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International Council for the Exploration of the Sea

C.M.1975/B:2
Gear and Behaviour Committee

REPORT OF THE WORKING GROUP ON RESEARCH AND ENGINEERING ASPECTS OF FISHING GEAR, VESSELS AND EQUIPMENT

Convenor and Rapporteur :	J.G. de Wit, Netherlands Institute for Fishery Investigations, IJmuiden - The Netherlands
Meeting time and place :	21 and 22 April, 1975 Ostend - Belgium
Terms of reference :	C.Res.1974/2:14(i)a: to discuss further developments in fishing gear, fishing vessels and their fishing auxiliaries, instrumentation, the technical parameters of fishing effort measurement and, in conjunction with the Working Group on Reactions of Fish to Fishing Operations, technical developments in electrical fishing.

Note: A meeting was held on electrical fishing in Ostend on 23rd April, 1975.
It was decided that a seperate report of this meeting will be submitted to the Gear and Behaviour Committee, as an appendix to both the Engineering and Fish Reactions Working Group reports (see C.M.1975/B:10)

PARTICIPANTS

Belgium

G. Vanden Broucke	Fisheries Research Station - Ostend
J. Van Hee	" "
P. Hovart	" "

Canada

P.J.G. Carrothers	Department of Environment Biological Station - St. Andrews N.B.
G. d'Entremont	Department of Environment Industrial Development Branch - Ottawa

France

G. Kurc	Institut des Pêches Maritimes - Nantes
R. Le Men	" "
J. Prado	" "

*) General Secretary, ICES, Charlottenlund Slot, 2920 Charlottenlund, Denmark.

Germany	
E. Dahm	Institut für Fangtechnik - Hamburg
K. Lange	" "
R. Steinberg	" "
Netherlands	
E.J. de Boer	Netherlands Institute for Fishery Investigations - IJmuiden
S.J. de Groot	" "
P. Korbee	" "
A. Verbaan	" "
J.G. de Wit (convenor)	" "
Norway	
I. Bjørkum	Institute of Fishery Technology Research - Trondheim
L. Karlsen	" "
St. Olsen	" "
K. Olsen	Institute of Marine Research - Bergen
United Kingdom	
R.S.T. Ferro	Marine Laboratory - Aberdeen
J.J. Foster	" "
J.F. Foster	White Fish Authority Industrial Development Unit - Hull
A.R. Margetts	Fisheries Laboratory - Lowestoft
J.A. Pope	Marine Laboratory - Aberdeen
U.S.S.R.	
A.I. Treschev	All-Union Research Institute of Marine Fisheries Oceanography (VNIRO) - Moscow
V.P. Simbirev	Ministry of Fisheries of the U.S.S.R. - Moscow.
F.A.O.	
C. Nédélec	Fishery Industries Division - Rome

AGENDA

The Working Group adopted the agenda as proposed by the Chairman.

21 April, 1975

1. General assembly
2. Opening and progress reports
3. Deep sea trawling
4. Deep water trap fishing
5. Swept Volume Method

22 April, 1975

6. Aimed trawling
7. Pair trawling for roundfish
8. Multi-purpose vessels
9. Drum seining

10. Mechanized long lining
11. Effects of fishing gear, oil pipelines, etc. on the sea bed
12. Capelin density estimates from pelagic trawl catches and by echo-integrator
13. Technical aspects of aquaria
14. Films and slides.

GENERAL ASSEMBLY

The chairman of the Gear and Behaviour Committee will report on the general-assembly matters (see C.M.1975/B:6).

OPENING

It was noted that Iceland, Ireland, Italy and the USA had announced that no participants from these countries would attend the meetings.

The chairman noted that the present deplorable state of a number of fish stocks urges the people working in the development of the fishing gear, the fishing vessels and its equipment to give higher priorities to more selective rather than to bigger fishing gears. The sharply increasing costs of labour and material require fishing gears which are cheaper and easier to make and to repair. About fishing vessels he noted the present need of the fisheries to make the vessels suitable for more than one fishing method and to proceed with mechanization of fishing gear handling; these will increase the flexibility of the use of the vessel and reduce the heavy human labour and labour cost on board can be reduced.

PROGRESS REPORT

Rapp. A.R. Margetts

Below are listed the main subjects of study within technology of fishing gear and vessels by member countries during the past year and at present.

Canada

1. Engineering study of groundfish trawl
2. Development of stern seining
3. Triple gear handling on one vessel
4. Long-line automation
5. Trawl headline lifting by rotor (low priority)
6. New design of small trawls (Quebec province)

Fed. Rep. of Germany

1. High-opening bottom trawls, including model tests
2. Modified (ropes) pelagic trawl
3. Otter boards for bottom and pelagic trawls
4. Introduction of small-boat pelagic pair trawl

Norway

The recently established Fiskeriteknologisk Forsknungsinstitutt of the Fisheries Research Council deals with ships at a unit in Trondheim, and with fishing gear at a unit in Bergen. The latter is so far concerned mainly with coastal fishing investigations which include:

1. Long-line automation
2. Deep sea traps
3. Pelagic trawl selectivity
4. Methods of reducing capture of small fish by shrimp trawls
5. Detection techniques and catching methods for krill
6. Acoustic methods of bottom type discrimination
7. Mechanization of gill-netting.

U.K. (England)

1. Solid state sector-scanning sonar
2. Measurement of trawl efficiency, using acoustic tags and scanner
3. Reactions of fish to components of trawl
4. (with Scotland) Configuration of Danish seine net and ropes in action, and reaction of fish to ropes
5. Effects of otter trawl tickler chains
6. Deep trawl "on bottom" indicator
7. Bottom type discrimination by sector scanner
8. (with Scotland, Norway et al.) Trawl/pipelines observations

U.K. (Scotland)

1. High-opening bottom trawl, including model and small scale trials
2. Engineering measurements, data logging and computor analysis of trawls.
3. Data bank for trawl information
4. Danish seine investigations (a) keeping net open by divertors,
   (b) trials of groundropes,
   (c) (with England) varying configuration of ropes in action
5. Pelagic trawl design for blue whiting fishery
6. Semi-pelagic trawl
7. Finely graded mesh trawl
8. Instrumentation for parameter measurement by divers
9. Deep-water net sounder for deep pelagic trawl

U.K. (White Fish Authority)

1. Long-line automation
2. Model gear flume tank (ready Sept. 1975)
3. Measurement of performance of pelagic trawl for vessels of power $<$ 750 kW
4. Assisting fishermen by introduction of new methods from one area to another

U.S.S.R.

1. Quantifying fishing effect by universal method
2. Gear selectivity
3. Pelagic trawls
4. Electric trawls

F.A.O.

1. Design and testing of fishing vessels and gears suitable for developing fisheries
2. Development of pelagic and semi-pelagic trawls for inshore vessels.
3. Fishing gear for tropical inland waters (lakes, rivers and reservoirs)
4. Purse seines for small sized fish (less than 10 cm) and/or small boat operation
5. Mechanization of inshore fishing vessels, in particular by the use of haulers for gillnets and/or longlines

Belgium

1. Increasing capacity of beam trawl for round fish
2. Semi-pelagic Danish type pair trawling
3. Engineering study of parameters of pelagic pair trawl

The Netherlands

1. Introduction of high headline trawl on beam trawlers
2. Conversion of beam trawlers to multi-purpose trawlers
3. Data logging on freezer trawlers for statistics collection and for performance studies
4. Operational economies and cost-cutting on fishing vessels
5. High headline trawl (a) accepted for stern trawlers
   (b) trials in sand-ridge areas
6. Pelagic trawling for cod
7. Comparative fishing trials with electrified trawls

France

1. Adaptation of high-opening bottom trawl for small vessels
2. Comparative study of bottom otter boards
3. Lorient model gear flume tank (complete June 1975)
4. Sinking speed of tuna purse seine

DEEP WATER TRAWLING - Agenda item 3

Two written contributions are summarized below.

"Investigations in Deep water Trawling" by G. Freytag and H. Mohr, Institut für Fangtechnik - Hamburg - F.R. of Germany.

Fishing area, and method of the investigations:

The trials took place in the area west of the British Isles from May 5th to June 6th 1974 when priority was given to fishing technology.

The vessel engaged in these investigations was the FRV "Walther Herwig". Technical Data:

77,7 m L.o.a.
2 500 GRT
2 x 2300 hp propulsion
winch drum capacity 4300 m of 32 mm dia warps

To compensate for the increased depth, a conventional bottom trawl of 200 feet headline was loaded by additional weights at the otter boards and the groundrope in order to keep the gear in close contact with the bottom. A 100 feet groundrope with solid rubber bobbins was used instead of hollow iron ones. The 8 m^2 Polyvalent otter boards of 2 tons each were ballasted with an additional weight of 240 kg. Using warps of 4 inch in circumference (32 mm Ø) made it possible to reach a depth of 2100 m with a warp length of 4100 m at the reasonable towing speed of 4,5 knots. The floats were replaced by 1 or 2 kites and 6 plastic airfilled 80 liter floats to aid when shooting the net; these floats collapse at depth to a very reduced volume. A gear without ponyboards and with 50 m bridles was used. The performance of the gear was observed at depths of 600 and 800 m by means of a netzsonde and at greater depths by the shipborne warp-loadmeter on each side, which showed when the net touched the bottom after shooting. The thrust varied according to the depth, between 18 tons at 600 m and 24 tons at 1200 m depth.

For fish finding and bottom control, several vertical echosounders with frequencies of 18, 30 and 37 kHz were used. These sounders were useless for fish detection. But for bottom control, especially at depths of 800 - 1200 m, a high-power 18 kHz sounder with an expanded-scale writer was useful in showing up hazards like steep slopes, pinnacles, etc. For navigation, plotter-charts, in connection with Loran C were used.

Preliminary results:

Deep water fishing has the following disadvantages when compared with traditional shallow water fishing: more expensive material, more energy and time, and the fish stocks will generally be less dense.
Some factors may be restricted to the initial stage of this fishery e.g. damage or loss of gear will occur more frequently than on traditional grounds, detailed charts of which exist.
The echosounder presently available do not indicate scattered fish at a depth of, say, more than 400 m, so an efficient aimed trawling cannot be conducted.

During the trials hauling, lifting and manoeuvering the gear gave no difficulties.

Because of the ballasted otterboards and the solid bobbins, shooting of the trawl could be performed within a reasonable time. After the warps were shot, it took up to 10 minutes until the trawl had settled on the bottom. The gear touching the bottom could be clearly observed by means of the warp load meter.

The average time of shooting the warps (= from shooting the otterboards until the settling on the ground) and hauling (= from start of hauling to hanging the otterboards at the gallows) in relation to water depth is shown in the following table:

water depth	warp length	shooting	hauling
(200)	(850)	(8.5 min)	(10.8 min)
400	1400	16.8 min	20.8 min
600	1700	21.1 "	24.9 "
800	1900	27.1 "	28.4 "
1000	2500	40.4 "	37.2 "
1200	2700	47.8 "	44.5 "

(The data in brackets are for commercial trawlers during normal bottom trawling.)

From this table it can be concluded that the lost fishing time per haul in 1200 m exceeds that of normal bottom trawling by 1 hour and 13 minutes, provided that no damage occurs and that all other working time spent at the gear between two hauls is the same as in traditional trawling.

Observations on adequate towing times in deep water trawling have not been undertaken up to now. Referring to English experience, it should not exceed 2 hours because of the danger of damage.

Considering only the amount of catch and neglecting their recent marketability, the results during the cruise in spring were promising. The average catch per hour was about 20 baskets (à 50 kg) with occasional hauls exceeding 200 baskets. At each depth particular species were prevailing: at 800 m this always was the grenadier (Coryhaenoides rupestris); at 1000 m the smoothhead (Alepocephalus bairdi); at 1200 m deep water dog fish (Deania calcea and related species); at 400 and 600 m the catch composition depended also on other factors and the main species differed from place to place.

"Deep water trawling" by J.F. Foster, White Fish Authority, U.K.

Investigation into the suitability of existing fishing gears:

Whilst it was evident that in order to fish to depths of 700 fathoms, headline floats and groundrope bobbins would need to be strengthened to withstand the increased hydrostatic pressure, it was not immediately apparent what length of warps would be required to achieve this depth. To investigate maximum depth fishable with the warps usually carried by British stern trawlers (1100 - 1200 fm) and to give some guidance as to the likely modifications to existing trawls which would be required to achieve 700 fathoms, a mathematical investigation was conducted for the White Fish Authority by the British Hovercraft Corporation. In this it was assumed that the standard 78 ft. headline Granton trawl (Figure 1) would be used with 10.5 ft x 5.75 ft flat rectangular trawl boards (Figure 2) having a weight in air of 1.0 tons and that ballast would be added to the trawl boards (Figure 3).

The results are shown in Table 1 and Figures 4, 5 and 6 in which the warp tensions are the estimated tensions in one warp only. As trawl speed increases, more warp is required to maintain constant depth. At the same time, tensions in the warps will increase as a result of the increased drag of the gear and weight of additional warp. The limitation on depth will therefore be imposed by the speed of towing, the maximum length of warp available and the acceptable tensions in the warps.

Table 1

Board	Standard		Standard + 1 ton		Standard + 2 ton	
Speed (Knots)	Depth (Fathoms)	Warp Tension (Tons)	Depth (Fathoms)	Warp Tension (Tons)	Depth (Fathoms)	Warp Tension (Tons)
4.0	517	6.6	578	7.1	627	8.0
3.5	586	5.9	650	6.6	705	7.5
3.0	667	5.4	737	6.0	800	7.2

It can be seen from Figure 3 that, providing a towing speed of 2.3 kts. is acceptable, it is possible to achieve a depth of 800 fathoms without alteration to the standard gear. The addition of 1.0 and 2.0 tons of ballast to the trawl boards enables depths of 875 and 940 fathoms respectively, to be attained at the same speed. If this speed is not acceptable and the more normal towing speed of 4 kts. is required, then the maximum depth is limited to 517 fathoms with standard boards, 578 fathoms with 1.0 tons of ballast and 627 fathoms with 2.0 tons of ballast. In general terms, for each knot decrease in speed there is an increase in depth of 165 fathoms.
The current class of British stern trawlers should be capable of trawling down to 700 fathoms. Subsequent trials and deep water survey voyages have substantiated these findings.

Deep water trawling experiences:

In July 1972 the 246 ft. stern freezer trawler "Southella" was chartered for three days to carry out gear-performance trials. Part of the trials was to carry out deep-water trawling.

The trawls used during subsequent deep water trials were the standard Granton (Figure 1) and the 96 ft. headline Stella (Figure 7). The headline and groundrope rig used on the Stella trawl is shown in Figure 8. This arrangement was also used on the Granton but modified slightly to suit the trawl's shorter headline and groundrope.

The trawl boards used with the trawls were the standard flat rectangular boards of Figure 2 modified by the addition of 0.5 tons of ballast as shown in Figure 3. Ideally, heavier boards would have enabled greater depths to be achieved, but the construction of the door prevented more than the 0.5 ton of ballast being added.

No trawl instrumentation was used during the deep water trials. Information on the behaviour of the trawls was obtained by observing the warp tensions and abrasions on the trawl boards and ground gear when hauled.

The maximum depth reached by the Stella trawl was 550 fathoms, towed with 1000 fathoms of warp at 2.5 kts. With the Granton trawl a depth of 600 fathoms was reached with 1050 fathoms towed at the same speed. Although this speed appears low compared with the more normal 4 - 4½ knots, experience from deep water trawling suggests that towing deeper than 450 fathoms with 1051 fathoms of warp, the towing speed should be around 3.0 kts. At higher speeds there is a tendency for the gear to lift off the seabed.

Discussion:

The German methods and results were closely similar to those used by England over the past three years. The German research vessel "Walther Herwig", however, has a much bigger winch and heavier warps and otter boards than do British distant water trawlers, enabling deep trawling at higher speeds. One notable difference between techniques was that the grounding of the trawl was sensed by the warp load meters on the German vessel but not on the British, thus the Lowestoft Laboratory had developed a "trawl on bottom" telemeter (see C.M.1974/B:3), Appendix 1).
Whereas British work on this subject was not being continued, the initial project having been completed, German work continues with the trial use of bigger trawls to increase catches. Exploitation beyond 1200 m depth appears to be not worthwhile because of paucity of fish available there.
Russian work in these deep fisheries is at present only experimental.

DEEP WATER TRAP FISHING - Agenda item 4

Written contribution: "Norwegian experiments with deep sea traps"

by John W. Valdemarsen, Norway.

This paper will be up-dated and submitted to the next meeting of the Gear and Behaviour Committee.

The results of first trials of the method in deep Norwegian waters are encouraging. The indications are that the species selectivity of the gear is very different from that of longlines and trawls.

SWEPT VOLUME METHOD - Agenda item 5

Rapp. C. Nédélec

Two written contributions were presented and discussed:

"Questions of the Swept Volume Method for Fishing Effort Measurement",

by P.J.G. Carrothers, Canada.

The following is a summary:

Several factors condition the impact of the fishing effort on the fish resource, in particular the operational factors (i.e. the finding of suitable fish concentrations and the gear manoeuvring during fishing operation), and the herding effect of sweeplines and otterboards which must be considered when assessing the fishing effort of bottom trawls.

Treschev, Karpenko and Beljaeva, 1974 (ICES C.M.1974/B:7) in Table 5 "Correlation of the factors obtained as a result of experiments completed at different vessels" present the following picture:

Series	Experiment	Correlation of catches	Correlation of volumes of water swept	Correlation of vessel's displacements	Correlation of vessel's lengths
4	1	1	1	1	1
	2	0.80	0.88	1	1
1	1	4.90	2.06		
	2	3.81	2.00	0.82	0.83
2	1	2.52	0.86		
	2	3.24	0.96	0.82	0.83
3	1	7.09	4.26		
	2	5.95	3.40	0.70	0.78

The following data from the same paper serve as a key to that table:

Series	vessel's engine output (hp)	vessel's length (m)	vessel's displacement (t)
4	3880	102	4640
1	2000	84.7	3800
2	2000	84.7	3800
3	1340	79,8	3275

The authors commented on Table 5 as follows:

"Data given in the Table show that between the catch and the volume of water swept exists a much more evident dependence than between the catch and the characteristics of vessel that is observed not only under identical conditions (fishing process at the parallel or alternative trawling at one time and within the same area), but also under different conditions. It was registered that usually the gross tonnage vessels catches are larger than those taken by small ones during the same time, which may be explained by the fact that those vessels use fishing gears of greater size, tow them with higher speed and, as a rule, posess fishing gears and scouting instruments of better quality".

Carrothers applied the "F" test to the above mentioned data.

Series	Experiment	Swept Volume Rate $10^6 m^3/hr$	Horsepower	Catch per Unit Effort: Swept Volume tons/$10^6 m^3$	Catch per Unit Effort: Power x Time kg/hp-hr
1	1	0.49	2000	6.37	1.56
	2	0.44	2000	5.12	1.13
2	1	0.44	2000	7.86	1.74
	2	0.49	2000	9.09	2.22
3	1	0.97	1340	4.47	3.24
	2	0.88	1340	4.71	3.09
4	1	0.81	3880	2.69	0.56
	2	0.71	3880	2.44	0.45
		$x =$		42.75	13.99
		$\sum x^2 =$		266.5537	32.2283
		$\bar{x} = \Sigma x / n$	=	5.344	1.749
	s^2	$= \dfrac{n \Sigma x^2 - \Sigma^2 x}{n\ (n - 1)}$	=	5.444	1.109
	c	$= s / \bar{x}$	=	0.437	0.602
	F	$= (0.602/0.437)^2$	=	1.9	

which is not significant.

(For $P = 0.05$ and $n'_1 = n'_2 = 7$, $F = 3.8$)

Carrothers concluded that the catch per unit swept volume is numerically slightly less variable than the catch per horsepower-hour, but that the "F" test applied to the coefficients of variation indicates that this difference is not statistically significant. That is, power times time is as good a measure of fishing effort as is swept volume. Horsepower times time can be calculated more easily and more precisely than can swept volume.

As regards the swept volume of driftnets Carrothers noted that several unknown factors such as the relative velocity between the gear and the fish have to be taken into account. Finally the importance of the catching efficiency of gear was pointed out, as this characteristic varies with both the gear construction and the fish behaviour and therefore introduces a bias into population estimates based on catch and effort statistics only.

"Comments on A.I. Treschev's Swept Volume Method for Evaluation of Fishing Power", by C. Nédélec, FAO.

Nédélec said that the following comments reflected not only his own opinion, but also that of several of his colleagues specialized in stock assessment, fisheries statistics and gear technology (in particular J.A. Gulland, L.P.D. Gertenbach, L. Butler and J. Schärfe).

His contribution is here reproduced in full.

1. General definitions:

The terms used for fishing gears are those of the International Standard Classification of Fishing Gear, as adopted by ICES.

These comments are limited to fishing gears commercially important or widely used. Miscellaneous or relatively rare gears, such as falling gear (cast nets, cover baskets, grappling and wounding gear (rakes, harpoons etc.)) and harvesting machines have not been considered.

The swept volume method discussed here below is that described in Treschev's original papers: Rapp.P.-v.Réun. Cons. Int. Explor. Mer, 168. 54-47. Jan. 1975. and ICES.C.M.1971/B:9.

The following documents have also been consulted: ICNAF Redbook 1973, Part III, p. 233-241. Treschev, Karpenko, Beljaeva, ICES.C.M.1974/B:7.

The following terms, used in these comments, are similar to those defined by Treschev in 1970 (1975):

"Fishing power" implies the zone (or the importance) of action of a gear in the process of fishing per unit time or per unit operation.

"Fishing effort" expresses the total fishing power exerted during the period considered (e.g. per day, month or year).

"Fishing efficiency" designates the ratio of the catch for a given period to the fishing effort exerted during the same period (or by taking the definition of the fishing power, the ratio of the catch to the total fishing power exerted during the period of fishing).

2. Evaluation of Fishing Power:

Treschev's method appears mainly useful for active fishing gears, which are effectively sweeping a certain volume of water per unit of time or per set, i.e. trawls, surrounding nets, seine nets and lift nets. The calculation of the water volume swept by these gears requires, however, the knowledge of precise parameters of the gear in action (e.g. opening height and width for trawls, effective fishing depth and sinking speed for purse seines), which are generally not precisely known, except for a limited number of gear types for which accurate measurements of the net in operation have been made on board research vessels. Moreover, for some types of gear, such as seine nets (i.e. Danish seines, boat seines, beach seines) or purse seines for shallow water operations, the knowledge of the area fished would to be appear more important for the evaluation of the fishing power than the water volume swept. Attracting fish by light or by bait, associated with gear operation, would also appear to be predominant factors as compared with the water volume swept by the net.

For these reasons, in practice, for general fisheries statistics work, simpler evaluations of fishing power have to be preferred, e.g. for trawls the main engine power of the vessel, and for purse seines the gross tonnage of the vessel, as these characteristics are generally directly related to the catching efficiency of the fishing unit (vessel + gear).

It should be pointed out, however, that for research or gear technology work, the precise evaluation of the fishing power, determined after preliminary measurements of the gear parameters, can lead to very useful information on the fishing efficiency of the gear. The knowledge of the changes which occur in fishing efficiency of a given type of gear, e.g. in the course of a period of several years, will enable a more precise interpretation of catch per fishing effort data, in particular with a view to accurately determining the abundance indices of fish stocks.

As regards the other gears, it seems advisable, also for gear research and experimental fishing work, to use the following evaluating methods of fishing power, some of which were proposed by Treschev.

For gillnets and entangling nets by the area of the mounted nets. Driftnets should be treated in the same manner as ordinary gillnets.

For longlines by the number of hooks per unit length of line (or more precisely per unit of distance covered by the longline or per unit area of sea-bed.

For trapnets by the area of the mounted wings and/or leader.

For pots by the number of pot entrances per unit of distance (if the pots are set in line), or per unit area of sea-bed (if pots are set individually).

For liftnets, by the volume of water swept or more simply by the area of the mounted net.

For the same practical reasons as explained above, for fishery statistics work, simpler expressions of fishing power for these gears are used, generally referring to the number of standard gears (i.e. of gears of well-known dimensions and particulars).

In Table I are summarized some of these various expressions for the main fishing gears, for the two main cases, i.e. for general fishery statistics work and for gear research.

Table I. Expressions of fishing power for the main categories of fishing gear, depending on the purpose, i.e. for fishery statistics and for gear research.

	Fishing Power	
Fishing gear	For Fishery Statistics	For Gear Research
Trawls	Main engine power of trawler	Volume of water swept per unit time
Purse seines	Gross tonnage of purse seiner	Volume of water swept per set
Gillnets and entangling nets	Number of standard* nets	Area of mounted nets
Longlines	Number of hooks	Number of hook per unit length of line of unit area of sea-bed
Trapnets	Number of standard* trapnets	Area of mounted wings and/or leader
Pots	Number of standard* pots	Number of pot entrances per unit of distance or unit area of sea-bed
Liftnets	Number of standard* liftnets	Volume of water swept (or area of mounted net)

* Standard means usual gear of known specifications

3. Comparison of fishing powers:

Due to the fact that different units are recommended for the various gears, the comparison of fishing power is only possible within a given category of gear, and consequently, it is practically impossible to compare the fishing powers of gears of different categories.

However, we whink that this impossibility is not a too serious drawback, when considering the basic differences between the various kinds of catching operations, in particular in relation to the different behaviours of the species sought depending on the type of gear used. It would therefore seem unrealistic to try to use the same unit for the fishing powers of all kinds of gear. Furthermore, in commercial fishing, what is in fact important is the catch in relation to the investment in fishing means (vessel + gear) and manpower.

With regards to stock assessment problems, in addition to the fishing effort data (which results from the information on fishing power, catch and fishing efficiency), the evaluation of the catch intensity (expressed as the ratio of the catch to the available stock) would appear to be the common coefficient for comparing the importance of two different fishing techniques used in the same area.

Discussion:

The chairman drew the meeting's attention to the report of a discussion on the Swept Volume Method in this working group (IJmuiden, 5 May, 1973) - C.M.1973/B:3.

Treschev stated that a manual for guidance in the application of the swept volume method is being prepared in English for presentation at the next Gear and Behaviour Committee Meeting.
He presented an improved mathematical model for expressing fishing power which aims to take into account the main factors having an influence on the fishing operation. He explained the action of bottom trawls in terms of a zone of action and a fishing zone taking into account the herding effect of the sweeplines and otterboards. The contribution of the zone of action to the swept volume is to be explained in the manual. The same applies, for example, also to the ship's factors already mentioned in the working group's report (C.M.1973/B:3 p. 12). He also described an experiment for defining the zone of action of a fixed gear (a bottom set gill net) using tagged fishes released at several points around a set net with and without current in the Northern Caspian Sea.

In the discussion, doubt was expressed about the practical utilization of the swept volume method for measuring fishing effort. In spite of the recent modifications to improve the accuracy of the method, it is feared that the introduction of too many unknown factors will restrict the application of the formula to a limited number of well defined cases, because of preliminary evaluation of these additional factors would be necessary.
It was noted that for management purposes it is usually preferable to use simple and easily obtainable measurements of fishing effort, such as horse-power x time. However, it was observed that the swept volume method could be of interest for gear research or experimental fishing work, for instance to assess the catching efficiency of trawls or other active gears.

The swept volume method has been supplemented and amended in the course of time and, probably, is still undergoing such modifications. Certain countries are studying the application of this method. Other countries had done so and submitted their results to the 1973 meeting (C.M.1973/B:3).

As the results for beamtrawls and bottom trawls did not show greater significance than do other commonly used fishing effort parameters, the participants from these countries were inclined not to continue with the application, at least until they had been able to study the promised guidance manual and were sure that they were working along the same lines as Treschev.

All members of the Working Group were urgently requested to study the manual and thereafter consider the value of the swept volume method in both study of fishing gear technology and fishing effort for the next years.

Note 1 - The contribution "Latest experiments of the Institut für Fangtechnik, Hamburg, in the field of midwater trawling" (p. 18) showed the interdependence of the netmouth opening on speed, bridle length between net and otterboard and the type of otterboard. The Figures presented were thought to be of importance for an application of the swept volume method to midwater trawl (see Figures 10 a - b - c).

Note 2 - The contribution "A relationship between capelin density as sampled by echo integrator and by pelagic trawl" by W. Dickson indicated a swept volume trawl efficiency of 50-80%. This paper will be submitted to the 1975 meeting of the Gear and Behaviour Committee.

AIMED TRAWLING - Agenda item 6

Rapp. J.J. Foster

The following paper were presented and discussed:

"Latest experiments of the Institute for Gear Research, Hamburg, in the field of midwater trawling" by R. Steinberg and E. Dahm (summarized below).

"Comparative trials with different otterboards" by K. Lange, Institute for Gear Research, Hamburg (summarized below).

"Experiments with spinning rotors (spintrols) on hi-lift and midwater trawls in Canada" by W.W. Johnson (summarized below).

"A simple computer model of trawl gear motion" by R.S.T. Ferro, Marine Laboratory, Aberdeen, Scotland (will be submitted to the 1975 meeting of the Gear and Behaviour Committee).

"Selectivity of pelagic trawls" by Steiner Olsen, Institute of Fishery Technology Research, Bergen, Norway (will be submitted to the 1975 meeting of the Gear and Behaviour Committee).

"Latest experiments of the Institute for Gear Research, Hamburg, in the field of midwater trawling" by R. Steinberg and E. Dahm.

In general, only two types of pelagic trawl are being used in Germany: the 1000 meshes net (400 mm meshes in the forenet) and the 630 meshes net (800 mm meshes in the forenet), which, in the net mouth circumference in terms of 200 meshes, correspond to 2000 and 2500 meshes respectively.

The components of these nets are almost identical and interchangeable (see Figure 9). This cost-lowering simple system has made its breakthrough in a surprisingly short time and has shown its advantages on board the trawlers, because of shortage of skilled deck hands.

Performance tests of one of the above mentioned net types involving experiments on the influence of kind and size of otter boards, lengths of legs, the wing weights and number and sort of floats on the headline were carried out. Some results produced by aid of a computer, given in Figures 10 a to 10 c, lead to the following conclusions: Polyvalent otter boards are less efficient than Süberkrüb doors of the same area (Figures 10 a and 10 b). Fishermen will therefore have to go on working with two types of otter boards in midwater and bottom trawling. Süberkrüb doors are sometimes too effective, when the doors are not of the appropriate size (Figure 10 a and 10 b). Too large doors increase the horizontal spread so much that the net shape is considerably deformed. This may be of advantage in exceptional cases when very thin layers of fishes or fishes near the bottom have to be caught.

In general, this will lead to inadmissible loads in the net which soon will cause damage. At least such deformation will reduce the catching efficiency of the net. (For further details of this investigation see paper "Comparative trials with different otter-boards" by K. Lange p. 19 of this report).

Leg-lengths also influence the area of the net opening considerably; longer legs result in a smaller horizontal spread of the net (see especially low towing speeds in the Figures 10 a to 10 c).
Wing-weights experiments showed that heavier weights tend to increase the net opening, but lead more easily to undesired deformations.
The comparison of rigid floats and inflatable ones revealed a considerably greater efficiency of rigid floats, but the efficiency of kites was paramount.

A "rope net" is a type of net, the front part of which is made not of netting but of ropes running parallel to each other (see Figure 11).
Originally ropes were expected to reduce the towing drag, and it was assumed that the front part of the net has only a guiding function which can be fulfilled by ropes as well as by the commonly used big meshes. It is evident that this is correct (see Figure 12).
The front part of a rope net -less sensitive to damage because of the greater diameter of the ropes- also allows fishing on the bottom.
Stones and other obstacles passing over the groundrope fall between the ropes back to the bottom. It is necessary only to approach the bottom very carefully to prevent the belly netting from touching the bottom.
It is important to protect the connections of the ropes to the groundrope. Without protection these points show severe abrasion after a short time. Rubber disks pressed on the groundrope at both sides of the connection points prove to be the best solution.
The ropes do not offer special difficulties in gear handling.
Repairing a rope takes much less time than mending a tear in the big meshes of a conventional net, but it is often difficult to identify exactly which rope in the array is the damaged one. Colour coding can cut down the required time for repairs.

Since its first trials the rope net has given good catches in the fisheries for herring, saithe and blue whiting, e.g. in February 1975 13.5 t/hr of blue whiting were caught. The few data available on the behaviour of blue whiting in the front part of a midwater trawl have been augmented by our observations (see Figure 12). These fishes keep a well defined distance from the upper and lower ropes of the net opening. The herding effect of the ropes seems to be proved by this observation.

"Comparative trials with different otter boards" by K. Lange

The following types were tested and compared:

1. 8 m^2 Süberkrüb (rectangular, cambered)
2. 6 m^2 Süberkrüb (rectangular, cambered)
3. 8 m^2 Polyvalent (oval, cambered, slotted)
4. 6 m^2 Polyvalent (oval, cambered, slotted)
5. Norwegian type (oval, flat, slotted)

The gear used was a 1000 meshes (40 cm) 4-seam midwater trawl with a leg length of 150m, 900 kg sinker weight at each lower wing tip, and a warp length of 500m. The speed (v) was measured with a propeller log fixed at the headline. Headline height and distacnce between the upper wing tips were obtained from a multi-netzsonde. Diagram nr. 13 gives an impression of the accuracy of the measurements. Each point represents the mean value of 45 single values measured within half a minute.

The regression curves are of the type:

$$y = A + Bx + Cx^2.$$

Diagram nr. 14 shows the headline heigth and the upper wing tips spread of the five gear configurations in relation to the towing speed (v). In all cases the headline height decreases with increasing speed; the upper wing-end spread increases except with the Süberkrüb boards which give an almost constant spread value.

Combining the formulae for H and B it is possible to get an equation for the area of the net mouth (F) of the type:

$$y = A + Bx + Cx^2 + Dx^3 + Ex^4.$$

In fact F is not a real area but it can be assumed that the product H x B is proportional to the size of the net mouth (see diagram nr. 15).

Obviously the Norwegian type of otter board is not sufficient for this gear. The other boards give higher values of spread and net opening area, probably because of the cambers of 13% (Süberkrüb) and 8% (Polyvalent).

It must be recognized that the equations for H and B, and therefore of F, are only valid in the speed range covered by the measurements; the extrapolation to higher and lower values of towing speed may lead to incorrect net openings.

"Experiments with spinning rotors (spintrols) on hi-lift and midwater trawls in Canada" by W.W. Johnson.

During fishing tests carried out in March and April, 1974 off Canada's Atlantic Coast, spinning rotors called "spintrols" operating on the "Magnus effect" attached to the headrope of bottom high-lift and midwater trawls proved successful in controlling trawl opening and distance off bottom or from surface, when operated remotely from the bridge without changing trawling speed or warp length.

The trials indicated that the Spintrols with a few minor additional improvements have been developed to the point that they are now ready for the planned further evaluation under semi-commercial fishing conditions.

In the future spintrols may be linked with acoustic equipment for the automatic control of trawls.

Fishing trials in 1971 and 1972 as well as in 1974 were carried out on the 154 foot L.O.A., 1250 h.p. stern ramp trawler "Cape Argos". Improvements were made to the underwater connectors and to the spintrol rotors during the winter of 1971 and they were tested off Nova Scotia, July/August, 1972. This time the spintrols performed satisfactorily for 3 tows when attached to an Engel high-lift bottom trawl and for one tow when attached to a Canadian Diamond IX midwater trawl. Mechanical failure causing the spintrols to jam brought the experiment to a close for 1972.

The 1974 fishing trials were with totally new spintrol rotors designed by Georges Imbeault, improved underwater connectors and a separate winch to handle the special conductor cable (see Figure 16). This cable not only allows the use of the netzsonde but complete control of the spintrols as well. However, due to its being slightly larger in diameter than the normal netzsonde cable, it requires a changeover of the spooling gear box on the netzsonde winch. The use of neoprene in place of polyethylene would reduce the time needed for vulcanizing connections from the present 16 hours to 3 hours.

A radically new large mesh hi-lift bottom trawl spread by midwater trawl doors and designed to be used with spintrols was also tested. This new 1974 semi-pelagic trawl was designed to fish on the grounds where Canada is not normally able to compete with foreign vessels, such as the Spanish pair trawlers when fish are sparse. Surprisingly it also proved to be effective for midwater fishing as well. The indications are that it will also be usable on much rougher grounds than conventional bottom trawls. It is fished with the pelagic trawl doors well in advance of the trawl and well off the bottom, although the footrope is on the bottom.
The trawl employs large meshes beginning with 559 mm (22") mesh in the wings and first belly section, followed by 406 mm (16") and 203 mm (8") mesh in the second and third belly sections respectively, with the lengthening piece and codends being of the legal size required for the species sought. While the trawl was designed primarily for roundfish such as cod, haddock, pollack, redfish etc., it is also designed to be used for catching such species as herring, capelin, mackerel and sand lance merely by changing to the appropriate size and type of codend.

The working dimensions of the trawl give it a vertical opening of 10 - 11 fathoms at speeds of up to 4 knots, while the horizontal opening is approximately 36 m. Total hung length of the headrope is approximately 101 m while the footrope length is 137 m and the overall strechted length is approximately 159 m. Süberkrüb doors of 5 m^2 were used to spread the trawl. The bobbin and roller section of the footrope is kept relatively short, being about 30.5 m in length. Flying-type wings which keep the wings well off the bottom were used. Only 2 wings attached to the forward end were employed while the belly sections of the trawl are made in 6 separate panels, making it similar in cross section to the Canadian Diamond series midwater trawls.

As was anticipated, problems were encountered handling such a large bottom trawl on the deck of the "Cape Argos" which had too small a net reel. Most of the gear damage during the voyage occured when hauling and shooting the trawl. A whole new system of hauling and handling the gear had to be developed.

The new spintrol rotors were successfully tested. The rotating cylinders are made of fibre glass re-inforced plastic, approximately 1 foot in diameter and 6 feet in length with 2 feet diameter end flanges, and are driven by 2 h.p. submersible electric motors. Current for the electric motors is carried from the ship to the 3 phase submersible electric motors through the special electro acoustic cable (see Figure 16). Although the trawl was designed for use with two rotors, a single rotor was able to lift the trawl 30 fathoms in approximately two minutes at a trawl speed of $3\frac{3}{4}$ knots with about 425 fathoms of warp in a depth of 134 fathoms. Only onw tow was made with two rotors because failure of an underwater connector for the second rotor prevented further trials using both.

Discussion:

Discussion on the midwater trawl with ropes replacing the front part of the net concentrated mainly on the need for acurate determination of the rope length and touched upon fish behaviour considerations. It was reported that both model tests and calculations based on the headline shape (a catenary) had been used.
Difficulties had been experienced in ensuring that the correct length of each rope had been used, where one rope was too short, damage was likely.

It was reported that similar experiments had been tried in Norway (see Figure 17), but catch rates had been inferior to the standard pelagic trawls.

The problems of measuring performance against speed were emphasised. There is a choice of speed measurement - at the surface or at the level of the gear. This was further complicated because of the limitations in measuring equipment. It was agreed that in some instances ship r.p.m. or other surface parameters could be used in graphs showing comparisons of otterboard performance.

The polyvalent type of otterboard is accepted in some countries for dual purpose application (bottom and midwater), but for pure midwater applications the high-aspect ratio Süberkrüb otterboards have the best hydrodynamic performance.
The Dutch reported that, because they need a dual purpose spreading device in some of their operations, they chose the polyvalent board. Satisfactory spreading forces in both midwater and bottom trawling are obtained by changing the weights.

In discussion fears about "spintrols" were expressed on the size of the rotors attached to the headline in relation to handling. It was pointed out that to reduce size was difficult because optimum performance of the rotors was at a much larger (10 : 1) aspect ratio than used at present (4 : 1).

Some surpise was shown at the large amount of copper used in the cable; whilst reducing loss of power down the length, this could give problems of flexibility.

Some members of the group felt that vertical control of the gear could be satisfactorily achieved simply by variation in towing speed and warp length, and that the greater need was to improve detection of fish, thus allowing ample time for the gear and ship to be aimed.
In the UK (Scotland) attention had been given to using rotors on the otterboards and this was being extended to give control in the horizontal as well as the vertical plane.

Ferro presented his paper describing a midwater trawl mathematical model. Only the vertical plane was covered in this model, but quite good correlation with experimental data was found, and plans for considering the 3-dimensional case were in hand. An important part of these studies was the determination of net drag. Empirical formulae for predicting net drag from a net drawing had been developed and after some further checking and possible refinement would be presented at a future meeting. Some members were worried that the mesh configuration in actual operation would influence the drag and that this would upset such predictions. Scottish experience was that the coefficients used in such formulae provided results well within a 10% margin.

Olsen presented his paper on the selectivity of a nylon pelagic trawl. It was reported that similar work was being conducted by Germany at the Spitsbergen area and their results will be reported at a future meeting.
Because the selectivity was higher than expected, considerable discussion ensued about the possiblity of small fish present in the shoal influencing the results. Herring fishermen in the UK tend to fish at the top of the shoal because they believe that the larger fish are in the upper layer. It was also noted, however, that juvenile herring usually occur on different grounds from the mature ones.

Another question dealt with in some detail was the possible influence of trawling speed on selectivity, especially in relation to the closing of meshes at higher speed. In view of the fact that speed is so important in the economics of this fishing method, work on this aspect should be pursued and reported at future meetings.

PAIR TRAWLING FOR ROUNDFISH - Agenda item 7

G. Vanden Broucke (Belgium) presented his paper: "Application of the seine fishery principle in pair trawling" which describes the Danish pair-trawl system in which the principles of the seine net fishery; using the ropes to herd the fish towards the net and using the ropes to keep the net open, are applied. The paper will be edited for the 1975 meeting of the Gear and Behaviour Committee.

MULTI-PURPOSE VESSELS - Agenda item 8

Rapp. E.J. de Boer

"Development of the beamtrawler to a multi-purpose vessel" by E.J. de Boer, to be submitted to the 1975 meeting of the Gear and Behaviour Committee, is summarized as follows:

Because beam trawlers are very powerful and the fishing methods in The Netherlands are limited to trawling operations only, beam trawlers are being converted to vessels which, in addition to beam trawling, can perform bottom, one boat and two boat midwater trawling. The interested skippers looked for a fishing system enabling a fast change-over of fishing gears, if possible even on the fishing grounds. 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 limitations of beam trawlers.

"Newfoundland 65 foot steel stern trawler/seiner" by W.W. Johnson and D.A. Peeling (Canada), is summarized:

It describes innovations to make a 65 foot trawler capable of engaging in trawling, stern purse seining and Scottish seining, without the need of changing deck machinery or rigging in any way. Only the overboard fishing gear itself is changed and no more than four hours are needed at the dockside to take the trawl gear off and replace it with stern purse seine gear.

While incorporating multi-purpose fishing into the vessel, improvements were made to all three methods, so that each is greatly improved over what is practiced with conventional 65 foot vessels using any one of the methods individually. This can be attributed to the deck lay-out incorporating three parallel longitudinal alleyways and the use of split combination net reel trawl winches of the waterfall type, developed especially for these vessels. The stern trawling arrangement provides many advantages for the improvement of purse seining, called stern seining and Scottish seining.

The advantage of the 3-lane deck system (the two outside lanes have net reels, the centre lane is for handling the codend) is that a gear can be shot when still hauling another gear and, if necessary, changing-over from bottom to midwater trawling can be performed very fast. The net reels are designed to take the standard bottom gear with bobbins. The specific doors, "Polyvalent" for bottom trawling and "Süberkrüb" for midwater trawling, are stored on racks on the side of the vessel. The towing blocks are fixed at the quarters.

Discussion:

Whereas recently built Dutch vessels have sufficient hold capacity numerous older beam trawlers have to be lengthened in order to operate efficiently on more distant grounds.

Regarding warp lay-out over the deck on board the Dutch multi-purpose vessels, although it might be preferable to route them longitudionally along the bulwark to the stern, instead of crossing the working deck, some skippers want to change-over at sea from beam trawling to e.g. otter trawling and in that case the beam trawls stored alongside the bulwark so blocking the passage of the warps. The height of the warps above the deck at the aftpart of the fore-castle is about 2.2 m.

The stern seine has been used on board the Canadian 65' trawlers and also on board the specially converted 19 m vessels when fishing for herring and mackerel and worked very well.

Although it is normal to operate drums (reels) for handling purse-seines in the salmon fishery on the Canadian west coast, so far the reels were not able to freewheel, therefore during the trials on the proto-type vessel the seine net was shot from the deck.

The net reels of the Canadian triple/parallel stern trawl-seiners are designed to wind on bobbins up to a diameter of 12" and, during the trials there were no difficulties with this.

DRUM SEINING - Agenda item 9

"Development of stern drum seining in Canada" by W.W. Johnson was presented and is summarized:

Initial success has been achieved on Canada's Atlantic coast during 1974 in the development of a method called "Stern Drum Seining" which has significant advantages over drum and power block seining.
It is an advanced technique conceived by the Fishing Operations Division, Industrial Development Branch, Environment Canada, while developing improved multi-purpose fishing vessels and techniques and combines ideas from drum seining, lampara seining and stern-ramp trawling.

When setting a stern seine (basically a modified lampara seine with a bunt or codend in the centre, see Figures 18 and 19) the entire seine wound on one net reel is payed out over the stern as the vessel follows the course pre-determined by the skipper. An over-run tow line attached to the first end of the seine is also payed out as the seine is set in a circle, and retrieved as the distance to the first end shortens. With the seine set, the first end is retrieved by the over-run tow line, the two end attached to separate net reels, ans hauling on both reels begins as the vessel continues to move ahead slowly. The entire seine, other than the bunt or codend is then recovered on the reels. For the reels, see Fig. 21.

After the catch is removed by pumping or brailing or, in the case of vessels with a stern ramp, hauled up the ramp and emptied, the entire seine is then wound back onto a single net reel, ready for setting again.

Although the power skiff is still required when fishing in shallow water or close to shore, it need not be as large or as powerful as used with conventional purse seiners because the skiff tows the vessel from the bow while the seine is recovered over the stern.

In making sinking nets, the seine is merely allowed to sink to the desired depth before hauling begins.

During the introduction of drums for handling trawls, it was easy to see how they could also be used for handling purse seines as in British Columbia. However, it was clear that the trawl drums were far too small for handling purse seines and that stern ramp trawlers were simply not laid out for bringing the bunt end alongside for removal of the catch by pumping.

Slowly it was realized that a lampara seine and the technique of hauling might be made to order for use on stern ramp trawlers with net reels. The lampara seine would not have to be as bulky as a purse seine and could probably be wound on one of the three drums of a large trawler employing the triple parallel gear system. Because a lampara seine is towed to close, having no purse line, and is retrieved by hauling both wings simultaneously, it became evident that it could be set from one net reel and hauled by two while the stern trawlers moved slowly ahead. Furthermore, it was also clear that the bunt with its catch could be hove right up the trawler's ramp.

If the catch was too large then its weight could easily be suspended by the cork line from the aft bipod mast while it was pumped out. Heavy weights in the net are known from experience to be more easily handled over the stern than alongside. It was also evident after some study that the lampara seine together with the stern ramp trawler deck layour coupled with the three net drums were made for each other and offered numerous advantages over other methods of seining.

In 1973 the Newfoundland Department of Fisheries offered the opportunity to lay out the gear handling system for three new 65 foot steel multi-purpose fishing vessels (see page 24). This immediately led to the vessels being laid out as the pocket stern ramp trawlers with twin net drums located at the forward end of the working deck for handling a stern drum seine, bottom or midwater trawls or Danish seines employing the fly dragging technique, and to change over without altering deck machinery or layout. The first vessel was scheduled to begin fishing trials in the spring of 1975.

A special net deflector called a beaver tail, (Fig. 20) adopted from drum seining was used to deflect the seine, preventing it from fouling the rudder and propeller while hauling, was also attached to the aft end of the ship.

The shooting and hauling methods conceived proved correct and the skipper and his three man crew quickly learned the basic essentials for handling the gear. However, no fish were caught since the only concentration were close to shore in shoal water for which the seine was too deep.

During the initial fishing tests, scattered marks of mackerel were set on but none were caught as the fish were usually swimming too fast to be encircled and when they were, the crew being new to stern seining, hauled too fast on the headline, allowing them to escape under the leadline.
Later, when the crew were more experienced in hauling with the drums, large catches of mackerel and herring were landed. The maximum day catch amounted to 18.6 tonnes of herring. Normally no more than two sets were made in a day. Fishing was carried out with the bunt being set in shoal water and the seine being towed away from the beach where the water deepened rapidly as it was being closed and hauled.
A trap net skiff equipped with a 20 h.p. outboard motor was used as a power skiff. While this sufficed because of the method of towing the seiner by the bow and low resistance of the seine, a more powerful skiff is to be recommended.
The time required to set the seine depends entirely on the vessel's speed while encircling the fish, but it takes only five minutes to haul back. However, with a large catch, the modified ring net seine built of such fine twine could not be hauled back fast enough for fear of bursting the mesh. It is now expected that with the use of the proper stern seine (presently under construction) considerably less than 20 minutes will be needed to set, haul, and have the seine ready to set again, plus the time required for bringing the catch aboard. All of the time saving and catch improvement is accomplished with a crew of only four men. It is felt that even this could be further reduced to three if necessary, as they state that the labour of each man is only one fifth of that on other seiners with far larger crews.

MECHANIZED LONGLINING - Agenda item 10

Rapp. E.J. de Boer

"Longline mechanization in Norway" by Ivar Bjørkum, to be edited for the 1975 meeting of the Gear and Behaviour Committee, was introduced and is here summarized:

During the last decade, the Norwegian Government supported trials to increase and to improve the mechanical handling of longlines.
In 1971 the so-called Mustad-Trio Autoline system came into production, but in practice this system needed too much maintenance and adjustment, and the breakdowns were frequent. The weakest point proved to be the baiting machine. The development continued and now a good working mechnical system for baiting is available. In fact two baiting machines are manufactured, a modified version of the original TRIO baiting machine and a Mustad baiting machine. The Institute of Fishery Technology Research has tested both baiting machines and compared the hooking performance with hand baited hooks. As bait, several qualities of herring and mackerel were used. From these experiments it became clear that in fact little is known about longlining, e.g. sinking speed, efficiency etc.
In Norway a programme has been started to investigate the effect of the spacing and the length of the snoods. When conducting the experiments a remarkable decline in catch rate was observed at the last end of the lines. This might be caused by the twisting of the snoods around the groundline and so removing the fish from the hooks. It was stated that, at present, a reliable system for mechanized longlining is available for commercial application on board vessels with an overall length exceeding 25 m.

Discussion

Concerning whether the automatic baiting machine would work efficiently with fresh bait, for a good baiting efficiency the bait must have a certain hardness.
The length of the magazine rails limits the system to vessels over 25 m in length.
The first baiting machine suffered from the following malfunctions: too low shooting speed, not stable enough, frequent supervision and maintenance needed, and the acceleration of the machine was not sufficient in bad weather resulting in unbaited hooks.

Braided groundlines to prevent twisting of the snoods had not yet been tested.

Two Norwegian vessels are in operation with the new system.

EFFECTS OF FISHING ON THE SEA BED AND FISHING CONSEQUENCES OF OFFSHORE OIL INDUSTRY - Agenda item 11

Rapp. A.R. Margetts

The chairman of the Gear and Behaviour Committee reported that the Liaison Committee, 1975, was omitting reference to this subject in its report to NEAFC and that it did not request further work. However, both interest and concern were shown by several members of the Working Group in the effects on fisheries of offshore oil and gas operations, notably the results of trawls striking pipelines (but excluding any consequent pollution), whether pipelines become obstructions to fishing, the loss of fishing grounds resulting from pipelaying and drilling, and the aggregation of fish near offshore oil/gas structures.

The research programme, initiated by Norway and financed largely by Norway but also by sponsors (mainly commercial companies, but including UK Government) was noted; results of this must remain confidential for one year after the final report (April 1975).

Clearly these are subjects to concern ICES. One suggestion was that the matter might be treated by ICES as was offshore sand and gravel extraction. The satisfactory machinery for ICES consideration of it already exists. The Working Group asked its members to submit papers on any work relevant to the general subject to the ICES Statutory Meeting, 1975, and further asked the Chairman of the Gear and Behaviour Committee to bring the subject to the early attention of members of that Committee, requesting that they undertake and report investigations soon.

Margetts showed film of sector scanner records of telegraph cables in a sand-ridge area of the Southern North Sea and of beam trawl tracks in the same area.

CAPELIN DENSITY ESTIMATES FROM PELAGIC TRAWL CATCHES AND BY ECHO INTEGRATOR - Agenda item 12

The attention of the Working Group Meeting was drawn to a paper by W. Dickson:

"A relationship between capelin density as sampled by echo integrator and by pelagic trawl"

On a research vessel cruise in areas of sparse fish concentrations estimates of capelin density from pelagic trawl catch data compared reasonably well with acoustic estimates by the echo integrator technique, and indicated a swept volume trawl efficiency of 50-80%.

This paper will be submitted to the 1975 meeting of the Gear and Behaviour Committee.

TECHNICAL ASPECTS OF AQUARIA - Agenda item 13

S.J. de Groot reported briefly on the technical aspects from the ad-hoc meeting on the fundamental aspects of aquarium design and operation (C.Res.1974/2:8). This meeting had raised no topics that needed further discussion in the Engineering Working Group.

FILMS AND SLIDES - Agenda item 14

During an evening session, slides on the mechanization of longlining were shown by Bjørkum, and on drum seining by d'Entremont.
Films were shown by Margetts on fish reactions to trawl as seen by sector scanning, by de Boer on beam trawling and on tank testing of samll trawlers.

OTHER BUSSINESS

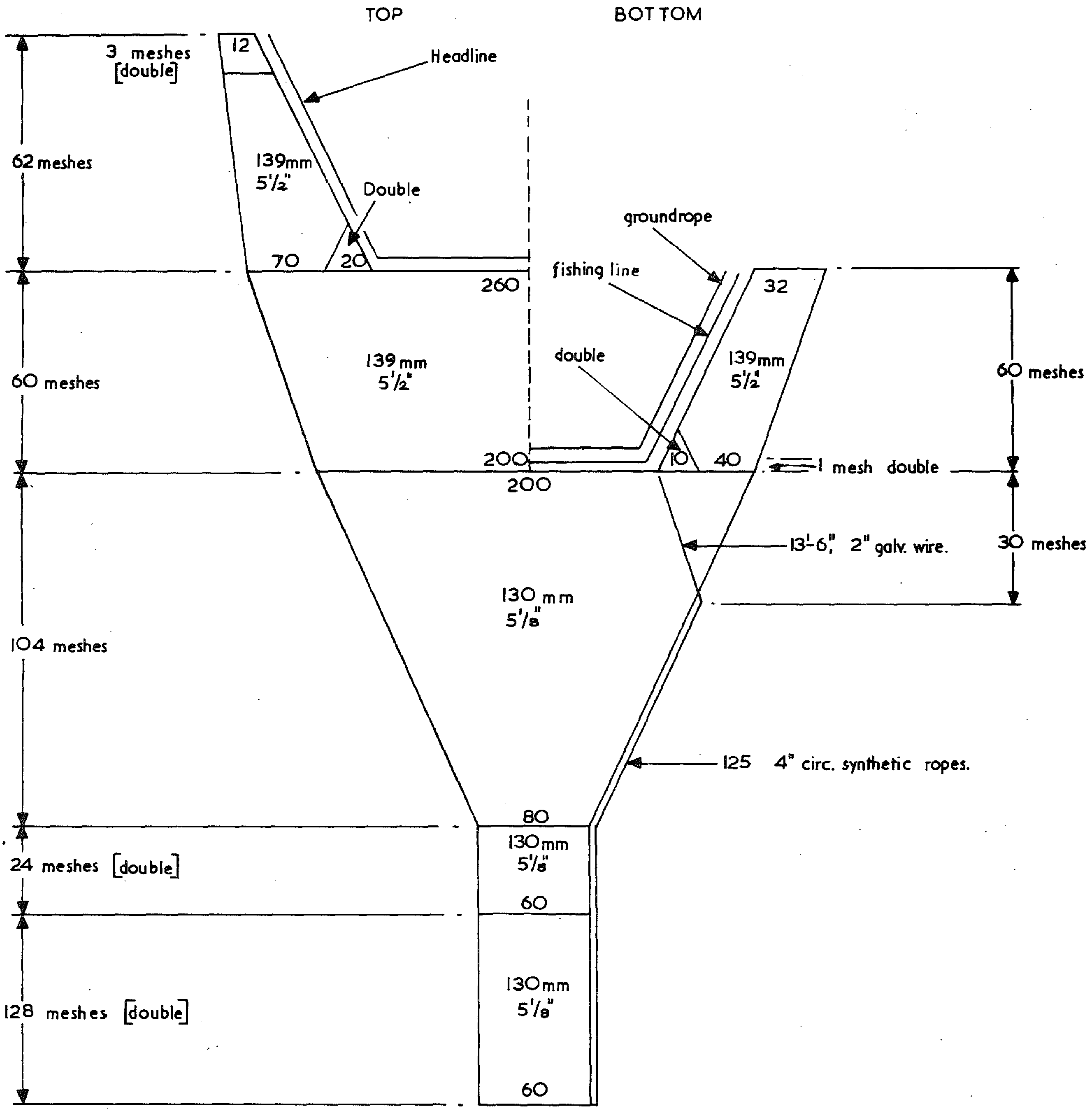
S. Olsen distributed a limited number of copies of a Sintef-report "Fish Telemetry, report 5 - Devices and Results 1974 -" by B. Holand, I. Mohus and R. Berntsen, which was not discussed, but can be summarized as follows.

Equipment developed in 1974 is presented in some detail, including various types of fish-borne ultrasonic transmitters, hydrophones, receivers and dataprocessing devices. The microcomputer-based fishtracking system "PINPOINT" is presented, with a brief description of the equipment and programmes involved, together with examples of practical results. Other important practical experiments undertaken during 1974 are also described, including tracking of cod in Lofoten, tracking of salmon from Suldalslagen, tracking of cod near Tromsø, and tracking of lobster at Gamle Hellesund.

IJmuiden (The Netherlands), August 1975.

J.G. de Wit

78 ft. GRANTON TRAWL



HEAD LINE 78 ft [14·25' + 14·25' + 21' + 14·25' + 14·25'] 1¾" circ. 6 x 19, galv. wire rope served with Marlin.

GROUND ROPE 120 ft [14·5' + 14·5' + 20' + 20' + 20' + 14·5' + 14·5'] 1¾" circ. 6x19, galv wire. rope. plus 7 shackles.

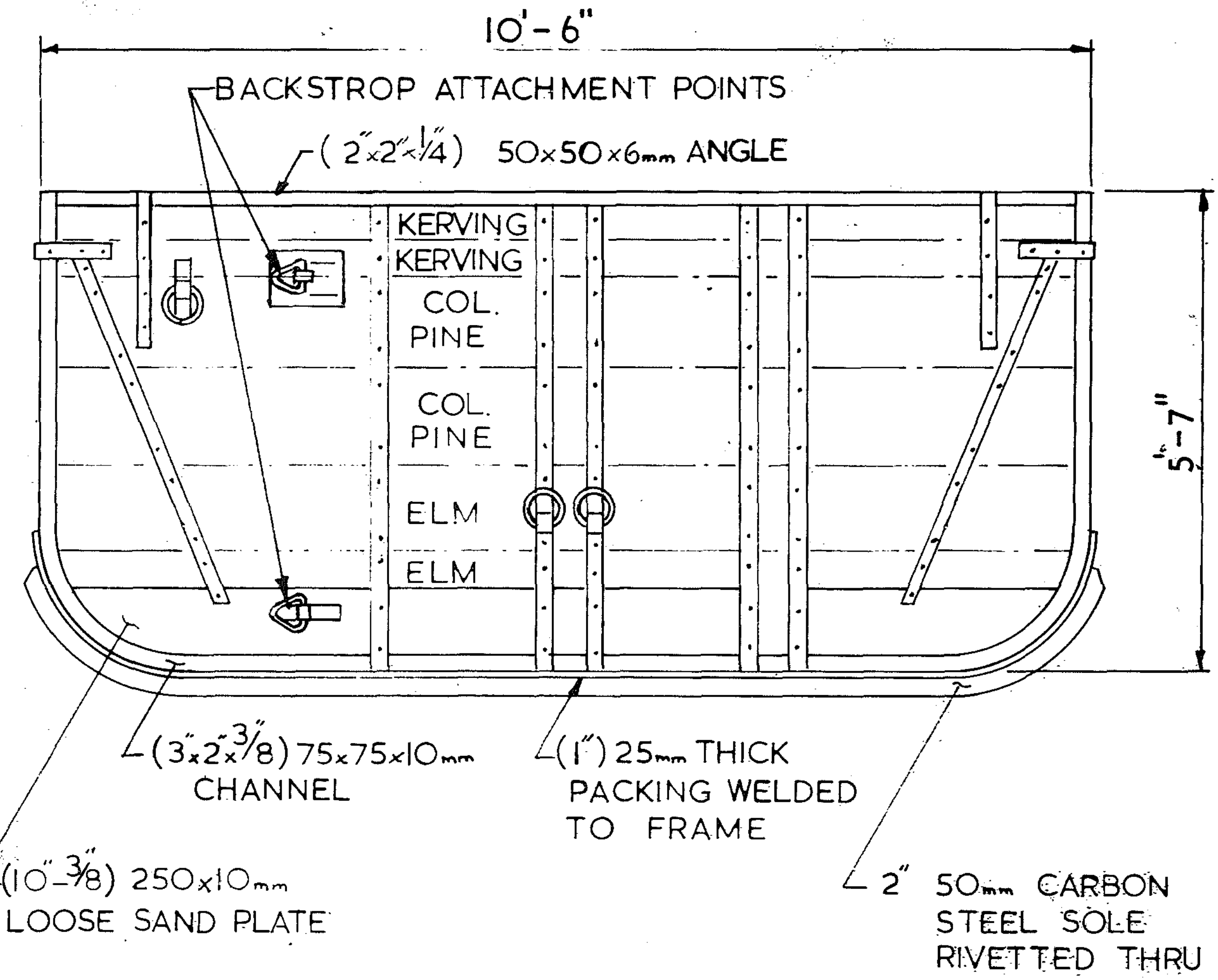
FISHING LINE 125 ft 3" circ. combination rope 6 stranded

TWINE 80 yds/lb polyethelene in wings square & belly.
80 yds/lb polypropylene in cod end and lengthener.

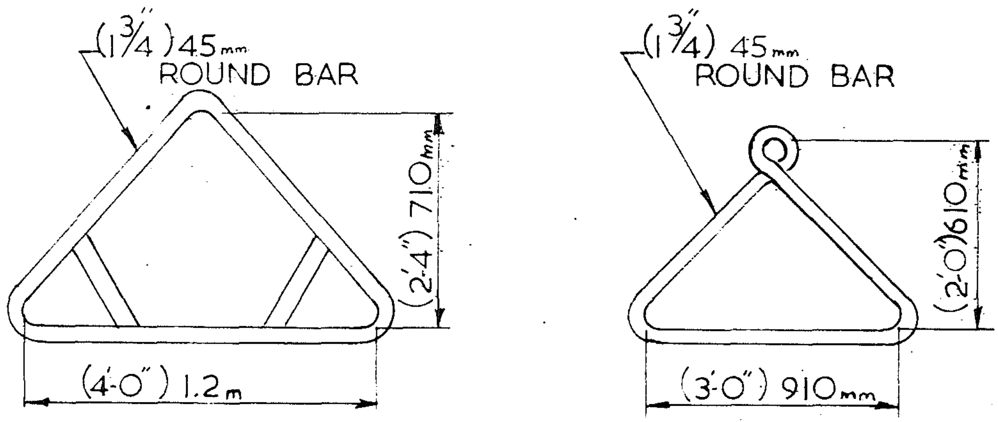
FIG. I.

STANDARD TRAWL BOARD
(GRANTON)

RI-12a



TOTAL WEIGHT 1 TON



DETAILS OF TRIANGLES

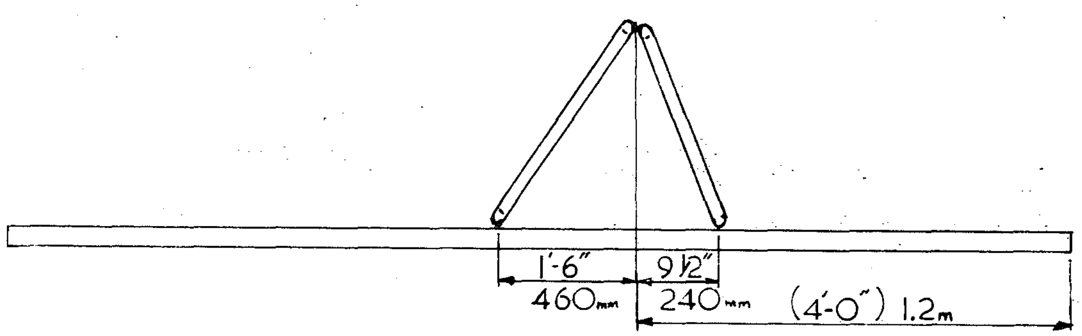
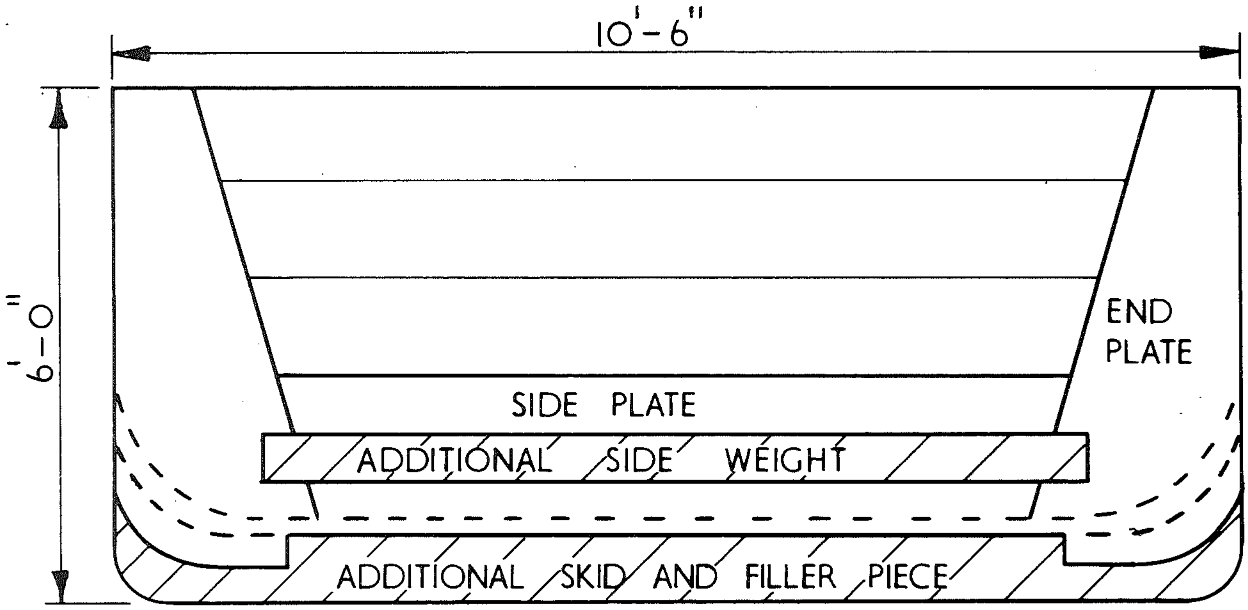


FIG. 2

MODIFIED TRAWL BOARD FOR DEEP WATER FISHING



IN EFFECT THE DOORS WERE INCREASED IN WEIGHT FROM 1 TON TO 1.5 TONS EACH. THE OVERALL HEIGHT OF EACH DOOR WAS INCREASED BY 3". THE ADDITIONAL STEELWORK IS SHADED IN THE DRAWING.

FIG. 3

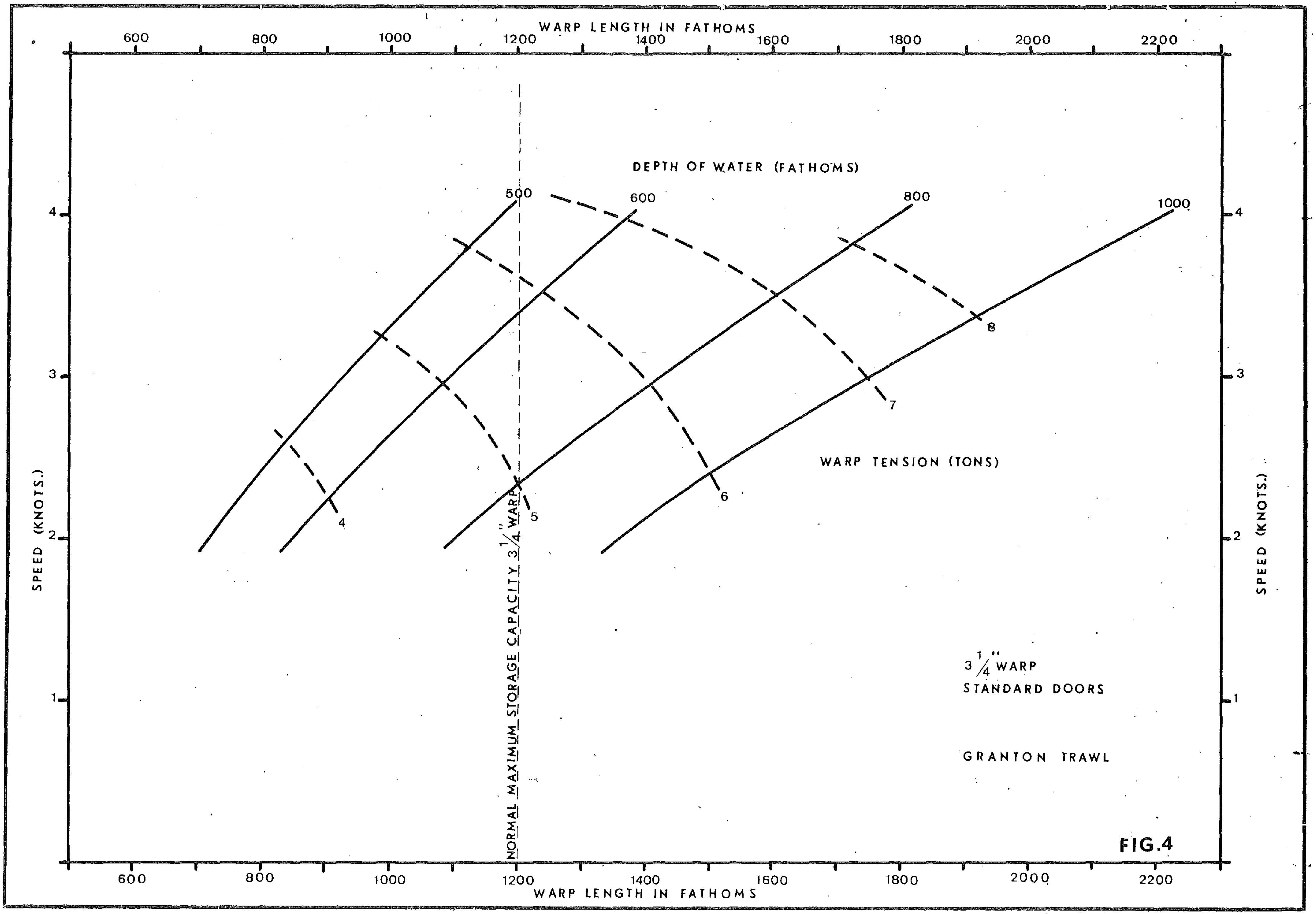

WARP LENGTH IN FATHOMS
600
800
1000
1200
1400
1600
1800
2000
2200
SPEED (KNOTS.)
1
2
3
4
DEPTH OF WATER (FATHOMS)
500
600
800
1000
WARP TENSION (TONS)
4
5
6
7
8
NORMAL MAXIMUM STORAGE CAPACITY 3 1/4" WARP
3 1/4" WARP
STANDARD DOORS
GRANTON TRAWL

FIG.4

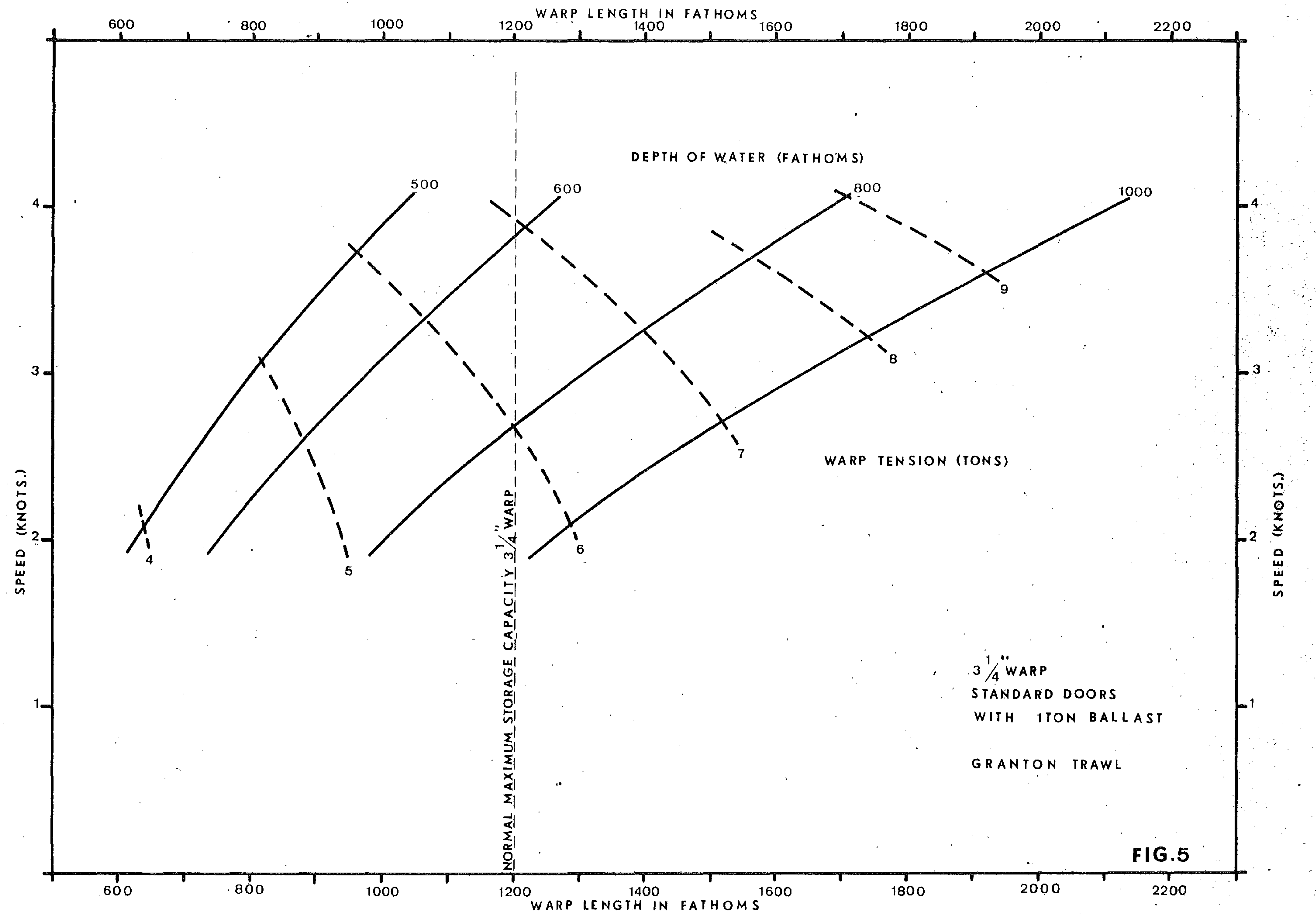

WARP LENGTH IN FATHOMS
600
800
1000
1200
1400
1600
1800
2000
2200
SPEED (KNOTS.)
1
2
3
4
DEPTH OF WATER (FATHOMS)
500
600
800
1000
WARP TENSION (TONS)
4
5
6
7
8
9
NORMAL MAXIMUM STORAGE CAPACITY $3\frac{1}{4}$" WARP
$3\frac{1}{4}$" WARP
STANDARD DOORS
WITH 1TON BALLAST
GRANTON TRAWL

FIG.5

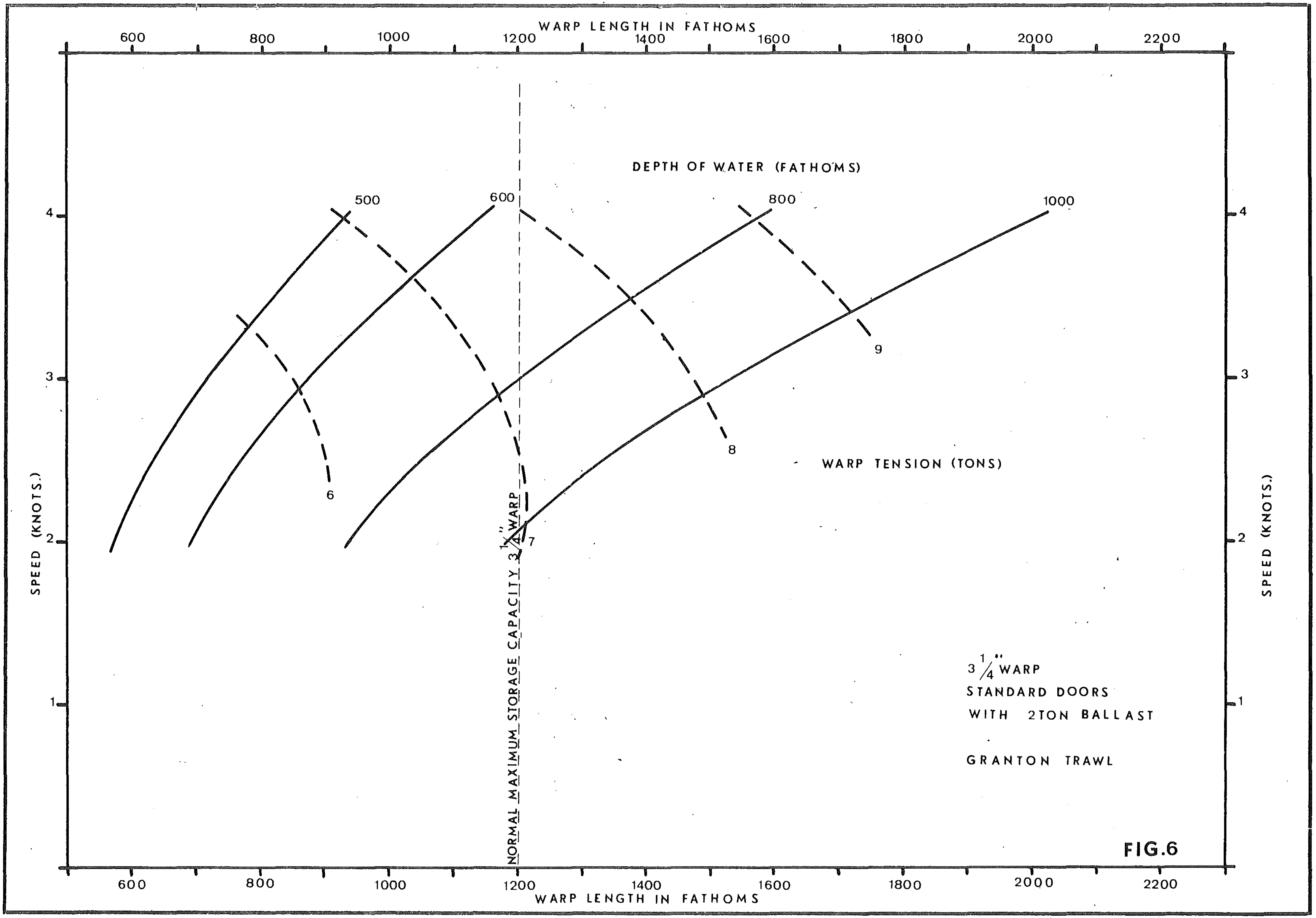

WARP LENGTH IN FATHOMS
600
800
1000
1200
1400
1600
1800
2000
2200
SPEED (KNOTS.)
1
2
3
4
DEPTH OF WATER (FATHOMS)
500
600
800
1000
WARP TENSION (TONS)
6
7
8
9
NORMAL MAXIMUM STORAGE CAPACITY 3 1/4" WARP
3 1/4" WARP
STANDARD DOORS
WITH 2TON BALLAST
GRANTON TRAWL

FIG.6

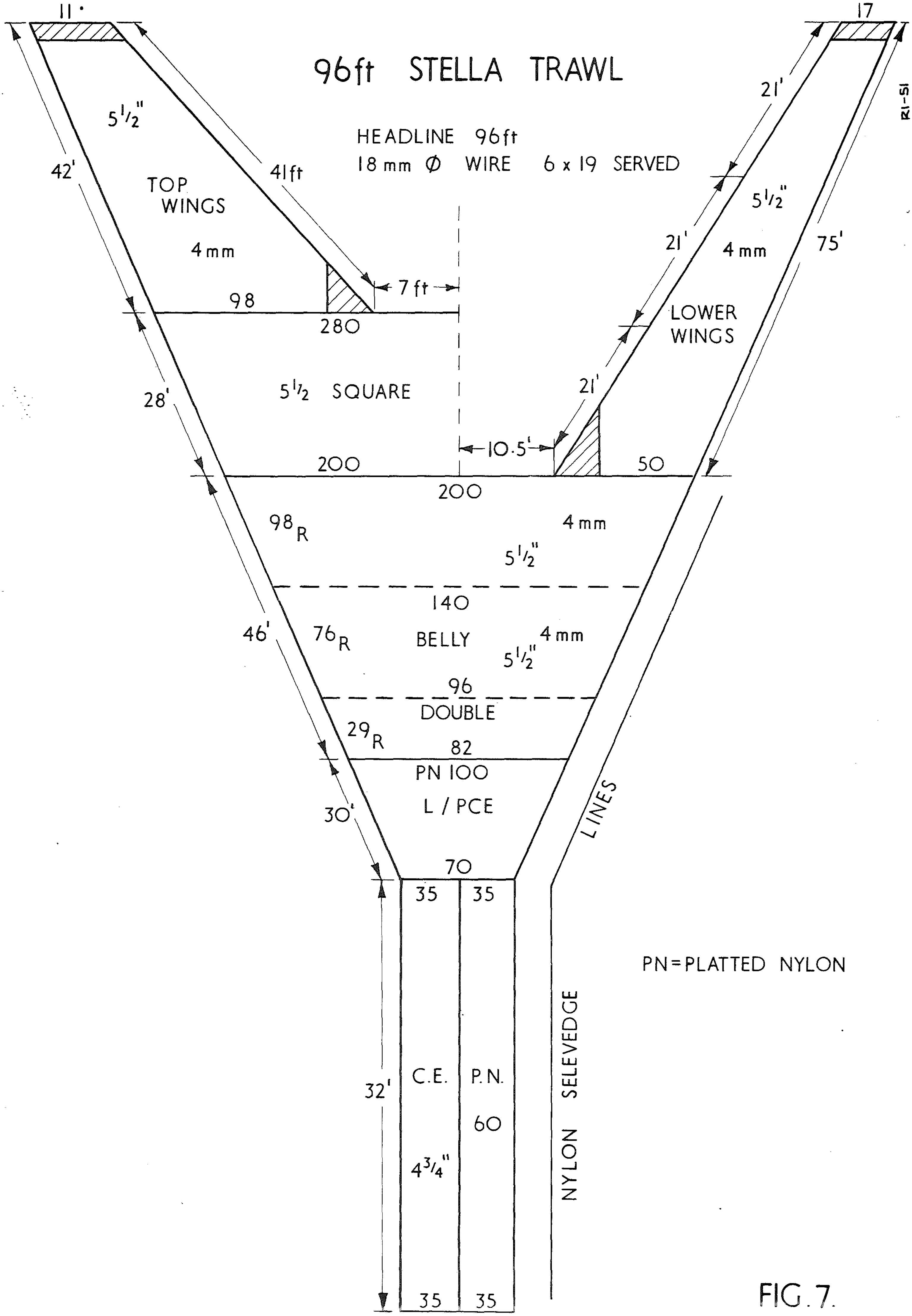

96ft STELLA TRAWL
HEADLINE 96ft
18 mm Ø WIRE 6 x 19 SERVED
11
17
5 1/2"
42'
TOP WINGS
41ft
4 mm
7 ft
98
280
21'
21'
21'
5 1/2"
4 mm
75'
LOWER WINGS
28'
5 1/2 SQUARE
10.5'
200
50
200
98 R
4 mm
5 1/2"
140
46'
76 R
BELLY
4 mm
5 1/2"
96
DOUBLE
29 R
82
PN 100
L / PCE
30'
LINES
70
35
35
32'
C.E.
4 3/4"
P.N.
60
NYLON SELEVEDGE
35
35
PN = PLATTED NYLON

FIG. 7.

STELLA TRAWL — HEADLINE AND GROUNDROPE RIGGING

R1-31a

NOTE

AS FROM HAUL 23 A COMPLETE RIG OF RUBBER BOBBINS WITH A 22" RUBBER DANLENO BOBBIN WAS FITTED.

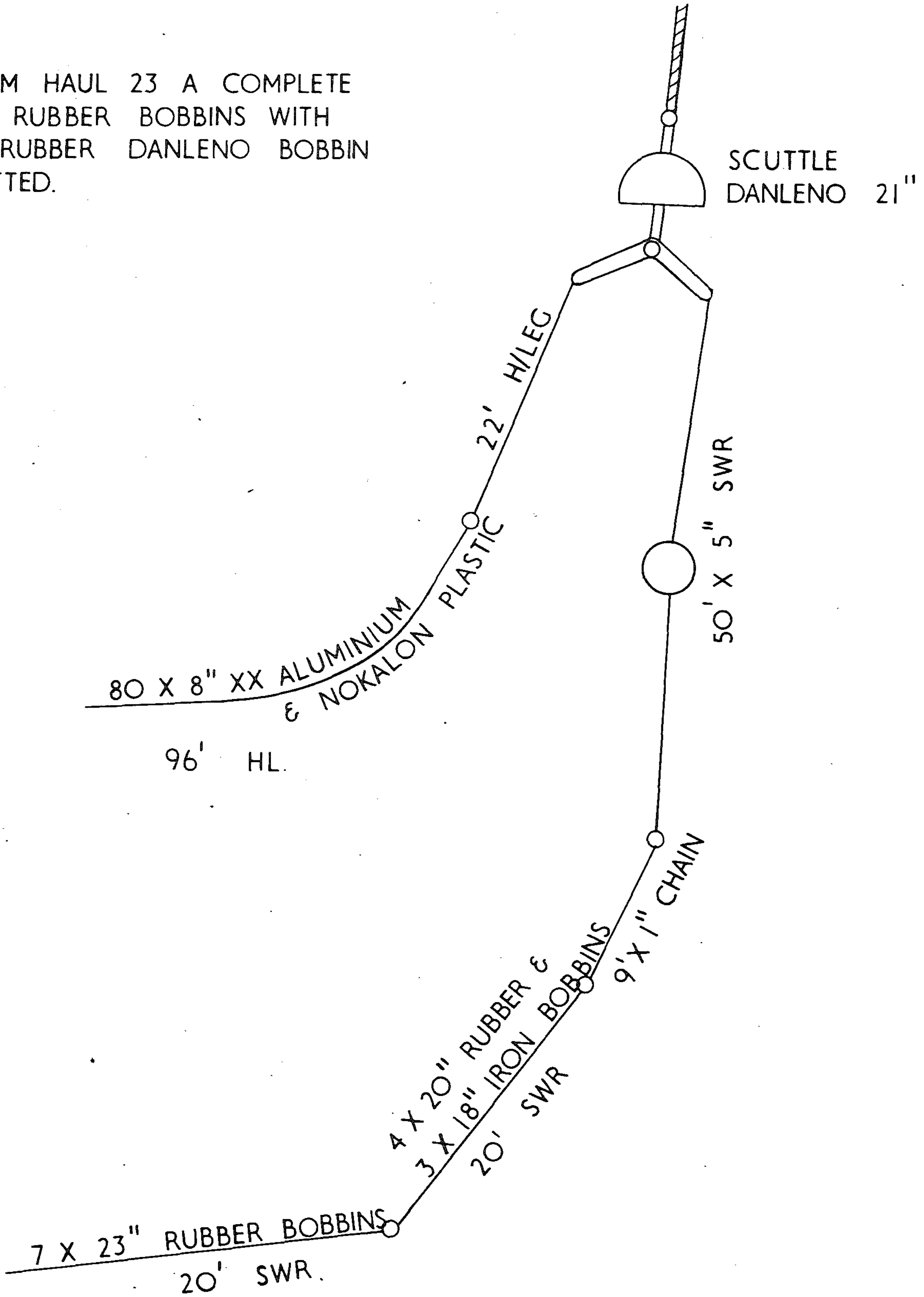
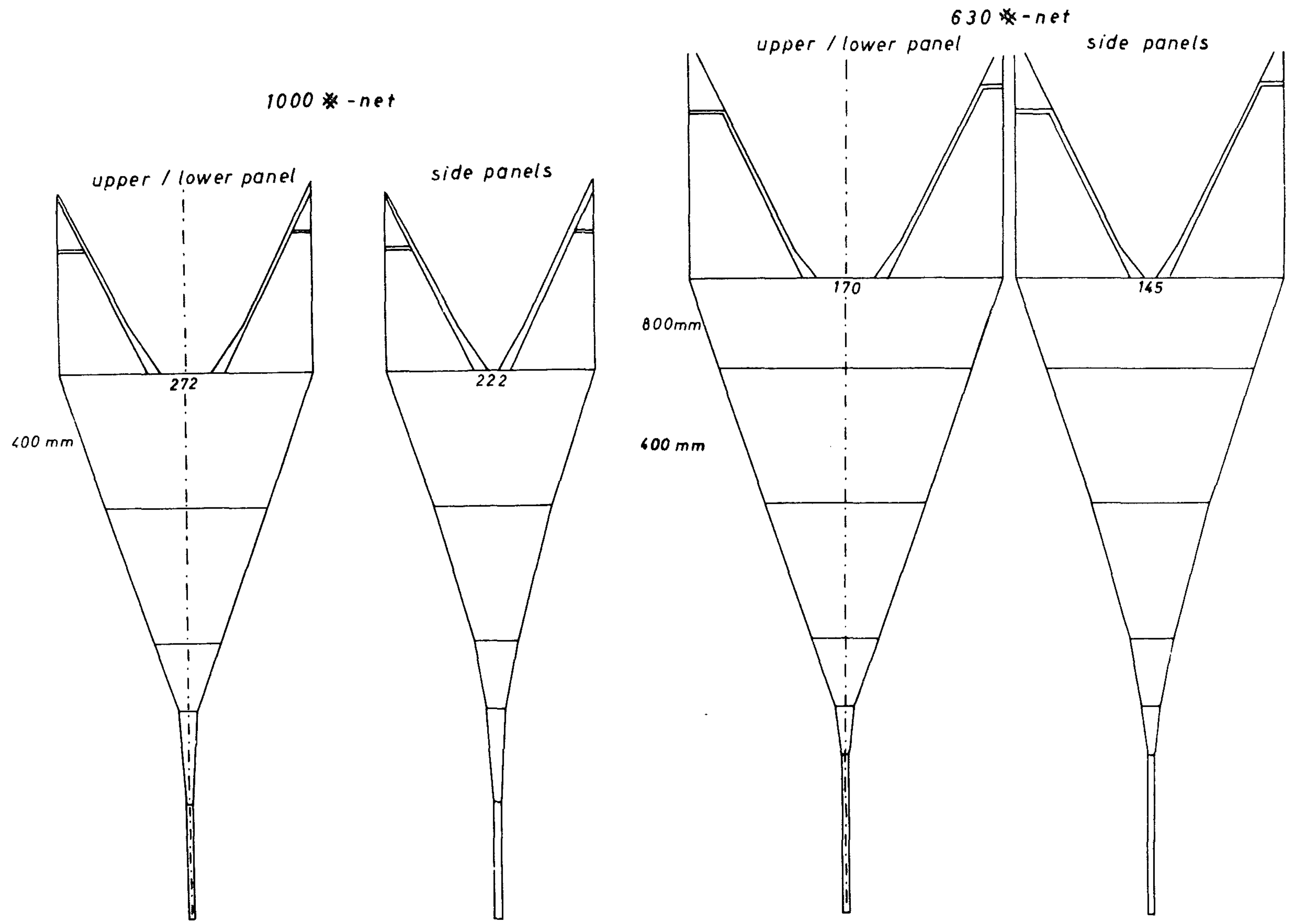


FIG. 8.



<u>Fig</u> 9 Sketches of the 1.000 ※ and 630 ※ net showing the exchangeability of the different parts of the two nets.

Fig. 10 Influence of the leg + length on shape and size of the opening of a 1000 meshes (40 cm) midwater trawl.

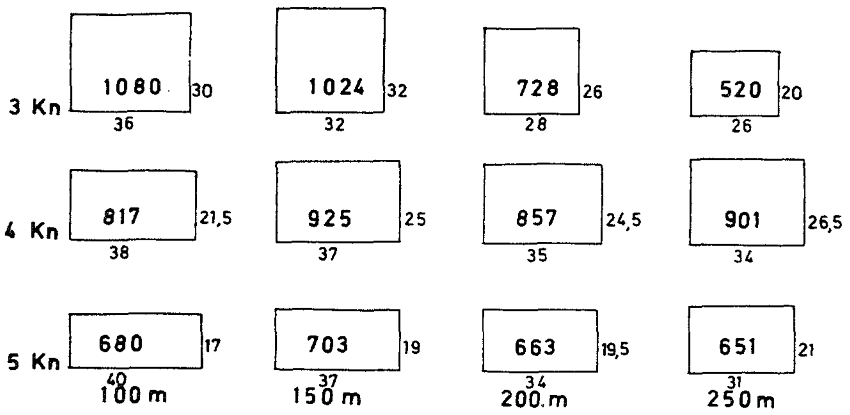


Fig. 10 a

otterboards : 8 m^2 polyvalent

weights : 1200 kg to lower legs
100 kg of chain to bosom
100 kg of chain to each wing

floats : 6 x 80 liter to headrope

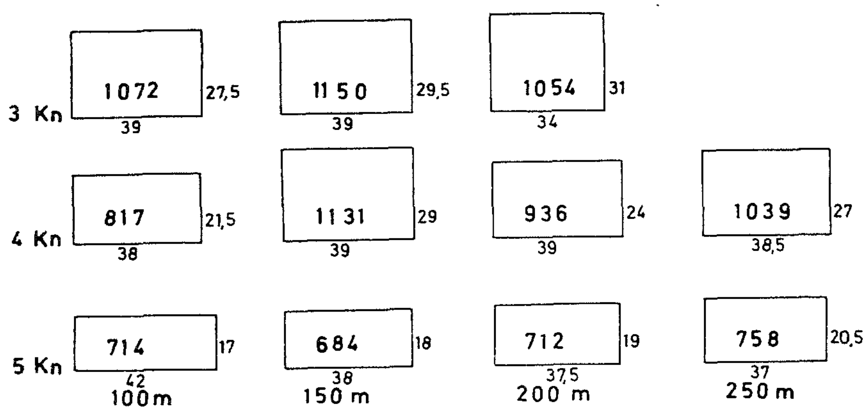


Fig. 10 b

otterboards : 8 m^2 Süberkrüb

weights : 1200 kg to lower legs
100 kg of chain to bosom
100 kg of chain to each wing

floats : 6 x 80 liter to headrope

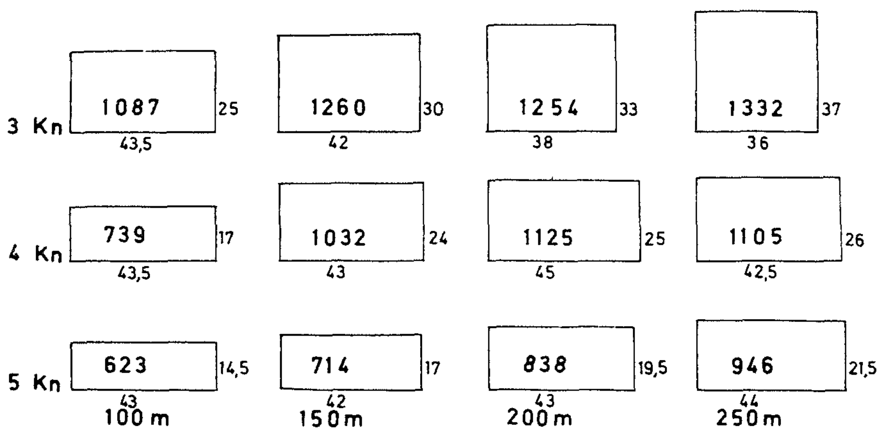


Fig. 10 c

otterboards : 10 m^2 Süberkrüb

weights : 1200 kg to lower legs
100 kg of chain to bosom
100 kg of chain to each wing

floats : 6 x 80 liter to headrope

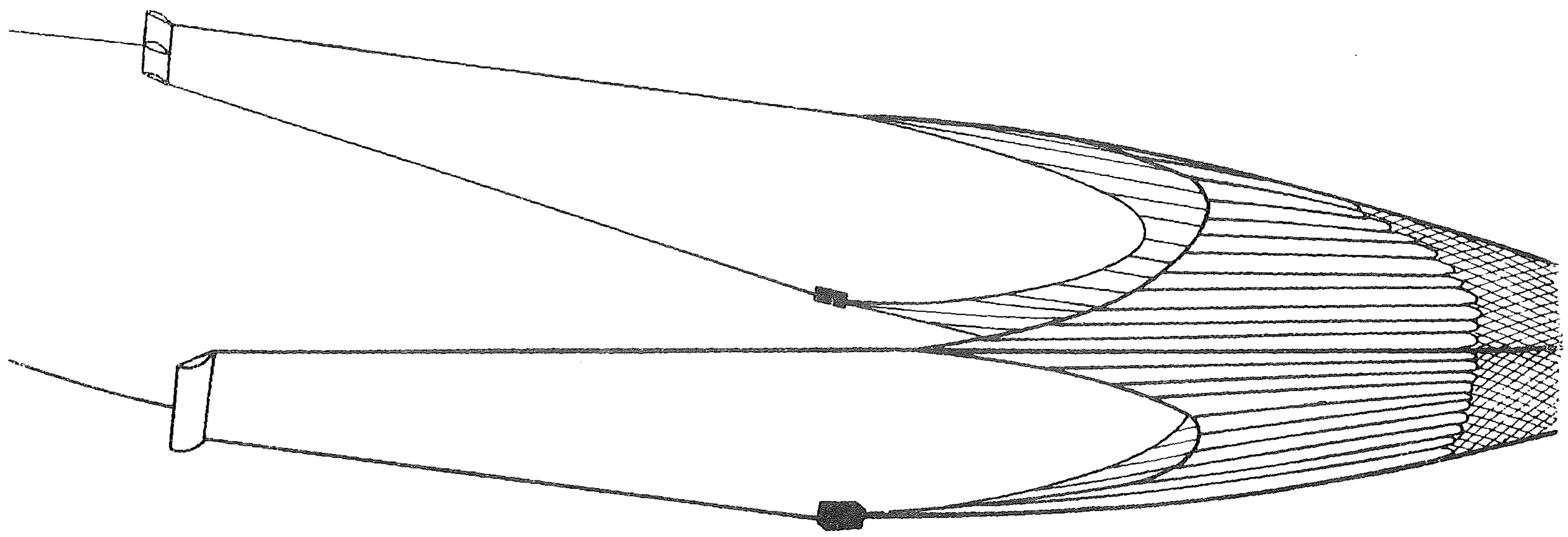


Fig. 11 "Rope" - Trawl for combined fisheries in midwater and on the bottom

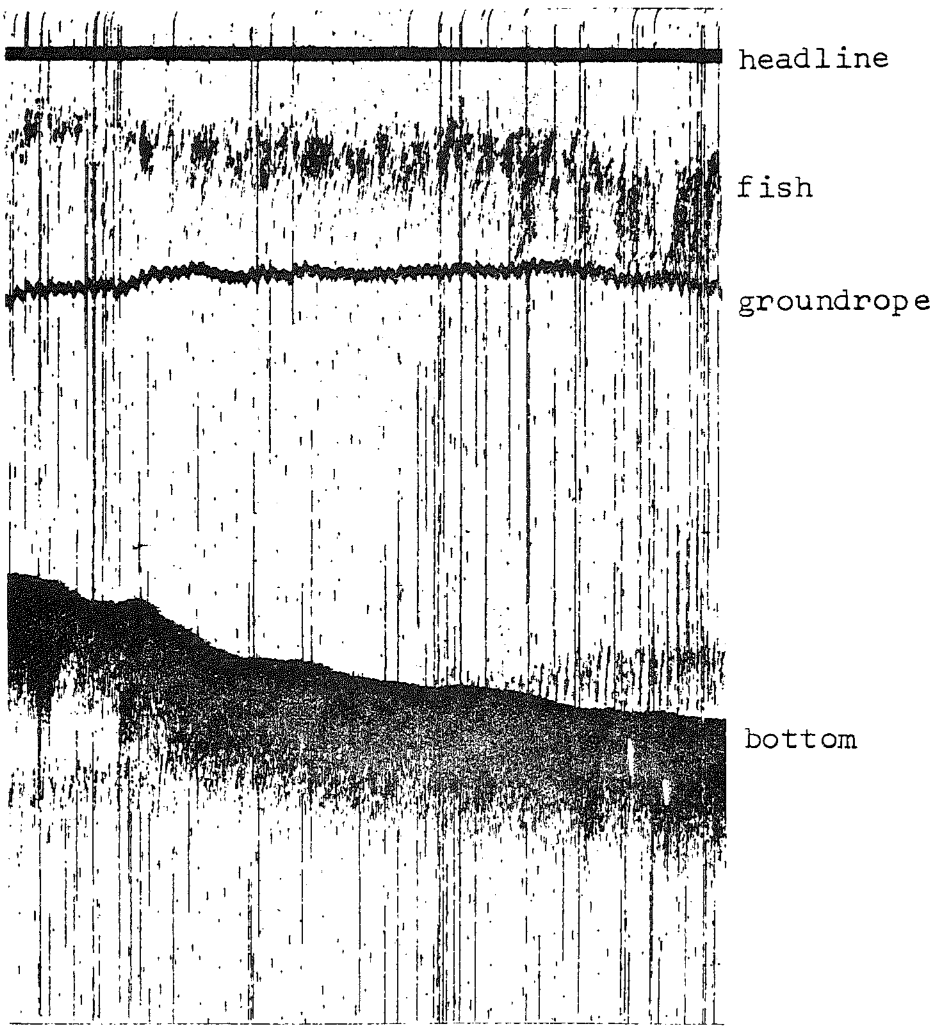
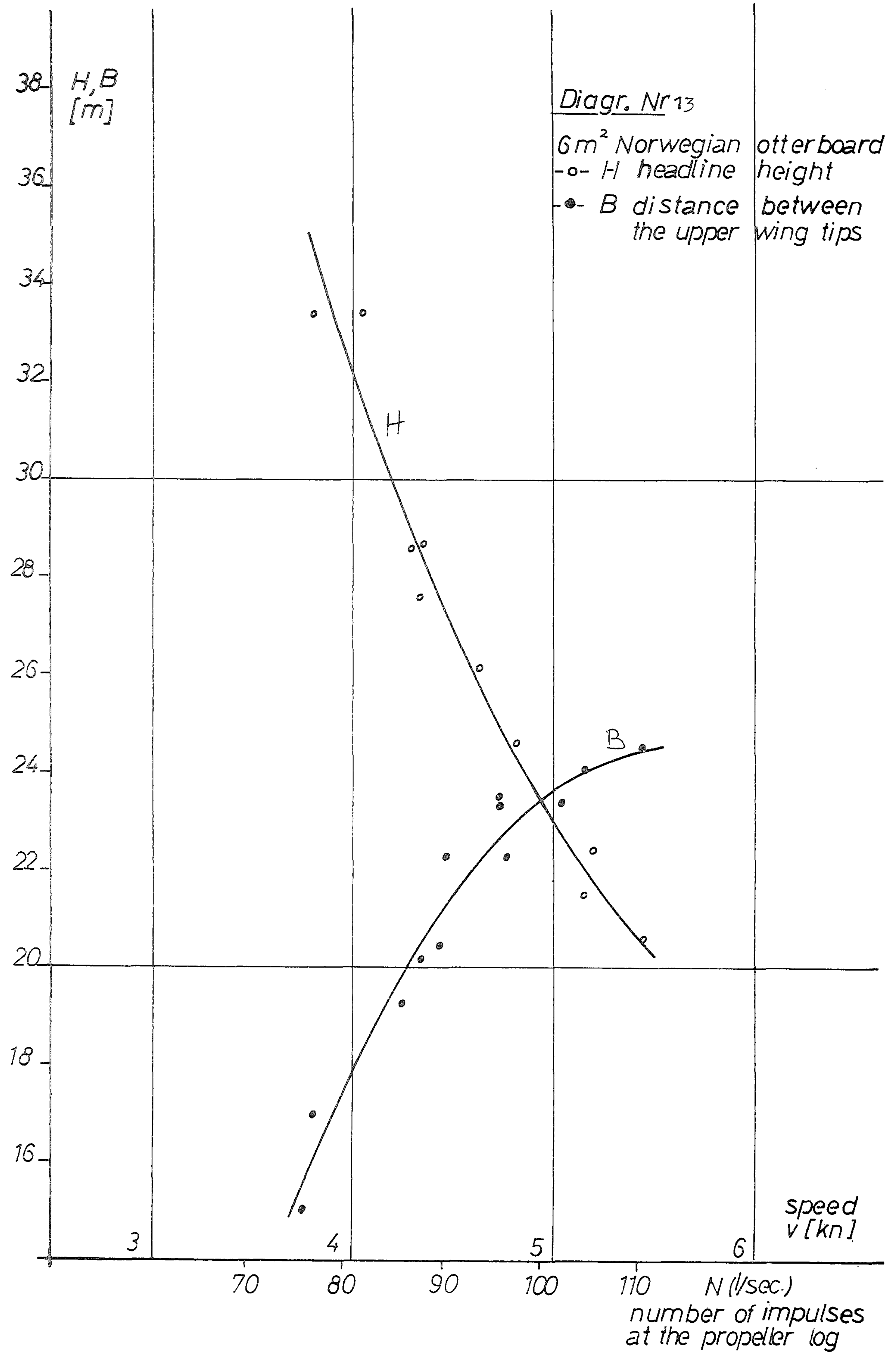
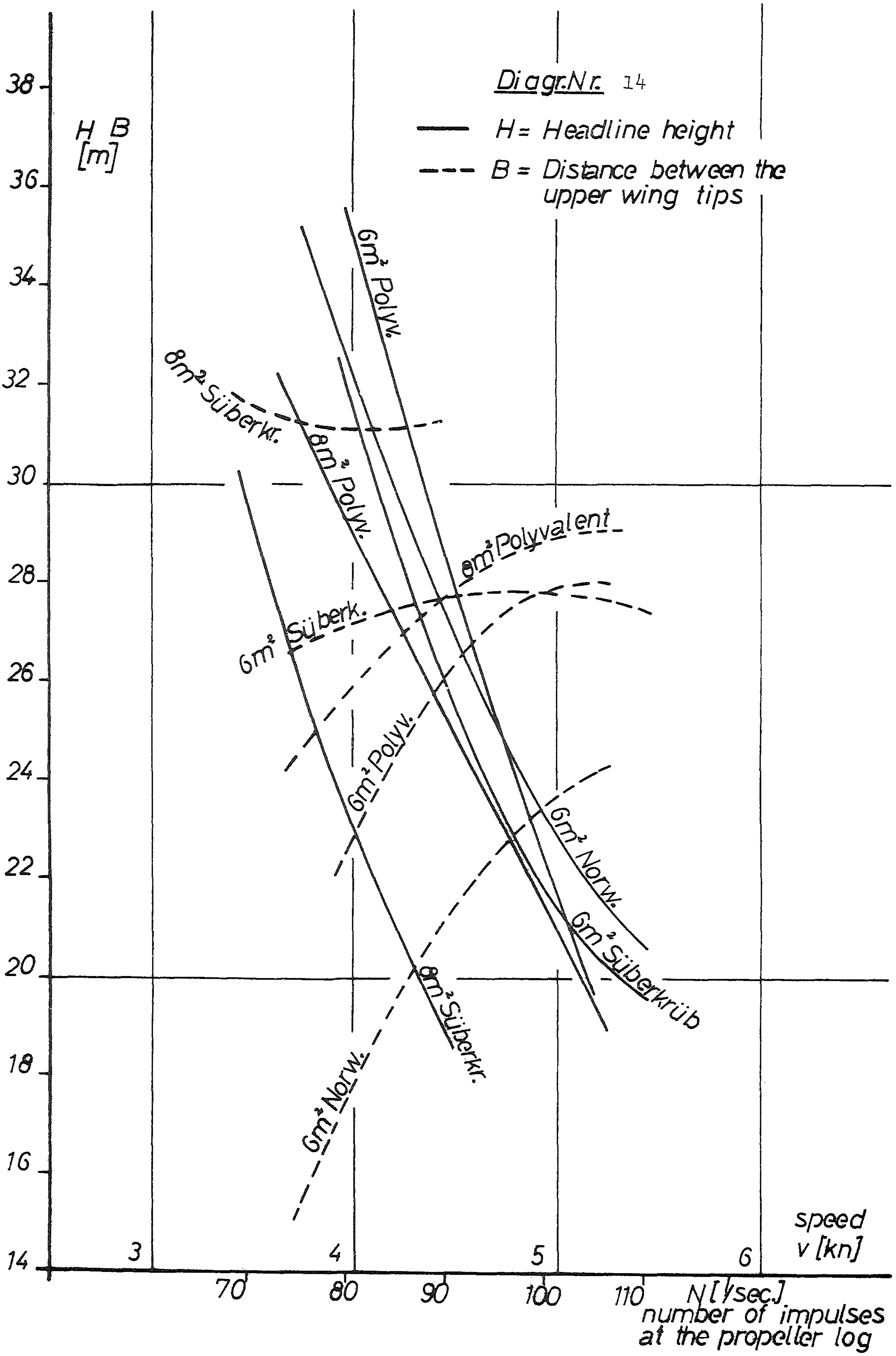
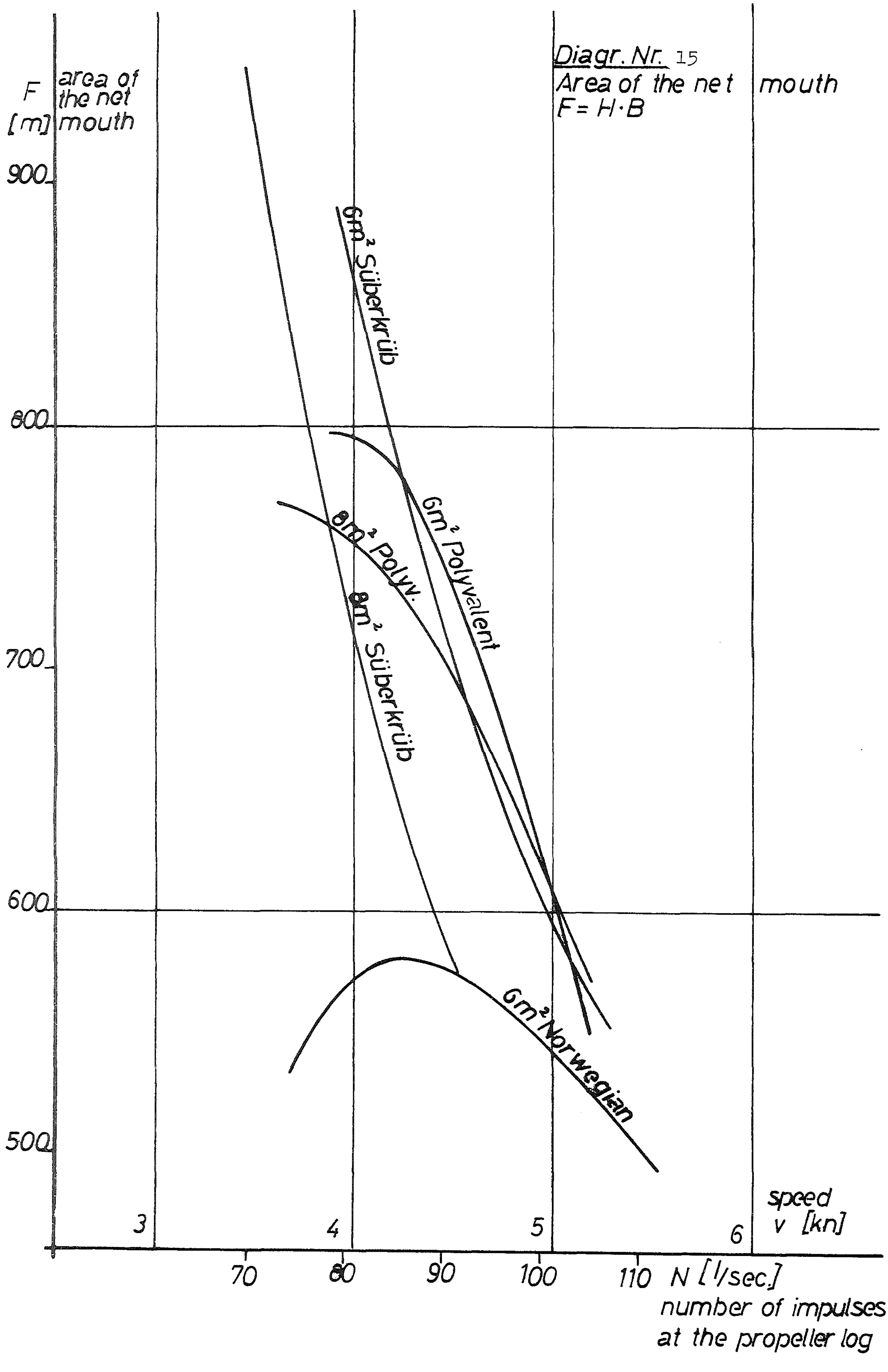


Fig. 12 Behaviour of blue whiting in the net mouth of a rope net
(Netsonde FRV "Walther Herwig" February 1975)

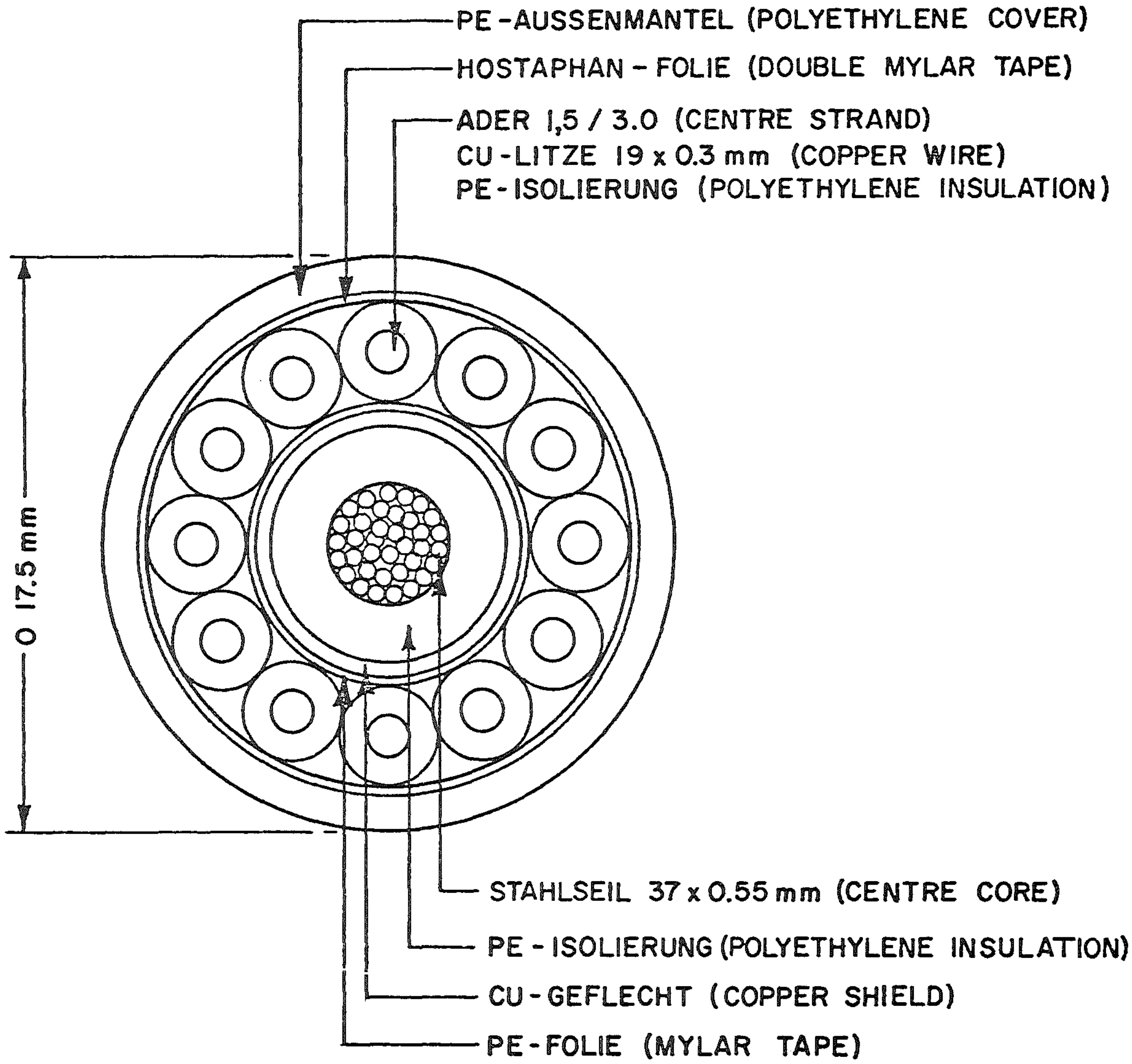

H, B [m]
38
36
34
32
30
28
26
24
22
20
18
16
Diagr. Nr 13
6 m² Norwegian otterboard
-o- H headline height
-●- B distance between the upper wing tips
H
B
speed v [kn]
3
4
5
6
70
80
90
100
110
N (l/sec.) number of impulses at the propeller log



Diagr.Nr. 14
H = Headline height
B = Distance between the upper wing tips
H B [m]
38
36
34
32
30
28
26
24
22
20
18
16
14
6m² Polyv.
8m² Süberkr.
8m² Polyv.
8m² Polyvalent
6m² Süberk.
6m² Polyv.
6m² Norw.
6m² Süberkrüb
8m² Süberkr.
6m² Norw.
3
4
5
6
speed v [kn]
70
80
90
100
110
N [1/sec.] number of impulses at the propeller log



Diagr. Nr. 15
Area of the net mouth
F= H·B
F [m] area of the net mouth
900
800
700
600
500
6m² Süberkrüb
6m² Polyvalent
8m² Polyv.
8m² Süberkrüb
6m² Norwegian
3
4
5
6
speed v [kn]
70
80
90
100
110
N [1/sec.] number of impulses at the propeller log



SPECIAL COMBINATION SPINTROL / NETSONDE CABLE

AS MANUFACTURED

KABELAUFBAU A 406
NORDDEUTSCHE SEEKABELWERKE AG
NORDENHAM

FIG. 16

NEW PELAGIC-TRAWL

For the catch of
"Blue Whiting"

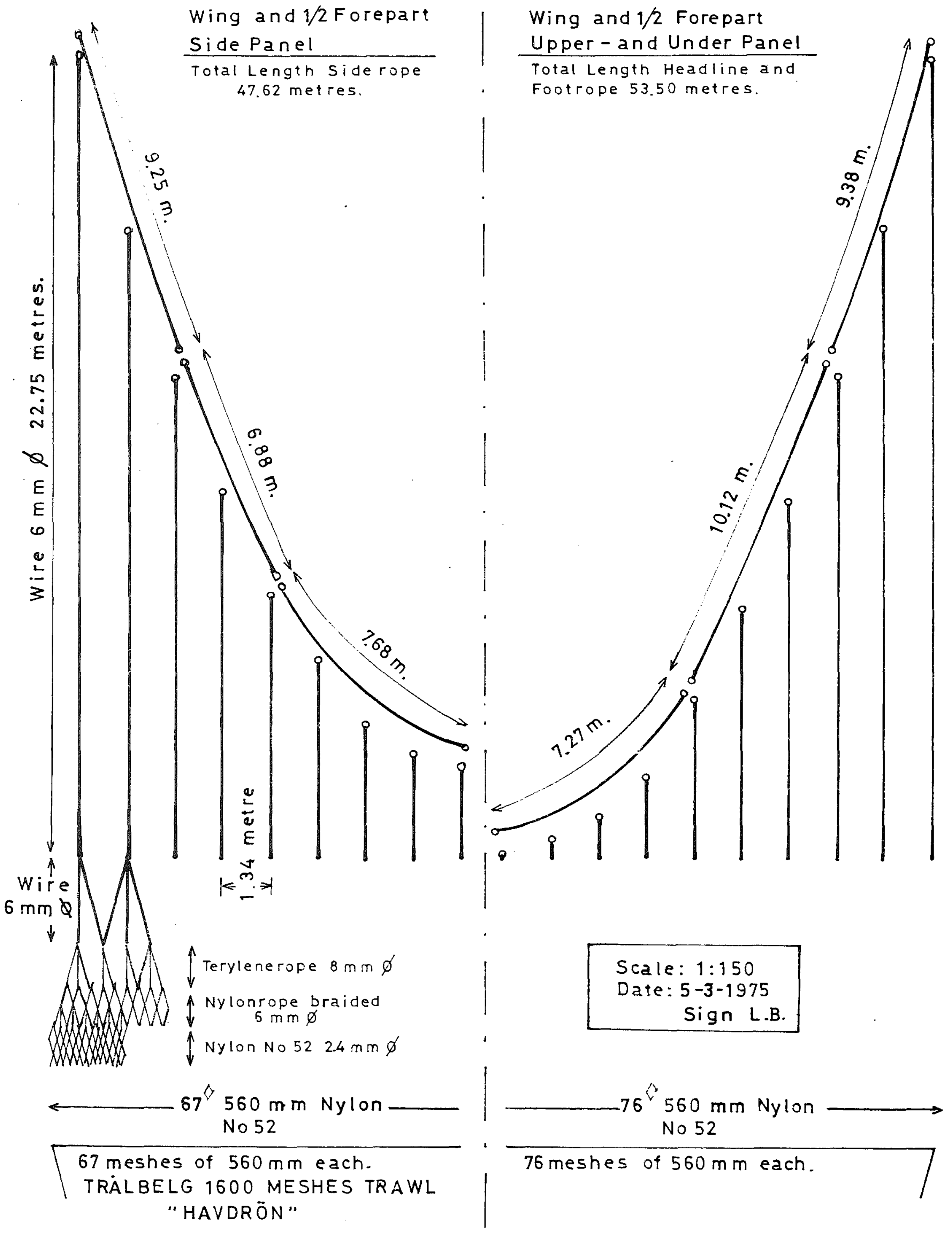


FIG. 17

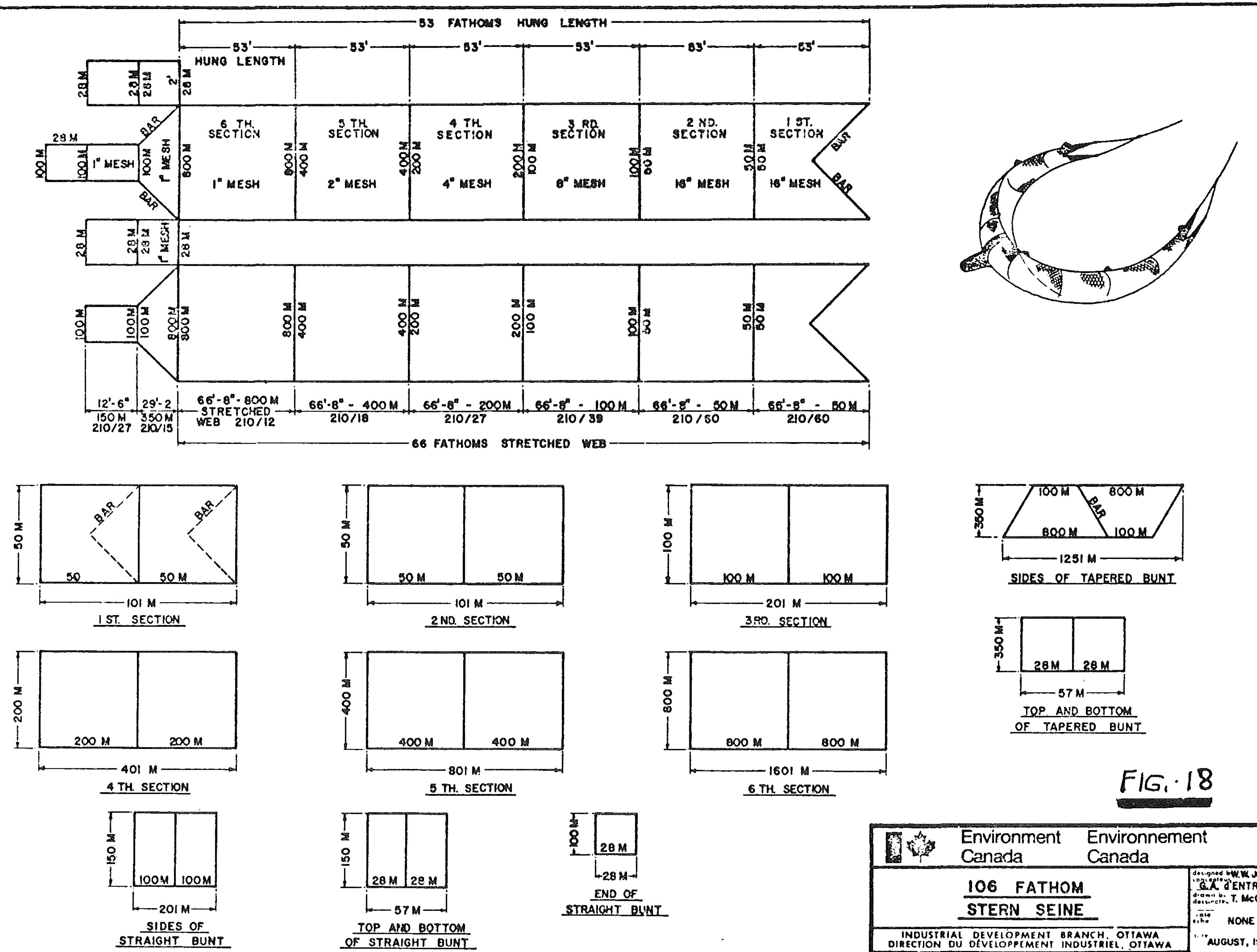


FIG. 18

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106 FATHOM STERN SEINE

INDUSTRIAL DEVELOPMENT BRANCH, OTTAWA
DIRECTION DU DÉVELOPPEMENT INDUSTRIEL, OTTAWA

FISHERIES AND MARINE SERVICE
SERVICE DES PÊCHES ET DES SCIENCES DE LA MER

designed by W.W. JOHNSON
G.A. d'ENTROMONT
drawn by T. McCALLION
scale NONE
date AUGUST, 1974
I.D.V. 443-c

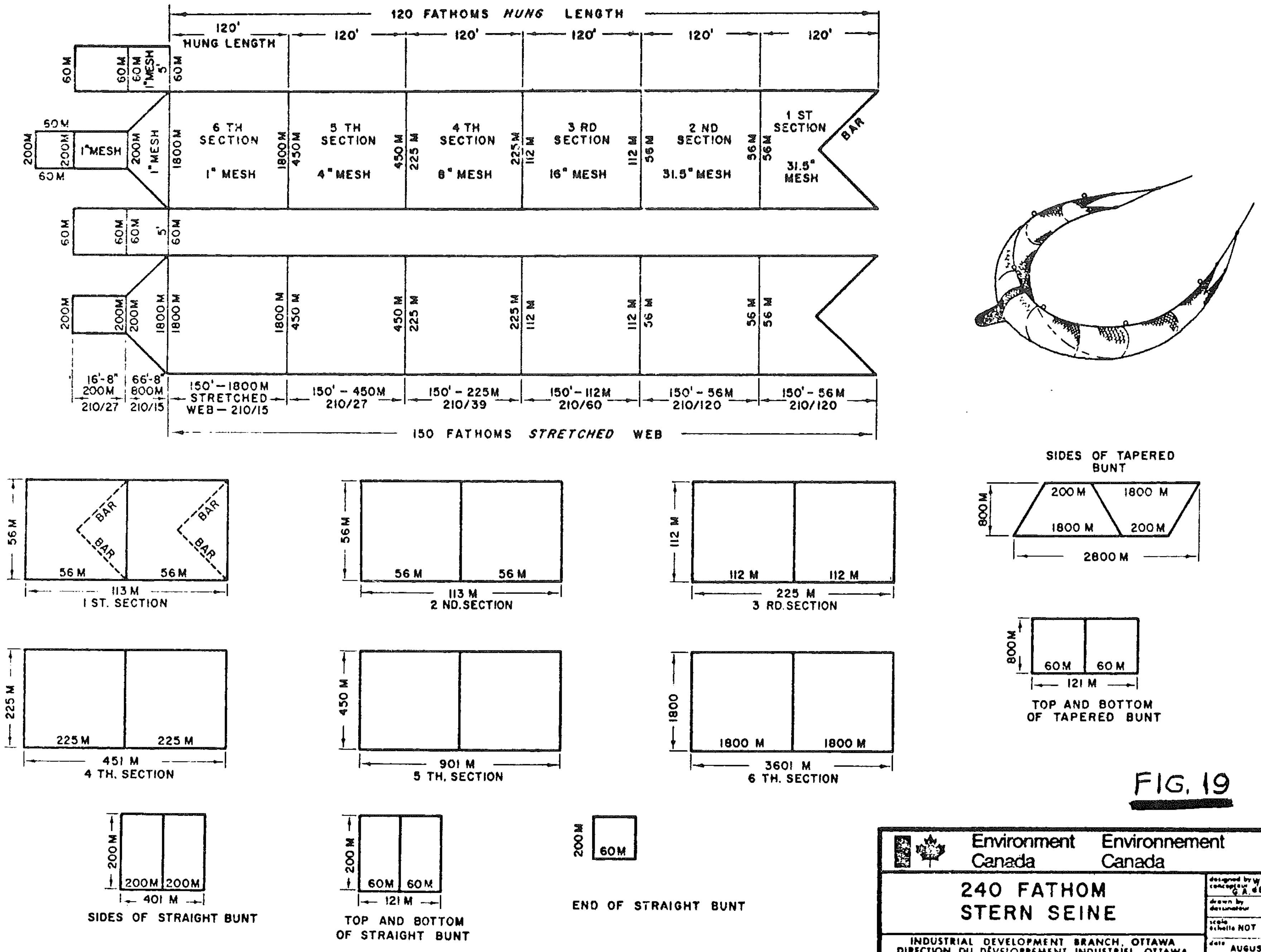


FIG. 19

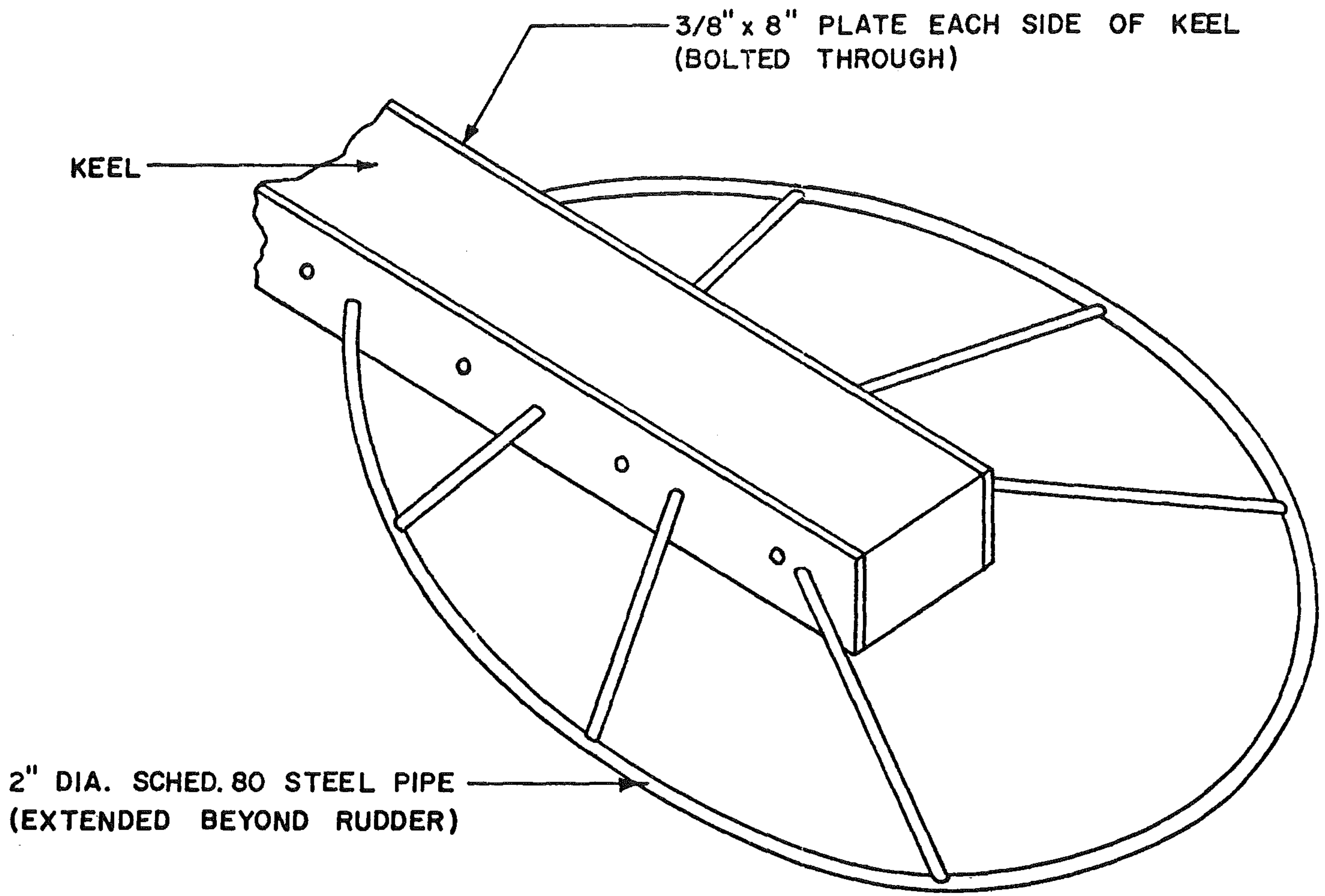
Environment Canada — Environnement Canada

240 FATHOM STERN SEINE

INDUSTRIAL DEVELOPMENT BRANCH, OTTAWA
DIRECTION DU DÉVELOPPEMENT INDUSTRIEL, OTTAWA

FISHERIES AND MARINE SERVICE
SERVICE DES PÊCHES ET DES SCIENCES DE LA MER

designed by / conception	W. W. JOHNSON, G. A. d'ENTREMONT
drawn by / dessinateur	J. S-T.
scale / échelle	NOT TO SCALE
date	AUGUST, 1974
dwg. nº / nº du dessin	I. D.V.-444-C



BEAVER TAIL

FIG. 20

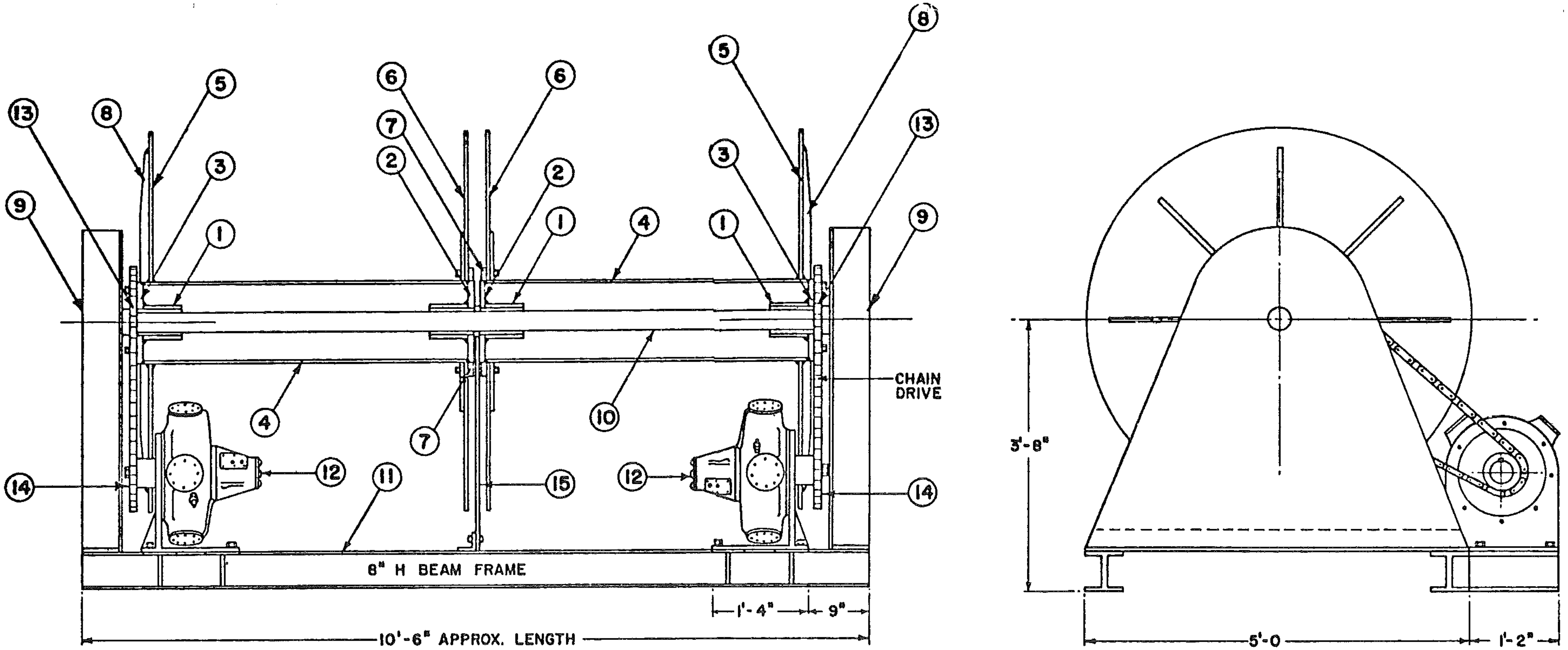


FIG. 21

Nº.	Nº. REQ'D.	NAME	MAT'L.
15	1	PLATE SUPPORT	
14	2	120B 12T SPROCKETS	
13	2	120B 36T SPROCKETS	
12	2	B45 STAFFA MOTORS	
11	1	8" H BEAM FRAME	M. S.
10	1	3" DIA. MAIN SHAFT 10 FT.	H. S. D.F.
9	2	MAIN END FRAMES	M. S.
8	16	RIB SUPPORTS	M. S.
7	2	BOLTING COLLAR	M. S.
6	2	SLIDING DRUM FLANGES	M. S.
5	2	FIXED DRUM FLANGES	M. S.
4	2	DRUM CORE	STD. PIPE
3	2	DRUM CORE FLANGES	M. S.
2	2	DRUM CORE FLANGES	M. S.
1	4	3"x 6" BRONZE BEARINGS	BRONZE & M.S.

Environment Canada / Environnement Canada

SPLIT DRUM SEINE WINCH

INDUSTRIAL DEVELOPMENT BRANCH, OTTAWA
DIRECTION DU DÉVELOPPEMENT INDUSTRIEL, OTTAWA

FISHERIES AND MARINE SERVICE
SERVICE DES PÊCHES ET DES SCIENCES DE LA MER

Designed by / conçu par

Drawn by / dessiné par T. McCALLION

Scale / échelle NONE

Date FEBRUARY, 1975

I.D.V. 471-c

DESIGNED BY

Hawboldt Industries Limited

P. O. BOX 80, CHESTER, N. S.

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