MINISTERIE VAN LANDBOUW
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Kommissie voor Toegepast Wetenschappelijk Onderzoek
in de Zeevisserij (T.W.O.Z.)
(Voorzitter : F. LIEVENS, directeur-generaal)

APPLICATION OF THE SEINE FISHERY PRINCIPLE IN PAIR TRAWLING

G. VANDEN BROUCKE

Onderwerkgroep " Techniek in de Zeevisserij "

Mededelingen van het Rijksstation voor Zeevisserij (CLO Gent)

Publikatie nr. 115 - TZ/73, 1975

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D/1975/0889/14

INTRODUCTION.

In the period March-August 1974 research on the so-called Danish Pair Trawl System was carried out in Belgium.

The Danish Pair Trawl System is a kind of pair trawling by which the principle of the seine-net fishery is partly applied. The seine-net fishery itself is based on two principles : in the first place the ropes are used to herd the fish towards the net and secondly to keep the net open.

The Danish and Scottish methods of seining require only one vessel. After the warps have been shot and the net set the hauling in the Danish system is stationary, whereas in the Scottish system the vessel keeps steaming while hauling the net .

In the Danish Pair Trawl fishery a special rigging is used to obtain the effect of the seine fishery. Two trawlers steaming at a certain distance from each other, tow a pair trawl with long bridles.

The present paper gives a description of this fishing techniques.

In a first paragraph the net and its rigging are described. A second paragraph deals with the shooting and hauling of the net, whereas in a third paragraph some considerations are given.

§ 1.- The net and its rigging.

a. The net.

The caracteristics of the net are given in figures 1 and 2 and in tables 1 and 2.

b. The rigging.

The rigging of the net is schematically given in figure 3. Figures 4 and 5 show details of the danleno, the triangle and the legs.

Table 3 gives some specifications of the rigging of the net.

As to the rigging, it must be mentioned that during the experiments some modifications were made.

1) In the first place the long and short bridles made of cable were replaced by steel wires.

This reduces the wear and the breaking of the bridles, when fishing on rough grounds.

On the other hand this change resulted in enough weight to keep the bridles on the ground.

2) Secondly it must be noticed that either a danleno (with arm) figure 4) or a triangle (figure 5) was used.

Table 1 - Characteristics of the "Danish pair" trawl

Net part		A	A_1	C	C_1	C_2	D	E	F	G	H
Material		PA	PA	PA	PA	PA	PA	PA	PA	PA	PA
Color		black	black	black	black	black	black	black	white	white	white
Mesh sizes (mm)		120	120	120	120	120	120	120	100	100	100
Breaking load of the yarn (kg)		266	266	266	266	266	266	266	266	266	2x266
Titre R ... tex		4100	4100	4100	4100	4100	4100	4100	4100	4100	4100
Length headline (m)		35.6									
Length groundrope (m)		39									
Number of meshes upperside		3	2	46	41	57	206	180	180	80	50
Number of meshes underside		46	41	83	57	70	180	145	80	50	50
Depth of net pieces		21.5	19.5	100.5	80	40.5	20	70	100	45	40
Cutting rate	outer	B	B	1N8B	1N8B	1N4B	1N4B	3N2B	1N2B	1N1B	N
	inner	B	B	16x12BIT+52B	B	B					
Taper ratio	outer	1/1	1/1	4/5	4/5	2/3	2/3	1/4	1/2	1/3	0/1
	inner	1/1	1/1	96x7/6+26x1/2	1/1	1/1					

Table 2 - Some dimensions (m) of the net

Dimensions	Dimensions of the net (fig. 1 and 2)
Length of the extension of the headline	1.20
Length of the extension of the groundrope	1.70
Length headline	35.60
Partition headline	1.20 + 15.50 + 2.20 + 15.50 + 1.20
Length groundrope	39.00
Partition groundrope	1.70 + 16.70 + 2.20 + 16.70 + 1.70

Figure 1 – Plan of the „Danish pair" trawl – upper panel

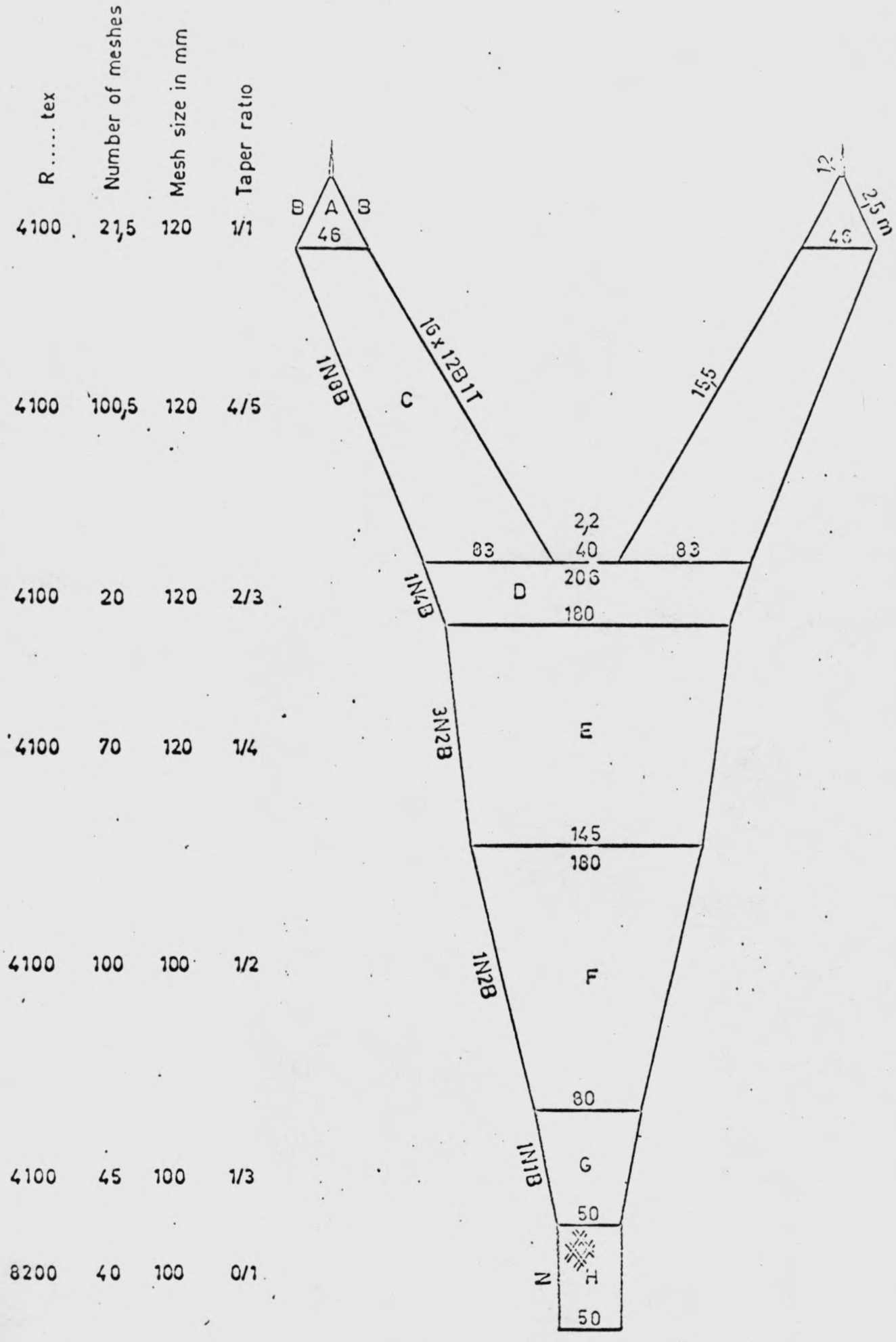


Figure 2 _ Plan of the „Danish pair" trawl _ lower panel

R.....tex	Number of meshes	Mesh size in mm	Taper ratio
4100	19,5	120	1/1
4100	80	120	4/5
4100	40,5	120	2/3
4100	70	120	1/4
4100	100	100	1/2
4100	45	100	1/3
8200	40	100	0/1

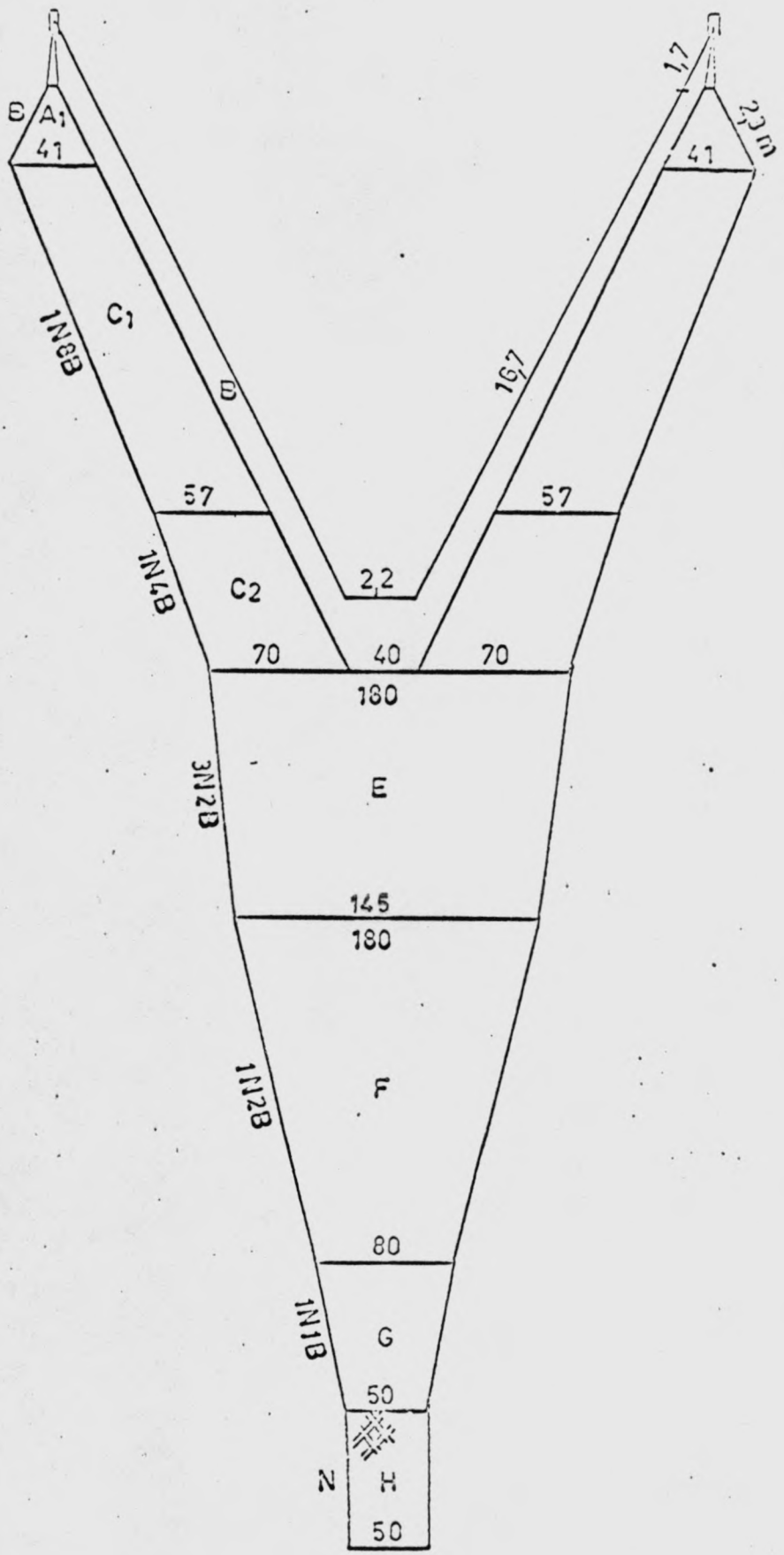


Table 3- Specifications of the rigging.

Parts	Material	Diameter (mm)	Length (m)
A (upper leg)	mixed	16	28.00
B (lower leg)	mixed	24	28.60
H (danleno and chain)		16	1.50
H_1 (connecting shoe)	steel		
C (extension of the headline)	mixed	16	1.20
D (extension of the groundrope)	mixed	16	1.70
E (upper wing headline)	mixed	16	15.50
F (headline of the square)	mixed	16	2.20
G (groundrope of the lower wing)	steel wire	14	16.70
F_1 (bottom groundrope)	steel wire	14	2.20
I (short bridle)	steel wire	18	90.00
J (long bridle)	steel wire	18	180.00
K (warp)	steel wire	16	275-550
Danleno : - large (2 pieces)	rubber	370	0.22
- small (4 pieces)	rubber	270	0.16
Arm : - upper side	steel plate	0.10 m width and	
- lower side	steel plate	0.01 m thickness	
Triangle : equilateral triangel of 0.16 m and 0.02 m thickness			

Figure 3_ Scheme of the rigging

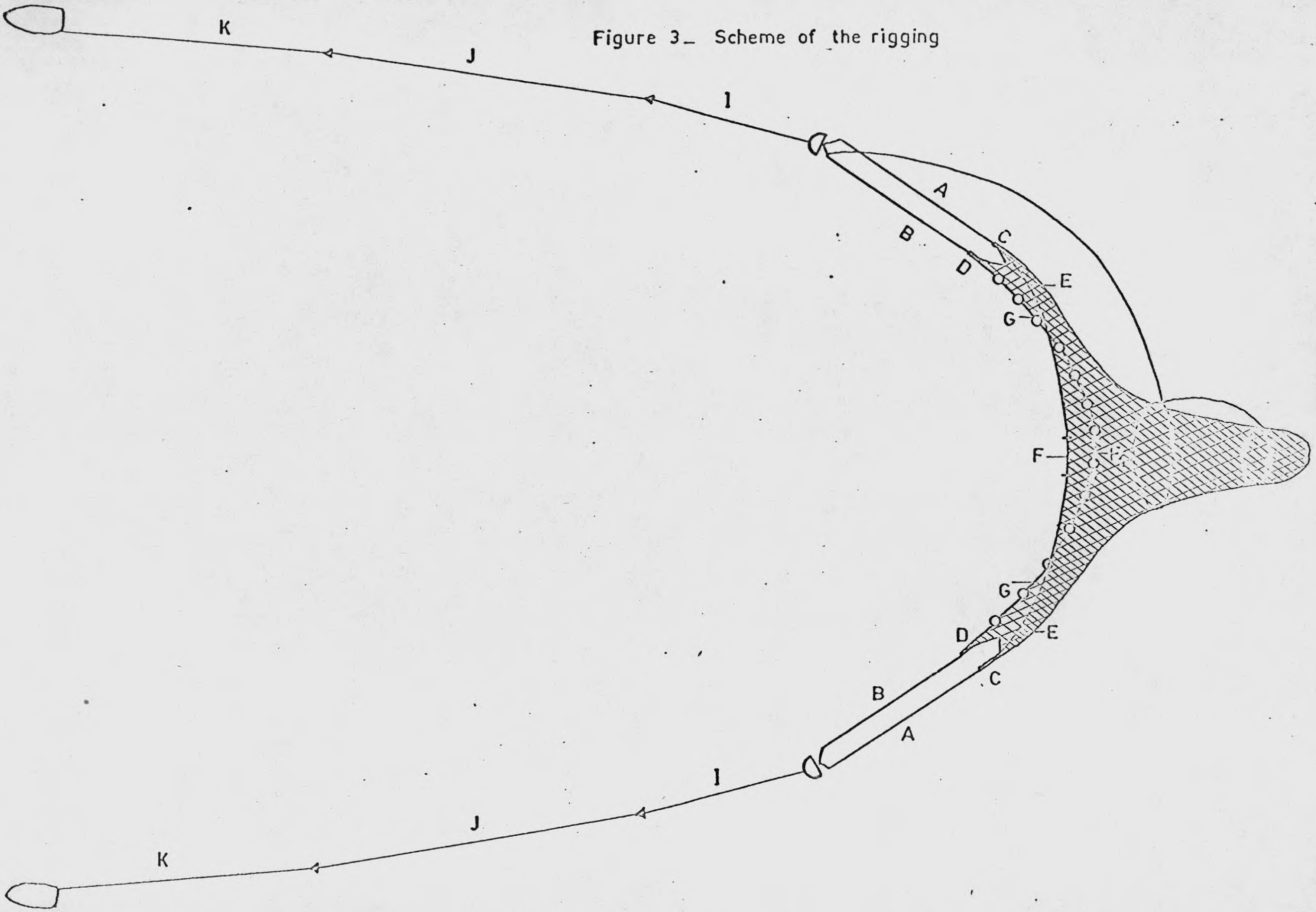


Figure 4 – Detail of the danleno and legs

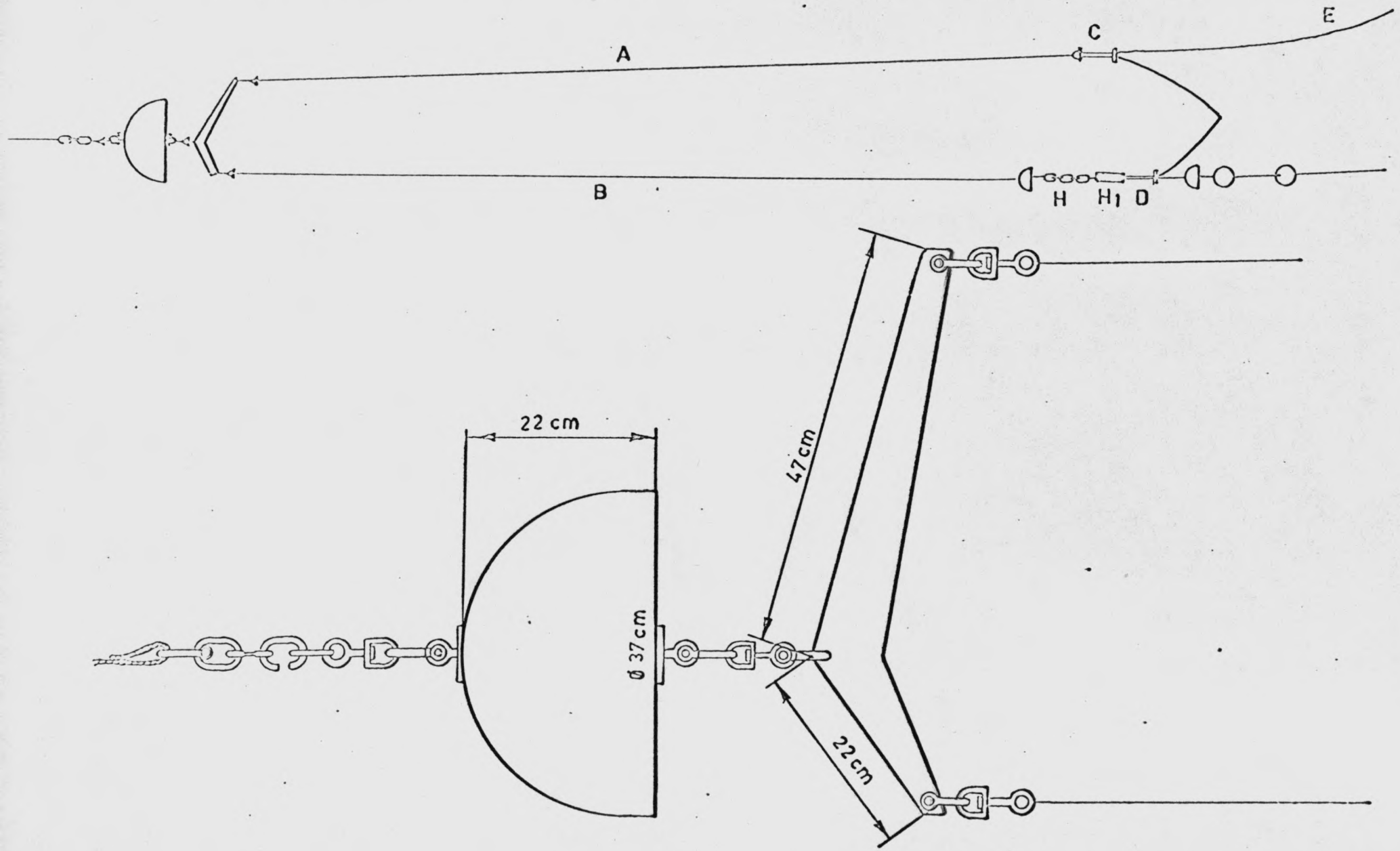
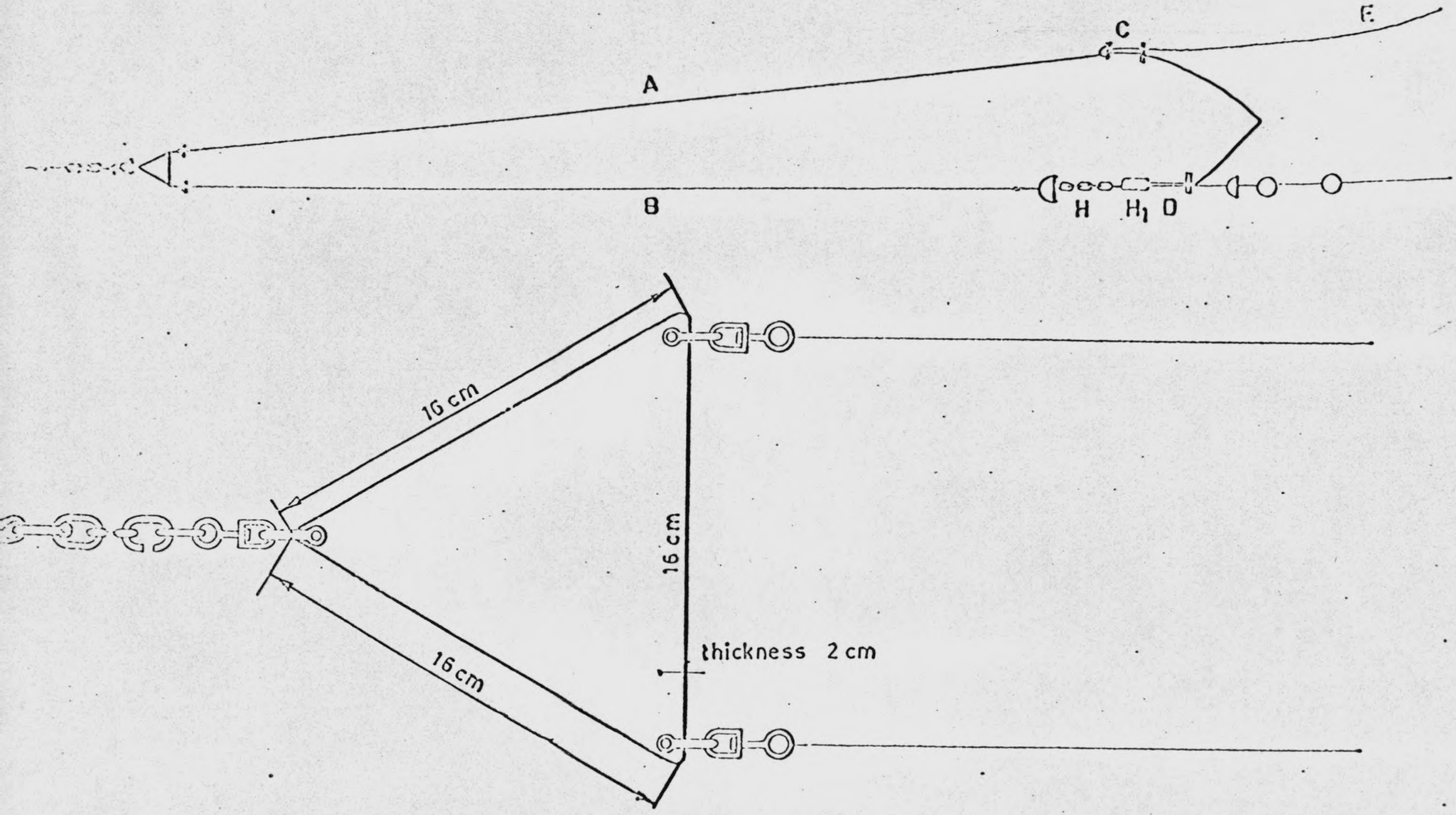


Figure 5 _ Detail of the triangle and legs



When using the danleno the arm was often deformed and while fishing the legs turned around each other. Nevertheless, on some vessels the danleno continued to be used for fishing more easily on rough grounds with less damage to the net.

When using the triangle the time needed for hauling could be shortened, as it was possible to wind up as far as the net, in other words the danleno must not be pecked out. On the other hand the fishing efficiency increased, especially for demersal fish, because the bridles were nearer to the bottom.

3) Finally the length of the legs was changed in the sense that the lower leg was shortened (to fish on rough grounds) or lengthened (to catch more demersal fish on smooth grounds).

The difference in length between the upper and lower legs is very important from the point of view of fishing efficiency as well as for the possibility to fish on rough grounds.

The length of the lower leg is measured from the arm or triangle to the bolt connecting the shoe and the groundrope, whilst the upper leg is measured from the arm or triangle to the extension of the headline.

This difference in length amounts to 0.60 m and is adjusted by means of a chain between the danleno and the connecting shoe.

The partition of the bobbins and the floats is given in figures 6 and 7.

§ 2. - Shooting and hauling of the gear.

During the experiments shooting and hauling were carried out in a special manner.

Figure 6 _ Partition of the bobbin chain

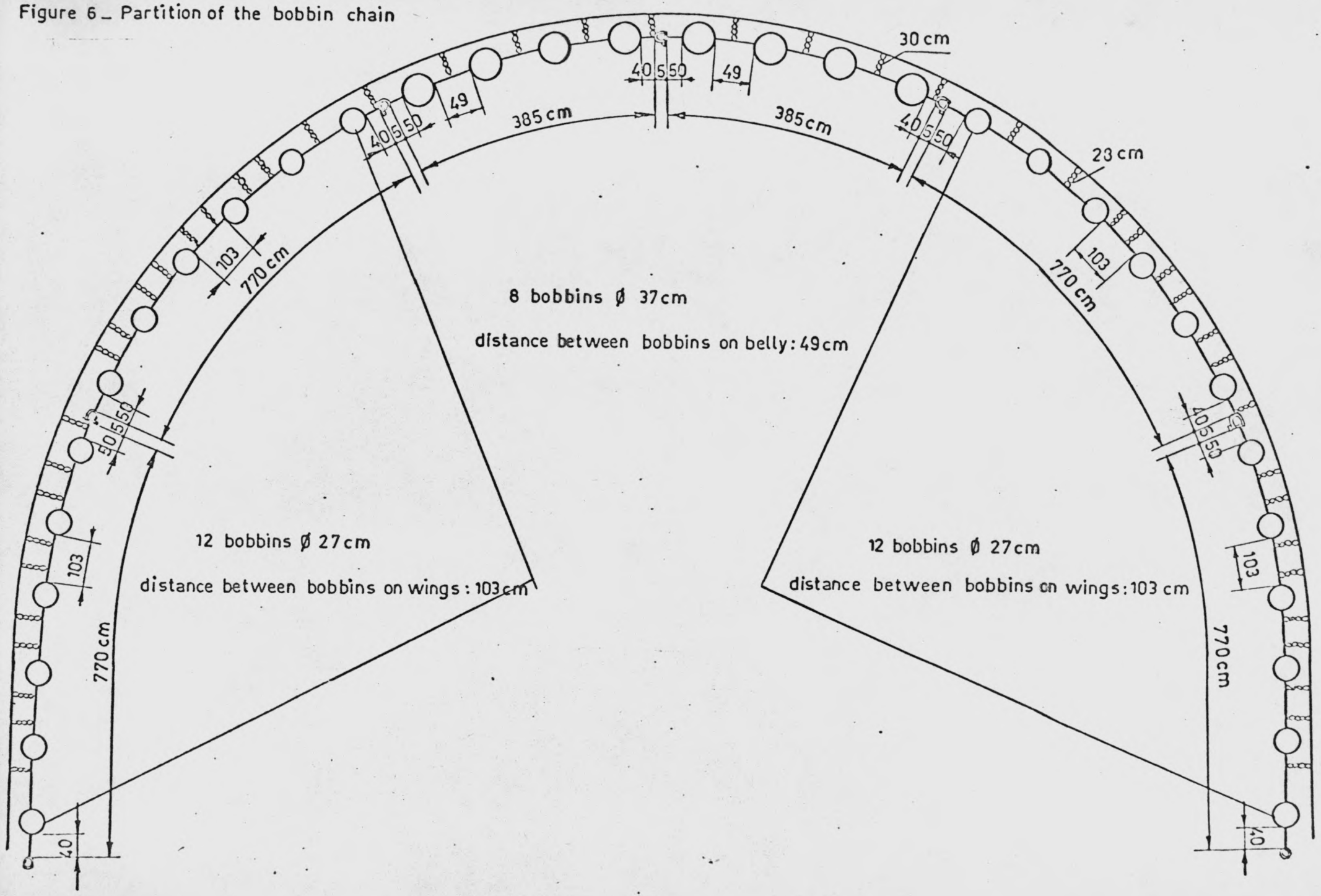
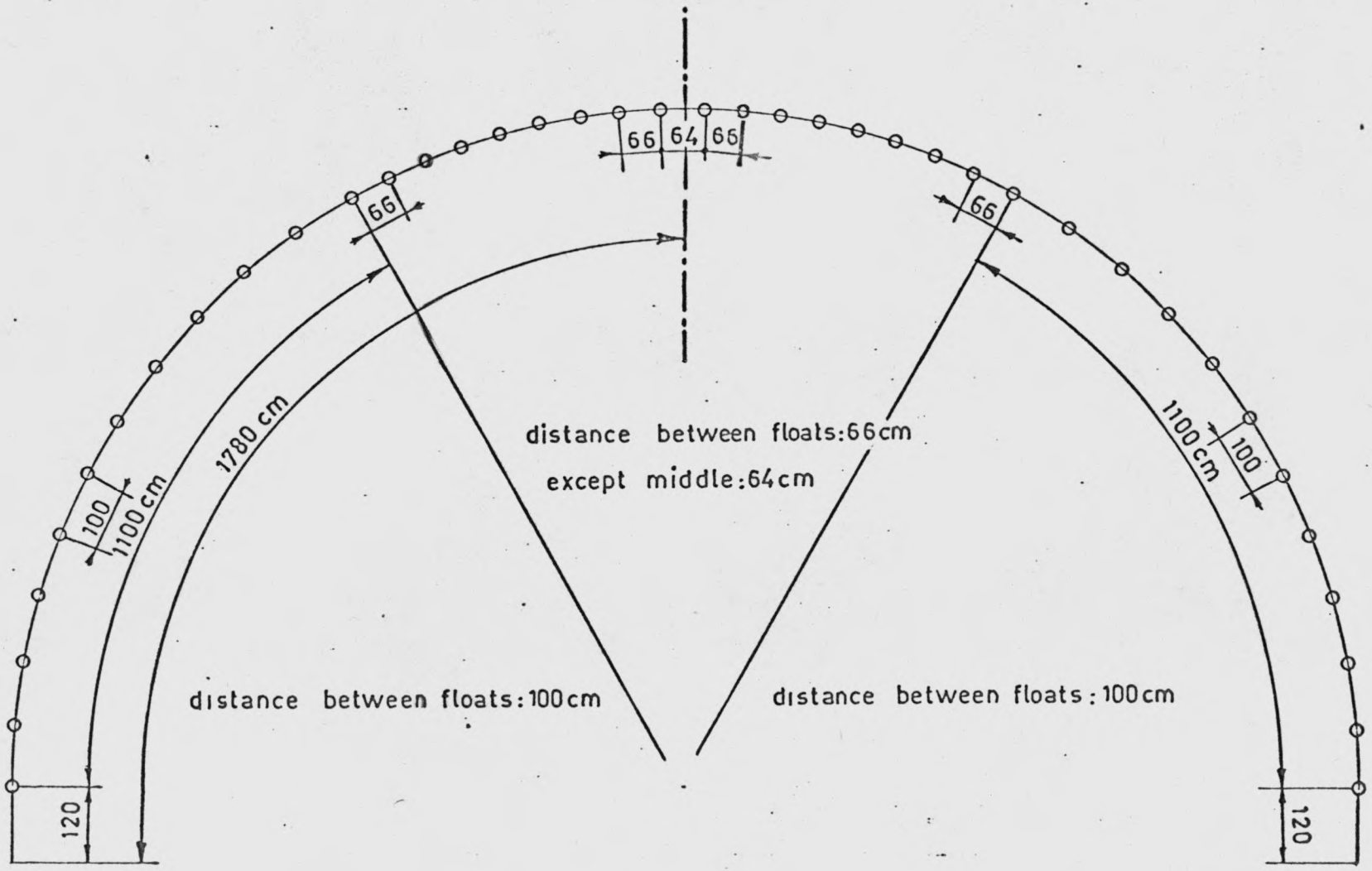


Figure 7_ Partition of the floats



a) Shooting.

The shooting of the gear can be described in four phases (figures 8-11).

1. Phase 1.

Vessel A with the net on board shoots on starboard the net and legs up to the danleno. Vessel B approaches vessel A starboard aft and hands over a line.

The aft danleno, this is the danleno at the aft gallows of vessel A, is wound up by means of the line to the front gallows of vessel B. The short bridle is then pecked in the danleno. The line is loosened and remains on board of vessel B.

2. Phase 2.

The two vessels both have a danleno in the front gallows, so that the short bridle can be shot.

Ship A, turning 10° over starboard, slowly, shoots the short bridle, while vessel B, approaching vessel A at portside, also gradually shoots the short bridle.

3. Phase 3.

Both vessels now have their short bridles shot and shooting can be continued. In the meantime they steam in the fishing direction.

4. Phase 4.

After shooting the long bridles and the warps the two ships should be at a distance of 1/4 mile (460 m) from each other.

Figure 8 _ Shooting: phase 1

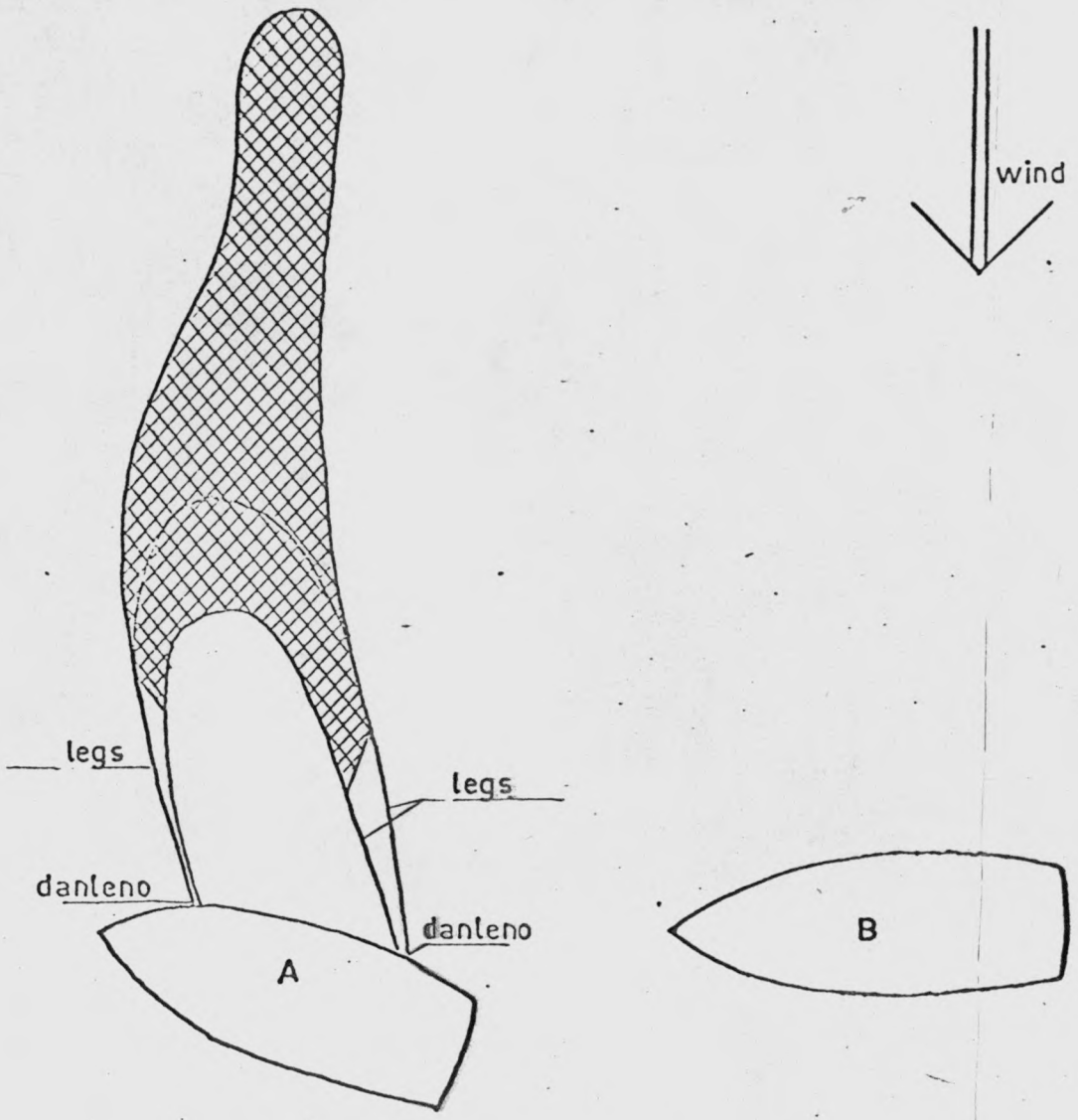


Figure 9 _ Shooting: phase 2

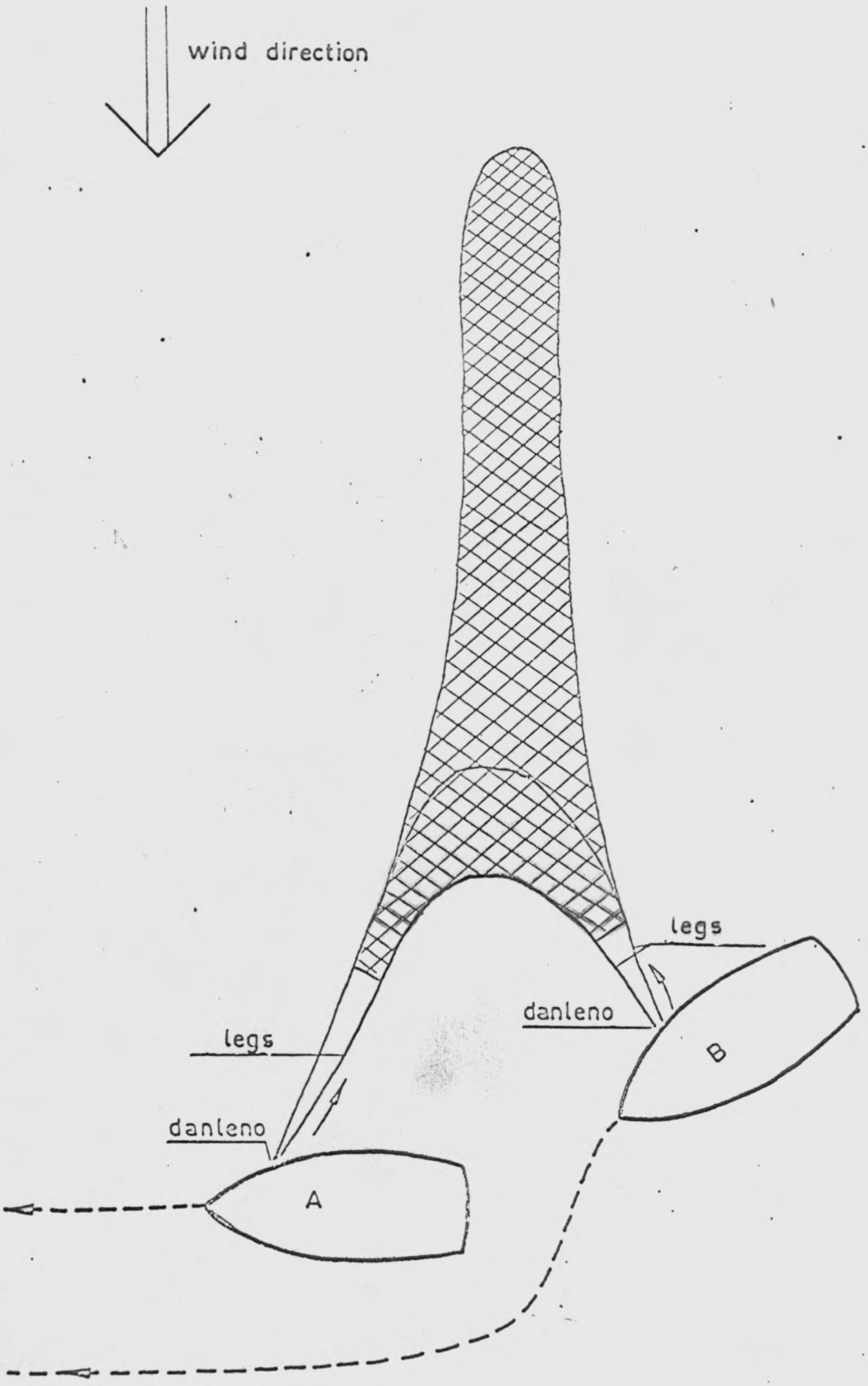


Figure 10 – Shooting : phase 3

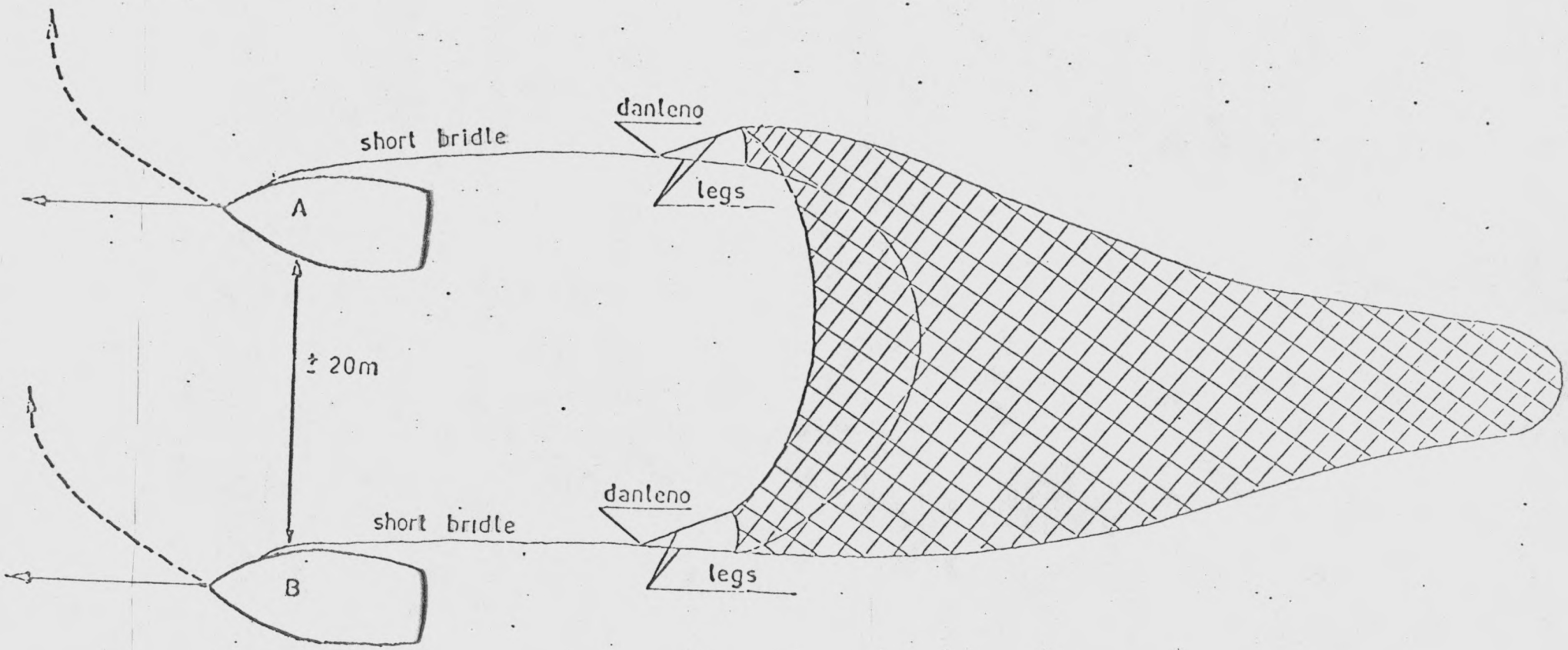
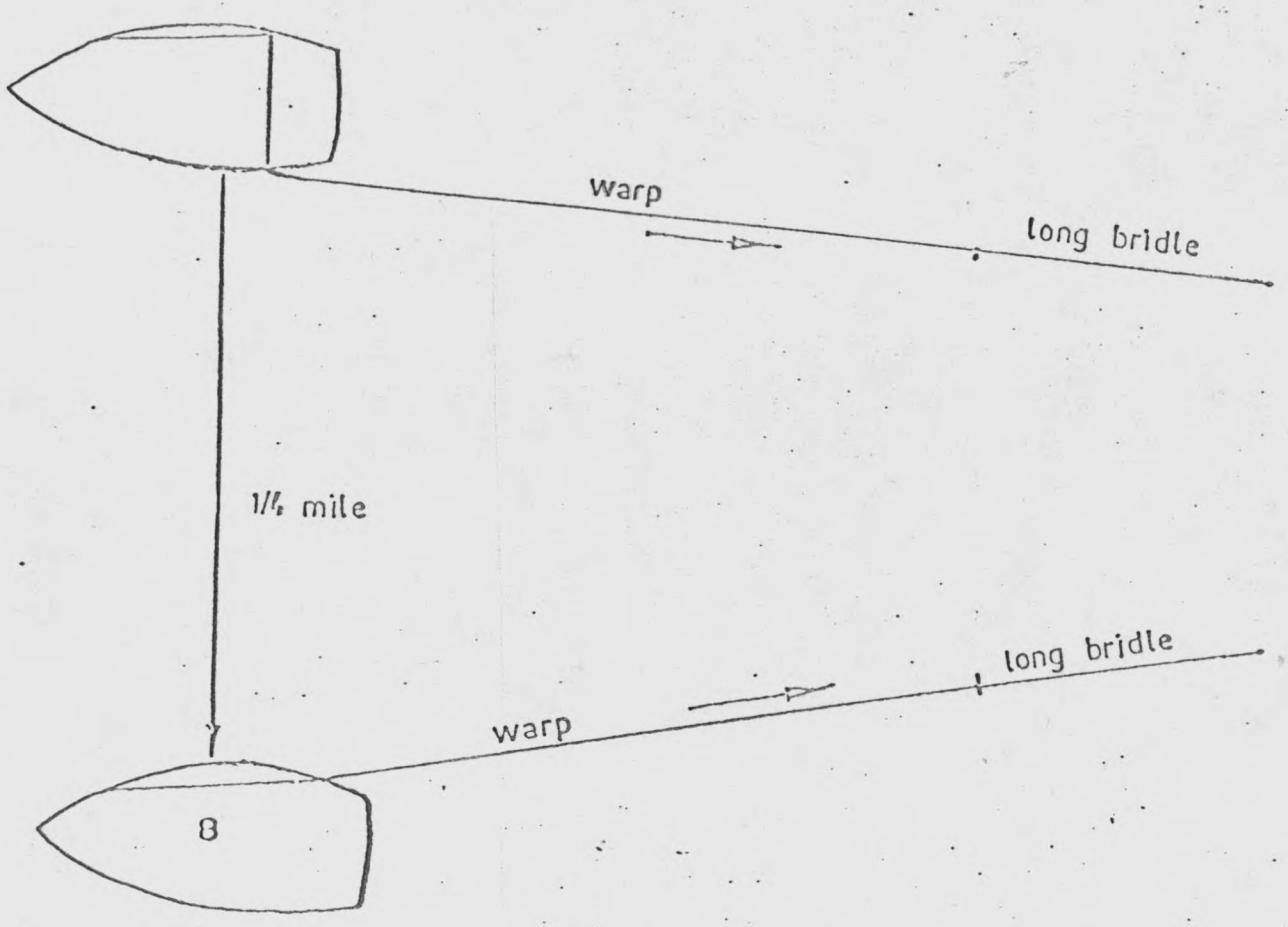


Figure 11 – Shooting: phase 4



The warp length shot is only partly function of the depth. For example 250 fathoms can be shot for depths of 35 fathoms as well as for depths of 45 fathoms. The warp length is determined by the distance of 1/4 mile between both vessels. With less warp, and for a same distance between the two vessels, the angle increases, the bridles act as tickler chains and the fish swim over the bridles.

b) Hauling.

The hauling of the gear can be described in five phases (figures 12-16).

1. Phase 1.

Both vessels approach each other at the distance of 50 m and continue fishing for about seven minutes at a higher speed because the angle of the bridles decreased.

2. Phase 2.

When hauling the warps on the front gallows both ships turn with their stem towards the net.

The warps and the long bridles are taken in, up to the swivel connecting the short and the long bridle.

3. Phase 3.

If both vessels are in the right hauling direction according to the wind direction the short bridles are tightened.

Figure 12 _ Hauling : phase 3

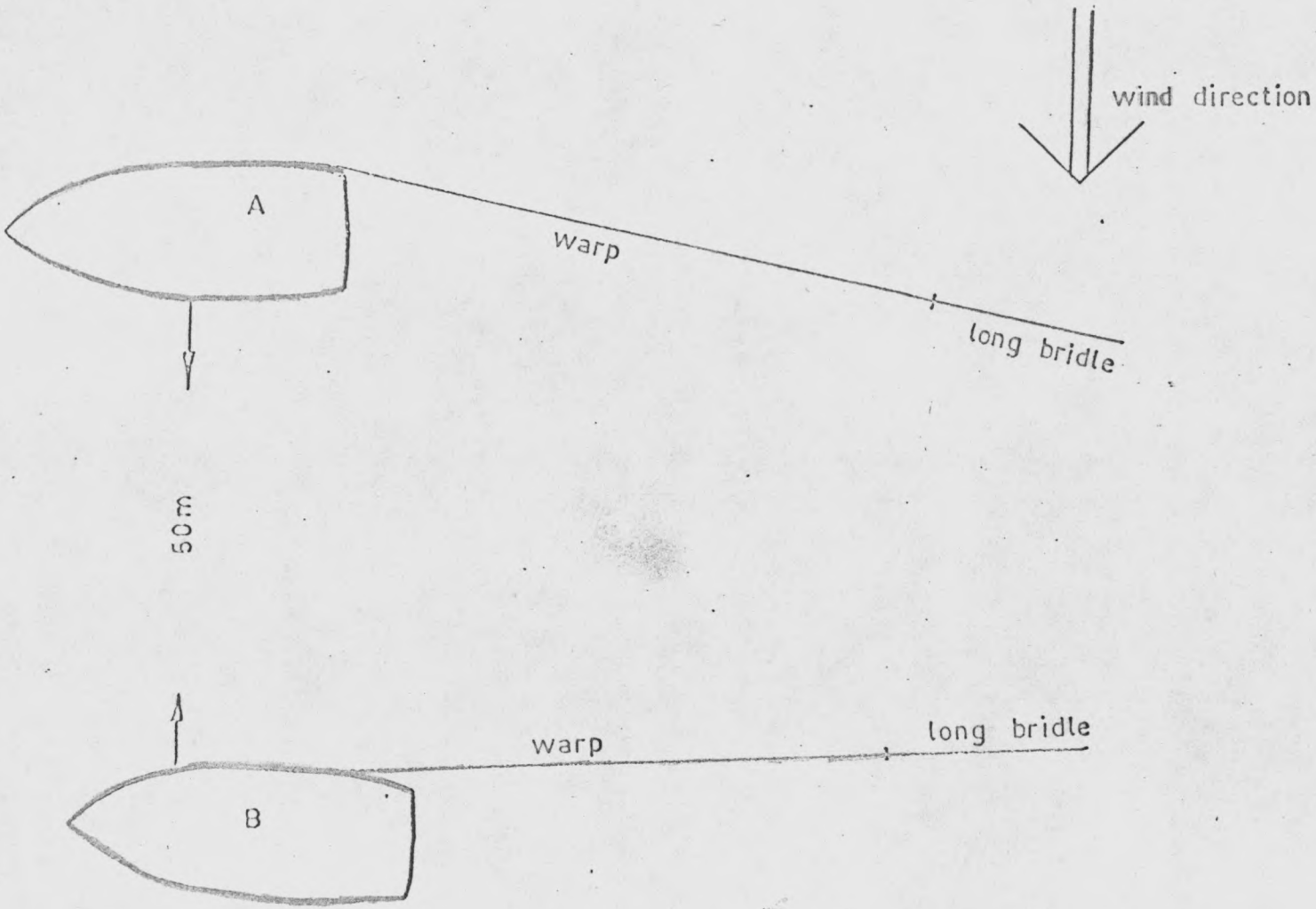


Figure 13 _ Hauling: phase 2

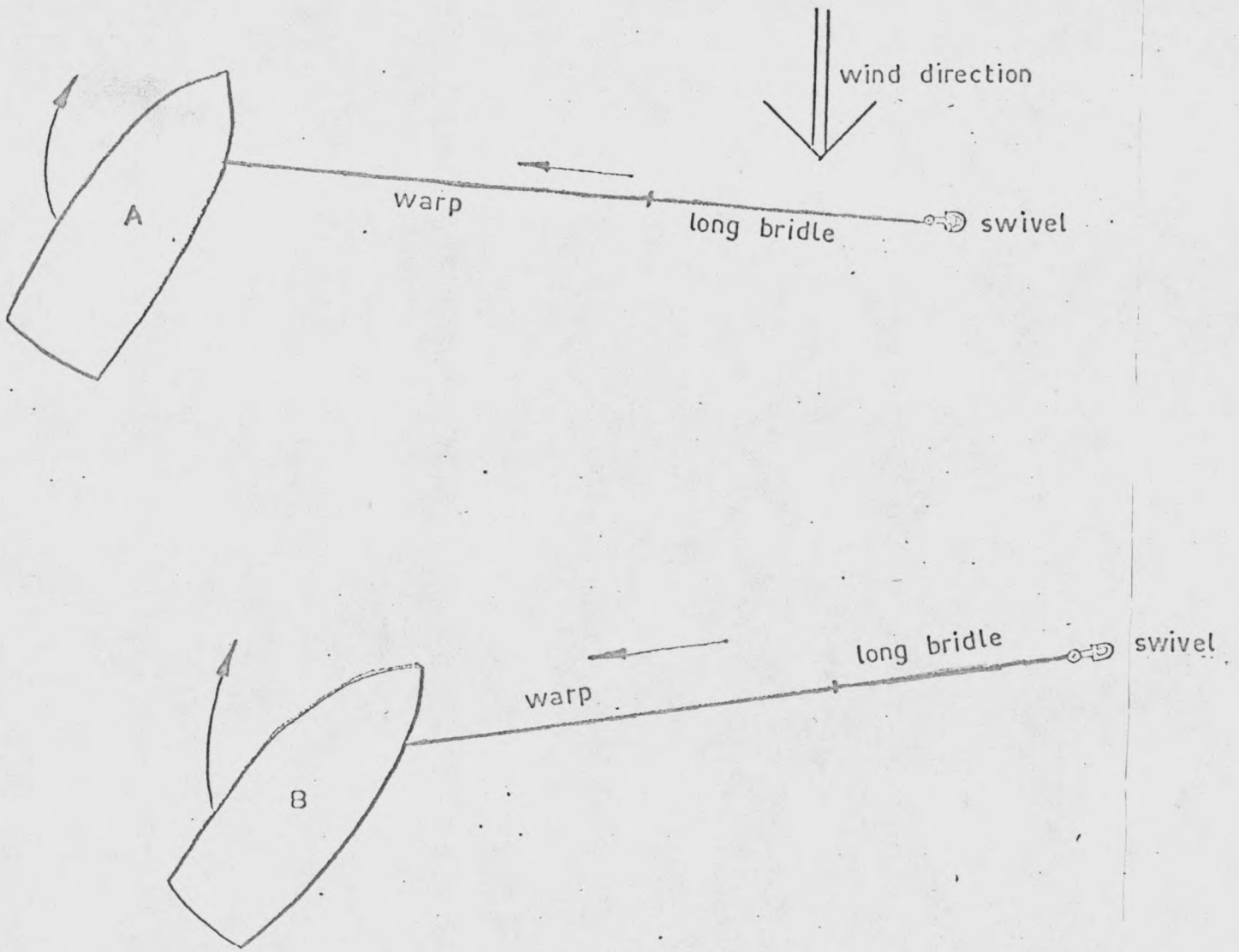


Figure 14 – Hauling : phase 3

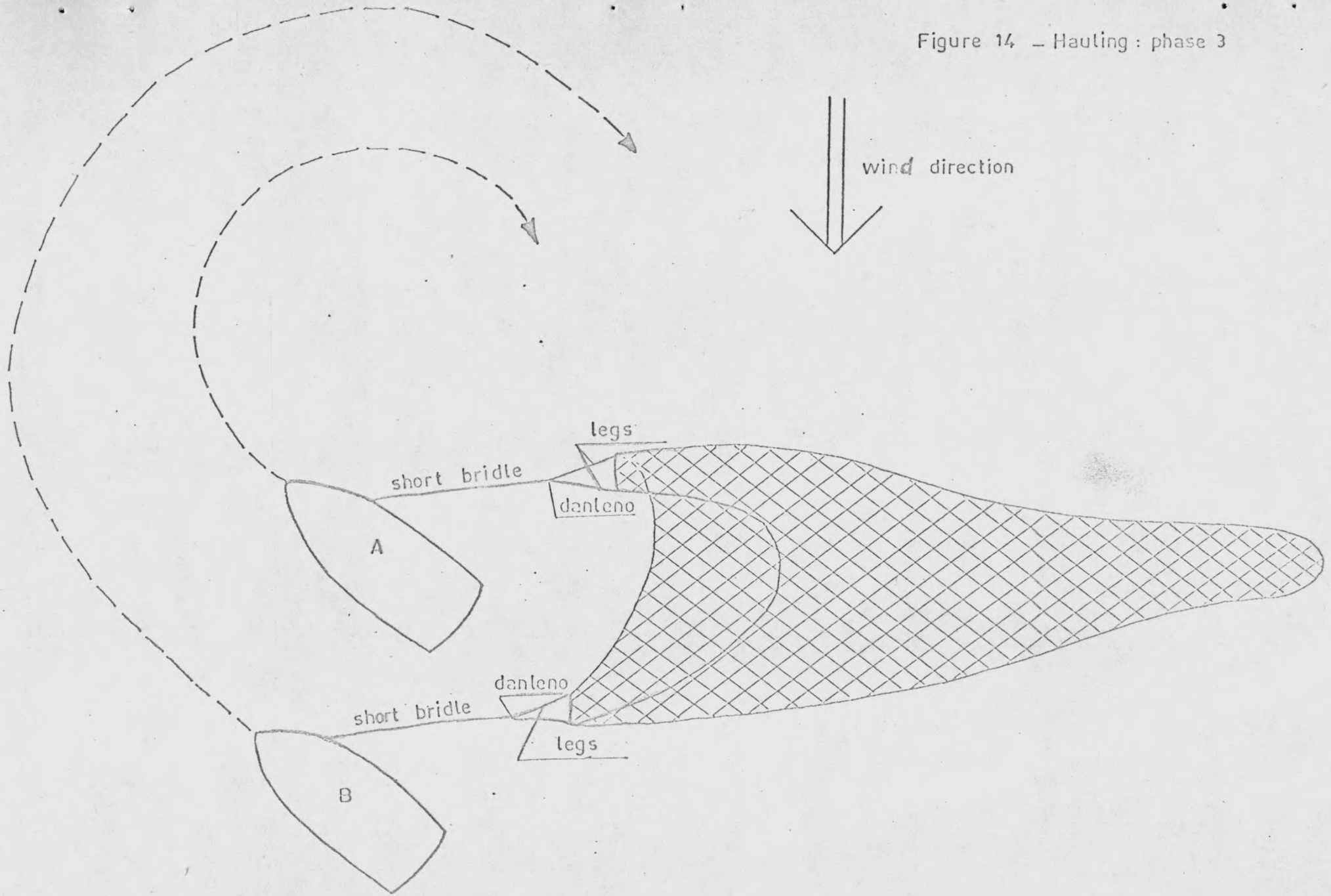


Figure 15 _ Hauling: phase 4

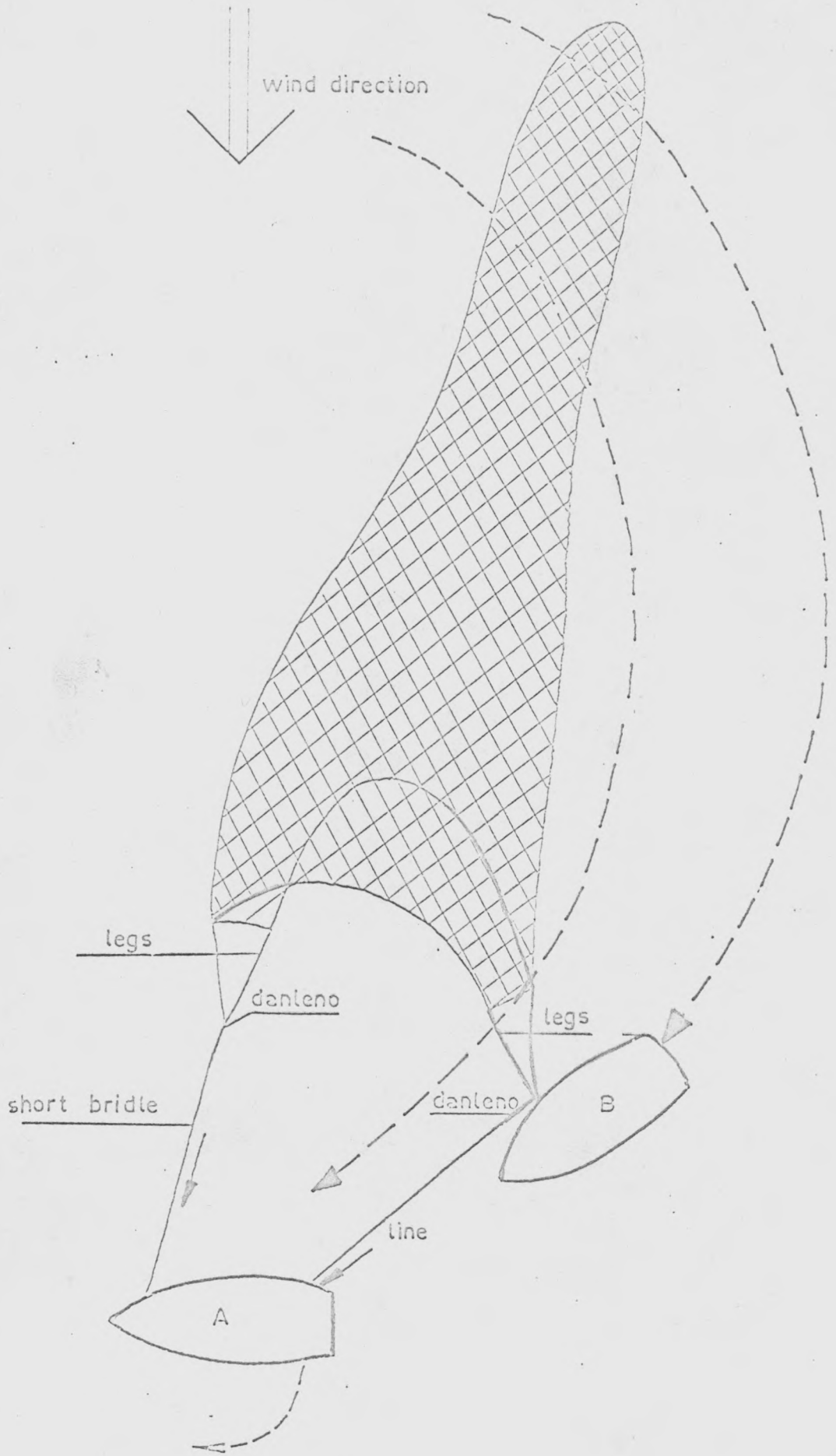
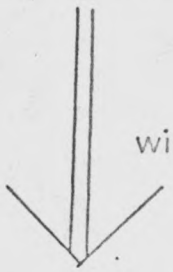
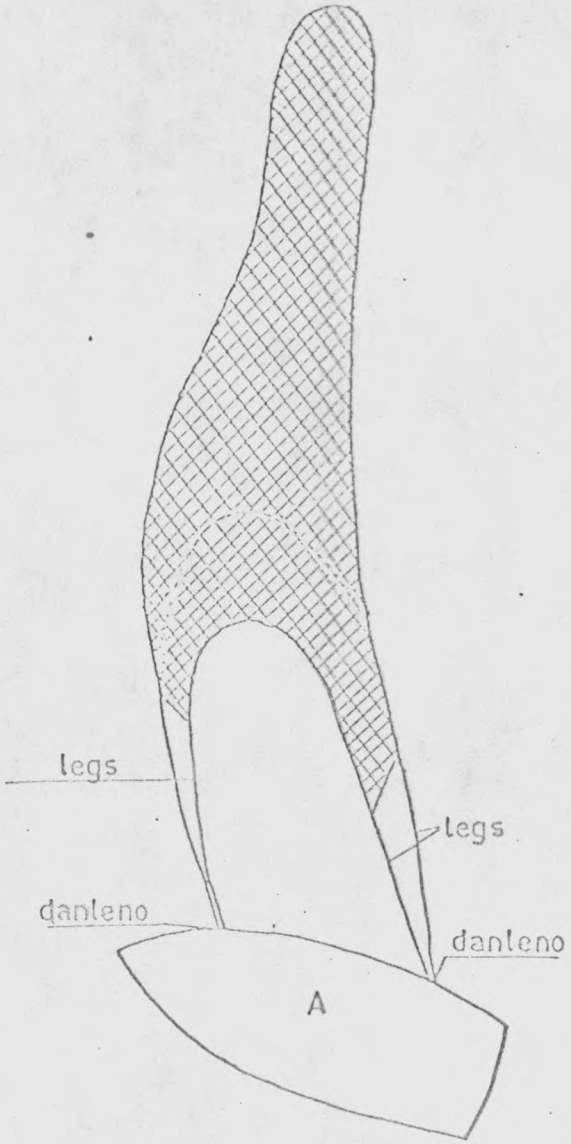
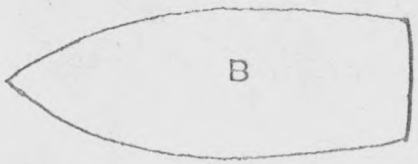


Figure 16 _ Hauling: phase 5







4. Phase 4.

Vessel B steams to the stern of ship A and hands over the line to vessel A. Vessel B then winds the danleno in the front gallows. The short bridle is then pecked out and the line is pecked in the danleno in the front gallows of vessel B.

Vessel B sets the danleno free and vessel A now has the trawl. When hauling is continued both danlenos arrive in the gallows of vessel A.

5. Phase 5.

The bobbin chain and the headline are wound in.

The further hauling procedure then continues as on the traditional side trawler.

Some remarks have to be made for the shooting and the hauling of the gear :

1) While hauling the speed of approach of both vessels is very important.

The fishing efficiency of the trawl undoubtedly increases when the approach is made slowly, i. e. in 6 to 8 minutes. In this way the herding effect will be more pronouced.

It is also important that the vessels, once they are at a distance of about 50 m from each other, keep steaming for about 7 minutes (the so-called "close-up"). In this manner the fish herds towards the net between the bridles and due to the increased speed of the vessels the fish can be caught.

2) The speed of hauling is also an important facter to prevent fish escaping.

3) In the Danish Pair Trawl fishery identical pull of the two vessels upon the warps is an important parameter. This can not always be achieved because of the characteristics of the vessels. The use of traction meters is recommended.

§ 3. - Considerations.

The Danish Pair Trawl fishery was applied by 20 Belgian middle-water trawlers with an average power of 348 hp (max. 425 hp - min. 250 hp) and an average gross tonnage of 96.31 (max. 130.90 - min 73.24).

From these experiments the following conclusions can be drawn :

1. The Danish Pair Trawl Fishery is efficient from March till September because the "Danish Pair" trawl fishery is a day fishery.

2. Alternatively using a trawl on each vessel offers some advantages, as the vessel having the net on board will have more time to handle the fish and when the gear is damaged less time will be lost. Moreover, operating is this way enables a better sharing of the work. Finally the number of hours fishing can be increased, as the time between two hauls is reduced.

3. If the gear is lost a drag-hook and a fishing buoy with light is to be recommended.

4. Experience has shown that the stretch of the legs must be regularly controlled (for exemple after 48 h) and, if nescessary, adjusted i. e. shortened.

Stretching causes the lower leg to become longer, the fishing efficiency of the trawl is influenced adversly and the chances of damage increase.

As a general rule it may be postulated that the length of the legs and also the length of the bridles must regularly be checked.

5. The question can be raised if the Danish Pair Trawl fishery requires more power than about 200 hp, as the towing speed is only 2.5 knots and as according to experience the towing speed may not be too high.

6. The use of traction meters during the Danish Pair trawl fishery is to be recommended, especially for ships with different power, inertness, propeller characteristics, gross tonnage etc.

7. Another adaptation which may be considered is the transformation of the existing winches to winches with variable speeds. In this way the speed of hauling could be increased independently from the motor speed and the fishing efficiency could be improved during hauling.

8. Another important factor in relation to the fishing efficiency is that both vessels fish at exactly the same position is relation to the net. This is possible if the radar bearing is taken on the bow of the other ship instead of midships (figure 17). It must then be kept in mind that only one vessel alters its speed.

9. Although there are no data available to determine the effect of wind direction and force on the catches it may be assumed that the wind force rather than the wind direction affects the catches. High wind speeds cause an irregular pull on the warps.

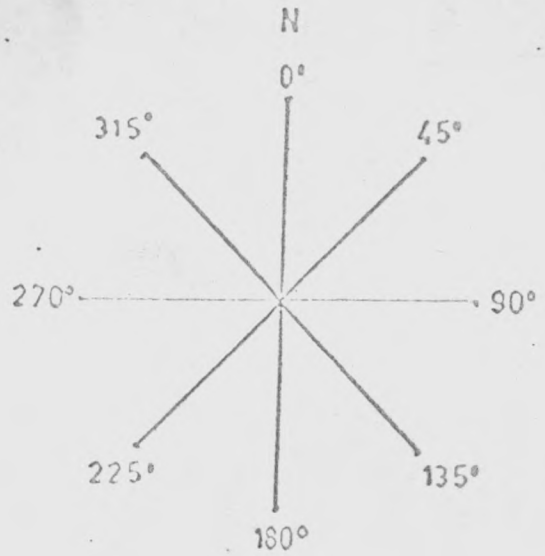
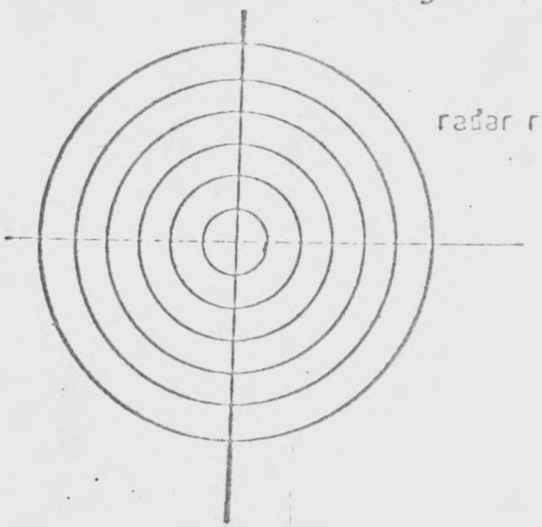
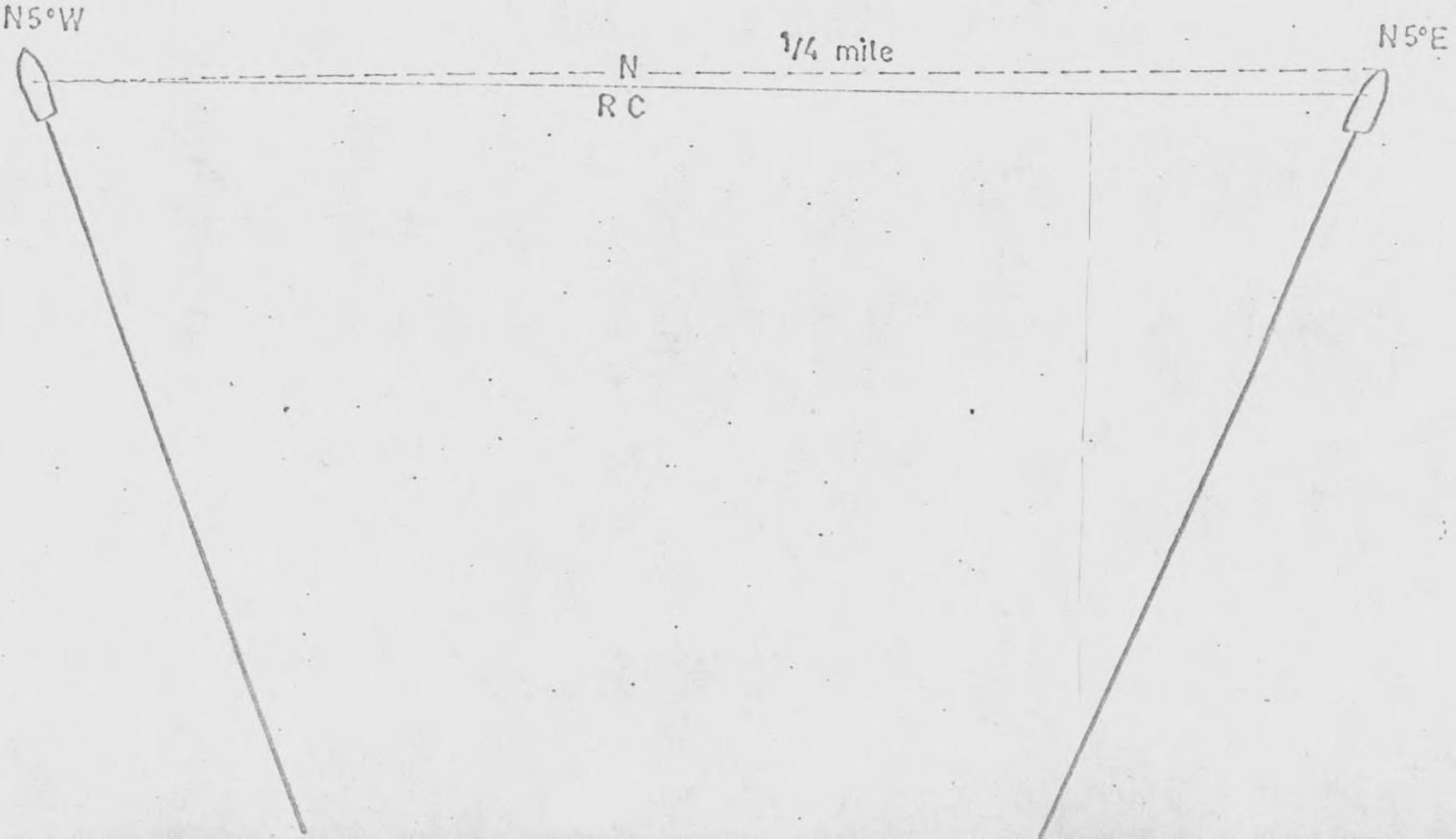


Figure 17 – Radar bearing



radar range 1,5 mile



10. The influence of currents on the behaviour of the gear could not be investigated. From general experience however it can be concluded that currents, especially when fishing with a cross tide of more than 1.5 knots can deform the net and decrease the herding effect of the bridles.

11. Experience has shown that the catches are larger with clear water and bright sunshine.

12. The nature of the bottom has an important influence on the duration of the haul and on the catches. Scanning the bottom with the aid of an echo sounder with ground discriminator can undoubtedly contribute much to the success of the Danish Pair Trawl fishery.