# RADIATION PHYSICS NOTE #10

# MUX TESTS WITH A CHIPMUNK

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October 14, 1976

Radiation Physics Note #8 concerned the chipmunk response to a pulsed radiation field as a function of several detector and field parameters. This note reports on a study of the dose rate reported by MUX compared to the actual dose rate as a function of several parameters.

Current from the chipmunk ion chamber goes into a current digitizer. The digitizer puts out one TTL pulse for each 2.5 μrem of dose. The pulse sets a latch which is read by MUX each 14.4 msec. That means the maximum count rate for no loss to occur is 70 Hz. (Obviously if a second pulse comes before the latch is read out MUX still sees only one pulse and thus data is lost.)

The amount of data which gets lost obviously depends on the rate at which digitizer pulses occur. The pulse rate depends on the instantaneous dose rate, time constant (between the ion chamber and current digitizer) machine cycle time and spill length.

Most of the apparatus used to study these losses is the same as described in Radiation Physics Note #8. The only change is the addition of the circuit in Figure 1. That circuit is used to count digitizer pulses from the chipmunk the same way MUX counts.

We compared the actual digitizer count during a specific time period with the number of counts as determined by "MUX". This comparison was made as a function of dose rate for combinations of parameters shown in Table 1.

With a time constant of 1 sec. significant errors begin to show up when the machine cycle time is as great as 15 sec (Figure 2). However, in the worst case ($\tau = 1$, $c = 20$, $s = 1$) the error is only 30% at 100 mrem/hr (Figure 3). Figures 4 and 5 show that this problem is totally corrected with the 20 second time constant. Figure 6 indicates that even for energy double/saver type duty factors the "MUX performance" is satisfactory.

A word of caution is in order. Sometimes MUX information is used at dose rates higher that 100 mrem/hr. Figure 7 shows that the MUX system saturates at about 600 mrem/hr when the cycle time is ten seconds and the spill is 1 second. We did not measure the saturation curve for other conditions but this is some indication of the maximum dose rate for which the MUX information is reliable.

TABLE 1

Combinations of Parameters Studied

s = spill length (sec)

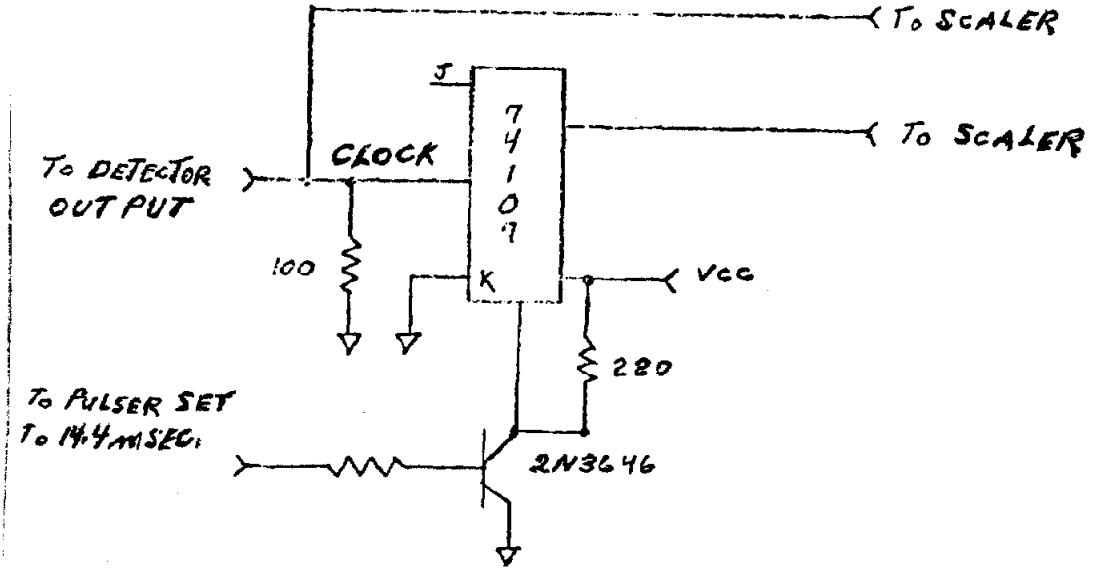
c = cycle time (sec)

$\tau$ = time constant (sec)

| C \ s | 1 | 2 | 10 |
|---|---|---|---|
| 10 | $\tau = 1$<br>$\tau = 20$ | $\tau = 1$<br>$\tau = 20$ | |
| 15 | $\tau = 1$<br>$\tau = 20$ | $\tau = 1$<br>$\tau = 20$ | |
| 20 | $\tau = 1$<br>$\tau = 20$ | $\tau = 1$<br>$\tau = 20$ | |
| 60 | | | $\tau = 20$ |

Figure 1

# MUX-CHIPMUNK TIME CONSTANT TEST CIRCUIT

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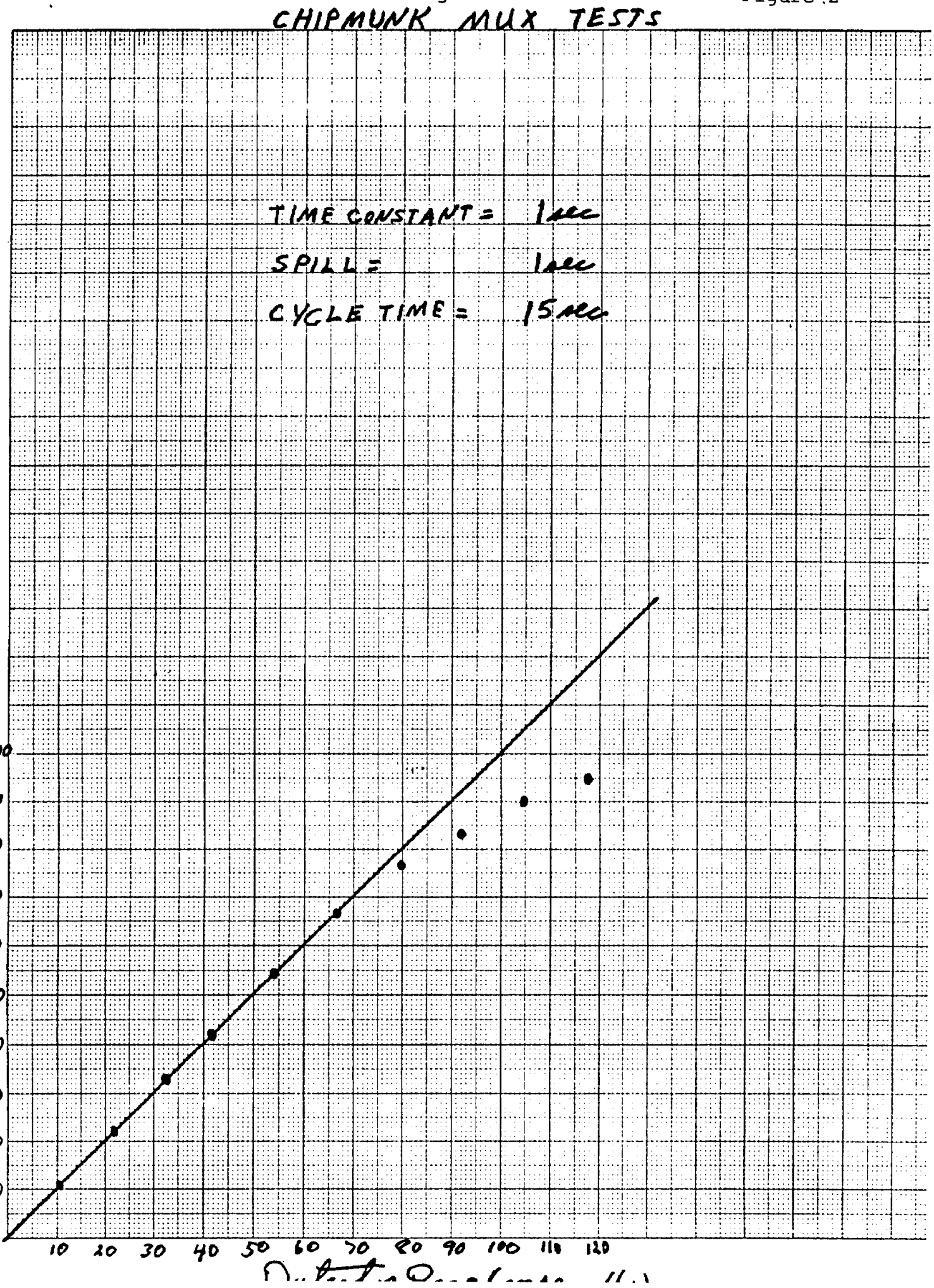
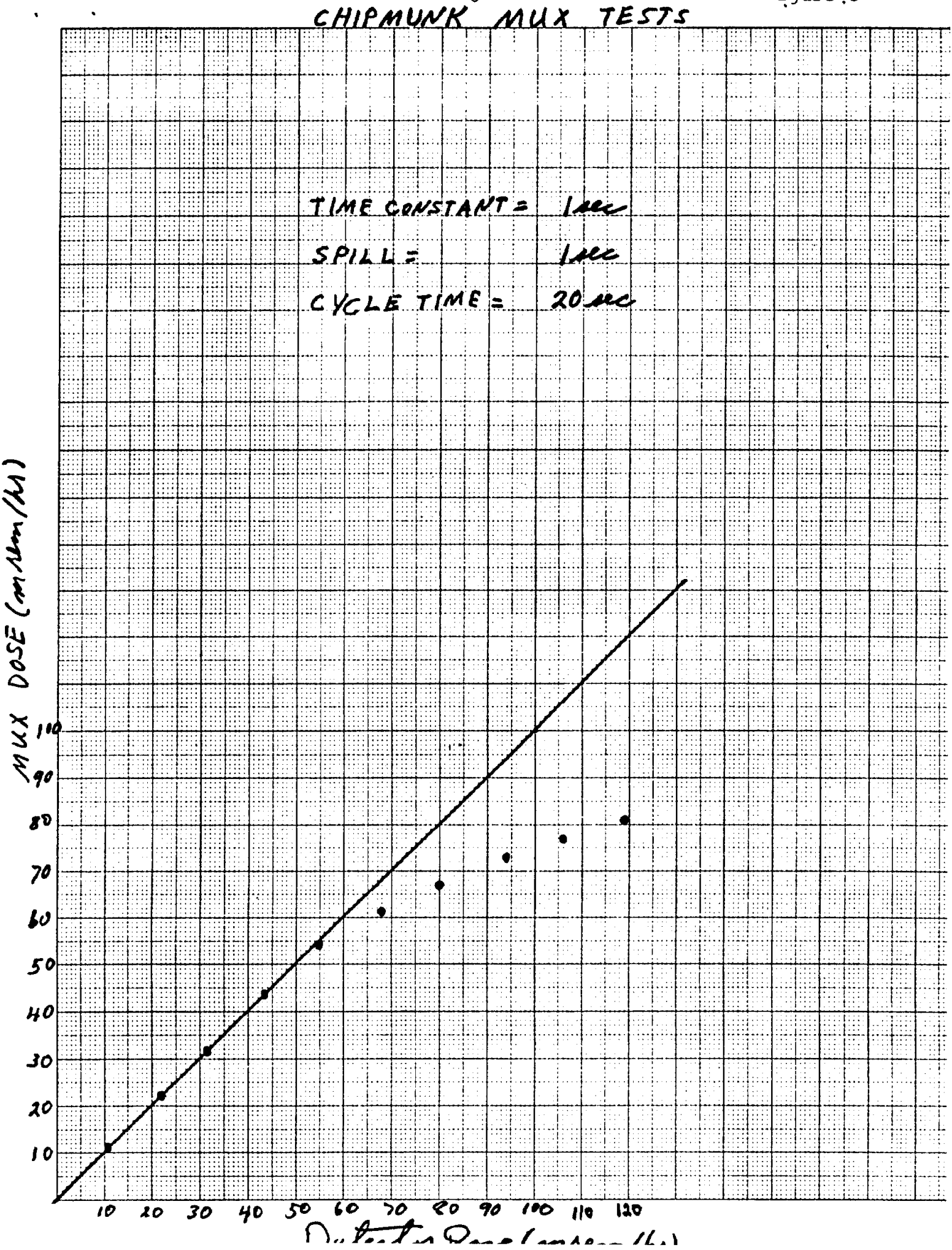
9-17-76

Figure 2



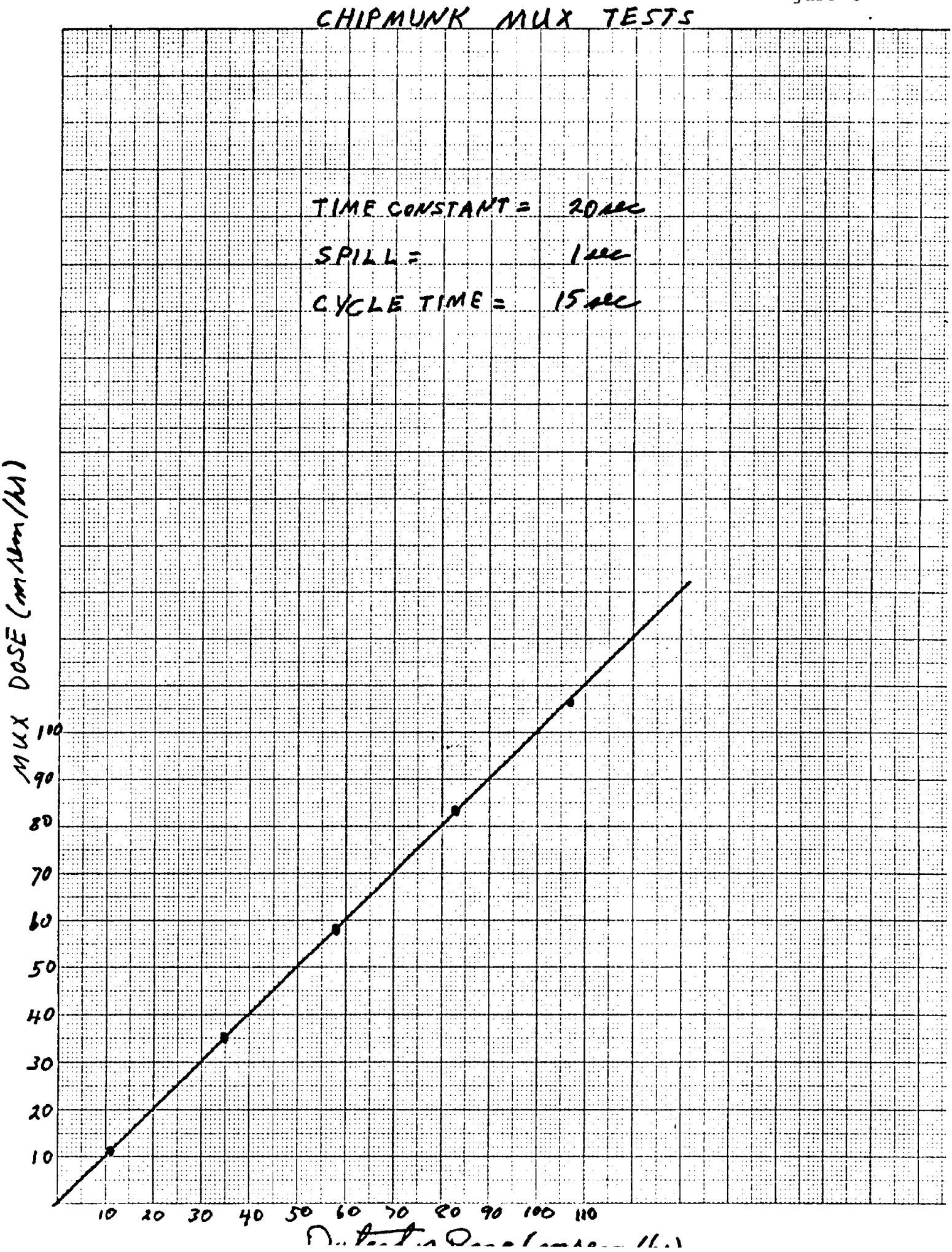

K+E 10 X 10 TO THE CENTIMETER • 25 X 38 CM. KEUFFEL & ESSER CO. MADE IN U.S.A. 47 1510

Figure 3



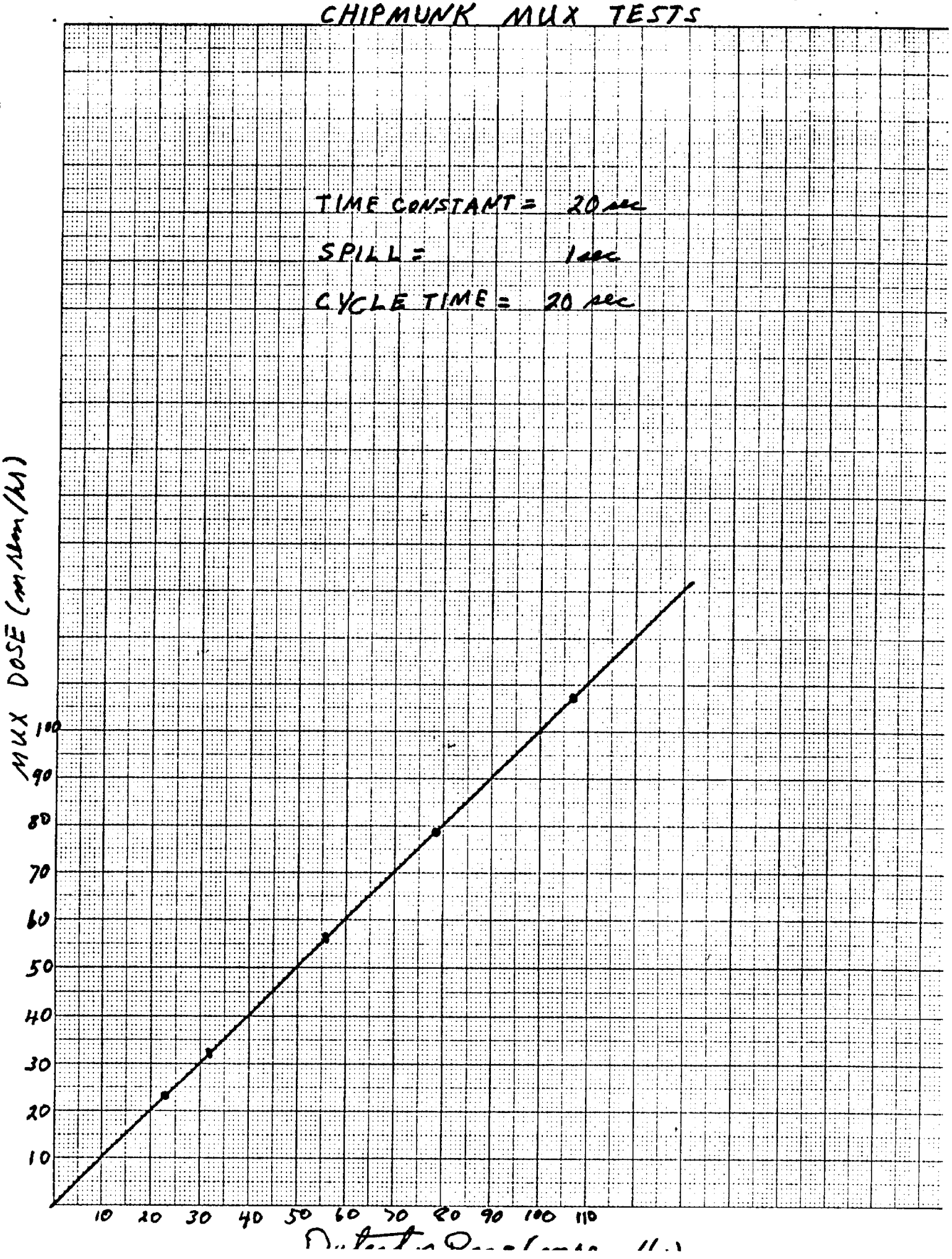

K+E 10 X 10 TO THE CENTIMETER 25 X 38 CM. KEUFFEL & ESSER CO. MADE IN U.S.A. 47 1510

Figure 4



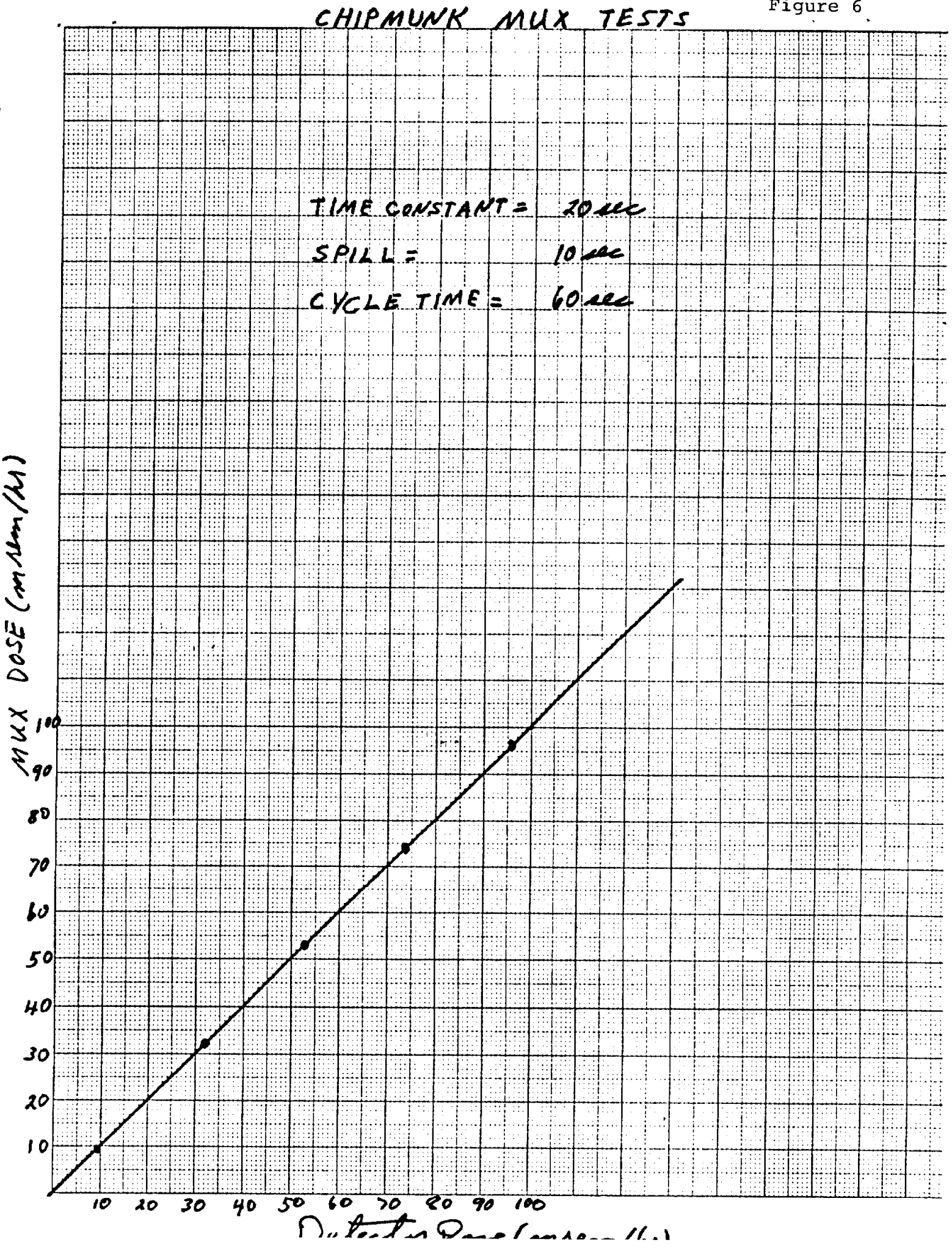

K+E 10 X 10 TO THE CENTIMETER • 25 X 38 CM. KEUFFEL & ESSER CO. MADE IN U.S.A. 47 1510

Figure 5

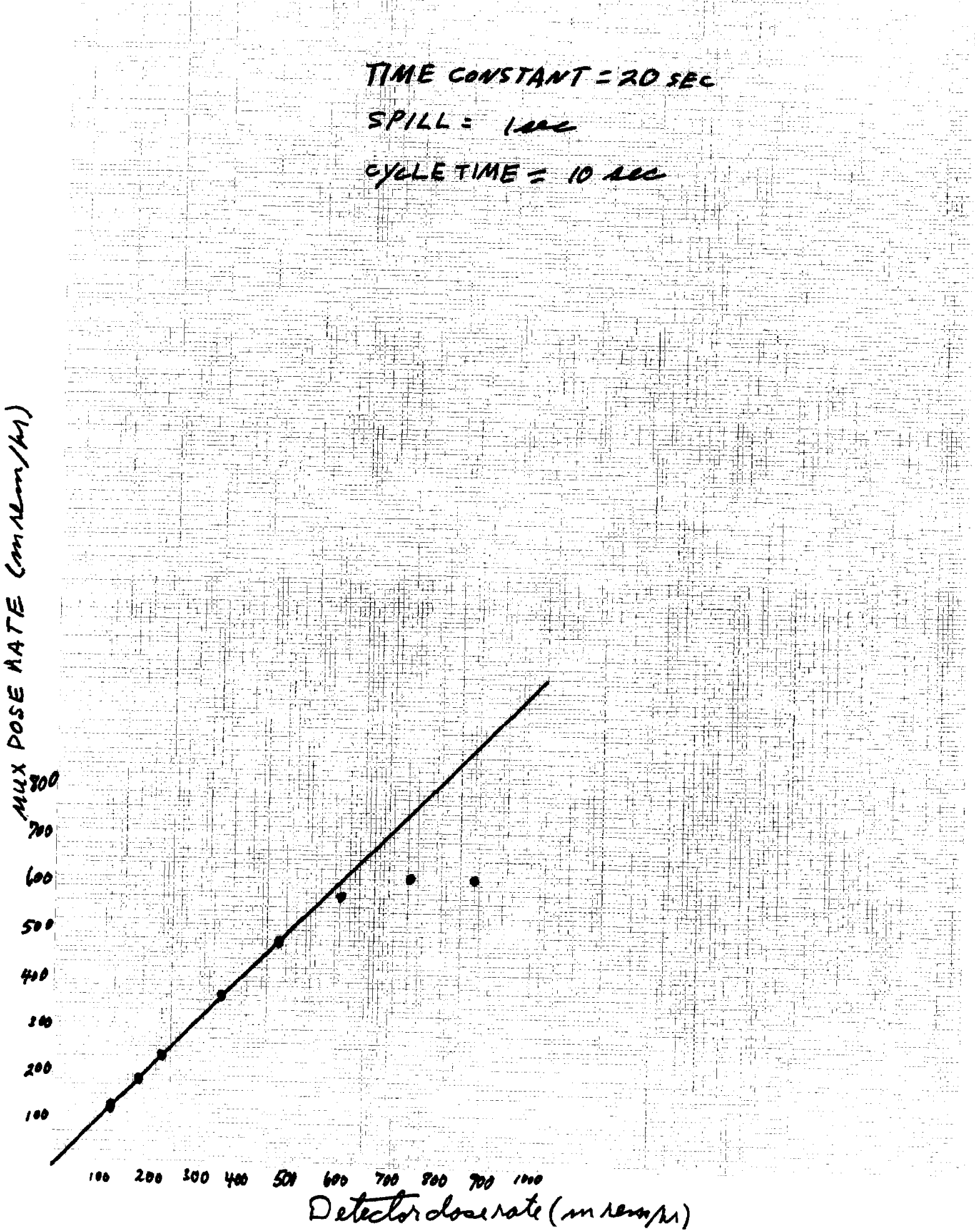



K+E 10 X 10 TO THE CENTIMETER • 25 X 38 CM. KEUFFEL & ESSER CO. MADE IN U.S.A. 47 1510

Figure 6




K+E 10 X 10 TO THE CENTIMETER 25 X 38 CM KEUFFEL & ESSER CO. MADE IN U.S.A. 47 1510

Figure 7

# CHIPMUNK MUX TESTS