6 December 1976

MEMORANDUM TO: VLA File

FROM: C. C. Aleksoff and A. Klooster

SUBJECT: Additional Experimental Results for π-Shifted Signals

This memo follows the work of a previous memo [1], and shows further experimental results using the experimental VLA processor. In the work in this memo, the reference wave is on the optical axis (i.e., no offset on the reference wave). Further, the reference wave intensity is always greater than the peak of signal wave intensity at the output plane.

Given that $S(x,y)$ is the Fourier transform of the input signal $s(u,v)$ and R is the reference wave, the governing equations are:

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[1] C.C. Aleksoff and A. Klooster, ERIM memo to VLA file, 24 November 1976, "Initial Experimental Results Showing Subtraction of π-Shifted Signals.

$$I_R = |R|^2 \tag{1}$$

$$I_S = |S|^2 \tag{2}$$

$$I_0 = I_R + I_S + 2RS \tag{3}$$

$$I_\pi = I_R + I_S - 2RS \tag{4}$$

$$I_0 - I_\pi = 4RS \tag{5}$$

$$I_0 + I_\pi = 2\ I_R + 2\ I_S \tag{6}$$

where

$$I_R \geq \text{Max } I_S \tag{7}$$

FIGURE 1.

Here the input was a slit. Hence, S is proportional to

$$\text{sinc}(x)$$

There are about 165 samples per mainlobe (null-to-null) in the sinc function (Figure 1f). Figure 1e shows the diode variations for a uniform incoherent illumination. (NOTE: All the vertical and horizontal scales represent the same output values. Thus, all figures can be compared directly). Neither this diode variation or reference wave nonuniformity (Figure 1b) have been compensated in obtaining the difference functions shown in Figure 1f.

FIGURE 2.

Here the input is a circular aperture of diameter 3.175 mm on a 10 ℓp/mm carrier. Thus, the scanned ouput is centered from the zero frequency position at a distance of about 13 times that of the null-to-null mainlobe width.

FIGURE 3.

The input is a .08" slit on a 10 ℓp/mm carrier.

FIGURE 4.

The input is a 0.4" slit on a 10 ℓp/mm carrier.

FIGURE 5.

The input is a 0.8" slit on a 10 ℓp/mm carrier

FIGURE 6.

The input is a slit of about 1.6 mm on a 10 ℓp/mm. The difference signal and sum signal were read out and Fourier transformed by a Federal Scientific Model UA-14A. The FT of the difference signal should give back a rect function, which is confirmed by the results shown in 6e and 6f. The FT of the sum signal should be a triangle function (i.e., the FT of sinc^2), which tends to be confirmed by 6c and 6d.

CCA:sd

cc: Cindrich
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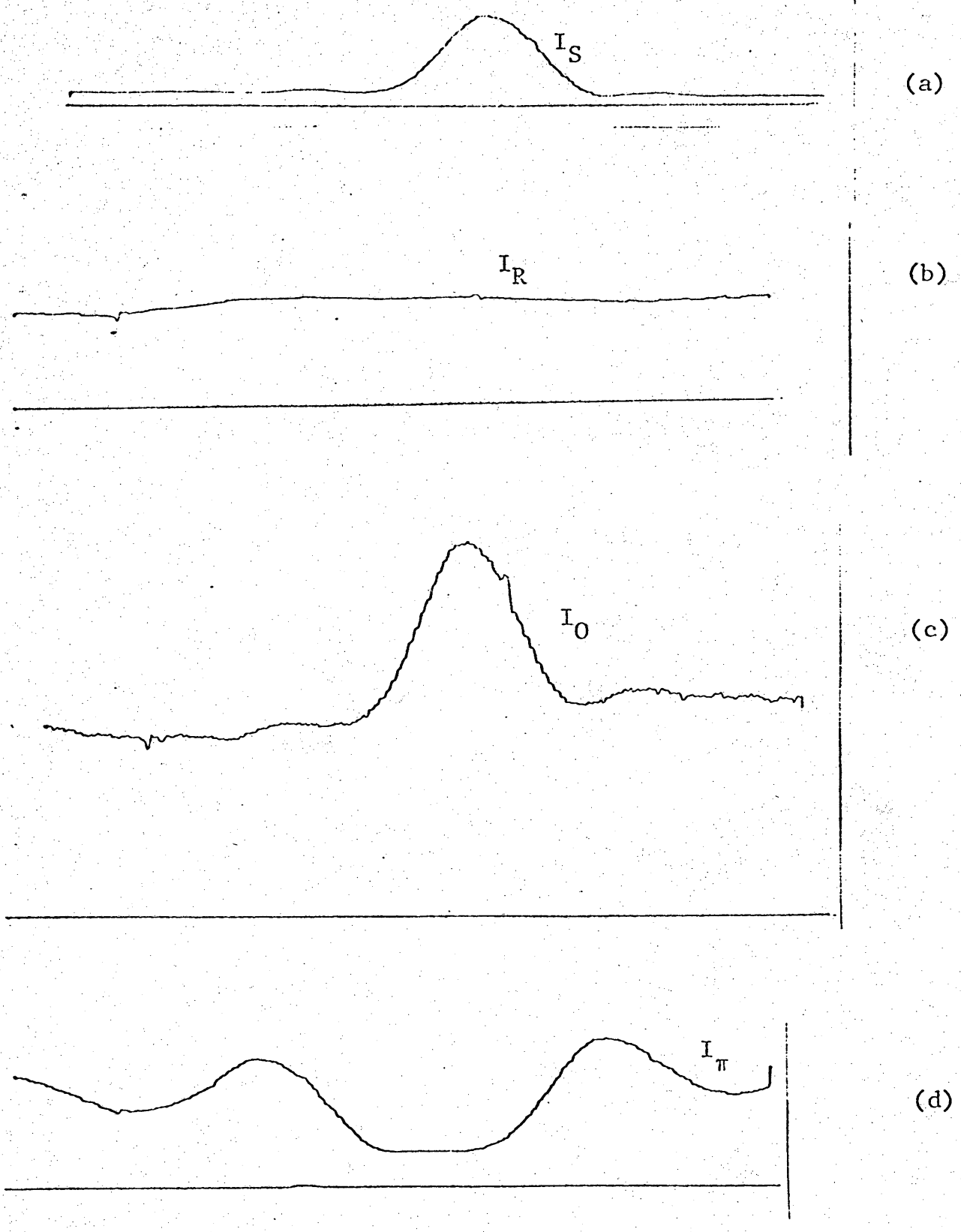


Figure 1

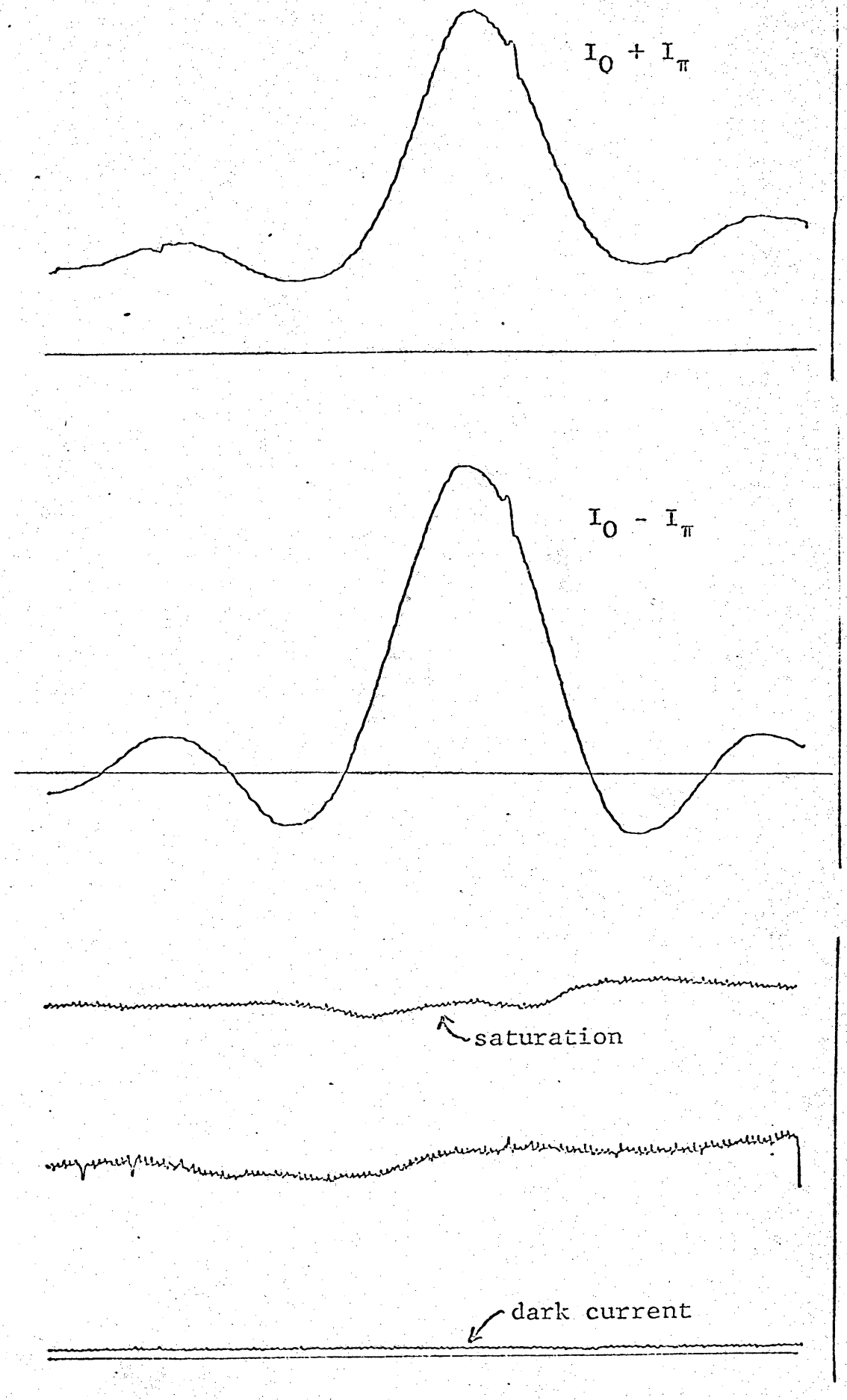


Figure 1

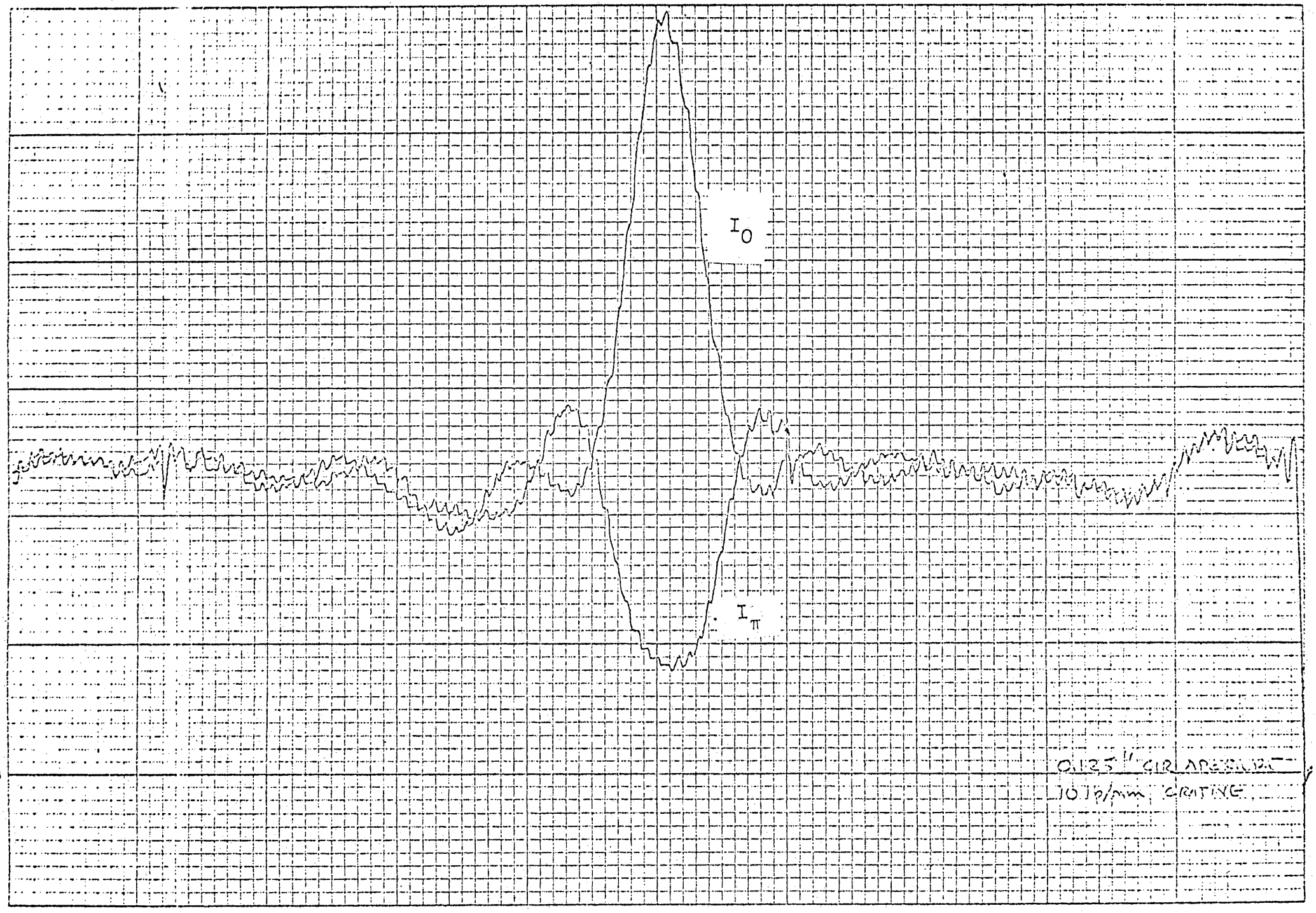
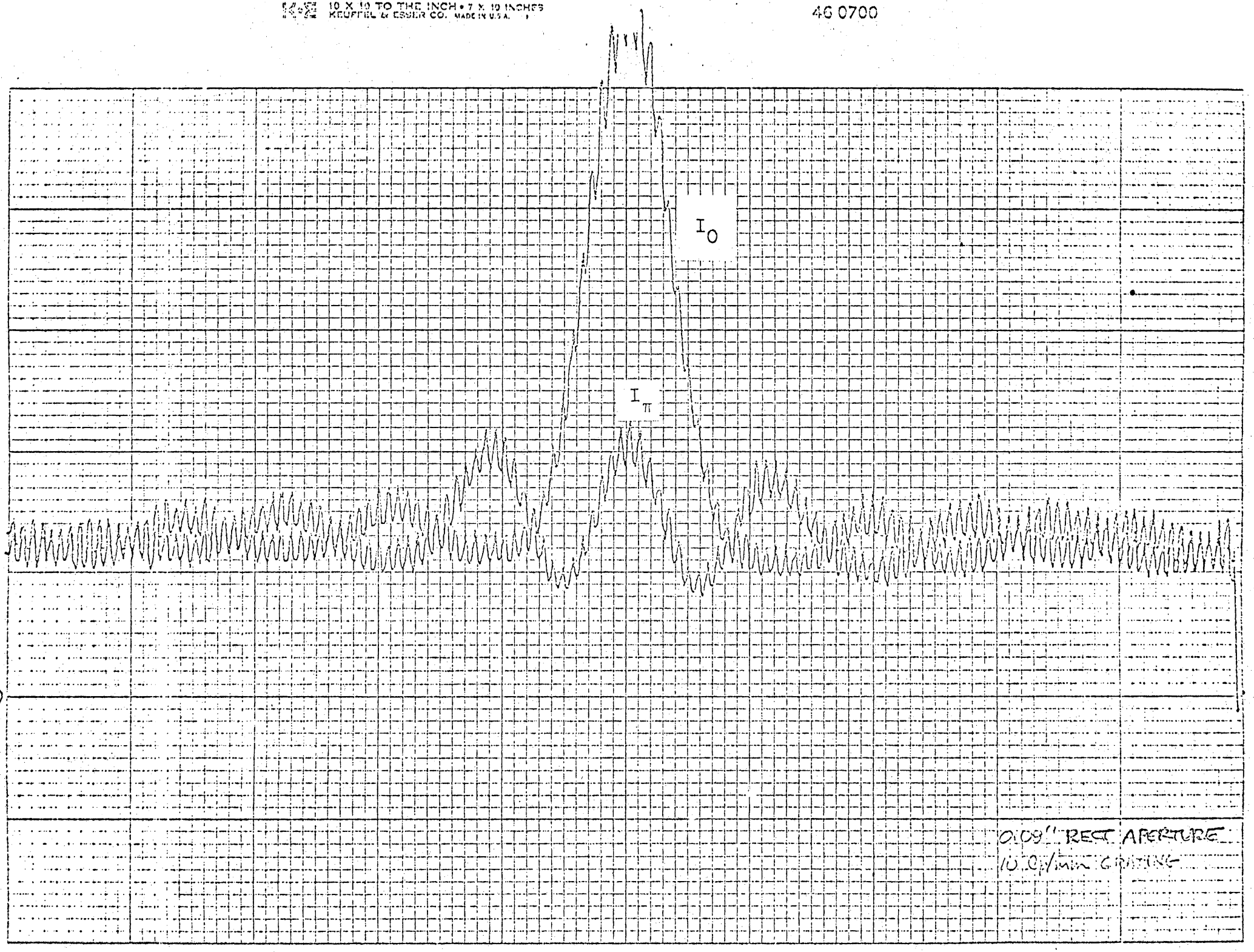


Figure 2a

Figure 21b



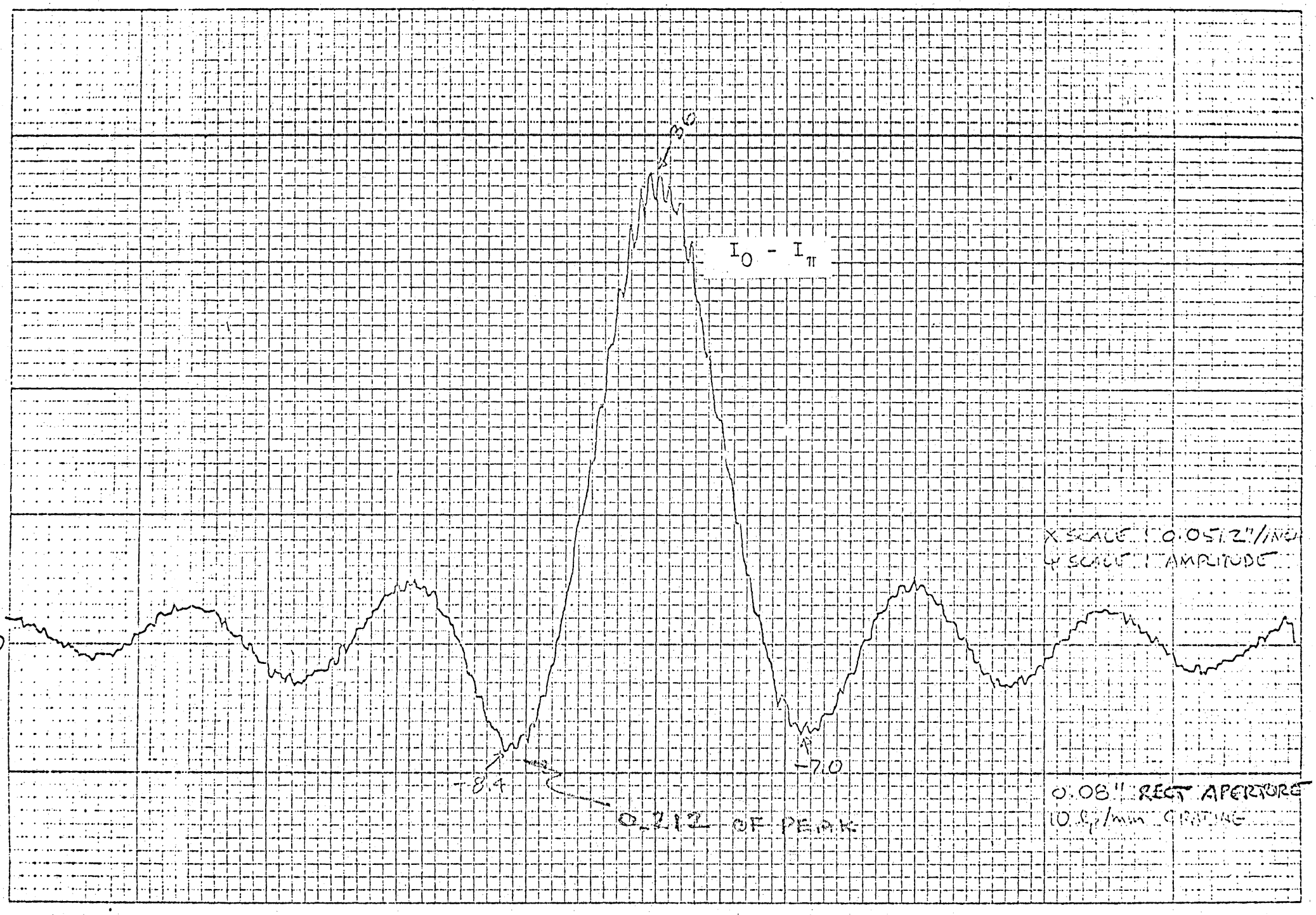
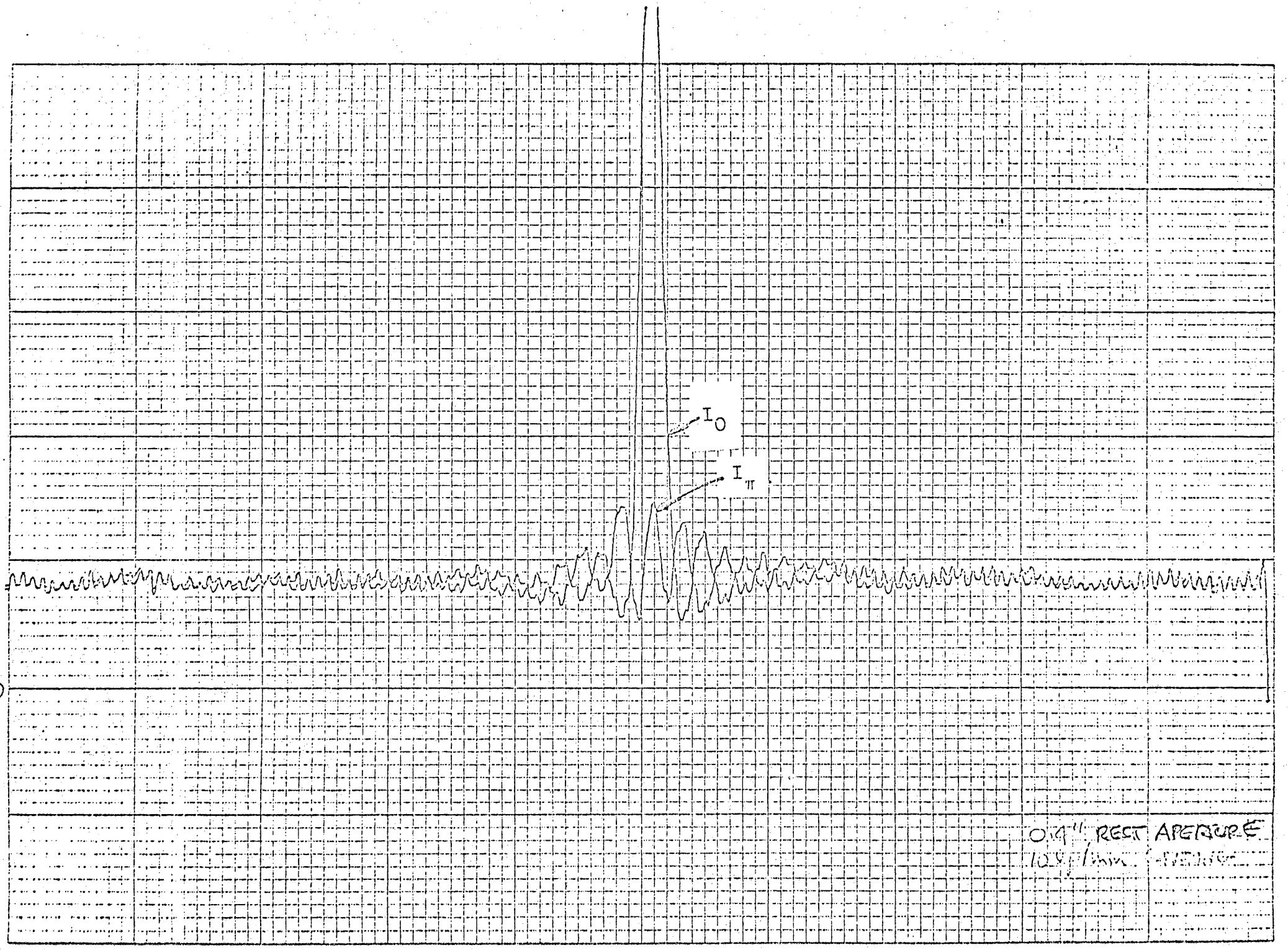


Figure 3b

46 0700



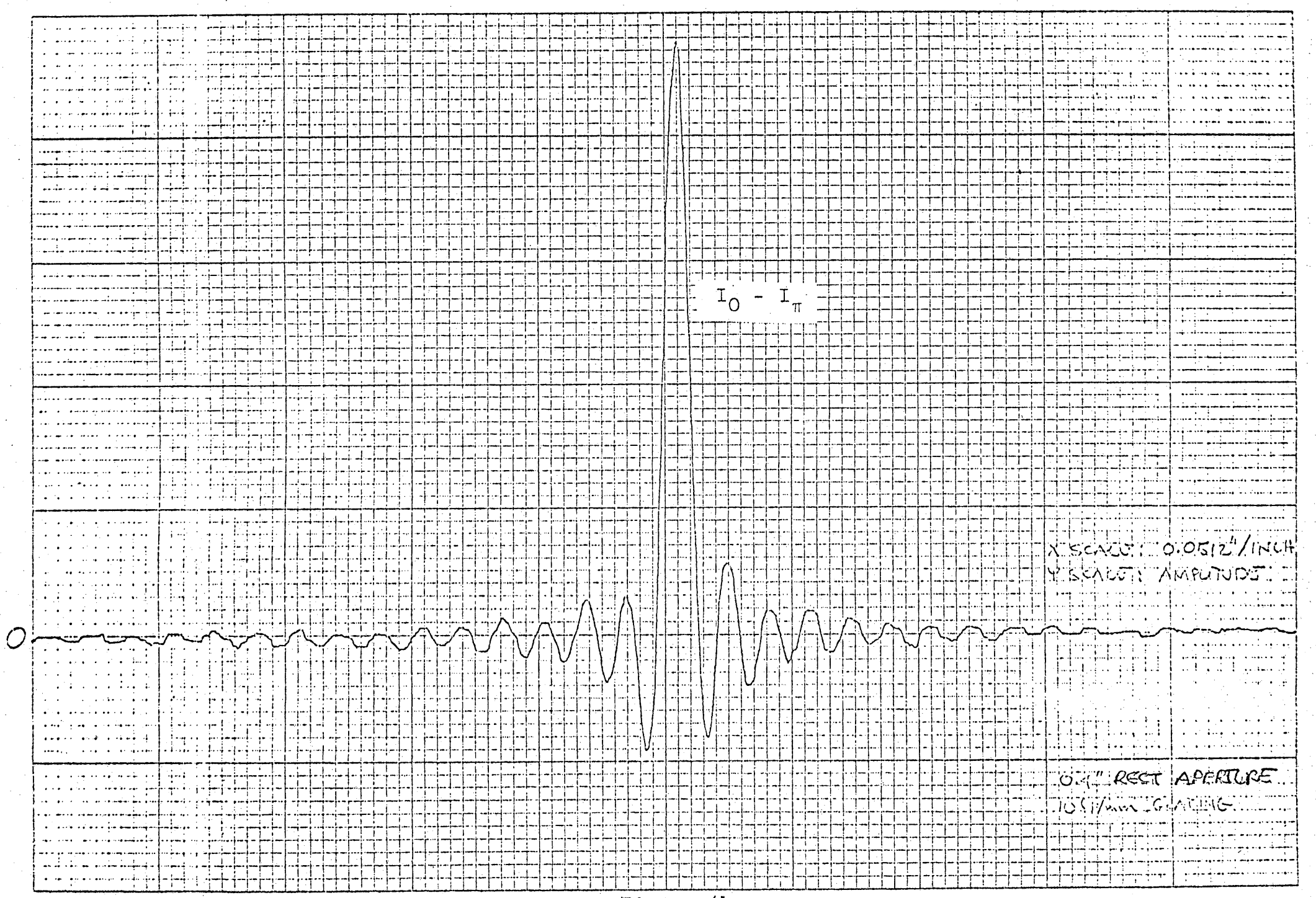
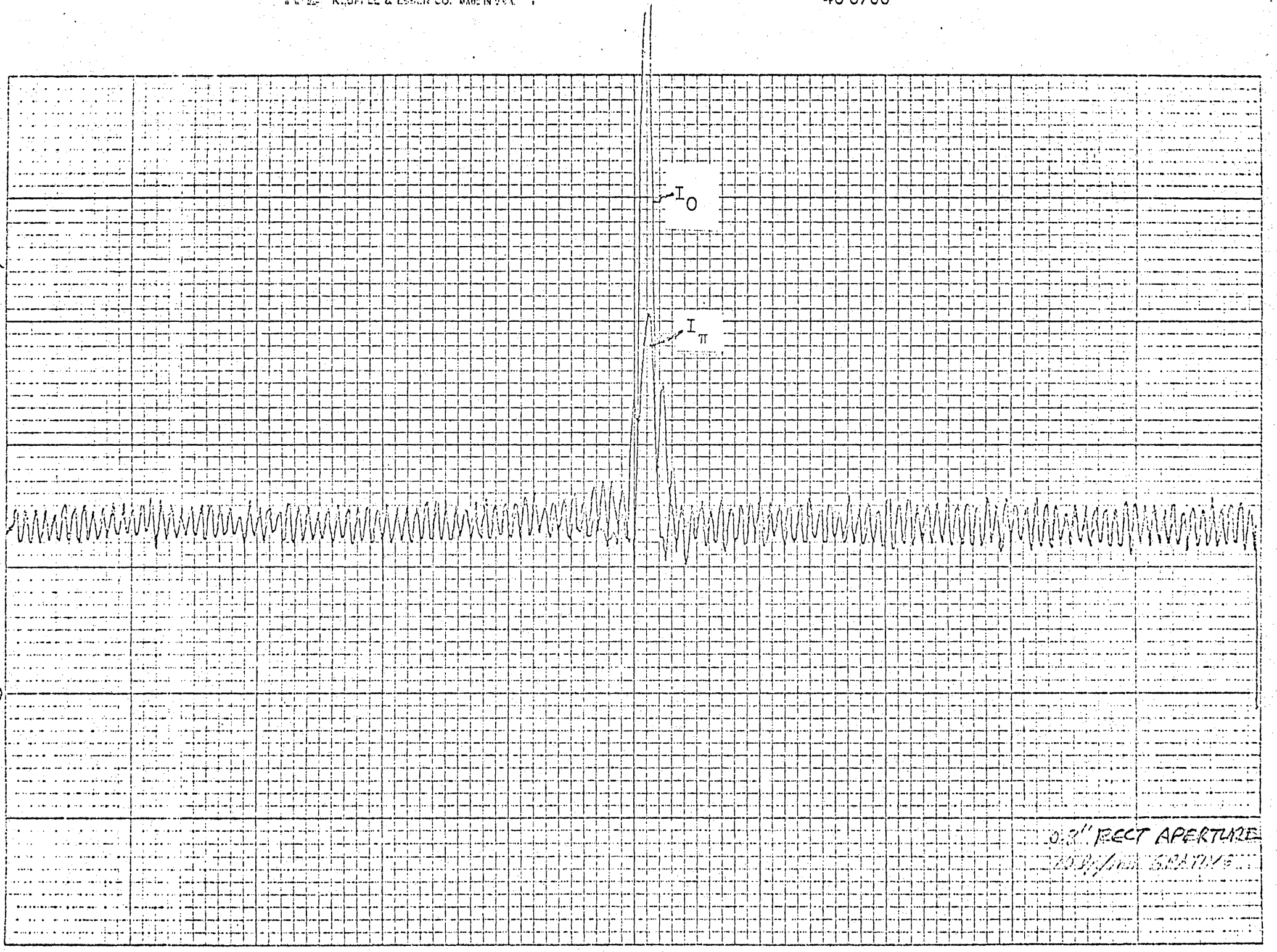


Figure 4b

46 0700



0.2" RECT APERTURE

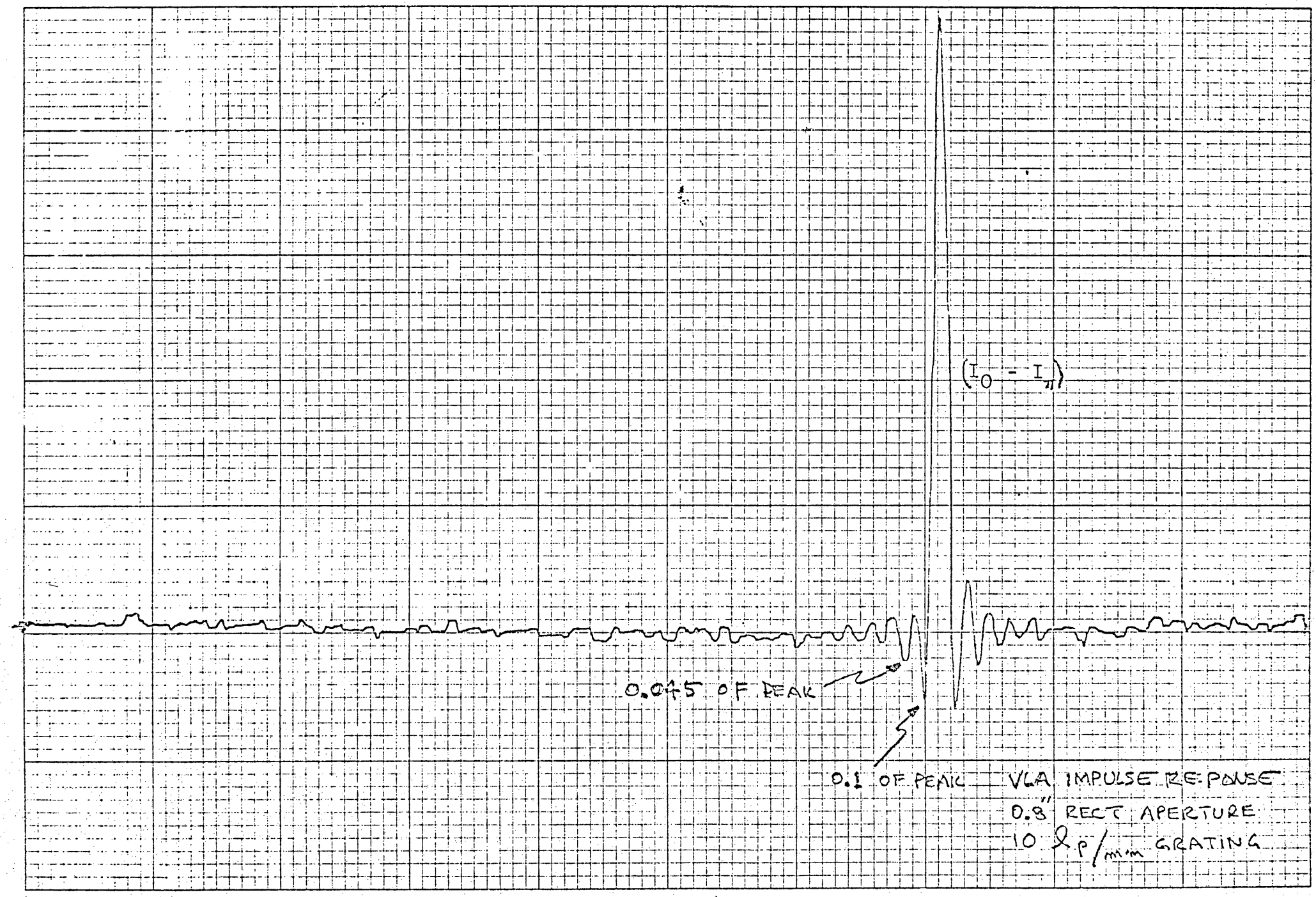
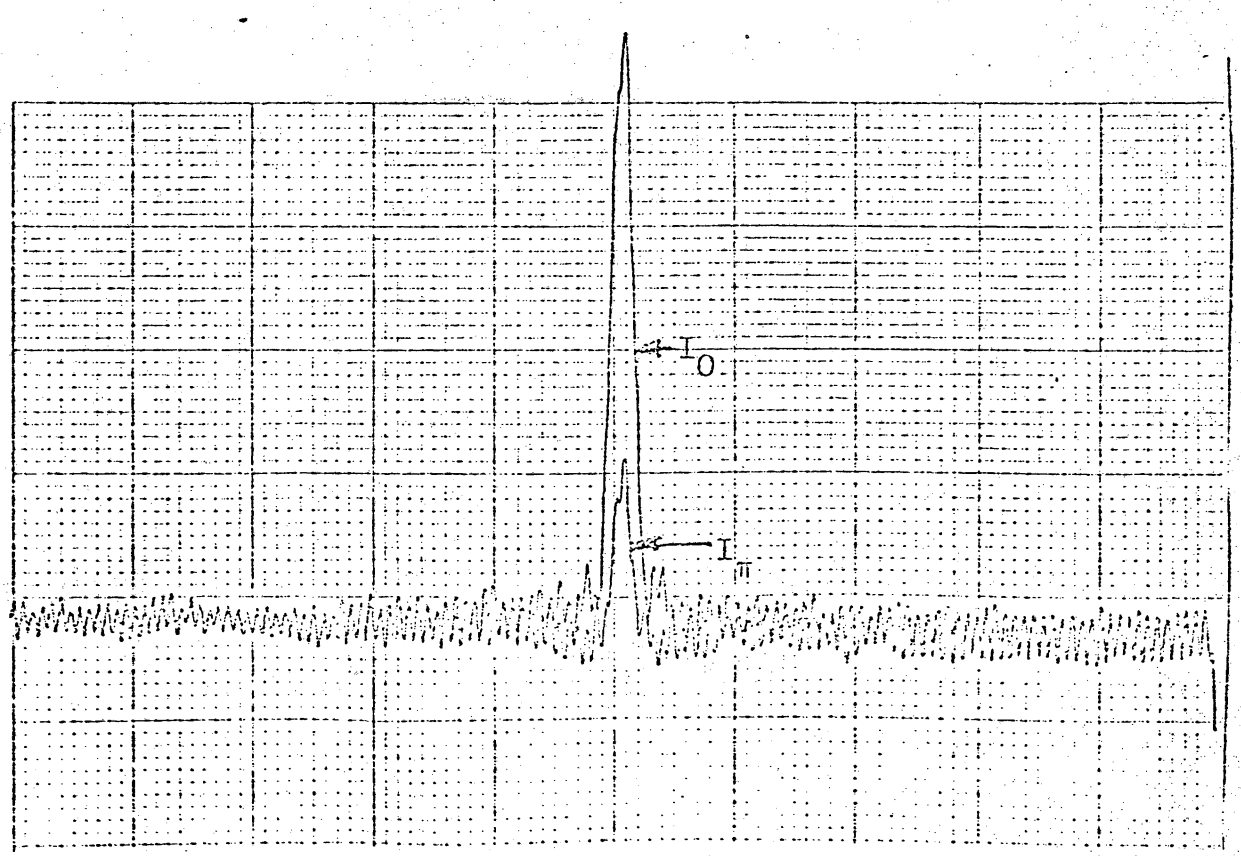
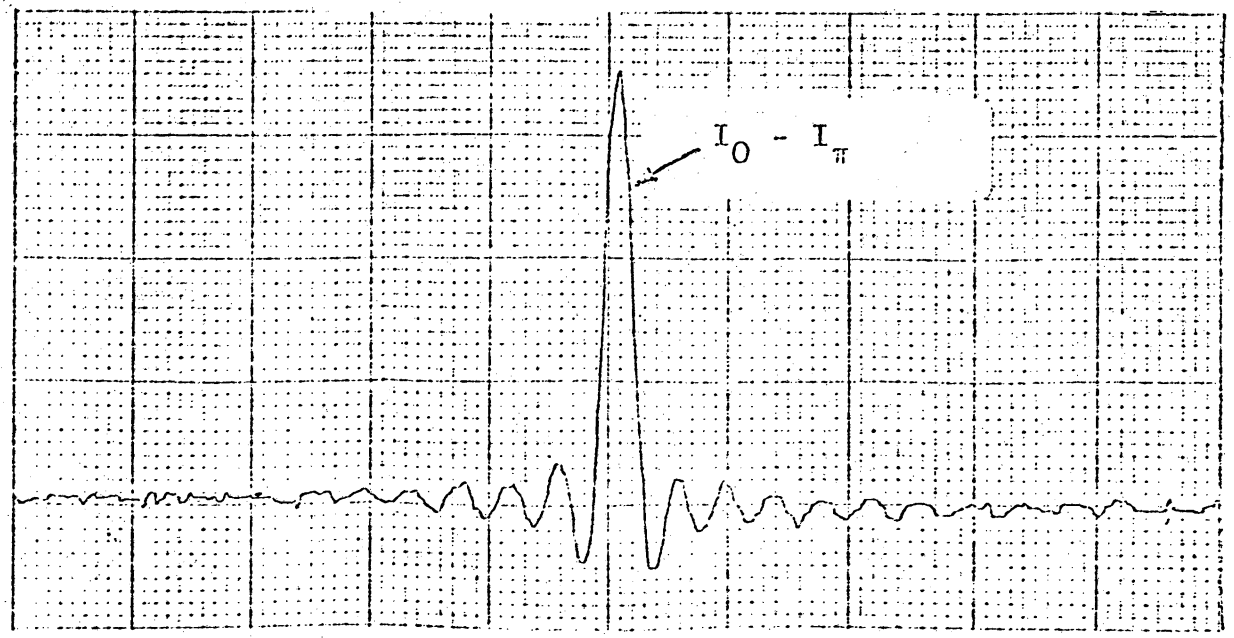


FIGURE 5b

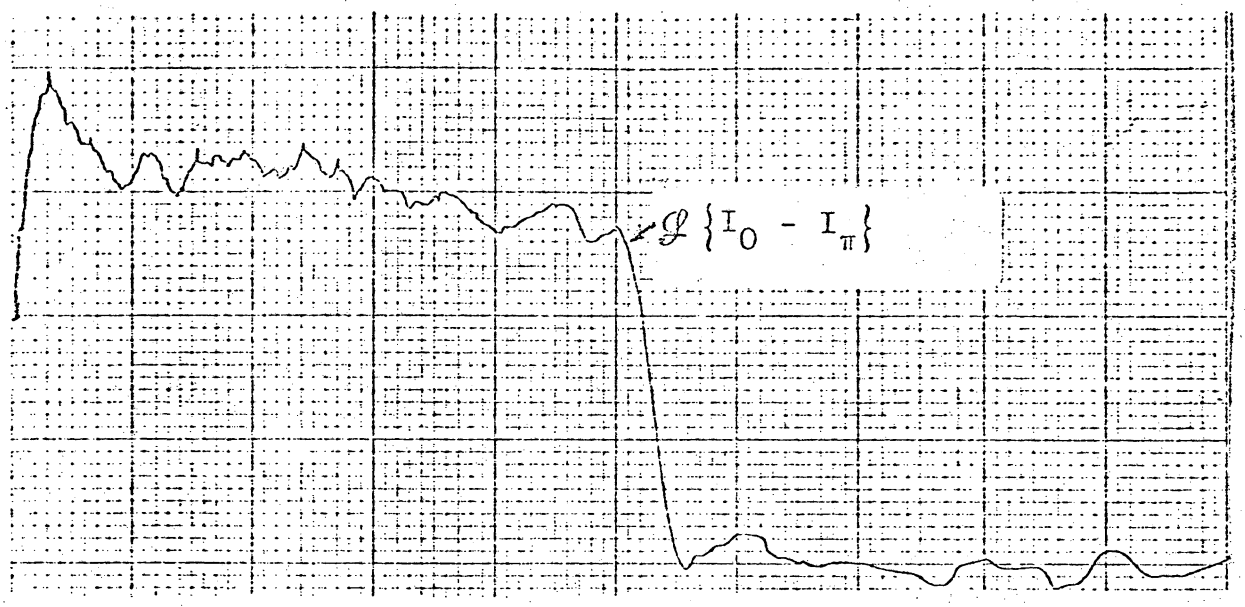


(a)

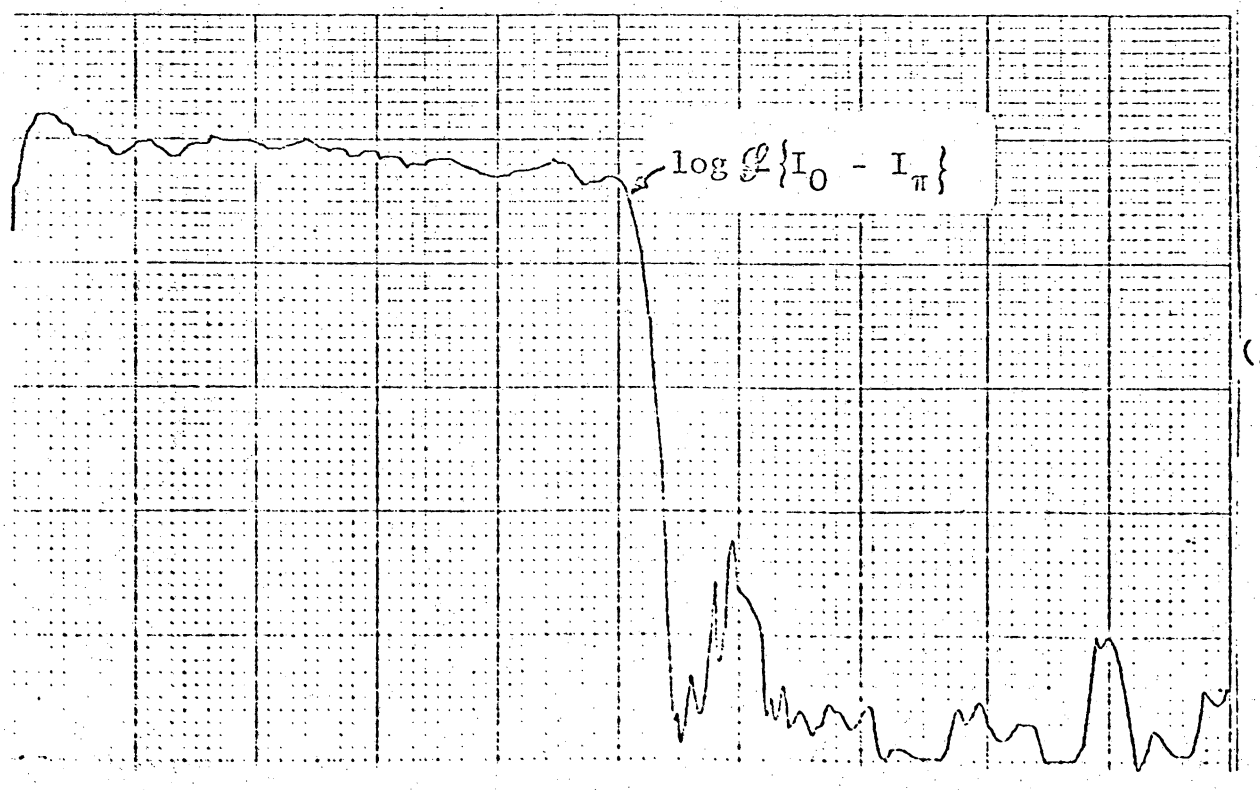
Figure 6



(e)

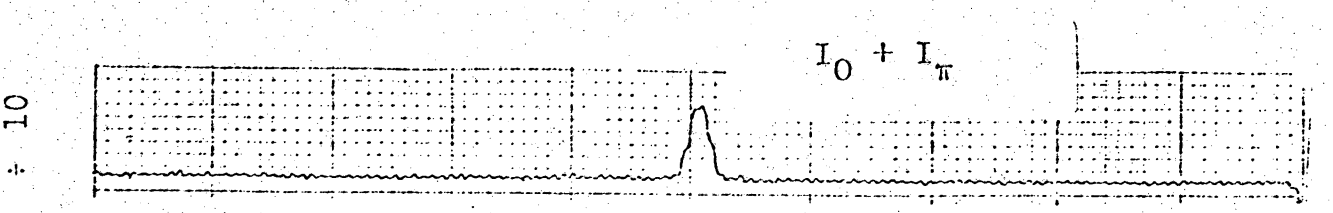


(f)

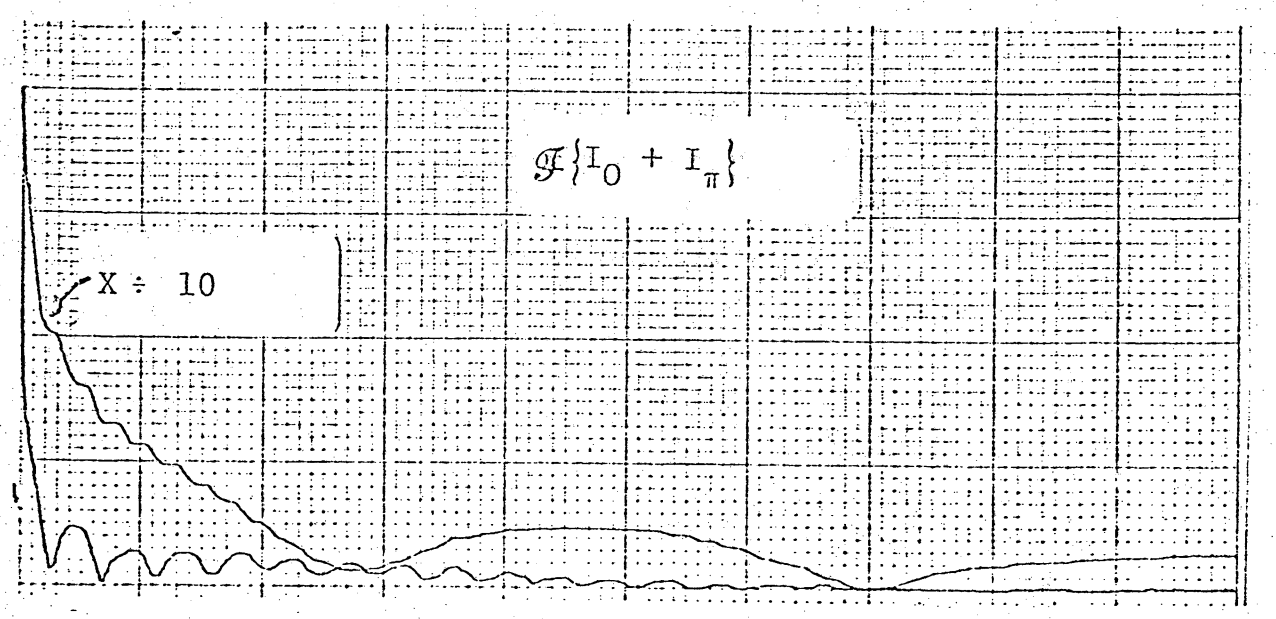


(g)

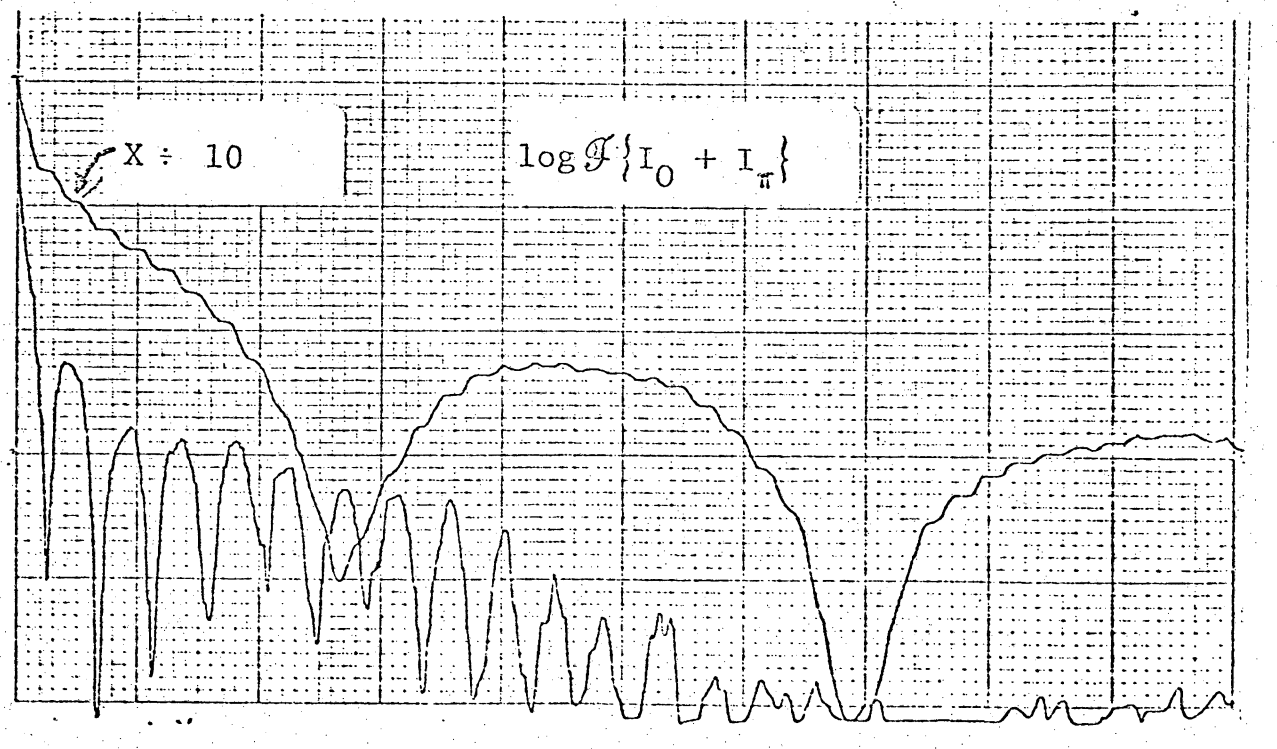
Figure 6



(b)



(c)



(d)