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INTERNATIONAL COUNCIL FOR THE  
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C.M. 1977/B: 25  
Gear and Behaviour Committee



REVIEW OF THE NETHERLANDS' INVESTIGATIONS INTO A PELAGIC ROPE TRAWL.

by

A. Verbaan

Netherlands Institute for Fishery Investigations,  
Technical Research Department,  
P.O. Box 68, Ymuiden, The Netherlands.

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Department, P.O.Box 68, IJmuiden -  
The Netherlands.

Introduction

As already mentioned in the "Report of the Working Group on Research and Engineering Aspects of Fishing Gear, Vessels and Equipment" number C.M. 1976/B:7 item 4.3., the research for rope trawls in The Netherlands started in January 1976. The main object was to catch, with this type of trawl, herring on a rough bottom.

One of the criteria is that the rigging of rope trawls must be the same as the rigging of a meshed midwater trawl for the same propulsive power. In that case it is easy for the fishermen at sea to switch from a common midwater trawl to a rope trawl.

The first rope trawl design was derived from the common midwater trawl of 434 meshes with a stretched length of 800 mm. This midwater trawl is used by vessels with a propulsive power of 1100-1300 hp.

During the whole year 1976 a number of different rope trawls were tested under almost the same conditions and in the same area with the FRV "Tridens". The tests were carried out under full midwater conditions. In order to compare the different trawls, a number of parameters has to be measured simultaneously. The geometry of these trawls, especially of the front parts, could then be determined.

In this paper only the most relevant information is given.

Gear rigging

The common midwater trawl and the rope trawls were tested with the following rigging:

- . 4.3 m<sup>2</sup> Süberkrüb doors of 740 kg weight;
- . 100 m upper bridles of 15 mm diameter;
- . 100 m lower bridles of 21.8 mm diameter lengthened at the wing tips by 6.4 m chain;
- . weight at wing tips of 450 kg.

During some trials the chain on the lower bridles was lengthened to 8.4 m and the weight at the wing tips increased to 525 kg.

This gear rigging is commonly used for midwater trawlers with a propulsive power of 1100-1300 hp.

Measurement equipment and collected gear parameters

For measuring the various gear parameters the following acoustic equipment was used:

- A Furuno wireless netsounder, type FRN-2, mounted in a paravane construction;
- A Furuno transponder (converted wireless netsounder) mounted in a paravane construction, and a Furuno recorder;
- Elac netsounder equipment (two channels) and an ELAC recorder, type LAZ-17-CFT;
- A seven-channel Elac multi-netsounder and an Elac synchronous recorder, type MP-23.

With this equipment the following gear parameters could be collected simultaneously:

- |   |   |  |
|---|---|--|
| • horizontal distance between the wing tips                       | ) | wireless netsounder  |
| • vertical netopening   | ) |  |
| • distance of the headline to the surface                         | ) |  |
| • horizontal netopening   | ) |  |
| • vertical distance between the wing tips                         | ) | multi-netsounder, starboard netsounder winch               |
| • horizontal netopening in the second netsection/behind the ropes | ) |  |
| • vertical netopening in the second netsection/behind the ropes   | ) |  |
| • distance of the Süberkrübdors to the surface                    | ) | 2-channel netsounder equipment; port-side netsounder winch |
| • spread of the doors   | ) |  |

The tension in the warps was measured with two 20-tons load-cells and presented on an analog recorder, Hewlett Packard 7404 A.

The fishing speed was registered with a Doppler-log, switched at "water-track", and presented on the same H.P.-recorder (4-channels).

The delivered shaft horse-power was presented on a Philips analog recorder.

The wireless netsounder and transponder were also used to measure the horizontal and vertical distance between the selvages in the front part of the second netsection resp.

connection points of the ropes to the webbing. The distances between the selvages are important data for the design of a rope panel.

Those parameters were collected for a range of propulsive powers (1000-1300 s.h.p.) and warp lengths (200-325 ftms). Figures 2, 3 and 4 give an impression how the different transducers were connected in the gear and net.

#### Characteristics of the different trawls

The investigations started with the "meshed" midwater trawl having a circumference of 434 meshes with a stretched length of 800 mm (see figure 5). This trawl is used by vessels having a propulsive power of 1100-1300 hp.

The reason why the investigations started with the "meshed" midwater trawl was that the collected data could be compared with those of the different rope trawls. Therefore the trials were carried out in almost the same area with less influence of tide and stream (near the Canary Islands and in the Gulf of Cadiz).

The first rope trawl was a converted common midwater trawl, as described before. The wings and the first panels of 800 mm of the original webbing were replaced by nymplex (P.E.) ropes of 16 mm diameter (breaking load 2800 kg), varying in length between 39/42 metres at the selvages to 17 metres in the centre of upper, lower and side panels (see figure 6).

The same rope trawl was also constructed with nylon (polyamide) ropes of 10 mm diameter (breaking load 2080 kg). The table in figure 1 gives an impression of the differences in gear geometry between the "meshed" midwater trawl and the various rope trawls. All vertical dimensions of the first rope trawl were better than those of the "meshed" midwater trawl.

With a propulsive power of appr. 1000 s.h.p., the fishing speed of the meshed trawl was 4.6 knots, while under almost the same conditions, the fishing speed of the first rope trawl was 4.1 knots.

The designed horizontal and vertical distance between the wing tips was 54 resp. 44 m.

According to the collected data of the "meshed" midwater trawl and the first rope trawl a new "rope panel" was designed and constructed (see figures 7 and 8).

The frame wires of that "rope panel" were assumed to be catenaries. The distance between the wing tips was horizontal 39 m and vertical 20 m. The connection points of the ropes to the webbing were supposed to lie in a plane perpendicular to the towing directions. The length of the ropes could be calculated now.

The nylon ropes (polyamide) have a diameter of 10 mm.

During the tests with that modified rope trawl it became clear that the design values could not be reached. Especially the vertical dimension of the "rope panel" were reduced in comparison with those of the first rope trawl and "meshed" trawl.

For the above mentioned reason the designed vertical distance between the wing tips was increased from 20 m to 32 m. The lengths of the side-wires remained the same, so the lengths of the nylon ropes had to be adapted (see figure 9). The results, after this modification, were better but especially the vertical dimensions did not come up to the expectations (see figure 1).

During the last trial, in November 1976, with the F.R.V. "Tridens" near the Canary Islands, the "rope panel" was converted. The horizontal wing tip distance became 45 m and the vertical one's 20 m (see figures 8 and 10).

The philosophy was than, when more slack is brought in the upper- and lower panels, the vertical net dimensions increase (balloon-effect).

This modification too did not come up to the expectations (see figure 1).

The last days of the trip were used to do some measurements on a rope trawl with a "meshed" upper panel (see figure 11). Therefore the "meshed" upper panel was connected to the headline and the selvages without removing the "rope" upper panel. For the results see figure 1.

In the designs of the rope trawls the elongation ( $\Delta$  1) of the ropes was not taken into consideration. In the opinion of the Institute we must first of all know what the distribution of the loads in the ropes and selvages looks like. The question was now how to get that information.

In a laboratory of the Institute of Fishery Products T.N.O. in IJmuiden, the elongations ( $\Delta$  1) as a function of the tension in the ropes and selvages was determined.

The selvages are made of double polyamide rope; 2 x 16 mm diameter with a breaking load of 2 x 5300 kgf.

The tests were carried out with wet material. The ropes and selvages, from an unused rope trawl, were marked with a fixed length of 1 metre.

During the last trip one haul was made with this rope trawl, only equipped with one netsounder. The shooting and hauling of the gear was done very carefully, to provide extreme tensions in the ropes and selvages during this operation. After the haul the elongation of the ropes and selvages was measured.

In combination with the laboratory test-results and these elongations measured in practice the loads in the different ropes and selvages could be determined. The lower panel of the rope trawl takes the main part of the load. Of course this is only an impression because this measurement could be done only once (see figure 12).

### Conclusions

The collected data of the different rope trawls indicate that the results of the "first" rope trawl are the best (see figures 1 and 6). The intention is to check the measurements of that rope trawl in 1977. The catchability of this trawl will also be tested during a trip in June, the start of the herring-season. Pending these results and the results of the different model-tests, a decision will be made how to continue the investigations in rope trawl design. The Institute also has the intention to do further investigations on a rope trawl with a "meshed" upper panel.

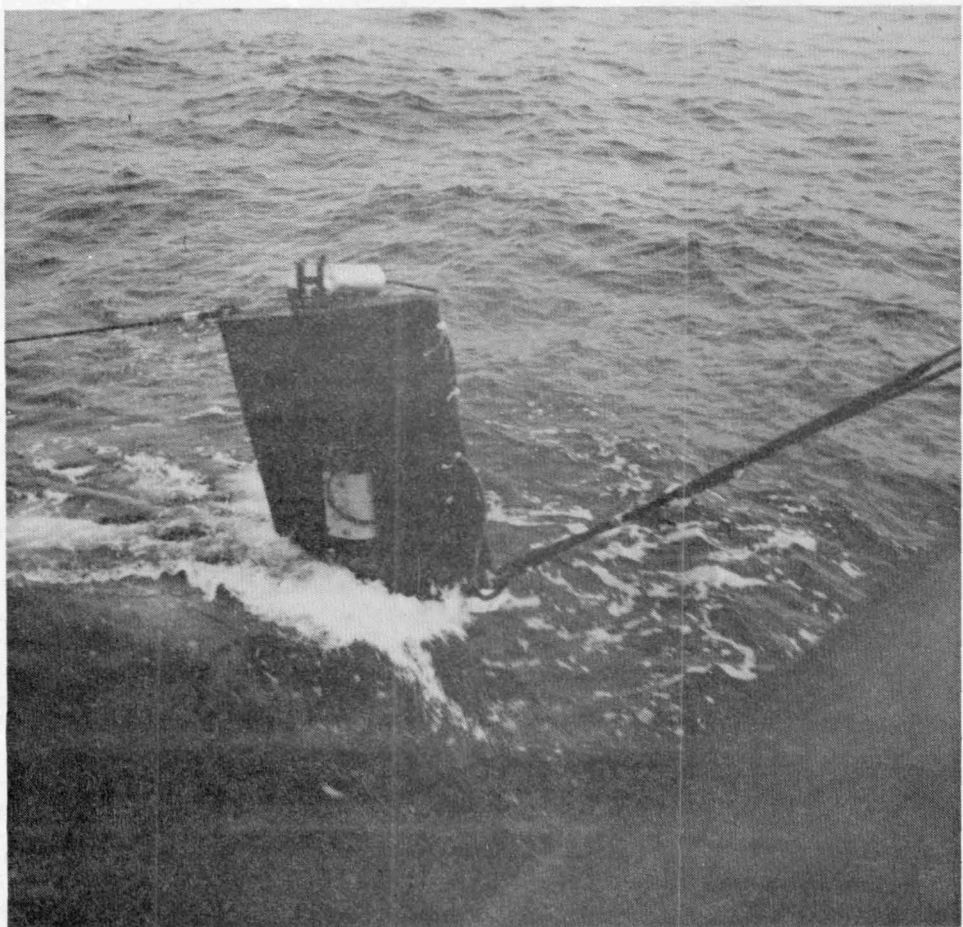
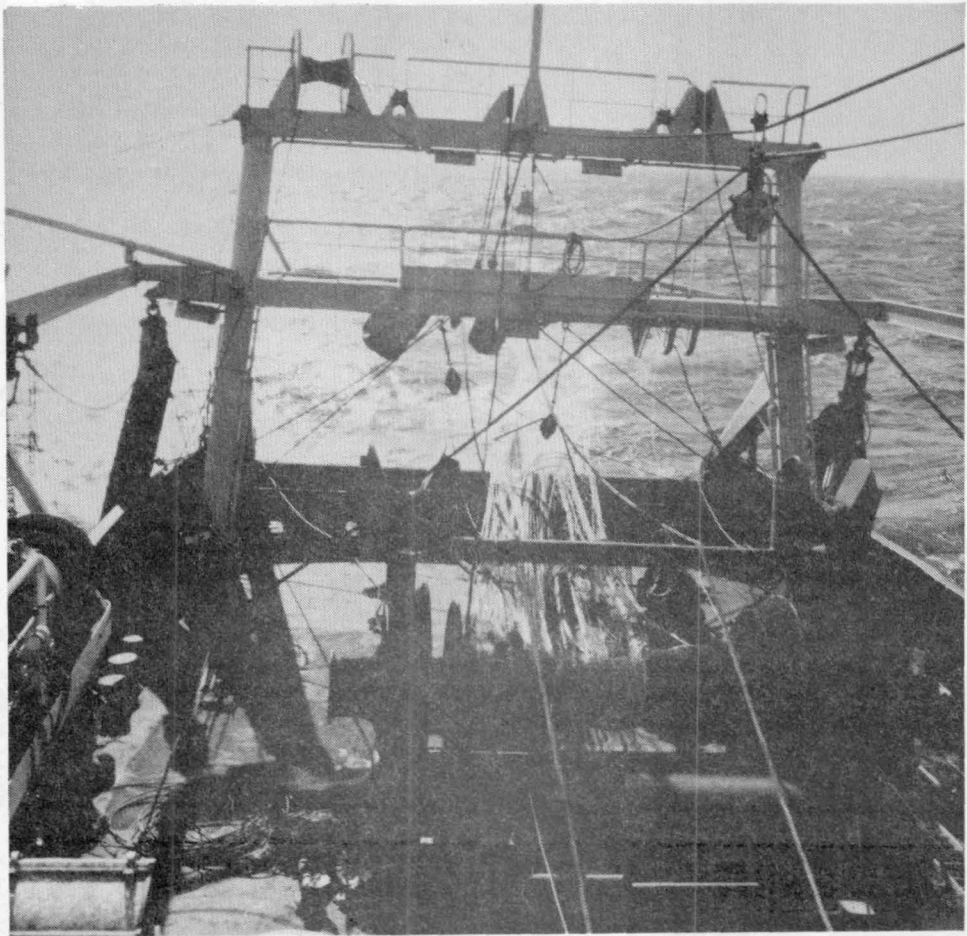


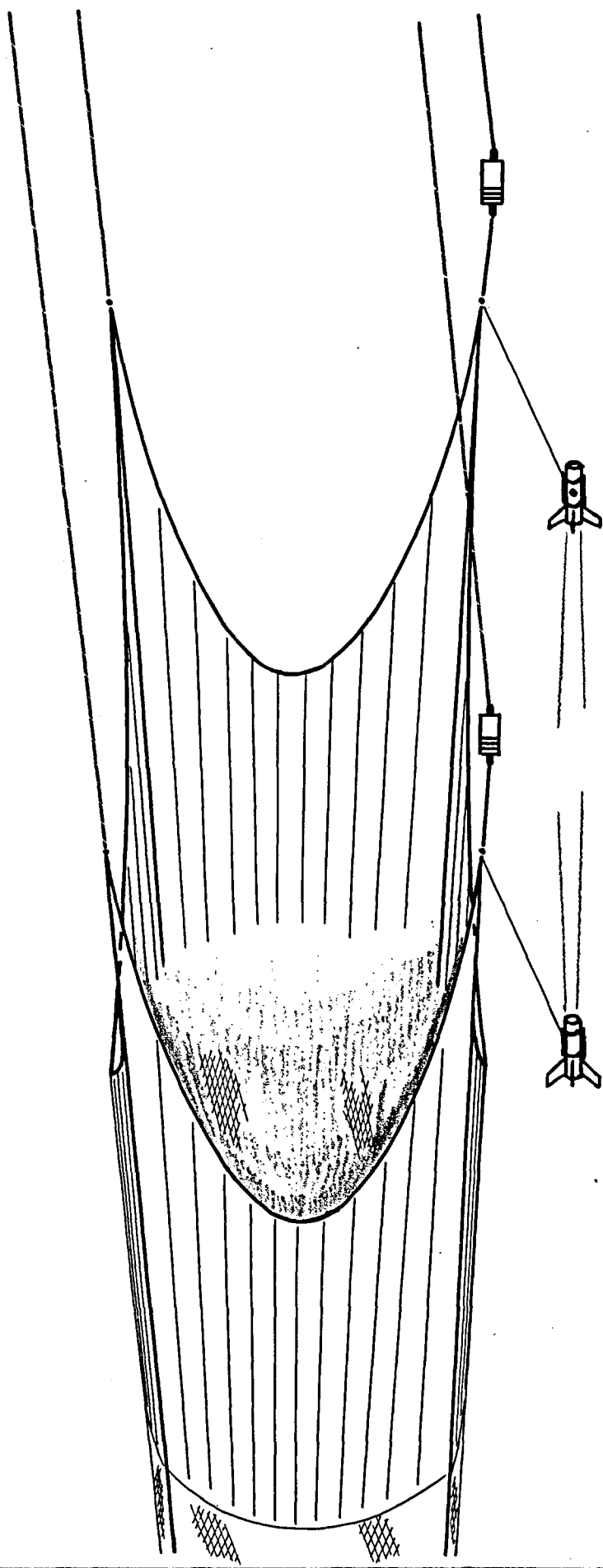
Figure 1

## MEASUREMENT RESULTS

=====

Warp length: 275 fathoms

	Propulsive power	Fishing speed	Total warp tension	Vert. dist. between wing tips	Hor. dist. between the wing tips	Vertical netopening	Horizontal netopening	Vertical netopening in 2nd netsection	Horizontal netopening in 2nd net section	Distance of head-line to the surface	Distance of doors to the surface	Spread of the doors	
"Meshed" midwater trawl 436 meshes x 80cm	990 hp	4.6 kn	10.3 tonf.	17 m (621 m <sup>2</sup> )	36.5 m	16.5 m (495 m <sup>2</sup> )	30 m	14 m (378 m <sup>2</sup> )	27 m	89 m	72 m	88 m	) lengthening of lower bridles=8.4 m
"First" rope trawl Design wing tip distances Hor.=54m Vert=44m } 2376m <sup>2</sup>	1010 hp	4.1 kn	11.1 tonf.	19 m (627 m <sup>2</sup> )	33 m	20.75 m (633 m <sup>2</sup> )	30.5 m	21 m (588 m <sup>2</sup> )	28 m	115.5m	98 m	71.5 m	
Rope trawl Design wing tip distances Hor.=39m } 780m <sup>2</sup> Vert=20m	1000 hp 970 hp	4.05kn 3.85kn	10.25tonf. 9.7 tonf.	13 m (475 m <sup>2</sup> )	36.5 m	15.25 m 15.25 m (457.5 m <sup>2</sup> )	28.5 m 30 m	12 m	16.5 m	96 m 97 m	79 m 80 m	92.5 m 93 m	) lengthening = 6.4 m weights=450 kg
Rope trawl Design wing tip distances Hor.=39m } 1248m <sup>2</sup> Vert=32m	1020 hp	4.8 kn	8.9 tonf.	(19 m) (542 m <sup>2</sup> )	28.5 m	17 m (451 m <sup>2</sup> )	26.5 m	14.5 m (341 m <sup>2</sup> )	23.5 m	77 m	53 m	68 m	) lengthening = 8.4 m weights=450 kg
Rope trawl Design wing tip distances Hor.=45m } 900m <sup>2</sup> Vert=20m	990 hp	4.5 kn	9.0 tonf.	17.75m (532.5 m <sup>2</sup> )	30 m	17.25 m (449 m <sup>2</sup> )	26 m	15 m	21.5 m	80 m	60 m	80 m	)
Rope trawl with "meshed" upper panel. Design wing tip distances Hor.=45m } 900 m <sup>2</sup> Vert=20m	1010 hp	4.3 kn	9.6 tonf.	15.5 m (542.5 m <sup>2</sup> )	35 m	18 m (477 m <sup>2</sup> )	26.5 m	14.5 m	(ca.23.5m)	82 m	71 m	68 m	) lengthening = 6.4 m weights=450 kg



TRANSDUCER.

TRANSDUCER.

Benaming MEASUREMENT HORIZONTAL DISTANCE BETWEEN THE WINGTIPS WITH WIRELESS NETSOUNDERS.

Formaat

A4

FIG. 2

Schaal

Gecontroleerd

Getekend A. Verbaan

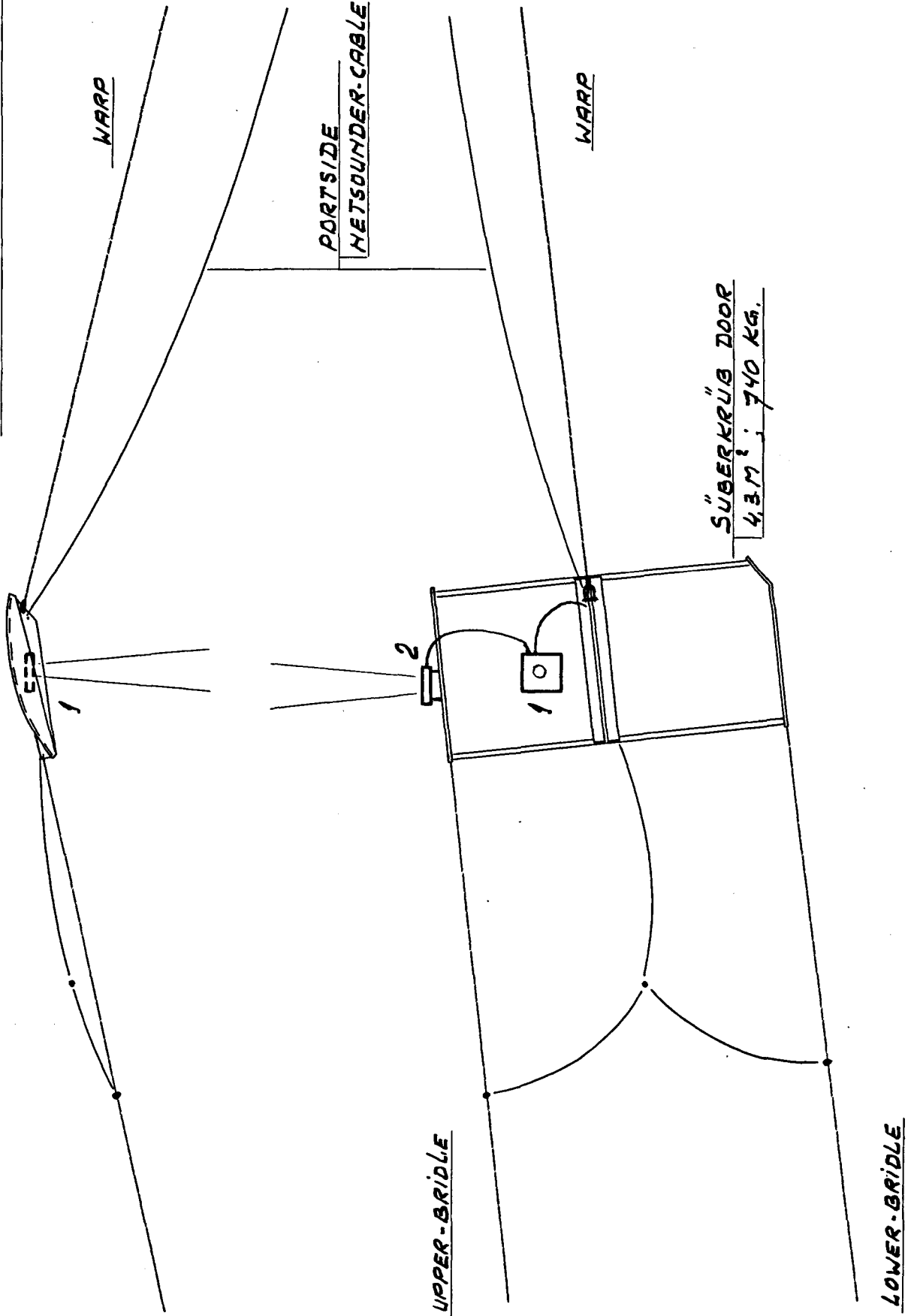
Gezien 1-4-1977

Rangschikmerk



1: DISTANCE BETWEEN THE DOORS

2: DISTANCE OF DOOR TO SURFACE



Benaming

SITUATION NETSOUNDERS ON SÜBERKRÜB DOOR

Formaat

A4

FIG. 3

Schaal

Gecontroleerd

Getekend *A. Verhaan*

Gezien 1-4-'77

Rangschikmerk,

1 : DISTANCE OF HEADLINE TO SURFACE

2 : VERTICAL NETOPENING

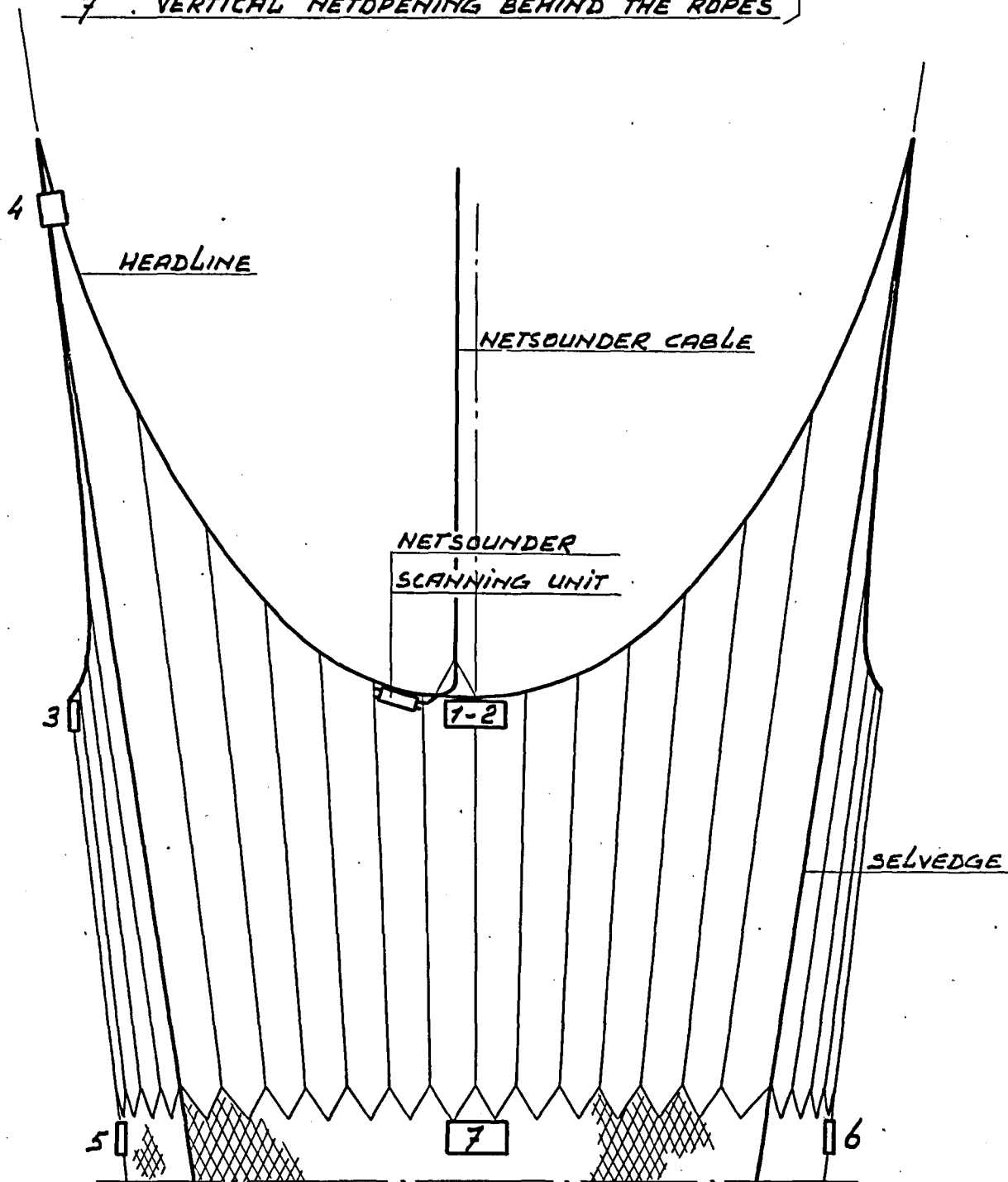
3 : HORIZONTAL NETOPENING

4 : VERTICAL DISTANCE BETWEEN WINGTIPS

5/6 : HORIZONTAL NETOPENING BEHIND THE ROPES

7 : VERTICAL NETOPENING BEHIND THE ROPES

STARBOARD  
NETSOUNDER  
WINCH.



Benaming SITUATION MULTI-NETSOUNDER IN ROPE-PANEL

Formaat

A4

FIG. 4

Schaal

Gecontroleerd

Getekend *A. Kerbaan*

Gezien *30.3.77*

Rangschikmerk

Auteursrecht voorbehouden volgens de wet

Getekend W. Toet.

Gezien

Rangschikmerk 70-A-05-07-30

**TECHNISCH VISSERYONDERZOEK**

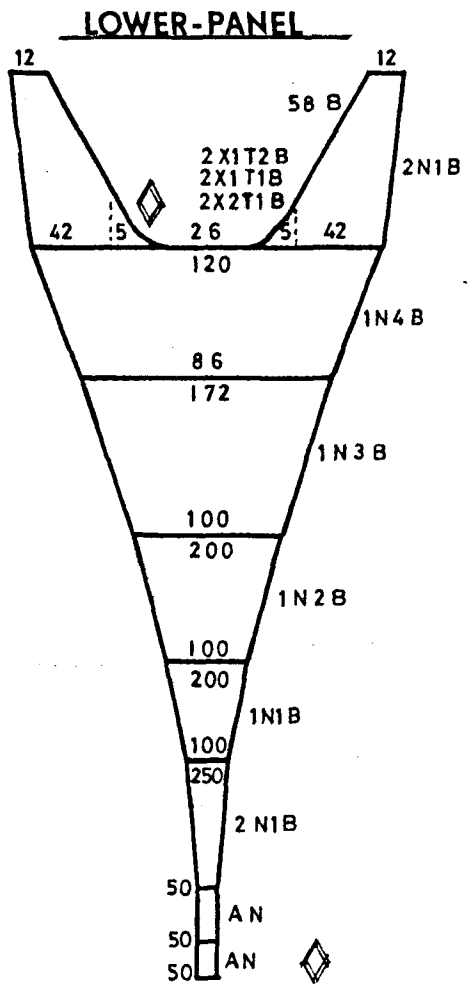
Schaal 1:1000

Gecontroleerd

**PELAGISCH NET**

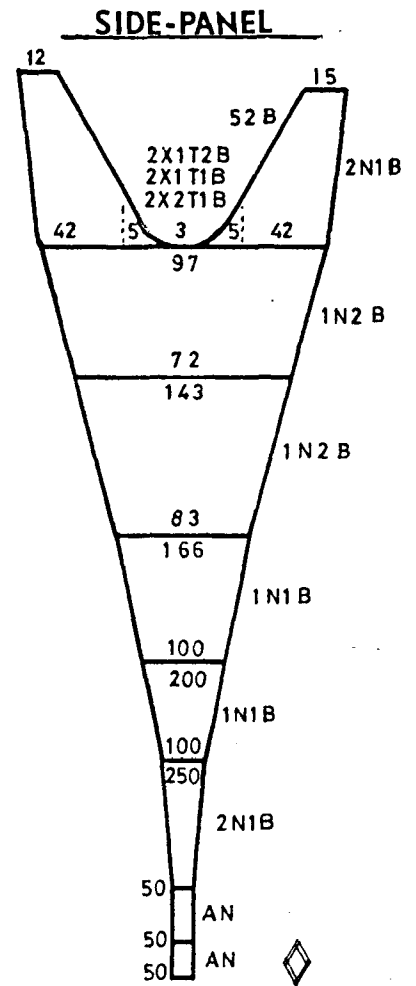
Benaming  
 Net van 434 mazen omtrek a 80 cm = 1736 mazen a 20 cm.  
 Voor schepen met motoren van 1100-1300 p.k.

Formaat  
**A4-263**



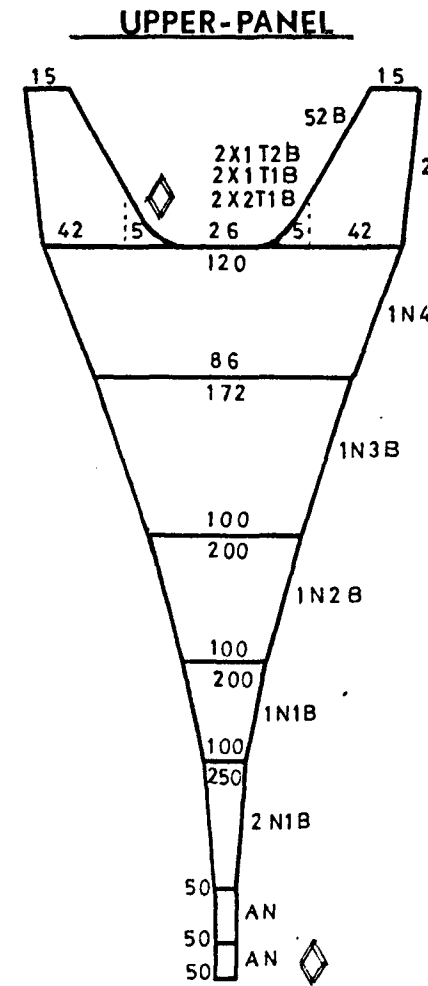
**Lengte Onderpees**

2,-	meter	Nok	
22,50		58 B	
2,-		2X1T2B	2X
1,40		2X1T1B	
2,-		2X2T1B	
8,-		Midden	
67,80		Totaal	



**Lengte Zijpees(2X)**

2,-	meter	Nok(2X)	
22,50		58 B	
2,-		2X1T2B	2X
1,40		2X1T1B	
2,-		2X2T1B	
20,15		52 B	
57,45		Totaal	



**Lengte Bovenpees**

2,-	meter	Nok	
20,15		52 B	
2,-		2X1T2B	2X
1,40		2X1T1B	
2,-		2X2T1B	
8,-		Midden	
63,10		Totaal	

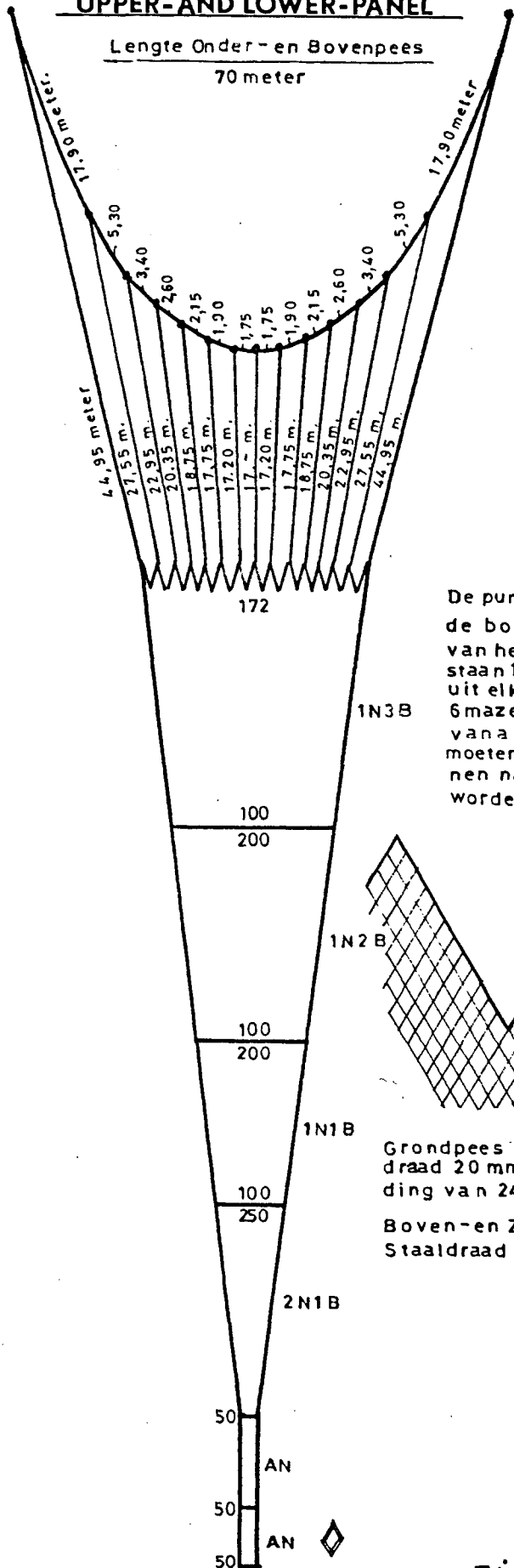
Lengte in mazen	Maast in mm	Garen dikte	Lengte in meters
33	800	210/180	26,40
30			
25	800	210/180	20,-
60	400	210/96	24,-
100	200	210/60	20,-
150	100	210/39	15,-
500	40	210/39	20,-
200	40	210/48	8,-
130	40	210/60	5,20
<b>Totaal</b>			<b>138,60</b>

FIG. 5



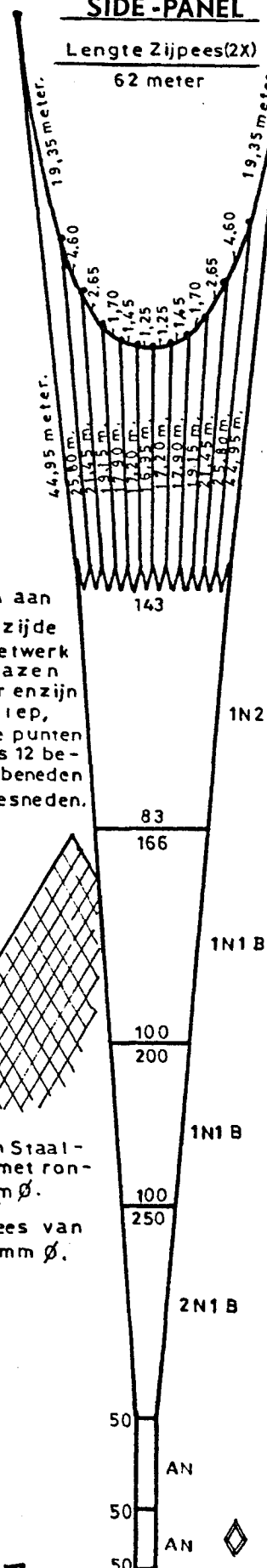
### UPPER-AND LOWER-PANEL

Lengte Onder- en Bovenpees  
70 meter



### SIDE-PANEL

Lengte Zijpees(2X)  
62 meter



De punten aan de bovenzijde van het netwerk staan 12 mazen uit elkaar en zijn 6 mazen diep, vanaf de punten moeten dus 12 benen naar beneden worden gesneden.

Grondpees van Staal-draad 20 mm  $\phi$ , met ronding van 24 mm  $\phi$ .

Boven- en Zijpees van Staal-draad 14 mm  $\phi$ .

Lengte in mazen	Maas in mm	Garen dikte	Lengte in meters
		De lijnen van het net naar de pezen zijn van Nymplex 16 mm $\phi$ , of van Nylon 10 mm $\phi$ .	
		De verlenging van de naden zijn van Nymplex 24 mm $\phi$ , of Nylon 16 mm $\phi$	44,95
60	400	210/180	24,-
100	200	210/108	20,-
150	100	210/39	15,-
500	40	210/39	20,-
200	40	210/48	8,-
130	40	210/60	5,20
Totaal			137,15

FIG. 7

Benaming PELAGISCH-NET

De mazen van de vlerken en 1<sup>e</sup> perk zijn vervangen door lijnen.  
Oorspronkelijk net voor 1100-1300 pk.

TECHNISCH VISSERYONDERZOEK

Schaal 1: 500

Gecontroleerd

Afgeleid van A4 263

Formaat

A4

734

Auteursrecht voorbehouden volgens de wet

Getekend W.Toet.

Datum: 12-4-1976

Rangschikmerk 76-A-05-07-70

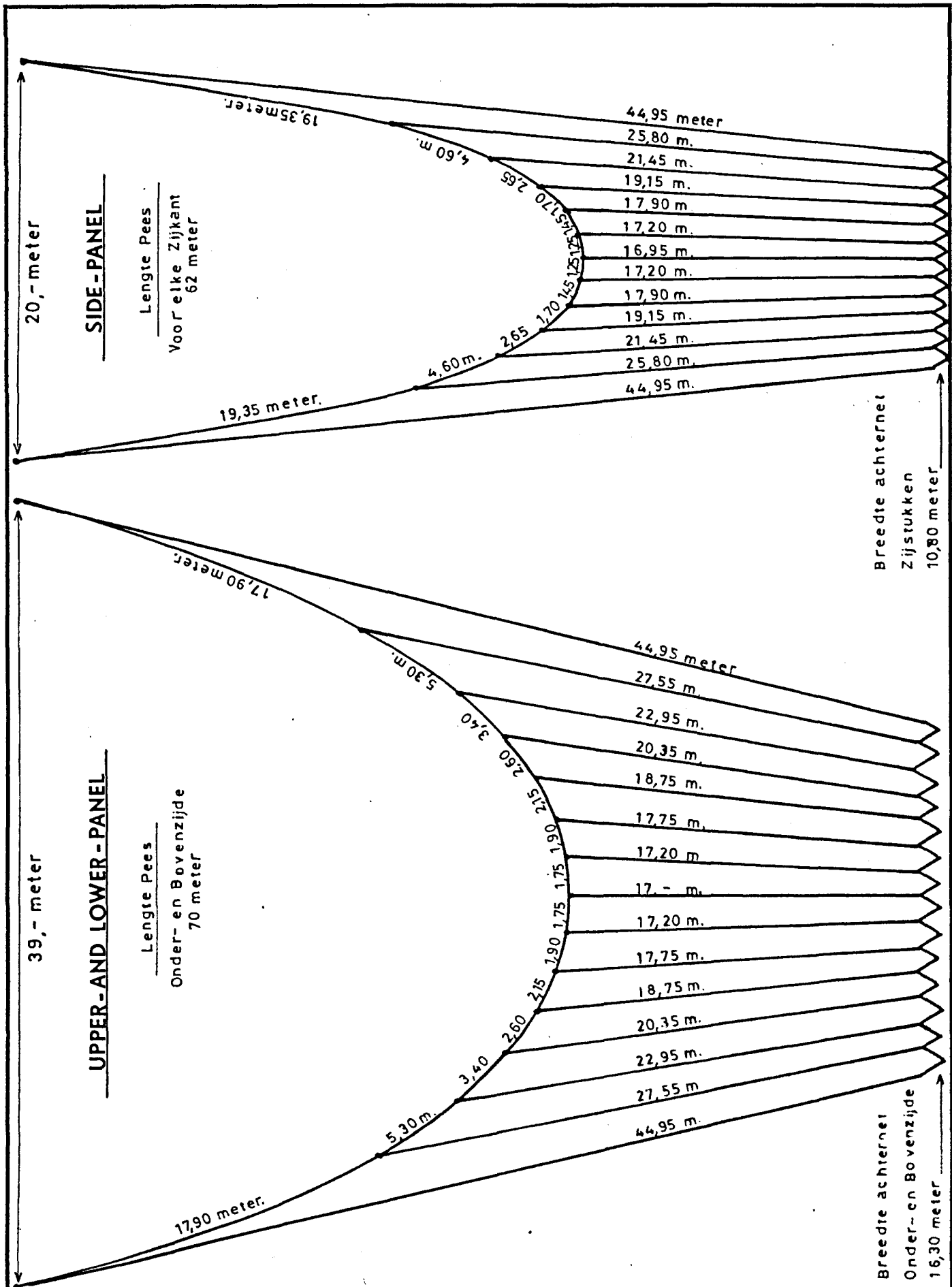


FIG. 8

Benaming <u>Verbeterde Kop van Lijnen-Net</u>		Formaat	
Zie voor opbouw van achternet nettekening A4/652		A4	
TECHNISCH VISSERYONDERZOEK	Schaal 1:250	Gecontroleerd	732
Auteursrecht voorbehouden volgens de wet	Getekend W.Toet.	Datum: 16-2-1976	Rangschikmerk 76-A-05-07-68

SIDE - PANEL

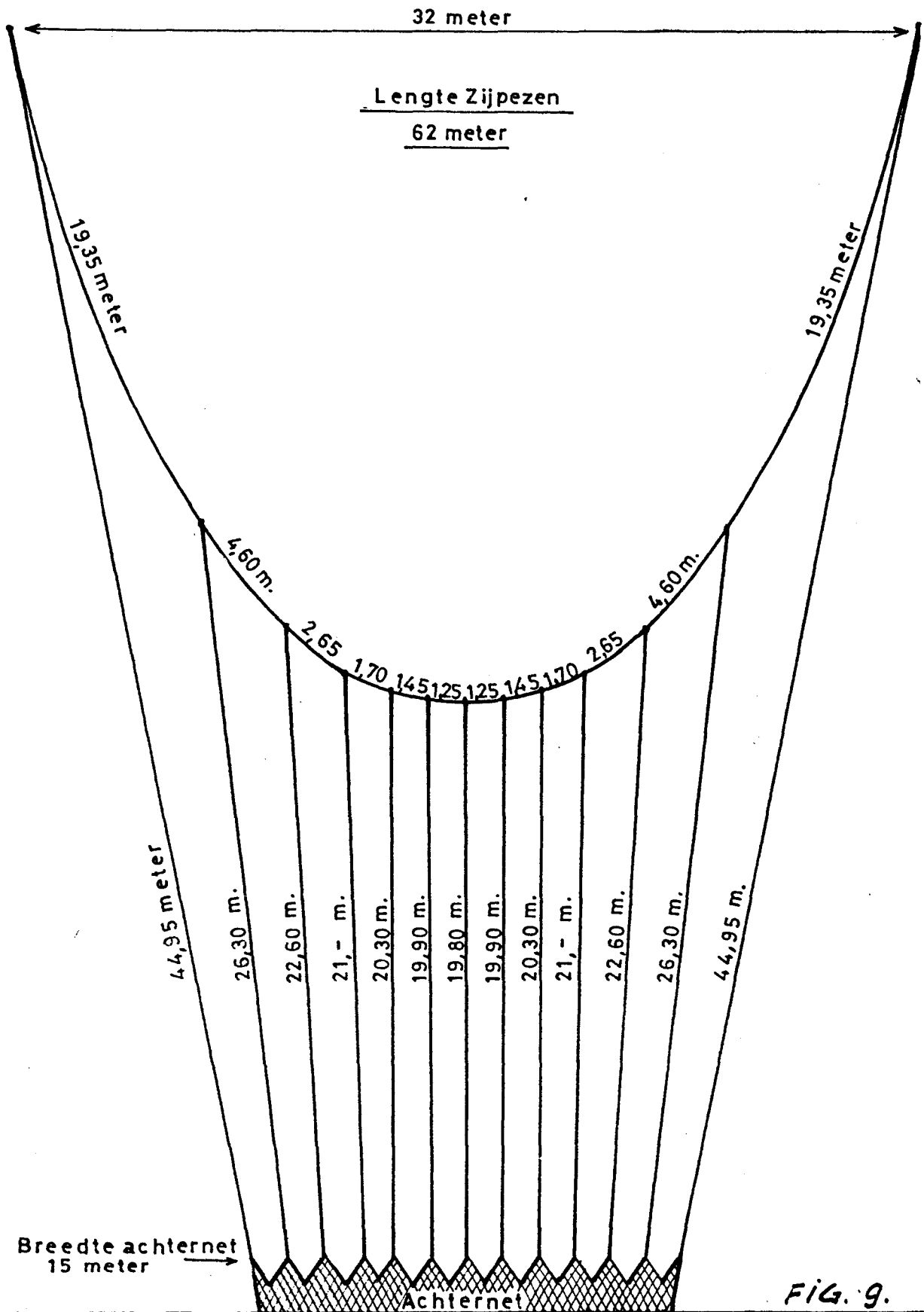


FIG. 9.

Benaming Gewijzigde zijkant van lijnennet van tekening A4/732. De verticale nokafstand is breder uitgezet waardoor de lijnen langer zijn geworden.

TECHNISCH VISSERYONDERZOEK

Schaal 1:200

Gecontroleerd

Formaat

A4

739

Auteursrecht voorbehouden volgens de wet

Getekend W.Toet.

Datum: 3-8-1976

Rangschikmerk 76-A-05-07-72

UPPER-AND LOWER-PANEL

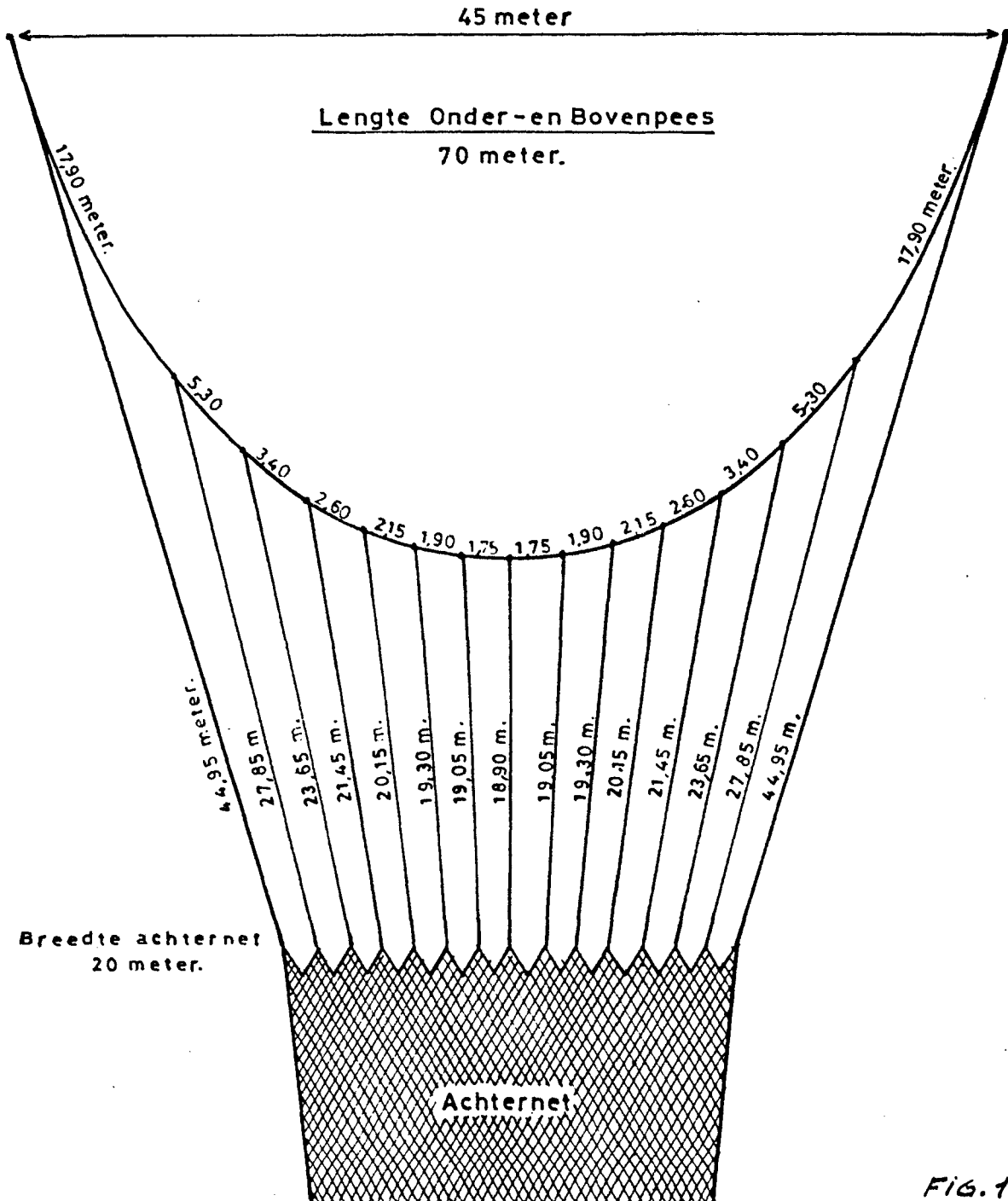


FIG. 10

Benaming	Kop van Onder- en Bovenzijde Lijnennet. Zoals deze tijdens de reis in november 1976 werd veranderd.		Formaat	750
	TECHNISCH VISSERYONDERZOEK.	Schaal 1:300		
Auteursrecht voorbehouden volgens de wet		Getekend W. Toet.	Datum: 10-1-1977	Rangschikmerk 77-A-05-07-74



**MESHED UPPER-PANEL FOR ROPE TRAWL**

Lengte Bovenpees	
31 meter	Vlerk
8	" Midden
31	" Vlerk
70	" Totaal

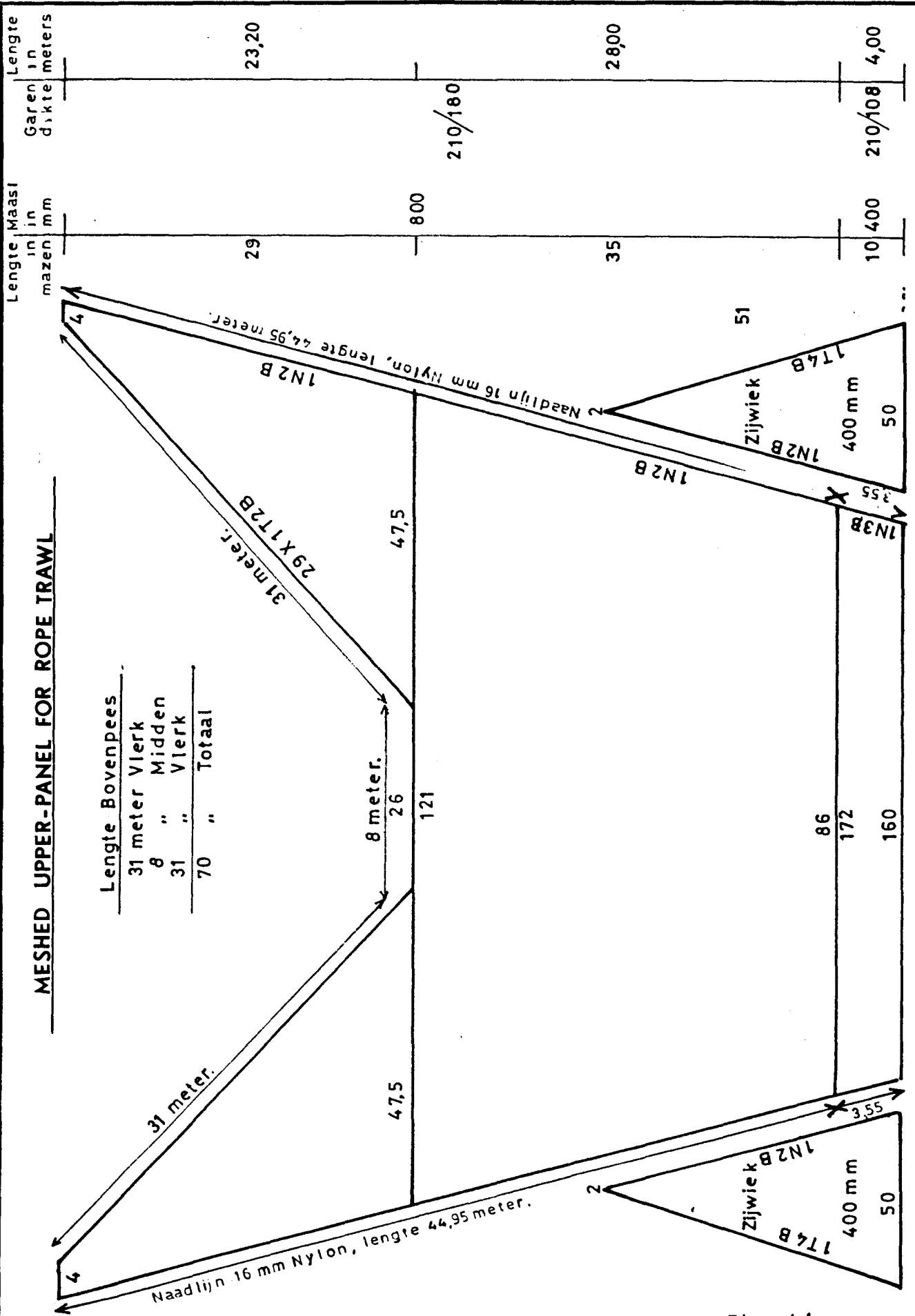


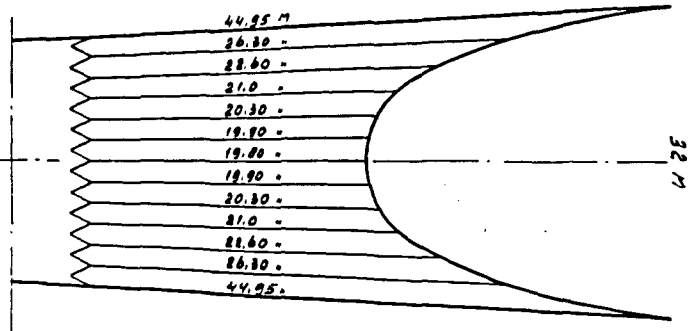
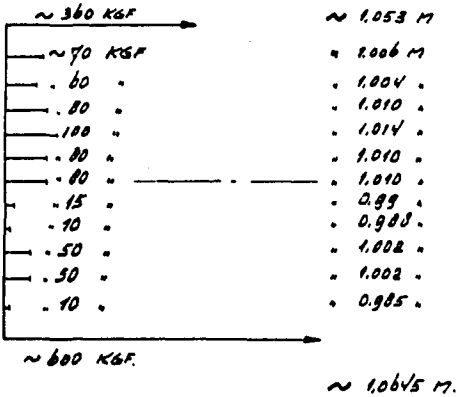
FIG. 77.

Benaming <u>Veranderde Kap met bovenvlerken voor Lijnennet</u>		Behoort bij A4/734	
TECHNISCH VISSERYONDERZOEK		Formaat	749
Auteursrecht voorbehouden volgens de wet		A4	
Schaal 1:300	Gecontroleerd	Rangschikmerk 77-A-05-07-73	
Getekend W. Toet.	Datum: 7-1-1977		

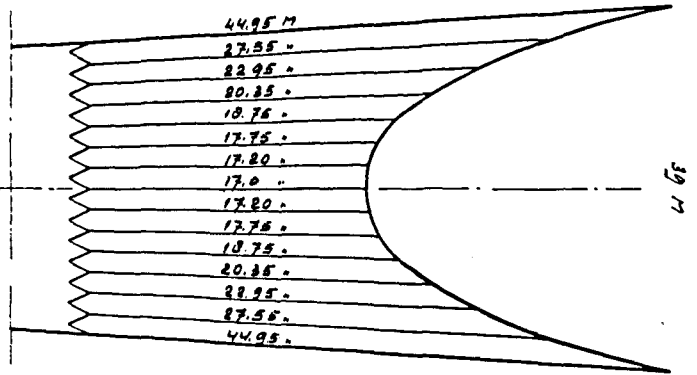
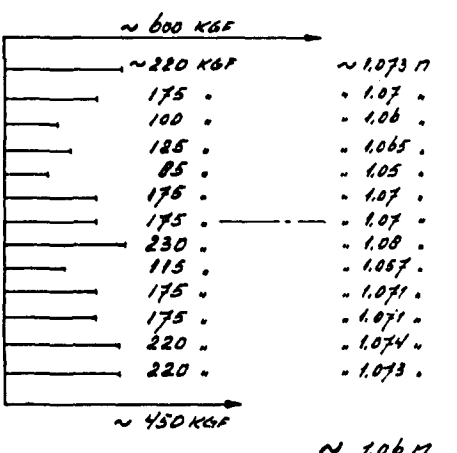
**LOAD :**

**ELONGATION / M :**

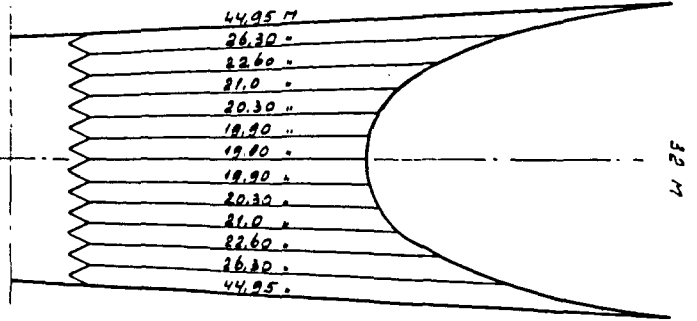
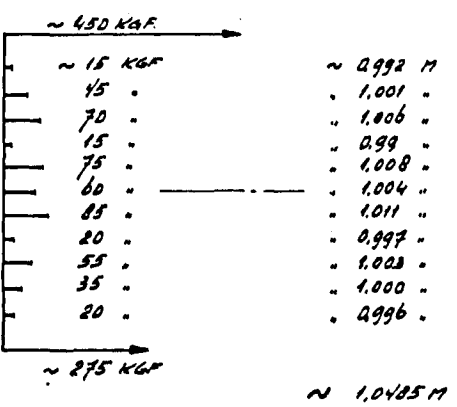
**DESIGN LENGTHS**



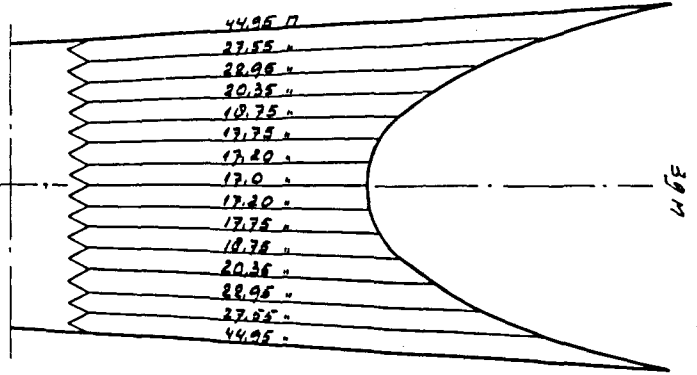
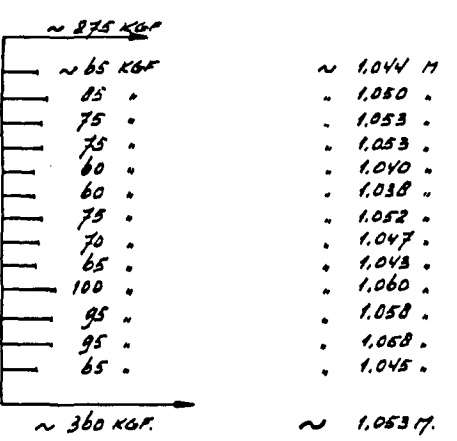
PORTSIDE-PANEL



LOWER-PANEL



STARBOARD-PANEL



UPPER-PANEL

PROPELLIVE POWER = 1100 SH.P.  
 WARP LENGTH = 550 M.  
 FISHING BOARD = 465 CM.  
 TENSION-POST = 49 TONS.  
 TENSION-STRAP = 4,7

Bemanning		Elongation/LOAD RESULTS	
Schiel	Gecontroleerd	Format	A3
Geekend P. H. de Vries	Gezien 13-1-1977	Fig. 12	
Auteursrecht voorbehouden		Rangschikmerk	