

**Project Planning for Small and  
Medium Scale Industries No.8**

**Fishing Net**

**Manufacturing Plant**

**March 1985**



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**JAPAN CONSULTING INSTITUTE**

This technical brochure was compiled to help in the drafting of a suitable plan for the construction of a Fishing Net Manufacturing Plant.

The production scale and manufacturing process have been described in this brochure on the basis of a typical instance.

The profitability was estimated by fixing certain required conditions, which may differ from country to country.

We hope that the data contained in the brochure will help you to draw up the most suitable plan for the industrialization of your project.

In case a government or public organization requests the Japan Consulting Institute to conduct a feasibility study of the above industry for the purpose of establishing the most suitable plan, it is possible for us to carry this out free of charge.

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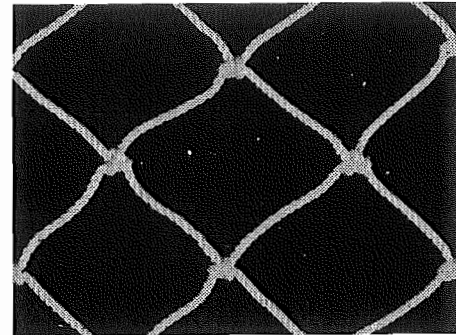
## 1. Introduction

This paper is prepared for the purpose of providing preliminary knowledge in planning and designing of the project to those who are interested in the manufacture of fish nettings, by giving an outline of various fish nettings to be used to catch different kinds of fish and also an outline of manufacturing process, required machinery & equipment and the profitability of the most typical model plant as an instance.

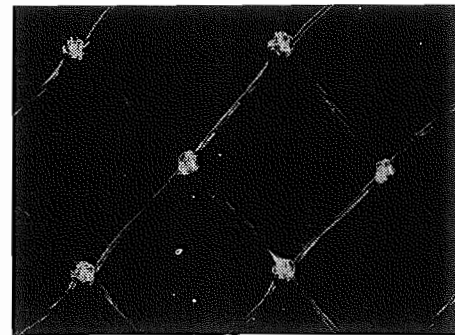
### Trend of fishing net manufacture in its own country

In recent years, it is becoming remarkable that the countries who were importing the fish nettings are changing their policy to manufacture the fish nettings in their own countries for the purpose of saving foreign exchange, enlarging employment opportunity and transferring light industry technique, etc.

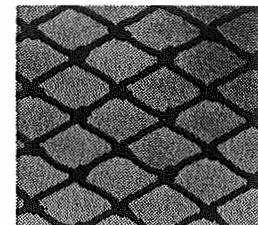
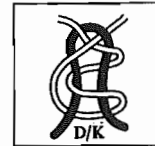
With the progressive establishment of 200 mile regime since 1970, the coastal countries who are benefitted with marine resources are setting their policy to develop and to catch their own resources by themselves. As the means of catching such fish as those caught in their water, the quantity of fish netting's consumption increases and technique also modernized and necessity arises to supply suitable type and size of fish netting in time of respective fishing season to come. In addition, in view of protecting fish resources, it becomes necessary to produce fish nettings in their own country so that any type and size of nettings may be produced to suit for their reasonable regulation. As well as developing countries, advanced countries, too, whose requirement for marine nutrition is increasing and who start reviewing the necessity of utilizing their marine resources for export also are moving to manufacture the fish nettings in their own country at present.



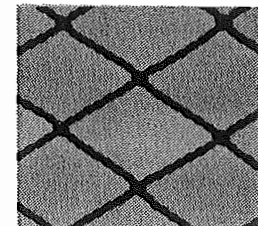
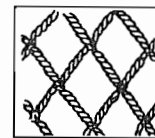
Multifilament Nylon Net



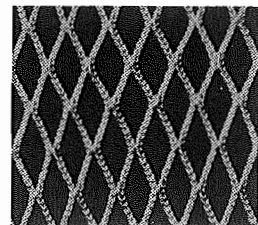
Monofilament Nylon Net



English Knot



Knotless (Kantsu Type)



Knotless (Raschell) Netting

Fig. 1 Fishing Net

History of fishing net manufacturing in Japan

Before the 18th century, the fish nets were made from such natural fibre as cotton and hemp, etc. by hand weaving, but from 1890 the production of fish nets were mechanized as a part of textile industry and in 1897 tela-knot nets and in 1912 English-knot nets and twisted knotless nets were developed in Japan. From 1940 when remarkable development on synthetic fibre was made, the synthetic fibre which has superiority in the corrosivity, strength, friction and dehydration, etc. to natural fibre took the place of natural fibre in the field of fish nets.

In the field of fishing technique too, in the beginning fishing was limited to coastal fishing, river fishing and lake fishing, but with the progress of fishing boat from non-mechanized boat to sail boat and to mechanized boat and also to ocean-going deep sea vessel of larger capacity, the fishing equipments also simultaneously very much developed by adoption of electronic, hydraulic technique, etc. and accordingly the fish nets had to be designed to suit for such new technology of fishing. Moreover, in order to improve fishing efficiency, new technique is introduced to catch fish according to each characteristics of fish and consequently the kinds of fish net also increases.

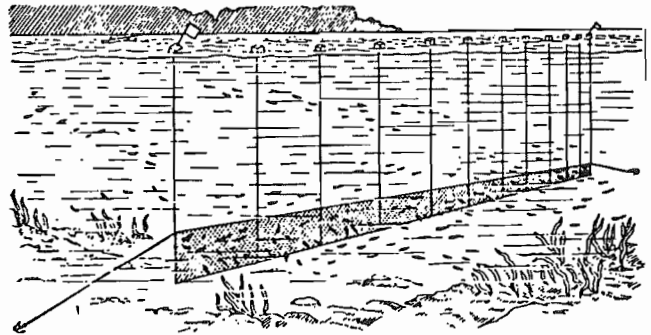
**2. Fishing Method and Fishing Nets**

The characteristics of fish nets classified according to difference of fishery are outlined as follows.

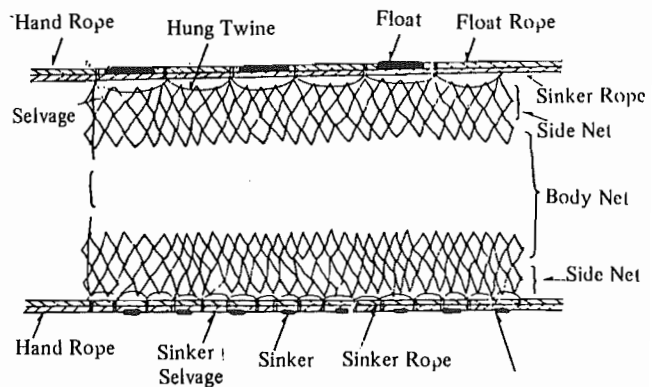
- (1) Gill net fishing :
  - (a) Bottom gill net
  - (b) Drift gill net
  - (c) Trammel net
  - (d) Seine gill net
  - (e) Floating gill net

As an example, sketches of bottom gill net are shown in Fig. 2 and Fig. 3.

Structure of gill net is rather simple. With a piece of netting, floats are fixed on the top of the net and of sinkers on the bottom of the net to get good balance of buoyancy and weight in the water so that the meshes open properly to get the fish gilled into meshes. Depending on the method of operation, it is classified as (a) to (e) above. Tightly woven non-slip knots are most important and strong fibre having reasonable elongation is required, hence double knotted English knot net made of either nylon multifilament or nylon monofilament are mainly used for gill net.



**Fig. 2 Drift Gill Net**



**Fig. 3 Design**

- (2) Drag net fishing : (a) Beach seine net  
 (b) Small sail trawl net  
 (c) Two boat trawl net  
 (d) Otter trawl net

As an example, sketches of otter trawl net are shown in Fig. 4 and Fig. 5.

The net consists of bag net and two wing nets opened toward horizontal direction and the net is dragged horizontally by towing ropes. The fish to be caught by this method are cuttle fish, octopus, cod, flat fish and shrimp and those which live in the bottom of sea or in the midwater. In general, since the bottom of the net would touch the sea bottom, the material which is strong against friction and having high tensile strength with less water resistance is required, hence either polyethylene or nylon is mainly used. On structure-wise, the netting is to be heat-setted horizontally so as to keep mesh open and type of knot is mainly single English knot. (Recently twisted knotless nets which have less friction on the knots are increasingly used in Japan.)

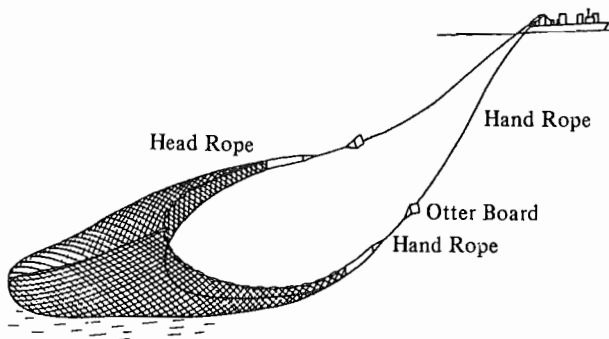


Fig. 4 Otter Trawl

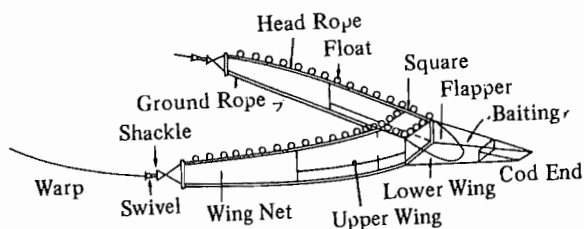


Fig. 5 Name of Each Part and Arrangement

- (3) Seine net fishing : (a) Single seine net  
 (b) Two boat seine net

As an example, sketches of two boat seine net are shown in Fig. 6.

The net having rectangular shape is mounted with floats on the top and the sinkers on the bottom of the net so that the fish is caught by surrounding and gradually closed toward cod end. The fish to be caught by this method are sardine, mackerel, tuna and those which live in the surface of the water.

The float rope should be selected from the higher strength with less elongation, the sinker from heavier specific gravity material and the net itself from those of less volume. As material, either nylon or polyester is therefore used for the net with either English knotted and/or knotless in combination.

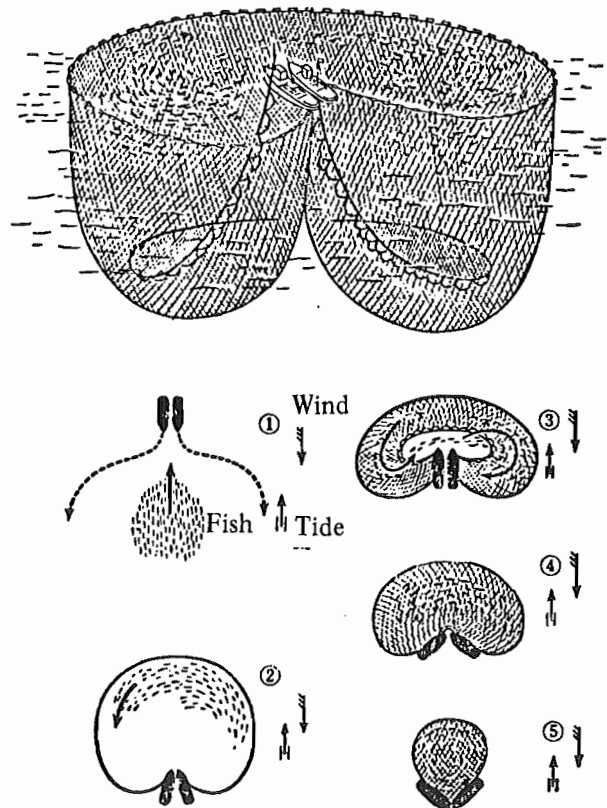


Fig. 6 Two Boat Seine Net

- (4) Lift net fishing :
- (a) Stick held dip net
  - (b) Floating lift net
  - (c) Bottom lift net
  - (d) Four boat lift net

As an example, sketches of stick held dip net are shown in Fig. 7.

This net having square shape, round shape or hat shape is spread in the water awaiting the fish gathering over the net. The net is then lifted rapidly from frame side so that the fish left over the net is caught by lifting the net. By this method, such fish as those who gather to the light or scattered bait like horse mackerel, mackerel, saury, sardine and skipjack can be caught efficiently.

In order to prevent the net from blowing by tide current, English single knotted net made of polyester which is relatively larger in its specific gravity is mainly used for this type of net.

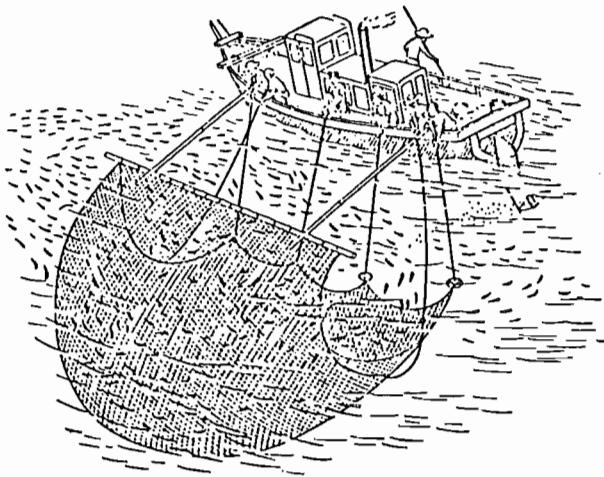


Fig. 7 Stick Held Dip Net

- (5) Set net fishing :
- (a) Large set net with trap
  - (b) Trap net
  - (c) Fish pen net

As an example, the sketches of trap net are

shown in Fig. 8 and Fig. 9.

This net consist of leader net(s) which intercept the fish passage and lead the fish toward the trap and to a bag net to get the fish in. There are in general two types in this kind of fishery; one is to catch yellow tail, salmon and cod, etc, which have a certain excursive passage and another is to catch the fish in the coastal waters by using tide difference. Since the net has to be kept its proper shape in the water against wave or tide current, such material as that which is heavy enough and anti-seaweed or anti-seagrow is to be used, like nylon with lead core mixed with polyethylene or with polyester knotless net or Raschel net. In structure wise, consideration is to be given so that the trap can keep constant shape.

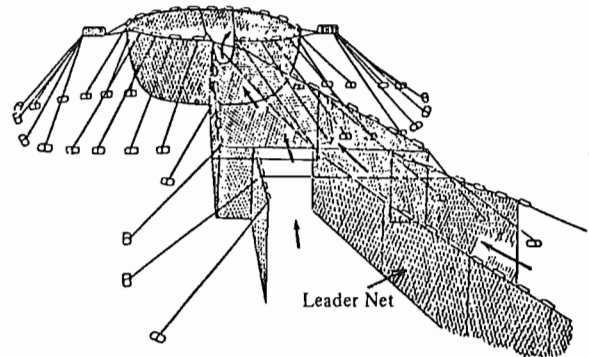


Fig. 8 Trap Net

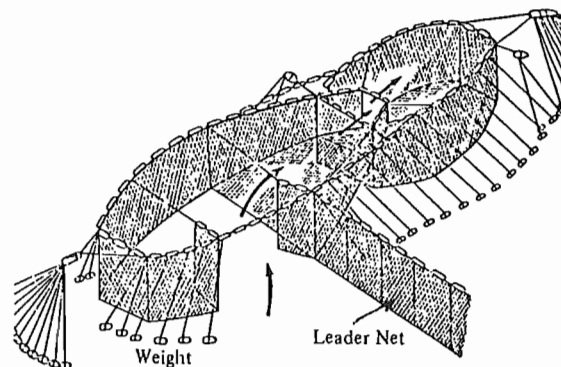


Fig. 9 One Side Trap Net

(6) Fish culture

Culturing of fish caught by trap or fish from fry until its full grown for marketing is widely studied, experimented and adopted recently to protect the marine resources and to keep constant supply of fish. Not to hurt the fish, knotless net or Raschel type net is mainly used. To study the design of the net which can dispose the bait

sedimented is also being carried out recently.

3. Raw Material

3.1 Raw Material

The kind of material and characteristics of the material used for fish nets and ropes are as described in Table 1.

**Table 1. The Kind of Material and Characteristics of the Material Used for Fish Nets and Ropes**

Kind		NYLON	POLYETHYLENE
		Filament	Filament
		Common	Common
Efficiency	Dry	4.8 – 6.4	5.0 – 9.0
	Wet	4.2 – 5.9	5.0 – 9.0
Tensile strength	Dry	28 – 45	8 – 35
	Wet	36 – 52	8 – 35
Specific gravity		1.14	0.94 – 0.96
Moisture rate (%)	Standard	4.5	0
	20°C, 65% RG	3.5 – 5.0	0
Weathering test (being out door)		Intensity deteriorated slightly, some case turned to yellow a little.	Intensity didn't deteriorate almost.
Influence by acid		Dissolved (resolved partly) by concentrated hydrochloric acid, sulfuric acid & nitric acid.	No deterioration almost by concentrated hydrochloric acid, sulfuric acid.
Influence by other chemicals		Good resistivity was found generally.	No alteration almost.
Influence by alkali		On intensity, almost didn't deteriorate by solution of concentrated caustic soda, ammonia.	On intensity, almost didn't deteriorate by solution of concentrated caustic soda.
Influence by insect, mold		Perfect resistivity was reported.	Perfect resistivity was reported.

In the field of petro-chemical industry and the amount of investment needed is so large that such materials are generally procured from raw material producers. In recent years, it has become possible to produce, however, such materials as polyethylene and nylon monofilament which can be extruded from peletted resin supplied from raw material producers.

[Note]

1. 1 Denier is an expression of thickness of long filament having the weight of 1 gram per 9,000 meter.
2. Thickness of nylon multifilament fish net twine is indicated by number of ply twisted by 210 denier yarn.

Nylon monofilament fish net line is indicated by No. No. 1 being equivalent to 220 denier.

Polyethylene monofilament fish net line is indicated by number of ply twisted by 400 denier.

In other cases, indicated by diameter of the twine or by number of denier together with number of ply like PE 360d/15 = polyethylene 360 denier 15 ply.

### 3.2 Subordinate Materials

Followings are needed as subordinate materials for making nets.

#### (1) Netting resin

To be used to fix the knots tightly while weaving the net.

#### (2) Finishing resin

To be used for the surface of the net to increase anti-friction strength and to increase anti-ultraviolet ray.

#### (3) Dyeing stuff

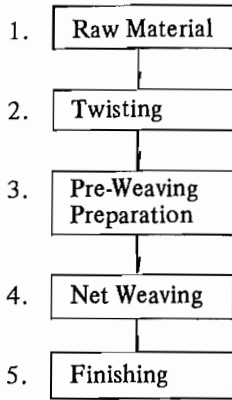
Since raw material is generally supplied in natural white, the net is dyed after woven to suit for the requirement. (In general, green for surface fish and red for deep sea fish.)

### 4. Manufacturing Process

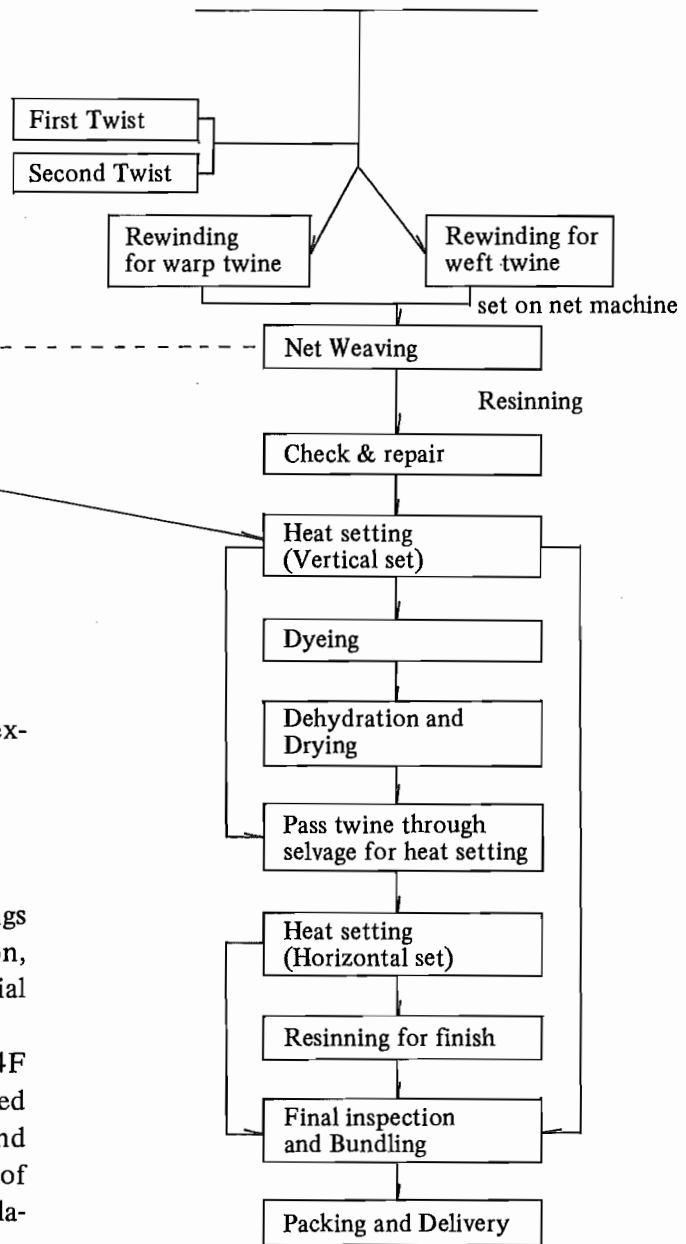
General outline of manufacturing process of fish netting is shown in Fig. 10.

Fig. 10 Fishing Net Manufacturing Process

(A) Multifilament Nettings



(B) Nylon Monofilament Nettings



Along with afore-drawn process, further explanations are made herein below.

(1) Raw Materials

Most popular materials used for fish nettings are nylon, polyethylene, polyester and vinylon, which are respectively supplied from raw material makers.

In case of nylon, multifilament of 210d/24F (210 denier 24 filament) is most widely produced for industrial use, but 420d/48F, 840d/96F and 1,260d/144F which are respectively multiple of 210d/24F are also available, so such heavy filament yarn may also be used to same pre-twisting process depending on the thickness of twine required. In case of monofilament nylon, except some special case, single monofilament is used for netting without passing the twisting process.

In case of polyethylene, monofilament of 400d/1F is standard, depending on requirement of thickness of twine, the monofilament is multiplied by twisting. In order to extrude polyethyl-

ene at its own factory by extruder, polyethylene resin shall be high density polyethylene of low pressure type.

In case of polyester, 250d/24F is standard and generally used, and depending on requirement of thickness, it is used by multiple of 250d/24F.

Polyester is superior and durable against temperature, heat and effect by sun and also heavier as compared with nylon, for such nets as those which require to sink quickly and to stand against tide current, polyester is most suitable. However, as it is weaker than nylon against shock strength, both nylon and polyester are used to make the most of respective characteristics for larger type purse seine net.

In case of vinylon, not like the yarns mentioned above which are all long continuous filament, this yarn is twisted staple fibre and very soft and will get tightened when absorbs water and is also durable against sun and temperature, hence very commonly used for set net and also most suitable for mounting twine.

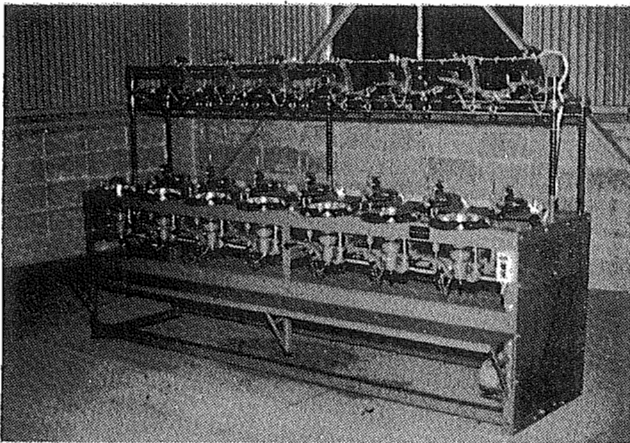


Photo 1. Spool Winder

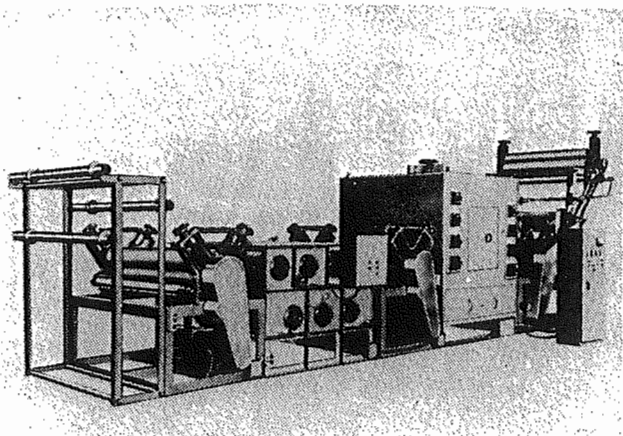


Photo 2. Vertical Heat Setter

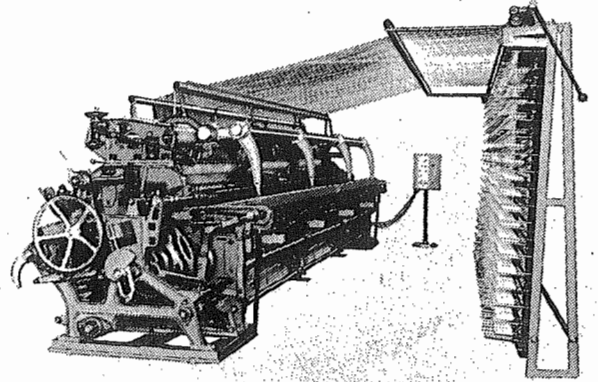


Photo 3. Netting Machine

## (2) Twisting

To twist material yarn itself by ring twister is called "first twist" and to twist such "first twist" by multiple of "first twist" to opposite direction is called "second twist," which is so-called "twine". In some special cases, there is such twine as that which has middle twist so called "retwisted twine" which is mainly used for frame part of net as selvages.

The twine gets "kink" when the twisting degree of first twist and second twist is not balanced. Also, if twisted too hard, the tensile strength gets weak and if twisted too soft, the net becomes slack, hence attention should be paid to the degree of twist.

## (3) Pre-weaving Preparation

Nylon monofilament on afore-mentioned twine is re-wound on the wooden spool for warp twine and on the shuttle for weft twine and respectively set on the netting machine at this stage.

## (4) Net Weaving

In the netting machine, there are principally 4 types, i.e., English-knot netting machine (single-knot, double-knot and triple-knot), minnow netting machine, Raschel netting machine and twisted knotless netting machine.

Minnow net and Raschel net are classified into textile goods which are woven to make meshes by textile machine with synthetic yarn and twine.

Twisted knotless net is made by special knotless netting machine which can do both twisting and mesh crossing process together in the machine.

The English-knotted net which is most popular fish net is woven by English-knot netting machine. As will be stated later, the net being to be heat-setted at finishing stage, the mesh size, meshes deep, and length of the net have to be adjusted to comply with the specification at time of finishing stage. Also, in case of gill nets, the net has to be treated with resin while weaving so that the knots may get fixed tightly.

#### (5) Finishing

Firstly the nets woven by netting machine are checked to inspect any broken hole or un-even mesh, etc. and after repair the nets are stretched by vertical heat-setter to tighten the knots to even horizontal direction. The nets are then dyed and dehydrated by centrifugal separator. After this step, steel bar is passed through all selvage meshes so that the net can be set in the horizontal heat setter to further tighten the knots to vertical direction by wet type using steam.

In general, gill nets and trawl nets are stretched both by vertical heat-setter and by horizontal heat-setter, but other nets are stretched only by vertical heat-setter.

After these heat-set treatments, the nets are treated with finish-resin to improve the strength and durability against friction and weather effects, and then go to final inspection.

The inspection is not only for appearance but is to be made to check the twisting degree by twine tester, tensile strength and knot breaking strength both in dry condition and in wet condition by chopper type tester.

#### (6) Packing and Delivery

Each piece of finished nets is bundled and tied with wrapping twine and wrapped with polyethylene bag or tarpaulin paper. Outer packing is generally made by polypropylene cloth or by hessian cloth.

### 5. Fishing Net Manufacturing Model Plant

As stated above, in order to plan to establish fishing net manufacturing plant, following articles are to be thoroughly studied and checked to determine the factory site, type, and capacity and kinds of net to be produced.

- (1) Kinds of fish to catch, where to catch, method of fishing, season and intended quantity of fish to catch.
- (2) Availability of cold storage, processing plant and convenience of transportation.
- (3) Possibility of procuring raw materials, dyeing stuff and chemical resins, etc. at economical cost.

In this paper, outline of a model plant to produce most popular fish nets like English-knotted gill nets, trawl nets and purse-seine nets shall be explained herein below.

## 5.1 Kind of Products

Kind of nets	Material used	Fishing method
(A) Single English-knot nets	Nylon multifilament	For purse-seine nets including thin gill nets
(B) Double-knot nets	Nylon monofilament	For gill nets
(C) Single English-knot nets	Polyethylene monofilament	For trawl nets

## 5.2 Specification and Quantity

### (a) Single English-knot nets of nylon multifilament

Twine size (D/ply)	Mesh size (mm sq)	Meshes deep (MD)	Length (m)	Wt/pce. (kg)	Quantity (pcs.)	Total weight (kg)
260/6	32	100	100	5.2	1,700	8,840
210/18	30	100	100	14.8	2,800	41,440
210/30	50	100	100	23.7	1,000	23,700
Total					5,500 pcs.	73,980 kg

[Note] Mesh sizes quoted above are measure between knot and knot.

### (b) Double knotted nets by nylon monofilament for gill nets

Twine size (mm)	Mesh size (mm sq)	Meshes deep (MD)	Length (m)	Wt/pce. (kg)	Quantity (pcs.)	Total weight (kg)
0.25	38	100	45	0.81	10,000	8,100
0.3	50	100	45	1.05	10,000	10,500
0.35	114	100	69	1.9	12,000	22,800
Total					32,000 pcs.	41,400 kg

(c) Single English-knot net by polyethylene monofilament for trawl nets

Twine size (D/ply)	Mesh size (mm sq)	Meshes deep (MD)	Length (m)	Wt/pce. (kg)	Quantity (pcs.)	Total weight (kg)
400/9	38	300	45	19.4	1,000	19,400
400/15	45	300	45	34.3	600	20,580
400/18	50	300	45	41.0	1,000	41,000
400/18	114	300	45	34.0	1,000	34,000
400/21	64	300	45	46.3	1,200	55,560
400/24	50	300	45	58.7	500	29,350
400/36	64	100	45	29.7	2,500	74,250
Total					7,800 pcs.	274,140 kg

5.3 Quantity of Materials Required

Annual quantity of raw materials required including 3% loss at netting machine and 2% loss at twisting machine is as follows.

(1) Main raw material

Nylon multifilament yarn

D/F	kg
420/48	14,259
1,260/144	43,512
840/96	19,656
<hr/>	
Total	77,427 kg

Nylon monofilament

mm	kg
0.25	8,505
0.30	11,025
0.35	23,940
<hr/>	
Total	43,470 kg

Polyethylene monofilament

400 denier	287,847 kg
------------	------------

(2) Subordinate materials

(a) Resin for netting	3,000 kg
(b) Resin for finishing	3,000 kg
(c) Dyeing stuff	2,000 kg
(d) Packing material	100,000 m <sup>2</sup>

5.4 Utilities

On the basis of 300 working days at 7 hours per day by 2 shifts:

Electricity	202.7 kWh x 14 hr x 300 days	851,340 kWh
Water	60 m <sup>3</sup> x 300 days	18,000 m <sup>3</sup>
Fuel (heavy diesel oil)	140ℓ x 300 days	42,000 ℓ

## 5.5 Machinery and Equipment Required

Kind of machine	Principal spec.	Quantity
Ring twister	200 spindles x 90mm ring dia.	1 set
	60 spindles x 140mm ring dia.	1 set
	120 spindles x 170mm ring dia.	1 set
	40 spindles x 180mm ring dia.	1 set
Quick traverse cheese winder	80 drums	1 set
Spool winder	6 spindles x 152mm spool dia.	4 sets
	4 spindles x 182mm spool dia.	1 set
	4 spindles x 212mm spool dia.	6 sets
	4 spindles x 272mm spool dia.	1 set
Netting machine	S/K 7.0mm pitch x 620 shuttles x 152mm spool dia.	1 set
	S/K 11.0mm pitch x 420 shuttles x 212mm spool dia.	2 sets
	D/K 9.5mm pitch x 430 shuttles x 152mm spool dia.	3 sets
	D/K 11.0mm pitch x 430 shuttles x 182mm spool dia.	1 set
	S/K 11.0mm pitch x 420 shuttles x 212mm spool dia.	1 set
	S/K 14.0mm pitch x 310 shuttles x 212mm spool dia.	1 set
	S/K 16.0mm pitch x 310 shuttles x 212mm spool dia.	1 set
	S/K 22.0mm pitch x 210 shuttles x 272mm spool dia.	1 set
Large package winder	8" x 10" winding x 3 spindles	1 set
Heat-setter	Lengthwise stretching	1 set
	Depthwise stretching	1 set
Boiler	1,000 kg steam/hr	1 set
Dyeing machine	Universal type 200 kg basket	1 set
Dehydrator	Centrifugal type separator	1 set
Resinning tank		1 set
Testing machine		1 line

## 5.6 Plant Layout and Building

Land required	About 4,000 m <sup>2</sup>
Building	
Factory building	2,772 m <sup>2</sup>
Office building	154
Warehouse	154
Total	3,080 m <sup>2</sup>

For your reference, the layout is shown in Fig. 11.

1 FISH NET MAKING MACHINE		
1-1	S/K 7.0mm Pitch x 620 Shuttles x 152mm	1 Set
1-2	S/K 11.0 " " 420 " 212	2 Sets
1-3	D/K 9.5 " " 430 " 152	3 Sets
1-4	D/K 11.0 " " 430 " 182	1 Set
1-5	S/K 11.0 " " 420 " 212	1 Set
1-6	S/K 12.7 " " 410 " 212	1 Set
1-7	S/K 14.0 " " 310 " 212	1 Set
1-8	S/K 16.0 " " 310 " 212	1 Set
1-9	S/K 22.0 " " 210 " 272	1 Set
2-1 SPOOL WINDER 6 Spindles 152 Spool dia. 4 Set.		
2-2	" " " " 182	1 Set
2-3	" " " " 212	6 Set
2-4	" " " " 272	1 Set
3-1 RING TWISTER 90mm Ring Dia 200 Spindles 1 Set.		
3-2	" " " " 60	1 Set
3-3	" " " " 120	1 Set
3-4	" " " " 40	1 Set
4 QUICK TRAVERSE CHEESE WINDER 80 Drums 1 Set.		
5 LARGE PACKAGE WINDER 8 x 10' Machine 3 Spindles 1 Set.		
6 HEAT SETTING MACHINE		
6-1 LENGTHWISE STRETCHING HEAT SET MACHINE 1 Set.		
6-2 DEPTHWISE STRETCHING HEAT SET MACHINE 1 Set.		
7 BOILER 1000 Kg Evaporation/hour 1 Set.		
8 DYEING MACHINE 2000 Kg Basket 1 Set.		
9 RESINNING TANK 1 Set.		
10 CENTRIFUGAL SEPARATOR 1 Set.		
11 TESTING MACHINE 1 Set.		

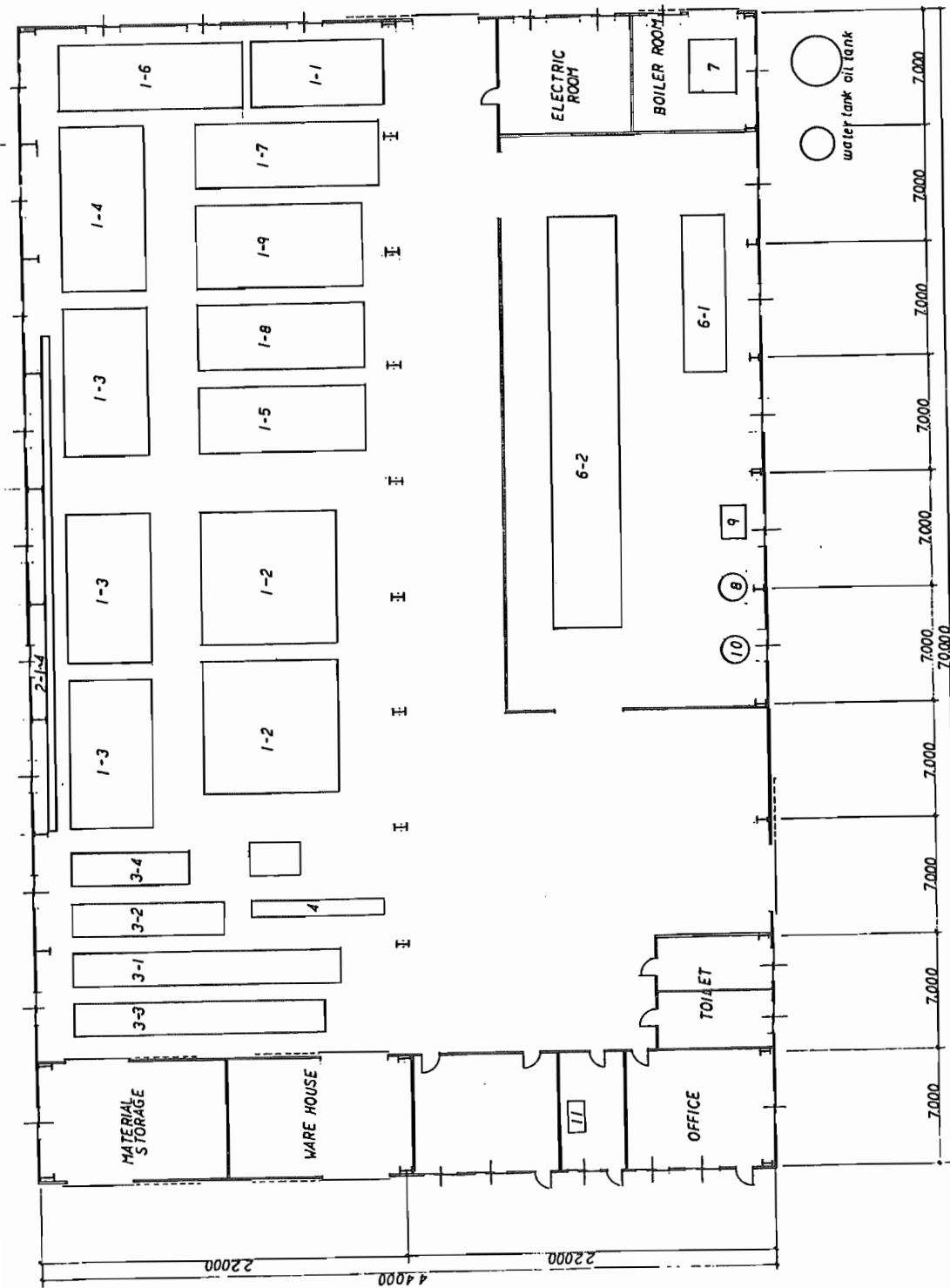


Fig. 11 Layout of Fish Net Making Plant

## 5.7 Required Number of Employees

Division	Officer & engineer		Foreman	Worker		Total
	Male	Female		Male	Female	
Factory manager	1					1
Officer	5	5				10
Driver	2					2
Maintenance	4					4
Miscellaneous	4					4
<hr/>						
Twisting			2	1	6	9
Netting			2	2	24	28
Heat-setting			1	4	2	7
Dyeing				2	2	4
Boiler			1	2		3
Laboratory				2	2	4
<hr/>						
Total	16	5	6	13	36	76
<hr/>						
Officer & engineer	21					
Skilled worker	19					
Unskilled worker	36					
<hr/>						
Total	76					

## 6. Profitability of Fishing Net Manufacturing Plant

In order to estimate the profitability of a fishing net manufacturing plant, it is necessary to calculate the production cost. But the basis of calculation being different according to a country, the profitability will be calculated in this paper on the basis of the following assumption.

### 6.1 Basic Conditions for Calculation of Production Cost, Fixed Capital and Working Capital

#### (1) Fixed Capital

- |                             |   |
|-----------------------------|---|
| (a) Factory building cost   | US\$250/m <sup>2</sup> (incl. office and warehouse) |
| (b) Machinery and equipment | FOB Japan price in 1984                             |
| (c) Spare parts             | 10% of the FOB price of machinery and equipment     |
| (d) Freight & insurance     | 10% of the FOB price of machinery and equipment     |
| (e) Installation cost       | 5% of the FOB price of machinery and equipment      |
| (f) Foundation work         | 10% of the FOB price of machinery and equipment     |
| (g) Cost of test run        | 5% of the FOB price of machinery and equipment      |
| (h) Training cost           | 5% of the FOB price of machinery and equipment      |

(i) Supervising cost	10% of the FOB price of machinery and equipment	
(j) Contingency	10% of the FOB price of machinery and equipment	
<b>(2) Working Capital</b>		
(a) Materials	For 2 month requirement	
(b) Stock of finished goods	1/12 of annual sales	
<b>(3) Production Cost</b>		
(a) Material costs	Based on international market prices	
Multifilament nylon yarn		US\$3.40/Kg
Monofilament nylon line		US\$4.00/Kg
Polyethylene		US\$2.10/kg
(b) Subordinate materials		
Resin for netting		US\$3.0/kg
Resin for finishing		US\$3.0/kg
Dyeing stuff for multifilament nylon		US\$0.5/kg
Dyeing stuff for monofilament nylon		US\$20.5/kg
Packing materials		US\$0.5/m <sup>2</sup>
(c) Utilities		
Electricity		US\$0.08/kWh
Industrial water		US\$0.20/m <sup>3</sup>
Fuel oil (heavy diesel)		US\$200/kl
(d) Labor cost (per head per year)		
Factory manager		US\$12,000
Office worker		US\$ 3,000
Engineer		US\$ 5,000
Skilled worker		US\$ 4,000
Unskilled worker		US\$ 2,000
Miscellaneous worker		US\$ 1,000
(e) Maintenance cost	3% of the FOB price of machinery and equipment	
(f) Depreciation	By straight line method	
Machinery and equipment		10 years
Building		20 years
(g) Insurance	5% of the fixed capital	
(h) Administration and sales cost	3% of annual sales	



(b) Subordinate materials cost		US\$
Resin for netting	US\$3.00/kg x 3,000 kg	9,000
Resin for finishing	US\$3.00/kg x 3,000 kg	9,000
Packing materials	US\$0.50/m <sup>2</sup> x 100,000 m <sup>2</sup>	50,000
Dyeing stuff	US\$20.00/kg x 2,000 kg	40,000
Total for (b)		US\$108,000
(c) Utilities cost		US\$
Electricity	US\$0.08/kWh x 900,000 kWh	72,000
Industrial water	US\$0.20/m <sup>3</sup> x 18,000 m <sup>3</sup>	3,600
Fuel oil (heavy diesel)	US\$200/kℓ x 42 kℓ	8,400
Total for (c)		US\$84,000
(d) Labor cost		US\$
Factory manager	US\$12,000 x 1	12,000
Officer	US\$3,000 x 10	30,000
Engineer	US\$5,000 x 6	30,000
Skilled worker	US\$4,000 x 19	76,000
Unskilled worker	US\$2,000 x 36	72,000
Miscellaneous	US\$1,000 x 4	4,000
Total for (d)		US\$224,000
(e) Maintenance cost	US\$1,550,000 x 0.03	46,500
(f) Depreciation	US\$2,557,500 x 1/10	255,750
	US\$770,000 x 1/20	38,500
(g) Insurance	US\$3,327,500 x 0.005	16,638
(h) Administration and sales cost	US\$2,446,100 x 0.03	73,383
(i) Interest	US\$3,327,500 x 1/2 x 0.1	166,375
Total (a) to (i)		US\$2,055,446

#### 6.4 Annual Sales Revenue

Multifilament nylon nettings		US\$
210/6 32mm 100MD x 100m	US\$44/pcs. x 1,700 pcs.	74,800
210/18 30mm 100MD x 100m	US\$111/pcs. x 2,800 pcs.	310,800
210/30 50mm 100MD x 100m	US\$150/pcs. x 1,000 pcs.	150,000
Sub-total		US\$535,600

Monofilament nylon nettings		US\$
0.25mm $\phi$ 38mm 100MD x 45m	US\$12/pcs. x 10,000 pcs.	120,000
0.30mm $\phi$ 50mm 100MD x 45m	US\$12.4/pcs. x 10,000 pcs.	124,000
0.35mm $\phi$ 114mm 100MD x 69m	US\$17.0/pcs. x 12,000 pcs.	204,000
Sub-total		US\$448,000
Polyethylene nettings		US\$
400/9 38mm 300MD x 45m	US\$109/pcs. x 1,000 pcs.	109,000
400/15 45mm 300MD x 45m	US\$185/pcs. x 600 pcs.	111,000
400/18 50mm 300MD x 45m	US\$220/pcs. x 1,000 pcs.	220,000
400/18 114mm 300MD x 45m	US\$177/pcs. x 1,000 pcs.	177,000
400/21 64mm 300MD x 45m	US\$250/pcs. x 1,200 pcs.	300,000
400/24 50mm 300MD x 45m	US\$316/pcs. x 500 pcs.	158,000
400/36 64mm 100MD x 45m	US\$155/pcs. x 2,500 pcs.	387,500
Sub-total		US\$1,462,500
Grand total of sales revenue		US\$2,446,100

## 6.5 Profitability

From the conditions and figures given above, the profitability of the model plant will work out as follows.

Annual sales revenue of products	US\$2,446,100
Total cost	US\$2,055,446
Total profit against sales	US\$390,654

The rate of profit against annual sales revenue  

$$\text{US\$390,654} / 2,446,100 = 16.0\%$$

The rate of profit against capital  

$$\text{US\$390,654} / 3,723,060 = 10.5\%$$

Judging from the above profit ratio, the designed model plant is found quite feasible.

## 7. Conclusion

As one of projects among light industries in the developing countries having rich marine resources, this paper of Fishing Net Manufacturing Plant is made on a model plant having production capacity of 74 tons of multifilament nylon nets, 42 tons of monofilament nylon nets and 275 tons of polyethylene nets and also on the assumption of various conditions for cost and profit calculation.

Therefore, when implementing this project, it will be necessary to study further taking various circumstances and factors into consideration in each country.

As a conclusion, nevertheless, it is thought to be one of the most promising projects for the developing countries to have such a fish net plant not only for their necessity and importance but also from social point of view to save foreign exchange, to increase employment and also to acquire technical transfer to develop one of export oriented industries.

## **Project Planning for Small and Medium Scale Industries**

- No. 1 Rice Milling Plant and Rice Bran Oil Manufacturing Plant
- No. 2 Plastic Woven Bag Manufacturing Plant
- No. 3 Container Board Manufacturing Plant
- No. 4 Plastic Blow Bottle Manufacturing Plant
- No. 5 Concrete Block Manufacturing Plant
- No. 6 Glassware Manufacturing Plant
- No. 7 Galvanized Iron Sheet Manufacturing Plant
- No. 8 Fishing Net Manufacturing Plant

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### **Project Planning for Small and Medium Scale Industries No. 8**

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