

This paper not to be cited without prior reference to the author
INTERNATIONAL COUNCIL FOR THE
EXPLORATION OF THE SEA

C.M. 1975/B : 12
Gear and Behaviour Committee



DEVELOPMENT OF THE BEAM TRAWLER TO A MULTI-PURPOSE VESSEL

by

E.J. de Boer, M.Sc.

**Netherlands Institute for Fishery Investigations,
Haringkade 1, Ymuiden, The Netherlands.**

International Council for the
Exploration of the Sea.

CM 1975/ B : 12
Gear and Behaviour
Committee

DEVELOPMENT OF THE BEAM TRAWLER
TO A MULTI-PURPOSE VESSEL

by

E.J. de Boer, M.Sc.

Introduction

Since the early sixties the beam trawl has developed into a very efficient gear for catching flatfish. With this gear, it is possible to tow an important number of tickler chains over the seabed without influencing the horizontal netopening as is the case with an otter trawl. The beam trawl can even be used on an undulated seabed or in an area with boulders (stonemat).

Since the fishing power increases with the number and/or the weight of the tickler chains, the beam trawler developed into a very powerful vessel. The very good financial results achieved by these vessels in the past, led to a continuous new building programme. In 1973, for instance, 42 beam trawlers entered service. The propulsive power ranged from 600 to 1500 hp, the average being 1160 hp. This record was broken in last year when 47 beam trawlers ranging from 600 to 2000 hp were delivered by the shipyards.

Simultaneously with the rise of the propulsive power of beam trawlers the dimensions of the vessels increased. In the early sixties the 18-22 m vessels had engines of 200-240 hp. The 26.25 m vessels built in 1968 had a propulsive power of 640 hp (average). An example of a beam trawler built in 1974 is the GO 1 "Catharina", one of a series of five identical vessels. The main dimensions are: length over all 36.6 m breadth 8.0 m and depth 4.7 m.

The vessel is powered by an engine developing 1760 hp at 315 r.p.m., driving a 2.7 m ducted propeller. The maximum thrust of this propeller at a fishing speed of five knots is 17.38 tonf.

Although the results of beam trawling in the last years were very good, the signs that the fish stocks were "overfished" could not be neglected. Both in fishing and research circles, the question of specific beam trawling fishing for other species, for instance herring and round fish, was put forward in the beginning of 1973. This should imply the application of otter trawling, one- and two-boat midwater trawling to the beam trawlers. The interested skippers demanded a fishing system enabling a fast change-over of fishing gears, even on the fishing grounds if possible. This meant a careful analysis of the characteristics of deck machinery, adapting the deck lay-out, selecting the gears and adjusting the gear handling operations to the restrictions of beam trawlers.

THE WINCH CHARACTERISTICS IN RELATION TO THE FISHING METHOD

a. Beam trawling

Special winches have been developed for this fishing method. The main features are:

- a high-torque/low-speed characteristic;
- low warp capacity of the drums;
- at least four drums (two for the warps and two for the topping lifts);
- friction clutches;
- remote-control from the wheelhouse (pneumatic or hydraulic);
- reversible drive (mainly electrical).

Beam trawlers fish with heavy gears in relatively shallow waters. In general the amount of warp paid out is 110 m (60 fathoms). The weight of a beam trawl of a 1110 hp vessel is approximately 4.5 tons. A gear of a 1760 hp beam trawler weighs 6.4 tons. Under normal fishing conditions the main engine delivers full power. When hauling, the skipper lowers the rotational speed of the fixed-pitch propeller to about 60 percent of the full speed. The winch has to pull the gears simultaneously in the direction of the vessel against the thrust of the propeller. During the hauling operation, the vessel is almost in the bollard condition. When the propeller specifications are available a calculation of the propeller thrust and an estimate of the warp tension is made.

Under normal conditions measurements onboard several beam trawlers proved the warp tension to be in agreement with these calculations.

These measurements also showed that the warp tension at the end of the hauling operation is 1.2 times greater than at the start. For a 1110 hp beam trawler, the winch pull is 11.0 tonf at the start of the hauling operation. The demand for warp speed-when-hauling is in the order of 50 m/min. In order to meet this requirement the winch drive should have a power of $\frac{11.000 \times 50}{0.85 \times 60 \times 75} = 145$ hp.

The coefficient 0.85 is the mechanical efficiency of the winch.

In general, the warp capacity does not exceed 300 m (165 fathoms). However, the warps are very heavy in respect to the propulsive power of the vessels (table 1). This is necessary in order to withstand the extreme warp loadings experienced when fishing in bad weather and/or on rough fishing grounds. Fishing in bad weather results in heavy dynamic loadings due to the vessel's pitch and roll.

On rough fishing grounds, for instance an undulating seabed or an area with boulders, the gears are frequently subjected to impacts. Heavy loadings also occur at the moment a gear fouls an obstruction. The warps have to withstand this treatment without unexpected breaking.

The warps of a 1110 hp beam trawler have a diameter of 30.3 mm (3 3/4" circumference). The length of warp per drum is 300 m. In order to fulfil these requirements of beam trawling the drum dimensions are:

- drum diameter 400 mm
- width between flanges 400 mm
- outside diameter of flanges 1200 mm

Taking into account drum dimensions, warp capacity and paid-out warp length, the gearing ratio of the winch-gearbox can be calculated. Onboard Dutch beam trawlers the winches are driven by electric motors with a rotational speed of 1050 r.p.m. exclusively. The mentioned calculation will result in a gearing ratio of 56.4 : 1. The performance of this winch is according to figure 1.

b. Bottom trawling

In order to fulfil the requirement of a fast change-over of fishing methods at sea, difficulties are created by the differences in warp dimensions. It will be clear that the 30.3 mm warp is far too heavy for bottom- and mid-water trawling, especially in deeper waters. Therefore, without special arrangements, changing over fishing methods at sea is impossible.

However, this problem can be solved by applying the "twin-warp" arrangement during beam-trawling operations. Figure 2 shows the warp to run from the towing block at the fore-castle's side to a double-sheave block in the boomtop, passing a block connected to the chainbridles of the beam trawl, returning to the double-sheave block and being fastened to the fore-castle. By applying this system to a 1110 hp beam trawler, the 30.3 mm warp-breaking load-47.7 tonf. -can be replaced by a double reeved warp of 21.8 mm - total breaking load 50.6 tonf.

In addition to the main advantage of performing several fishing operations with the same warp, regarding the winch and the rigging the following advantages have to be mentioned:

- the torques on the winch shaft, gearbox, friction clutches and brakes decrease considerably;
- the forces acting upon parts of the rigging become lower;
- the ratio of warp diameter and sheave diameter becomes more favourable;

For bottom and midwater trawling the warp capacity of a 1110 hp trawler has to be at least 1080 (600 fathoms) of 21.8 mm warp per drum.

For storing this warp length the drum dimensions are:

- drum diameter 400 mm
- width between flanges 520 mm
- outside diameter of flanges 1300 mm

One has to keep in mind that the winches of Netherlands beam trawlers are incorporated into the superstructure. Taking into account the width of the gearbox, drums for topping lifts and bearings, the maximum width available for the warp drums is limited. The maximum width of the drums having been determined, then the necessary volume for storing the warps can only be found by increasing the flange diameter.

For multi-purpose trawlers the most suitable trawl is the recently developed high-headline trawl. The specific gear for a 1110 hp trawler has a headline of 32 m (104 feet).

Measurements onboard the F.R.V. "Tridens" have shown the total warp tension when starting the hauling operation to be 7.7 tonf at a warp speed of 68.6 m/min. At the end of the hauling operation the total warp tension had increased to 8.8 tonf.

Practice has shown that the minimum warp speed at the start of the hauling operation must be at least 70 m/min. Skippers observed fish escaping in front of the cod end and lengthening piece, at lower hauling speeds.

If 250 fathoms of the 600 fathoms warp capacity have been paid out, the radius of the remaining quantity of warp on the drums when hauling the gear starts can be calculated. Secondly, the desired gearing ratio of the winch-gearbox can be determined in order to achieve a warp speed of about 70 m/min.

The gearing ratio for a 145 hp electric drive with a rotational speed of 1050 r.p.m. is 44.5 : 1.

Figure 3 shows the performance of this trawl winch. The warp speed at a total pull of 7.7 tonf is 71.5 m/min., and at the end of the hauling operation the winch can deliver a pull of 8.8 tonf at a warp speed of 57 m/min. For the calculation see (1), de Boer, 1974; and (2) Verbaan, 1974.

For beam trawling the warp is double-reeved. Therefore, the amount of warp paid out is 220m (2 x 60 fathoms). Figure 4 shows for beam trawling, the multi-purpose winch can deliver a total warp pull of 11.0 tonf at a speed of 46 m/min. During hauling, this pull will increase to 13.2 tonf resulting in a warp speed of 42.5 metres per minute.

Figure 4 shows that the maximum pull the winch can deliver when beam trawling, has a value of 24.4 to 27.4 tonf, depending on the amount of warp paid out. In an extreme situation this pull can be transmitted to one gear, resulting in a warp tension of 12.2 to 13.7 tonf. The minimum breaking load of the 21.8 mm warp is 25.3 tonf, which creates no real problem. It is stressed that this point should get careful consideration. The gearbox of beam-trawl winches on the Dutch vessels have a wide range of gearing ratio's. In the past, some skippers demanded very strong winches with regard to pull, resulting in winches with gearing ratio's up to 88 : 1 for a 145 hp/1050 r.p.m. electric drive system. It is clear that the equipment of such vessels with the double-reeved warp system can result in dangerous loadings on gears and/or rigging.

c. Midwater trawling

In the herringseason, some Netherlands beam trawlers change over to two-boat midwater trawling. The gears are very large but, taking into account, for the main part of the hauling procedure two winches are simultaneously in operation, no difficulties in relation to the available pull are ever encountered. When two-boat midwater trawling, 1000-1200 hp trawlers are applying warps with a diameter of 21.8 mm. This and the warp capacity of 1080 metres (600 fathoms) gives no problem.

For trawlers with a propulsive power exceeding 1000 hp one-boat midwater trawling for herring can be an alternative fishing method under certain conditions. The midwater trawl for a 1110 hp multi-purpose vessel will have a circumference of 400 meshes of 80 cm mesh length. This gear is used in combination with 4.3 m² Süberkrüb-doors and 100 m bridles.

An analysis of the performance of both winch and propeller of a 1000 hp combination side/stern trawler shows the total pull for hauling the mentioned gear to be 10.3 tonf at a warp speed of 60 m/min. Figure 5 shows that the multi-purpose winch - when 250 fathoms warp are paid out - can deliver a pull of 10.3 tonf at a speed of 53 m/min.

This performance is felt to be acceptable for a multipurpose vessel, taking into account that in sequence beam trawling and bottom trawling are the most important fishing methods.

THE HIGH-HEADLINE TRAWL

At the end of 1972 the Technical Research Department started the development of a high-headline trawl in cooperation with a well-known netfactory.

This cooperation started with the design, construction and testing of a 37 m (122 feet) head-line trawl constructed of netsections with mesh lengths of 40, 20, 10 and 5 cm respectively. The vertical netopening is obtained by the lifting action of three kites which are directly connected to the head-line. One of the kites is situated at the centre of the headline, the other two at each wing. The latter kites are rigged to give both lifting and sideways directed forces. The connection of the kites to the head-line with clip connectors enables a fast replacement by kites of different dimensions. This gives the skipper the opportunity to adjust the vertical netopening according to the conditions on the fishing grounds.

Although the high-headline trawl was not specifically developed for converted beam trawlers, the gear soon appeared to have potential value for this type of vessel. The skippers demanded a bottom trawl which could easily be handled by a small crew when fishing alternately for herring or roundfish.

Resuming, it can be stated that the development of high-headline trawl resulted in:

- increased mesh length in the wings, square and belly (40 cm stretched instead of 15 cm);
- reduced number of netsections with different mesh lengths (4 instead of 12-14);
- increased vertical netopening (depending on the gear dimensions up to 12 metres);
- simplification of the rigging (restraining lines and false-headlines are missing).

The only conversion of the net when changing-over from herring to roundfish fishing, is replacement of the 5 cm herring cod-end by a 8 cm one for roundfish.

Table 3 gives directives for high-headline trawls and their rigging in relation to the propulsive power.

THE OTTER BOARDS

Numerous beam trawlers have sufficient propulsive power for both bottom and one boat midwater trawling operations. In the Dutch fishing industry so far, two types of doors were in use: the flat rectangular door (wood) for bottom trawling and the curved Süberkrüb-door (steel) for midwater trawling. In general, the vessels of the middle-water fleet carry both types of gears, and consequently also the matching doors.

However, this is impossible on board beam trawlers being converted to multi-purpose vessels because of the lacking tackle for "switching doors" and the restricted storing facilities on the aft-deck.

Therefore, it became necessary to look for a suitable door for both bottom and midwater trawling. The solution proved to be the French "poly-valent" door of Morgère (St. Malo).

After trials on board the F.R.V. "Tridens" and a 1200 hp converted beam trawler, it was found that these doors have an excellent performance for bottom trawling. The performance as "midwater door" is slightly inferior in comparison with the conventional Süberkrüb-doors and mainly caused by the heavier weight. Illustrating, the 4.3 m² Süberkrüb-doors have a weight of 750 kg and the 4.57 m² poly-valent doors 1200 kg. Midwater trawling by the Netherlands trawlers is mainly performed with the net close to or even on the seabed. In case of unexpected bottom contact, the poly-valent doors will be less damaged or don't even suffer damage at all.

Advantages of the all-steel poly-valent doors are also the missing brackets and the easy replaceable shoe-plates.

RIGGING AND DECK LAY-OUT

When considering fishing operations with bottom or midwater trawls over the stern of beam trawlers, the running of the warps has to be discussed. It is possible to pass the warp through the boom sheave to the towing block at the stern gallows (figure 6). When fishing with an otter trawl the booms are in the horizontal position. At the end of the hauling operation, the skipper brings the booms in a steep position in order not to hamper the handling of the net and the cod-end along the starboard side. This solution is chosen when the skipper changes-over to otter trawling over the stern on the fishing grounds, or, when it is expected to last only for a relatively short period. The advantages are: no additional sheaves are needed and the working area on the foredeck is not obstructed by the warps.

A second way is to fit two special sheaves at the aft part of the forecastle according to figure 7. A disadvantage is the unfavourable running of the warps which are partly blocking the gangway. The booms can be put in the vertical position and safely secured or, in case the vessel has a gantry just in front of the wheelhouse, lowered alongship in the horizontal position and secured to a point of support on the forecastle.

When fishing with otter trawls for a long period of time the skippers will, however, decide to bring the booms ashore. The heavy booms will, especially in the vertical position, have a negative effect on the stability and the behaviour of the vessel in a seaway.

When fishing over the stern, a spacious working area at the aft part of the vessel is required. Until recently, the beam trawlers had in general a cruiser stern and the superstructure was situated far backwards. For gear handling, a netdrum is a necessity nowadays. This netdrum can be located on the aft-deck (figure 8) or on top of the aft part of the superstructure (figure 9). The latter solution has a negative effect on the stability, and due to this some skippers are in favour of placing the netdrum at deck level.

As figure 8 shows, the working area becomes rather limited, more so because the netdrum may not block the escape hatch of the crew's quarters. In order to limit the wear of the webbing when shooting and hauling the net over the bulwark, a horizontal stern roller is often fitted.

The bridles can be stored on the netdrum or on top of the warp on the drums. In order to wind the bridles on the netdrum two special compartments are available. For regular winding up and to protect the netdrum from sideways directed forces when the vessel is not straight ahead of the gear, vertical guiding rollers are fitted at the stern. These rollers can easily be removed.

When stern trawling, it is of great importance that the skipper has a good view at the aft-deck. As figures 8 and 9 show this creates a problem for most of the existing vessels. The navigational and winch controls are located in the front part of the wheelhouse and not immediately within reach of the skipper, when looking backwards standing in a doorway.

Shooting and hauling of the first 25 fathoms of the warps is executed from a position very close to the gallows. At these positions control units for the frictions/brakes of the warp drums are fitted. The rotational speed of the electric winch drive is controlled from the wheelhouse. At the beginning of shooting and at the end of hauling the warps, the skipper switches from wheelhouse to deck control. Because most Netherlands beam trawlers have pneumatically controlled winches, this extension of the control system is fitted easily. In an emergency case the skipper can immediately take-over control. For protection of deck hands and/or equipment on both sides of the superstructure, emergency switches are located within reach. When activating these switches, the winch stops immediately and the brakes come into action. The skipper can bring the winch into operation again after pressing the re-set switch. Figure 8 shows a netdrum with a high torque-low revs, high pressure hydraulic drive system. This system is mainly chosen because of its limited dimensions and the excellent characteristics. Netherlands beam trawlers, however, generally have two winch generators. One is the emergency winch generator, which is used after a breakdown of the main generator or the driving prime mover and in the harbour, for instance, when shifting the gears. Because sufficient electric power is available for driving both winch and netdrum and in order to restrict the vessel's equipment to electrical systems only, an electric drive for the netdrum is often preferred.

Since the skippers of beam trawlers showed increasing interest in otter- and midwater trawling, the vessels are built with transom sterns. The superstructure is placed more forward (figure 10). The result is a considerable increase in deck area at the stern. Figure 10 also shows a wheelhouse arrangement giving the skipper a good view in all directions independent of his position in the wheelhouse. This can only be achieved on board a new vessel, and is in fact the same arrangement as found on board the middle- and near-water stern trawlers.

It is felt that for multiple fishing operations with vessels over 35 m in length, the stern-trawler type is the most efficient one. An example of a multi-purpose stern trawler is shown in figure 11. This 2000 hp vessel (L.o.a. = 40.5 m) was built in 1974 and has proved its capabilities in both beam-trawl and otter-trawl operations. The normal complement is 7 and as the figure shows, when fishing with bottom- or midwater trawl the booms and beam trawls are of no hindrance to the men on deck.

GEAR HANDLING WHEN OTTER TRAWLING

In the following a description will be given of one of the shooting and hauling procedures when fishing with a high-headline trawl. The hauling operation is demonstrated by a series of drawings (figures 12 to 19).

When shooting the gear, the vessel moves slowly ahead on a straight course. The cod end is thrown overboard and the net is pulled off the netdrum by the cod end's drag until the headline's centre is clear from the netdrum. The netdrum is stopped to enable the crew to clip a kite and the netsounder transducer to the headline's centre. This being done, the netdrum pays out the trawl until the wings are clear from the netdrum. Now, three lengthening strops are connected to each upperwing and also the lengthening strop to each lower wing. Paying out the gear continues. The gear is being towed now by the bridles. The messenger wires are disconnected from their fixed points on board, and connected to the lengthening bridle's spreaders. Paying out the bridles from the warp drums continues slowly until the stoppers reach the Kelly's eyes of the backstrops. The G-hooks are connected to the recessed links and the doors are disconnected from the dog chains. Once this is done, the gear is ready for shooting. The warps are paid out until the doors are just below the surface and the correct spreading is checked. Next the required length of warp is paid out. Hauling is carried out in the reverse order. (figure 12).

The net is "dried up" and a dog rope is routed to the stern on the outside of the portside gallow (figure 13). Drying up continues till the length of the net still overboard approximately equals the length of the vessel. A becket is then brought around the net adjacent to the stern. The dog rope is connected to this becket and the lazy deckie is brought forward to the port whipping drum. The starboard whipping drum is used for the dog rope (figure 14).

The netdrum is wound off in order to have sufficient length of net outboard when bringing the cod end and the cod-end lengthening piece alongside at starboard side of the vessel. To achieve this, the vessel is brought hard over and both dog rope and lazy deckie are pulled in simultaneously (figure 15).

The vessel is put full astern to take way off and hauling of the dog rope and lazy deckie is continued (figure 16). The engine is stopped when the net is almost alongside the vessel. The gilson is attached to the halving becket. To ensure that the net does not foul the propeller, the bight of the net is lashed to the bollard just in front of the gallow.

An auxiliary wire is routed through a very wide sheave at the side of the wheelhouse. Next, this auxiliary wire is connected to the becket and takes over from the dog rope. For filling the cod end, the auxiliary wire is heaved on and at the same time the gilson is released (figure 17 and 18). After filling of the cod end, a bag is heaved over the bulwark while the auxiliary wire is slacking (figure 19). For the following bags this procedure is repeated.

REFERENCES

1. De Boer, E.J., 1974 - Multi-purpose vislieren voor kotters.
(Multi-purpose winches for small trawlers).
Rijksinstituut voor Visserijonderzoek, IJmuiden - Technical Research Department.
Report nr. 74-1.

2. Verbaan, A & Mulder, A.A.J., 1974 - Analyse van de prestaties van een vislierinstallatie bij het beoefenen van de boomkorvisserij.
(Analysis of a trawl-winch installation's performance when fishing with a beam trawl).
Rijksinstituut voor Visserijonderzoek, IJmuiden - Technical Research Department.
Report nr. 74-8.

TABLE I - BEAM TRAWLING - directives for warps

Propulsive power	500 hp	750 hp	900 hp	1200 hp	1500 hp
Warp diameter	23.3 mm	26.1 mm	28.3 mm	30.3 mm	32.5 mm
Minimum breaking load	28.0 tonf	36.0 tonf	41.8 tonf	47.7 tonf	55.1 tonf
Weight (100 metre)	191 kg	237 kg	278 kg	319 kg	365 kg

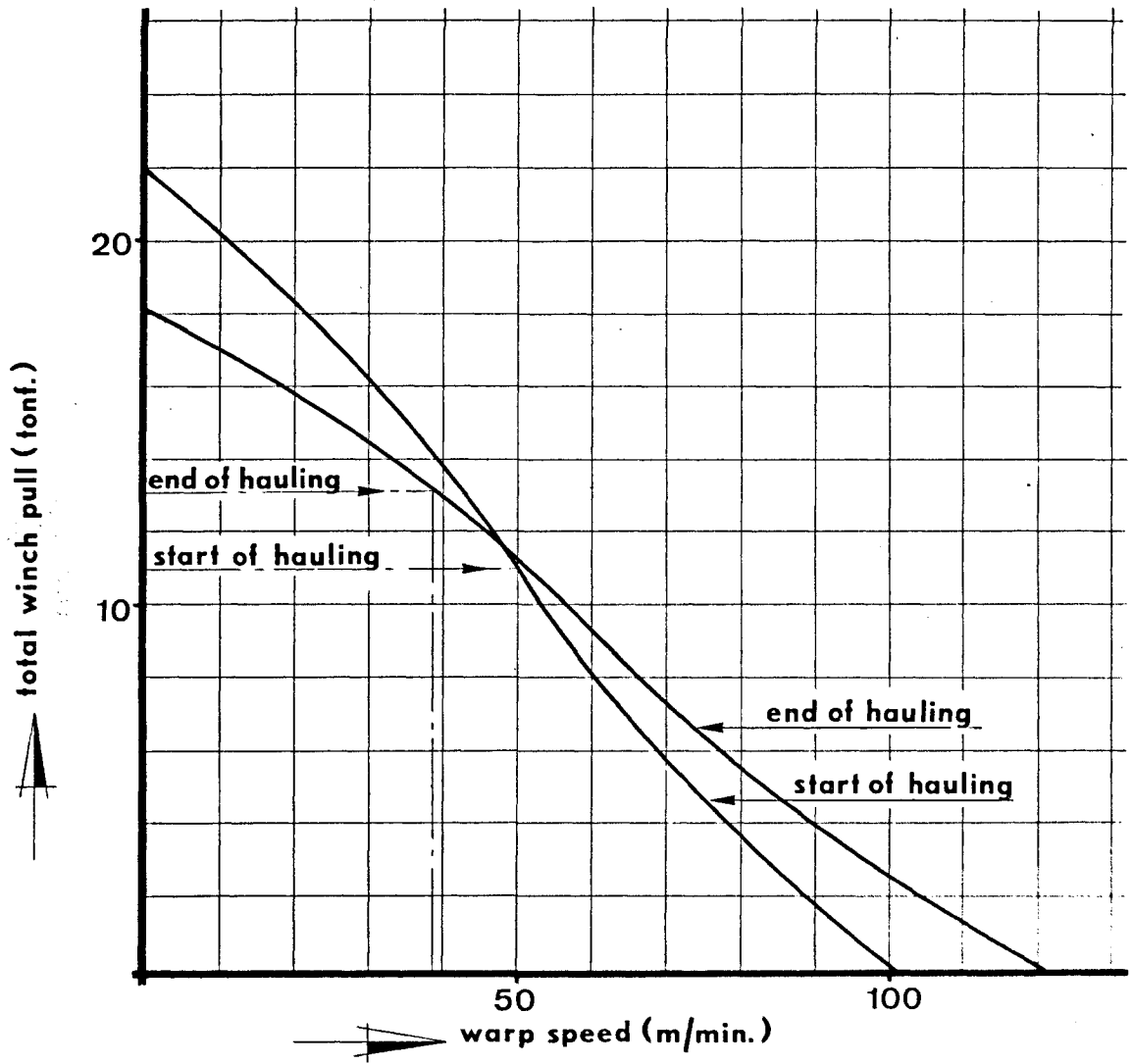
TABLE II - OTTER AND MIDWATER TRAWLING - directives for warps

Propulsive power	750-1200 hp	1200-1600 hp	1600-2300 hp
Warp diameter	21.8 mm	23.3 mm	26.1 mm
Minimum breaking load	25.3 tonf	28.0 tonf	35.9 tonf
Weight (100 metre)	168 kg	191 kg	237 kg

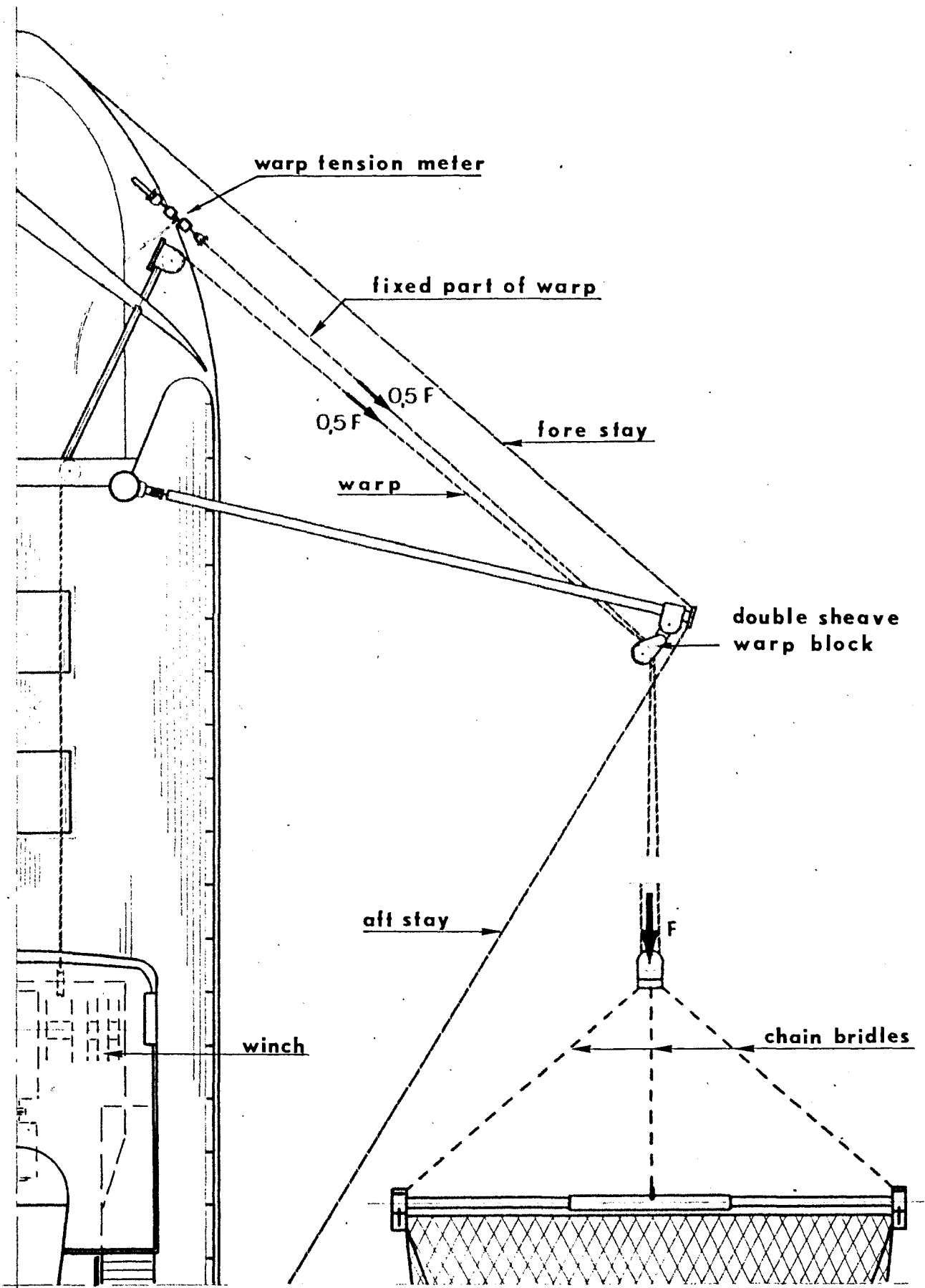
TABLE III - DIRECTIVES FOR HIGH-LEADLINE TRAWLS

Propulsive power (hp)	500 hp	750 hp	900 hp	1200 hp	1500 hp	1800 hp
Headline (m)	22.5 m	25 m	27.5 m	29 m	32 m	35 m
Groundrope (m)	35 m	37 m	40 m	42.5 m	46 m	49 m
Bridles (m)	60 m	70 m	80 m	100 m	100 m	120 m
Door dimensions (m)	2.6x1.2 m	2.7x1.2 m	2.8x1.3 m	3.0x1.3 m	3.2x1.35m	3.4x1.35m
Door weight (kg)	500 kg	700 kg	850 kg	1000 kg	1400 kg	1600 kg
Kite dimensions centre of headline (m)	.5x .7 m	.5x .7 m	.6x .8 m	.6x1.0 m	---- up to ---	.9x1.2 m
Kite dimensions wings (m)	.4x .6 m	.4x .6 m	.5x .7 m	.6x .8 m	---- up to ---	.6x1.0 m
Vertical netopening (m)	6 m	6.5 m	7 m	8 m	---- up to ---	12 m

BEAM TRAWLING
 145 hp winch
 gearing ratio 56,4:1



Benaming		Formaat	
		A4	fig. 1
Schaal		Gecontroleerd	
Getekend N		Gezien	
Auteursrecht voorbehouden volgens de wet		Rangschikmerk	



Benaming "TWIN - WARP" ARRANGEMENT

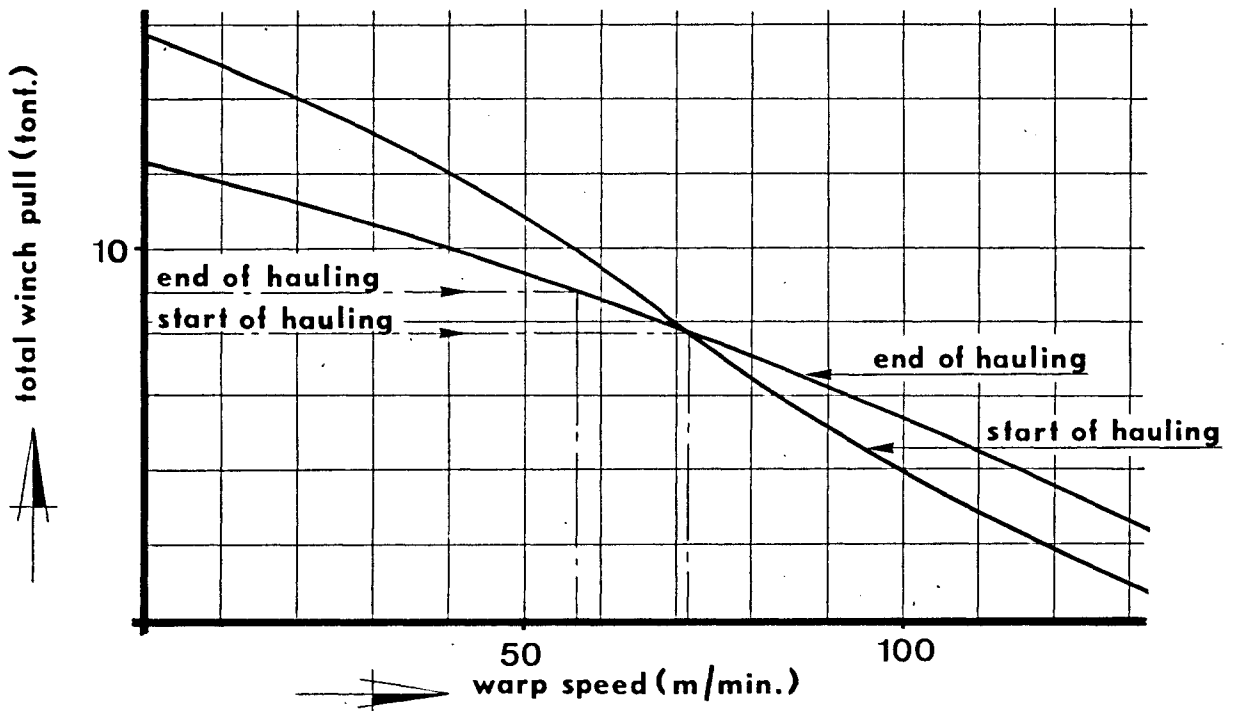
Formaat A4 fig. 2

Schaal Gecontroleerd

Getekend **A** Gezien

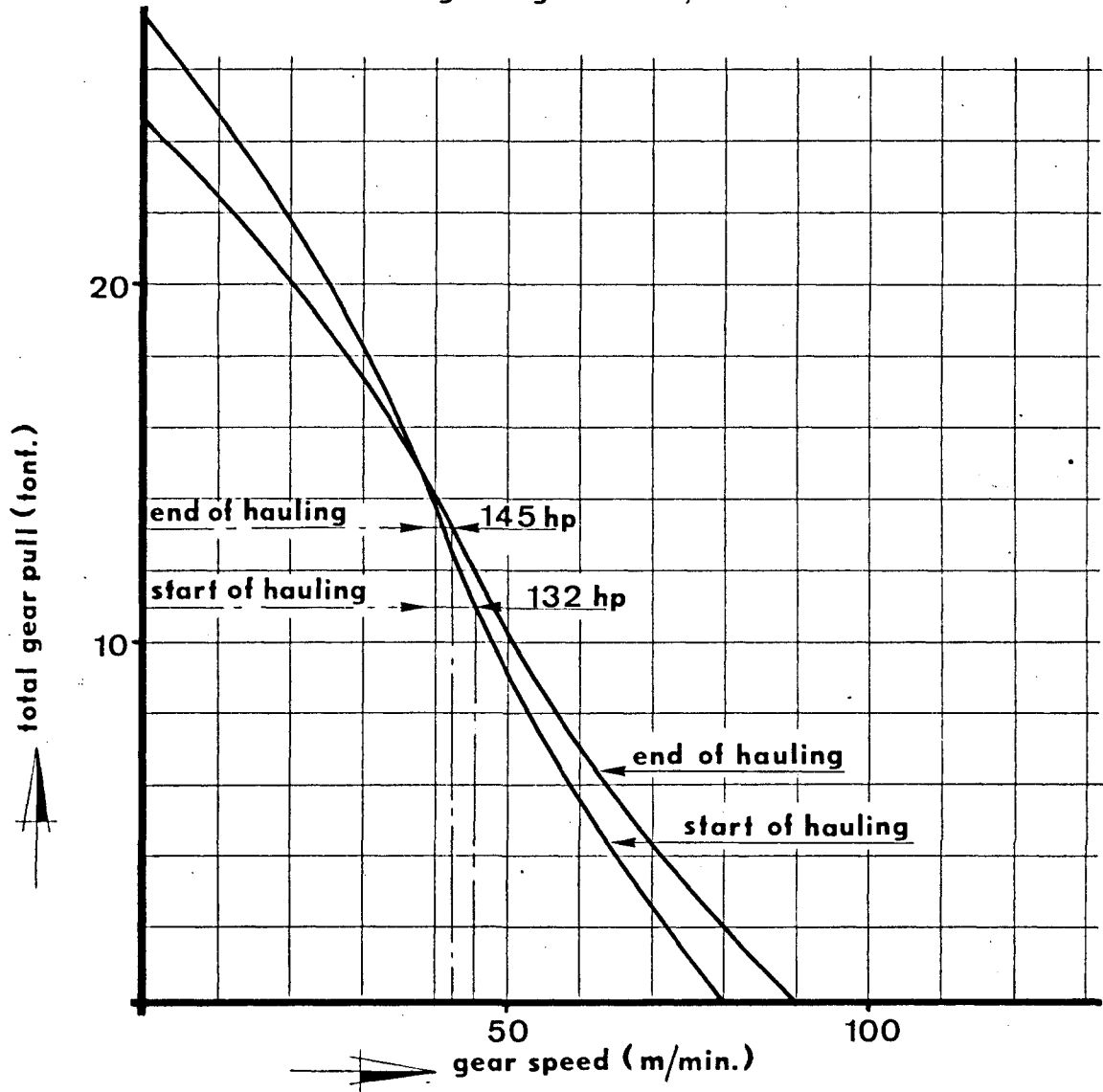
Rangschikmerk

BOTTOM TRAWLING
 145 hp trawlwinch
 gearing ratio 44,5:1



Benaming		Formaat	fig. 3
		A4	
Auteursrecht voorbehouden volgens de wet	Schaal	Gecontroleerd	Rangschikmerk
	Getekend A	Gezien	

BEAM TRAWLING
 145 hp multi-purpose winch
 gearing ratio 44,5:1



Benaming

Formaat

A4

fig. 4

Schaal

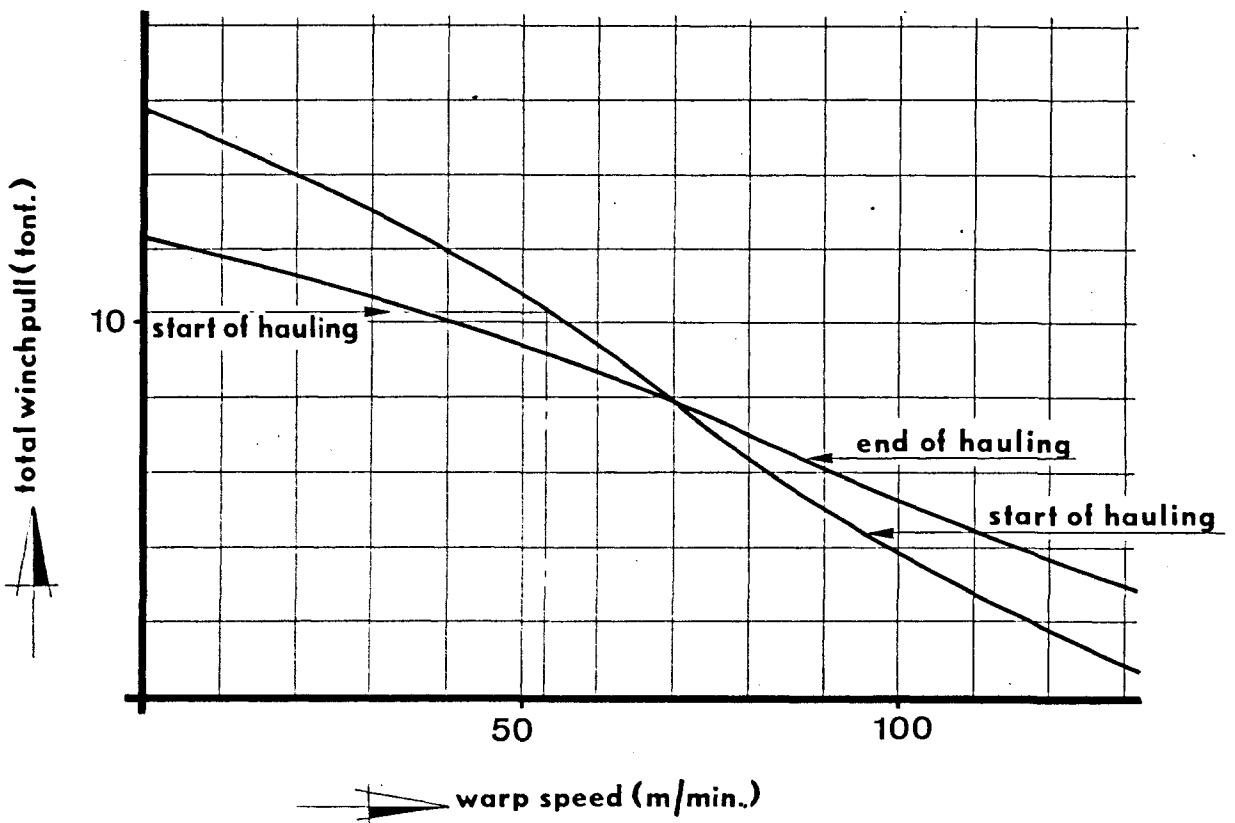
Gecontroleerd

Getekend **A**

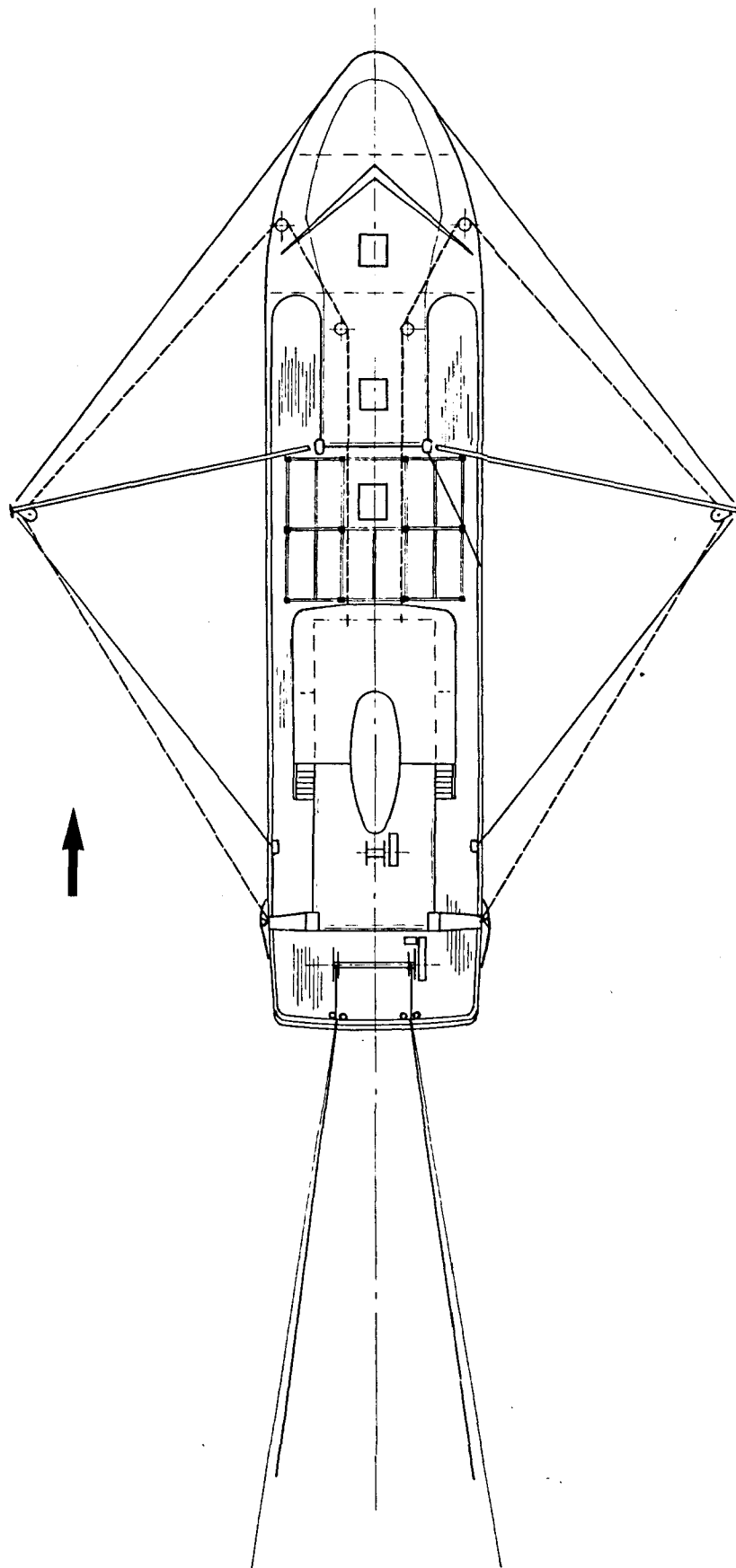
Gezien

Rangschikmerk

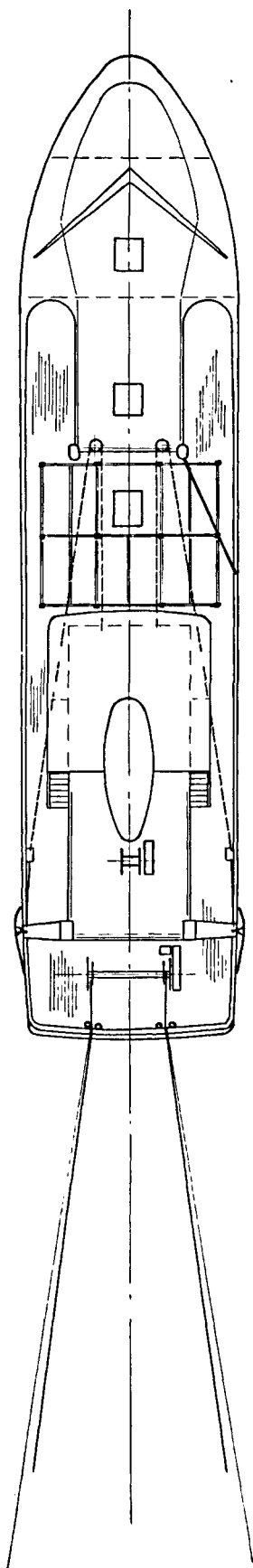
MID-WATER TRAWLING
 145 hp multi-purpose winch
 gearing ratio 44,5:1



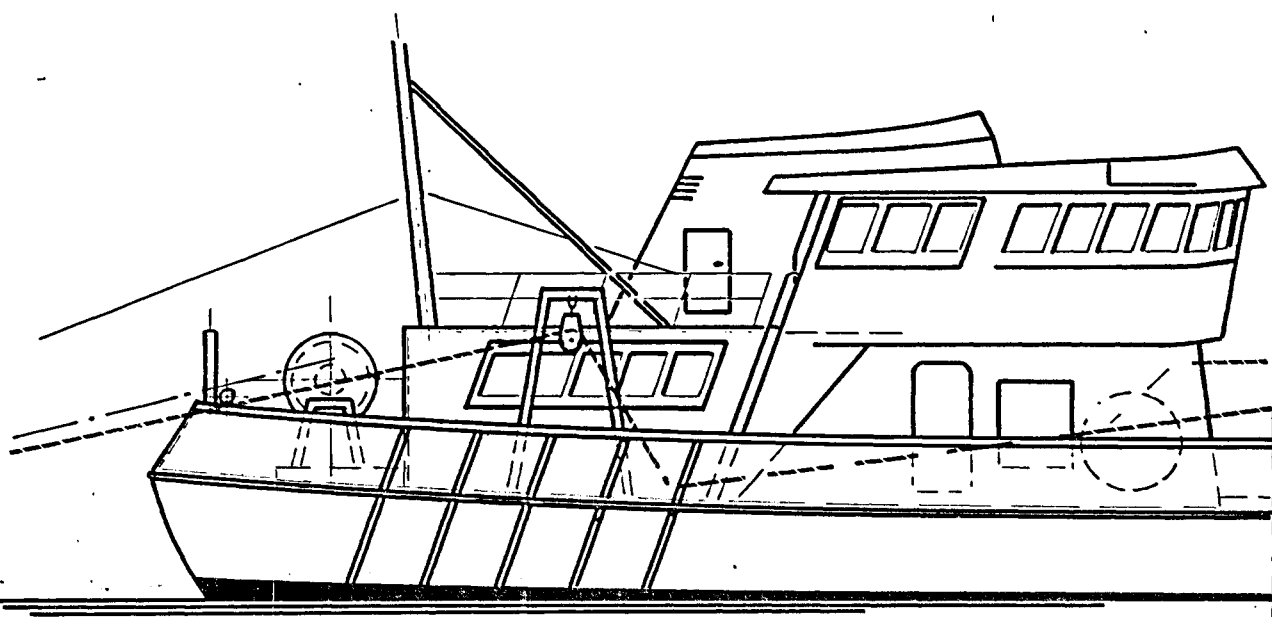
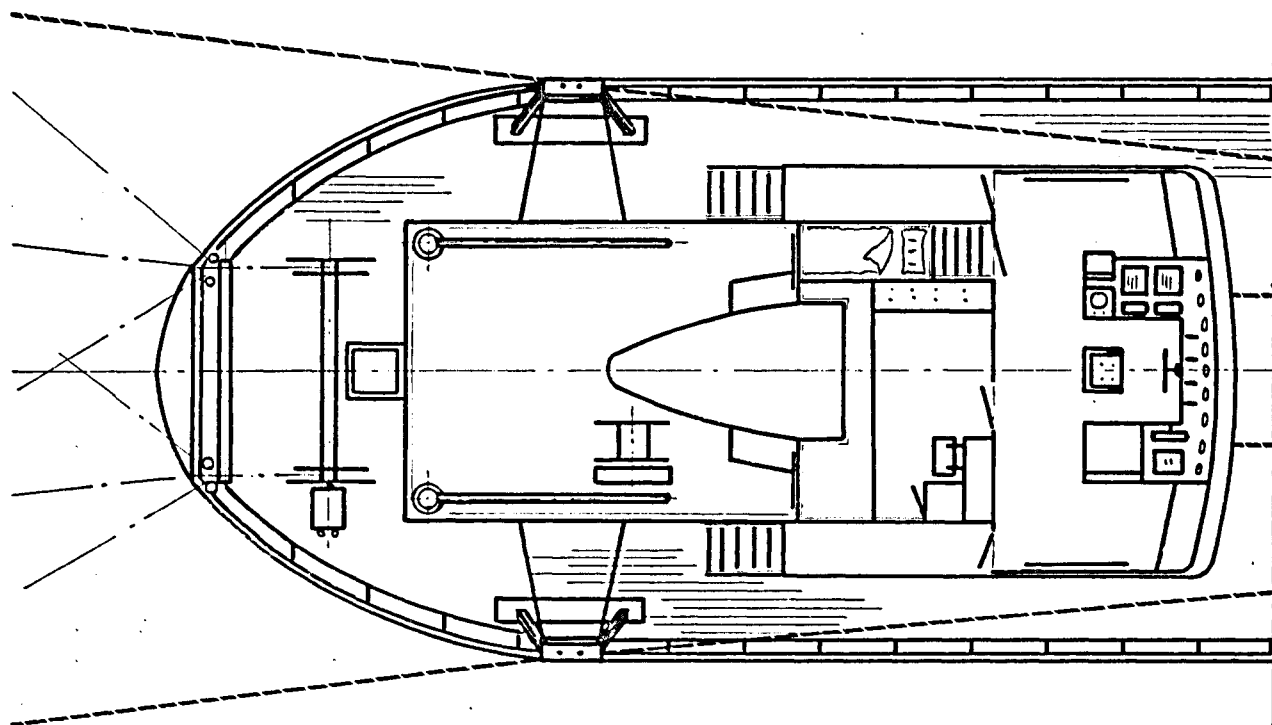
Benaming		Formaat	fig. 5
		A4	
Auteursrecht voorbehouden volgens de wet	Schaal	Gecontroleerd	Rangschikmerk
	Getekend A	Gezien	



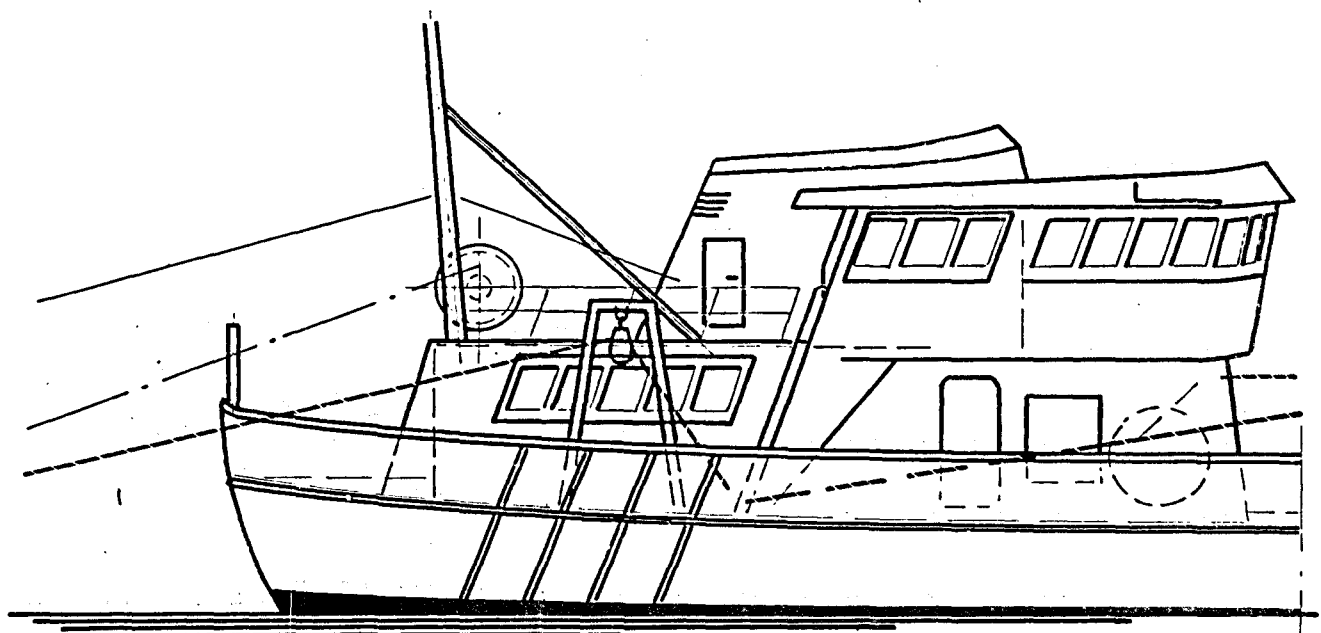
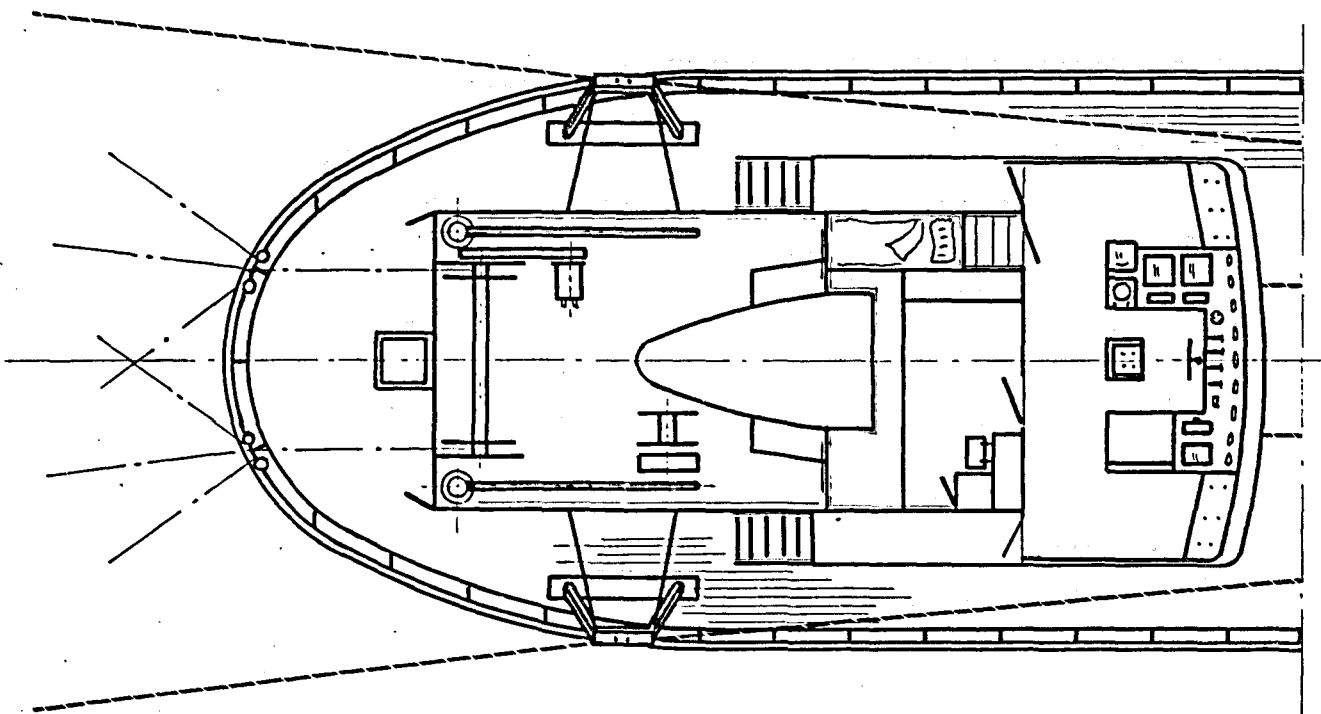
Benaming		Formaat A4	fig. 6
Auteursrecht voorbehouden volgens de wet	Schaal		
	Getekend	Gezien	Rangschikmerk



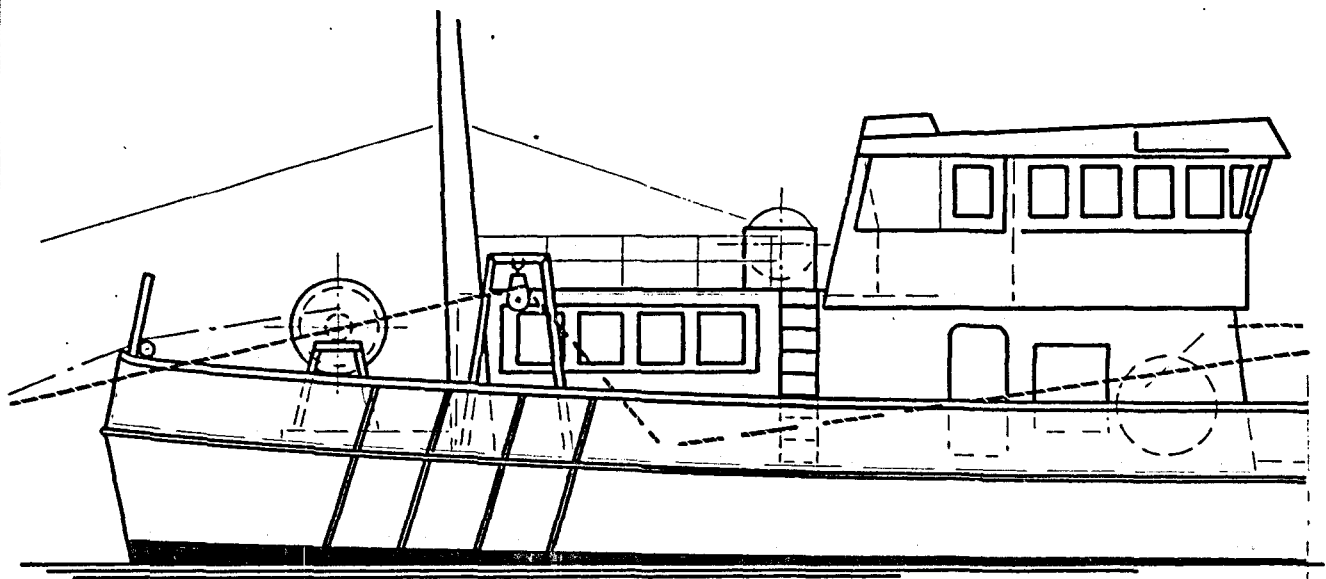
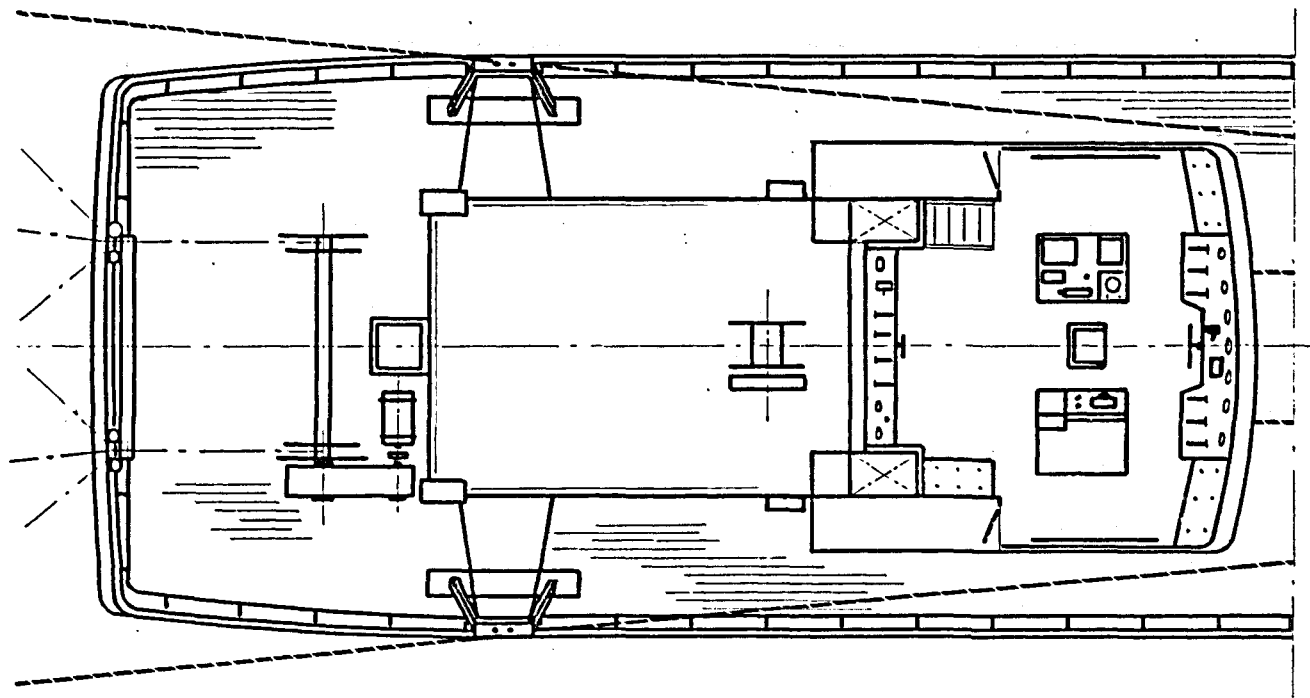
Benaming		Formaat	fig. 7
		A4	
Auteursrecht voorbehouden volgens de wet	Schaal	Gecontroleerd	Rangschikmerk
	Getekend	Gezien	



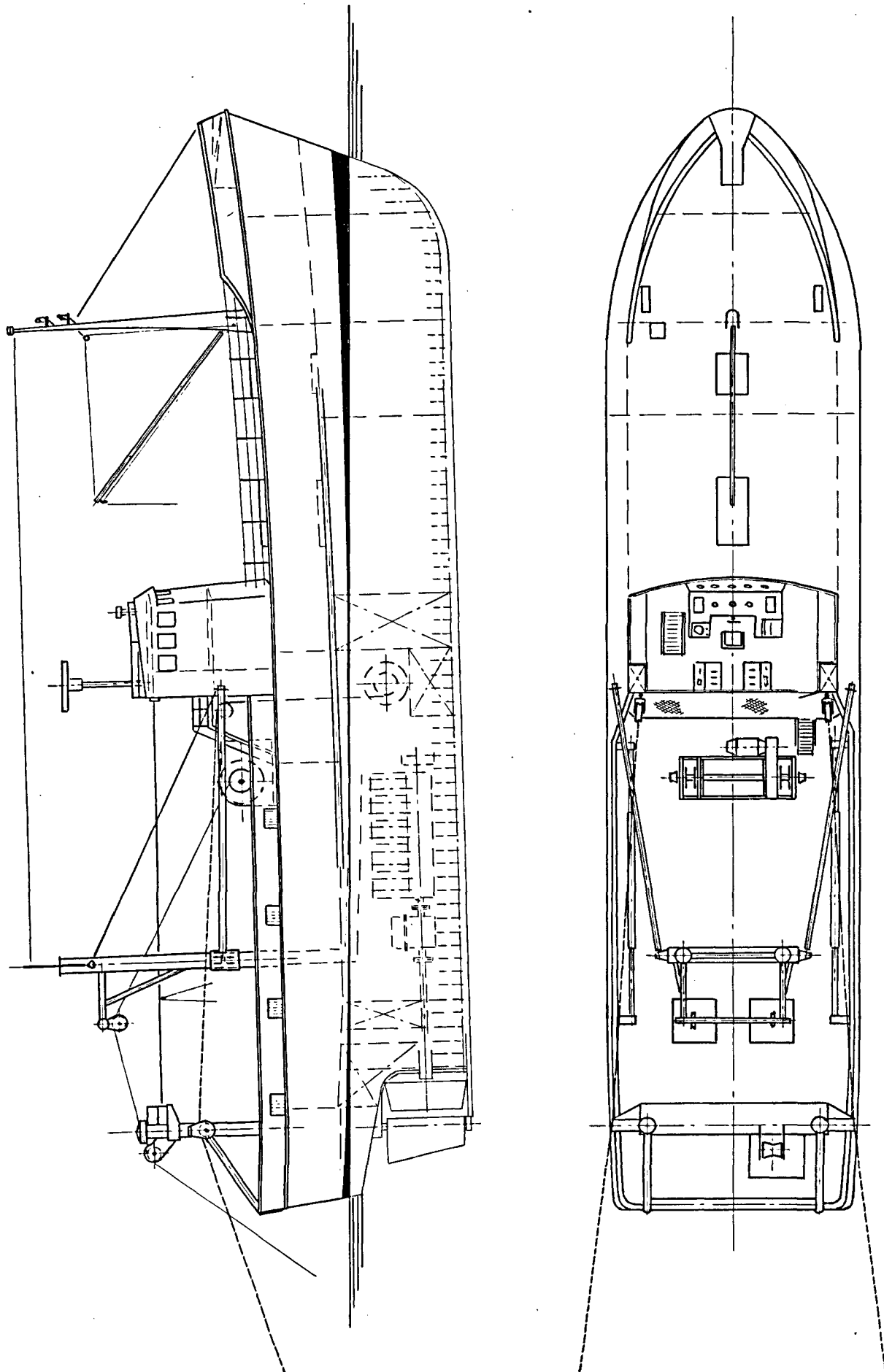
Benaming		Formaat	fig. 8
		A4	
Auteursrecht voorbehouden volgens de wet	Schaal	Gecontroleerd	Rangschikmerk
	Getekend	Gezien	



Benaming		Formaat	fig. 9
		A4	
Schaal		Gecontroleerd	Rangschikmerk
Getekend		Gezien	
Auteursrechten voorbehouden volgens de wet			



Benaming		Formaat	fig. 10
Schaal	Gecontroleerd	A4	
Auteursrecht voorbehouden volgens de wet		Getekend	Gezien
		Rangschikmerk	



Benaming		Formaat	
Auteursrecht voorbehouden volgens de wet		Schaal	Gecontroleerd
		Getekend	Gezien
		Rangschikmerk	

Formaat

A4

fig. 11

Auteursrecht voorbehouden volgens de wet

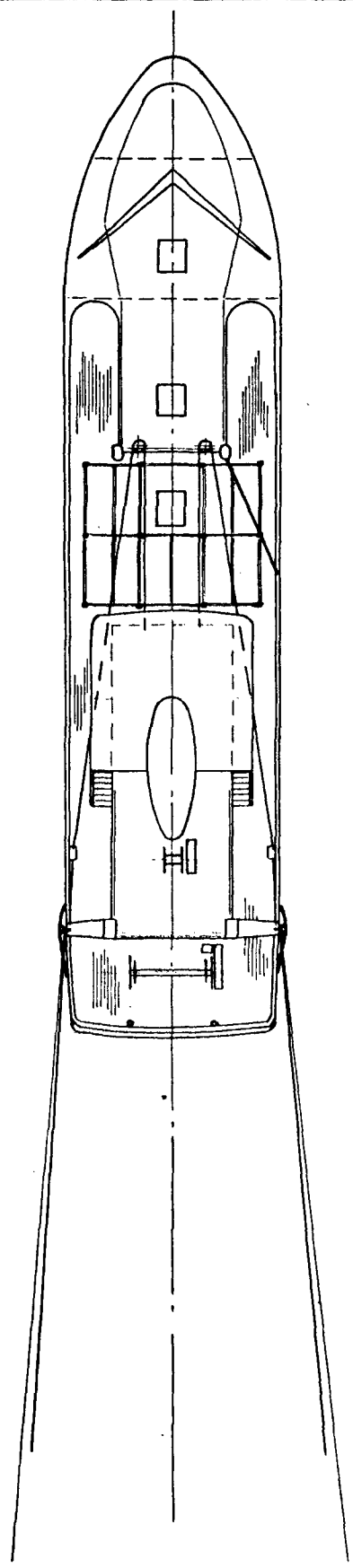
Schaal

Gecontroleerd

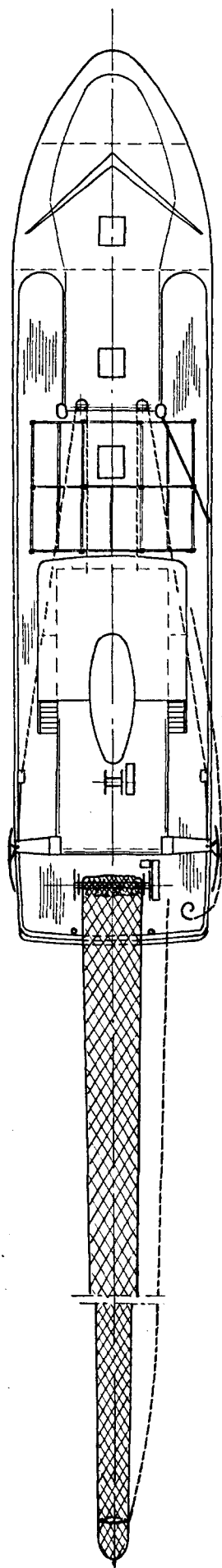
Getekend

Gezien

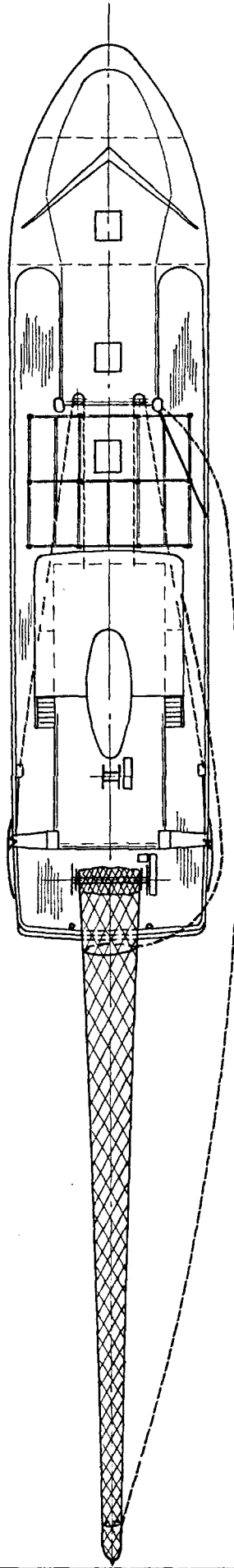
Rangschikmerk



KONINKLIJKE		Formaat	fig. 12
		A4	
Auteursrecht voorbehouden volgens de wet	Schaal	Gecontroleerd	Rangschikmerk
	Getekend	Gezien	

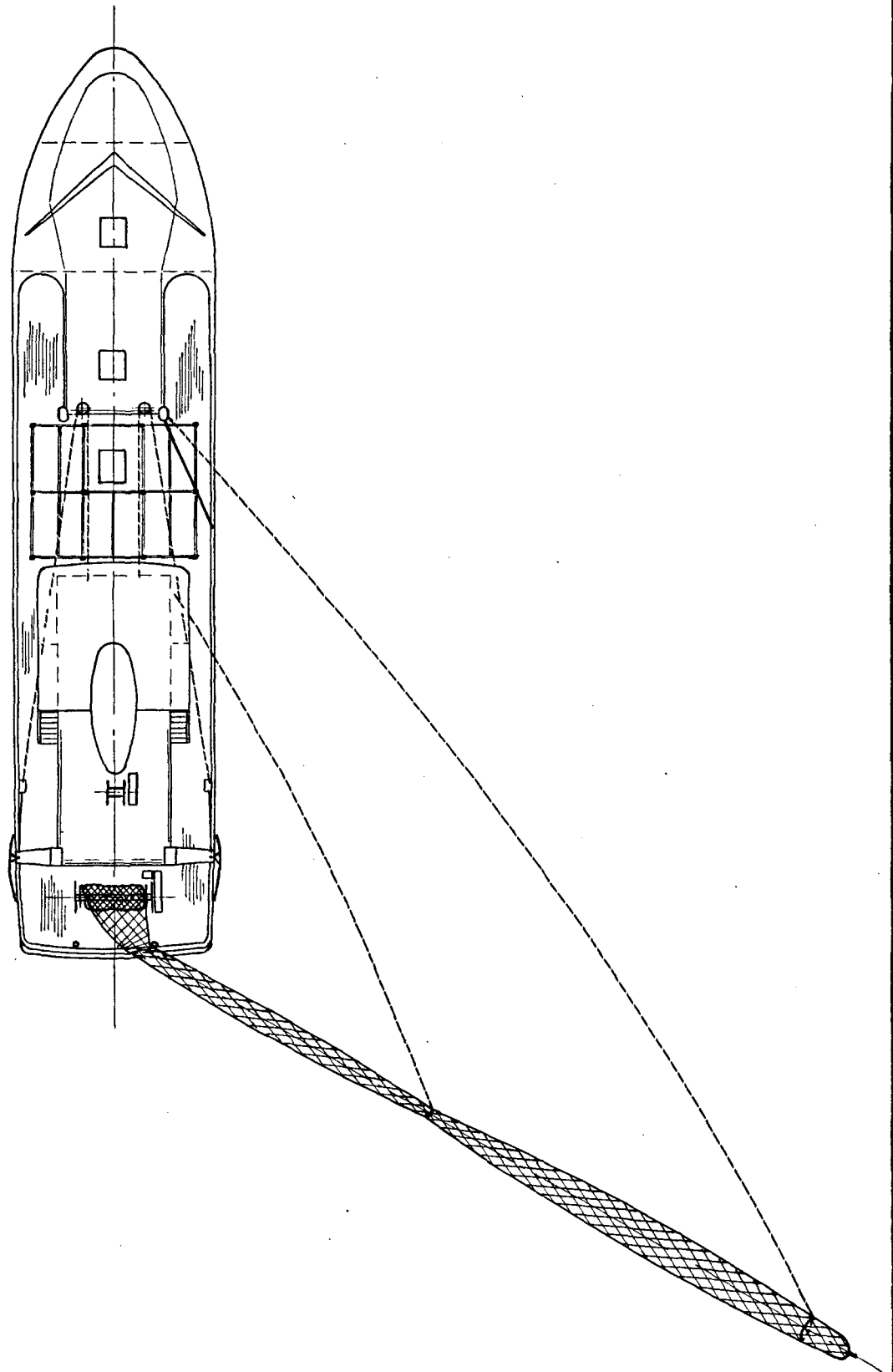


Benaming		Formaat	fig. 13
	Schaal	Gecontroleerd	
Auteursrecht voorbehouden volgens de wet		Getekend	Rangschikmerk
		Gezien	

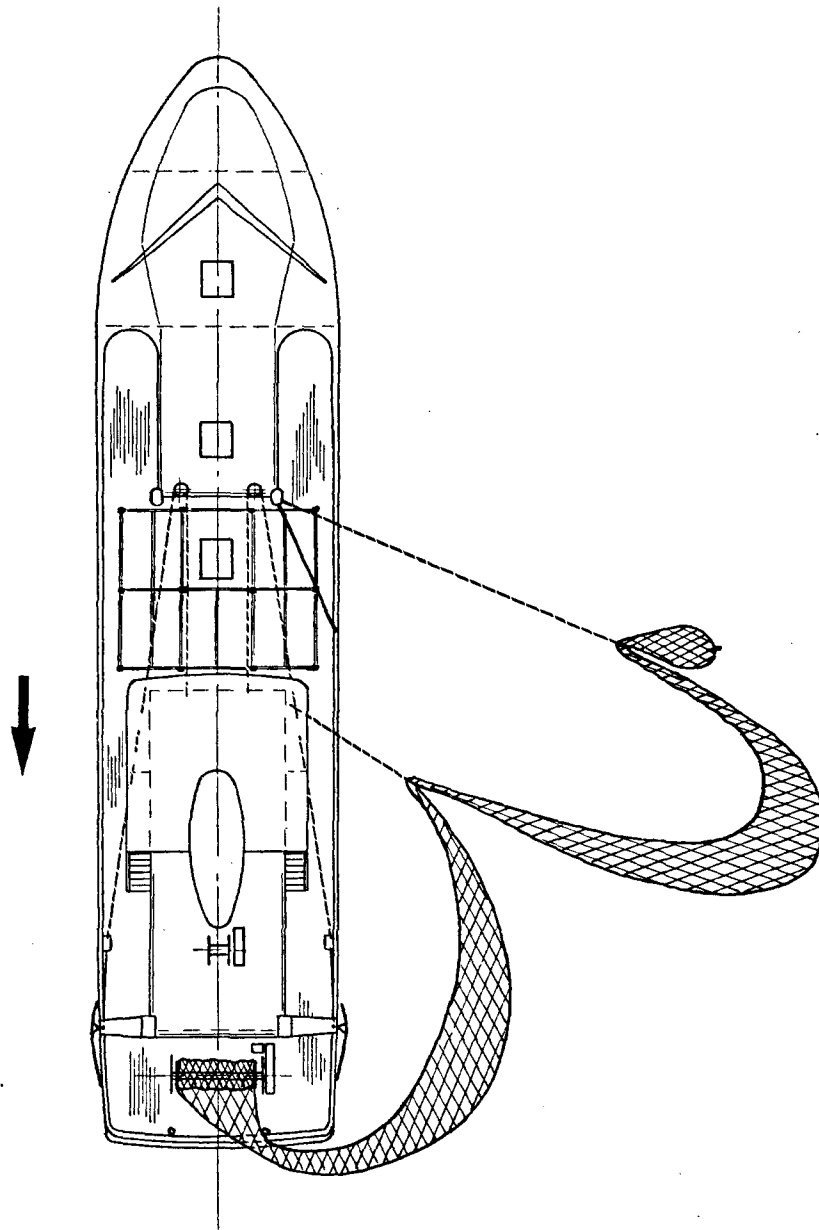


Benaming		Formaat A4	fig. 14
Schaal	Gecontroleerd		
Getekend	Gezien	Rangschikmerk	

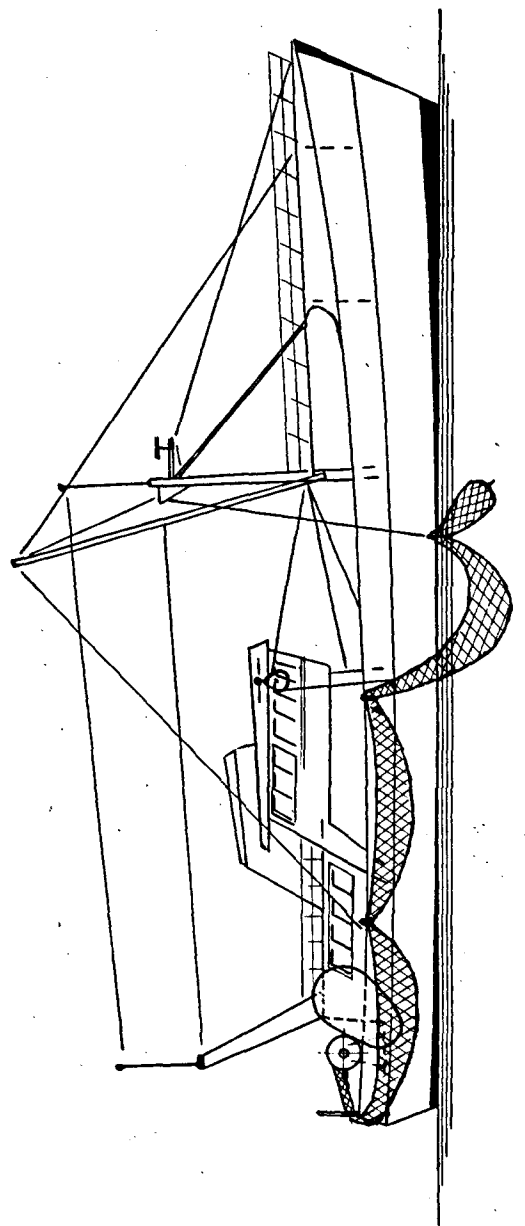
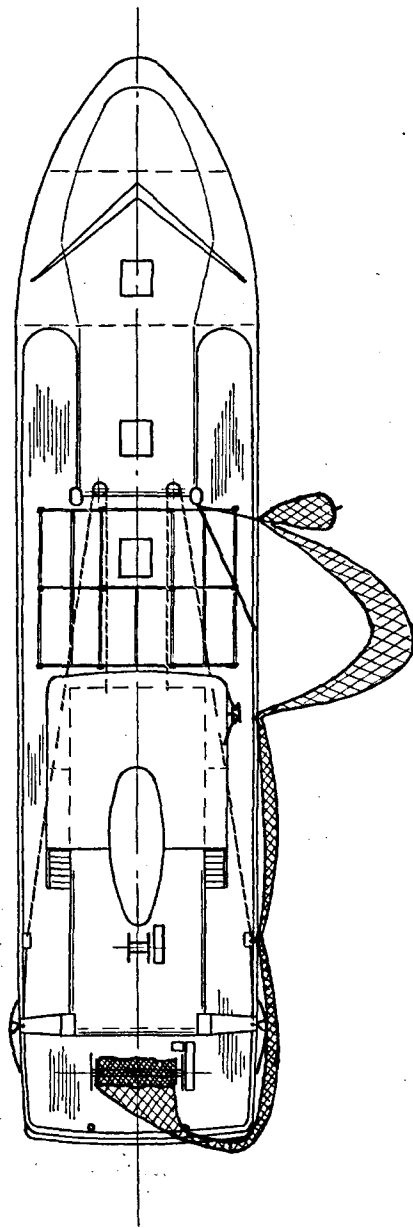
Auteursrecht voorbehouden volgens de wet



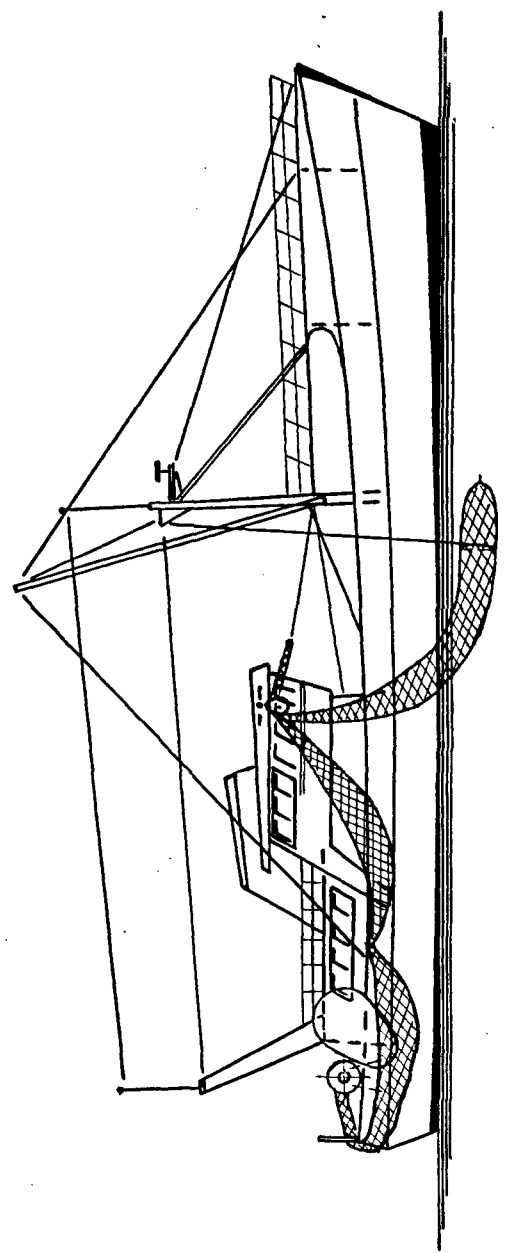
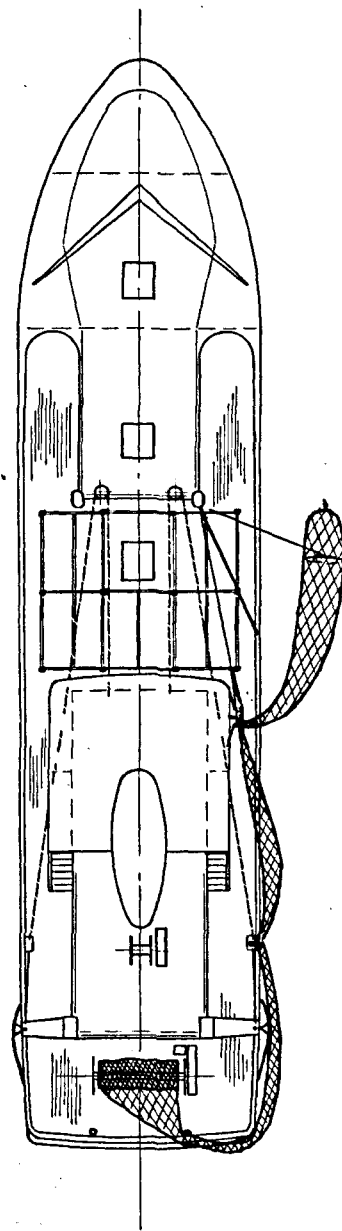
Benaming		Formaat	fig. 15
		A4	
Auteursrecht voorbehouden volgens de wet	Schaal	Gecontroleerd	Rangschikmerk
	Getekend	Gezien	



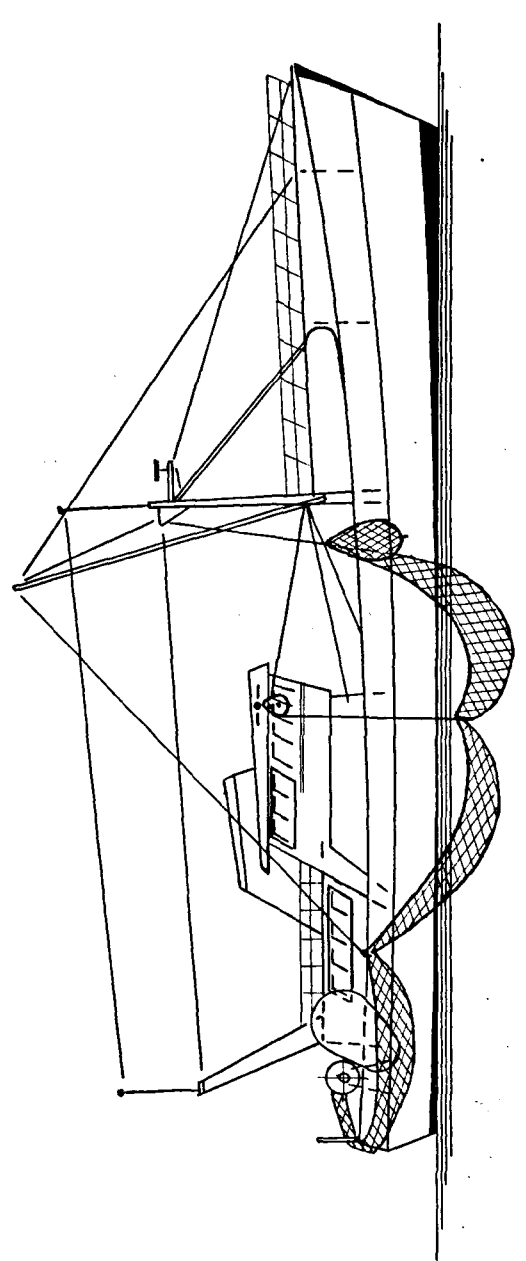
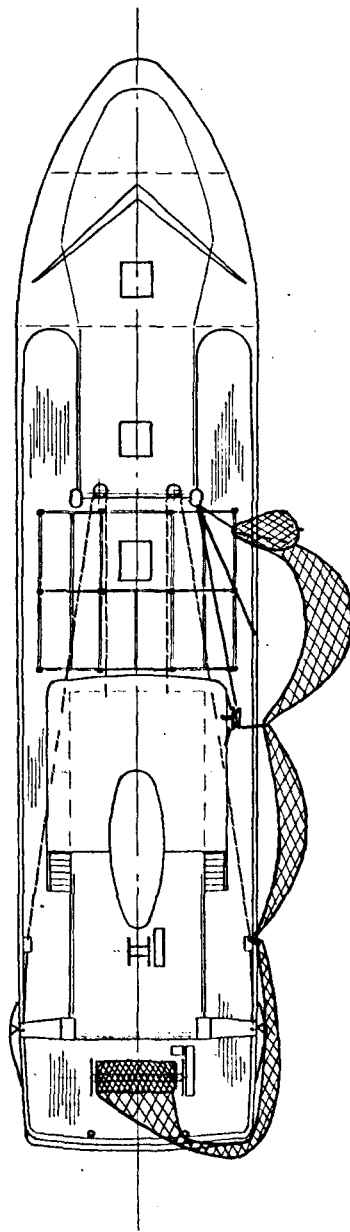
Benaming		Formaat	
		A4	fig. 16
		Schaal	Gecontroleerd
Auteursrecht voorbehouden volgens de wet		Getekend	Gezien
		Rangschikmerk	



Benaming		Formaat	fig. 17
		A4	
Auteursrecht voorbehouden volgens de wet	Schaal	Gecontroleerd	Rangschikmerk
	Getekend	Gezien	



Benaming		Formaat	
		A4	fig. 18
Schaal		Gecontroleerd	
Getekend		Gezien	
Auteursrecht voorbehouden volgens de wet		Rangschikmerk	



Benaming		Formaat	
		A4	fig. 19
Auteursrecht voorbehouden volgens de wet	Schaal	Gecontroleerd	
	Getekend	Gezien	
		Rangschikmerk	



Stern view of 1760 hp multi-purpose trawler





**Atdeck of 2000 hp multi-purpose combination wet fish/ freezer
stern trawler (L.o.a. 40,5 m)**