(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
8 November 2007 (08.11.2007)

PCT

(10) International Publication Number
WO 2007/125363 A1

(51) International Patent Classification:
A01K 61/00 (2006.01)

(21) International Application Number:
PCT/GB2007/050212

(22) International Filing Date: 25 April 2007 (25.04.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0608114.5 25 April 2006 (25.04.2006) GB

(71) Applicant *(for all designated States except US)*: **MARIS FISH RANCHES LIMITED** [GB/GB]; 1 Andromeda House, Calleva Park, Aldermaston, Berkshire RG7 8AP (GB).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **AYLING, Laurence John** [GB/GB]; Maywood Drive, Camberley, Surrey GU15 1LH (GB).

(74) Agent: **LUCAS, Brian**; Lucas & Co., 135 Westhall Road, Warlingham, Surrey CR6 9HJ (GB).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

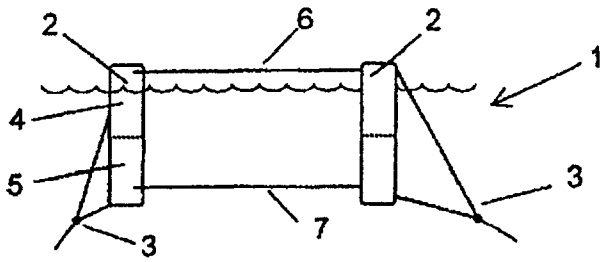
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:
— *of inventorship (Rule 4.17(iv))*

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: FISH ENCLOSURE



(57) Abstract: A net array (1) for fish farming and which may be deployed at sea and comprising: (i) a plurality of buoys (2) arranged for defining the exterior shape of the array; (ii) upper and lower enclosure mounting cables (6, 7) connected between the strut members (2); (iii) mooring cables (3) anchored to the sea bed and attached to the buoys (2) and arranged for maintaining the enclosure mounting cables (6, 7) in tension; and (iv) at least one net enclosure (8) comprising side members, a base member and a ceiling member and detachably attachable to the enclosure mounting cables thereby to be maintained in a fish containing configuration.

WO 2007/125363 A1

Fish Enclosure

The present invention relates to fish farms and to methods for farming fish.

Aquaculture has progressed with considerable success from ponds and rivers to estuaries and inshore cages. However, the largest cages in the open sea are expensive, vulnerable to storm damage and require a high density of fish in order to be economic. The resulting problems of disease and concentrated detritus are being combated with chemicals, medication and antibiotics etc. Although such aquaculture is developing relatively fast, fish reared in captivity cannot yet adequately replace the quality, diversity and survivability of wild fish.

Ideally, the stocks of each species of fish in the wild should be maintained at a naturally sustainable level, and the fishing fleets of the world should be able to catch enough fish to satisfy demand. However, many species are now endangered and quotas have had to be imposed. Some stocks are so low that fishermen are struggling to catch even their quota. There is no solution as yet proposed that will quickly and surely restore the stocks of wild fish to a naturally sustainable level and secure the future livelihood of the fishing community.

Existing fish farms which use cages are only suitable for inshore/sheltered locations and there is a limit to the size of enclosures that can be used and they suffer from defects such as:- they could lose cages and fish during storms; they are limited to less than 1 knot of current; the weighting of the nets requires more buoyancy; vessel access restricted to small boats; they are vulnerable to vessel collisions and theft; high algal growth, UV damage and corrosion; they require complex mooring system and maintenance; they have high unit costs, which escalate with size; there can be detritus concentrations; they have high asset risks due to exposure; they can be a hazard to navigation etc.

Another limitation is that, because of the size of the existing cages that can be used, these systems cannot be used to replenish the stocks of wild fish.

Patent Application PCT GB2003/003582 describes a structure for raising fish in which the structure is associated with an offshore platform, which is either tethered or fixed to the seabed and from which the submergence of the structure can be driven and/or controlled. Of course a suitable platform is not always available in locations where a large fish farm might be desired, and it will rather often not be a sensible or economic proposition to build such a platform for association with a fish farm.

Net enclosures are known that are towed from one location to another such as those containing tunny, but such enclosures are not easy to be kept substantially open and in shape.

The present invention provides a structure for fish farming which overcomes these problems and provides a wide range of tension structures that can contain fish with or without an associated fixed or floating platform or moored vessel.

According to the invention there is provided a net array for fish farming which comprises:

(i) a plurality of vertical strut members arranged for defining the exterior shape of the array;

(ii) enclosure mounting cables connected between the strut members;

(iii) mooring cables anchored to the sea bed and attached to the strut members and arranged for maintaining the enclosure mounting cables in tension;

(iv) at least one net enclosure comprising side members and a base member and detachably attachable to the enclosure mounting cables thereby to be maintained in a fish containing configuration.

Preferably the strut members are buoys comprising a flotation portion and a ballast portion whereby the strut naturally floats in a vertical configuration and there are associated winches for adjusting the tension and raising and lowering the array with respect to the surface. It may be desired to lower the array for example to avoid storm damage. The winches may incorporate depth sensing devices whereby the buoys can be permitted to rise and fall with tide, if desired, while maintaining the tension of the mounting cables. The winches are preferably mounted on the buoys and may be controlled and powered via cables run along the sea bed from land, insofar as rechargeable power means and remote control are unavailable or inadequate.

Where the strut members comprise piles attached to the sea bed winch means may be employed to lower the net array with respect to the piles.

Preferably the net enclosures have regular shapes which are defined by the net cables so that the sections have substantially straight sides, e.g. triangular, rectangular, square etc. which enables an array to be formed of separate sections connected together along their sides. The sides will not be mathematically straight as the cables will move with the water and sag etc. under their weight, but the sections should be able to form a network of linked sections, herein called a network structure. A triangular shape is preferred from the point of view of readily maintaining shape and tension.

There are preferably top and bottom mounting cables. Advantageously the net enclosures are detachably attached to both the top and the bottom cables. The mounting cables may be formed by steel wire, preferably stainless, or from fibre rope or chain, the intention being that the struts and cables may remain *in situ* for periods substantially longer than the net enclosures. Attachment of the net enclosure to a top cable may be by means of suitable cleats or bobbins and eyes, though ties or corrosion resistant carabiners may be employed.

The net enclosures are preferably formed from a light weight material which has a degree of endurance in sea conditions. Artificial fibre such as dynema is preferred, with nylon, glass, carbon or Kevlar being possible alternatives. Preferably the net enclosure has a roof member also.

In use the network structure is kept in tension by installing it within or between piles, in relatively shallow water or moored buoys in deeper water, the said buoy mooring also having no compression members between the buoys. Preferably the buoys have a high centre of buoyancy, generally by being buoyant in the upper part and negatively buoyant, or ballasted, in the lower part. The buoy mooring system is in tension, which is imposed by the mooring cables and the buoyancy of the upper part of the buoys, and the structure is devoid of any compression members.

In use, to avoid storms or rough weather, the network structure can be submerged by shortening one or more of the mooring cables and raised again by lengthening the mooring cables. The shortening or lengthening of the cables to submerge or raise the network structure can be achieved by winches mounted on a nearby platform. Alternatively, submersible winches (winches that are designed to operate under water) can be mounted on the buoys and can be operated remotely, preferably via a power and control, cable run to a nearby platform or land. In addition the ability to submerge enables the net sections to be moved clear of surface navigation and/or other business or leisure users on the water surface. Typically, submergence by 20 to 30 metres is desirable to avoid storm damage or surface navigation.

In order to maintain the three dimensional shape of the net section, the lower ends of the nets can conveniently be weighted or moored to the sea bed or to an anchor. In still water the weight of the nets will tend to keep the shape of the nets and no further weight would be needed. Preferably however the enclosure is attached to a bottom cable. This is advantageously accomplished via one-way catches associated with the

bottom cable and having lines attached to the top cable whereby pulling on one line lowers the net enclosure bottom toward the bottom cable and the one-way catch holds the enclosure to the bottom cable and pulling on the other line opens the one way catch and draws the fish enclosure to the surface.

In use a network structure can be built up from a number of individual net sections and there is no theoretical limit to the size of structure which can be built. The sections can be added or removed as required, so the size of the network structure can be adjusted to specific situations.

The large network structure can be installed, removed or replaced from a fishing vessel with the assistance of either a second vessel on the other side of the buoy mooring array or with manned intervention along an appropriately positioned walkway in mild sea conditions.

By building the array or structure up from individual units a large network structure can be easily assembled without the handling difficulties which would be caused by a single very large structure.

The buoy mooring array may itself be based on 3, 4, 5, 6 or more buoys, such that a balance is achieved between the simplest possible array for economic reasons, and adequate structural redundancy to minimise the effects of a failure in one or more tension members.

The network structure can be moored to large vessels such as fishing boats, offshore structures such as platforms or the shore by attachment to the buoys, and all handling of the net enclosures and all husbandry of the fish can be carried out therefrom, which facilitates the use of mechanical handling and remote control and increases safety.

The network structure enclosures can be towed slowly from one location to another by two or more towing vessels. The structure can be moved around between widely spread mooring points, either to change the geometry of the moorings in a strong current and so keep the structure level, or to assist in dispersing the detritus, particularly in locations where the water currents are insignificant.

The network structures of the present invention can be used offshore in the open ocean, inshore, in lakes and other inland waterways, in areas of high water currents, or of negligible water currents, in small installations or extremely large installations, but all with the feature that the fish enclosures consist entirely of tension members and that the enclosures can be individually removed or replaced without removing the buoy mooring array in which they are held in tension.

There can be cover to the structure such as a ceiling net so that when the structure is submerged the fish cannot escape. The ceiling net can also protect the fish from birds etc.

State of the art feeders are now available for floating, neutrally buoyant and 'heavy' fish feed. Such feeders can cater for surface, mid-water or bottom feeding species. Insofar as a reservoir of feed is not maintained, restocked when required, in close association with the array, feeding may be achieved by 'slugging', where the feed is transported to the enclosures fast enough to minimise its time in the long distance pipe, in a high density slurry that avoids breaking down the structure of the feed pellets; and, between slugs the long distance feed pipe is flushed clear of feed.

Removal of the fish may be effected by detaching the net enclosure from the mounting cables and reeling it into a suitable boat or towing it to land. Alternatively there can be an inner net enclosure, an opening in the net enclosure through which fish can be induced to pass, perhaps employing sound means to drive the fish or a suction tube

arranged to remove water and fish therein.

The operation and integrity of the enclosures can be monitored by ROVs (Remotely Operated Vehicles or 'eyeballs'), garaged on the sides of the vertical struts and powered and controlled by long distance power & control cables. These ROVs can also inspect the installation for marine growth. Free swimming ROVs or AUVs (Autonomous ROVs, without umbilicals), perhaps recharging at plugs mounted on the inside of the enclosures, connected to power available on the buoys can also swim with the fish and observe social and feeding behaviour.

Rather than use divers based on land or an adjacent platform, maintenance and repair can be carried out by work class ROVs based on the vertical, capable of removing marine growth and capable of patching any hole in the enclosure's net walls, floor or ceiling. Holes can be unlikely with dynema material as this is strong enough to resist attach by large predators. The ROVs, of all sorts can, themselves be maintained and repaired, during periodic visits by fishing boats in periods of good weather to the surfaced buoys.

Compared with the known cage structure presently used for fish farming, the present invention provides structures which are suitable for exposed 'open ocean' locations; can avoid storm damage by submerging; can be designed for any current e.g. up to 2 or 3 knots and higher, require no weighting of the nets, facilitate large vessel access and mooring, have higher security and safety due to submergence, have low algal growth, UV damage and corrosion, have a simple mooring system and maintenance, have lower unit costs, which reduce with size; any detritus is easily dispersed, and is minimal hazard to navigation.

In the open ocean and very deep waters, a net array according to the present invention can avoid the need for manned access completely. Some walkways may be provided

to enable manned access during installation (or removal) of the vertical struts only, which should stay in place for 10 to 15 years. By virtue of the present invention all fish ranching operations can be carried out remotely and, at the closest, over the side of a fishing vessel, to no more extent than is used to handle fishing nets normally. Intervention can be confined to periods of fair weather and at all other times the entire system is submerged. The need for manned access can be eliminated entirely.

Because of the size of the enclosures that can be formed, the system can be used to replenish the stocks of wild fish, as well as to supplement fish supply, provide research data and prepare for marine farming. The system enables wild fish, i.e. first generation fish bred from wild brood stock, to be reared economically, without overcrowding and in an open ocean or large lake environment. The system enables fish to grow in natural conditions with room to swim and feed as in the wild, but are protected form predators. In order to eliminate the need for medication and 'unnatural treatments' and oxygenation of the water, it is necessary to keep the density of fish low and the system of the present invention can achieve this. In practice brood stock from the hatching of eggs can be taken as fingerlings or juveniles from the hatchery or fishery areas into the enclosures into which they are released; a wide sampling of brood stock should ensure that the genetic range remains diverse.

In one embodiment some sections consist of nets with preferably a finer mesh net mounted on a coarser net mesh or lattice. This enables the containment of the young fry or fingerlings, and the coarser mesh net or lattice can transmit and spread the load of the moorings. A net enclosure of finer mesh to contain young juveniles may be located within, or adjacent to, a net enclosure of coarser mesh so that they may be easily reared and transferred from one enclosure to another.

The invention is illustrated in the accompanying drawings in which:-

Figs. 1a and 1b show elevation and plan views of the simplest example of a buoy

mooring array;

Figs. 2a and 2b show the net enclosure installed within the mooring array;

Figs. 3a and 3b show an extended mooring array;

Fig. 4 shows a method of handling the enclosure base corners;

Fig. 5 shows a variety of net enclosure configurations;

Fig. 6 shows a simplified configuration for low current conditions;

Fig. 7 shows an arrangement for locations with a significant current;

Figs. 8 and 9 illustrate different configurations;

Figs. 10 shows change of location of the enclosure;

Fig. 11 shows change of attitude on submergence;

Figs 12 and 13 show submerging of an enclosure and added buoys;

Fig. 14 shows a single enclosure of four compartments for use in high water current environments;

Fig. 15 shows a single enclosure for use in a low water current environment, and

Fig. 16 shows structures for use in fish ranches in lakes or at sea with typical capacity for fish @10kg/m^3.

Referring to fig. 1a this shows an elevation and fig. 1b shows a plan view of the simplest example of a buoy mooring array (1) without the nets in position. This structure consists of three buoys (2) moored with mooring cables (3) under tension in such a way that the whole structure substantially maintains its shape without the need for any structural compression members between the buoys. The buoys (2) have a high centre of buoyancy, generally by being buoyant in the upper part (4) and negatively buoyant, or ballasted, in the lower part (5). The cables at (6) and (7) connecting the buoys (2) complete the structure. The buoy mooring system is in tension imposed by the mooring cables (3) and the buoyancy of the upper part of the buoys (4), and there are no compression members. To submerge the structure one or more of the mooring cables (3) are shortened.

Referring to figs. 2a and 2b, these show the net enclosure (8) installed within the mooring array (1) of figs. 1a and 1b and held open, and substantially in shape by the mooring array (1) in such a way that the enclosure (8) substantially maintains its shape without the need for any structural compression members. Hence, both the mooring array (1) and the enclosure (8) are both entirely tension structures and can therefore be enlarged to many times the size of conventional fish cages without excessively increasing their complexity or cost.

Figs. 3a and 3b show a mooring array (1) extended to accommodate two simple enclosures (8a and 8b) and in which the enclosure at (8b) can be installed or removed by handling it from a vessel at (9a) with assistance of a vessel at (9b) or by manned intervention along the walkway (10).

The mooring array (1) would typically be installed, removed or relocated using an anchor handling or construction vessel and remain for many years, whereas the enclosures (8a and 8b) would be typically installed removed or replaced using a fishing vessel and remain for a matter of months only. Additionally both mooring array (1) and the enclosures (8a and 8b) would be accessed for inspection, cleaning or repairs by those with the seamanship skills and experience of handling cables, nets and fish, in the open ocean, preferably by seamen with fishing vessels.

The walkway (10) is also a tension structure and may also be partially buoyant to ensure it remains above water in significant sea swells. In Fig. 3a the attaching of the bottom edge of the enclosure (8) to the mooring array cable (7) at (18) can be carried out above water by running a halyard line or wire rope from (17) via eyes, chain links or sheaves at (18) and (19) to (20) at the top of the nearest buoy (2). Thereby passing the tethering tension laterally to the buoy (2) rather than pulling the two cables (6 and 7) towards each other.

Referring to fig. 4 the bottom edge of the net enclosure (40) can be pulled down to the bottom mooring array cable (7) with a 'one way catch' (41) by pulling upwards on line at (42) so that, once installed, no tethering tension force is transferred up line (42). The 'one way catch' (41) can be released by pulling upwards on line at (43). These details eliminate the need for diving which is costly and could be hazardous in bad weather and/or high water currents.

Figs. 5a and 5b illustrate net enclosure configurations that could be accommodated within the buoy mooring array (30). The net enclosures can be shaped and sized to fit two or more individual enclosures adjacent to each other, within the same space within the mooring array. Hence, 3 separate enclosures are installed separately in the mooring array space at (11). The enclosure at (12) is shown as a single enclosure partitioned into four sections or compartments to accommodate small fry in the smallest space, surrounded by fine mesh netting and up to large adult fish in the largest space within course mesh netting. Enclosure (13) has 3 sections and is adjacent to an enclosure (14), which can be separately removed. The mooring array space can be separately sectioned off with walkways as shown in (15) which could facilitate closer monitoring of several different batches of fry (say); such extra walkways could have intermediate buoys at (16) to assist with stabilizing the walkways in rough weather. In all cases however the design favours flexibility in handling various batches of fish reared in parallel and facilitates 'grading' which is the separating of fish by size, as they grow at different rates.

Fig. 6 illustrates a simplified configuration which can be used, where water currents are low, e.g. of less than about ½ knot, the buoy mooring is simplified to restrain only the upper edges of the net enclosure and the internal space and shape of the net enclosure may be substantially retained by the addition of weights around the lower edges. Additionally such net enclosures may be used in sufficiently sheltered waters

and not compete for surface space with other users and as such may not be required to submerge; in such cases it will not be necessary to close the enclosure roof, except to deter birds. A typical size for such an enclosure would be 100m x 115m with a depth of 10 to 20m. The capacity is about 500 to 1,000 tons of fish at 10Kg/m^2.

Fig. 7 illustrates the extra restraint available to maintain the enclosure shape in locations of significant currents (>1 knot) a typical size is 100m x115m with a maximum depth of 30m. The capacity is about 1,500 tons of fish at 10Kg/m^2. For use in lakes or sea an enclosure of dimensions 165m x 190m x 30m would have a volume of 400,000m^3 and a capacity of 4,000 tons fish at 10Kg/m^2.

Figs. 8 and 9 illustrate different configurations as examples of the arrangement of individual sections or compartments having typical dimensions of the arrangement of fig. 8 with dimensions of 200m x 200m with a capacity of 1,000,000 m^3 and a capacity of 10,000 tons fish at 10Kg/m^2.

Fig. 9, in particular illustrates the essential design principle, to achieve a fish enclosure system of a substantial size, with dimensions of 330m x 380m with a volume of 1,000,000 m^3 and a capacity of 24,000 tons fish at 10Kg/m^2 or more, that can allow the removal or replacement of temporary fish enclosures within a relatively permanent mooring array; only the present design is currently capable of providing an economic solution on such a scale. Figs. 14, 15 and 16 illustrate these arrangements.

Fig. 10 shows that the mooring system can change the location of the enclosure significantly in 2 dimensions, from position A to the other shown positions. This is important in areas of low water current, to spread the detritus and avoid high concentrations; it is also important in areas of high water current, where allowing the enclosure to move 'downstream' enables the enclosure to remain more level when the mooring lines resist the drag forces.

The off-centre location illustrated in fig. 10 is shown in Fig. 11 as having an upsetting or tipping effect, which is not of concern on the surface but is greatly increased once the enclosure is submerged and the buoys no longer have a 'righting' effect. Although this does not matter in deep water, it may be required to remain closer to the horizontal in shallower waters. This can be achieved by designing the buoyancy to conform to that shown in Figs 12a and 12b. Additionally the extra (external) buoys can wind in the slack cable and only come into operation when the enclosure is submerging, as in Figs. 13a and 13b. Referring to fig. 14 this structure provides a volume of 100,000m^3 with a capacity of 1,000 tons of fish @ 10Kg/m^2 and is suitable for use in areas of low water current such as lakes etc.

Referring to fig. 15 this structure provides a volume of 100,000m^3 with a capacity of 1,000 tons of fish @ 10Kg/m^2 and is suitable for use in areas of water currents of 2 –3 knots such as open ocean locations e.g. at sea etc.

Referring to fig. 16, these show structures capable of rearing very large quantities of wild fish as a fish ranch and show possible configurations of individual structures which can be put together.

In this specification references to sea and sea bed may be taken to refer to other stretches of water such as lakes and the beds thereof.

Claims

1. A net array for fish farming and comprising:

(i) a plurality of vertical strut members arranged for defining the exterior shape of the array;

(ii) enclosure mounting cables connected between the strut members;

(iii) mooring cables anchored to the sea bed and attached to the strut members and arranged for maintaining the enclosure mounting cables in tension; and

(iv) at least one net enclosure comprising side members and a base member and detachably attachable to the enclosure mounting cables thereby to be maintained in a fish containing configuration.

2. A net array as claimed in claim 1 and wherein the strut members are buoys having a flotation portion and a ballast portion whereby the strut naturally floats in a vertical configuration.

3. A net array as claimed in claim 1 or claim 2 and having associated winches for adjusting the tension and raising and lowering the array with respect to the water surface.

4. A net array as claimed in claim 3 and wherein the winches incorporate depth sensing devices whereby the buoys can be permitted to rise and fall with tide while maintaining the tension of the mounting cables.

5. A net array as claimed in any one of the preceding claims and which is substantially triangular in planform.

6. A net array as claimed in any one of the preceding claims and wherein there is a plurality of separate net sub enclosures.

7. A net array as claimed in any one of the preceding claims and wherein the net enclosure is attached to a top cable with cleats.

8. A net array as claimed in any one of the preceding claims and wherein the net enclosures are formed from dynema.

9. A net array as claimed in any one of the preceding claims and wherein the enclosure mounting cables comprise upper and lower cables.

10. A net array as claimed in claim 9 and wherein the net enclosure is attached to the lower cables via one-way catches associated with the bottom cable and having lines attached to the top cable whereby pulling on one line lowers the net enclosure bottom toward the bottom cable and the one-way catch holds the enclosure to the bottom cable and pulling on the other line opens the one way catch and draws the fish enclosure to the surface.

11. A net array as claimed in any one of the preceding claims and having a remotely operated vehicle or "Eyeball", garaged on the sides of a vertical strut and powered and controlled by long distance power and control cables.

12. A net array as claimed in any one of the preceding claims and having a walkway.

13. A net array as claimed in any one of the preceding claims and having a fish feeder comprising a feed reservoir an openable port and a timer.

14. A net array as claimed in claim 13 and wherein the fish feeder is associated with a vertical strut but is arranged to discharge feed approximate the centre of the array.

15. A net array as claimed in any one of the preceding claims and comprising a long distance pipe wherethrough feed is transported to the enclosures in a high density slurry which avoids breaking down the structure of the feed pellets and, between slugs the long distance feed pipe is flushed clear of feed.

16. A net array substantially as hereinbefore described with reference to the accompanying drawings.

Fig. 1a

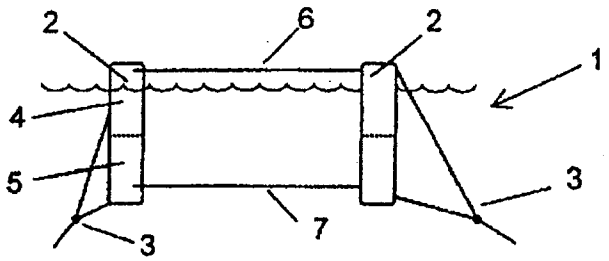


Fig. 1b

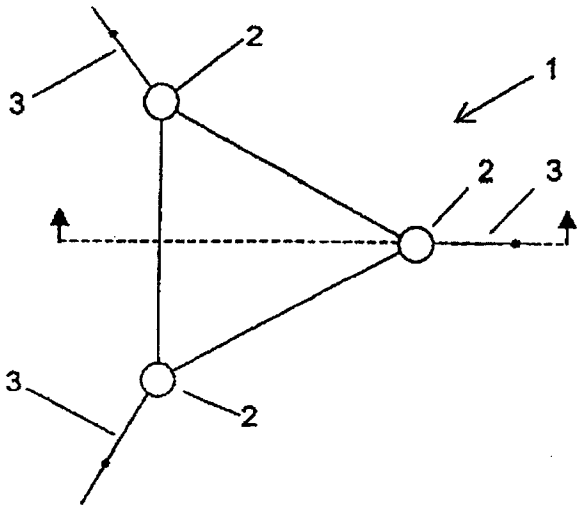


Fig. 2a

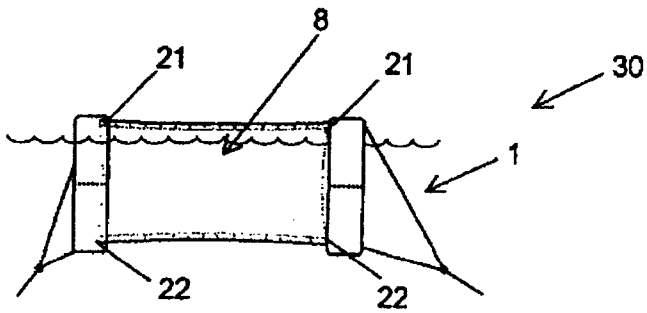


Fig. 2b

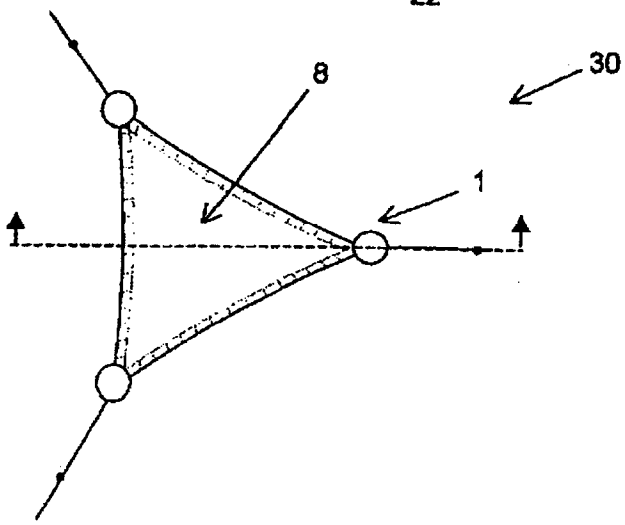


Fig. 3a

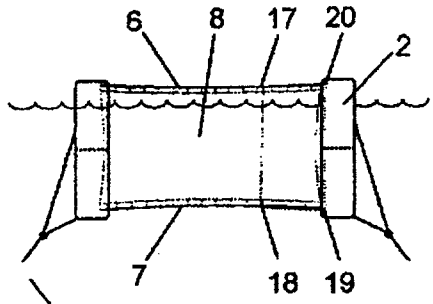


Fig. 3b

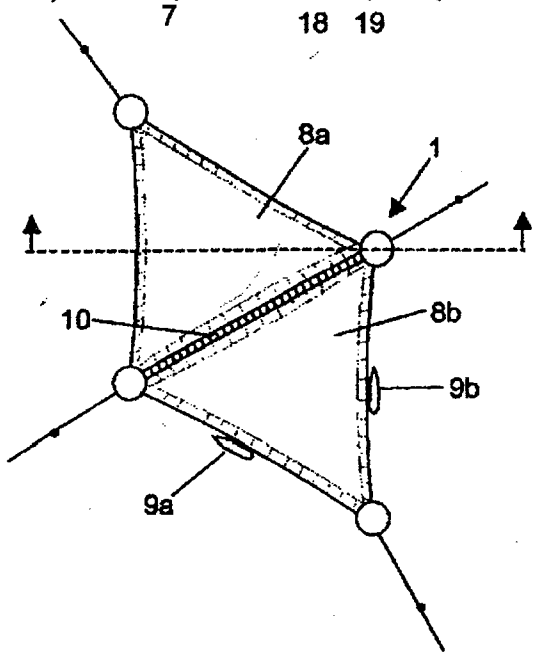
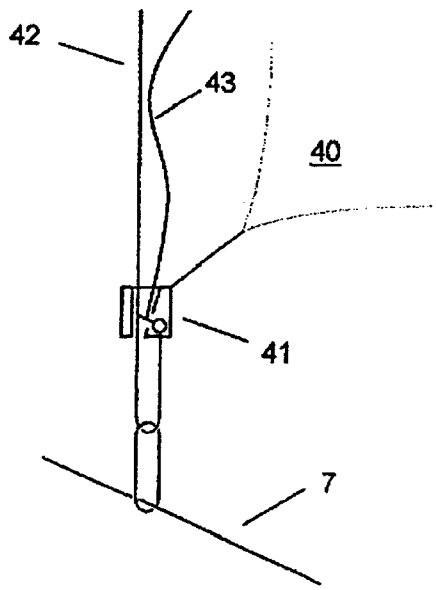


Fig. 4



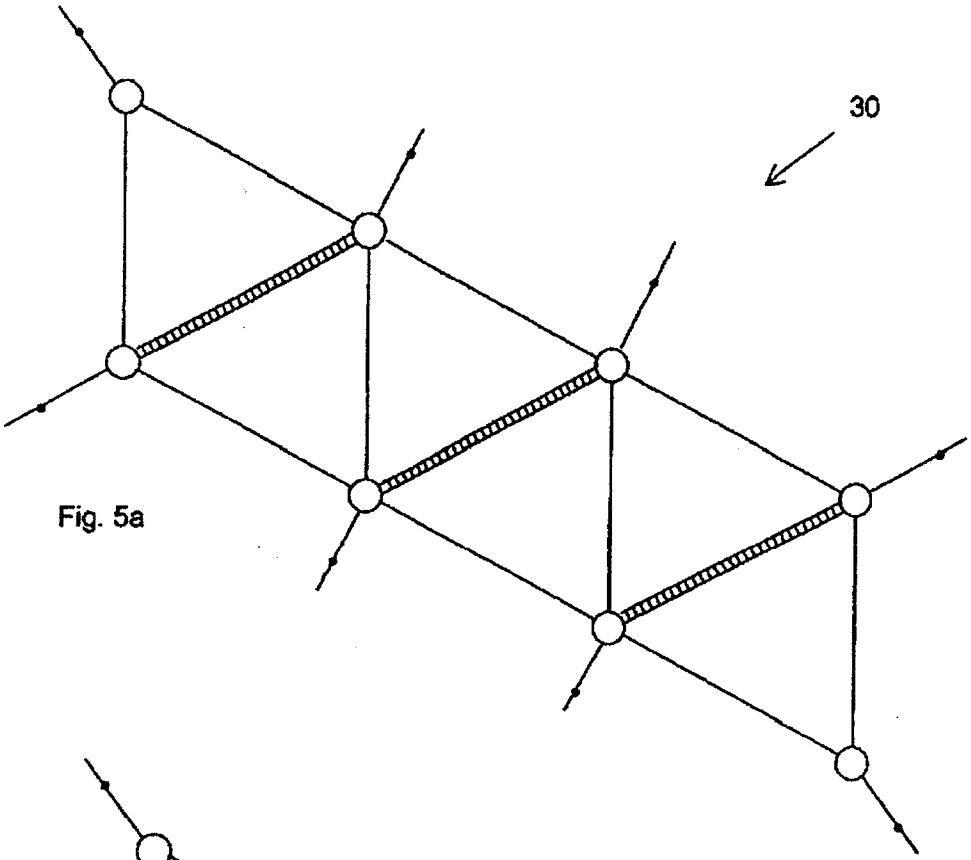


Fig. 5a

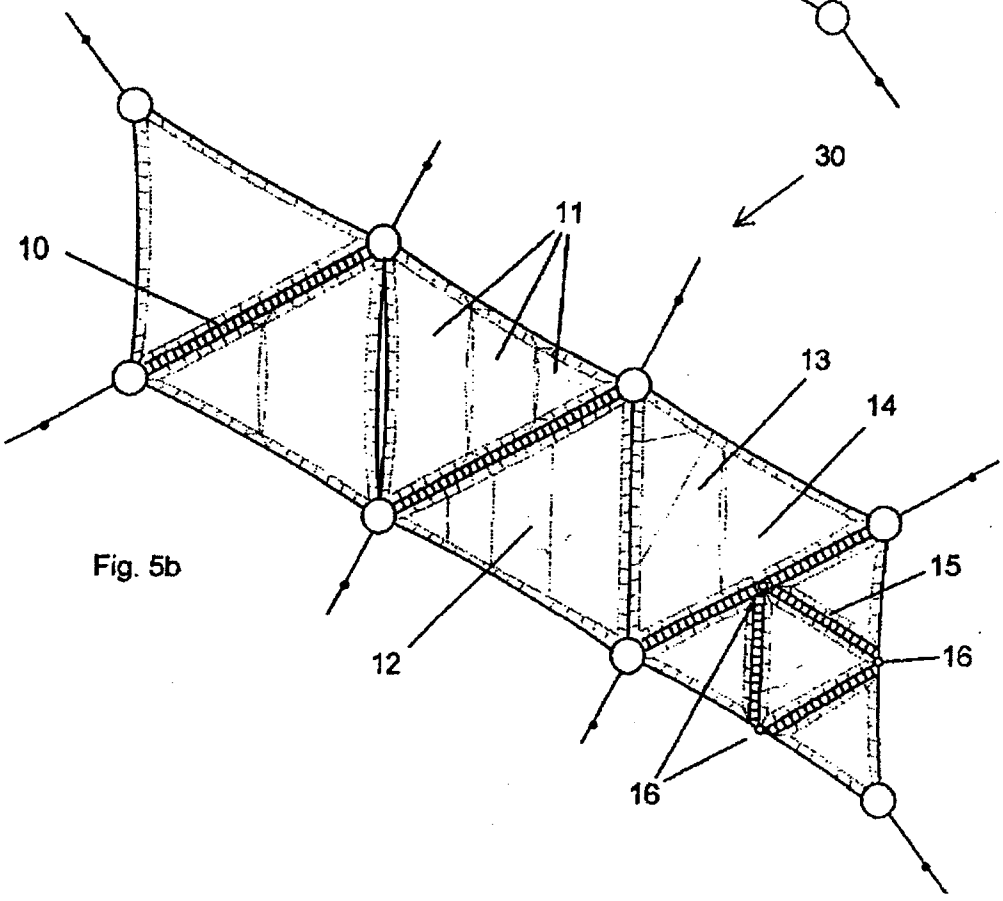


Fig. 5b

Fig. 6a

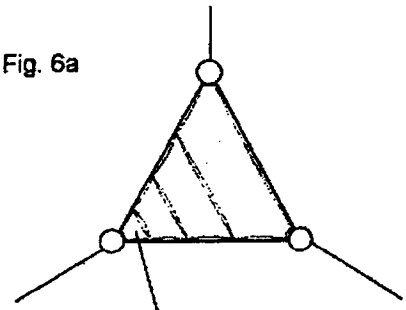


Fig. 6b

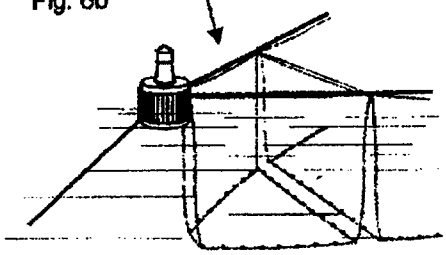


Fig. 7a

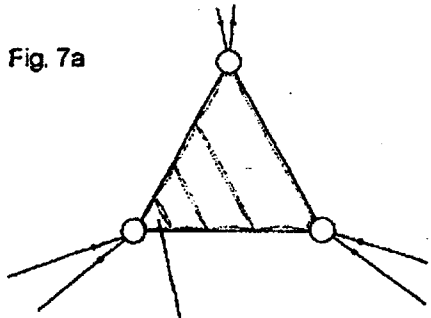


Fig. 7b

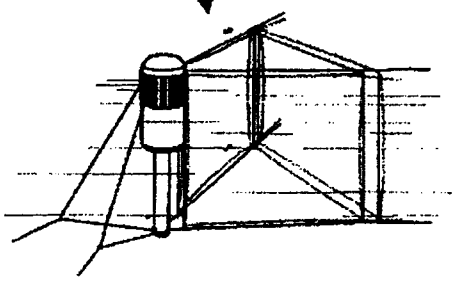


Fig. 8

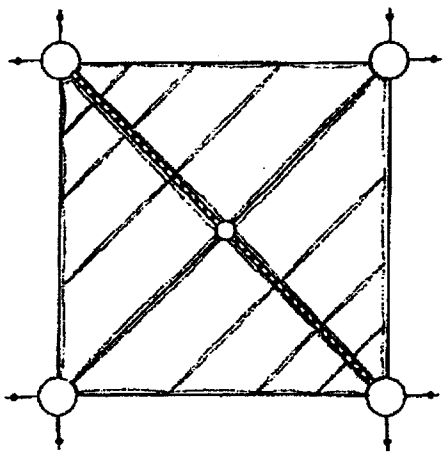


Fig. 9

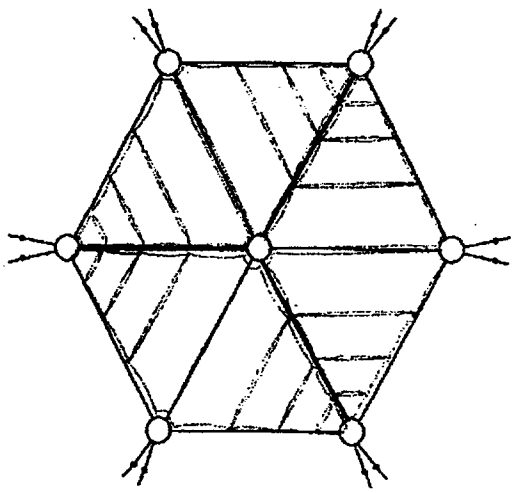


Fig. 10

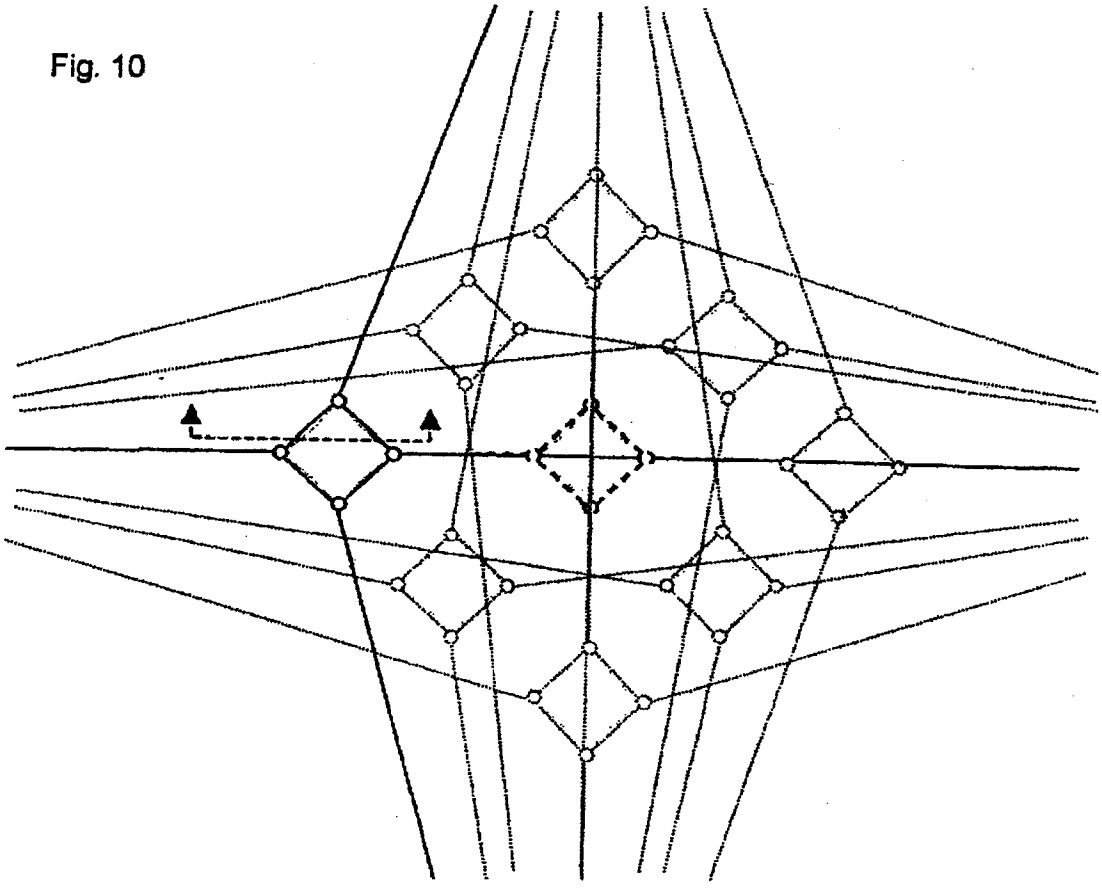


Fig. 11a

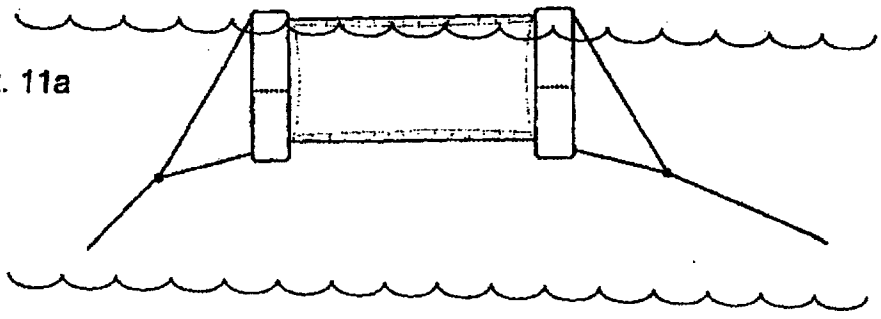


Fig. 11b

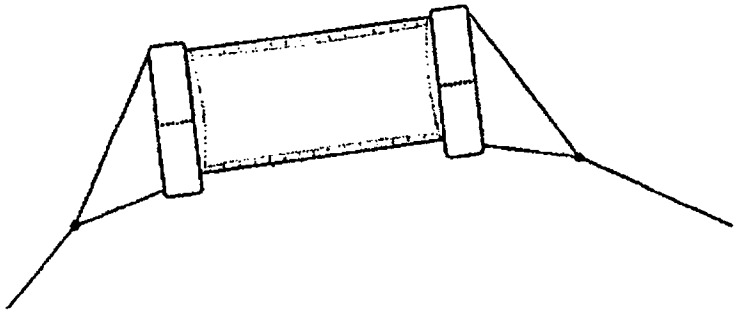


Fig. 12a

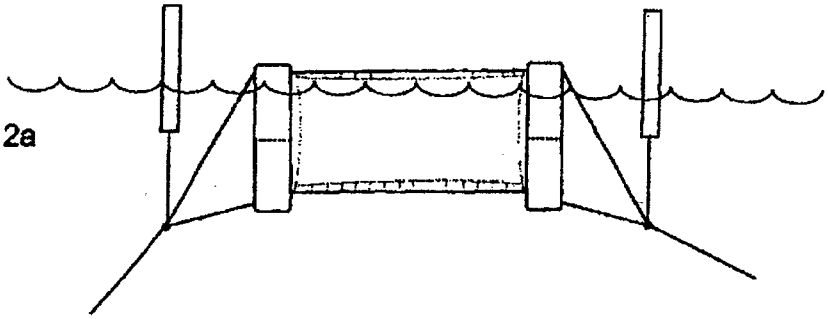


Fig. 12b

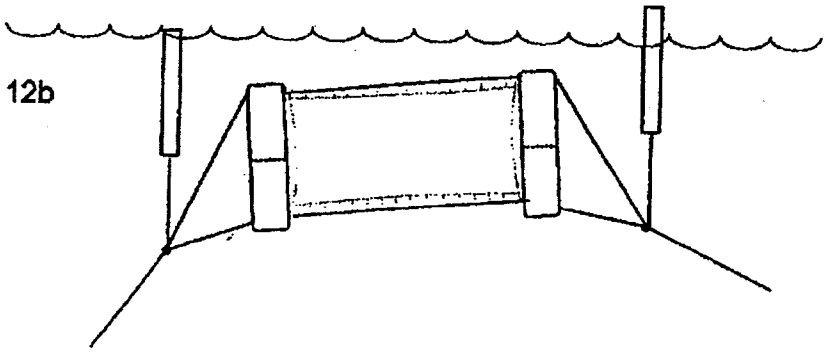


Fig. 13a

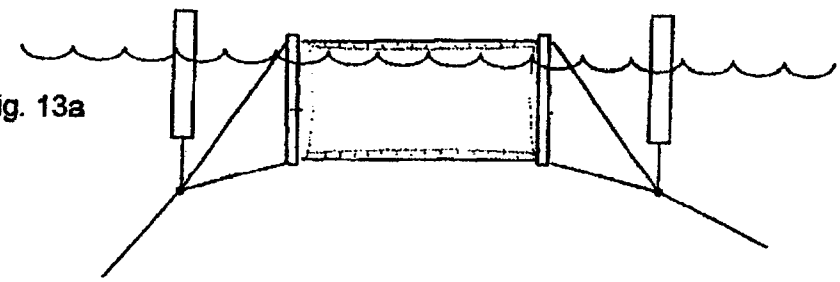
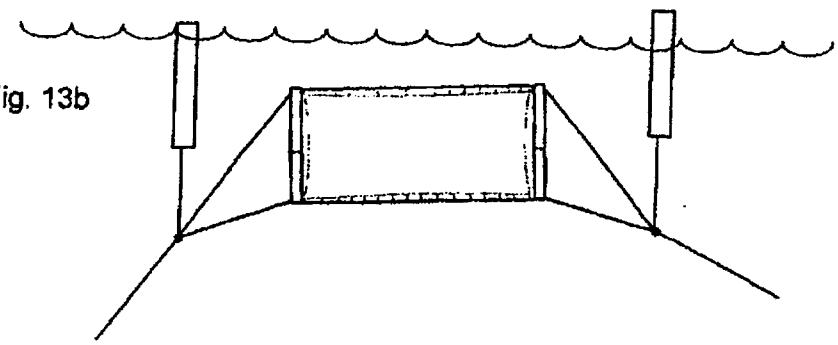


Fig. 13b



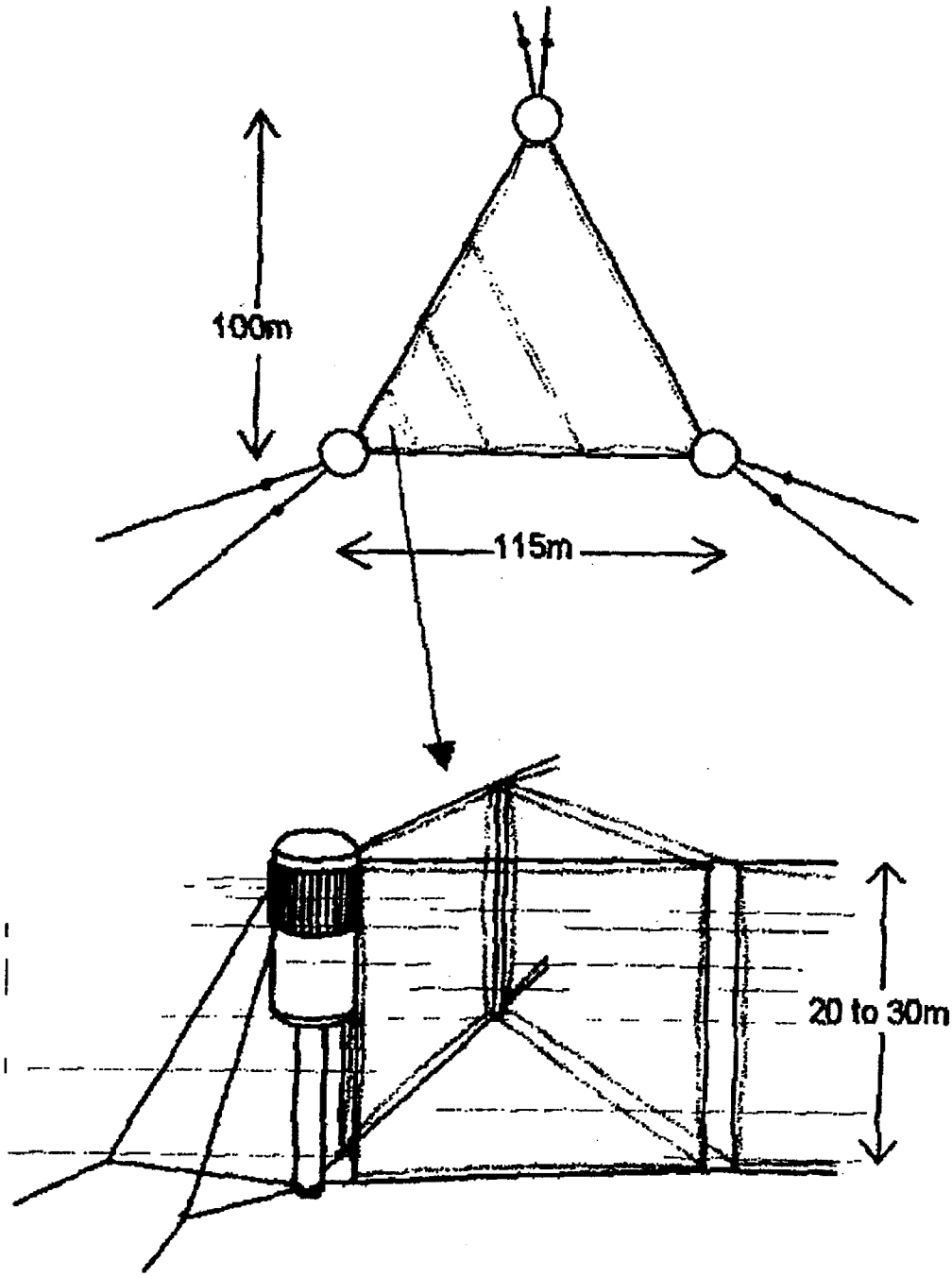


Fig. 14

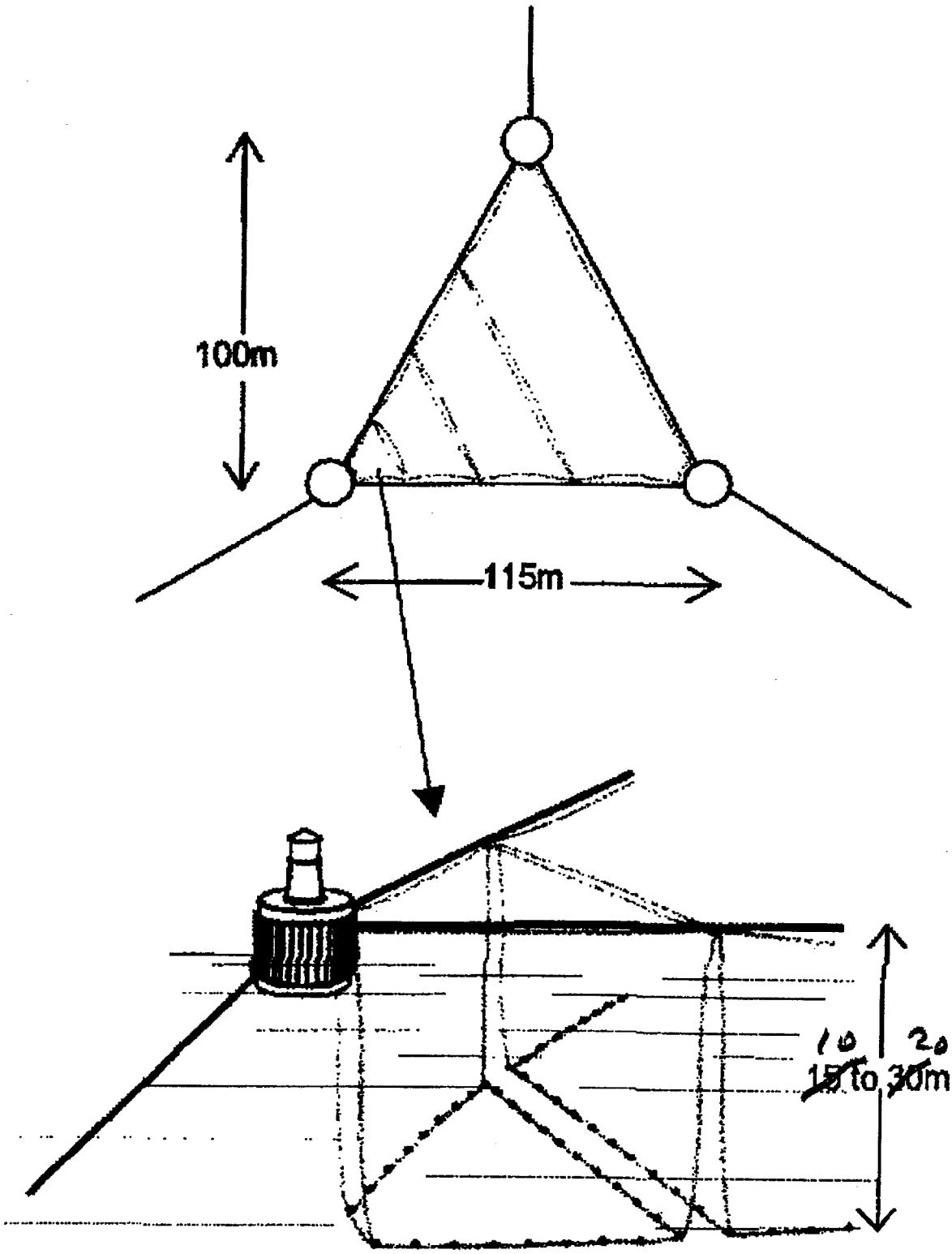


Fig. 15

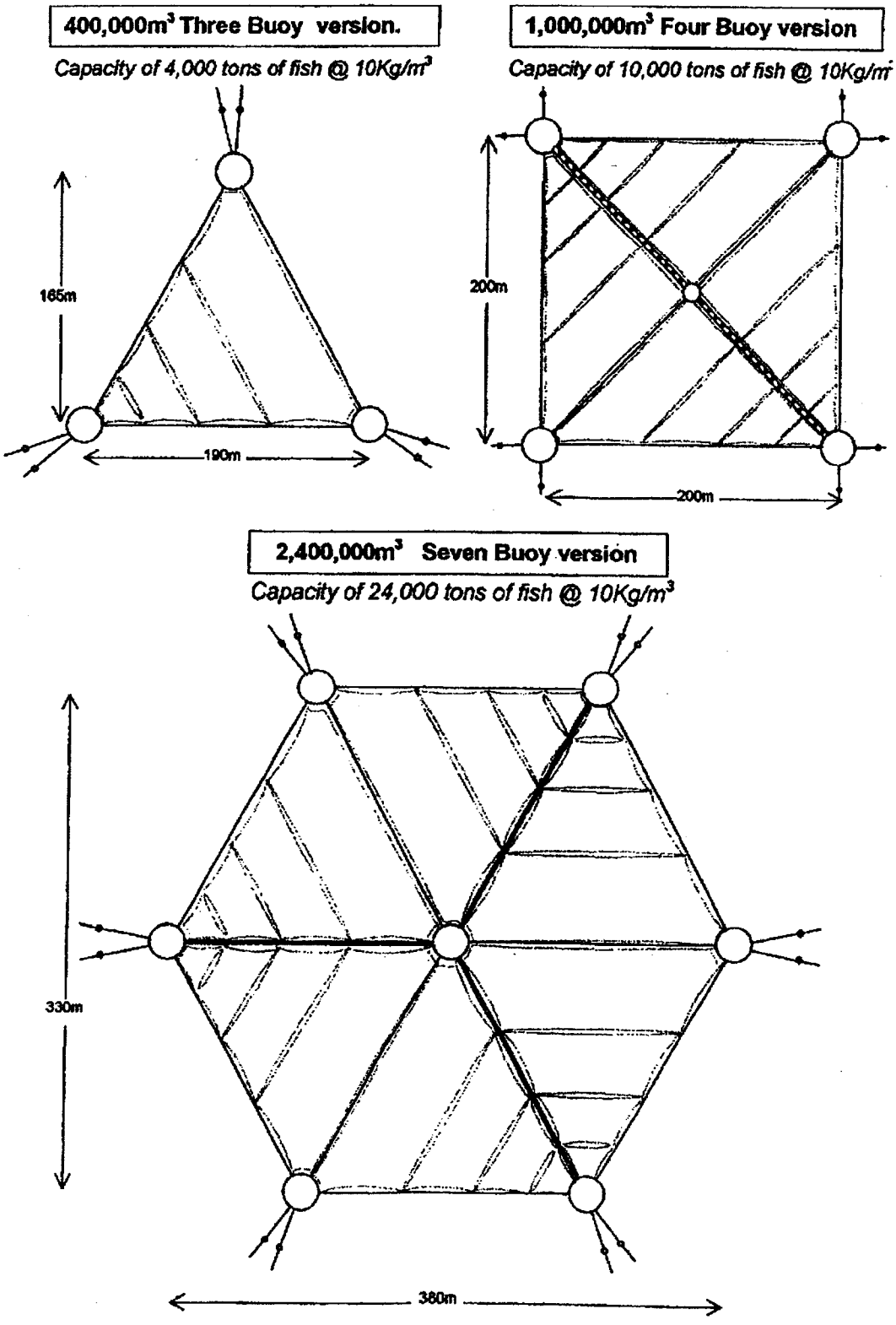

400,000m³ Three Buoy version.
Capacity of 4,000 tons of fish @ 10Kg/m³
165m
190m
1,000,000m³ Four Buoy version
Capacity of 10,000 tons of fish @ 10Kg/m
200m
200m
2,400,000m³ Seven Buoy version
Capacity of 24,000 tons of fish @ 10Kg/m³
330m
380m

Fig. 16

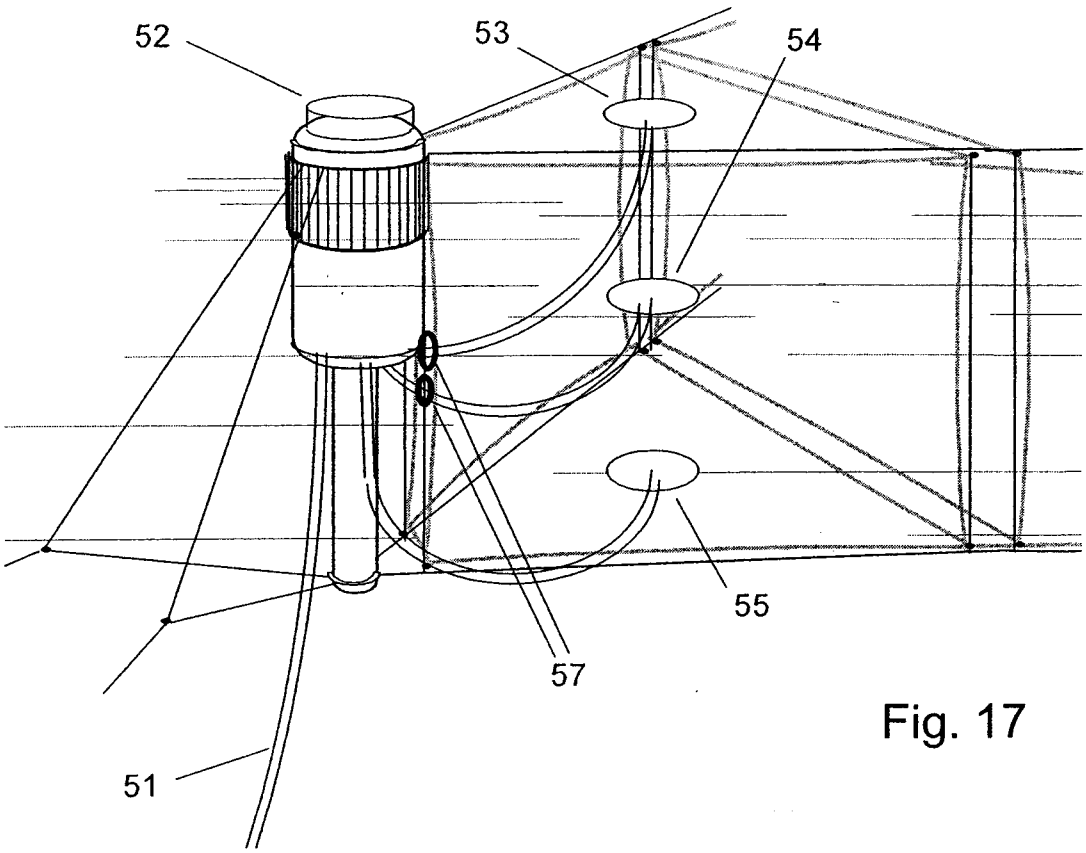


Fig. 17

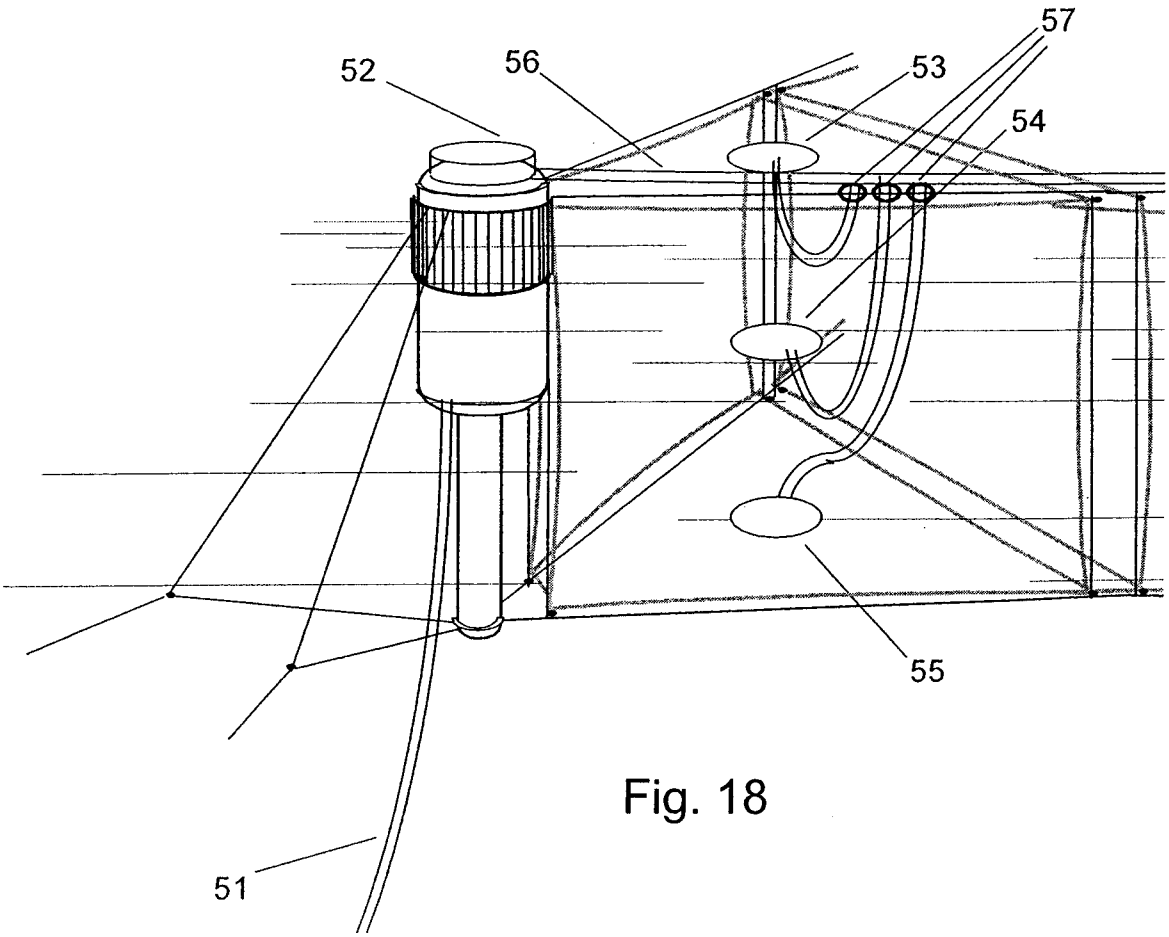


Fig. 18

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2007/050212

A. CLASSIFICATION OF SUBJECT MATTER
INV. A01K61/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A01K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2004/016079 A (MARIS TDM LTD [GB]; AYLING LAURENCE JOHN [GB]) 26 February 2004 (2004-02-26) cited in the application page 5, line 9 - page 6, line 8 page 12, line 7 - page 13, line 28 page 16, line 28 - page 17, line 6 page 19, lines 1-8 page 19, line 17 - page 20, line 5 figures 2-5,17,23a,23b,27,27a	1-7, 9-11,13
X	EP 0 393 276 A1 (NOR EASTERN TRAWL SYSTEMS INC [US] OCEAN SPAR TECHNOLOGIES LLC [US]) 24 October 1990 (1990-10-24) column 2, line 1 - column 3, line 4 column 3, line 23 - column 4, line 21 column 5, lines 2-41 figure 1	1,2,5,7, 9,12,13

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 July 2007	07/08/2007

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Been, Mathieu

2

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2007/050212

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	"FISH FARMS ON THE HIGH SEAS" POPULAR MECHANICS, HEARST COMMUNICATIONS INC., NEW YORK, NY, US, vol. 172, no. 10, 1 October 1995 (1995-10-01), page 24, XP000532271 ISSN: 0032-4558 the whole document	1,2,6,9
A	WO 2005/117573 A (MOTION DESIGN ASSOC INC [CA]; HARRISON JEFF [CA]; DOBSON PHIL [CA]; HO) 15 December 2005 (2005-12-15) page 7, lines 16-27 page 8, line 27 - page 9, line 32 page 10, line 26 - page 11, line 28 page 13, line 21 - page 15, line 15 figures 2,8,10	13-15

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 16

Claim 16 is unclear (Article 6 PCT) because it relies on references to the description and the drawings with regard to the technical features of the invention (see rule 6.2(a) PCT).

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2007/050212

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 16
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

see FURTHER INFORMATION sheet PCT/ISA/210

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/GB2007/050212

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2004016079 A	26-02-2004	AU 2003260721 A1	03-03-2004
		EP 1528855 A1	11-05-2005
EP 0393276 A1	24-10-1990	AT 130489 T	15-12-1995
		CA 1321514 C	24-08-1993
		DE 68924912 D1	04-01-1996
		DE 68924912 T2	18-04-1996
		ES 2080073 T3	01-02-1996
		GR 3018799 T3	30-04-1996
		JP 1969479 C	18-09-1995
		JP 2286024 A	26-11-1990
		JP 6097928 B	07-12-1994
		US 5007376 A	16-04-1991
WO 2005117573 A	15-12-2005	CA 2469601 A1	02-12-2005
		EP 1773116 A1	18-04-2007