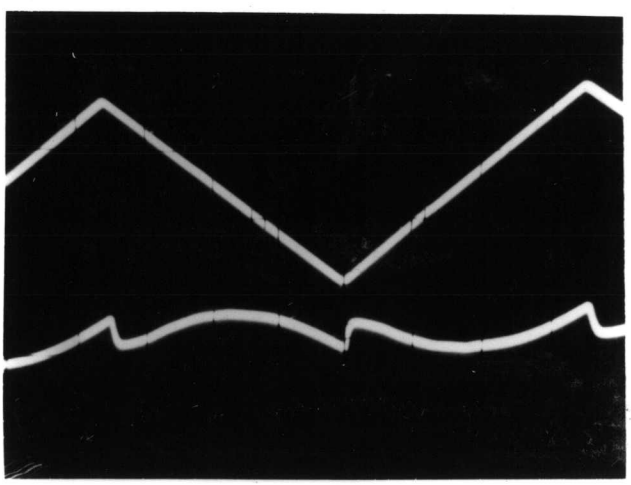
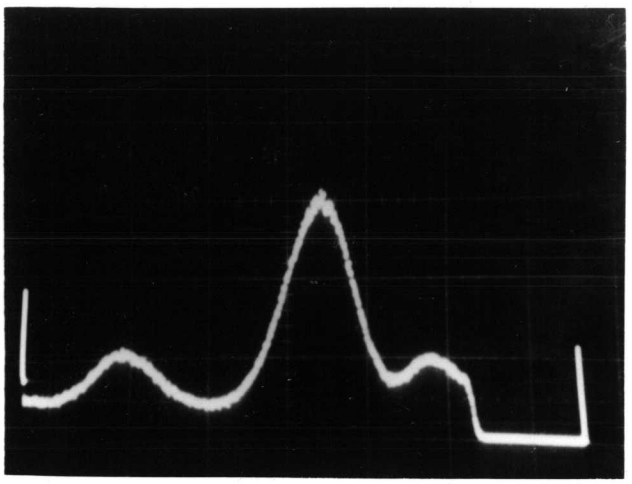


Fig. 5.1. (a) Oscilloscope display of the triangular reference signal, 300 mV_{p-p}, 24.4 Hz (upper portion) and the velocity pick-up signal (lower portion).

(b) Oscilloscope display of the reference signal and the error signal (4.5 mV_{p-p}).

(a)



(b)

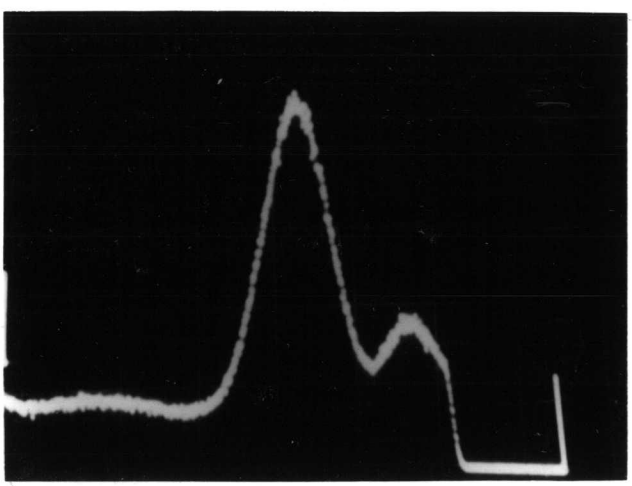


Fig. 5.2. (a) Gamma-ray spectrum of Mössbauer source.

(b) Gamma-ray spectrum of (a) with the Al-filter ($29.95\ mg/cm^2$).

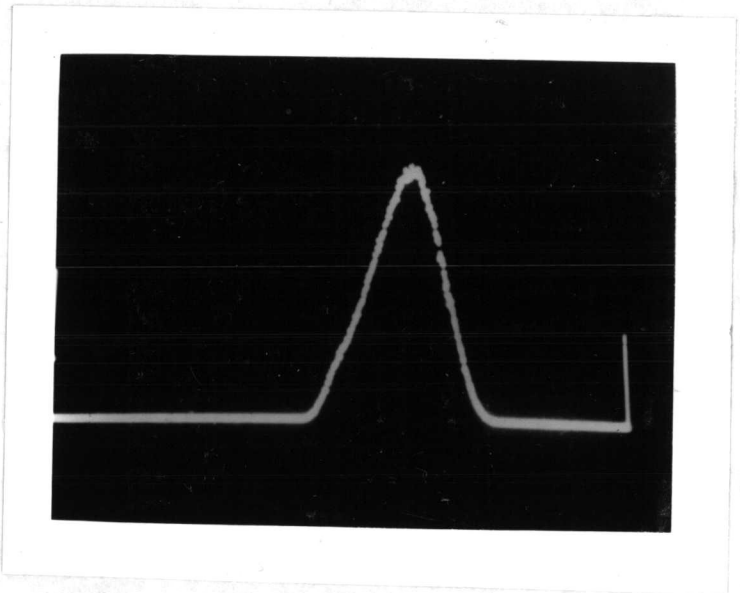


Fig. 5.3. The 14.41 KeV Mössbauer gamma ray peak being selected by the 406 A SCA.

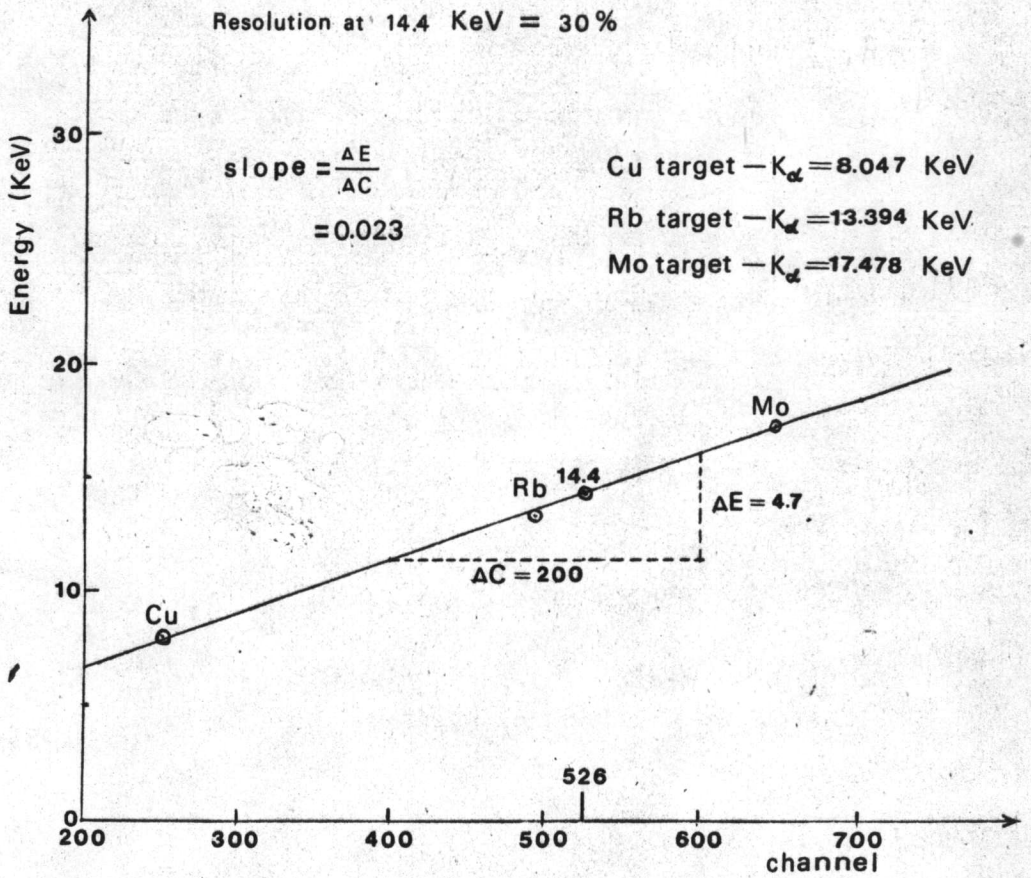
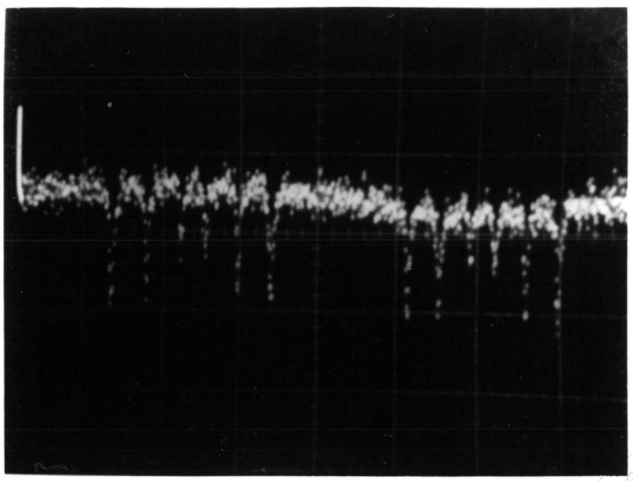


Fig. 5.4. The energy calibration curve using the variable X-ray source for the standard sources.

(a)



(b)

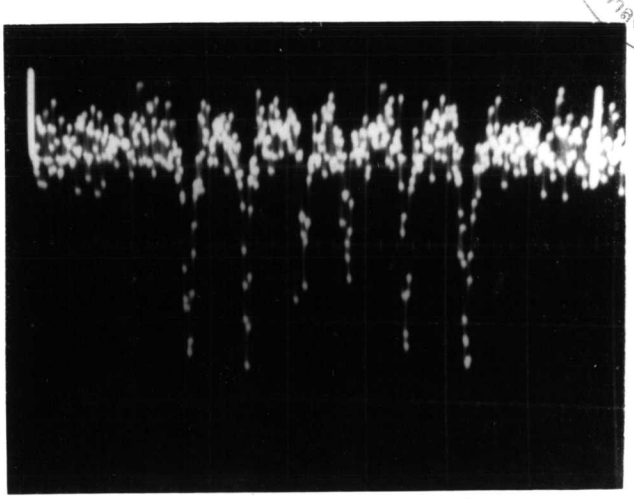
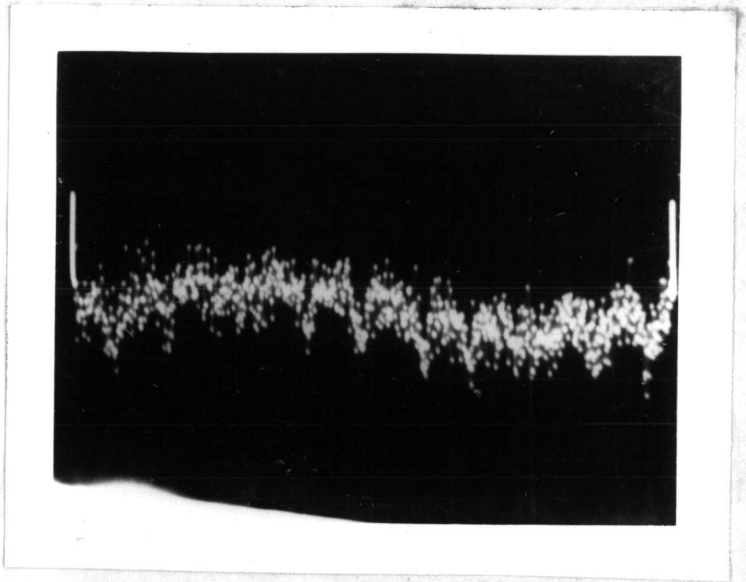


Fig. 5.5. (a) Mössbauer spectrum of a natural iron absorber (0.025 mm thick), the second half of the spectrum being the mirror of the first half.

(b) The first half of the spectrum.

(a)



(b)

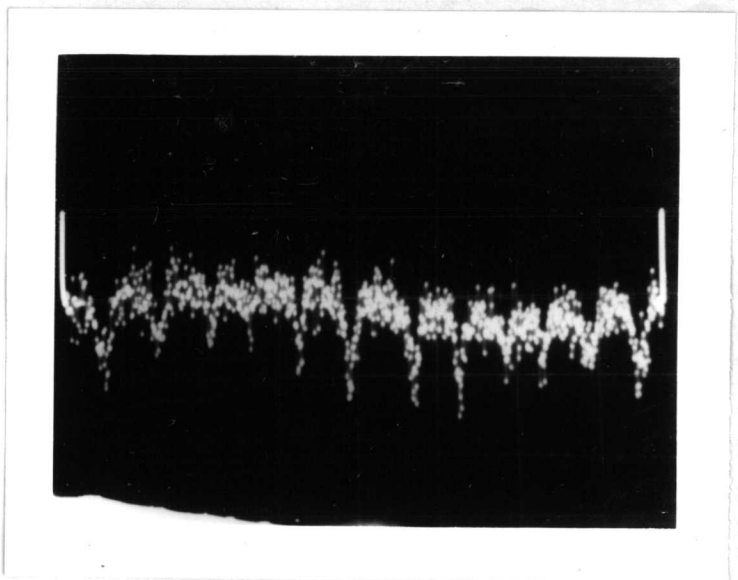


Fig. 5.6. (a) Mössbauer spectrum of $CoFe_2O_4$ absorber (the absorber being in the form of chunks).

(b) The $CoFe_2O_4$ absorber was ground to a fine powder.

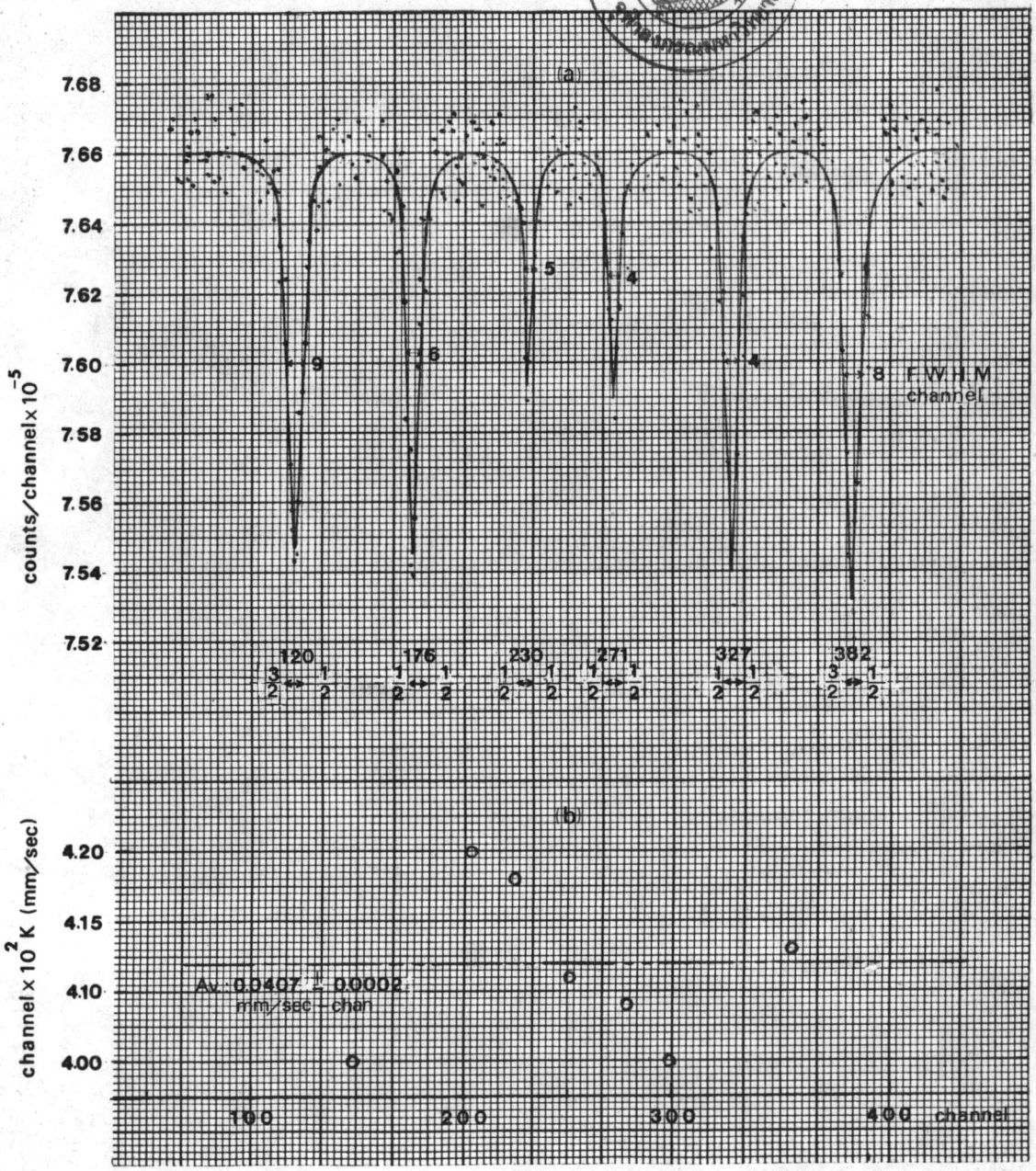


Fig. 5.7. (a) The folded data Mössbauer spectrum of the natural iron absorber. Velocity calibration using the magnetic hyperfine splitting in a natural iron.

(b) Calibration constant calculated from the data in (a). The constant (mm/sec-channel) has been plotted at the midpoint of the respective interval. The quoted error is the standard deviation of the mean of the seven data points.

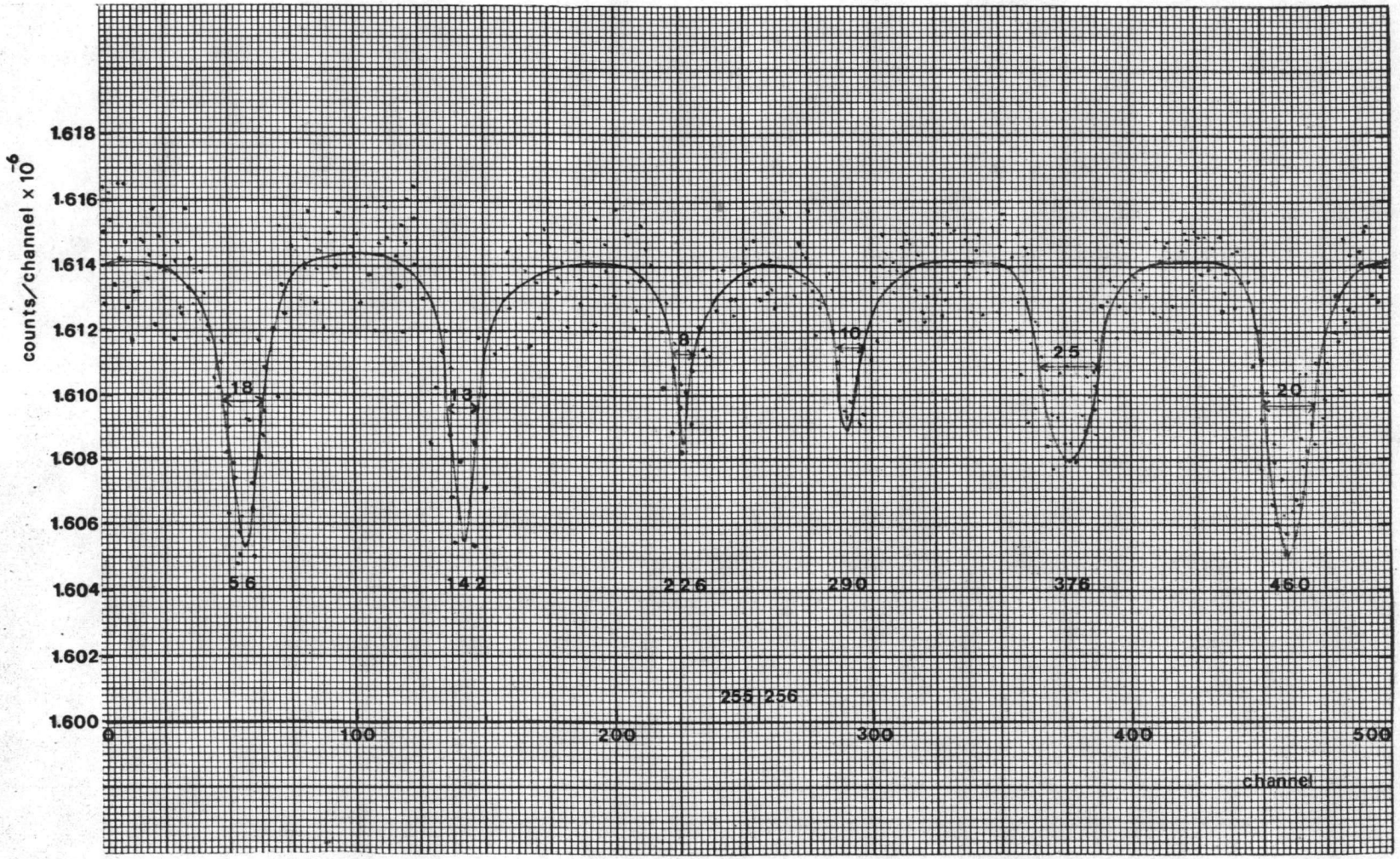


Fig. 5.8. The folded data Mössbauer spectrum of the $CoFe_2O_4$ absorber.