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DEVELOPMENT OF THE BEAM TRAWLER TO A MULTI-PURPOSE VESSEL

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223 1210

DEVELOPMENT OF THE BEAMTRAWLER TO A MULTI-PURPOSE VESSEL.

Introduction

The Dutch fishing fleet is specialized in trawling operations such as otter trawling, one- and two boat mid-water trawling, beam trawling and dredging. Of these fishing methods one boat mid-water trawling for herring and beam trawling for flatfish are the most important and the Dutch fishermen are well-known experts in these techniques.

One boat mid-water trawling is performed by the typical Dutch stern trawlers without stern chute. The trawl winches of these vessels are designed and constructed to match the demands of mid-water trawling, finding expression in the high pull characteristic of this deck machinery. Since 1969 two net-drums were incorporated into the winch for efficient gear handling. The Dutch stern trawlers take no part in distant water fisheries, but are restricted to the North Sea and the waters around the British Isles. The stern trawlers fish in relatively shallow waters with good or fair bottom conditions on which high quality species, especially herring, are found. These features explain the lacking stern chute, which is of great importance in respect of the design and construction of the gears. Unlike the slipway stern trawler, the gears are of lighter construction. This means that for manoeuvring the mid-water trawl, for instance, less powerful winches are needed.

Illustrating, a 2700 h.p. Dutch stern trawler has a winch which can deliver a pull of 25 tonf at a warpspeed of 75 m/min. This vessel is using a 2700 meshes -675 meshes of 80 cm stretched- mid-water trawl in combination with 8 m^2 Süberkrüb-doors.

At the moment the Dutch middle water fleet numbers 38 side trawlers (800-1200 h.p), 8 wet fish stern trawlers (950-1200 h.p) and 37 combination wet fish/freezer stern trawlers (1200-2700 h.p). Of the latter type 4 vessels are under construction. Fourteen of the side trawlers have been converted to combination side/stern trawlers, by clearing the boat deck and equipping the vessels at this position with a gantry, netdrum, stern roller and netsounder winch.

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 a great amount 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 (stone-mat).

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 h.p., the average being 1160 h.p. This record was broken in last year when 47 beam trawlers ranging from 600 to 2000 h.p. 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 metre vessels had engines of 200-240 h.p. The 26.25 metre vessels built in 1968 had a propulsive power of 640 h.p. (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 h.p. 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 in the beginning of 1973 the question of specific beam trawling fishing for other species, for instance herring and round fish, was put forward, implying the application of otter trawling, one- and two boat mid-water trawling. 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, adopting 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) and reversible drive (mainly electrical).

Beam trawlers fish with heavy gears in relatively shallow waters. In general the amount of warp paid out is 110 metres (60 fathoms). The weight of a beam trawl of a 1110 h.p. vessel is approximately 4.5 ton. A gear of a 1760 h.p. beam trawler weight 6.4 ton. The main engine delivers under normal fishing conditions 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. Measurements onboard several beam trawlers have proved that, under normal conditions, the warp tension is in agreement with these calculations.

These measurements also showed that the warp tensions at the end of the hauling operation is 1,2 times greater than at the start. For a 1110 h.p. beam trawler, the winch pull at the start of hauling the gears is 11.0 tonf. The demanded warp speed when hauling is in the order of 50 metres per minute. In order to meet this requirement the winch drive should have a power of $\frac{11.000 \cdot 50}{0.85.60.75} = 145$ h.p. The coefficient 0.85 is the mechanical efficiency of the winch.

In general, the warp capacity does not exceed 300 metres (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 undulated seabed or an area with boulders, the gears are frequently subject to impacts. Heavy loadings also occur at the moment a gear comes into a fastener. The warps have to withstand this treatment without unexpected breaking.

The warps of a 1110 h.p. beam trawler have a diameter of 30.3 mm (3 3/4" circumference). The amount of warp per drum is 300 metres. 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 warp length paid out, the gearing ratio of the winch-gearbox can be calculated. Onboard Dutch beam trawlers the winches are exclusively driven by electric motors with a rotational speed of 1050 r.p.m. 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 of 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 runs from the towing block at the side of the fore-castle to a double sheave block in the top of the boom, passing a block connected to the stays of the beam trawl, returning to the double sheave block and fastened on the fore-castle. By applying this system to a 1110 h.p. 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 torque's 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 favourable;

For bottom- and mid-water trawling the warp capacity of a 1110 h.p. trawler has to be at least 1080 metres (600 fathoms) 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 Dutch 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 h.p. trawler has a headline of 32 metres (104 feet).

Measurements onboard the F.R.V. "Tridens" have shown that the total warp tension when starting the hauling operation was 7.7 tonf at a warp speed of 68.6 metres per minute and 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 metres per minute. Observations by skippers has shown that at lower hauling speeds, fish in front of the "cod end lengthening piece" have the opportunity to escape.

If 250 fathoms of the 600 fathoms warp capacity is paid out, the radius of the warp on the drums when hauling of the gear starts, can be calculated. Secondly the desired gearing ratio of the winch-gearbox, in order to achieve a warp speed to the order of 70 metres per minute, can be determined. The gearing ratio for 145 h.p. 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 metres per minute and at the end of the hauling operation the winch can deliver a pull of 8.8 tonf at a warp speed of 57 metres per minute.

A summary of the specifications of the trawl winch is:

- winch drive 145 h.p. at 1050 r.p.m.
- gearing ratio 44.5 : 1
- drum diameter 400 mm
- width between flanges 520 mm
- outside diameter of flanges 1300 mm
- warp diameter 21.8 mm (6x26 Warrington-Seal)
- warp capacity 1080 m (600 fathoms)

The performance of this trawl-winch during beam trawling can be questioned. By this fishing method the warp is double reeved, therefore the amount of warp paid out is 220 metres (2x60 fathoms). Figure 4 shows that the multi-purpose winch can deliver the total warp pull of 11.0 tonf at a speed of 46 metres per minute and 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 h.p./1050 r.p.m. electric drive system. It is clear that fitting the related vessels with the double reeved warp system can result in dangerous loadings on gears and/or rigging.

c. Mid-water trawling

Some Dutch beam trawlers change, in the herring season, over to two-boat mid-water 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 mid-water trawling is in operation, 1000-1200 h.p. 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 h.p. one boat mid-water trawling for herring can, in certain conditions, be an alternative fishing method. The mid-water trawl for a 1110 h.p. multi-purpose vessel will have a circumference of 400 meshes with a stretched length of 80 cm. This gear is used in combination with 4.3 m^2 Süberkrüb-doors and 100 metres bridles.

An analysis of the performance of both winch and propeller of a 1000 h.p. combination side/stern trawler shows that the total pull for hauling the mentioned gear was 10.3 tonf at a warp speed of 60 metres per minute. 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 metres per minute. It is felt that this performance is acceptable for a multi-purpose 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 co-operation with a well-known netfactory.

This co-operation started with the design, constructing and testing of a 37 metre (122 feet) head-line trawl constructed of netsections with meshsizes (stretched) 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 sidewards directed forces. The connection of the kites to the headline with clip connectors enables a fast replacement by kites with 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 meshsizes in the wings, square and belly (40 cm stretched instead of 15 cm),
- reduced number of netsections with different meshsizes (4 instead of 12-14),
- increased vertical netopening (depending 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 roundfish one.

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 mid-water 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 mid-water 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 which are 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 mid-water trawling. The solution proved to be the French "poly-valent" door of Morgère (St. Malo).

After trials onboard the F.R.V. "Tridens" and a 1200 h.p. converted beam trawler it was found that these doors have an excellent performance for bottom trawling. The performance as "mid-water door" is slightly inferior in comparison with the convential Süberkrüb-doors and mainly caused by the heavier weight. Illustrating, the 4.3 m^2 Süberkrüb-doors have a weight of 750 kg and the 4.57 m^2 poly-valent doors 1200 kg.

Because mid-water trawling by the Dutch trawlers is mainly performed with the net close to or even on the seabed it is felt that, in case of unexpected bottom contact, the poly-valent doors will be less damaged or even suffer no 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 mid-water trawls over the stern of beam trawlers, the running of the warps can be questioned. A possibility is to let the warp pass through the boom sheave to the towing block at the stern gallows (figure 6). When fishing with an otter trawl the booms are in a 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 that 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 in a horizontal position in the longitudinal direction of the vessel 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 nowadays a necessity. This netdrum can be located on the aftdeck (figure 8) or on the top of the aft part of the superstructure (figure9). 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 from 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 warps on the drums. In order to wind

the bridles on the netdrum two special compartments are available. For regular winding and to protect the netdrum from sidewards directed forces when the vessel is not straight ahead of the gear, vertical guiding rollers are fitted at the stern. These rollers can be removed easily.

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 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 Dutch beam trawlers have pneumatic controlled winches, this extension of the control system is fitted easily. In case of emergency 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 choosen because of its limited dimensions and the excellent characteristics. Dutch beam trawlers, however, have in general 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 only electrical systems, often an electric drive for the netdrum is prefered.

Since the skippers of beam trawlers showed increasing interest in otter- and mid-water trawling, the vessels are built with transom sterns. The superstructure is placed more forward (figure 10). The result of both measures 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 by a new built vessel, and is in fact the arrangement as found onboard the middle- and near-water stern trawlers.

It is felt that for multiple fishing operations with vessels over 35 metres in length, the stern trawler type of vessel is the most efficient one. An example of a multi-purpose stern trawler is shown in figure 11. This 2000 h.p. vessel (L.o.a.=40.5 m) is 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 mid-water 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 demonstated 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 drag. When the headline is clear, the net-drum is stopped to allow the three kites and the netsounder transducer to be clipped to the headline.

In case the bridles are wound on the warp drums, these are connected to the net. The netdrum is rotated again in order to let the bridles take the pull, after which the messenger wires can be disconnected. Winding off the bridles is continued 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 of 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 run out.

Hauling is carried out in the reverse manner to shooting. The doors are pulled up to the gallows and the bridles are wound on the winch drums (figure 12). After disconnecting the kites and the transducer, the messenger wires of the netdrum are attached to the wing ends.

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 is continued till the length of the net still overboard equals approximately 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 then wound off in order to have sufficient length of net outboard when bringing the cod end and the cod end lengthening piece alongside the starboard side of the vessel. To achieve this the vessel is brought hard over and simultaneously both dog rope and lazy deckie are pulled in (figure 15).

The vessel is put full astern to take way off and hauling of 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 a bight of the net is lashed to the bollard just forward 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.

Table 1 BEAM TRAWLING - directives for warps

Propulsive power	500 h.p	750 h.p	900 h.p	1200 h.p	1500 h.p
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

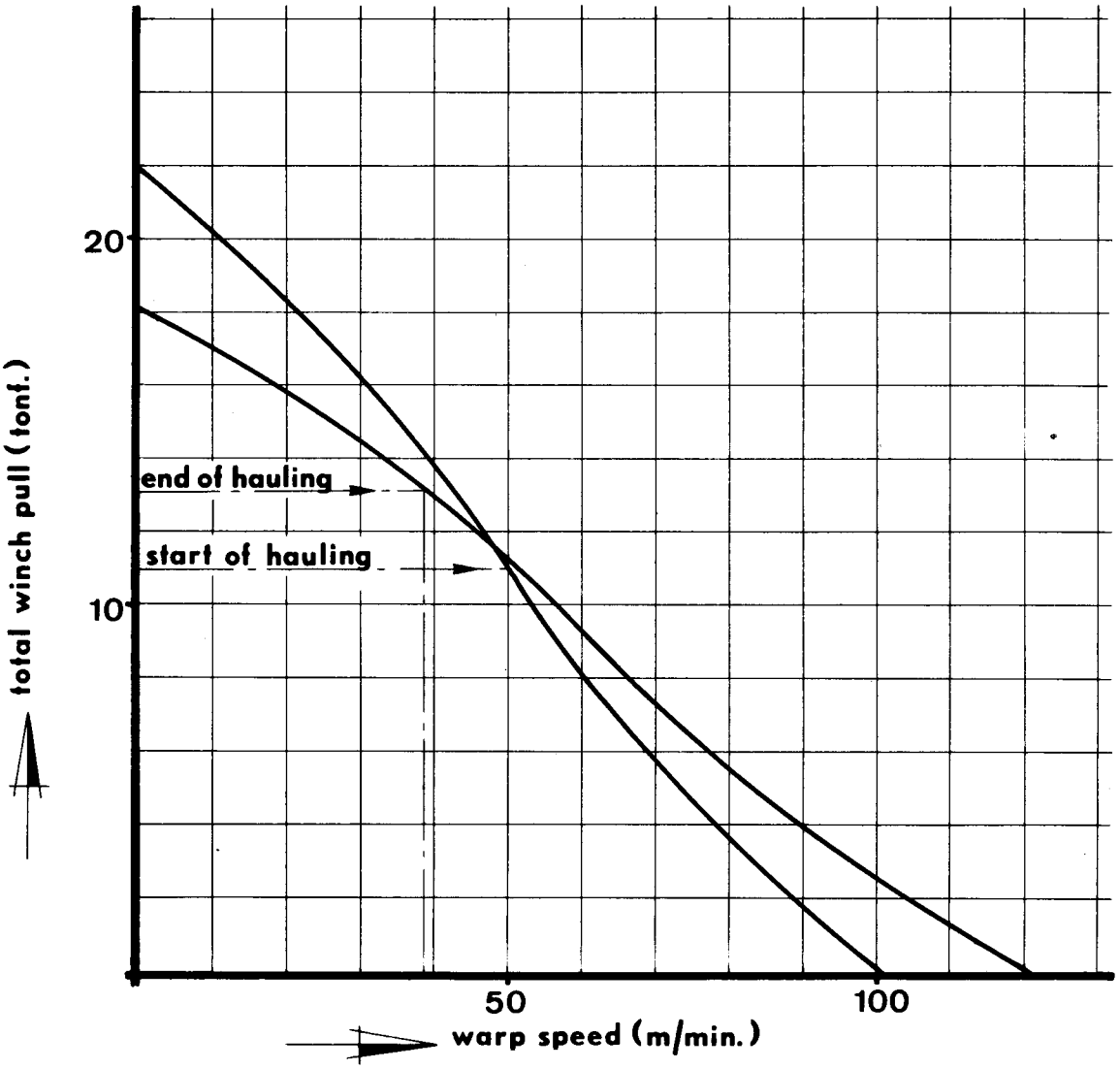
Table 2 OTTER- AND MID-WATER TRAWLING -directives for warps

Propulsive power	750-1200 h.p.	1200-1600 h.p.	1600-2300 h.p.
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

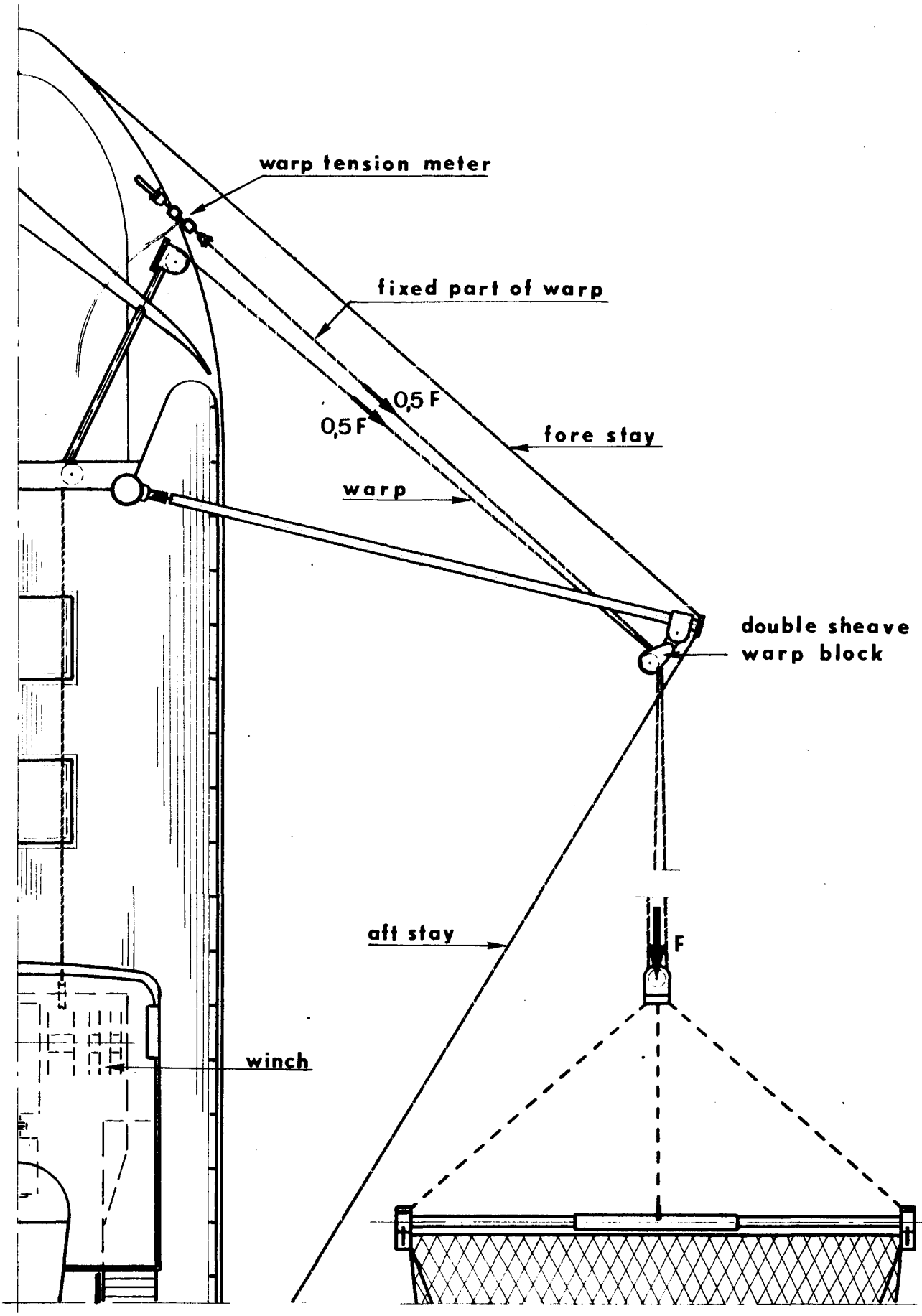
Table 3 DIRECTIVES FOR HIGH-HEADLINE TRAWLS

Propulsive power (h.p)	500 h.p	750 h.p	900 h.p	1200 h.p	1500 h.p	1800 h.p
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)	2.6x1.2m	2.7x1.2m	2.8x1.3m	3.0x1.3m	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	.6x1.0m-----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 net-opening (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		
Auteursrecht voorbehouden volgens de wet	Getekend AV	Gezien	Rangschikmerk	

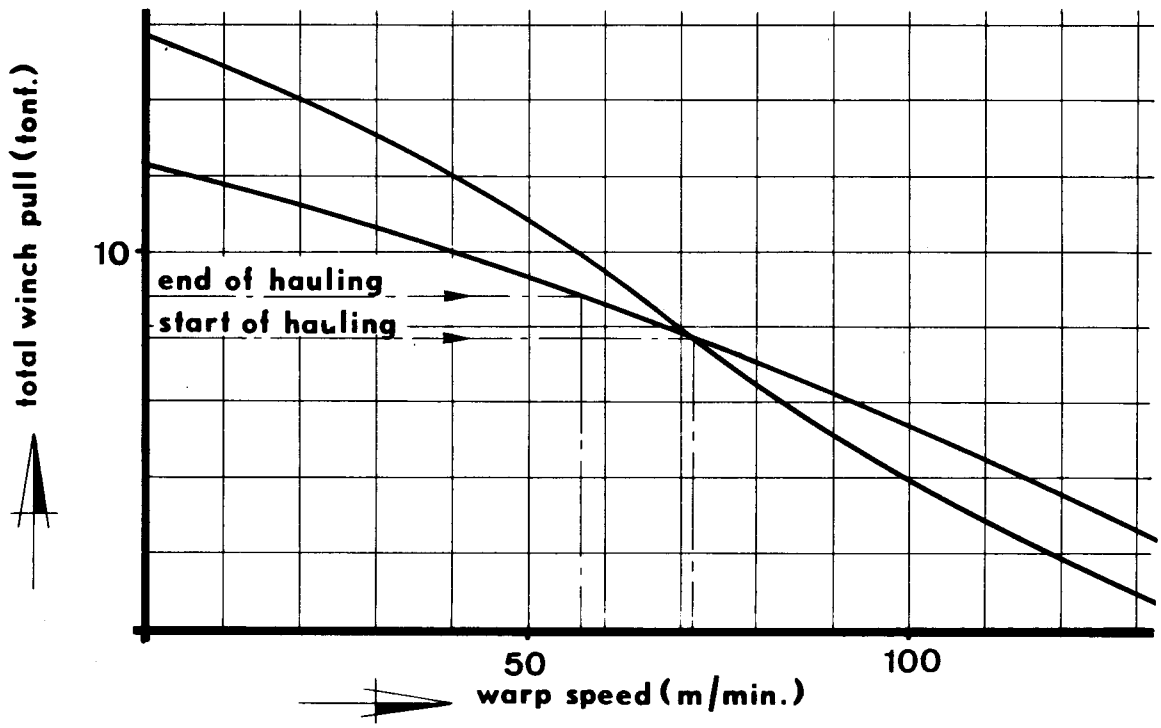


Benaming

"TWIN-WARP" ARRANGEMENT

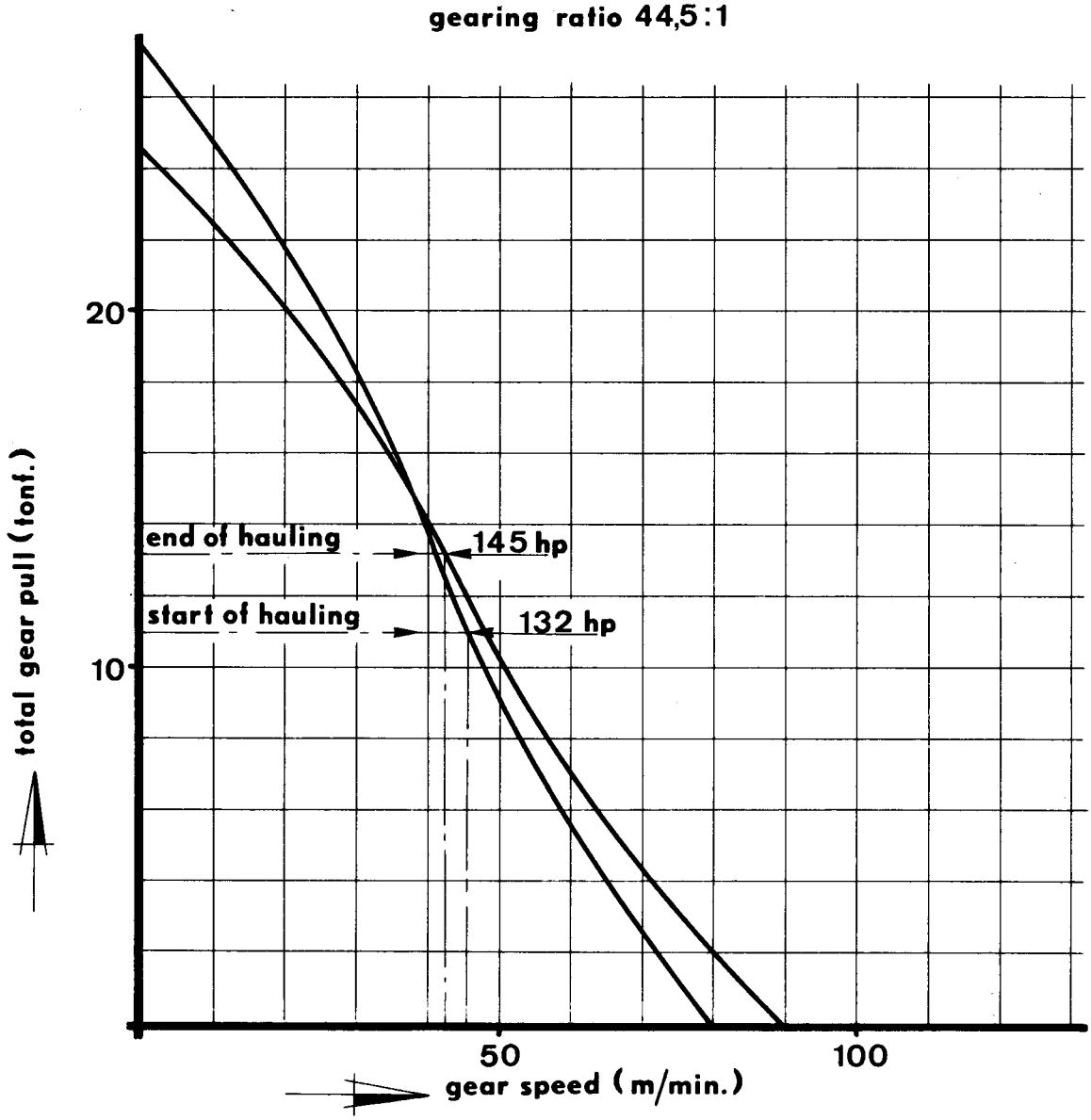
	Schaal	Gecontroleerd	Formaat A4 — fig. 2
Auteursrecht voorbehouden volgens de wet	Getekend AV	Gezien	Rangschikmerk

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



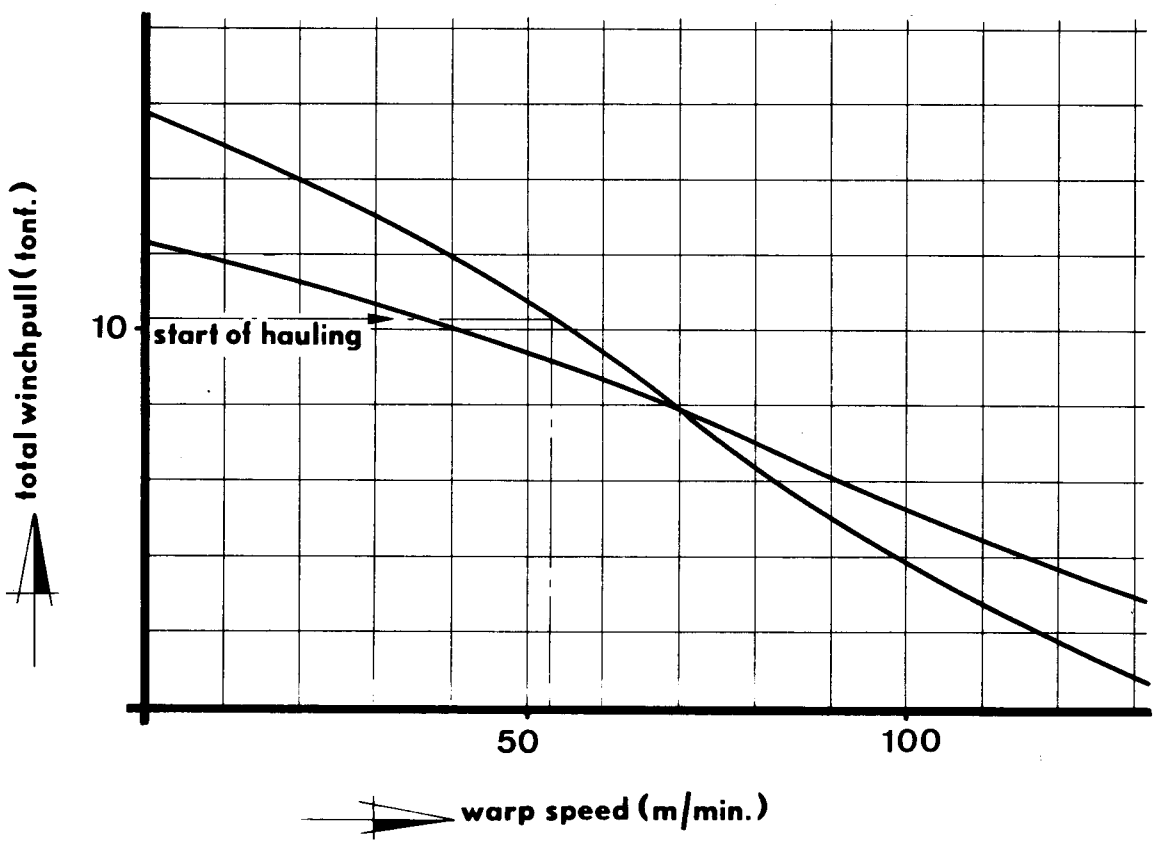
Benaming			Formaat A4	fig. 3
Auteursrecht voorbehouden volgens de wet	Schaal	Gecontroleerd		
	Getekend AV	Gezien	Rangschikmerk	

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



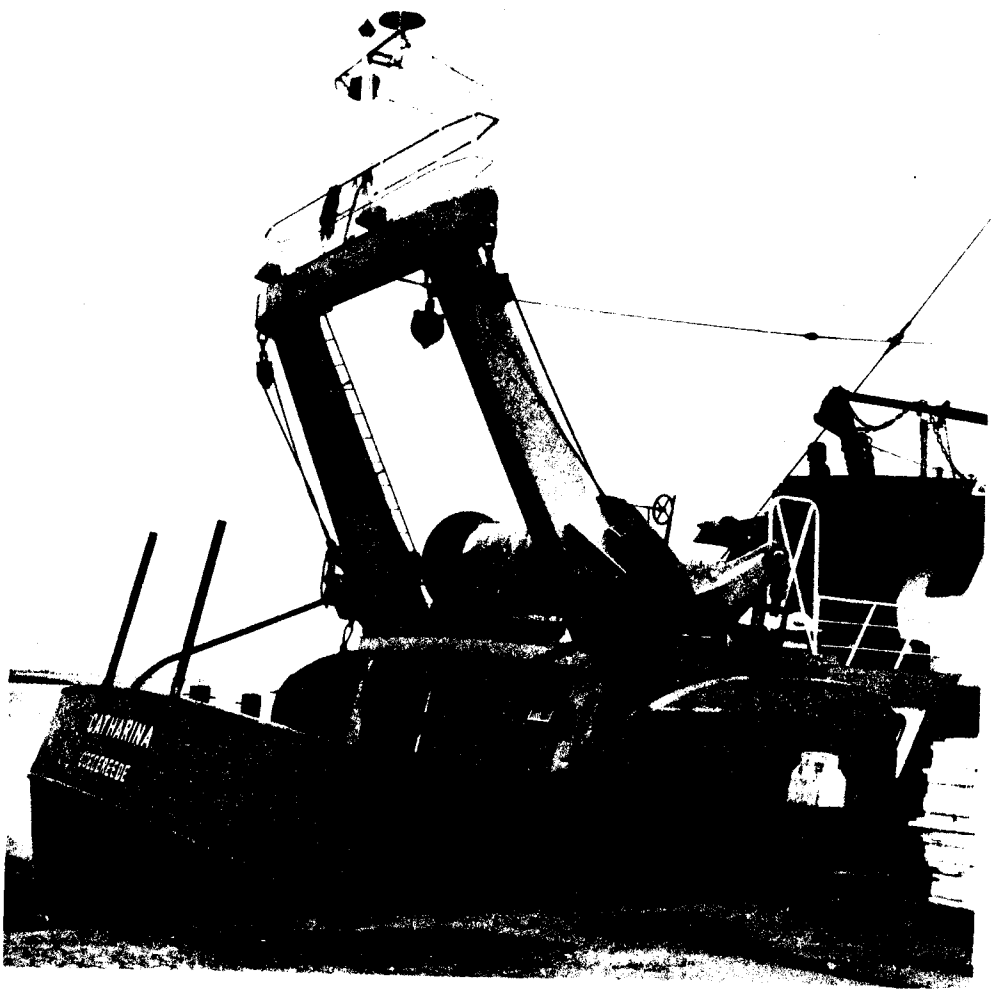
Benaming			Formaat A4	fig. 4
Auteursrecht voorbehouden volgens de wet	Schaal	Gecontroleerd		
	Getekend AV	Gezien	Rangschikmerk	

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

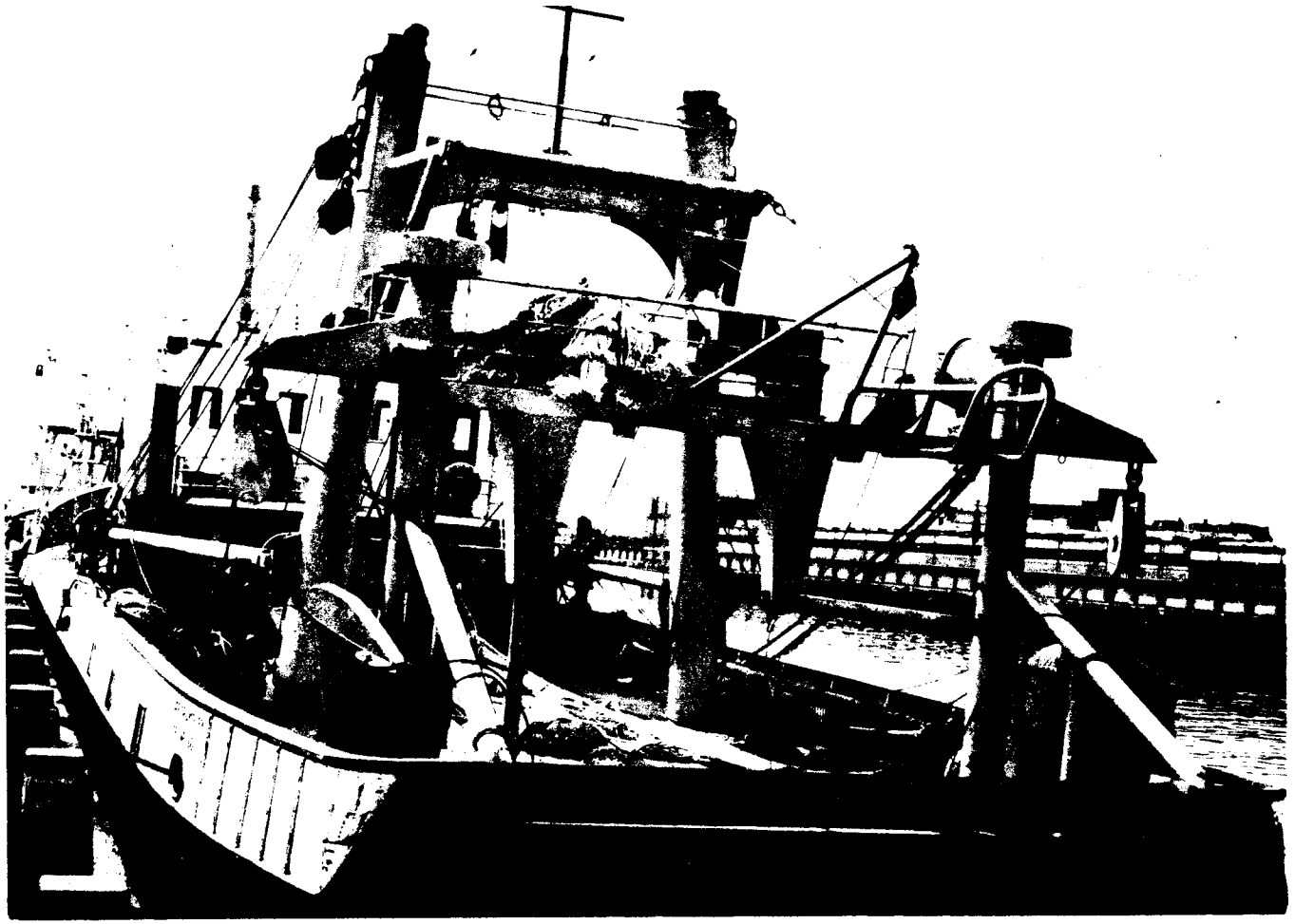


Benaming			Formaat A4	fig. 5
Auteursrecht voorbehouden volgens de wet	Schaal	Gecontroleerd		
	Getekend AV	Gezien	Rangschikmerk	

Stern view of 1760 hp multi-purpose trawler

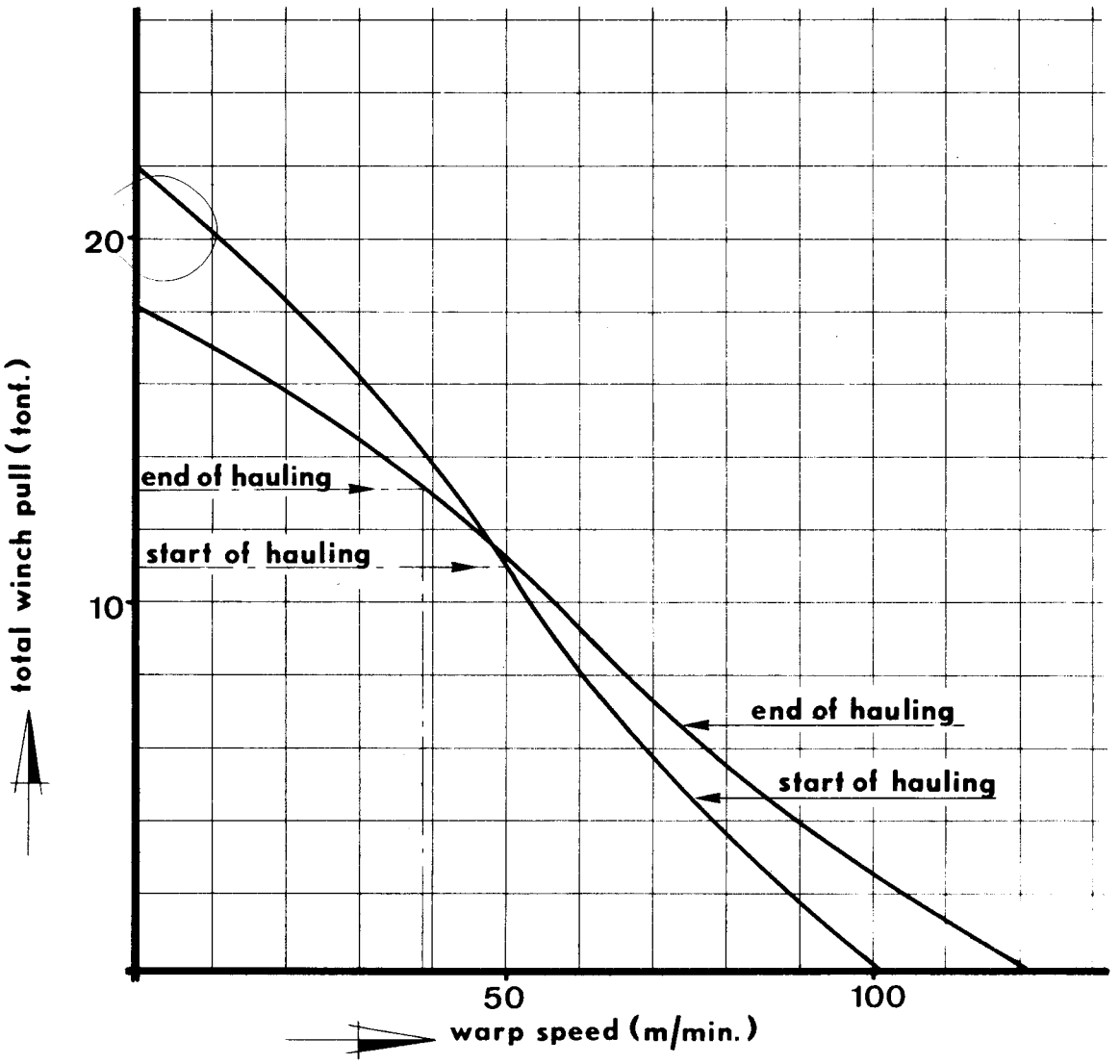


CM. 1975/B:12 Fish
Catching Committee

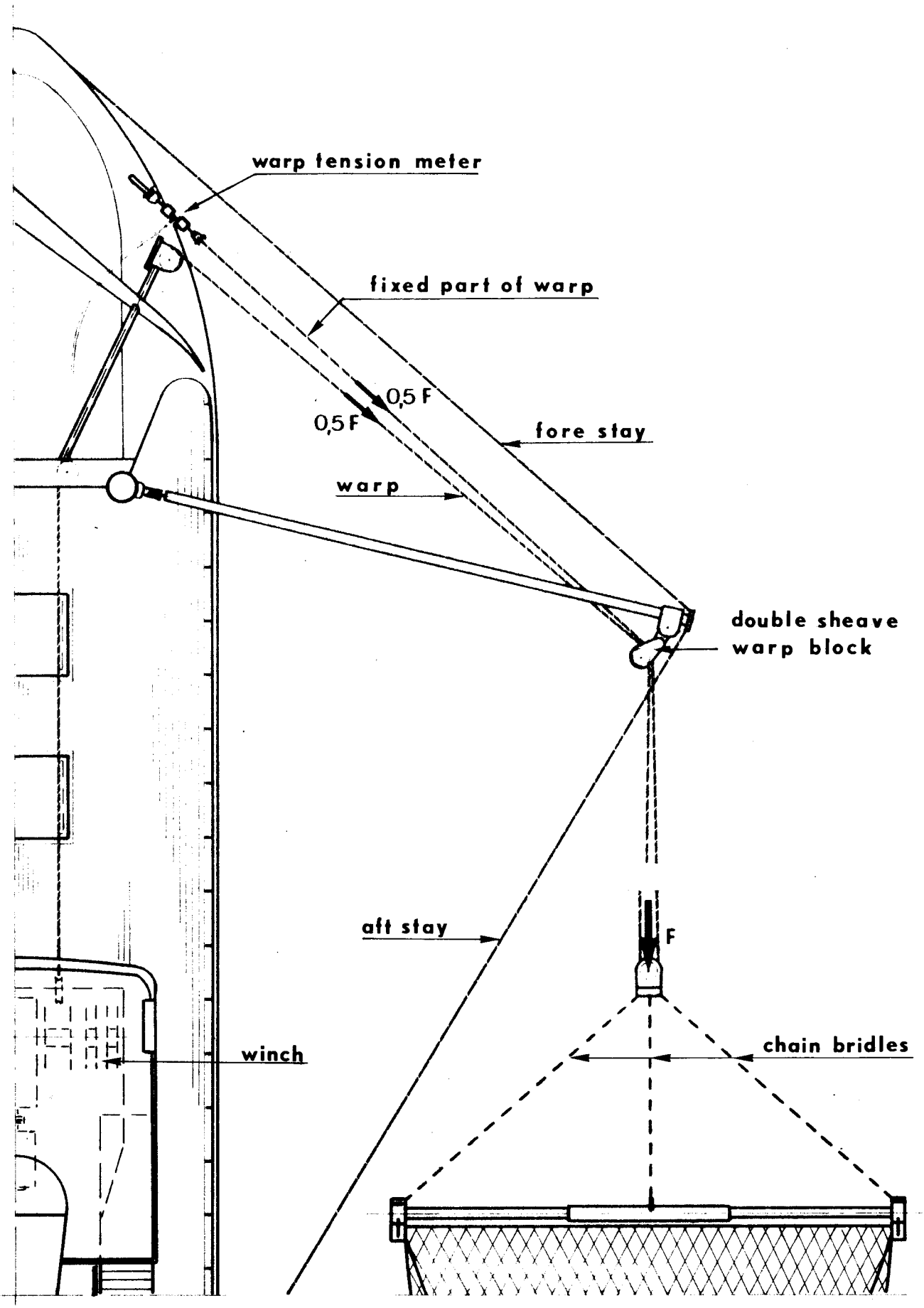


Aftdeck of 2000 hp multi-purpose combination wet fish/freezer stern trawler (L.o.a. 40,5 m)

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



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

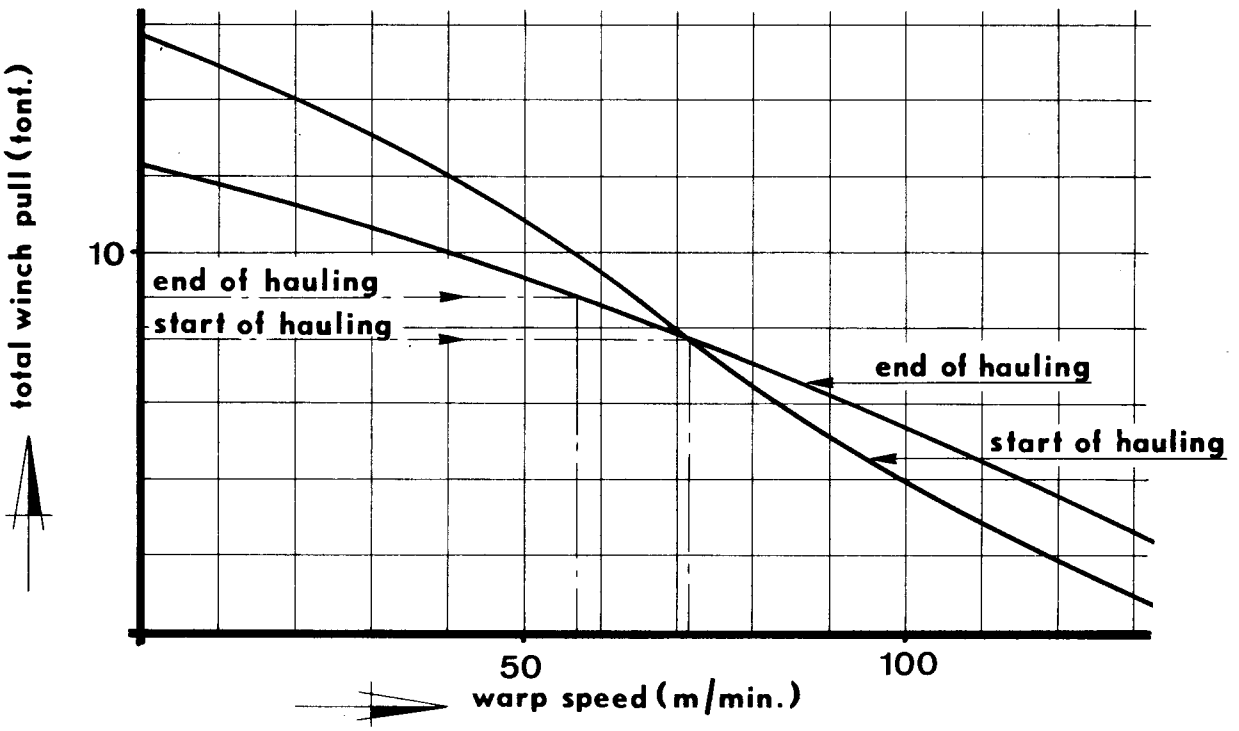


Benaming

"TWIN-WARP" ARRANGEMENT

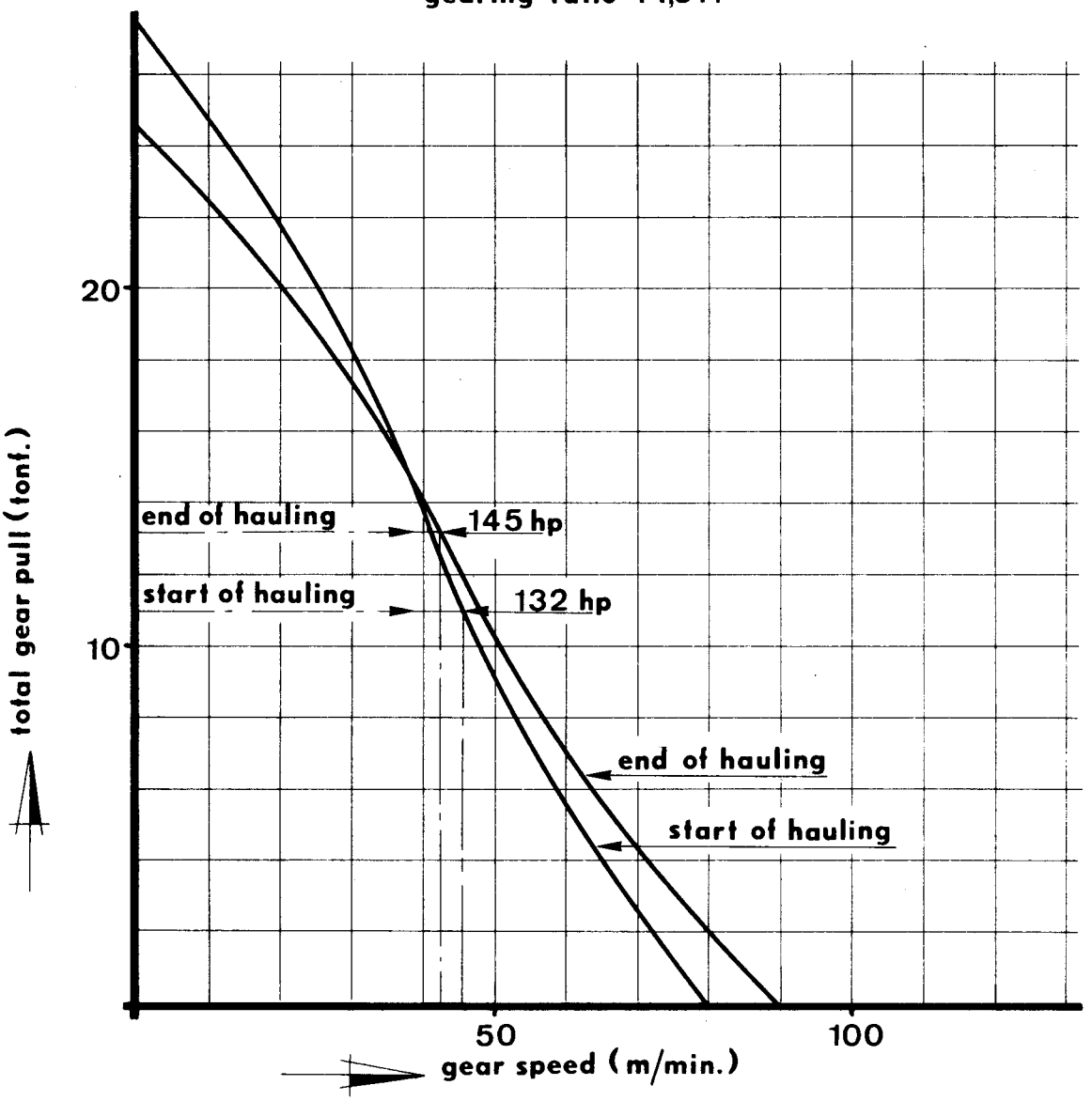
	Schaal	Gecontroleerd	Formaat A4 — fig. 2
Auteursrecht voorbehouden volgens de wet	Getekend AV	Gezien	Rangschikmerk

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



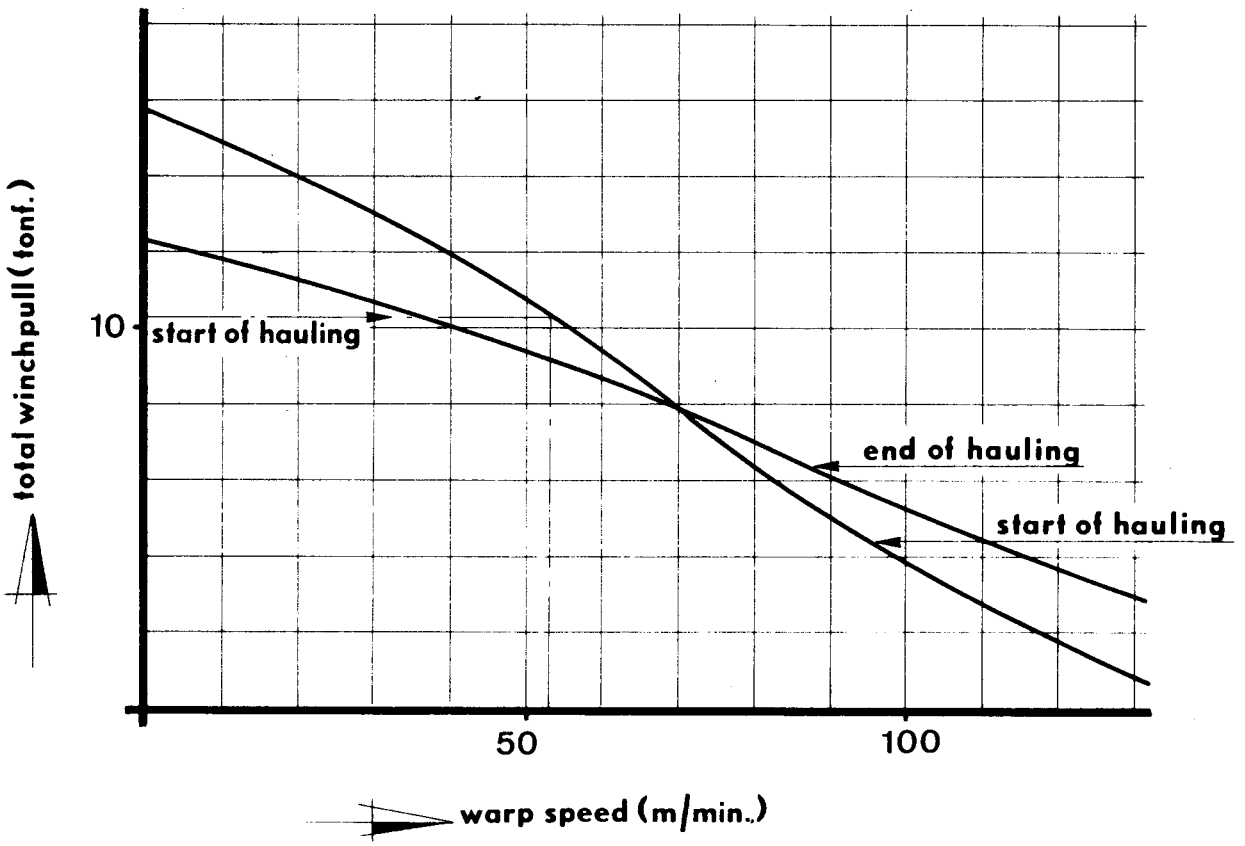
Benaming			Formaat A4	fig. 3
	Schaal	Gecontroleerd		
Auteursrecht voorbehouden volgens de wet	Getekend AV	Gezien	Rangschikmerk	

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

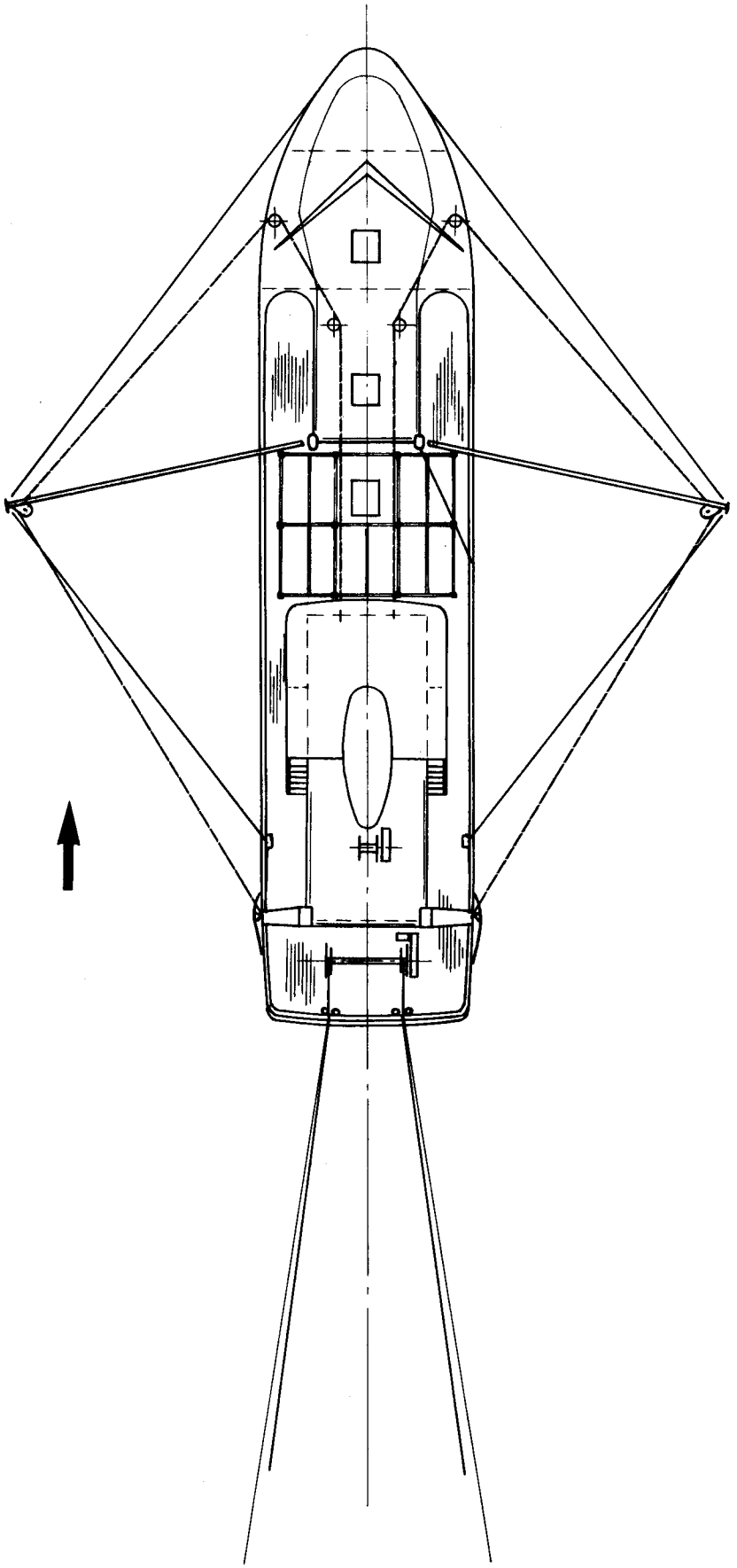


Benaming			Formaat A4	fig. 4
Auteursrecht voorbehouden volgens de wet	Schaal	Gecontroleerd		
	Getekend AV	Gezien	Rangschikmerk	

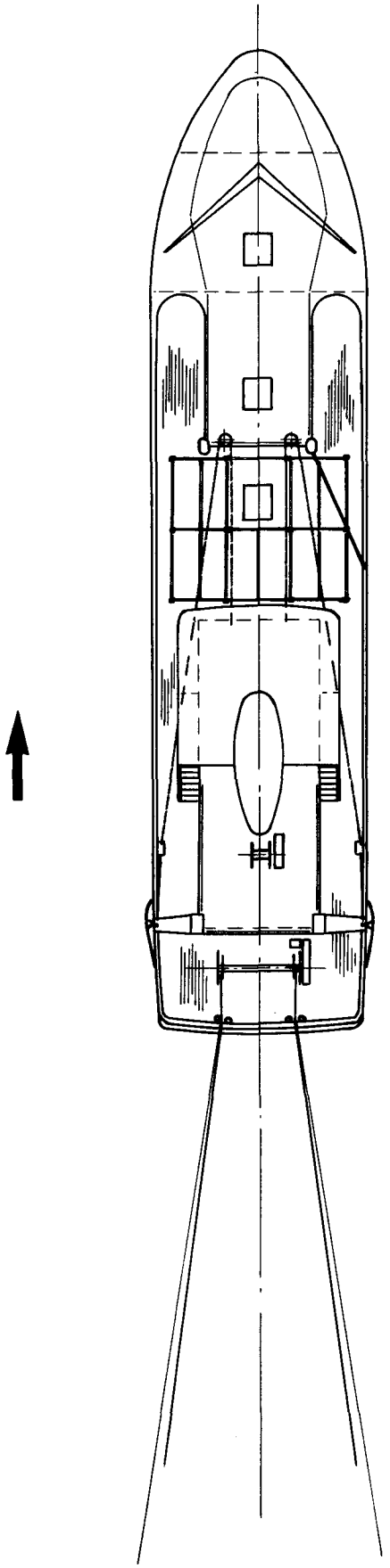
MID-WATER TRAWLING
145 hp multi-purpose winch
gearing ratio 44,5:1



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



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

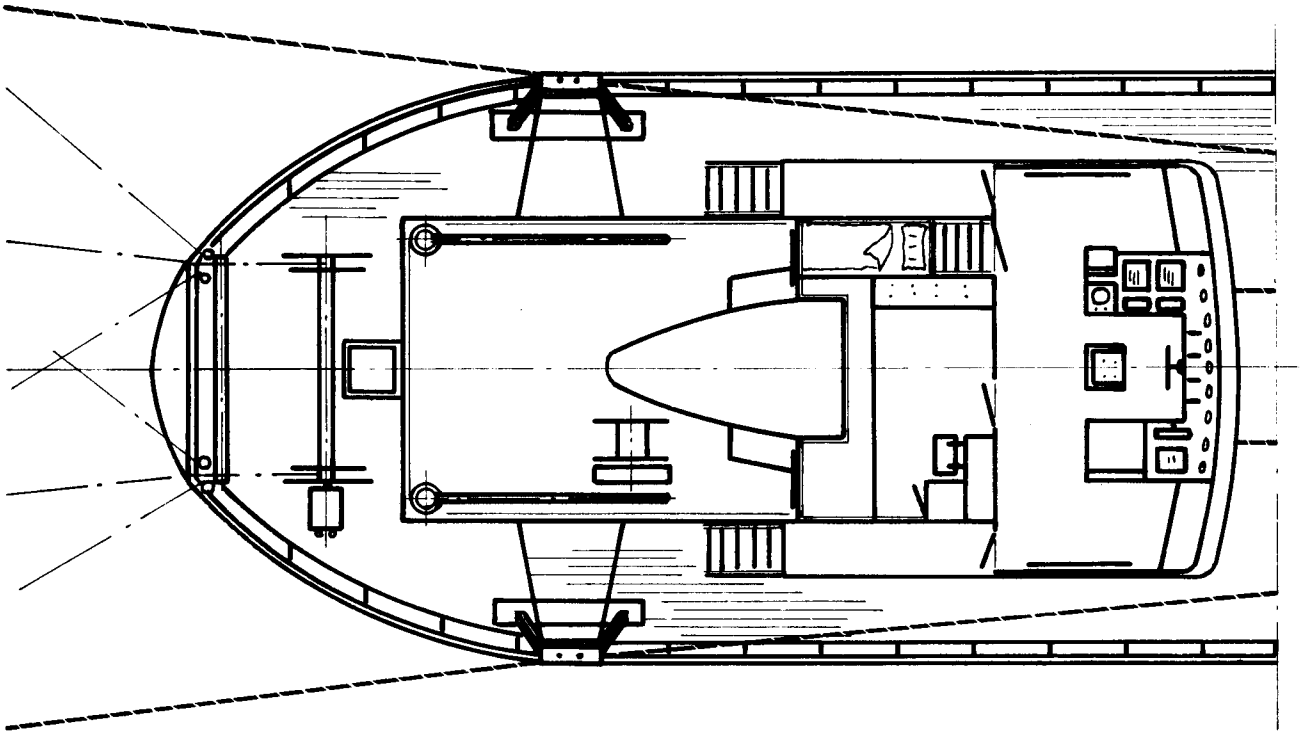


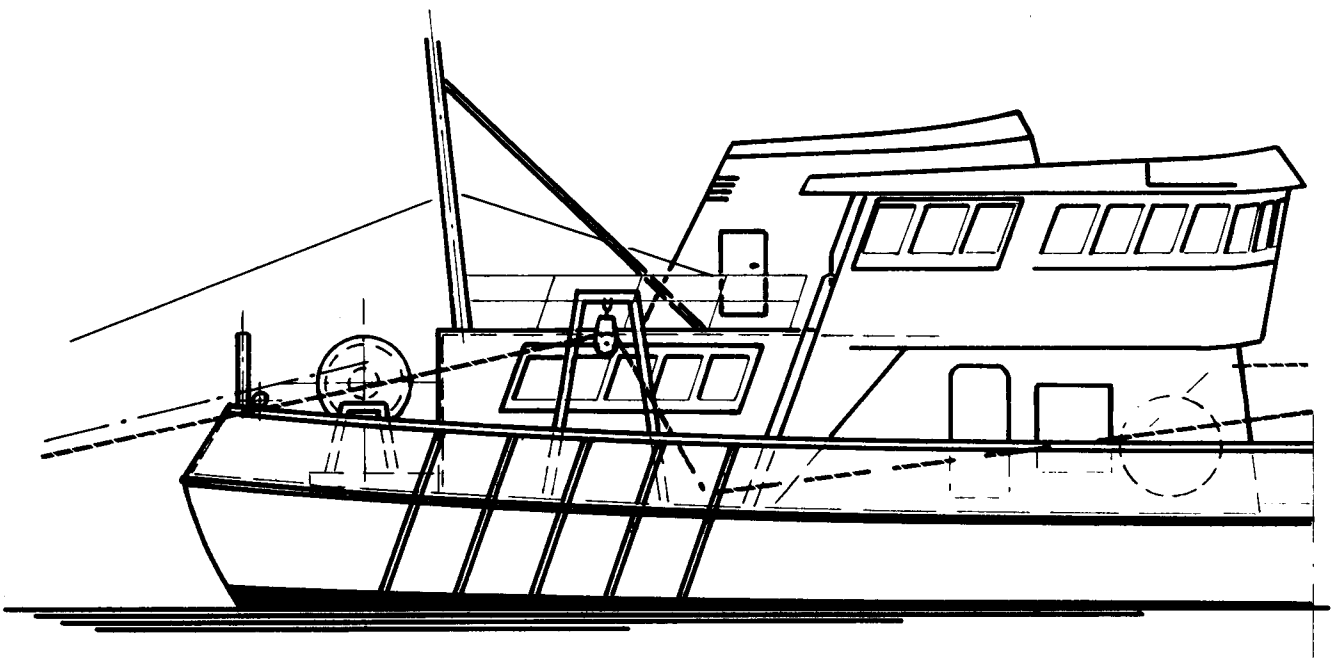
Benaming

	Schaal	Gecontroleerd	Formaat A4
	Getekend	Gezien	Rangschikmerk

fig. 7

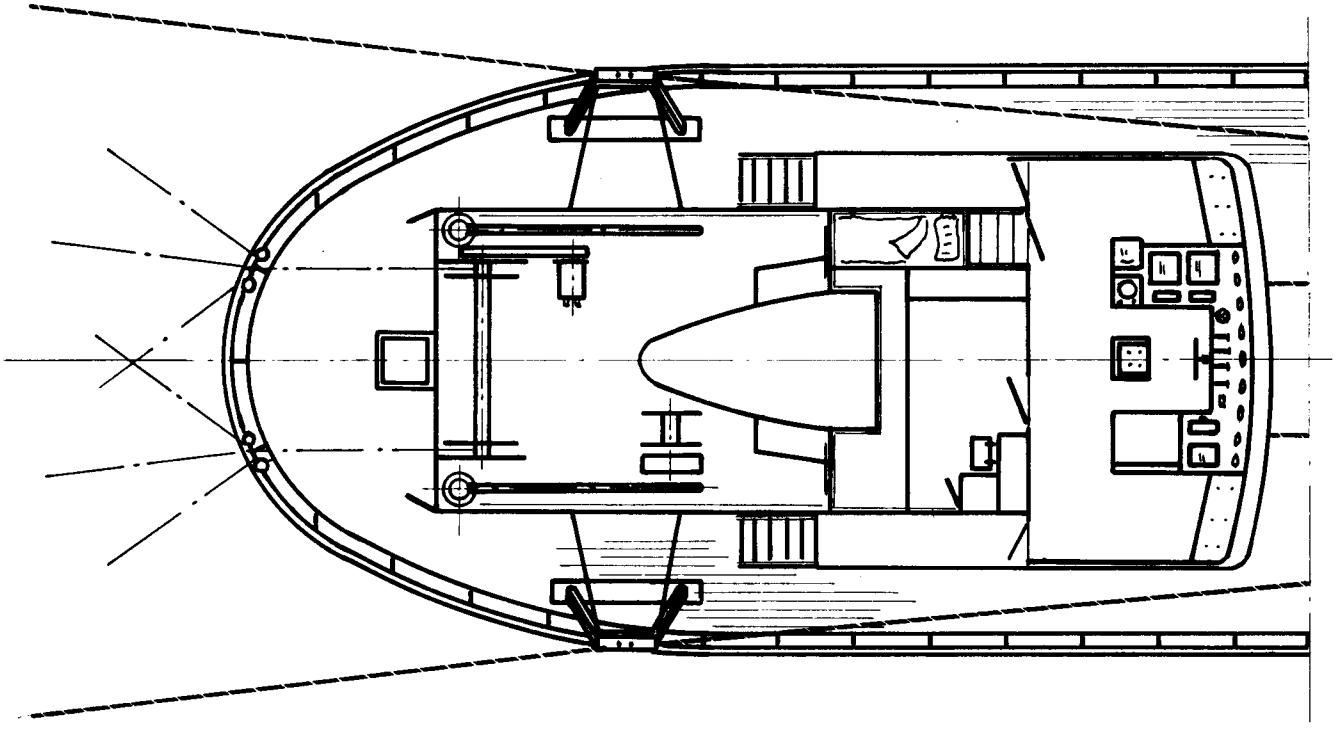
Auteursrecht voorbehouden volgens de wet

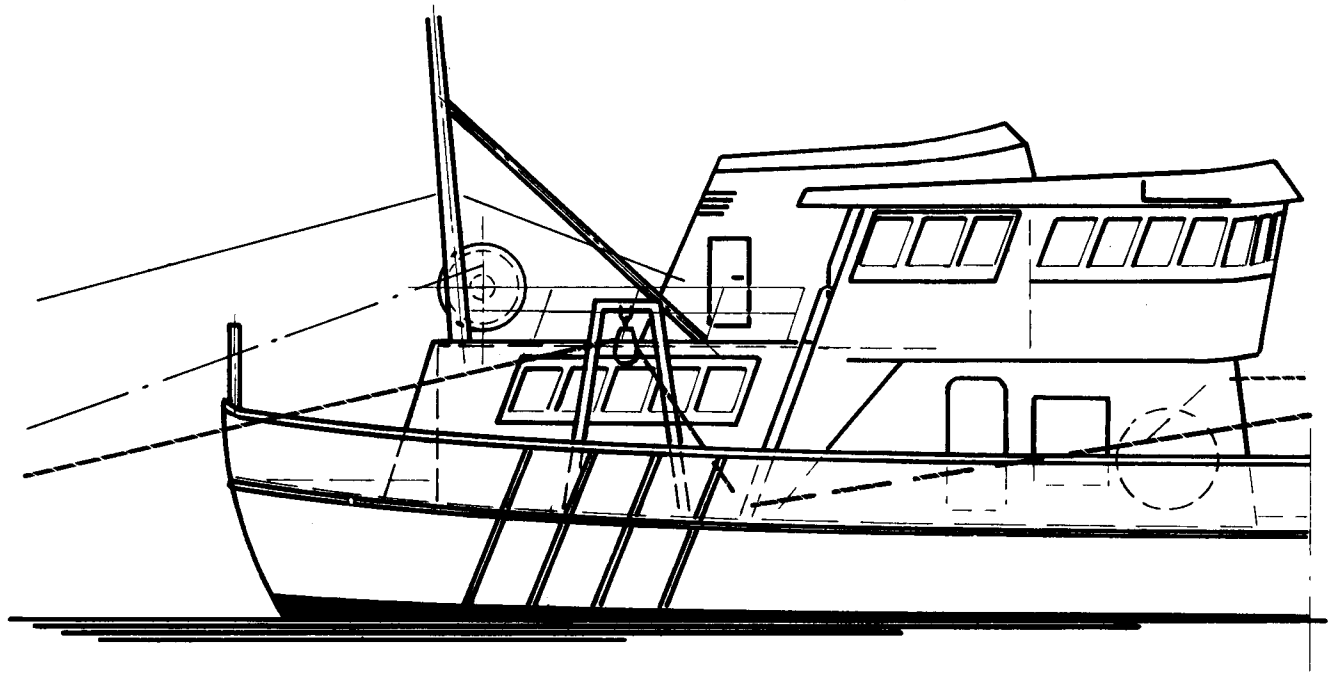




Benaming			
	Schaal	Gecontroleerd	Formaat A4 — fig. 8
	Getekend	Gezien	Rangschikmerk

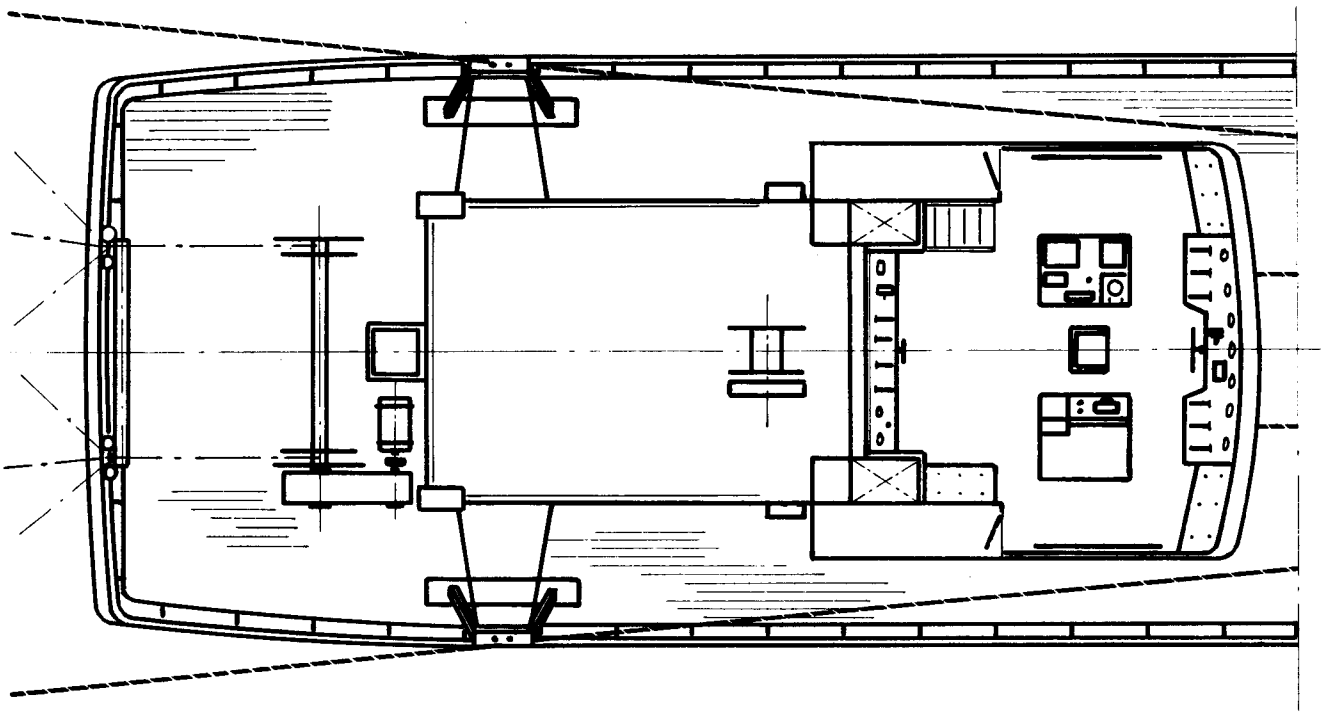
Auteursrecht voorbehouden volgens de wet

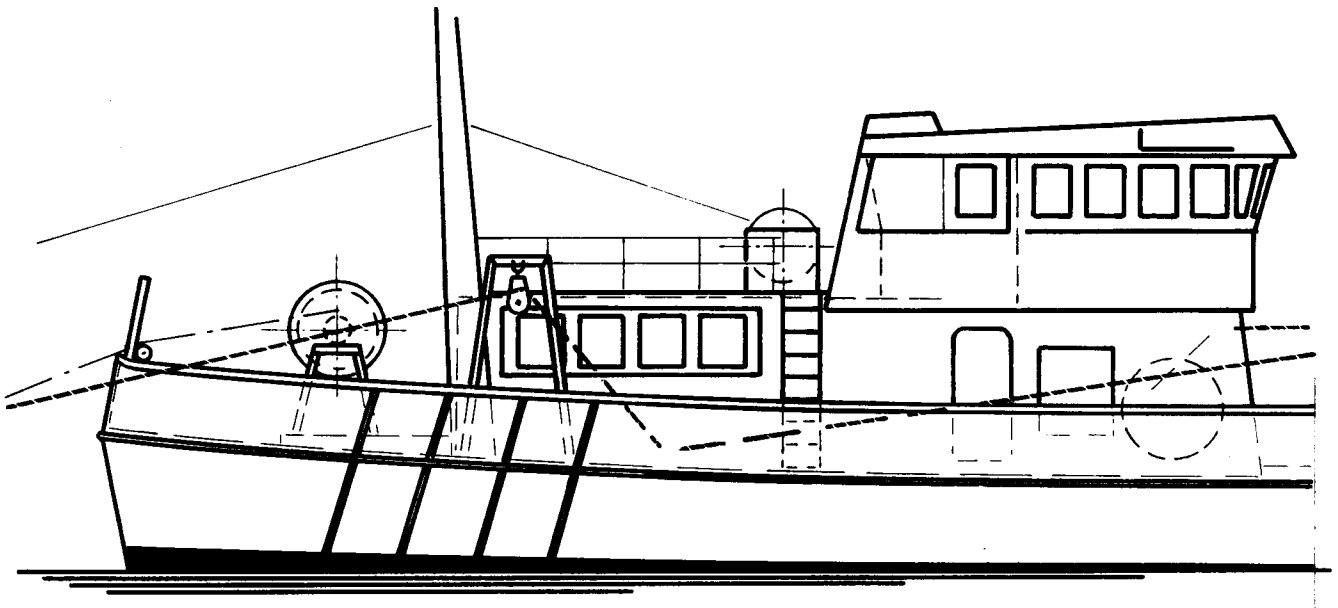




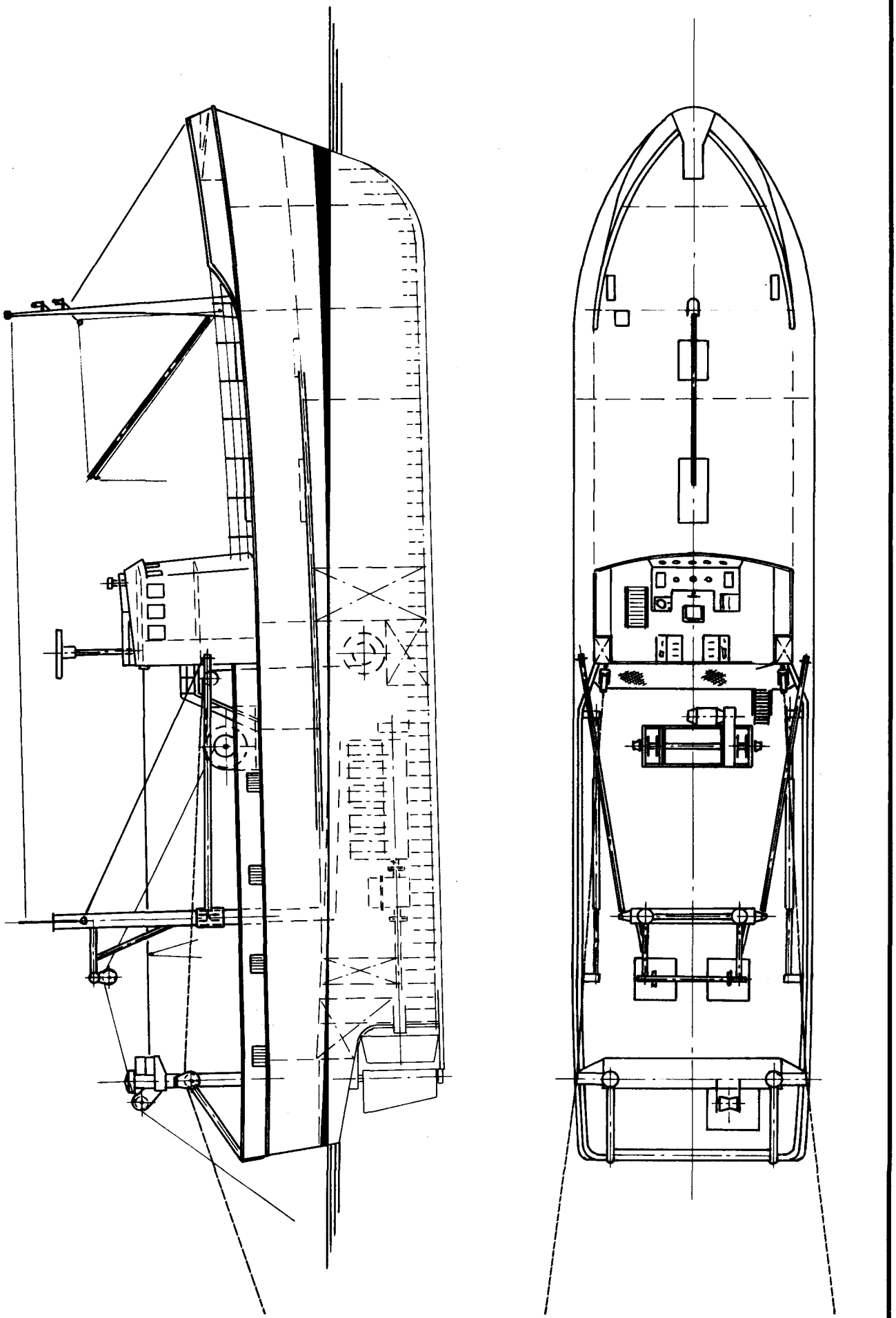
Benaming				
			Formaat A4	fig. 9
	Schaal	Gecontroleerd		
	Getekend	Gezien	Rangschikmerk	

Auteursrecht voorbehouden volgens de wet

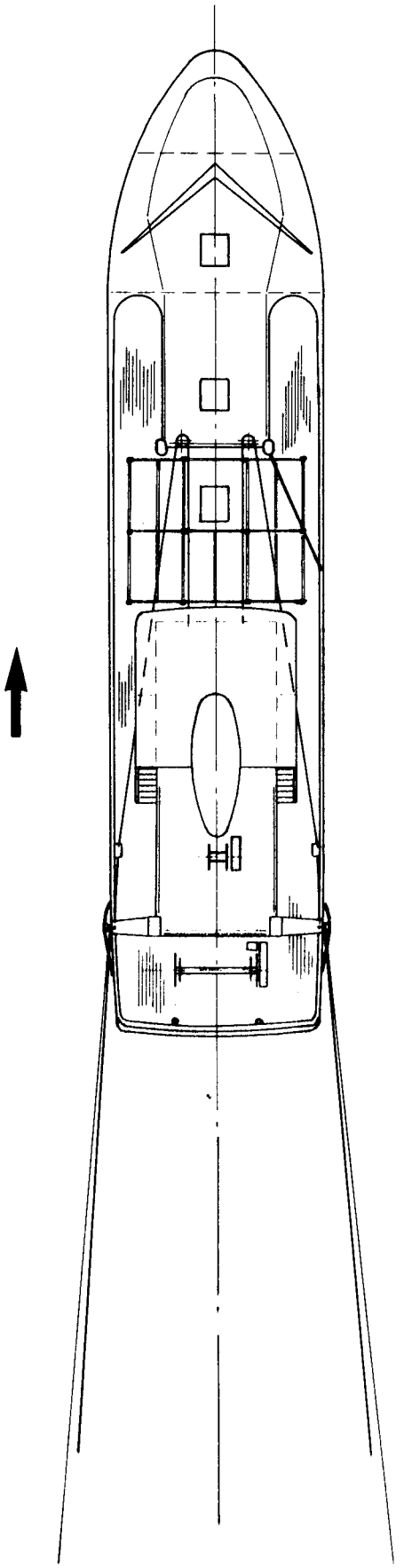




Benaming			
	Schaal	Gecontroleerd	Formaat A4 — fig. 10
Auteursrecht voorbehouden volgens de wet	Getekend	Gezien	Rangschikmerk



Benaming				
	Schaal	Gecontroleerd	Formaat A4	fig. 11
Auteursrecht voorbehouden volgens de wet	Getekend	Gezien	Rangschikmerk	

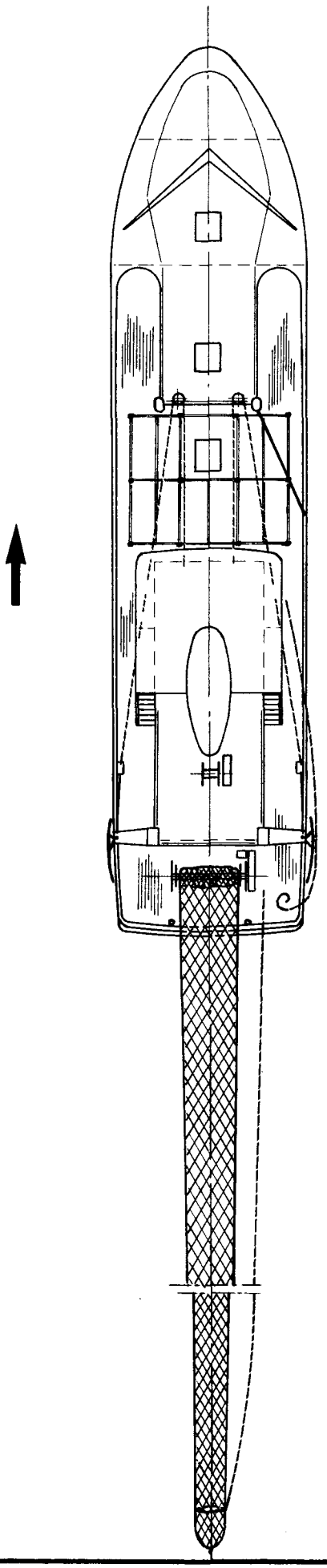


Remarks:

	Schaal	Gecontroleerd	Formaat A4
	Getekend	Gezien	Rangschikmerk

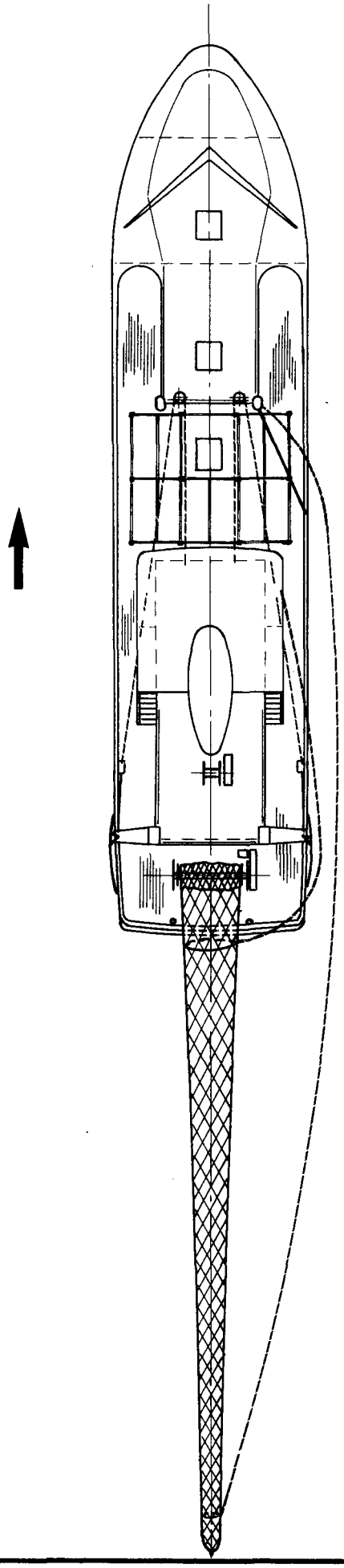
fig. 12

Auteursrecht voorbehouden volgens de wet



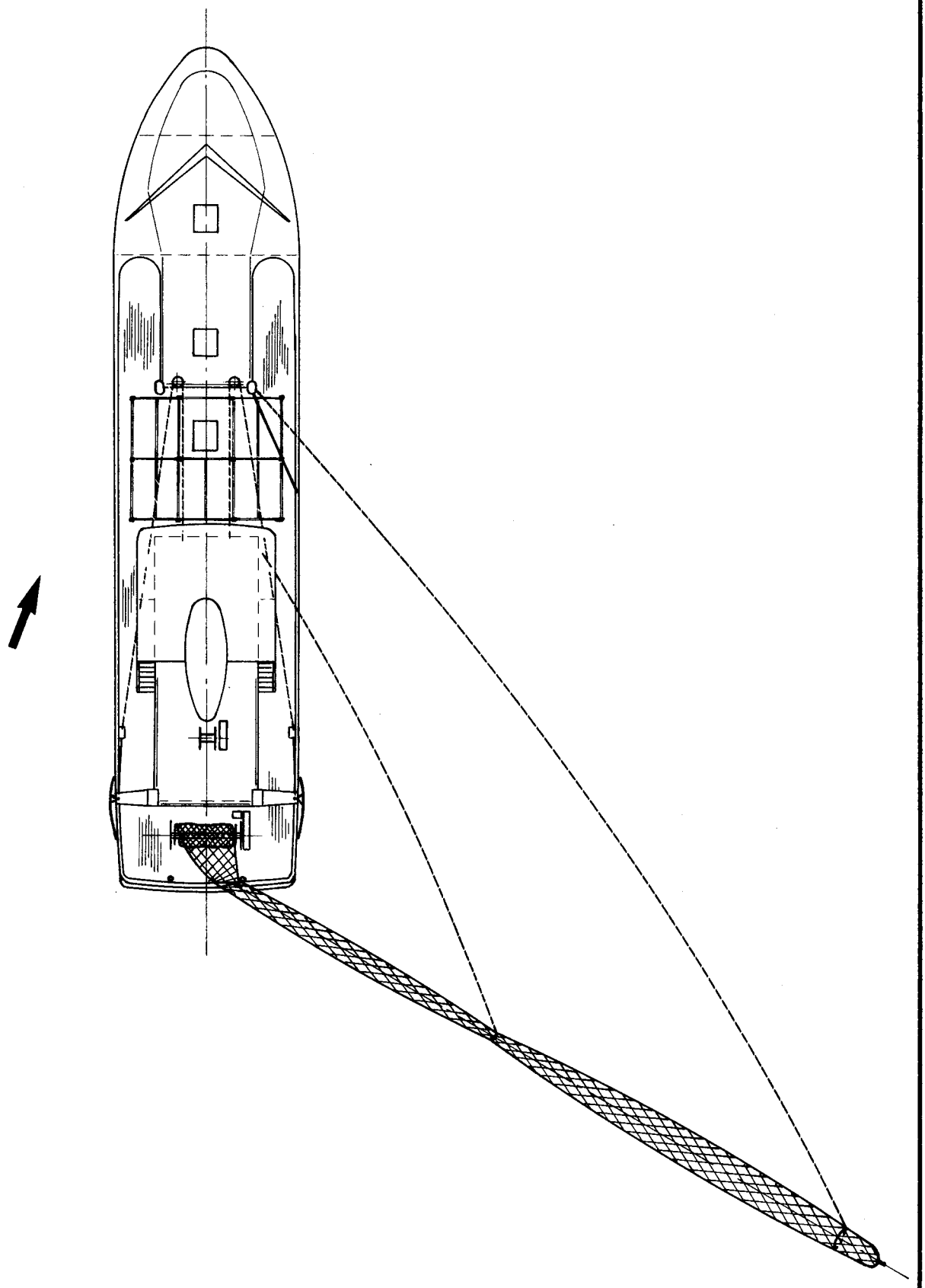
Benaming

	Schaal	Gecontroleerd	Formaat A4	fig. 13
Auteursrecht voorbehouden volgens de wet	Getekend	Gezien	Rangschikmerk	



Benaming

	Schaal	Gecontroleerd	Formaat A4	fig. 14
Auteursrecht voorbehouden volgens de wet	Getekend	Gezien	Rangschikmerk	



Benaming				
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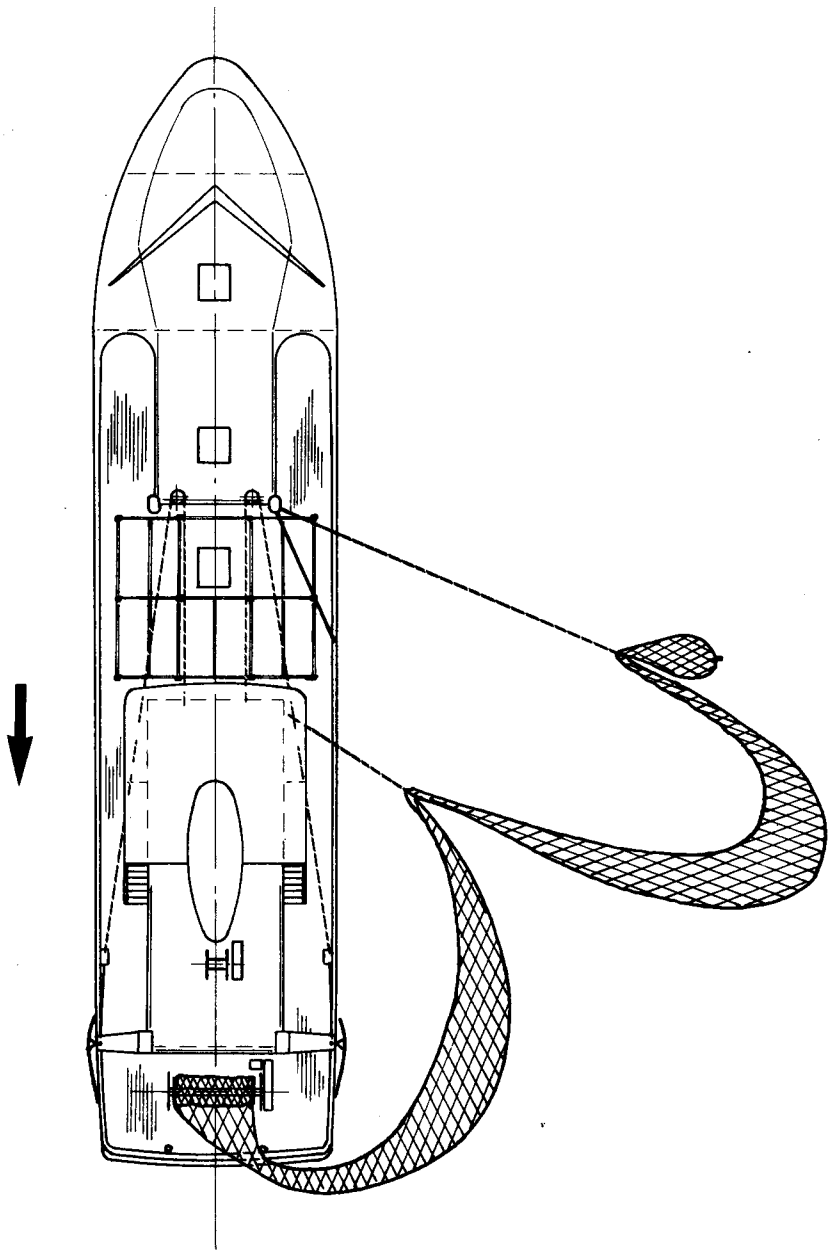
Auteursrecht voorbehouden volgens de wet	Getekend	Gezien	Rangschikmerk	

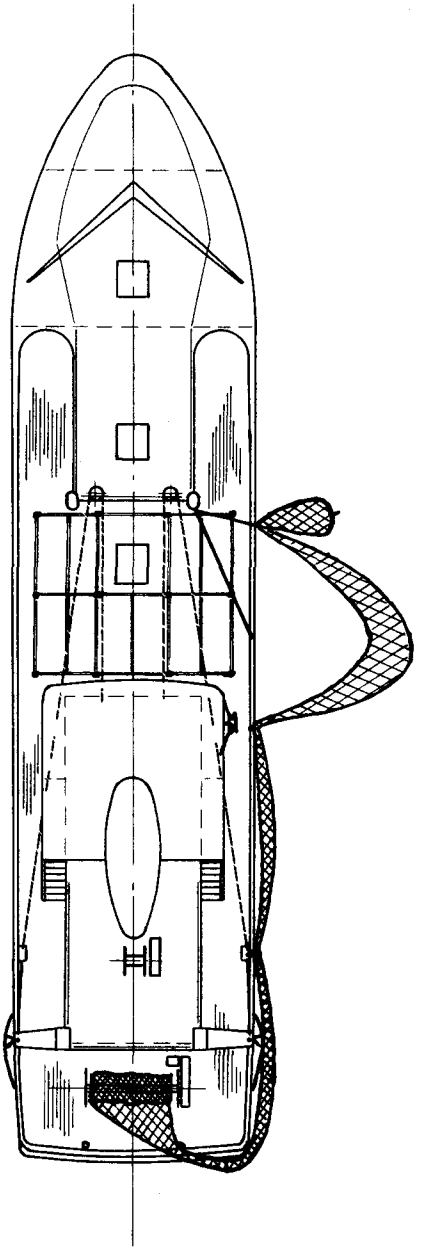


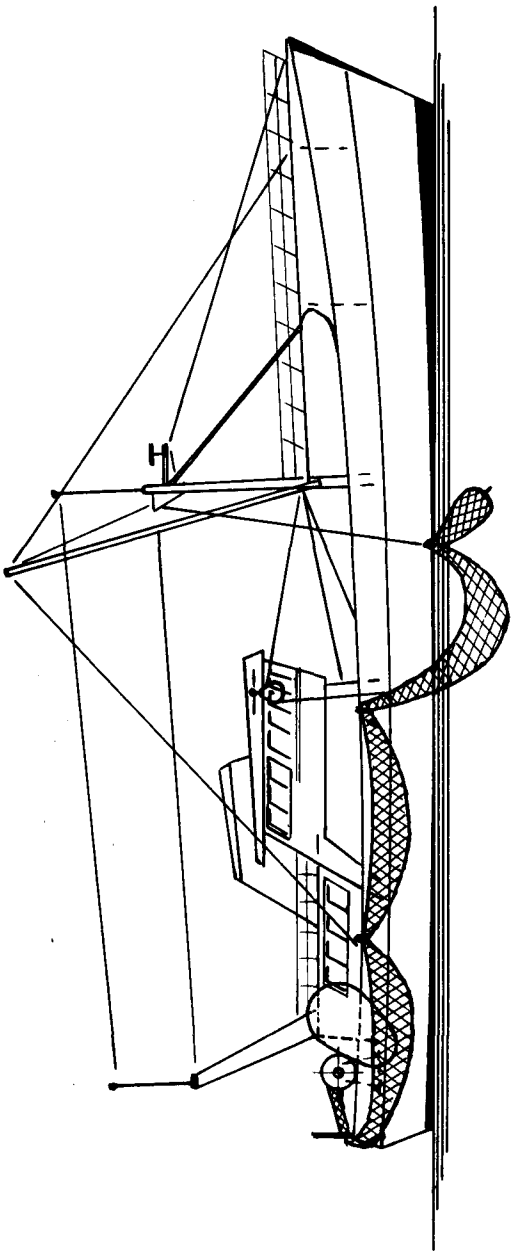
Benaming

	Schaal	Gecontroleerd	Formaat A4
	Getekend	Gezien	Rangschikmerk

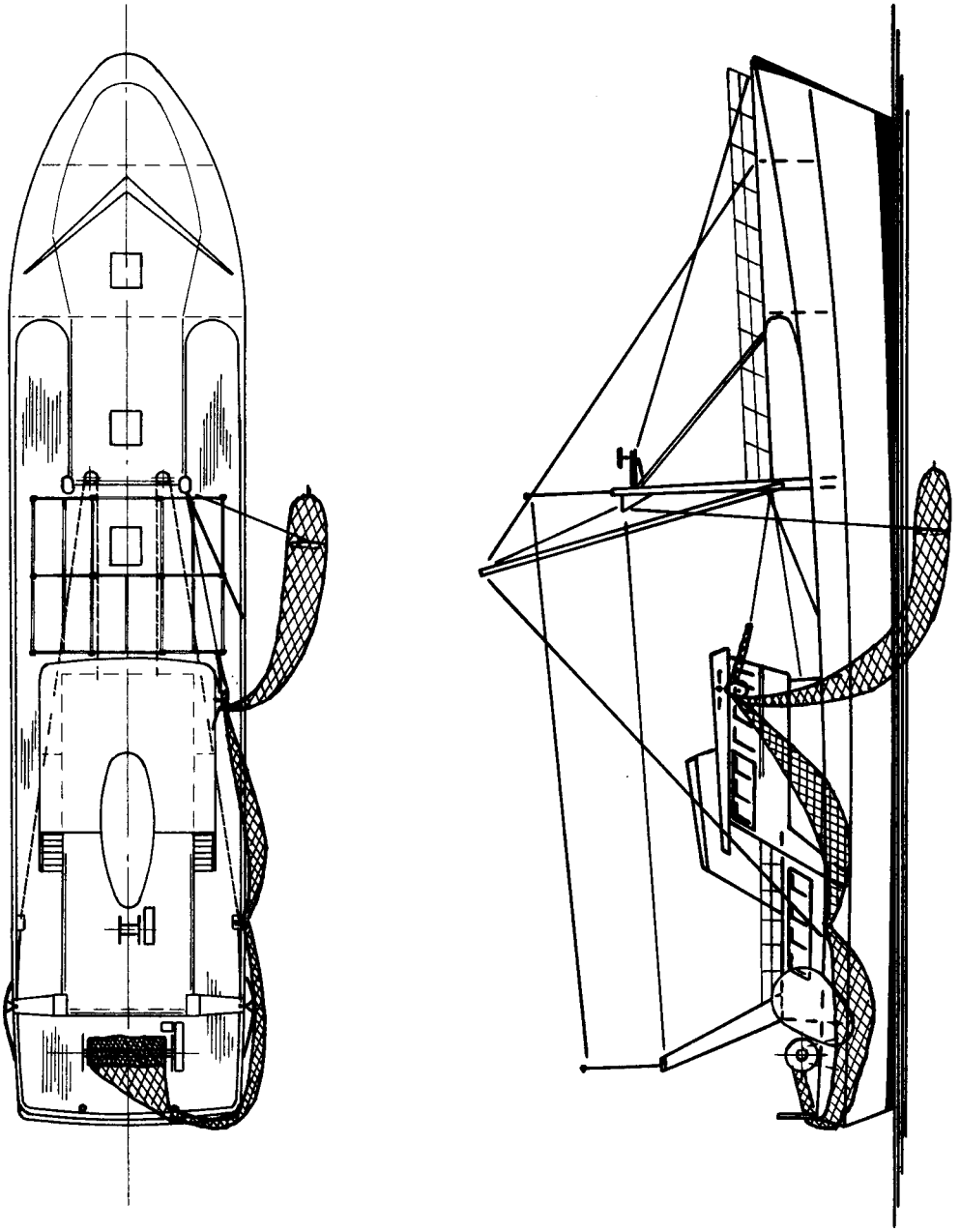
fig. 16

Auteursrecht voorbehouden volgens de wet



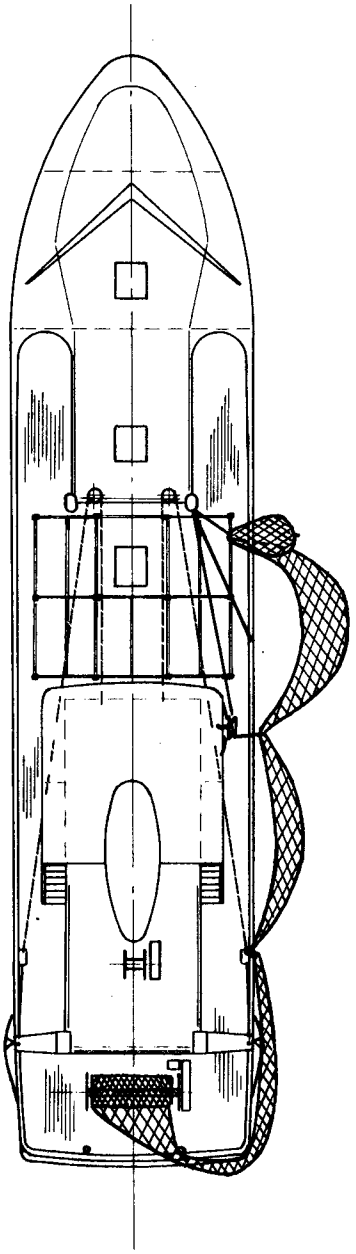


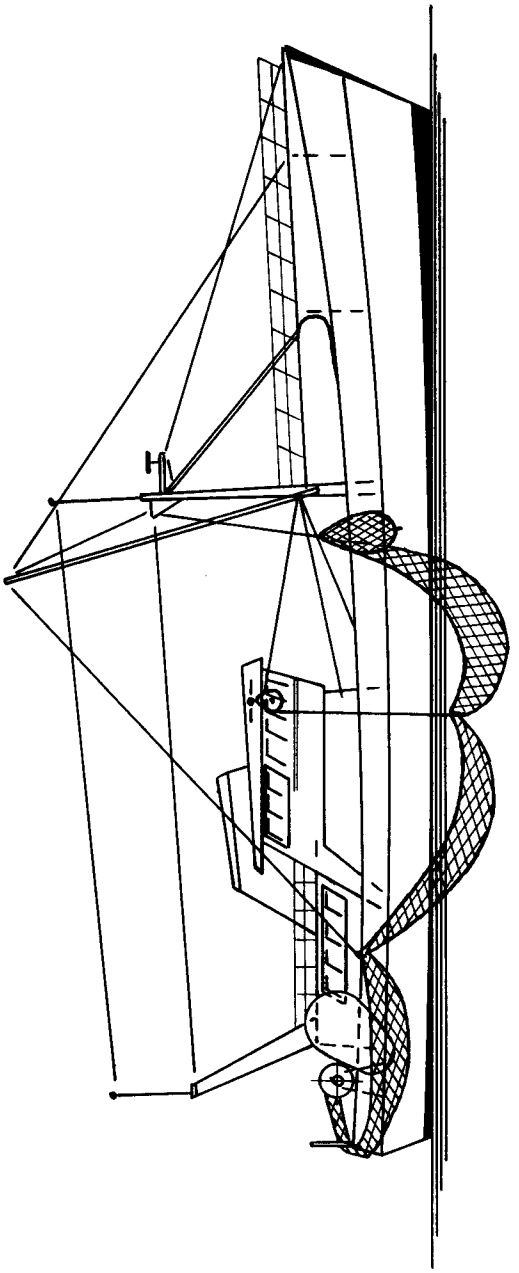
Benaming				
	Schaal	Gecontroleerd	Formaat A4	fig.17
Auteursrecht voorbehouden volgens de wet	Getekend	Gezien	Rangschikmerk	



Benaming			Formaat A4	fig. 18
	Schaal	Gecontroleerd		
	Getekend	Gezien	Rangschikmerk	

Auteursrecht voorbehouden volgens de wet





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