SEA FISH INDUSTRY AUTHORITY
Industrial Development Unit

BEAM TRAWLING

Twin-rig beam trawling is a popular fishing method adopted by European trawlers particularly those operating out of Belgium and Holland.

The beam trawl is the forerunner of the otter trawl, being one of the earliest forms of trawl gear, it was used extensively by sailing trawlers before the advent of steam power.

Basically, the beam trawl consists of a heavy steel beam of tubular section, supported by steel shoes at each end which run over the sea-bed. The headrope of the net is connected to the beam. The groundrope is attached between the bases of the shoes so that it curves backwards in either a 'D' shaped or 'V' shaped configuration depending on the design of net. The cod-end of the net is formed in the usual manner, rigged with a lifting strop and 'lazy line', attached to aid cod-end recovery.

The net is towed from a towing bridle made up of three wires, one from each shoe and the other from the centre of the beam. The bridle wires come together at one point and are shackled into the towing warp.

A number of advantages are claimed for the beam trawl in catching demersal species lying tight to the sea bed. These advantages include:

- warp length has less influence on the beam trawl than with the otter trawl
- the opening does not change during course alterations
- the influence of tide is less than with the otter trawl
- effectiveness of the gear is less affected by muddy bottoms than with the otter trawl

The winch on twin-rig beam trawlers is usually of the four-drum type as used in stern trawling, and is arranged to provide aft warp leads. Two drums are used for the warps and two for derrick (outrigger) topping and net handling.

During the fishing operation, when towing, the outriggers or "fishing derricks" are set at the almost horizontal position and inclined slightly aft. If one net should become foul of the sea-bed, the force at the derrick head is great enough, at worst to put the vessel in danger of capsize. This may be counteracted by a particular arrangement of warp leads developed in Europe. The warps are led from the winch drum to a block mounted aft on the after gallows or gantry and then out over the derrick head blocks to the gear. The towing block is attached to the derrick head by means of a slip-hook arrangement. If the net 'comes fast' on the sea-bed the slip-hook can be released, releasing the towing block so that the force is transferred from the derrick head to the block at the stern. This provides a much safer situation and makes gear recovery easier.

During the hauling operation both nets are hauled in until they are at the boom tips and the derricks are then topped some 30 to 40 degrees to the horizontal. The line attached to the cod-end becket is recovered and hoisted aboard by a tackle from a landing boom, taken to a warping head of auxilliary drum, and hoisted for emptying.

The shooting process involves hoisting the derricks from their stowed position and lifting the beams which are then swung out at about 30 degrees to the horizontal. This same procedure is used for recovery only in reverse. All operations are undertaken while the vessel steams along a straight course.

Beam Gear

The beam gear consists of three main components:

a) the beam and the trawlheads
b) the net
c) the tickler-chains

The beam has three parts (Figure 1). The middle section is stronger than the outer sections due to the greater bending moments. When bent after a fastener it is only necessary to replace the damaged part of the beam. The trawlheads (Figure 2) are situated at the ends of the beam. The parts of the beam and the trawlheads are kept together by the headline and the component of the tension in the bridles in the direction of the beam. The bridle, running to the middle section of the beam, is idle under normal fishing conditions. This bridle picks up a pulling force when the beam starts bending. The function of the beam with trawlheads is to give the net, under all working conditions, a fixed horizontal and vertical net opening. These parameters are not depending on the speed of the gear as is the case with an otter-trawl. Furthermore, the trawlheads act as connecting points for the tickler-chains. The amount of tickler-chain does not influence the net opening.

Figure 3 shows a beam gear when towed on the seabed.

Figure 4 is a drawing of the net. The net is a two seam net, the belly of which is cut away deeply. The mesh length is 72 (75) mm stretched. To resist the wear caused by the seabed, the part of the belly which contacts the seabed is doubled. The groundrope has a length of 22 metres. To the groundrope a 16mm chain is attached to keep the groundrope in good contact with the seabed, preventing the escape of fish underneath. Attached to this chain are five 12mm tickler chains (length resp. 2.5 - 3.5 - 4.5 - 5.5 - 6.5 metres). These lighter tickler chains cover the area between the heavy tickler chains and the groundrope. The function of the tickler chains is to chase the flat fish out of the seabed and bring them within reach of the net opening. This gear has six heavy tickler chains with various diameters. The chain lengths were resp. 15.7 - 14.9 - 13.8 - 13.1 - 11.7 - 10.0 meters.

Figure 2 "Trawlhead for beam trawl" shows that it is possible to connect as much as 10 chains to the trawlheads. The chain wear depends on the seabed conditions. Ater 6-12 weeks of fishing the chains have to be renewed. Due to the wear the chains are lengthened which can cause fouling of the chains.

The Rigging

For years the normal arrangement was the boom fitted to the main mast, with the warp running along the boom. With this arrangement the pull at the forestay and the buckling forces acting upon the boom are heavy. In general the forestay is fixed which makes it impossible to bring the booms on deck, e.g. in bad weather. Nowadays a few vessels have a disconnectable forestay; by means of a tackle the forestay can be paid out to make lowering of the booms on deck possible. However, in practice this system gives difficulties. The warps running along the boom give the following disadvantage when a fastener occurs: using this arrangement the fishing block situated at the top of the boom has to be connected by means of a wire to a sliphook.

In case of danger when hauling, the capsizing moment can be reduced by lowering the fishing block. By doing this the warp will run over the bulwark. When hauling with the warp in this position it will be damaged heavily or even break. So in practice the skipper mostly tries to get free from the fastener by hauling with the fishing block attached to the end of the boom. To overcome these difficulties the next step was the erection of a gallows as forward as possible. With this situation the pull at the forestay and the buckling forces at the boom reduce considerably. The difficulty of lowering the boom on deck is not solved.

The following step in the development of the rigging was the erection of a gantry in front of the wheelhouse. Using this arrangement the pull at the forestay and the buckling forces acting upon the boom decrease considerably. Furthermore it is important that the boom length can be reduced by some 2 metres, this has a great influence upon the resistance against buckling. When a fastener occurs the capsizing moment can be reduced by paying out the backstay. As a result the boom will swing forward to the position of the gallows and, if these are as forward as possible, reduces not only the forces acting upon boom and forestay, but also prevents the vessel from coming perpendicular to wind and/or current during a fastener. By situating the gallows as forward as possible the vessel will always come into tide decreasing the danger.

Forces acting on rigging when shooting the gear

Until recently the winch was generally driven by the main engine by means of a flat belt, a one-way drive for hauling only. Shooting the gears was accomplished with the drums free running, the weight and the resistance of the gears in the water pulled off the warps from the drums. Warp speed was controlled by the brakes. To decrease the shooting time, it is common to speed up the revs. of the main engine to full ahead. Just before the brakes are put on, the skipper reduces revs, in order to overcome heavy loads on warps and winch.

When the codend is emptied the skipper has to execute two actions, in order to bring the gears in fishing position. At first to bring the boom in his fishing position and secondly to pay out warp. In order to save time these actions are executed simulataneously.

The application of hydraulic and electric driven winches during the last two years made it possible to shoot the gears with frictions engaged. When the amount of warp paid out is sufficient the winch drive is stopped, after which the brakes are put on. By doing this the wear of the brake-linings and the loads at parts of the rigging is less compared to the formerly mentioned method. Furthermore the chance of fouling the gears, when shooting tideward, decreses considerably. The latter can be explained as follows: When shooting the gears with frictions engaged the difference between speed of the vessel and speed of the gears will be less than when shooting with disengaged frictions. Due to this, the chance that the relative speed of the gear with regard to the velocity of the tidal current becomes negative, can be neglected. As a result of this the net (nylon) cannot be pushed over the beam, because this would cause damage to the net when starting to tow. The disadvantage of shooting the gears with engaged frictions is the longer shooting-time compared to the former method.

Forces acting on rigging when hauling the gear

The moment the skipper thinks it necessary to haul, he engages the winch while dropping the revs. to such a value that the vessel stays manoeuvrable. The pull at the warps when haudling depends on:

a) The gear (weight, dimensions, mesh-size and yarn, cut of the net, etc.)

b) The catch (amount and species, bottom dirt, etc.)

c) The speed of the gear through the water and over the ground, these are dependent of the speed of the vessel through the water and over ground, the warp speed and the momentary ratio between water depth and warp length.

d) The condition of the seabed.

The influence of the condition of the seabed on the forces acting on the rigging

The condition of the seabed will be of great influence on the pull in warp, .forestay and topping-life.

In general, fishermen keep the warps steeper when fishing on rough grounds in order to get more lift.

On muddy grounds the variation in warp pull is mainly caused by the irregular motion of the gear. The gear shows the tendency to dig itself into the mud.

Figures 12 and 13 show an arrangement of ground gear that is commonly used by South Coast of England beam trawlers exploiting some of the fishing grounds with harder sea bed conditions than are usually exploited using beam trawls.

The chain mat arrangement is a means of allowing the beam gear to traverse 'stoney' ground without picking up rocks and boulders which would pass into the net and cause excessive damage.

As an extra preventitive measure a 'flip-up' rope arrangement has been added to this rig. Again the aim is to prevent entry of rocks and stones and other large objects of sea-bed debris. Figures 13 and 14 show details of the 'flip-up' rope arrangement.

Beam trawling - description of gear handling

The following description for handling of the gear on board beam trawlers applies to a side trawler with the booms fitted to a gantry in front of the wheelhouse. The handling of the gear on board stern trawlers and side trawlers with other rigging differs slightly from the given description. The side trawler with a gantry in front of the wheelhouse is chosen because this type is quite common.

Departure homeport (Figure 5)

The booms are in a vertical position, in order not to hamper the movement of the vessel in the harbour, the gears are stowed on deck. To overcome damage to the deck the trawlheads are placed on plates of plywood. The tickler-chains are lying on deck, the net is draped over the beam. Movement of the booms is prevented by the backstay.

Heading for fishing grounds (Figure 6)

As soon as possible after leaving port the booms are lowered so far that in general the booms are not touching the water surface due to the rolling of the vessel. To overcome slamming of the booms there is pull at the warp.

Shooting of gear (Figure 7)

For bringing the beam gear outboard the booms are brought in such a position that they make an angle of about 60 degrees with the horizon. By pulling the beam gears over the bulwark they are brought outboard. The aft part of the net stays on board. This is done to avoid the possibility of the net fouling in the propeller, e.g. when turning. The booms are lowered to their fishing position and the revolutions of the propeller are increased. The codend and the lazy decky are thrown overboard. The shooting of the gears can start. Shooting is done in general with almost full speed. Just before the shooting operation is stopped the revs. of the propeller are slowed down to diminish the jerk at the warp when engaging the brakes.

Fishing (Figure 8)

The only action taken when fishing is paying out or hauling warp. This depends on the depth variation of the seabed and on the condition of the seabed. The warps are hauled with the engine at half ahead. The moment the gear is almost vertical under the fishing block the boom is topped to such a position that the deckhand can reach for the lazy decky. At the end of the haul the engine is stopped.

Hauling codend (Figure 9)

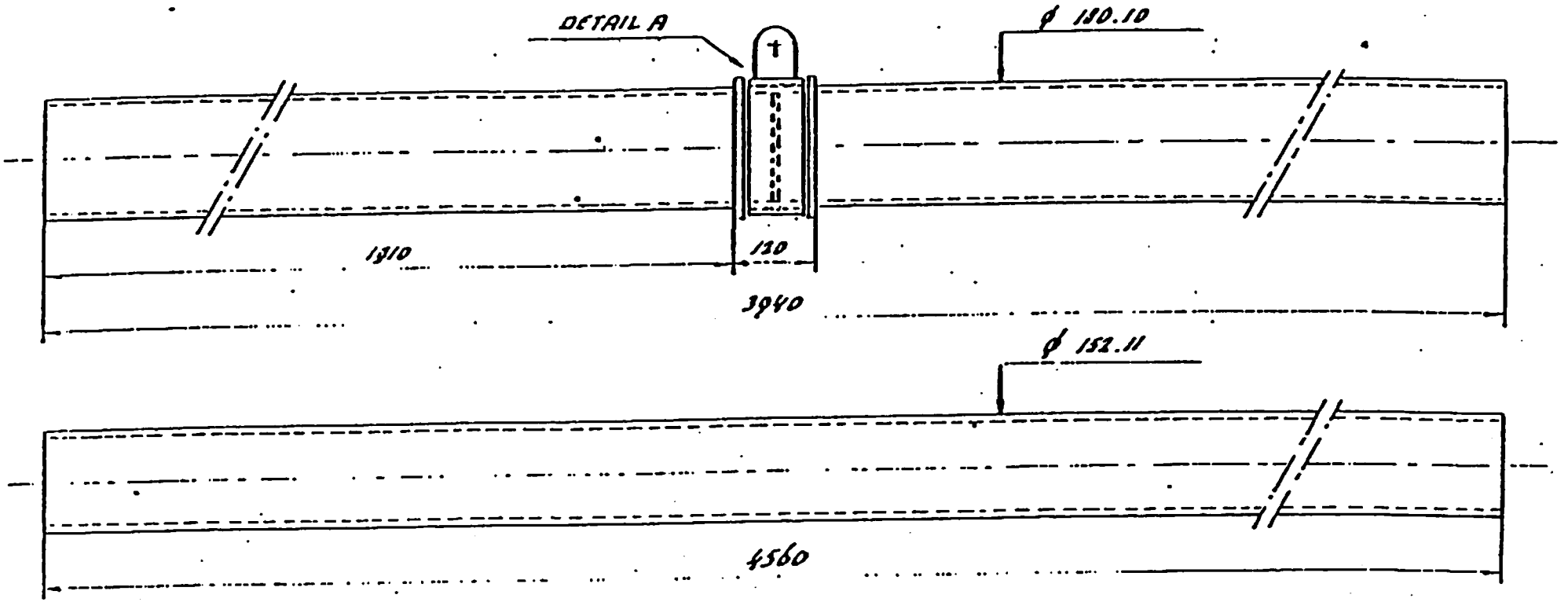
The lazy decky is brought to the whipping drum and the codend is hauled. The moment the splitting strop reaches the bulwark the hauling of the codend by means of the whipping drum is stopped. The hook of the fish tackle is attached to the splitting strop.

Lifting codend (Figure 10)

The fish tackle is running to a block at the top of the main mast. By means of the whipping drum the codend is brought to the fore part of the vessel and hoisted over the bulwark. Due to the movement of the codend the beam will turn to a fore and aft direction.

Emptying codend (Figure 11)

To prevent the beam from turning too far, the lazy decky is fastened to the bulwark. After emptying of the codend the engine is put at slow ahead and due to this the beams turn back to the normal position. The codend and the lazy decky are thrown overboard and the procedure of shooting the gear starts again.


DETAIL A
ϕ 130.10
1310
130
3940
ϕ 152.11
4560

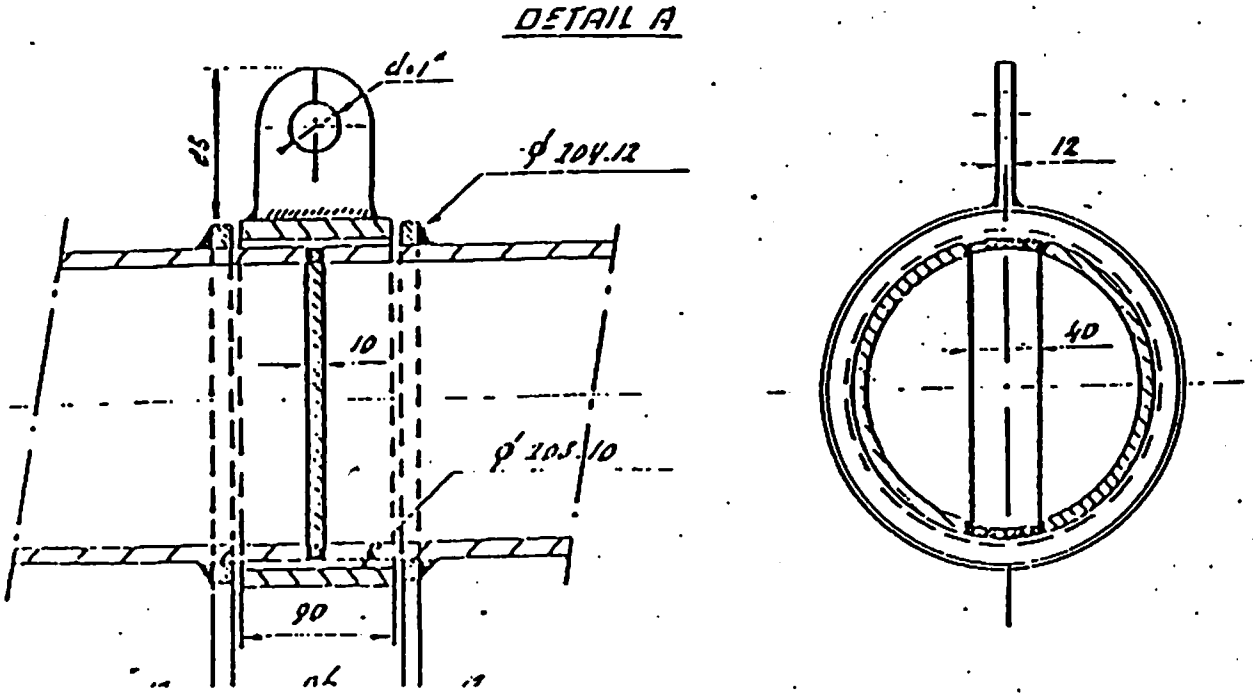
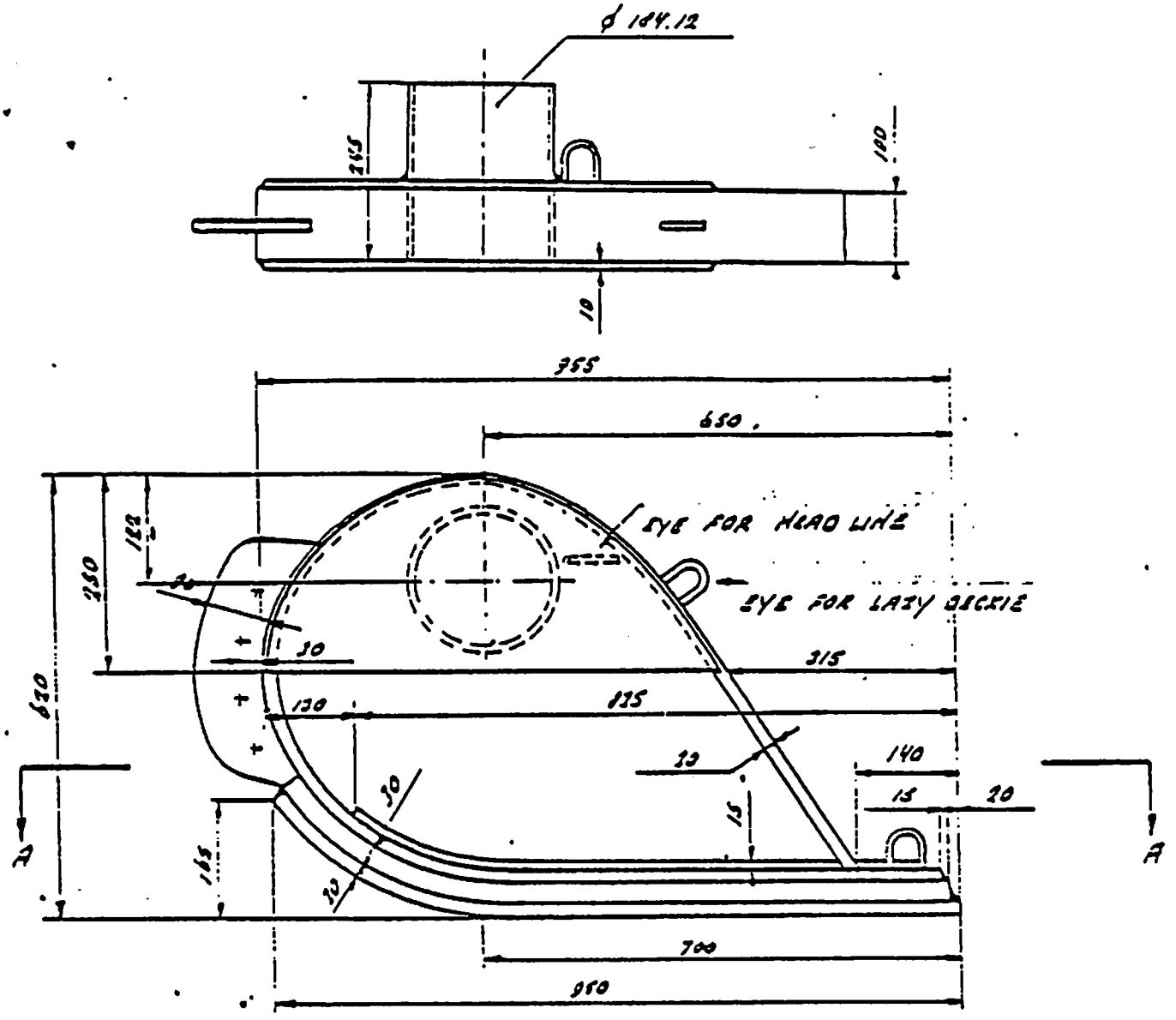

DETAIL A
d.1"
ϕ 104.12
15
10
ϕ 105.10
90
12
40

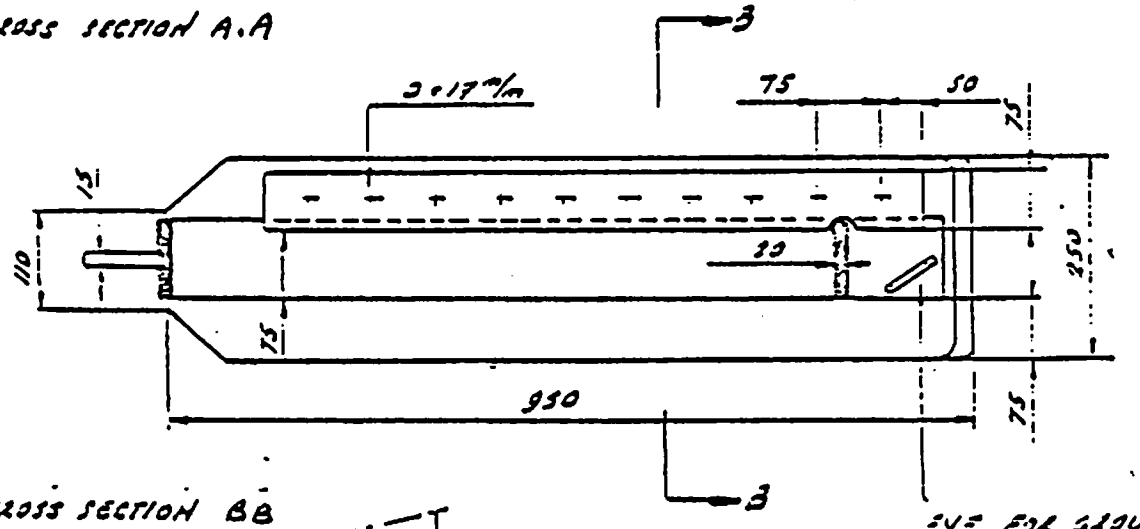
Figure 1

Figure 2

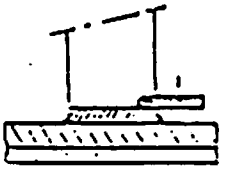
TRAWL HEAD FOR BEAM TRAWL.



CROSS SECTION A.A



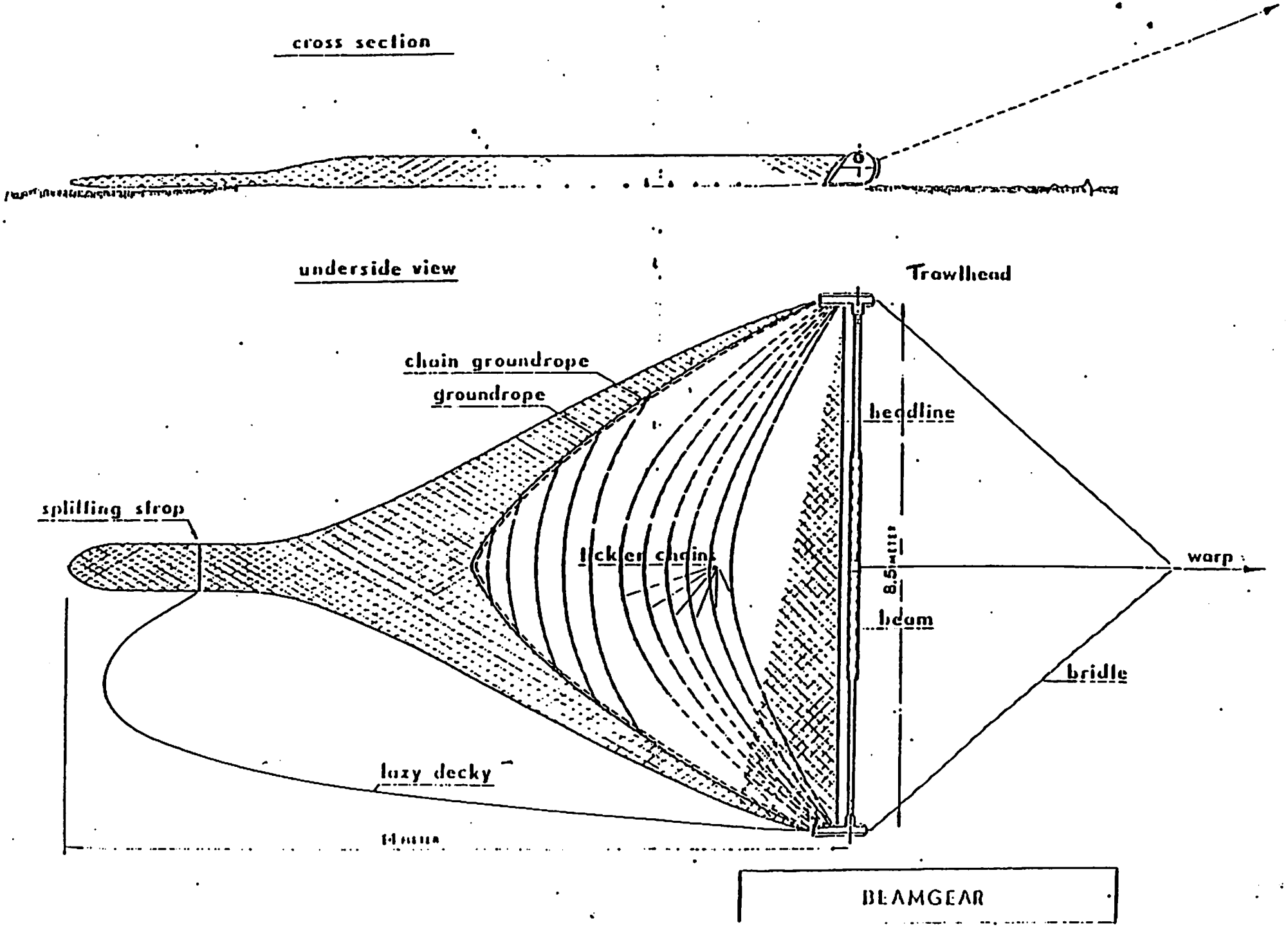
CROSS SECTION BB



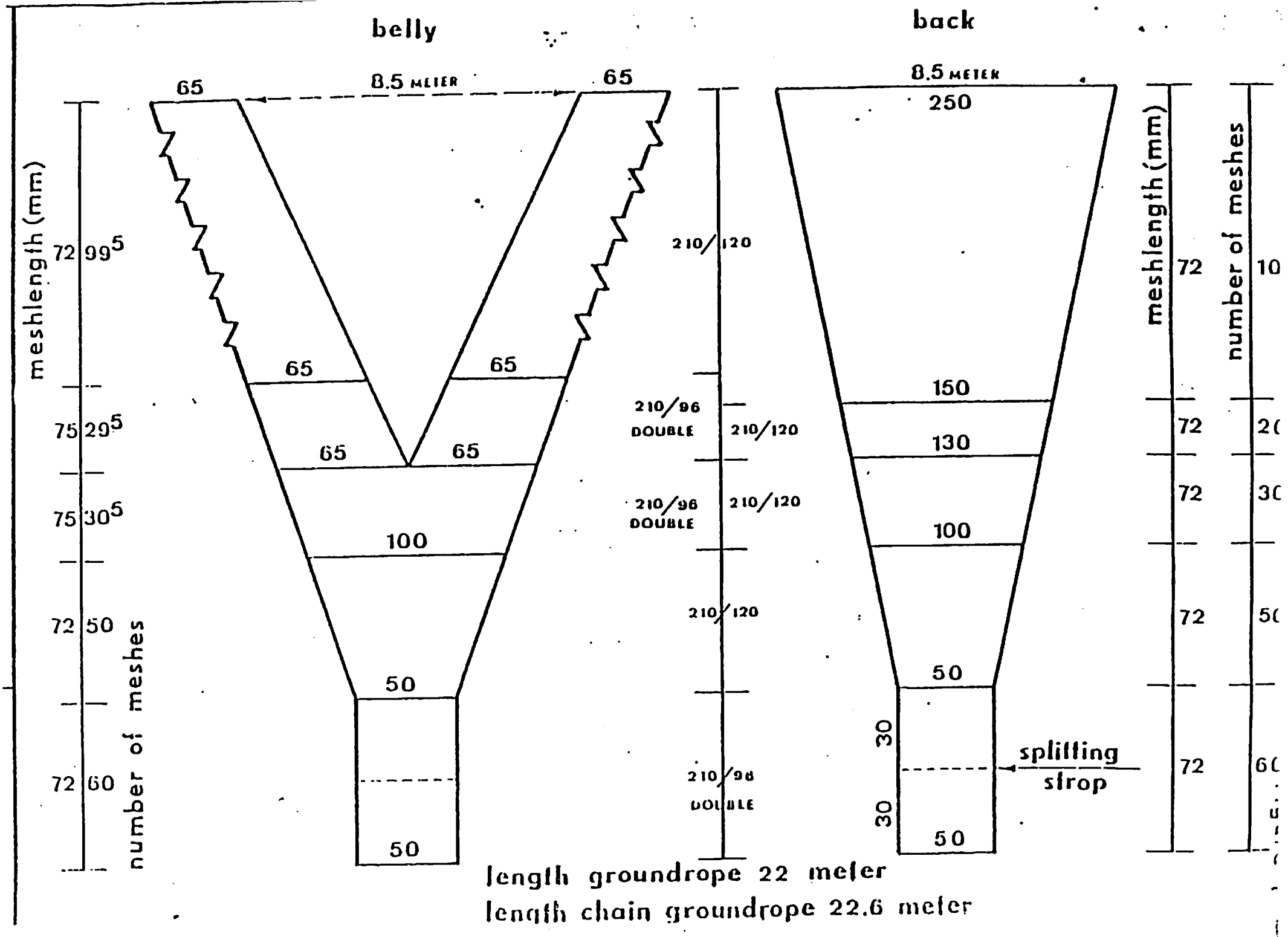
EYE FOR GROUND ROPE

Figure 3

BEAMGEAR

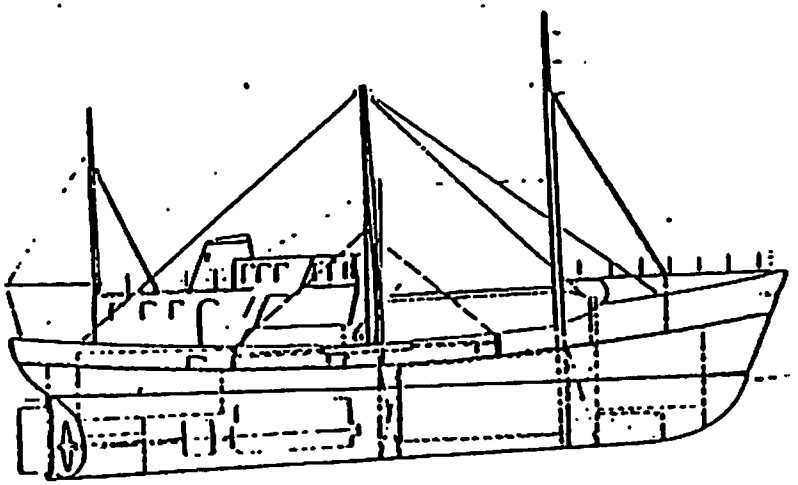


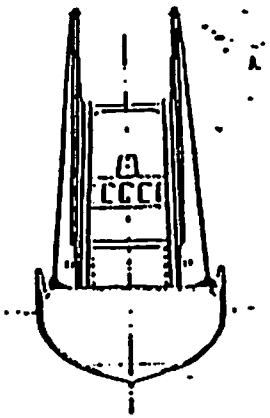
BEAMGEAR

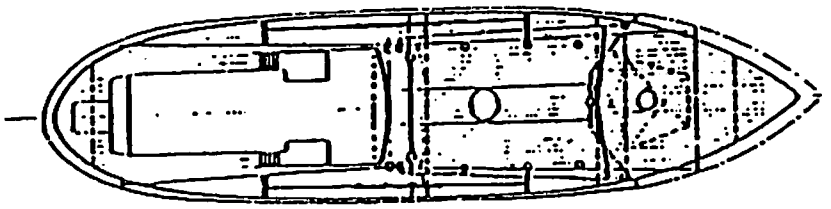


length groundrope 22 meter
length chain groundrope 22.6 meter

Figure 5

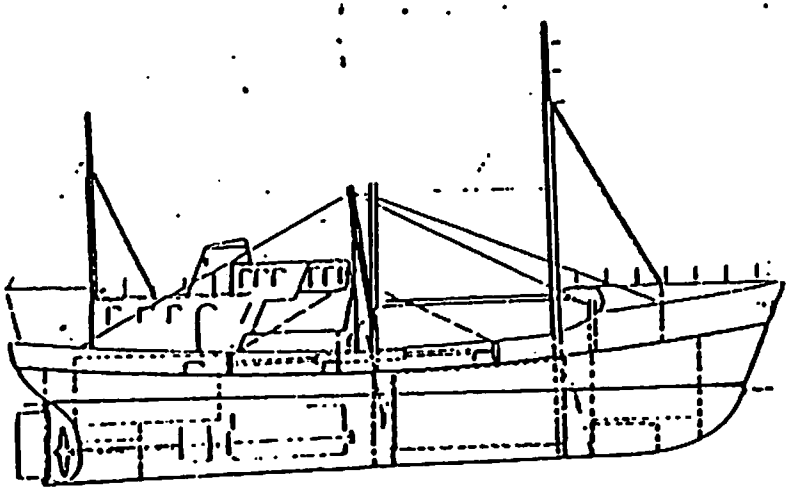


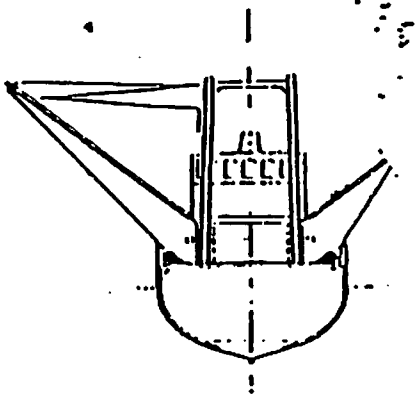


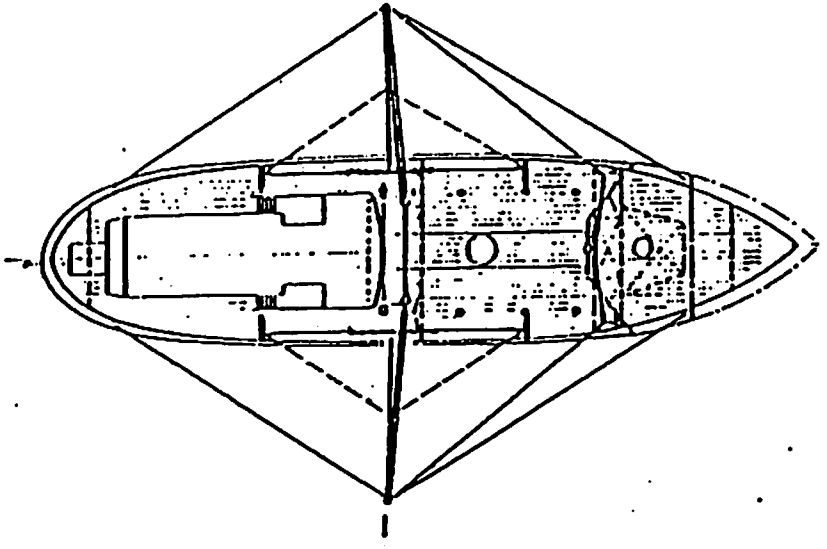


BEAM TRAWLING departure homeport

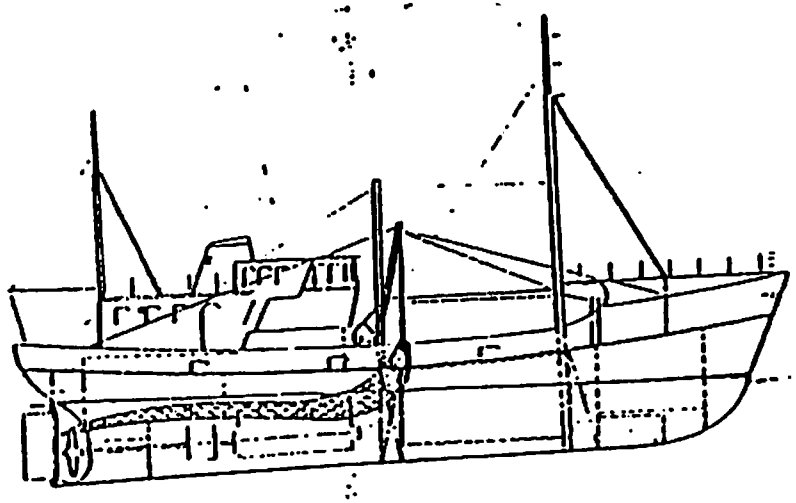
Figure 6

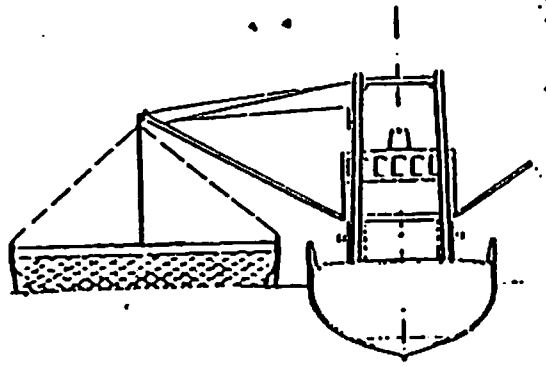


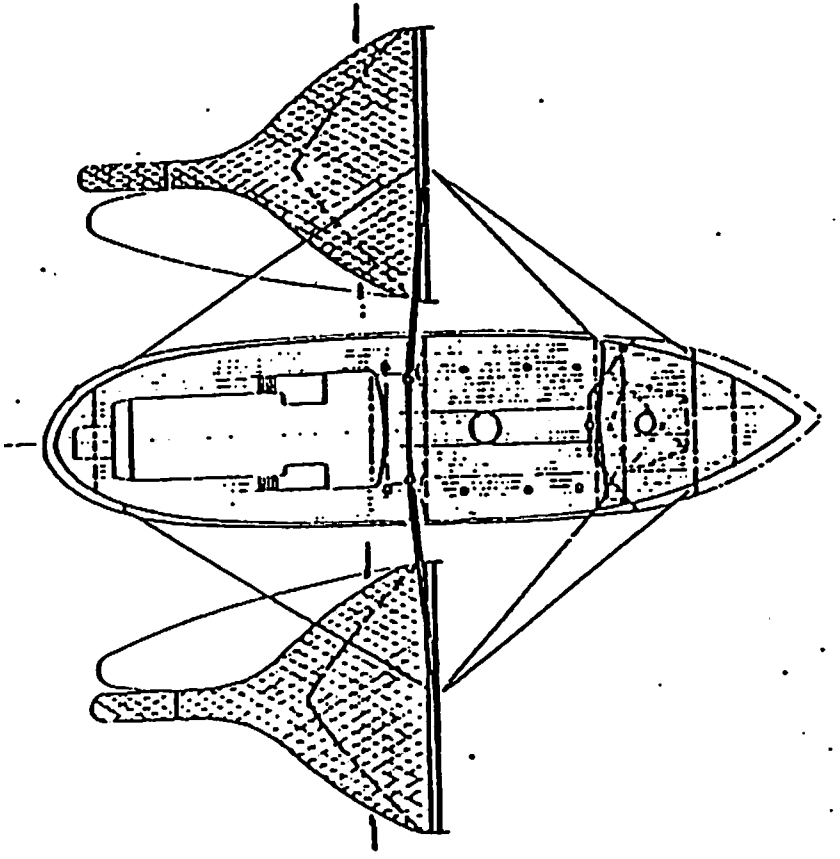




BEAM TRAWLING heading for fishinggrounds

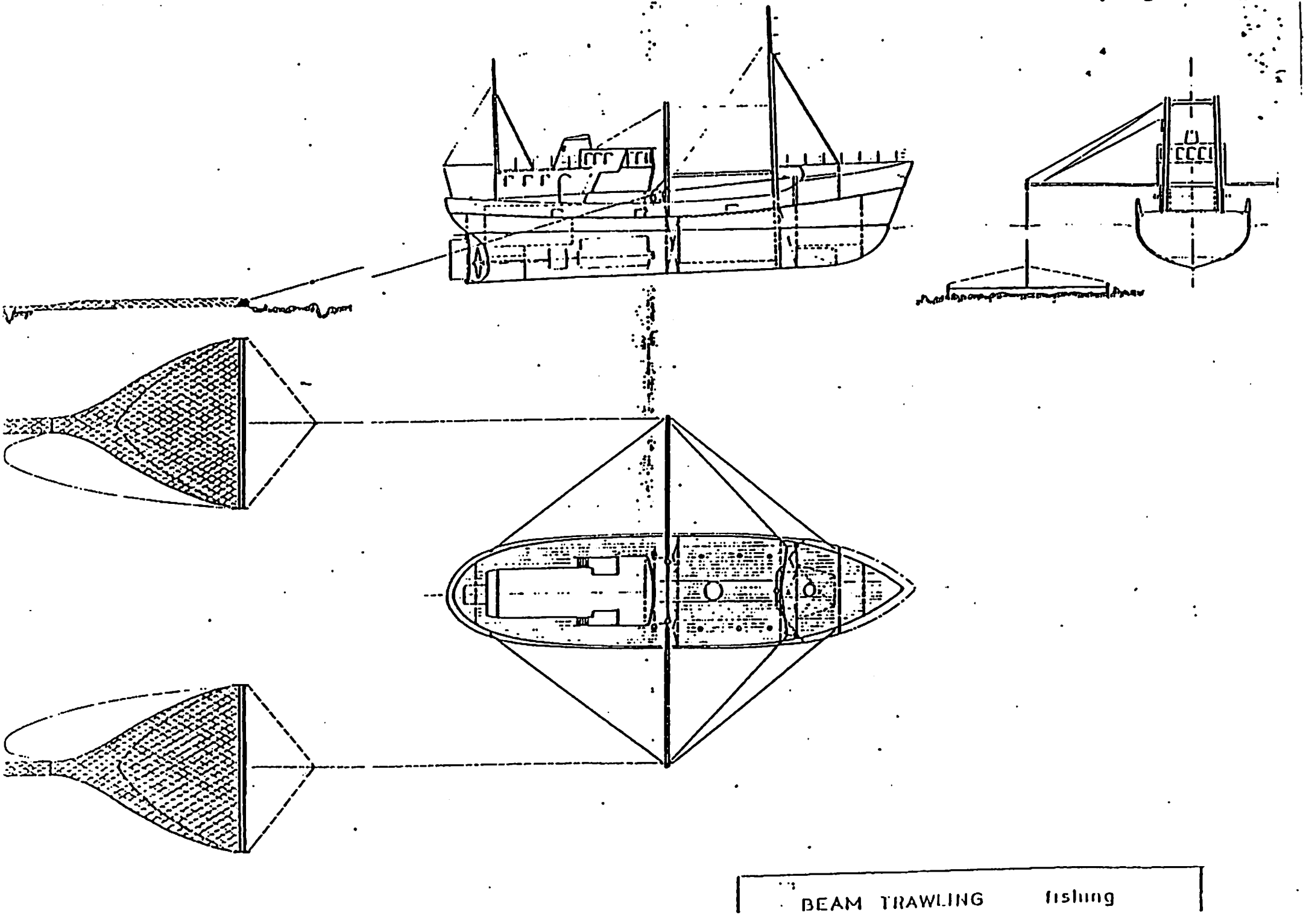






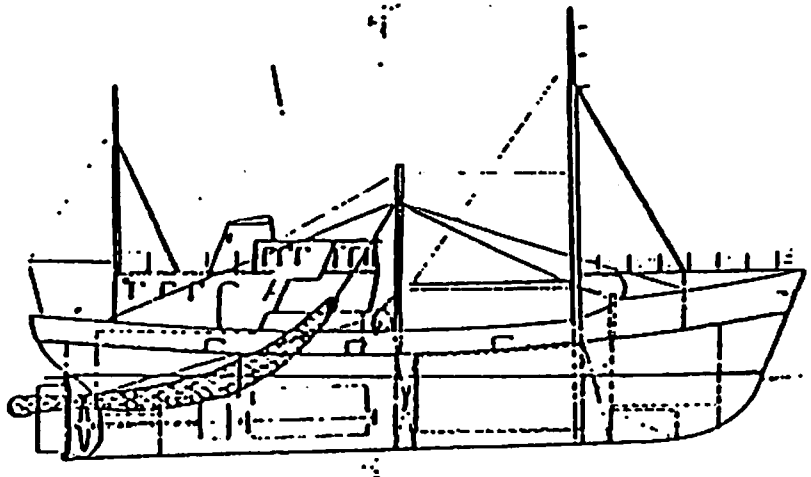
BEAM TRAWLING shooting of gear

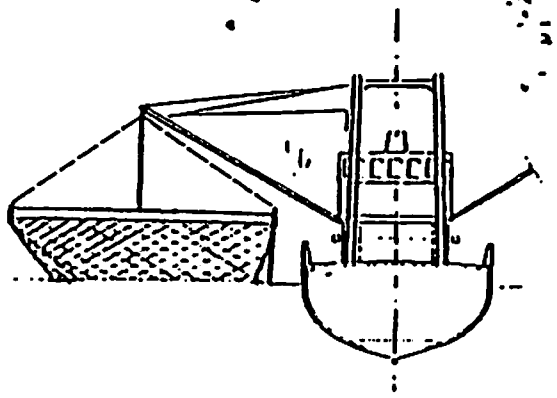
Figure 8

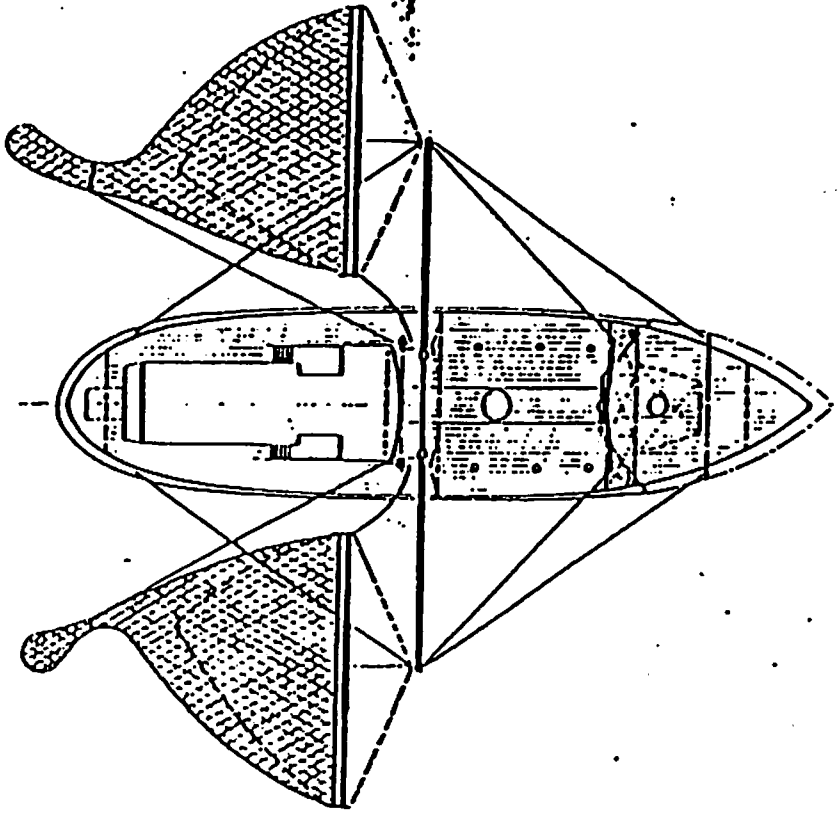


BEAM TRAWLING fishing

Figure 9

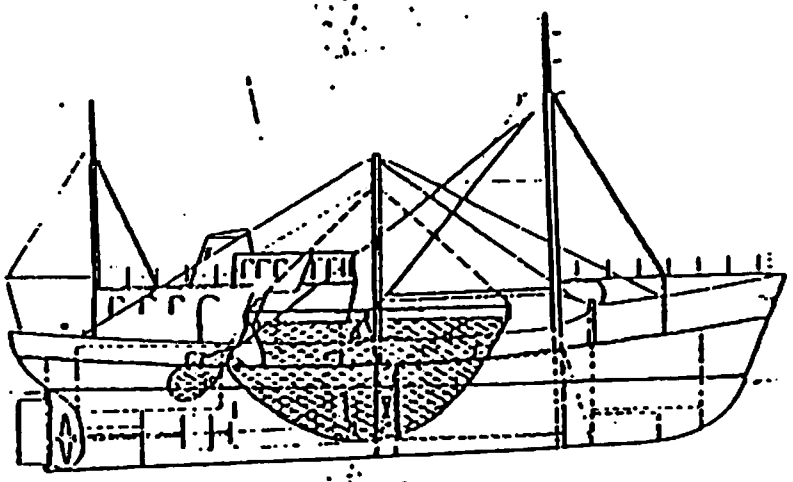


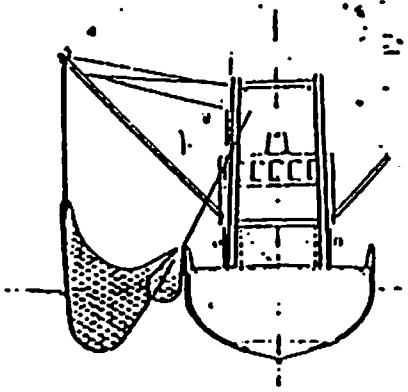


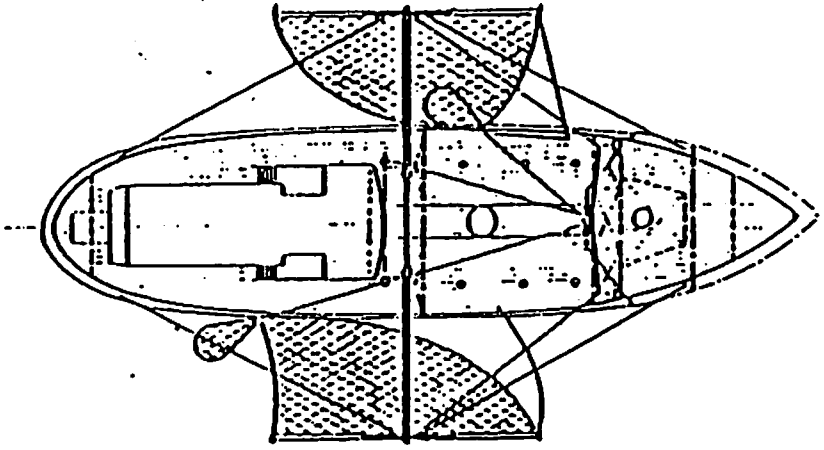


Processing

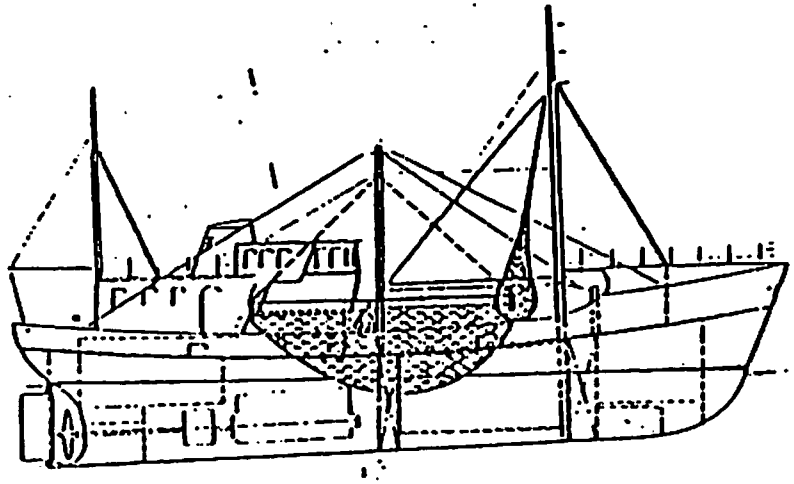
BEAM TRAWLING hauling codend

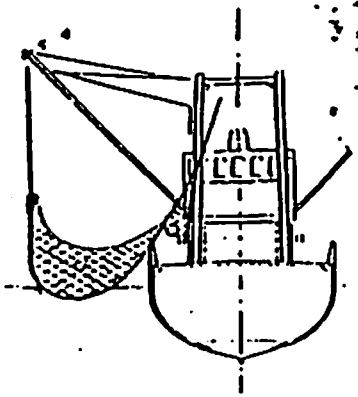


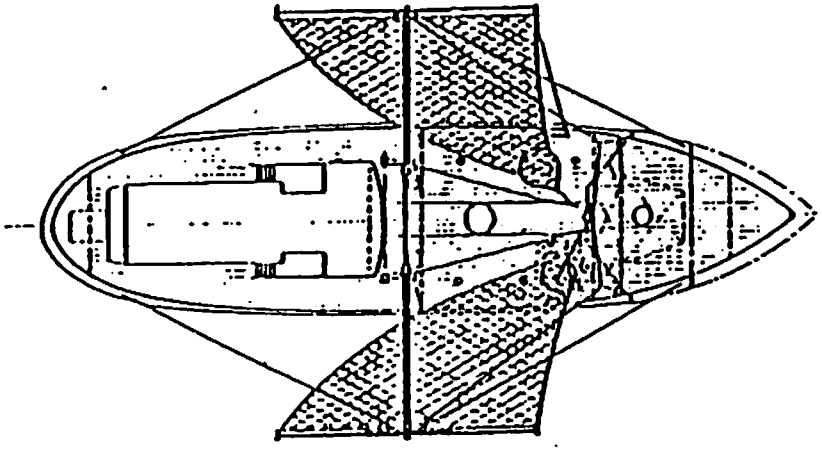




BEAM TRAWLING lifting codend

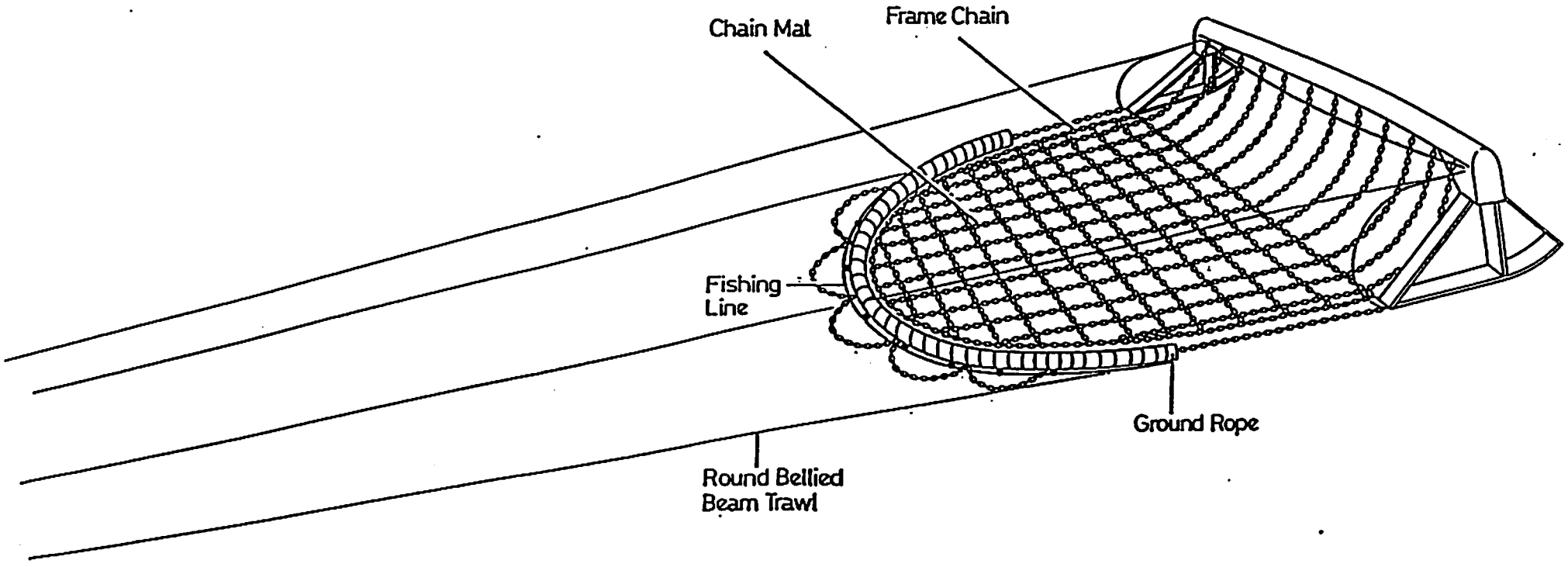






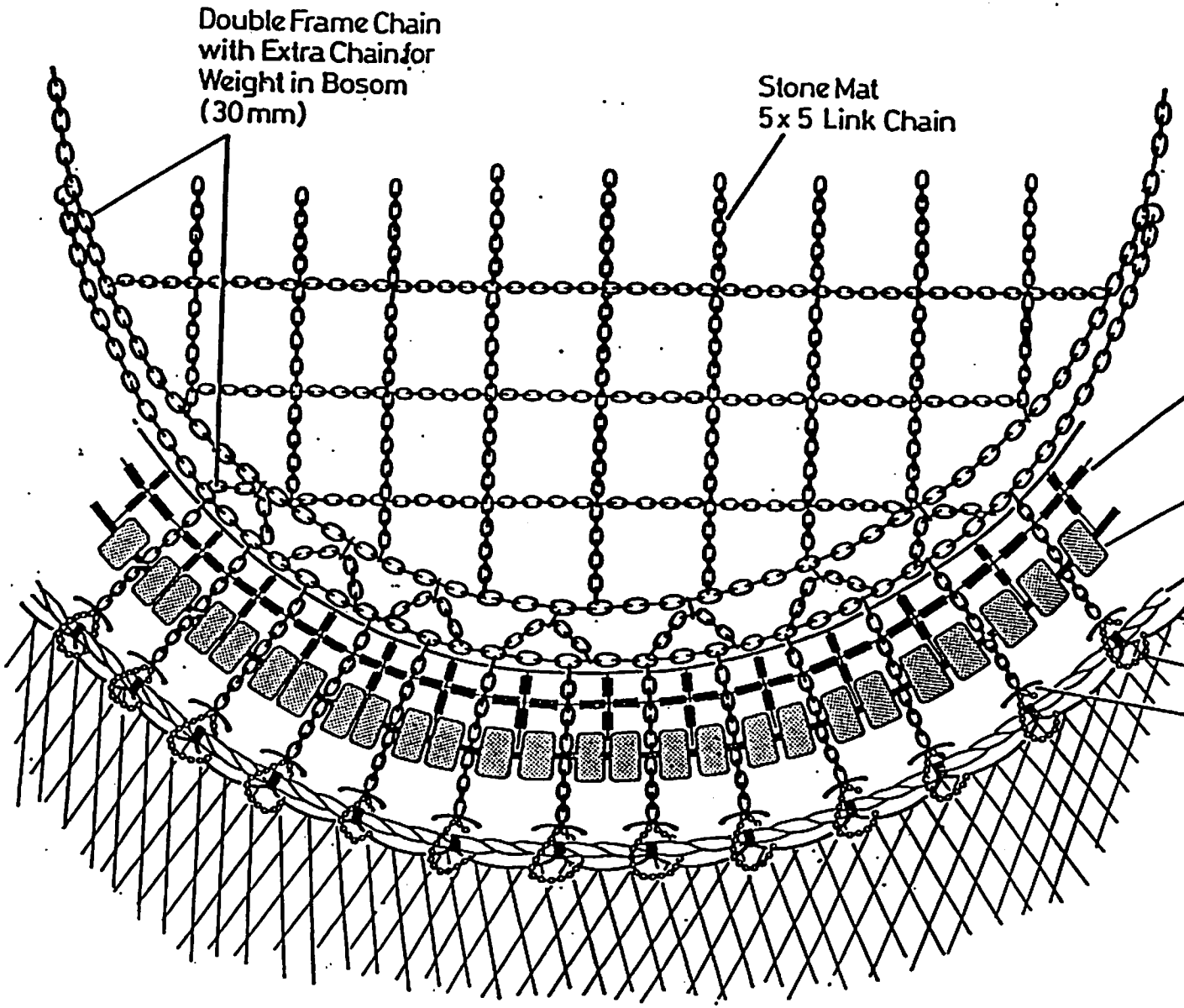
BEAM TRAWLING — emptying codend

FIG: 12.



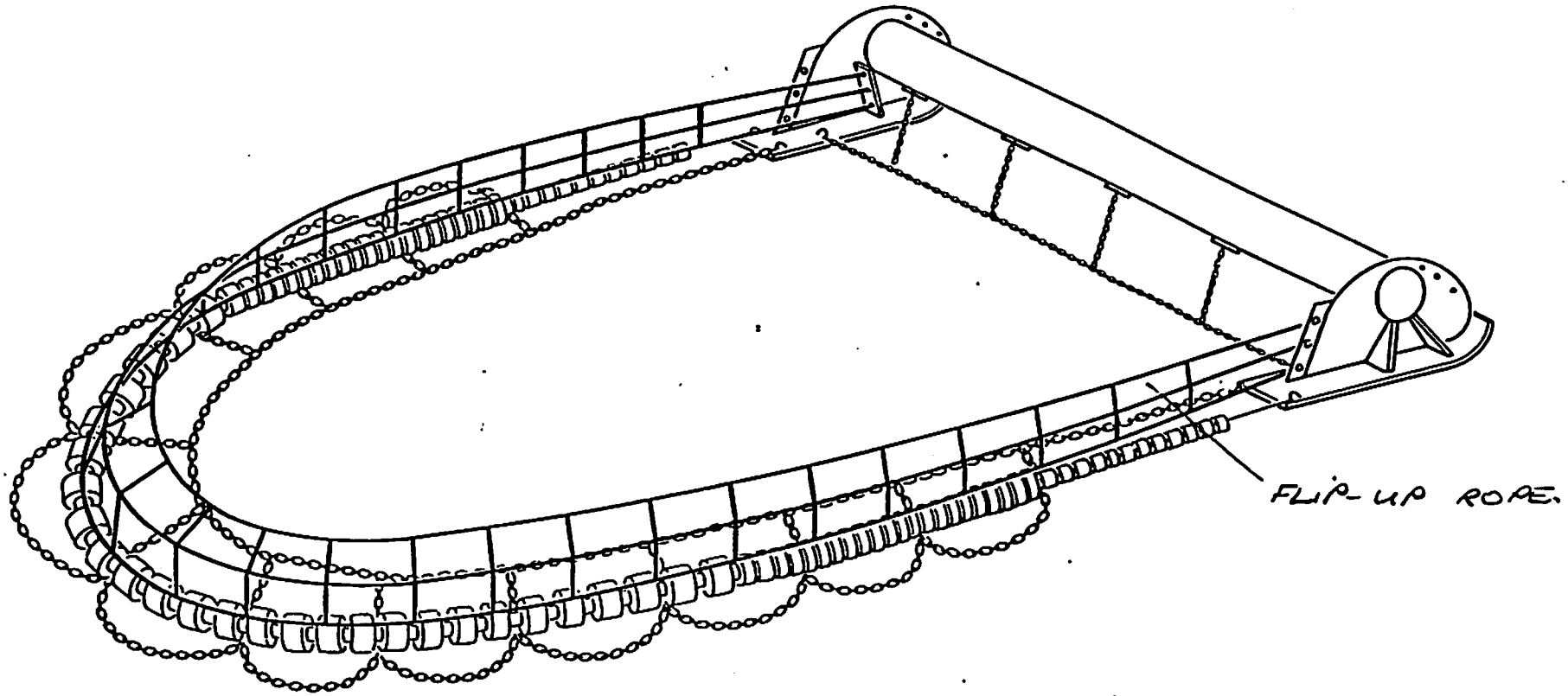
Beam Trawl Rigged with Chain Mat

Ground Gear - 8 metre Beam Trawl



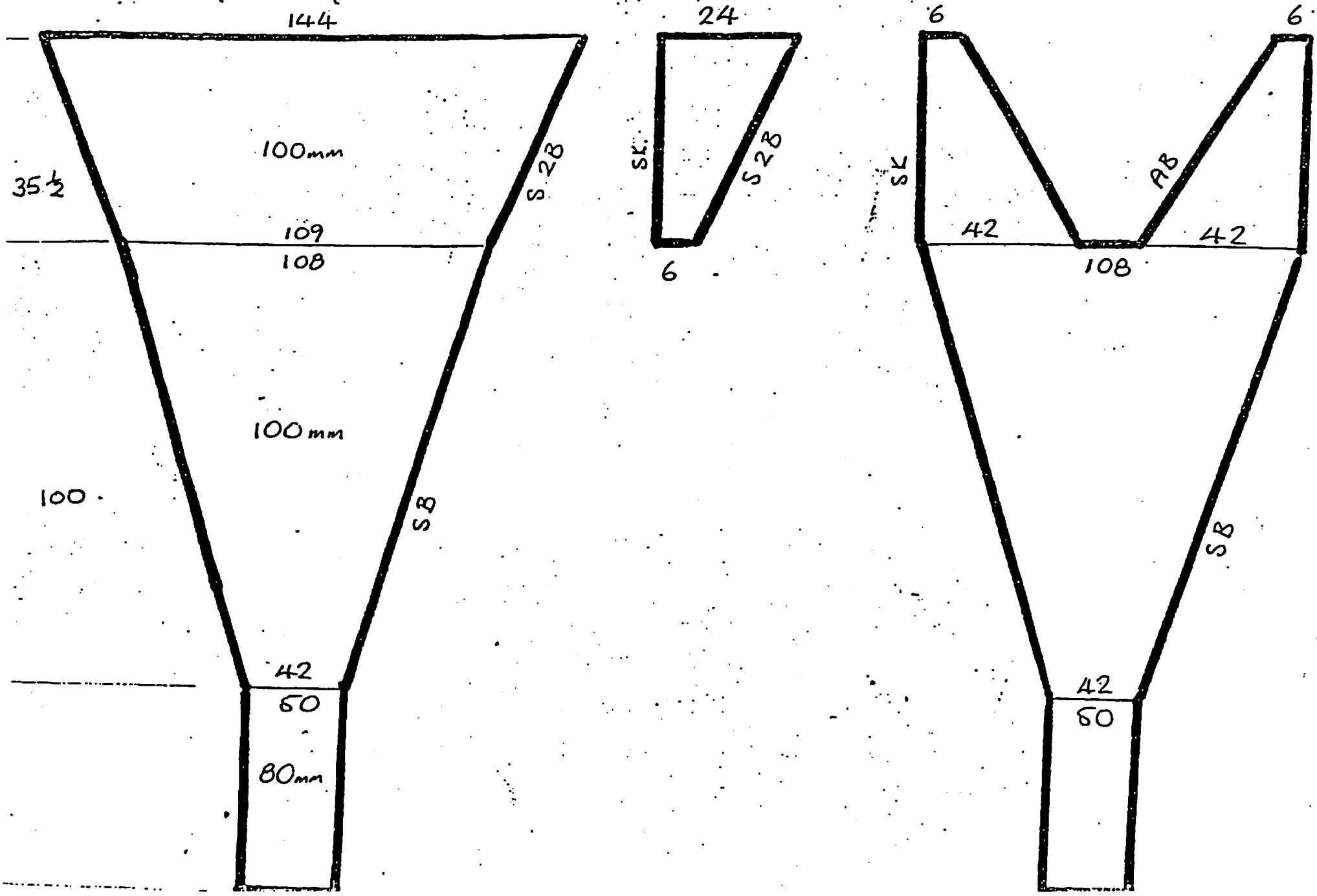
Towing Speed - 3½ knots

FIG. 14.



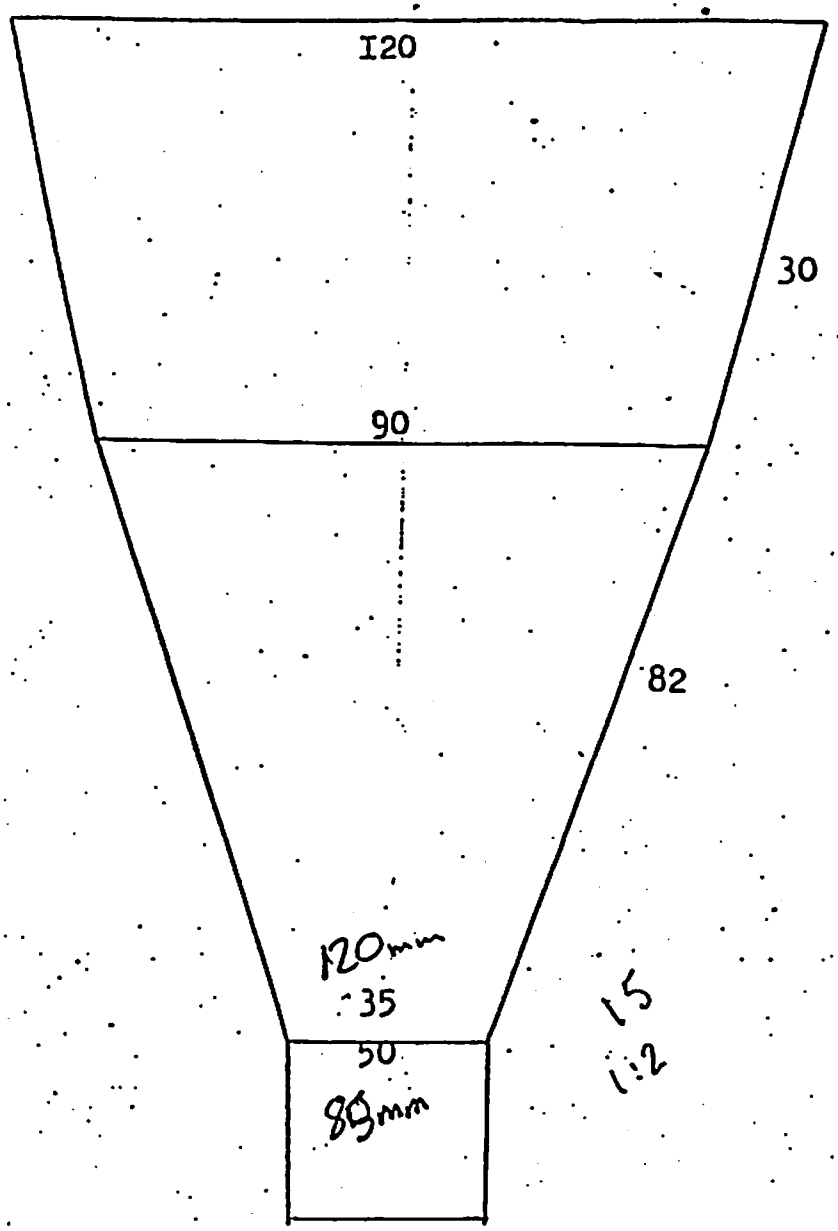
GROUND GEAR SHOWING 'FLIP-UP ROPE ARRANGEMENT.

20FT BEAM TRAWL



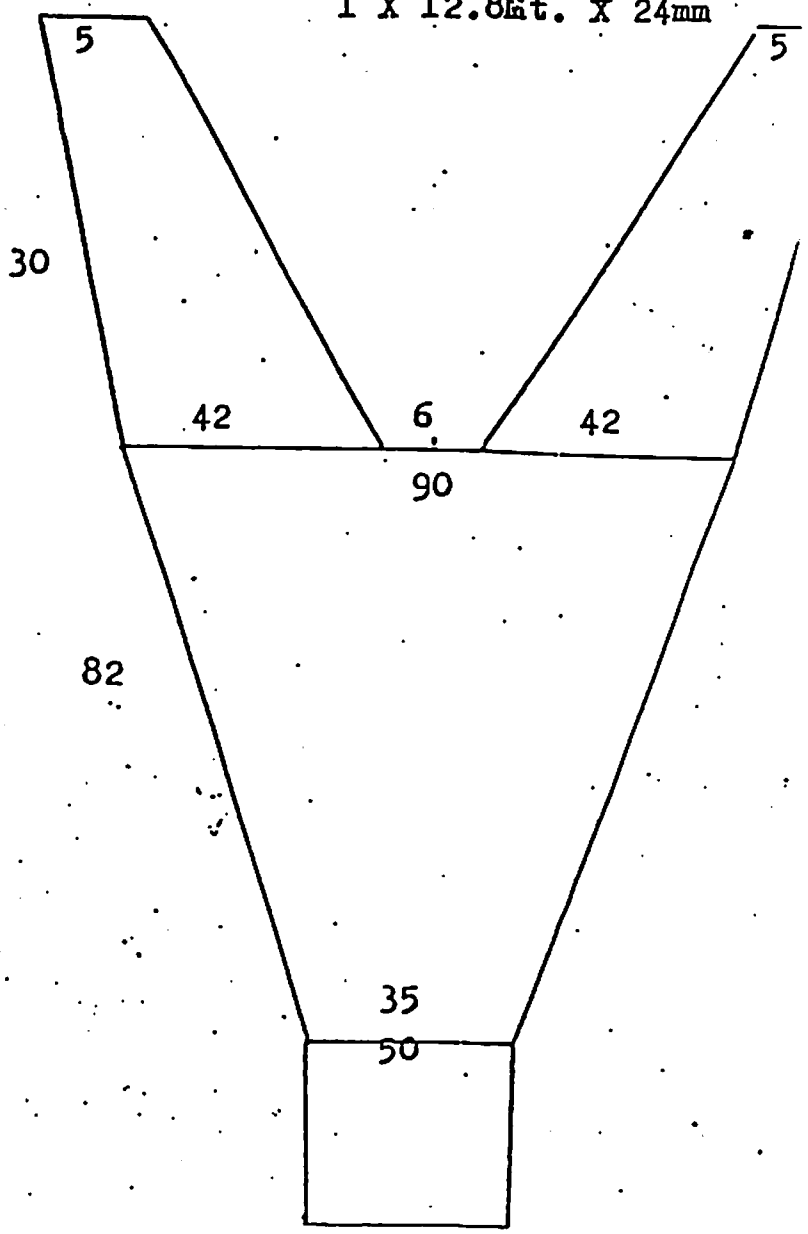
6 - Mtr Beam Trawl.

Headline 5.9. Mtrs.



Panel.

Fishing Lines.
I X II.8Mt. X 40mm
I X I2.8Mt. X 24mm



B

1:5
1:2