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SHOCK TESTING OF A NITROGEN TANK (CRYO DIFFUSION TYPE 220 VLR) ON THE MIDDLE WEIGHT SHOCK STAND

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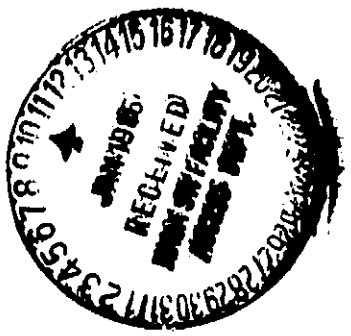

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16. Abstract

Results of shock tests on type 200 VLR nitrogen tank are given.

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I. INTRODUCTION /1*

At the order of the Federal defense organization TNO in behalf of the Ministry of Defense (Navy), a nitrogen tank, type 200 VLR, of the Cryoson Technical Laboratory at Middenbeemster was shock tested. The test was performed in the laboratory of the Institute TNO for Mechanical Constructions at Delft on the Middle weight Shock stand.

The dates of the test were May 24 and 25, 1972.

The Ministry of Defense (Navy) had determined that the maximal increase on the nitrogen tank, mounted on YS 50-75-LBS springs, had to be in the area between 6 and 8 g. (g = increase of the force of gravitation). The apparatus had to be shocked in two directions perpendicular to each other.

Altogether two shock tests have been made.

During the shocktests the movement of the surface and the movement of the nitrogen tank were registered on a magnetic tape. The measuring system is discussed extensively in /3/.

The filling degree of the nitrogen tank with the vertical test was approximately 75%. For the horizontal test the filling degree was reduced to 25%. The manufacturer Cryoson deemed this necessary for safety reasons.

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*Numbers in the margin indicate pagination in the foreign text.

The damage inspection after each shocktest was done by the IWECO-TNO as far as this was possible.

There was not found any indication of visible exterior damage.

The nitrogen tank was returned to the Optical Industry N.V. at Delft after the tests.

2. MOUNTING OF THE NITROGEN TANK /2

The IWECO has the nitrogen tank mounted to springs of the type Yielding Strip 50-75 LBS-decktype for the vertical as well as for the horizontal test. The springs were somewhat modified by making normal holes of the slits.

The pictures, figures 1 to 5, give a clear picture of the mounting. It is indicated at the pictures where the movements of the nitrogen tank are measured during the shocktests.

3. SETUP OF THE MIDDLE WEIGHT SHOCK STAND /3

The work method of the shock stand is not discussed in the present report. Reference to this has been made to /1/ and /3/.

The setup of the stand with the tests performed is found in Table I.

TABLE I

a Schok No.	b Schotelveren Druk c	Trek d	e Slag (mm)	f Voorspanning mm Trek	Druk	g Rubber-veren	h Massa's i Hulp-constr. (kg)	App. (kg)
246	16/32	12/24	10	2	2	6	300	208
247	16/32	12/24	10	2	2	6	300	146

Key: (a) Shock No.; (b) Disk springs; (c) Pressure; (d) Pull; (e) Beat; (f) Advance tension; (g) Rubber springs; (h) Masses; (i) Auxiliary construction

4. MEASUREMENT RESULTS

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In the figures 6 to 9 the time functions are found of the signals measured. In Table 2 the maximum values are given.

The maximum increase on the nitrogen tank was for the vertical and for the horizontal test in the increase area between 6 and 8 g. The remaining deformations of the YS-springs were between 1 and 3 mm.

TABLE 2

	a Beweging van het plateau		b Beweging van het stikstofvat xx	
	c Schok 246	Schok 247	Schok 246	Schok 247
d Versnelling $(m \cdot s^{-2})$	330	280	54	80/47
e Snelheid $(m.s^{-1})$	0,95	1,10	0,59	0,41/0,44
f Verplaatsing $(10^{-3}m)$	2.2	2.4	16/21)x	19
g Vertraging $(m \cdot s^{-2})$	110	100	54	93/60
T_1 $(10^{-3}s)$	10	70	30	22/30
T_2 $(10^{-3}s)$	9	80	-	-

)x The first and the second figure indicate the value of the first and the second recorder, respectively.

T_1 = the time in which the maximum speed is reached.

T_2 = the vibration time of the surface of the shock stand.

)xx the channels 4 and 7, respectively.

Key: (a) Movement of the surface; (b) Movement of the nitrogen tank; (c) Shock; (d) Speed increase; (e) Speed; (f) Displacement; (g) Speed decrease

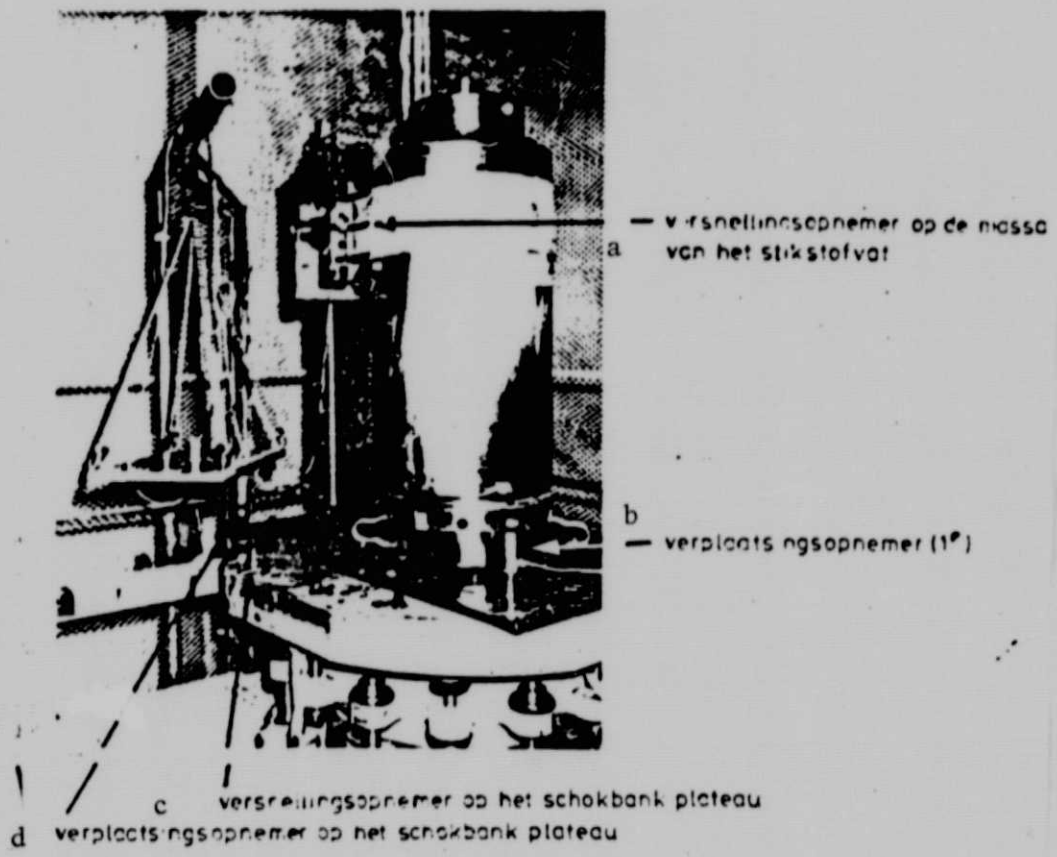

Fig. 1. View from the left side

Key: (a) speed recorder of the mass of the nitrogen tank; (b) displacement recorder; (c) speed recorder of the shock stand surface; (d) displacement recorder on the shock stand surface

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Fig. 2. Detail of the displacement recorder and of the YS confirmation

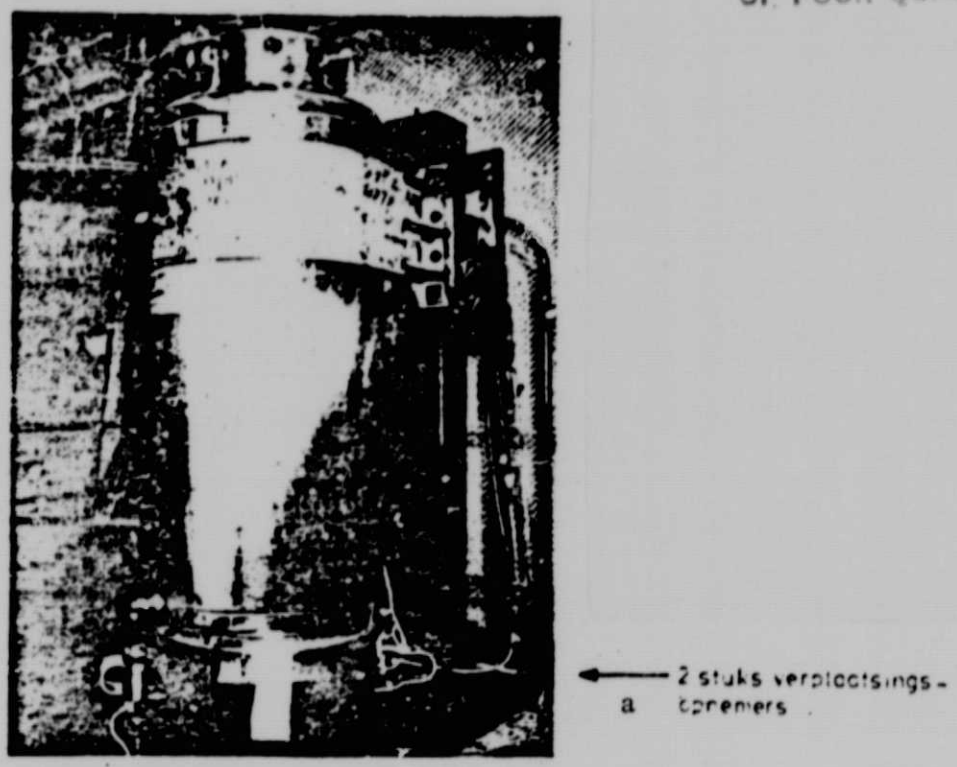

Fig. 3. View from the right side of the vertical test

Key: (a) 2 displacement recorders

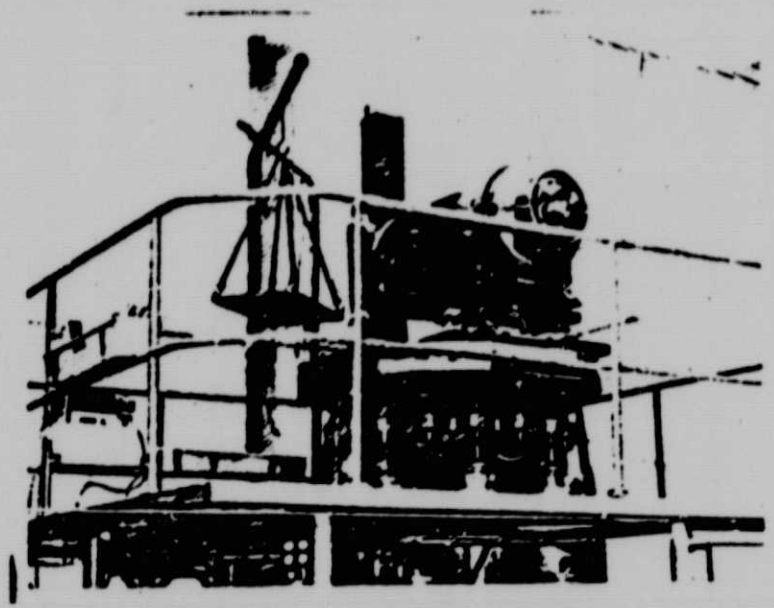

Fig. 4. Horizontal test

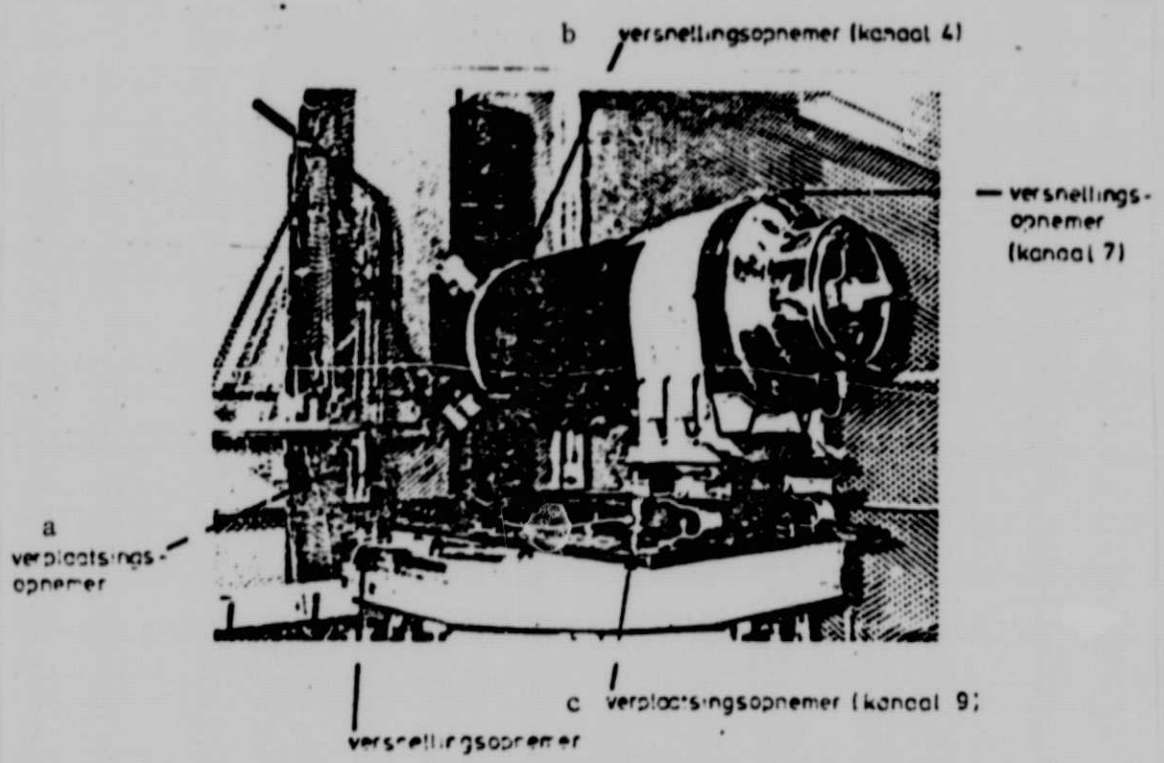

Fig. 5. Measurement areas for the horizontal test

Key: (a) displacement recorder; (b) speed recorder (channel 4); (c) displacement recorder (channel 9)

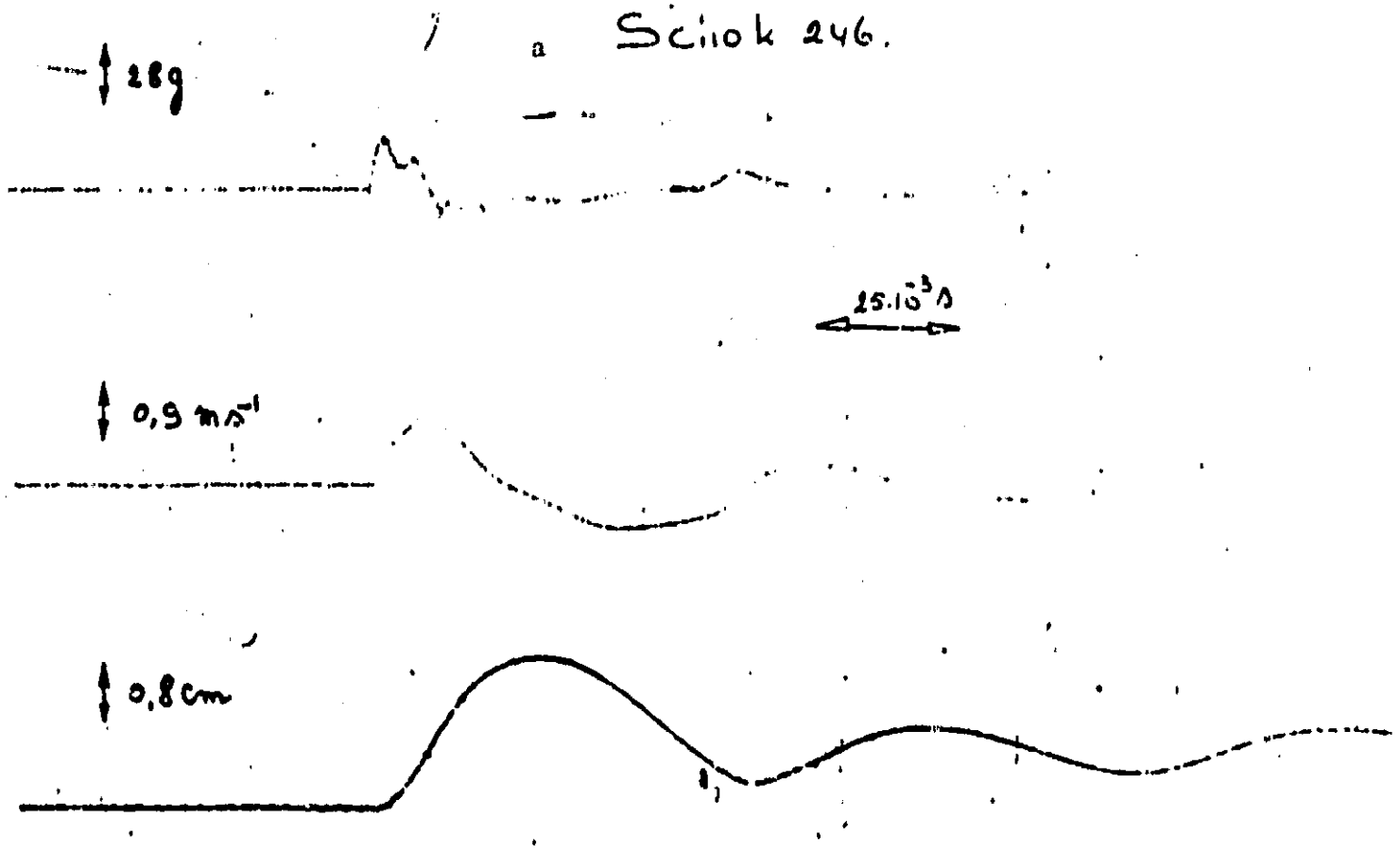

Fig. 6. Movement of the surface

Key: (a) Shock 246

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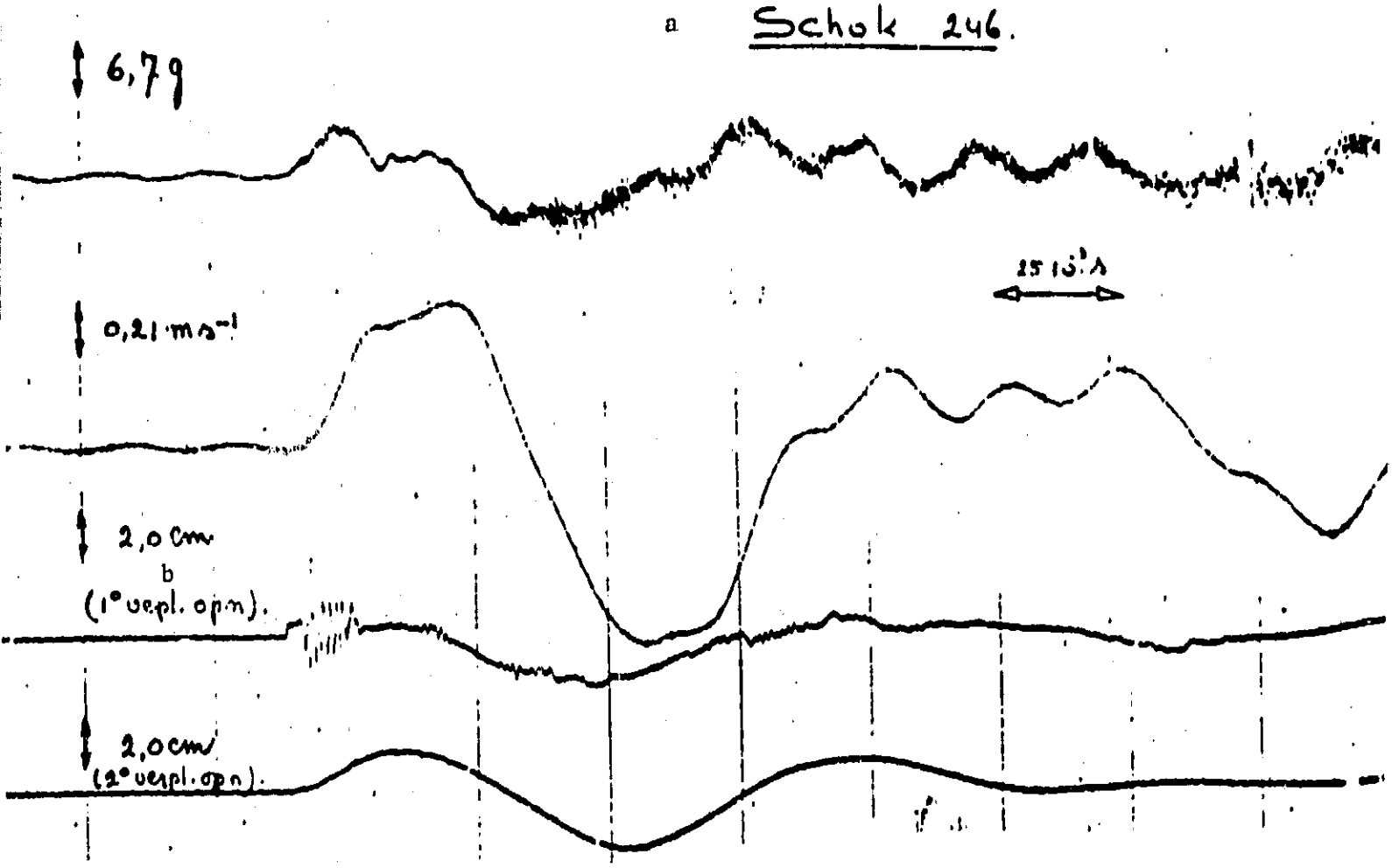

Fig. 7. Movement of the nitrogen tank

Key: (a) Shock 246; (b) displacement recorder

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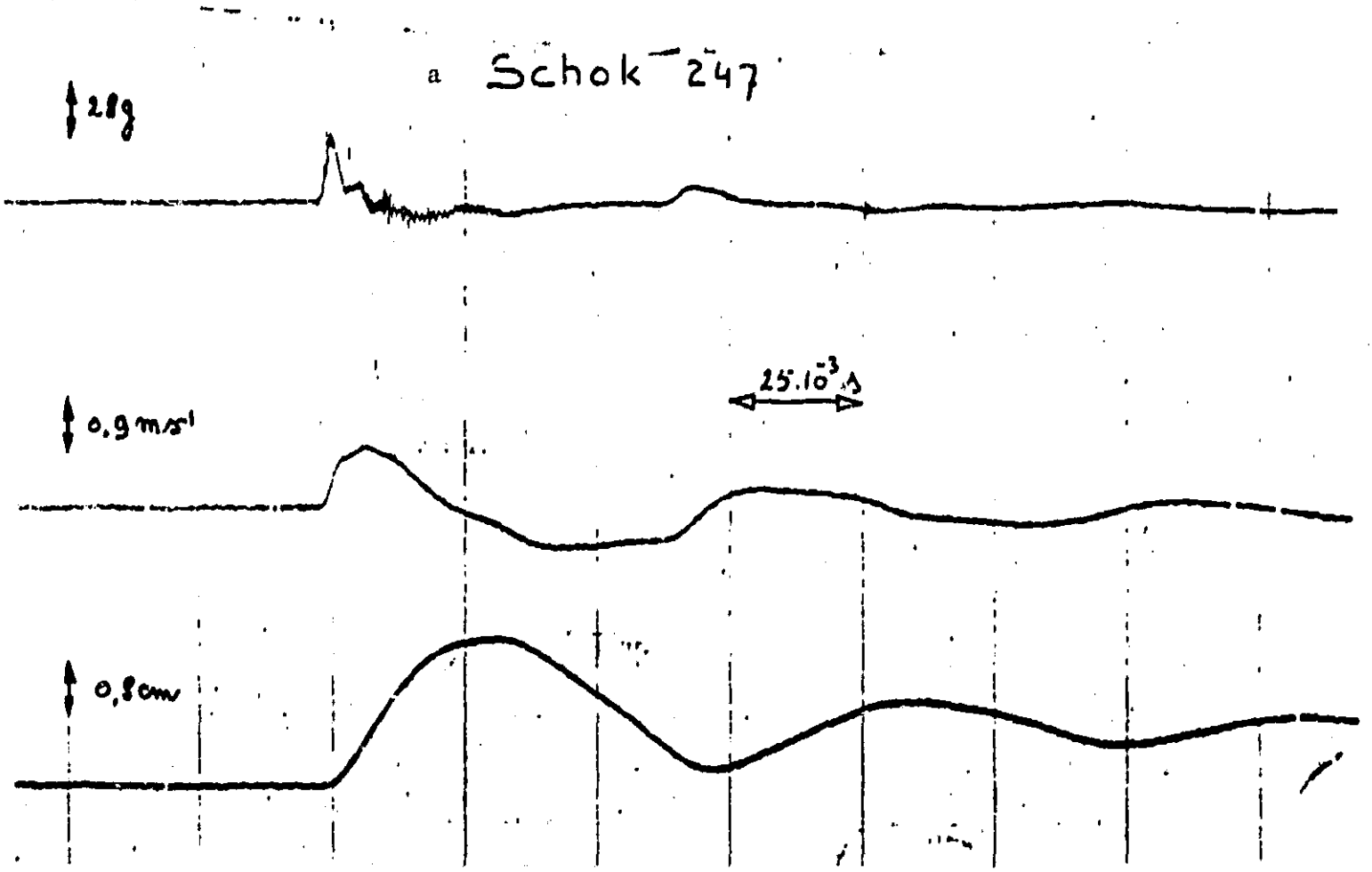

Fig. 8. Movement of the surface

Key: (a) Shock 247

/11

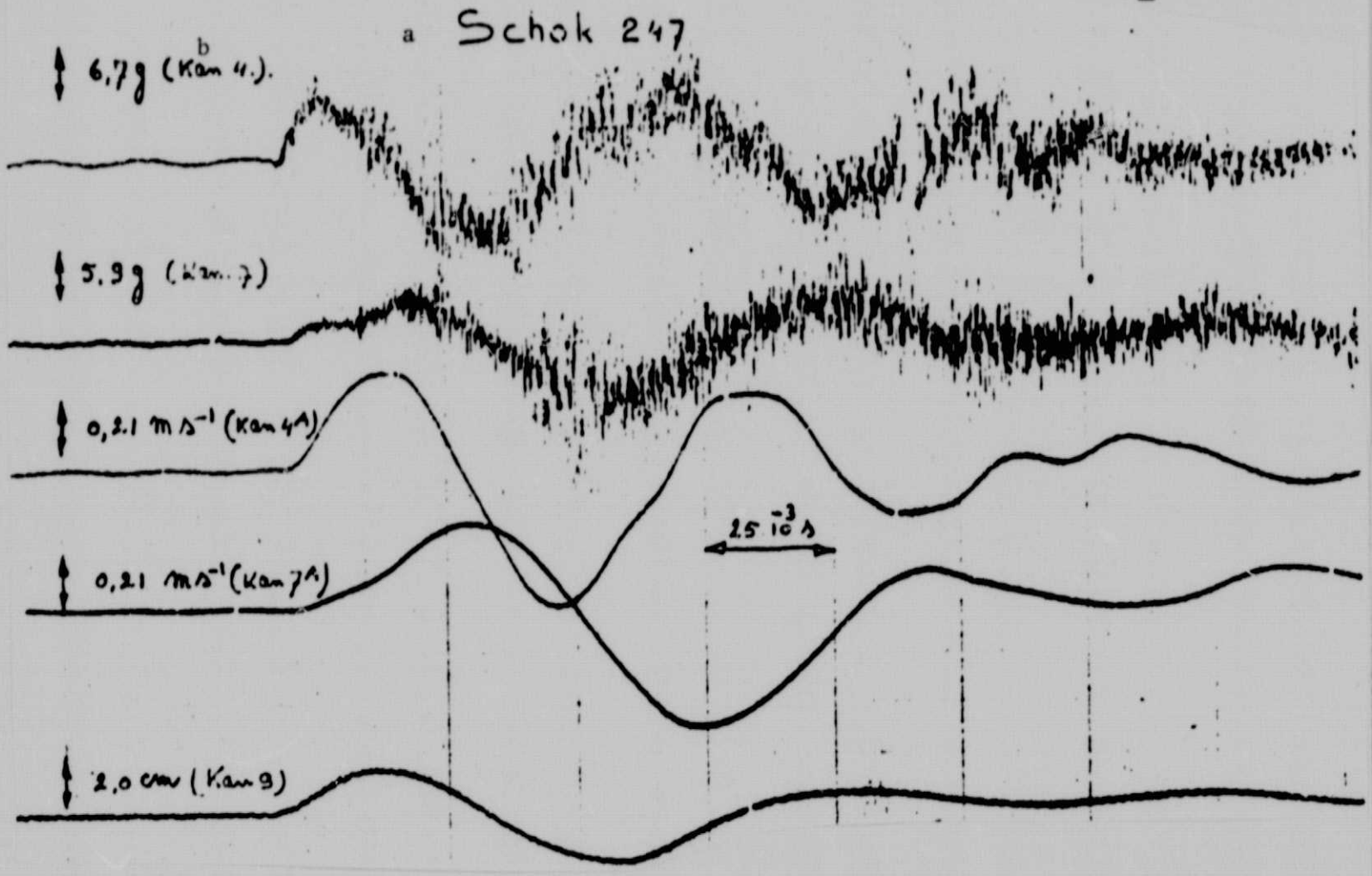

Fig. 9. Movement of the nitrogen tank

Key: (a) Shock 247; (b) channel

5. LITERATURE /12

(1) Regoord, R. "Handbook for shock as a result of underwater explosions," part 2, IWECO-report No. 4747/1, SA 69126.

(2) Regoord, R. "Handbook for shock as a result of underwater explosions," part 3, IWECO-report No. 4747/1, SA 69127.

(3) Schulze, R.A.P.J. "Shocktests to be executed by IWECO-TNO," IWECO - Memo No. 6909/56, SA 69068.