

ISR RUNNING-INRun 82 - 5 July 1971Ring 1 - 22 GeV/c - 20 bunches - Working line OLGAInfluence of long transvers field coils in SS517 on beam lifetime and pressure bump

4 pairs of Helmholtz coils have been mounted in SS517, extending over the whole length and giving a radial field of about 30 Gauss in the center of the vacuum chamber when excited at 60 % (36 A) with the power supply of H 517. Radial field magnet H517 was disconnected. Vacuum gauges VG 517.7, VG 333.1 and the positive clearing electrodes 517.1 and 517.9 were connected to recorders.

In straight section 517 pressure bumps have been observed in earlier runs, and it was here that E. Jones performed an experiment during run 74 with solenoids wound onto the vacuum chamber and giving a field of 5 to 10 Gauss along the axis.

Experiment

1. Stack with coils off - Fig. 1.a.
A 5.81 A beam was stacked from 89 pulses. There followed a rapid beam loss to 3.75 A, when the loss rate fell to about 0.2×10^{-3} per minute, interrupted at intervals of 1.5 to 2 minutes by small sudden (step like) beam losses.
2. Stack with coils on to 60 %, giving a radial field of about 30 Gauss. H 453 was put to 13 % to localize orbit distortion to I5: the resulting bump is about 3.4 mm. - Fig. 2.a.

Stacking was interrupted for 15 seconds at 2.2 A, when the scrapers were switched off, and 113 pulses were required to reach the maximum beam current of 5.4 A. Once again, after an initial rapid beam loss, this time to 3.5 A, the loss rate tapered off to the same level as was recorded in the first experiment, with similar discontinuities.

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3. Stack with coils off during stacking. The long coils and H 453 were put on and off three times during the decay of the stacked beam. - Fig. 3.a.

87 pulses were needed to stack a maximum current of 5.36 A. The initial rapid beam loss to 3.6 A was followed by leveling off to a more tolerable decay rate in the same way as the previous two stacks. Switching on and off the coils did not have any effect on the slope of the decay rate, though some extremely small beam losses did occur while the operation was being performed.

During the second stack it was discovered that the high voltage for the kickers for the Q-measurement was not switched off. For the third stack it was switched off and before dumping the stack put on again and fired a few times (H and V) to see if there was any correlation between the sudden beam losses and a possible self-triggering of the Q-meter kicker. No clear evidence was found.

Vacuum pressure and clearing electrode currents

SS517 did not show the same pronounced pressure bump as had been seen during earlier runs - neither did 333.1. Nevertheless, during stacking some pressure increase was noticed. The values recorded and the current measured at the clearing electrodes are given in the following Tables:

Stack	beam current (A)	Pressure (Torr)	
		VG 517.7	VG 333.1
before	---	$1.75 \cdot 10^{-10}$	$2.1 \cdot 10^{-10}$
1	5.8	$2.5 \cdot 10^{-10}$	$9.3 \cdot 10^{-10}$
	3.4	$1.9 \cdot 10^{-10}$	$5.0 \cdot 10^{-10}$
2	5.5	$2.2 \cdot 10^{-10}$	$8.1 \cdot 10^{-10}$
	3.46	$1.9 \cdot 10^{-10}$	$4.6 \cdot 10^{-10}$
3	5.3	$2.3 \cdot 10^{-10}$	$7.9 \cdot 10^{-10}$
	3.35	$1.95 \cdot 10^{-10}$	$4.7 \cdot 10^{-10}$

Stack	beam current (A)	Current at clearing electrodes(A)	
		517.1	517.9
1	3.04	$3.0 \cdot 10^{-9}$	$1.2 \cdot 10^{-8}$
2	3.04	$3.0 \cdot 10^{-9}$	$1.2 \cdot 10^{-8}$
3	3.00	$2.95 \cdot 10^{-9}$	$1.25 \cdot 10^{-8}$

A plot of the pressure at VG 517.7 during the three parts of the experiment is shown in Figs. 1.b, 2.b and 3.b.

Conclusion

There was no measurable influence of the transverse field on beam stacking, decay rate and pressure bump. Apart from the extra number of pulses required to make the second stack, which could have been due to the interruption during the stacking process, all three stacks behaved similarly. The very small beam loss which occurred when switching the transverse field on and off may be due to the fact that the coils and H 453 could not be operated exactly in parallel. None of the stacks were saturating when maximum current was reached.

The pressure bumps seen during earlier runs, with pressure increase from 10^{-10} up to over 10^{-7} Torr were not observed, either in SS517 or SS333, the maximum being by a factor of about 4 in SS333. There is some correlation between the "current spikes" measured at the clearing electrodes and the steplike beam losses. (Fig. 2.c).

A scan made at the end of the third stack shows pronounced beam loss in the centre of the stack (Fig. 4).

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Fig. 1.a.

Stack without coils

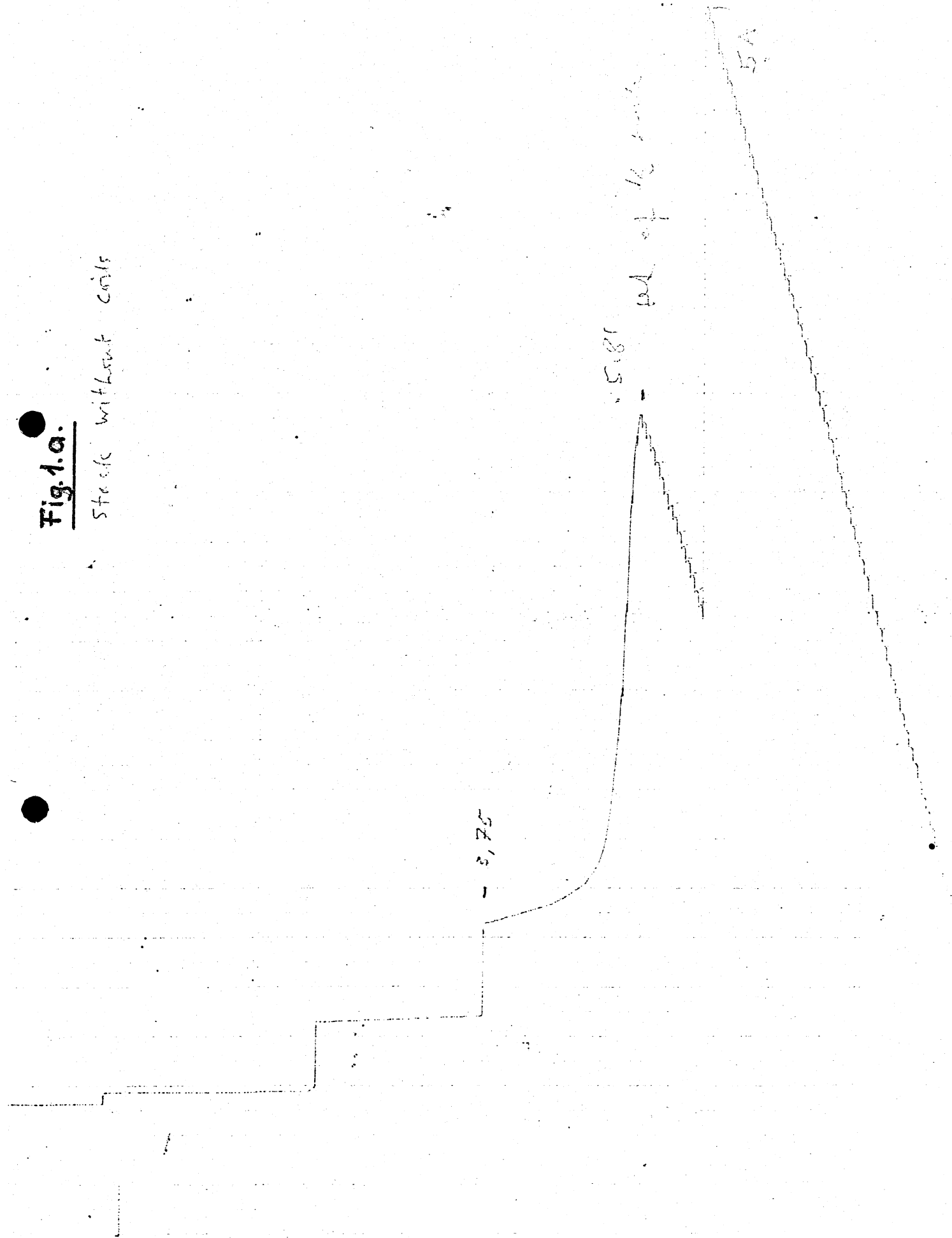


Fig. 2a.

Stacke with crabs

3,114 2150

3,532 A 9,48

5.4

Stacke for 5000

Fig. 3.a.

Coils off during start, but
switched on and off during
decay.

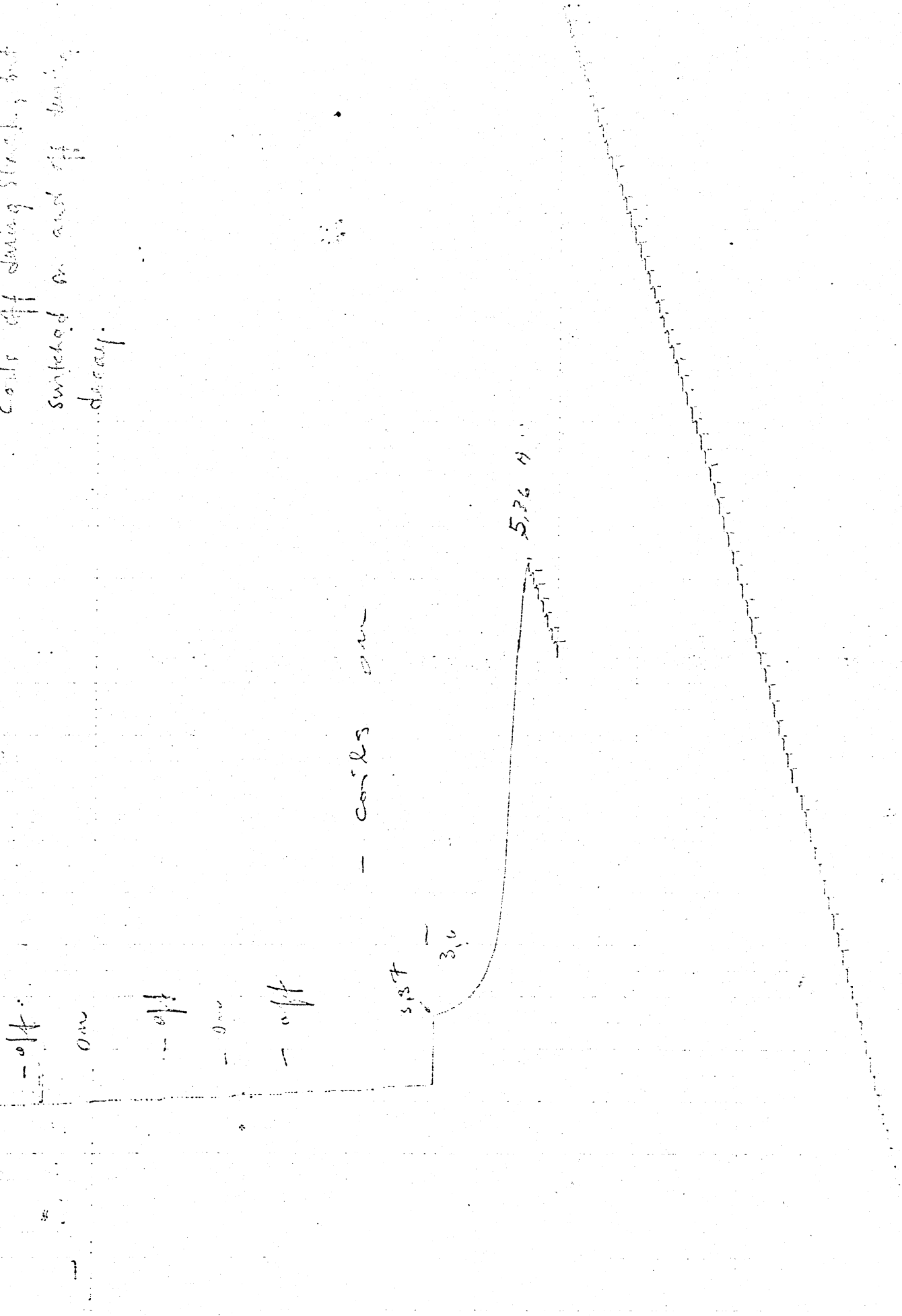


Fig. 1.b.

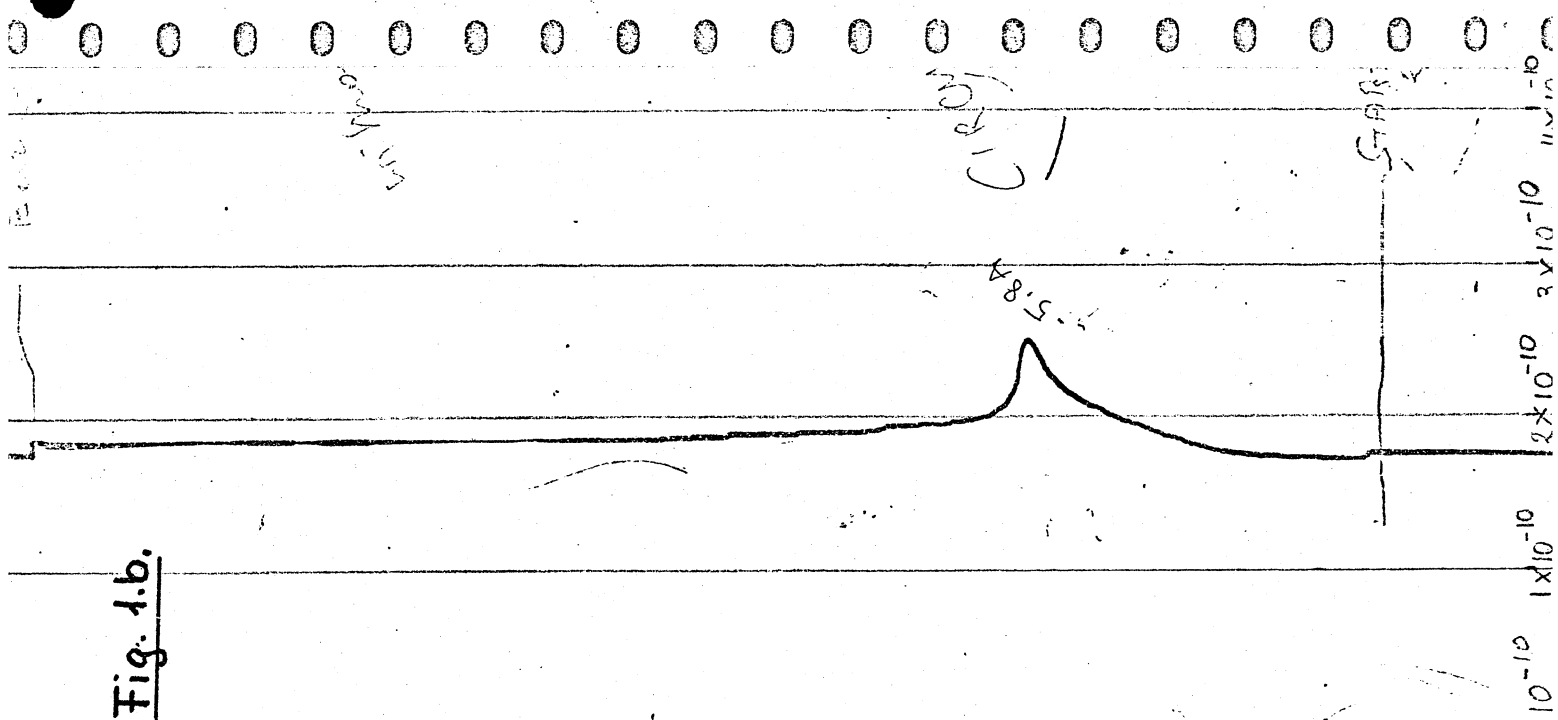


Fig. 2.b.

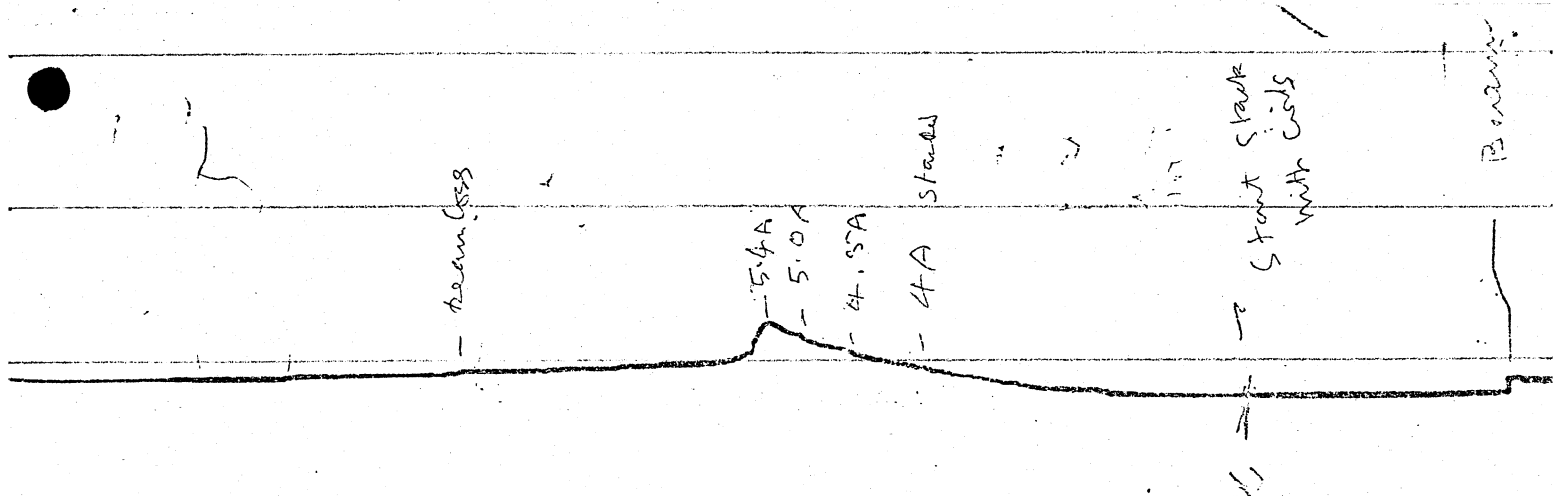
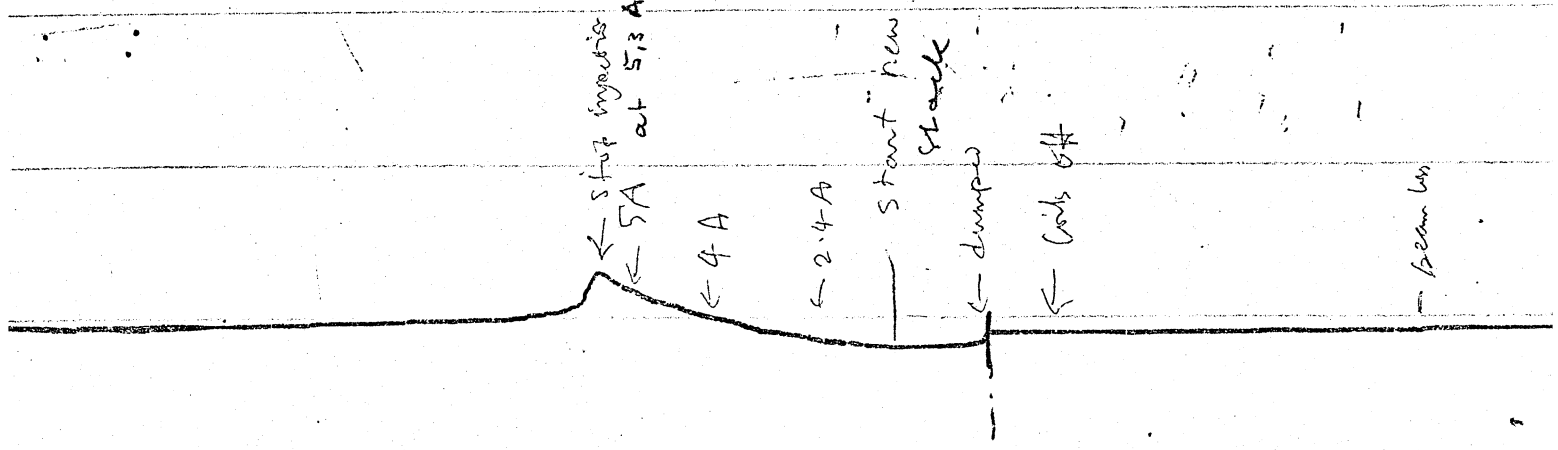


Fig. 3.b



$1.2 \times 10^{-8} \text{ ICE}$

(3.0962 A)

$\leftarrow 1.5 \times 10^{-8} \text{ A ICE}$

$(1 \times 10^{-7} \text{ A}) \text{ FSD.}$

shaking stopped.

$1 \times 10^{-6} \text{ A FSD.}$

(5 A)

(4.5 A)

Fig. 2.c.

strat 2

Cleaning electrode circuit

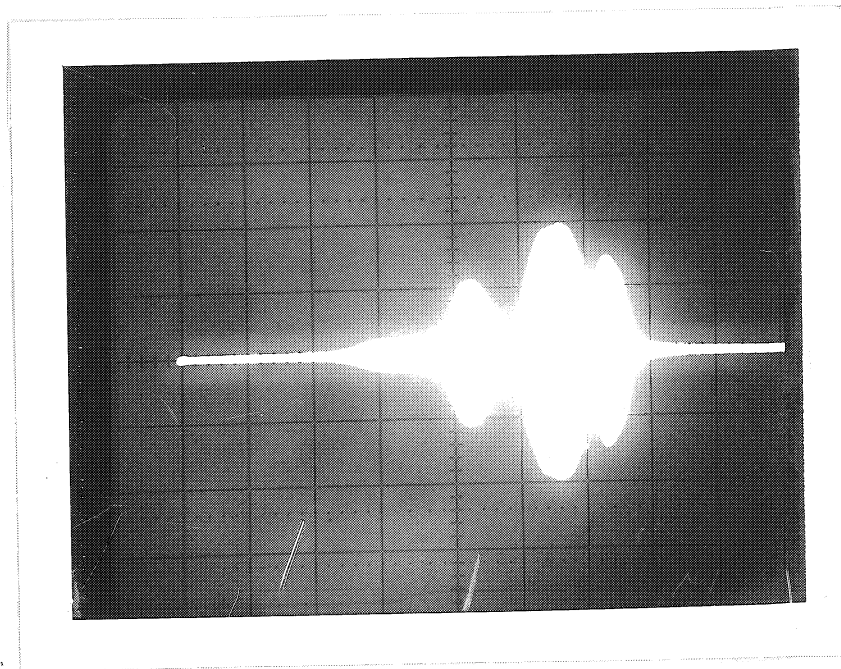


FIG. 4 - SCAN AT THE END OF THE THIRD STACK