FORM T-9
REV. 1-72

PUBLIC SERVICE COMPANY OF OKLAHOMA
FOR INTRA-COMPANY CORRESPONDENCE ONLY

SUBJECT Comanche Power Station Transformers DATE September 28, 1972

TO A. R. Wilson DEPT. OFFICE LOCATION Lawton

FROM John Leach EXT. 323 DEPT. Sub Engr. OFFICE LOCATION Tulsa

Attached are two copies of the Westinghouse Electric Corporation's certified test report on the unit # 1-1 power transformer manufactured on our P.O. #70262-3 and on their G.O. #TL-41926 and S.O. #MCM 0741.

All reported values are better than guaranteed values or within prescribed NEMA Standard variations of same.

Impulse test reports and oscillograms are also attached.

John B. Leach

JBL:pm

cc: MMarchbanks w/att.
CRHarvey w/att.
BLNolen w/att.

REPORT OF TRANSFORMER TESTS
FORM 45N

Westinghouse Electric Corporation

Purchaser Public Service Company of Oklahoma
Date of Test 8-1-72 Purchaser's Order No. 70262-3 G.O. TL-41926 S.O. No. MCM0741
Type FOA Shell Phase Three Cycles 60 Insulating Fluid Oil L. Spec. MCM0741-08 Polarity See I.P.

Winding	H.V.	L.V.	
Kva	90000	90000	
Voltage	138000 Grd. Y	13800	

For polarity, additional tap voltages and connections see Instruction Plate MCM0741-10.

RESISTANCES, EXCITING CURRENT, LOSSES AND IMPEDANCE—Based on normal rating, unless otherwise stated. Losses and regulation are based on wattmeter measurements. For three-phase transformers the resistances are the sum of the three phases in series.

SERIAL NO.	RESISTANCE IN OHMS AT 75°C WINDINGS H.V.	L.V.		% EXCITE CURRENT AT 100% RATED VOLTAGE	NO LOAD LOSS WATTS AT 100% RATED VOLTAGE	138 Kv TO 13.8 Kv 90000 Kva LOAD LOSS WATTS 75°C	% IMP 75°C	___ Kv TO ___ Kv ___ Kva LOAD LOSS WATTS 75°C	% IMP 75°C	___ Kv TO ___ Kv ___ Kva LOAD LOSS WATTS 75°C	% IMP 75°C
7001867	.8790	.0273		.71	72003	325931	14.01				
						TOTAL LOSS	% IMP. 75°C	TOTAL LOSS	% IMP. 75°C	TOTAL LOSS	% IMP. 75°C
AVERAGE				.71	72003	397934	14.01				
GUARANTEE				.91	74500	408500	14.00				

138 KV TO 13.8 KV REGULATION AT 75°C @ 90000 KVA

	100% PF	% PF	80% PF	% PF
AVERAGE	1.34		9.30	
GUARANTEE	1.47		9.45	

TEMPERATURE RISES—Average rise in degrees C., corrected to instant of shutdown, of transformer.
Serial No. 7001867 with windings connected and loaded as follows:
H.V. Winding 134.550 Kv 386 Amp.; L.V. Winding 13.800 Kv 3765 Amp.;
___ Winding ___ Kv ___ Amp. until constant temperature rise was reached.

Load Constant	RISE OF WINDINGS BY RESISTANCE H.V.	L.V.		GUARANTEE	TOP FLUID RISE	AMBIENT TEMP. INGOING WATER	~~TOTAL~~ OR ROOM	WATER RISE	GALLONS PER. MIN.	POUNDS PRESSURE
100%	45.7	48.7		55	38.0		25.0			

INSULATION TESTS	WINDING	VOLT RATING	TEST VOLTAGE APPLIED IN Kv	DURATION OF TEST IN SECONDS
APPLIED POTENTIAL TESTS (Voltage applied between each winding and all other windings connected to core and ground.)	H.V.	138000	34	60
	L.V.	13800		
	Wiring, Fans & Pumps		1.5	60

INDUCED POTENTIAL TEST: -- times rated voltage across full winding; 230 Kv from 134.550 Kv
Line terminal to ground; at 180 cycles per second for 7200 cycles.

REMARKS

See separate report for results of ASA Impulse and NEMA Steep Front tests.

This transformer was subjected to and successfully passed Westinghouse Quality Control Corona tests.

I hereby certify that this is a true report based on factory tests made in accordance with the latest Transformer Test Code C57 of the American Standards Association; and that each transformer withstood the above insulation tests.

Signed R. S. Fanning Date August 4, 1972 Approved

REPORT OF TESTS
FORM 9401G

Westinghouse

DATE August 4, 1972

PURCHASER Public Service Company of Oklahoma

WESTINGHOUSE GENERAL ORDER NO. TL-41926

APPARATUS Class FOA Shell Form Power Transformer

SHOP ORDER NO. MCM0741

RATING KVA 90000 - 138000 Grd. Y/13800 Volts, 3 Phase, 60 Hertz

Additional Test Data

Exciting Current and No Load Loss @ 110% Rated Voltage

	% Exciting Current	No Load Loss, Watts
Measured	1.70	102621
Guaranteed	3.96	--

Additional Impedance and Load Loss Measurements @ 75°C

Voltage Connection	NLTC Pos.	KVA	% Impedance	No Load Loss, Watts
148350 - 13800	1	90000	14.28	300812
134550 - 13800	5	90000	14.09	334557

Pump and Fan Losses

230 Volts, 3 Phase, 60 Hertz

	T.W.	A.W.
Measured	18800	25284
Guaranteed	20400	--

Ratio Tests

250 Volts Applied on H1H2H3

NLTC Pos.	Measured on X1X2X3		
	Phase A	Phase B	Phase C
1	40.28	40.28	40.28
2	41.16	41.16	41.16
3	42.20	42.20	42.20
4	43.30	43.30	43.30
5	44.33	44.33	44.33

Efficiencies @ 75°C

Load	Full	3/4	1/2	1/4
Measured	99.56	99.62	99.66	99.59
Guaranteed	99.54	99.61	99.65	99.58

THE ABOVE IS A TRUE AND CORRECT RECORD OF DATA OBTAINED FROM TESTS AT THE MUNCIE PLANT OF WESTINGHOUSE ELECTRIC CORPORATION.

SIGNED _____ ENGINEER

REPORT OF TESTS
FORM 94316

Westinghouse

DATE August 4, 1972

PURCHASER Public Service Company of Oklahoma

WESTINGHOUSE GENERAL ORDER NO. TL-41926

APPARATUS Class FOA Shell Form Power Transformer

SHOP ORDER NO. MCM0741

RATING KVA 90000 - 138000 Grd. Y/13800 Volts, 3 Phase, 60 Hertz

Current Transformer Resistance Measurements @ 75°C

	Terminal Block Points	Ohms
H2-L876732	X17-X18	.2218
	K1-K5	.1792
	K1-K3	.1484
	K1-K2	.0804
HO-L834351	W49-W53	.6343
	W49-W52	.4595
	W49-W51	.2476
	W49-W50	.2021
X1-L876780	J1-J5	.3534
	X10-X11	.3613
	J1-J3	.2586
	J1-J2	.0777
X2-L87678	J6-J10	.3357
	X12-X13	.3494
	J6-J8	.2419
	J6-J7	.0615
X3-L87678	J11-J15	.3265
	X15-X16	.3346
	J11-J13	.2347
	J11-J12	.0521

THE ABOVE IS A TRUE AND CORRECT RECORD OF DATA OBTAINED FROM TESTS AT THE MUNCIE PLANT OF WESTINGHOUSE ELECTRIC CORPORATION.

SIGNED _____ ENGINEER

ASA Impulse and NEMA Steep Front Tests
Plus Current Measurements
for
Public Service Company of Oklahoma

KVA - 90000
H - 138000 Grd. Y Volts - 550 BIL
X - 13800 Volts - 110 BIL

Three Phase, 60 Hertz

C.O. 70262-3
G.O. TL-41926
S.O. MCM0741
L-Spec. MCM0741-08
Serial 7001867

Terminal Surged	Wave* Applied	Oscillogram CMU-1039	Defl. In.	Sensitivity KV/In.	Crest KV	Time MS Or KV/MS	Timing Wave**
H1	RWE	21	1.50	247	371	1-1/2x30	5
	RWI	22	Current Measurements				20
	SF	19	1.72	494	849	970	.5
	SF	20	1.67	494	825	970	.5
	CW	23	1.72	370	637	4.8	1
	CW	24	1.72	370	637	4.0	1
	FWE	25	1.50	370	555	1-1/2x30	5
	FWI	26	Current Measurements				20
H2	RWE	27	1.50	247	371	1-1/2x30	5
	RWI	28	Current Measurements				20
	SF	17	1.69	494	825	970	.5
	SF	18	1.72	494	849	970	.5
	CW	29	1.72	370	637	4.7	1
	CW	30	1.72	370	637	4.0	1
	FWE	31	1.50	370	555	1-1/2x30	5
	FWI	32	Current Measurements				20
H3	RWE	33	1.50	247	371	1-1/2x30	5
	RWI	34	Current Measurements				20
	SF	13	1.68	494	829	975	.5
	SF	16	1.67	494	825	970	.5
	CW	35	1.72	370	637	3.7	1
	CW	36	1.72	370	637	3.9	1
	FWE	37	1.50	370	371	1-1/2x30	5
	FWI	38	Current Measurements				20

* RWE - Reduced voltage wave
RWI - Reduced current wave
SF - Steep front waves
CW - Chopped wave
FWE - Full voltage wave
FWI - Full current wave

** Timing Waves (Films 2 and 3)
.5 - 5 MS Sweep at 2000 KC
1 - 10 MS Sweep at 2000 KC
5 - 50 MS Sweep at 200 KC
20 - 200 MS Sweep at 200 KC

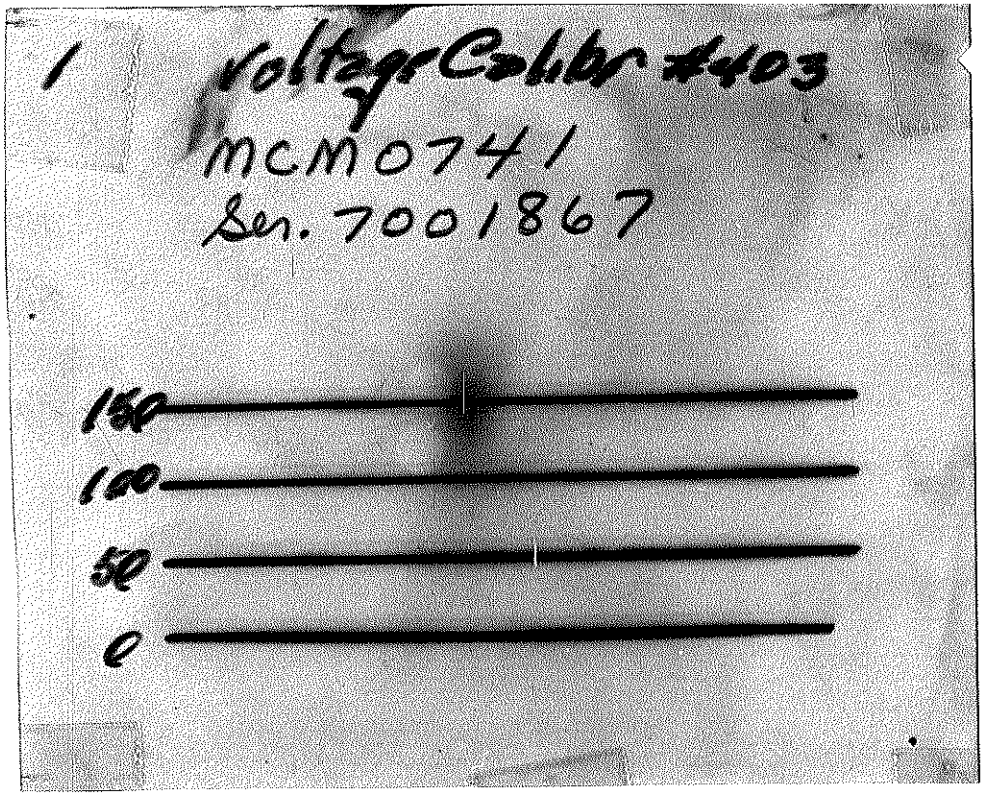
Terminal Surged	Wave* Applied	Oscillogram CMU-1039	Defl. In.	Sensitivity KV/In.	Crest KV	Time MS Or KV/MS	Timing Wave**
X1	RWE	52	1.50	49.6	74.5	2 x 10	5
	RWI	53	Current Measurements				20
	SF	50	1.97	99.1	195	325	.5
	SF	51	2.00	99.1	198	330	.5
	CW	54	1.80	74.3	134	3.4	1
	CW	55	1.80	74.3	134	3.7	1
	FWE	56	1.51	74.3	112	2 x 10	5
	FWI	57	Current Measurements				20
X2	RWE	58	1.50	49.6	74.5	2 x 10	5
	FWI	59	Current Measurements				20
	SF	47	2.02	99.1	200	333	.5
	SF	48	2.02	99.1	200	333	.5
	CW	60	1.78	74.3	132	3.4	1
	CW	61	1.78	74.3	132	3.2	1
	FWE	62	1.50	74.3	111.5	2 x 10	5
	FWI	63	Current Measurements				20
X3	RWE	64	1.50	49.6	74.5	2 x 10	5
	RWI	65	Current Measurements				20
	SF	45	2.02	99.1	200	333	.5
	SF	46	2.02	99.1	200	333	.5
	CW	66	1.77	74.3	131.5	3.3	1
	CW	67	1.77	74.3	131.5	3.1	1
	FWE	68	1.49	74.3	111	2 x 10	5
	FWI	69	Current Measurements				20
Ho	RWE	71	1.58	49.6	78.4	3 x 38	5
	RWI	72	Current Measurements				20
	FWE	73	1.58	74.3	117.4	3 x 38	5
	FWI	74	Current Measurements				20
	FWE	75	1.60	74.3	118	3 x 38	5
	FWI	76	Current Measurements				20

This transformer successfully passed the impulse tests which were applied in accordance with ASA and NEMA specifications. Copies of the oscillograms used are attached.

R. S. Farmer
Fellow Engineer

Attachments

/jf


1 VoltageCalibr #403
MCM0741
Ser. 7001867
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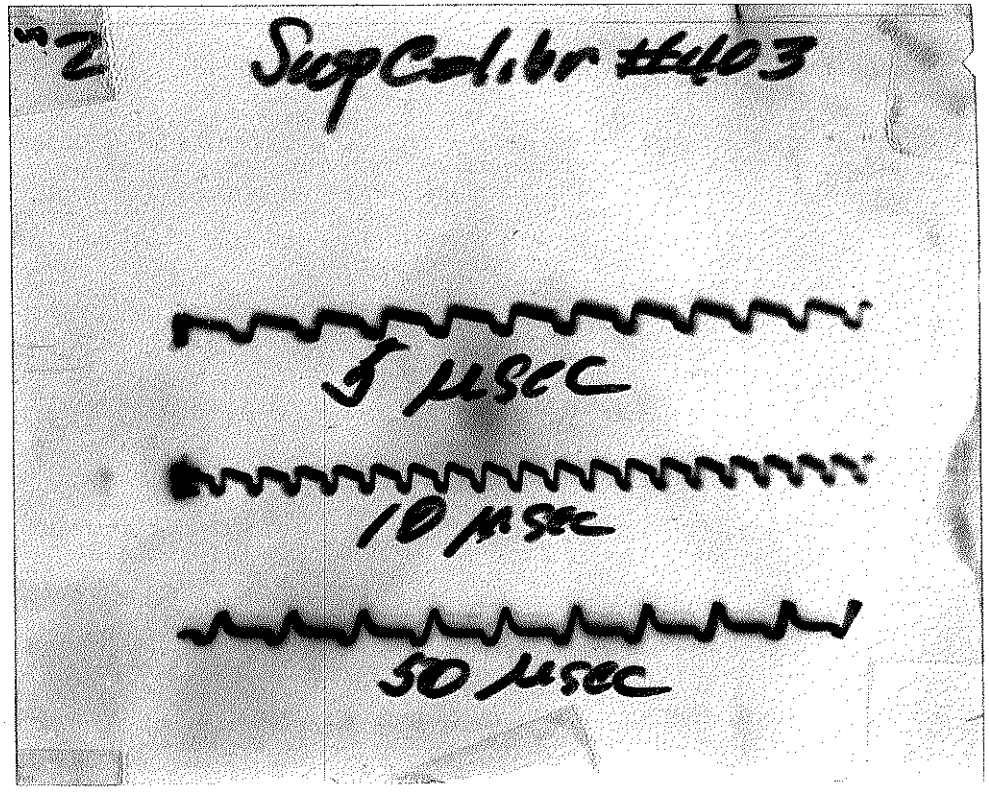
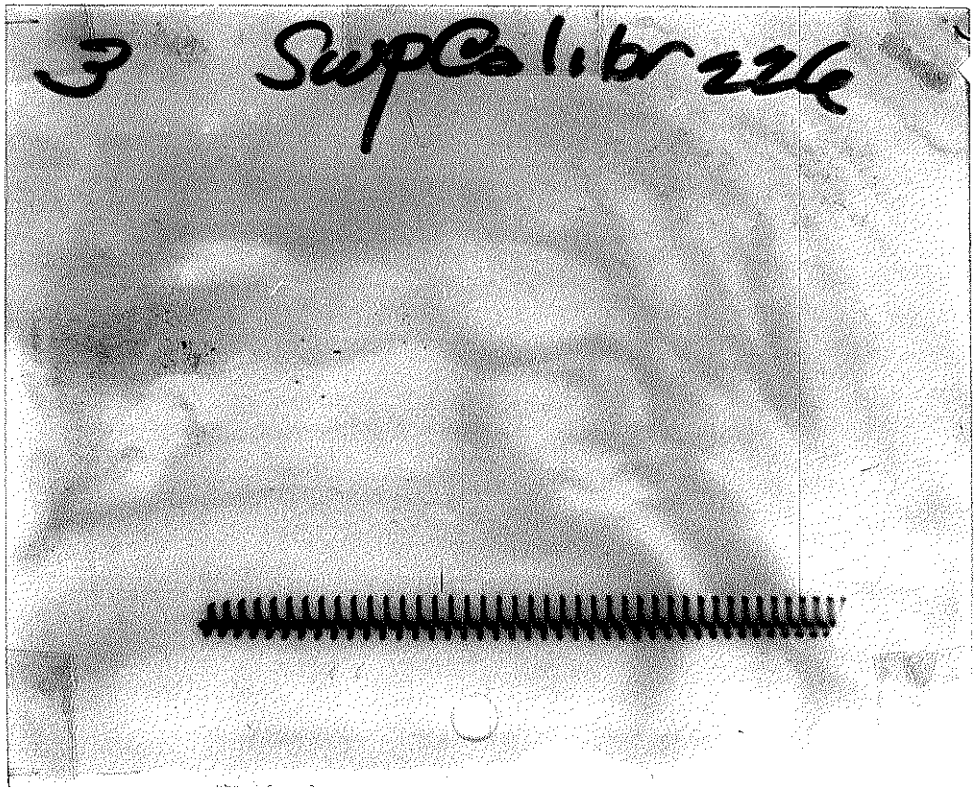
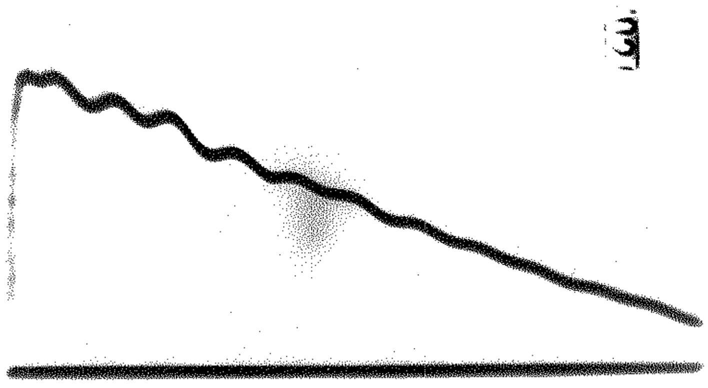
100
50
0

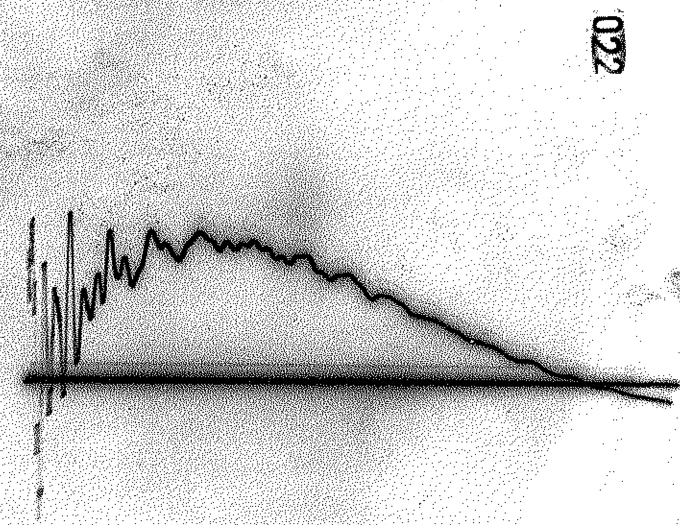

2 SweepCalibr #403
5 μsec
10 μsec
50 μsec


3 SweepCalibr 224

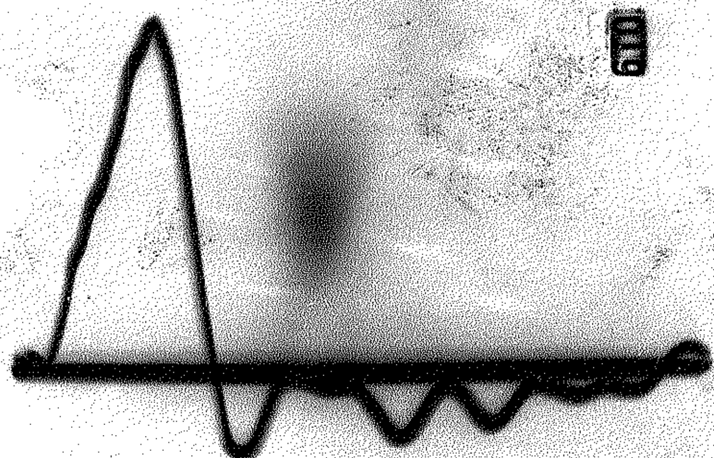
21 H1 RWE



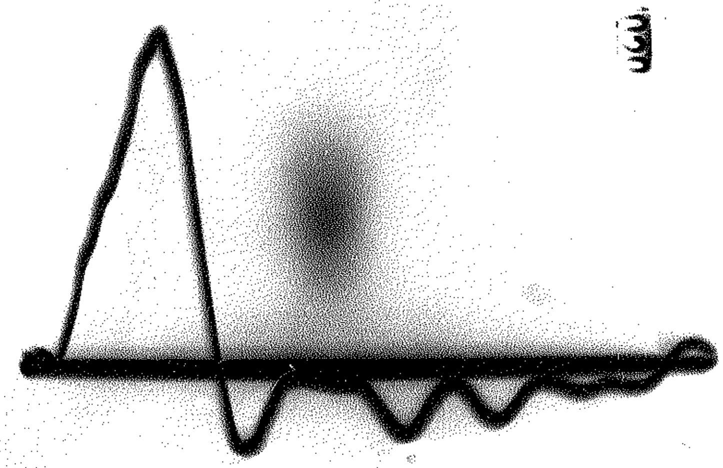
22 H1 RWI



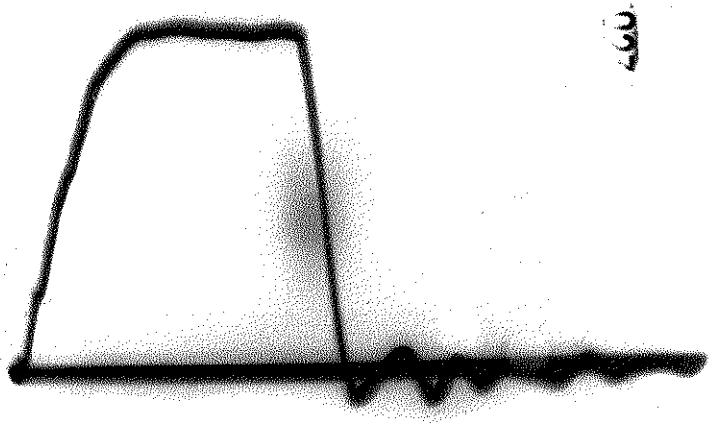
19 H1 SF



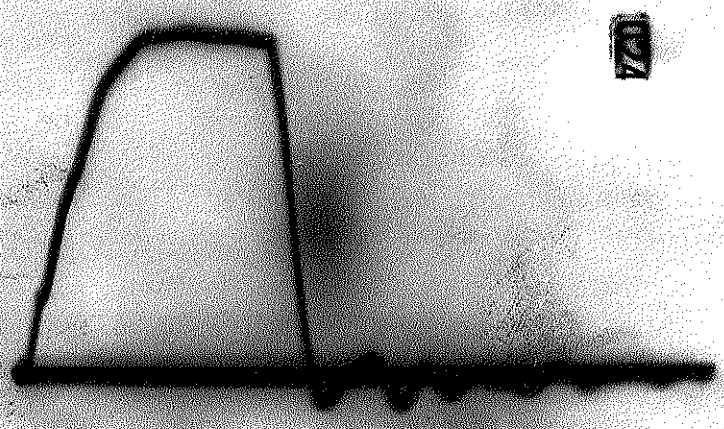
20 H1 SF



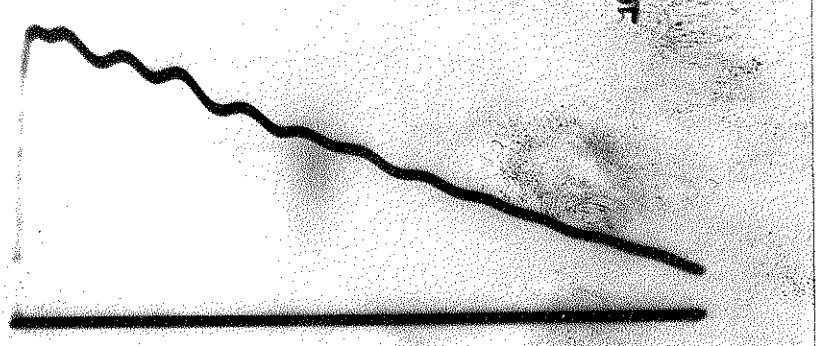
23 H, CW



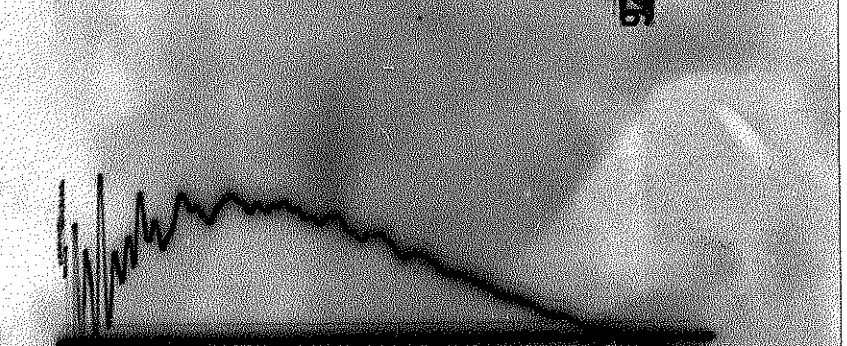
24 H, CW



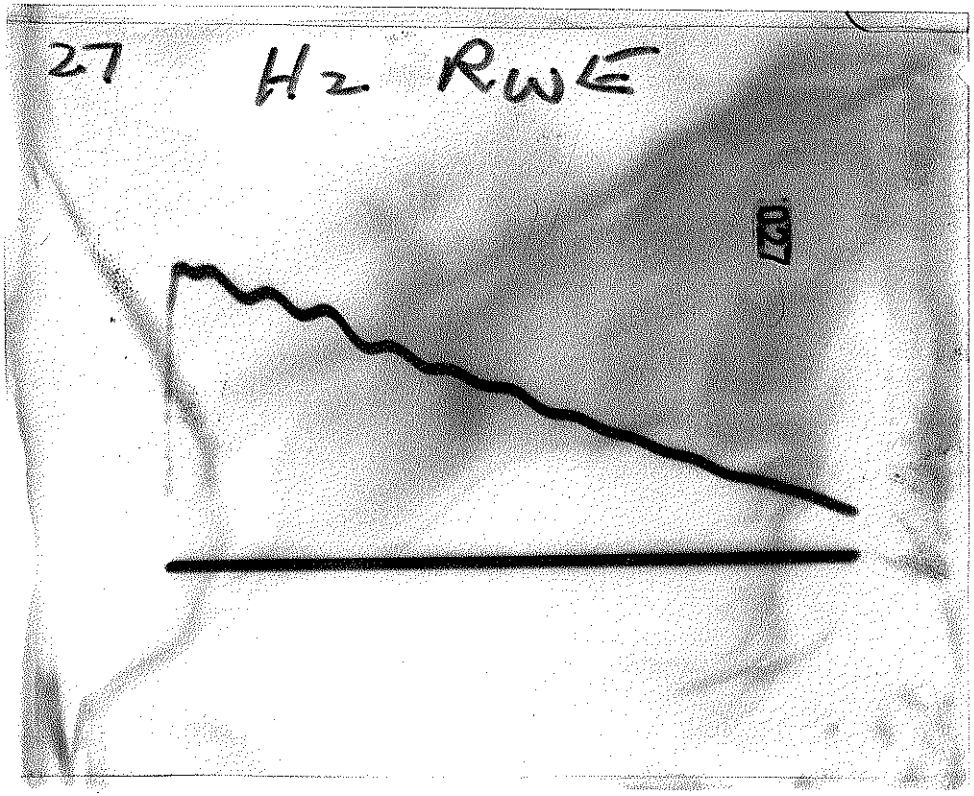
25 H, FWE



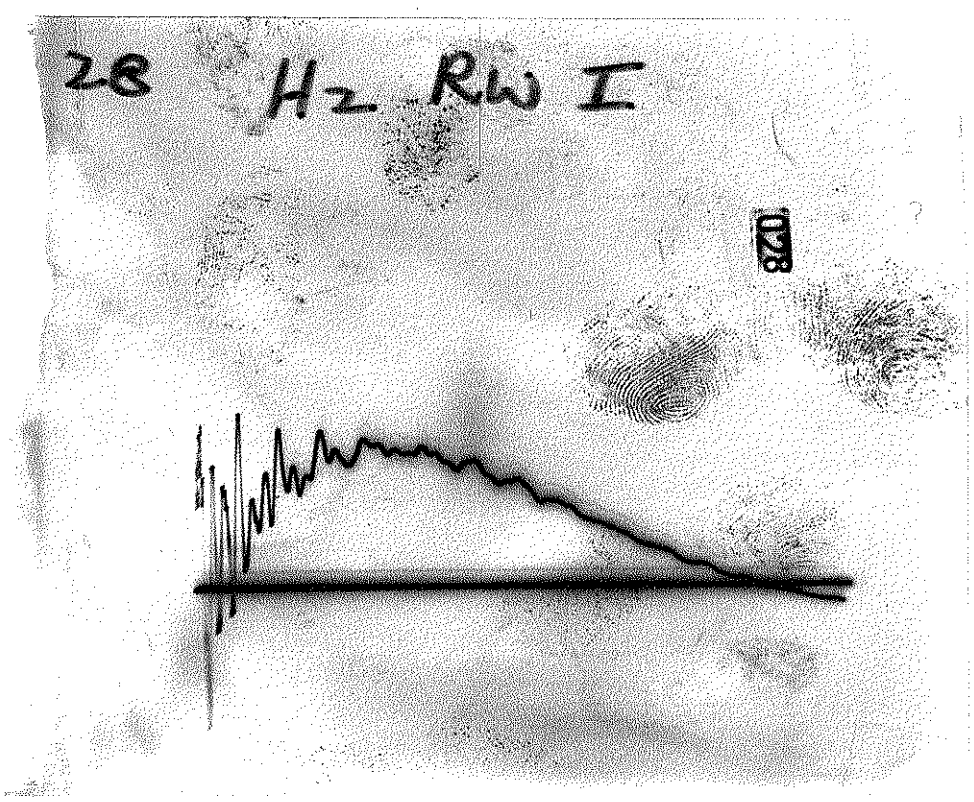
26 H, FWI



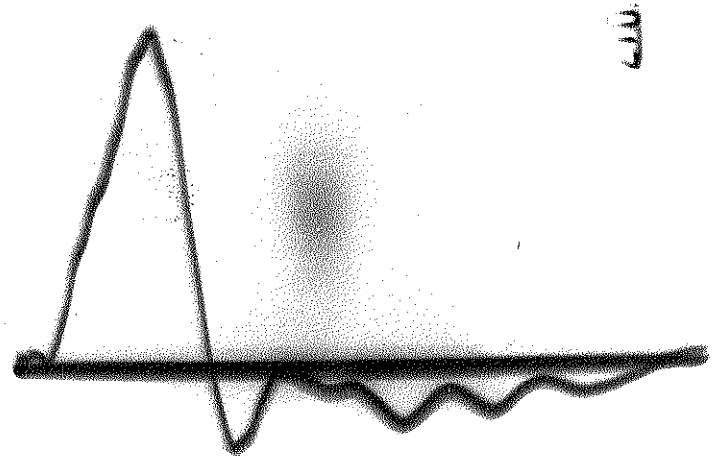
27 H_2 RWE



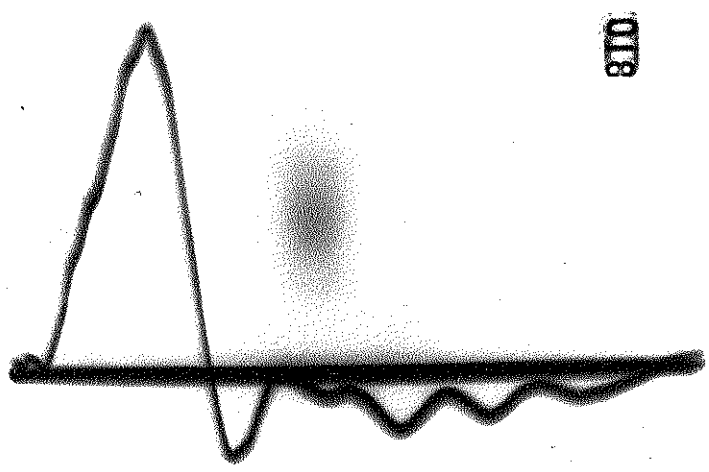
28 H_2 RW I



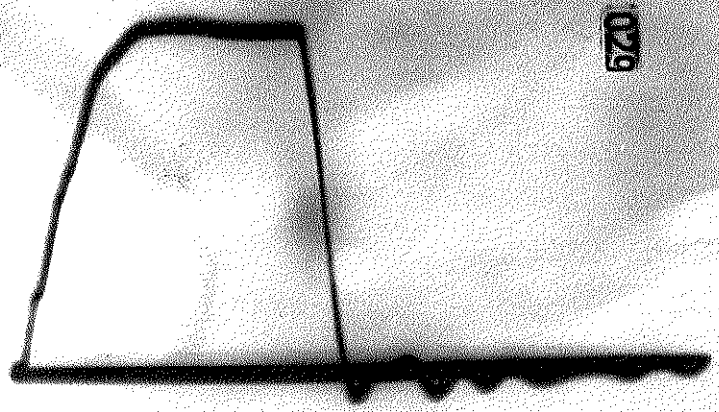
17 H_2SF



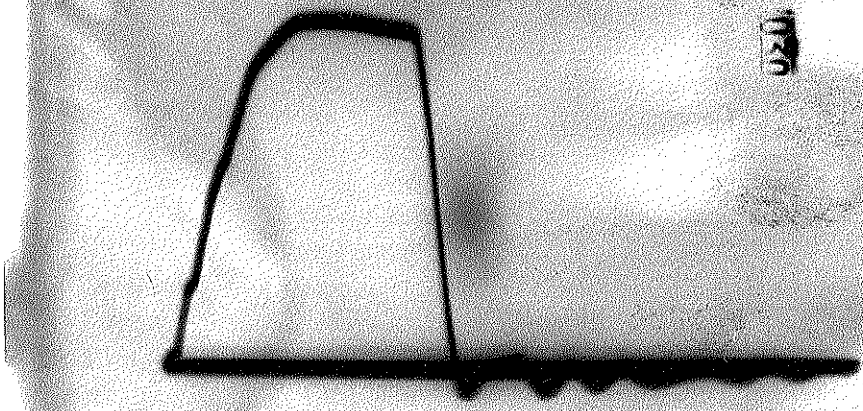
18 H_2SF



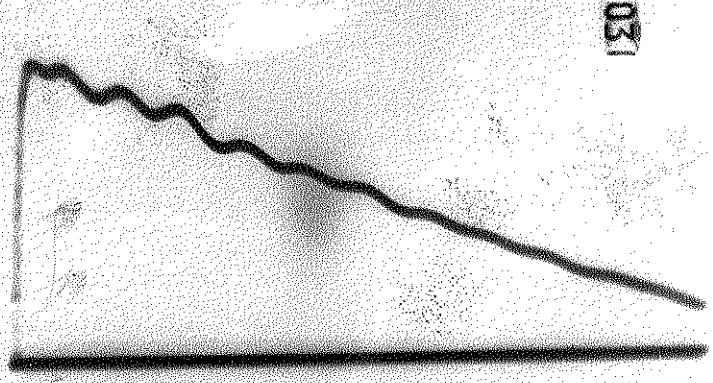
29 H_2 CW



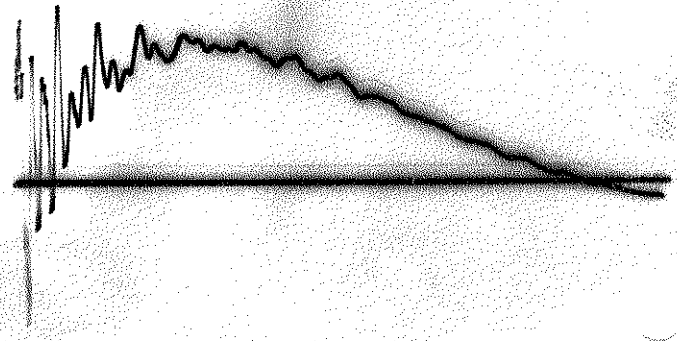
30 H_2 CW



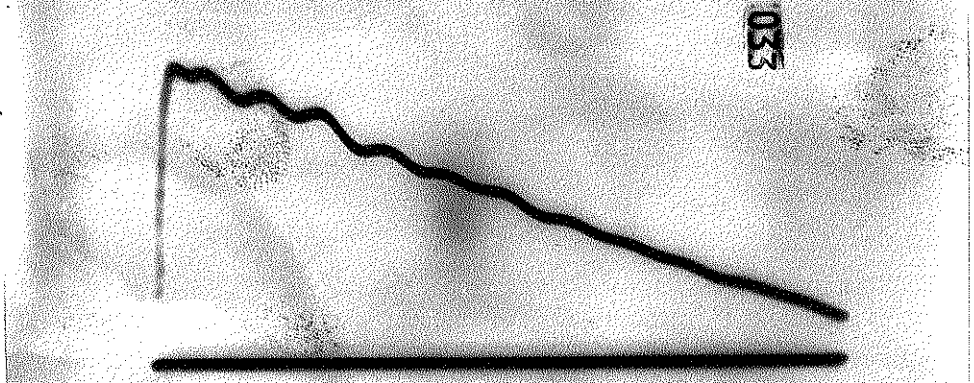
31 H_2 FWE



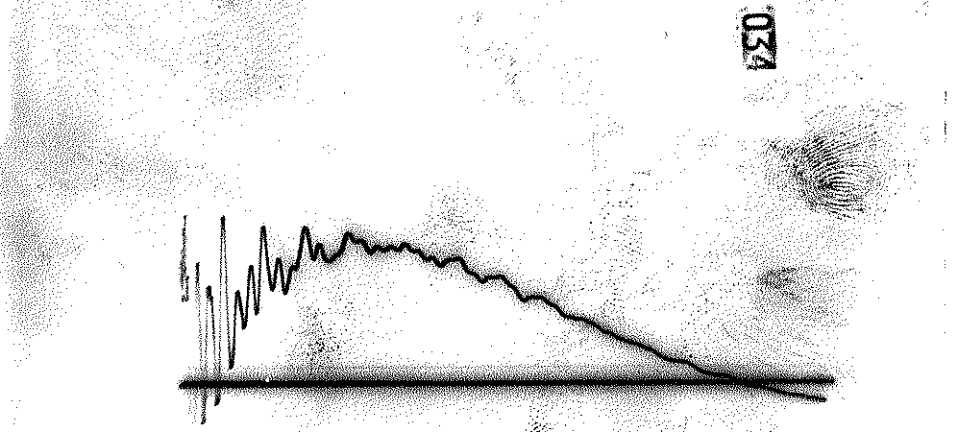
32. H_2 FWI



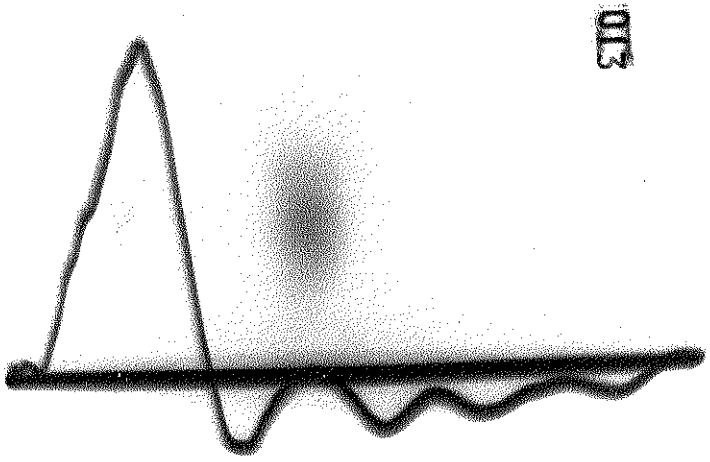
33 H3 RWE



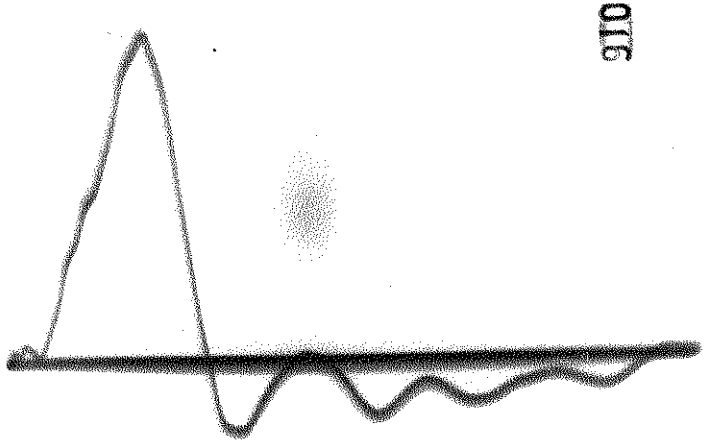
34 H3 RW I



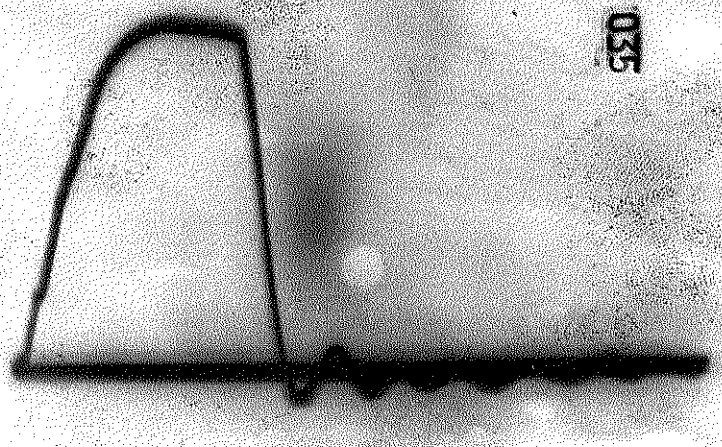
13 H3 SF



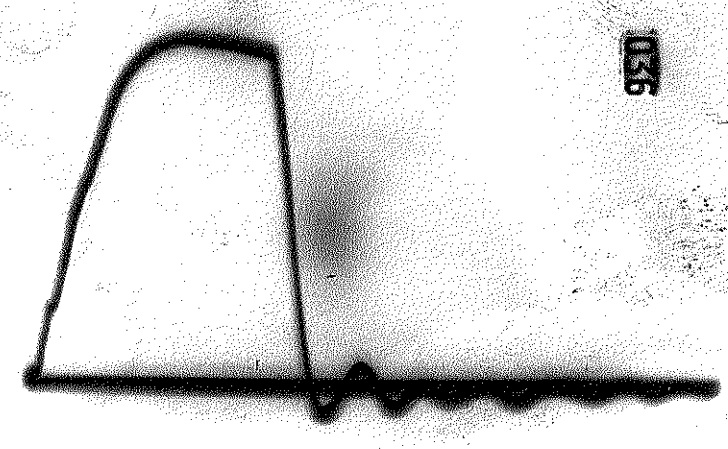
16 H3 SF



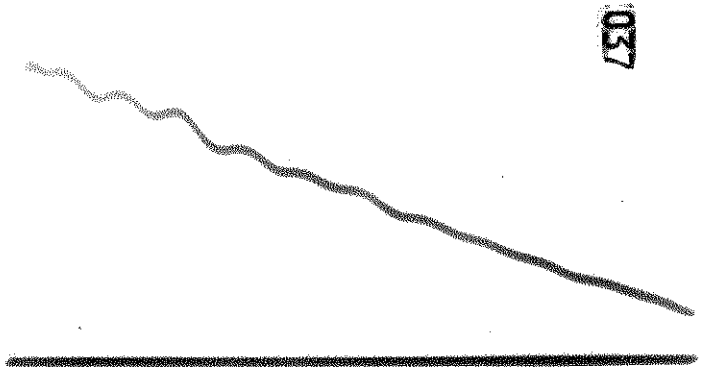
35 H_3 CW



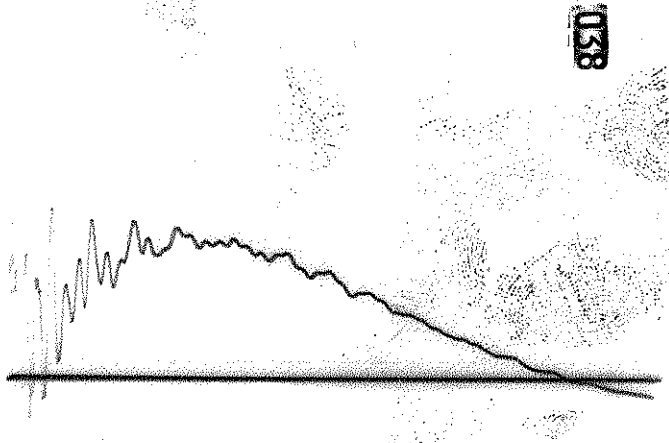
36 H_3 CW



37 H_3 FWE



38 H_3 FWI



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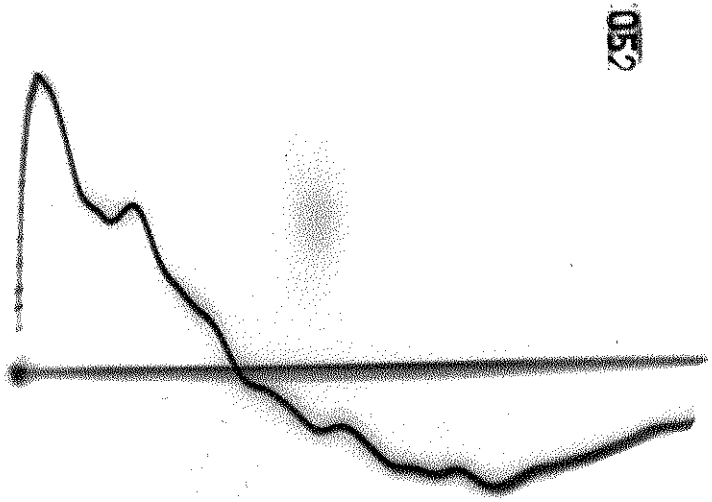

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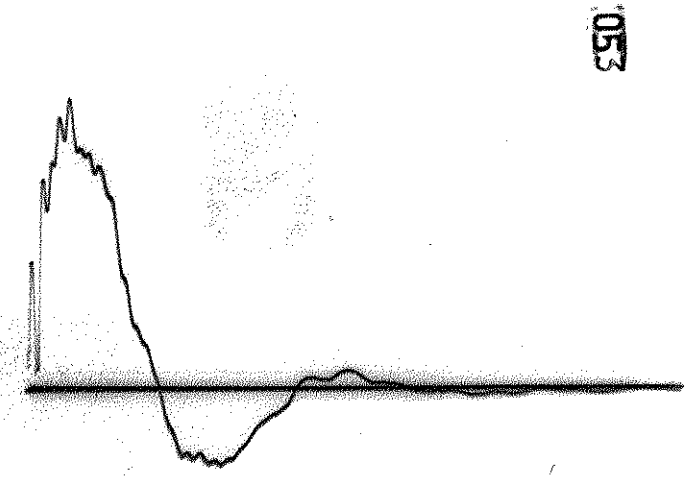

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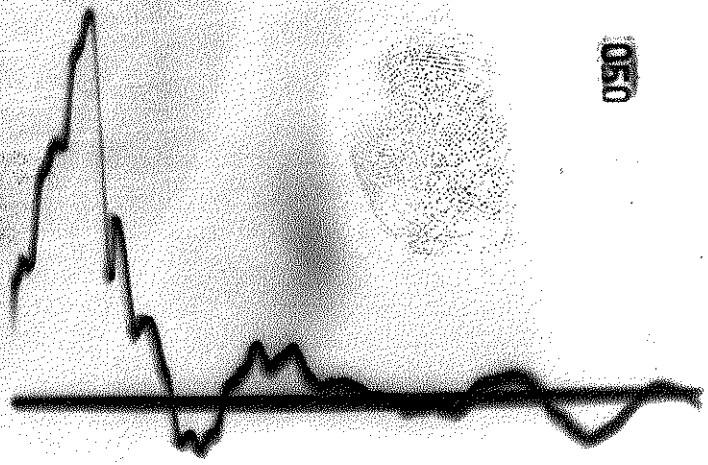

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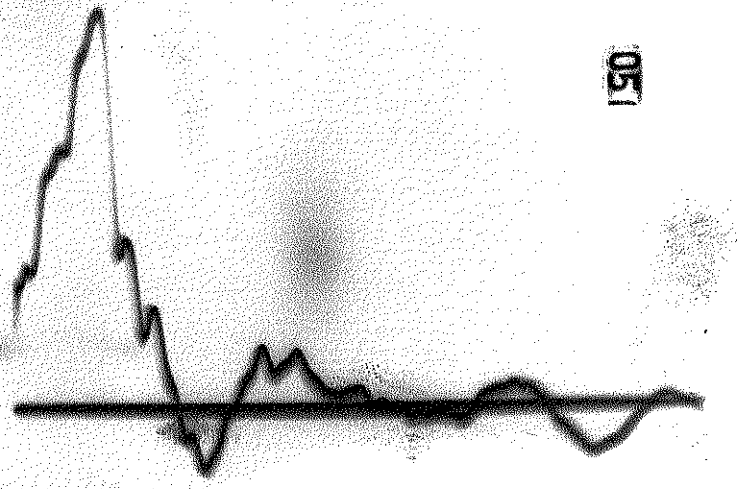

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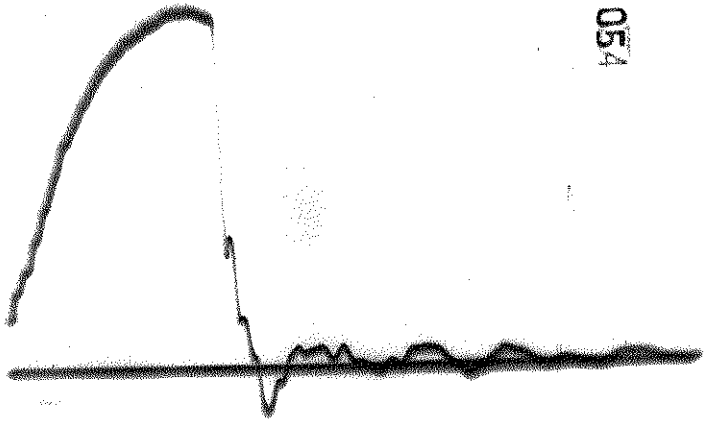

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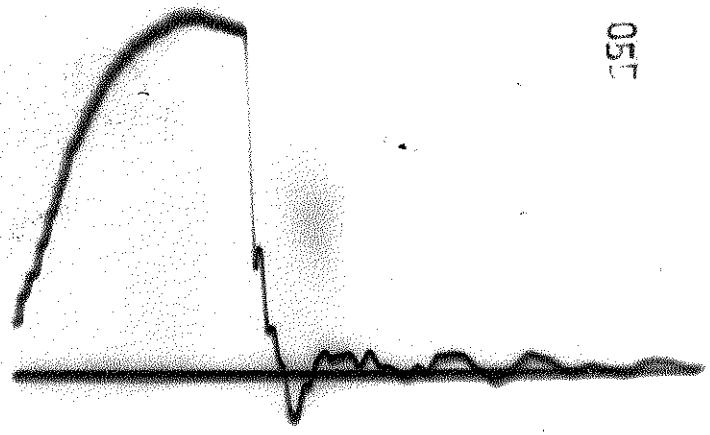
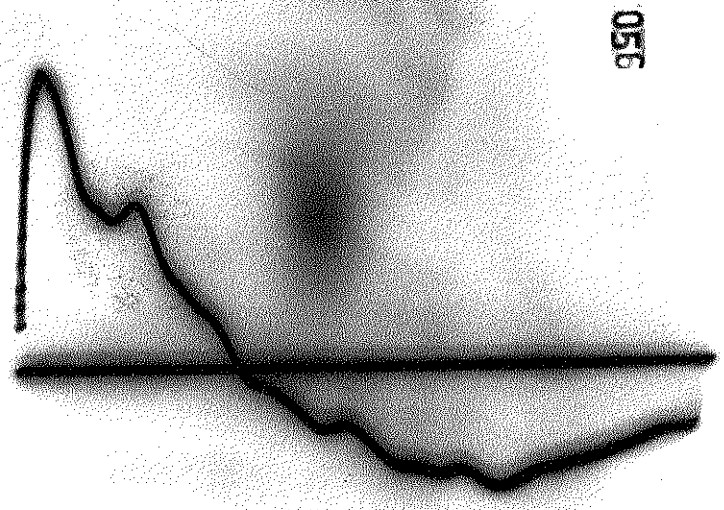
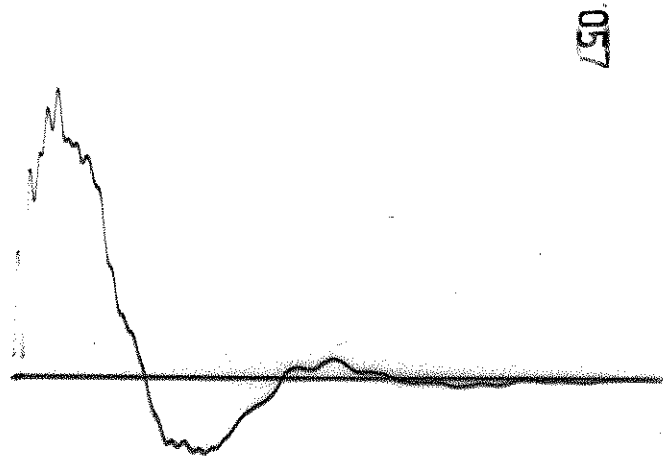


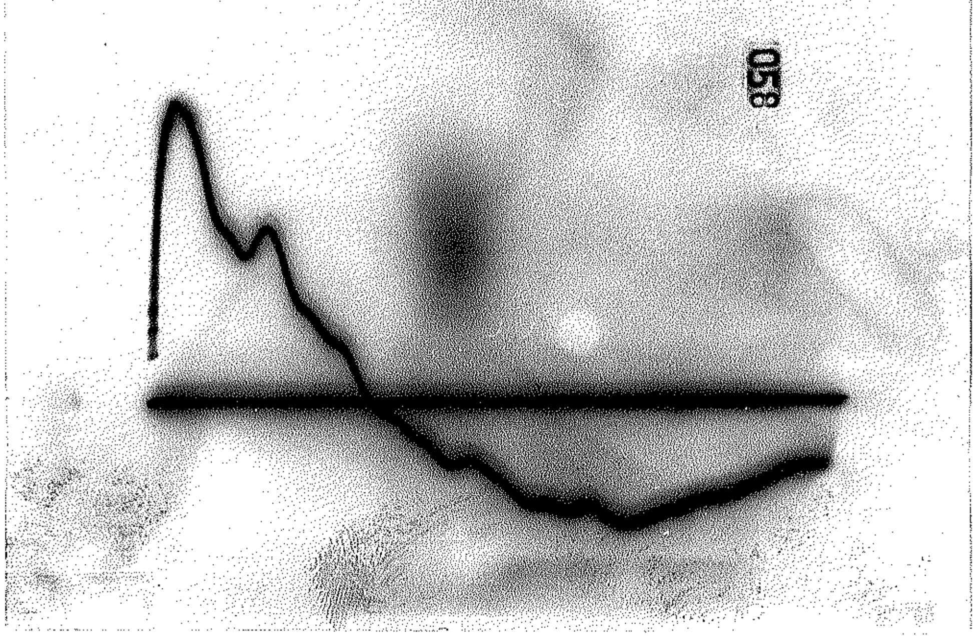
#56 FWE χ_1



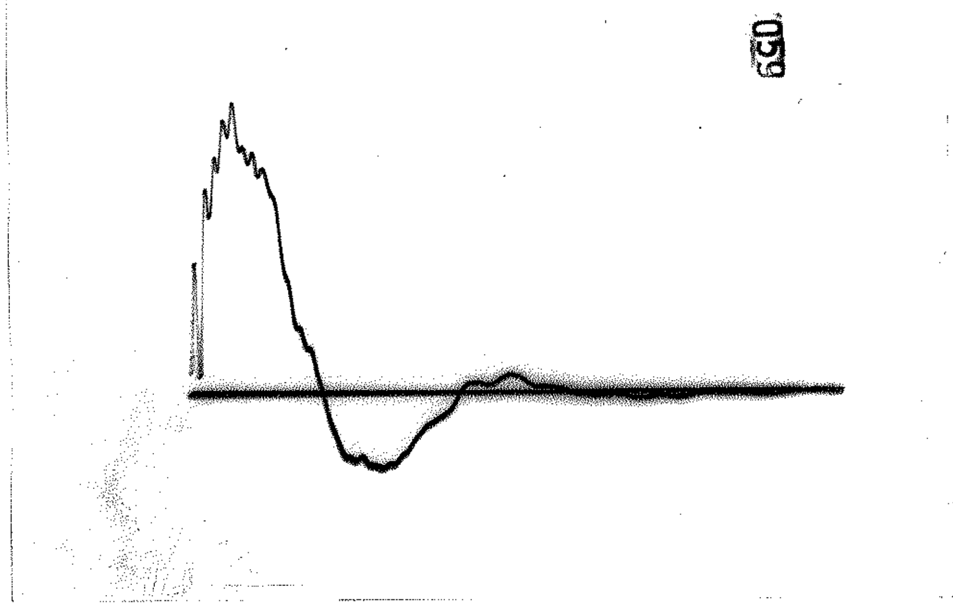
#57 FWI χ_1



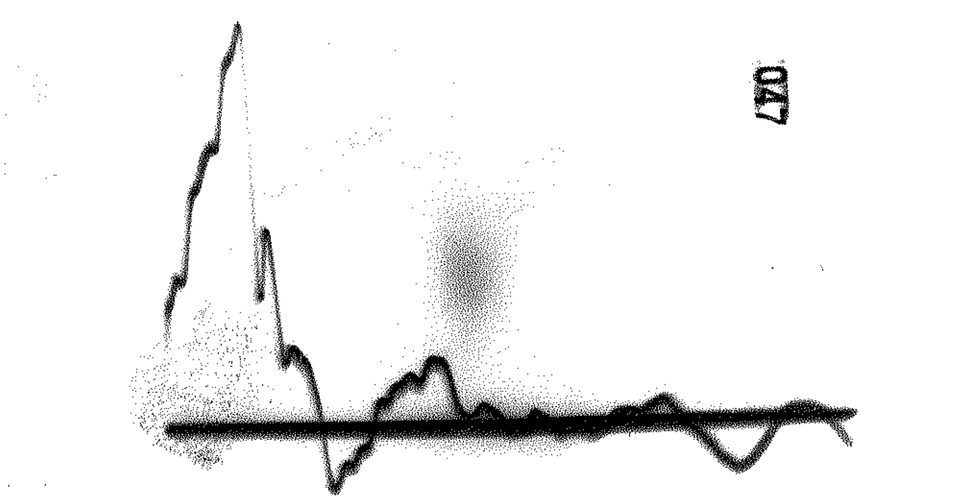
#58 RWE X_2



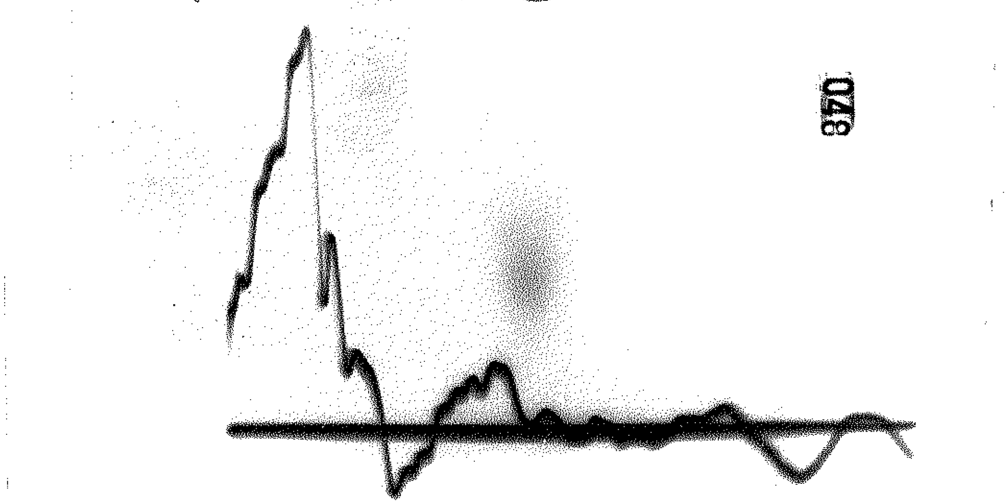
#59 RWI X_2



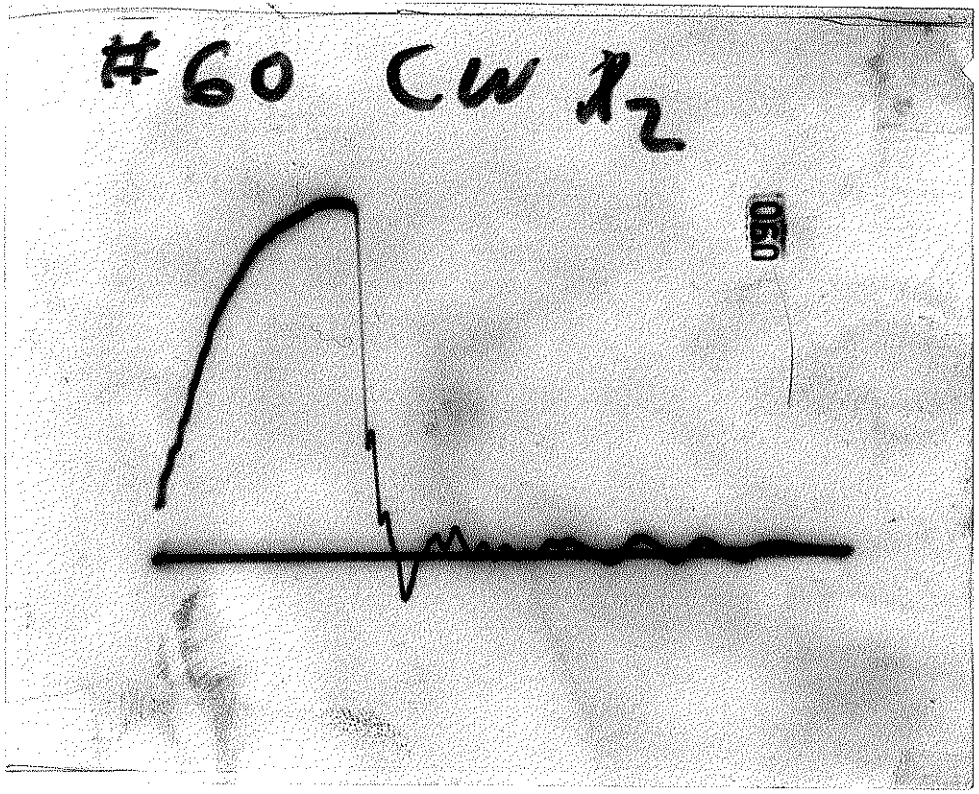
#47 X_2SF



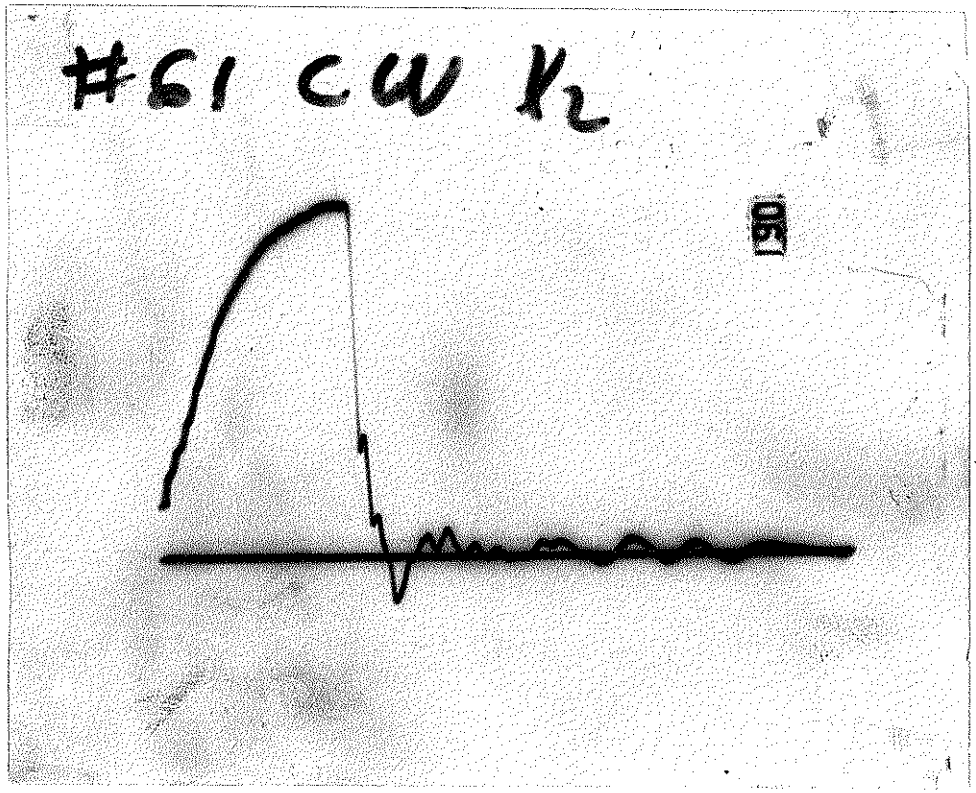
#48 X_2 SF



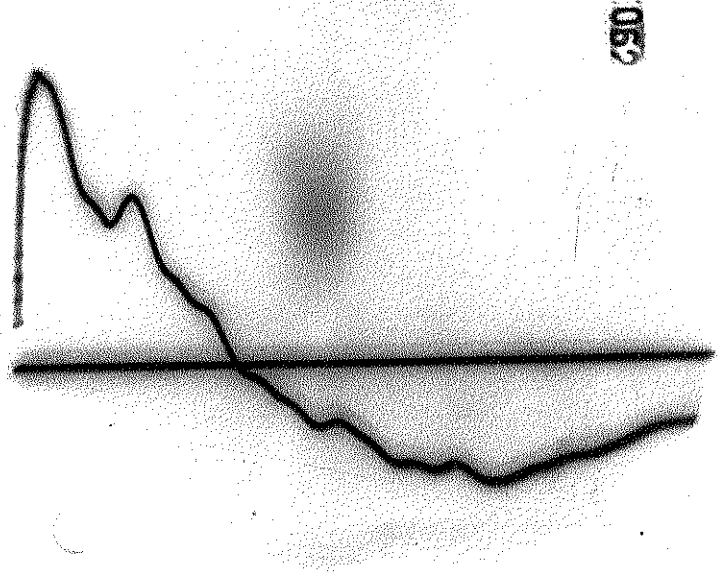
#60 CW χ_2



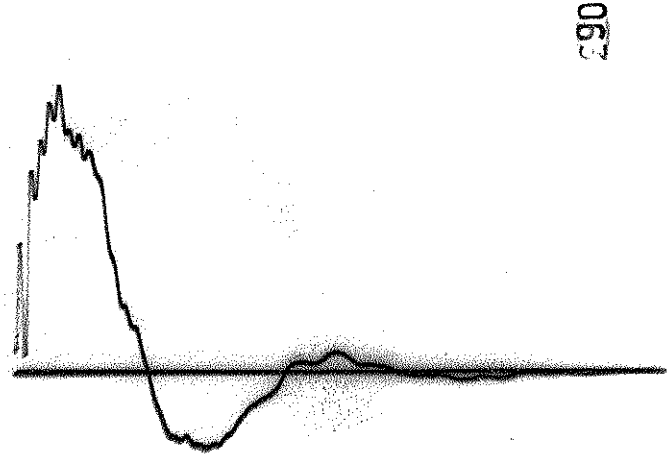
#61 CW χ_2



#62 FWE χ_2



#63 FWI χ_2



#64 RWE X_3

064

#65 TMV X_3

065

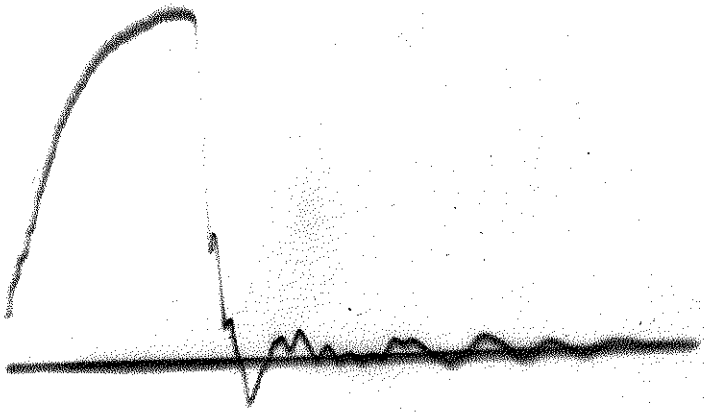
#45 SF X_3

045

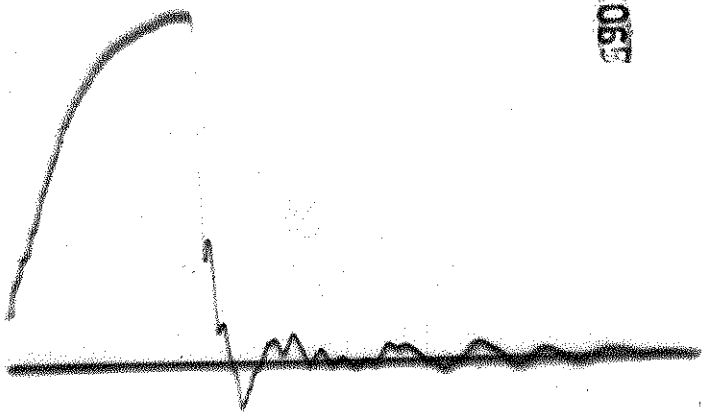
#46 SF X_3

046

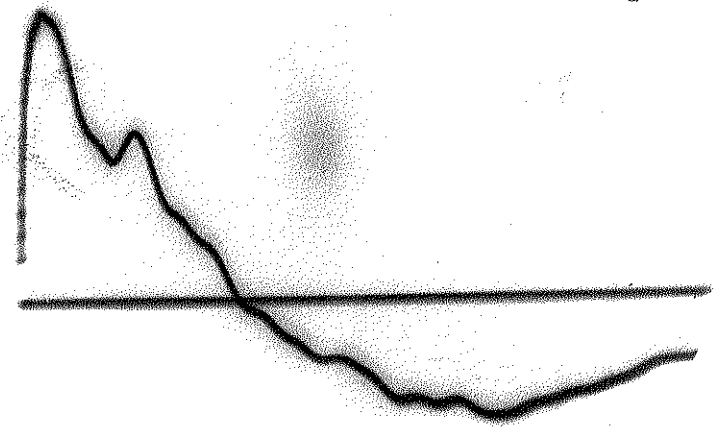
#66 CW X_3



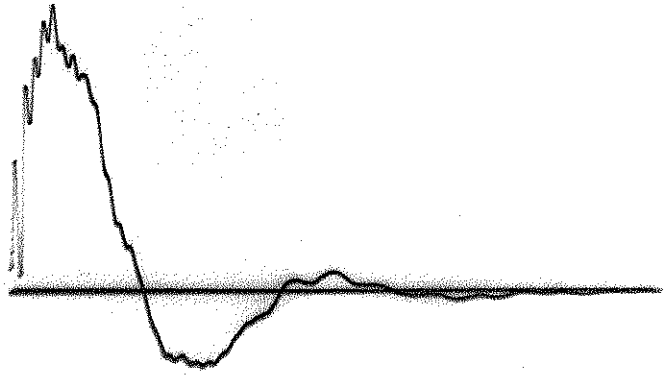
#67 CW X_3



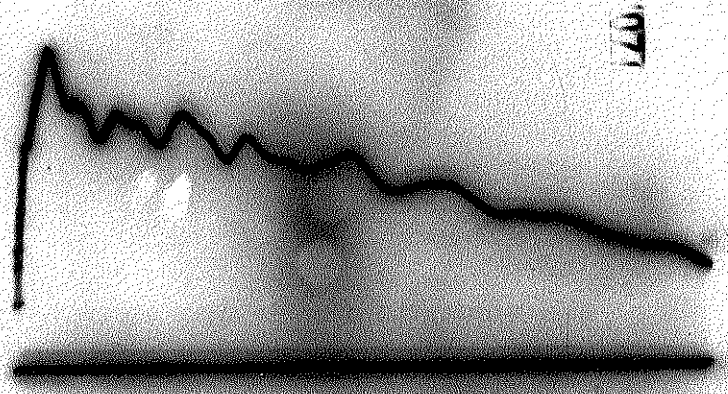
#68 FWE X_3



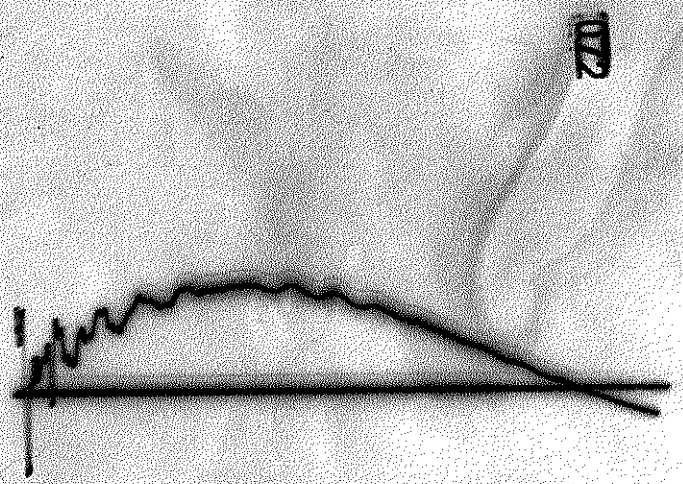
#69 FWI X_3



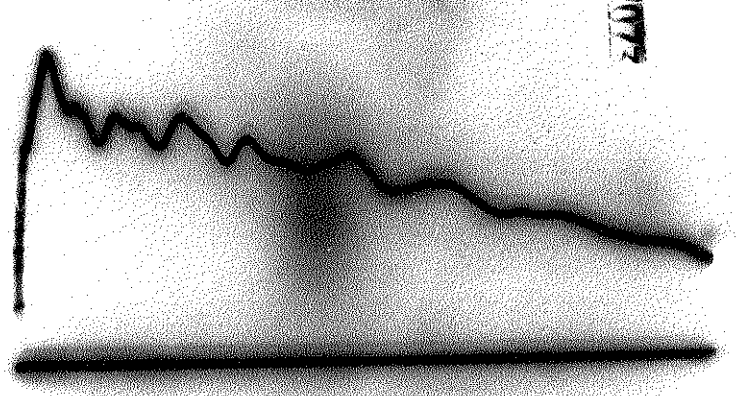
#71 RWE H_0



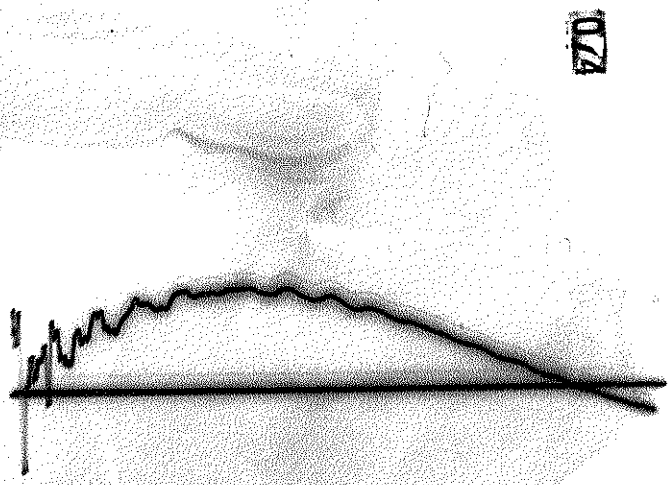
#72 RWI H_0



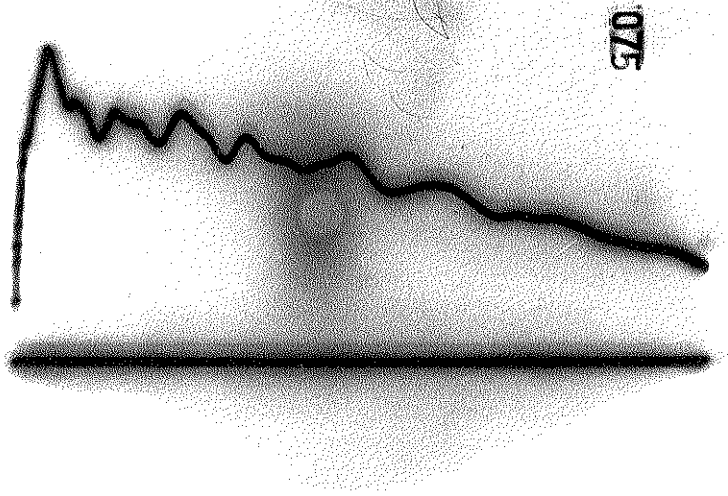
#73 FWE H_0



FWI H_0 #74



#75 FWE H_0



#76 FWI H_0