I.O.S.

HANDLING OCEANOGRAPHIC EQUIPMENT NOTES AND SKETCHES FROM A NETMAN'S LOG

by
R. G. (Dick) BURT

REPORT NO. 84

June 1979

INSTITUTE OF OCEANOGRAPHIC SCIENCES

NATURAL ENVIRONMENT RESEARCH COUNCIL

INSTITUTE OF OCEANOGRAPHIC SCIENCES

Wormley, Godalming,
Surrey, GU8 5UB.
(0428 - 79 - 4141)

(Director: Dr. A.S. Laughton)

Bidston Observatory,
Birkenhead,
Merseyside, L43 7RA.
(051 - 653 - 8633)

(Assistant Director: Dr. D.E. Cartwright)

Crossway,
Taunton,
Somerset, TA1 2DW.
(0823 - 86211)

(Assistant Director: M.J. Tucker

On citing this report in a bibliography the reference should be followed by the words UNPUBLISHED MANUSCRIPT.

INSTITUTE OF OCEANOGRAPHIC SCIENCES

HANDLING OCEANOGRAPHIC EQUIPMENT
NOTES AND SKETCHES FROM
A NETMAN'S LOG

by

R.G.(Dick) BURT

REPORT NO. 84

June 1979

Institute of Oceanographic Sciences,
Wormley,
Godalming,
Surrey GU8 5UB

CONTENTS

Foreword	PAGE
The gravity bomb corer	1
Sonar buoy	2
Seismic buoy	3
Deep water Dhan buoy	4
Piston corer	5
Gravity corer	6
Precision echo sounder	7
Deep water double Dhan	8
Small marker buoy	9
Precision echo sounder	10
Streamlined buoy	11
Carbon 14	12
Thumper boat	13
Underwater T.V. cameras	14
Pitch and roll buoys	15
Kelvin Hughes current meter No. 1	16
Current meter array for fast surface currents	17
Cloverleaf buoy	18
Neuston net	19
Pressure unit 1	20
Pressure unit 2	21
Rock dredge	22
Pitch and roll buoy	23
I.K. midwater trawl	24
Conical dredge	25

	PAGE
Tide frames	26
Thumper unit	27
Grabs	28
N.70 F.V. net	29
N.50 V net	30
The Engel trawl	31
Pop up net	32
I.K. midwater trawl cod end	33
Indian Ocean standard net	34
I.O.S.N. rigged for closing on the Levit principle	35
Pop up buoy	36
2 mm wire for mooring buoys	37
Temperature probe	38
Decca Seafix buoys	39
Large sonar buoys	40
Air gun	41
Pop up corer (boomerang)	42
Grapnels	43
R.M.T.8. Mk 1	44
R.M.T. combination net	45
Current frames	46
M.B.A. dredge	47
Bottom net I.O.S.	48
Spar buoy	49
Pop up buoy (P.U.B.S.) sphere	50
Tide float using a parachute	51
Pop up current float	52

	PAGE
Spar buoy	53
Longhurst net	54
Towed camera	55
Transponder buoy	56
Air gun array	57
Hydrographic lay	58
Hydrophones and magnetometers	59
Bottom net (opening and closing)	60
General information	61-62

Foreword

Reginald George Burt (Dick) joined the Royal Navy as a boy seaman in 1935, and left the Service in 1950. He joined the R.R.S. Discovery II, which was preparing for a voyage to the Southern Ocean, in April 1950, as an Able Seaman. During the voyage he was promoted to Boatswain's Mate and soon after the vessel's return to the United Kingdom was invited by the National Institute of Oceanography to become Netman.

The position of Netman had been a key one in the history of the Discovery Investigations. The post was held by a Senior Petty Officer who was responsible for the making, maintenance and repair of nets and other scientific collecting gear. The Netman was also in a large part responsible for the practical methods of using and handling overside gear.

From the mid 1950s onwards much more gear came to be tried and used and the scale and complexity of overside operations greatly increased the Netman's responsibilities. Some of the gear used during the 1950s and early 1960s was of a 'one off' nature and was often used for one experiment on a single cruise, some gear reappeared year after year modified in the light of experience until a degree of finality in design was achieved.

During the period that Mr Burt has been Netman he has kept a detailed note and sketch log of the equipment used from Discovery II and Discovery. This log contains notes and drawings of his own particular contributions, improvements making for quicker and easier operation of gear, and notes on new equipment for which he saw a need.

Mr Burt was awarded the British Empire Medal in 1970 in recognition of his services to oceanography. This report is a reproduction of his notes and sketches, the latter redrawn by Mr Burt for the purposes of black and white reproduction since most of the original sketches were in colour.

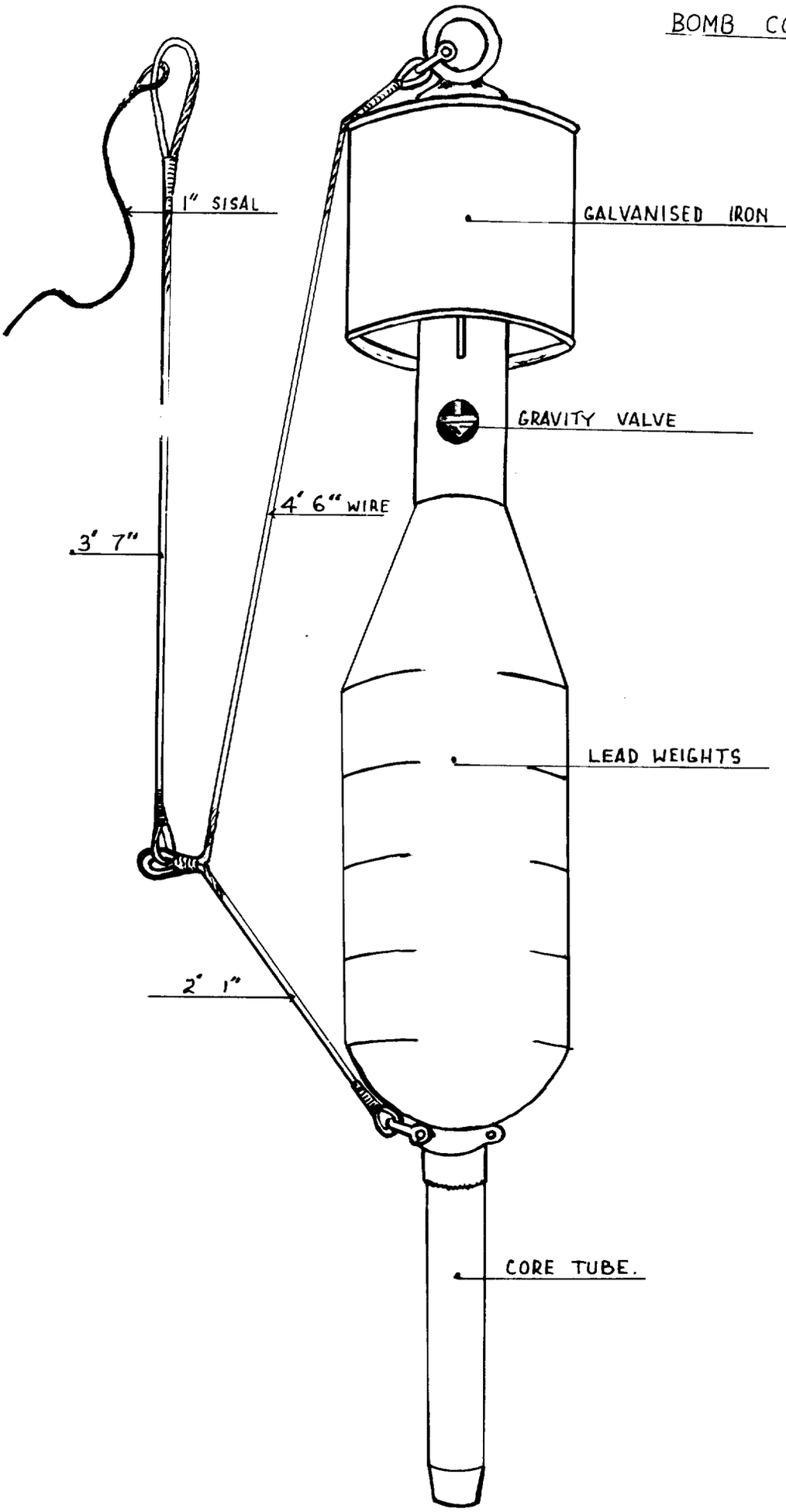
A.E.F., November 1976.

THE GRAVITY BOMB CORER

This was used on the 'Discovery II' over the starboard quarter gallows. Its weight is about 5 cwt, lifted in and out by a small tackle on the smaller of the two derricks. The corer is lowered until it is within 15 metres of the bottom. The main winch is then disconnected from its drive, and the corer run into the bottom under its own weight. When the main warp is seen to go slack (an indication of the corer striking bottom) the brakes are applied to the winch drum. The main winch is then connected to the drive, and hauled slowly for about 200 metres, or until the corer is judged to have left the bottom, then hauled in at medium speed. The corer is stopped when it is within a hand's reach of the gallows. The one inch sisal tail is untied, and the lifting sling hooked to the block of the tackle.

The whole is lifted inboard in a horizontal plane and placed in a crutch shaped to take the corer body on the deck. The core is extracted by pushing a rod through the tube with a plug attached to its end the same internal diameter as the tube. The core is pushed out onto a sheet of tarred brown paper. It is then wrapped up and sealed to prevent contamination for inspection at a later date. The corer is then hosed down, fitted with new jaws and is then ready for the next operation.

BOMB CORER.


1" SISAL
GALVANISED IRON BODY
GRAVITY VALVE
4' 6" WIRE
3' 7"
LEAD WEIGHTS
2' 1"
CORE TUBE.

SONAR BUOY

This is used exactly the same as for a deep-water buoy, but a little more care is exercised as the buoy contains electrical equipment. The piano wire is laid up into the one inch sisal rope, shackled to the anchor weight and lifted over the side. It is then paid out over a metre sheave under the control of the piano wire drum brake.

When the weight has reached the bottom, the piano wire is 'stoppered off' with a clamp stopper. The inboard end of it is then laid up into the second piece of one inch sisal rope, attached to the (AP8717) floats. The buoy is then placed in the water and cast off.

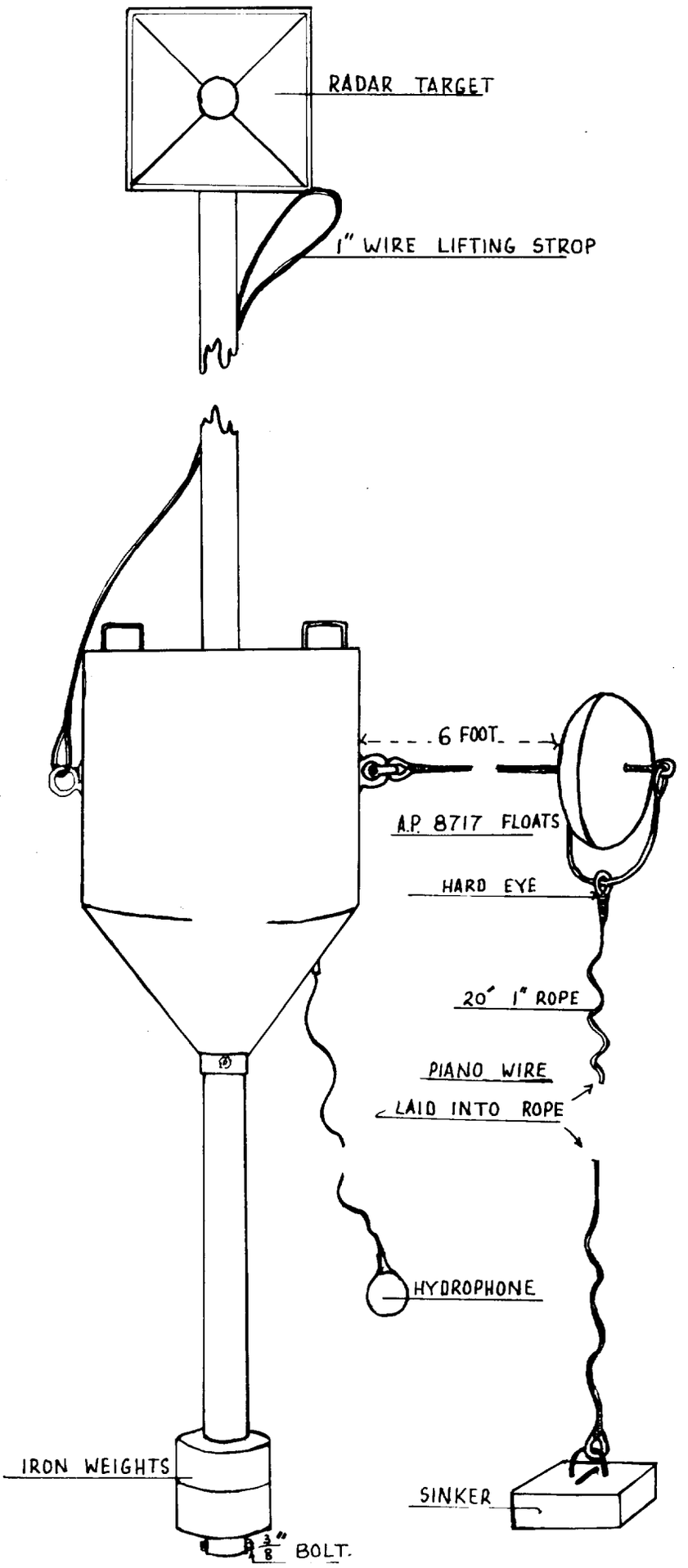
The method of laying the piano wire into the rope:- open the lay of the rope by twisting against the lay, place the piano wire into the lay and lay up the rope again. Make sure that the wire jumps one or two strands now and again, otherwise it will pull tight into the heart of the rope and slip out. Do this for about 20 feet. Put a very tight stop at about one foot intervals or so with nettle stuff using a constrictor knot.

When recovering the buoy, take the lifting strop attached to the pole of the buoy, to the end of the 'whip' or tackle, and lift until clear of the water. Once the hydrophone cable can be reached by hand, take it and haul in until it is clear and on deck.

Carry on lifting the buoy until the piano wire mooring is within reach (this may take two lifts). Cut the piano wire and discard the mooring.

Secure the buoy on deck in a vertical position (because of battery acid) making sure there is room to lift the electronics from it.

SONAR BUOY


RADAR TARGET
1" WIRE LIFTING STROP
6 FOOT
A.P. 8717 FLOATS
HARD EYE
20' 1" ROPE
PIANO WIRE
LAID INTO ROPE
HYDROPHONE
IRON WEIGHTS
SINKER
3/8" BOLT.

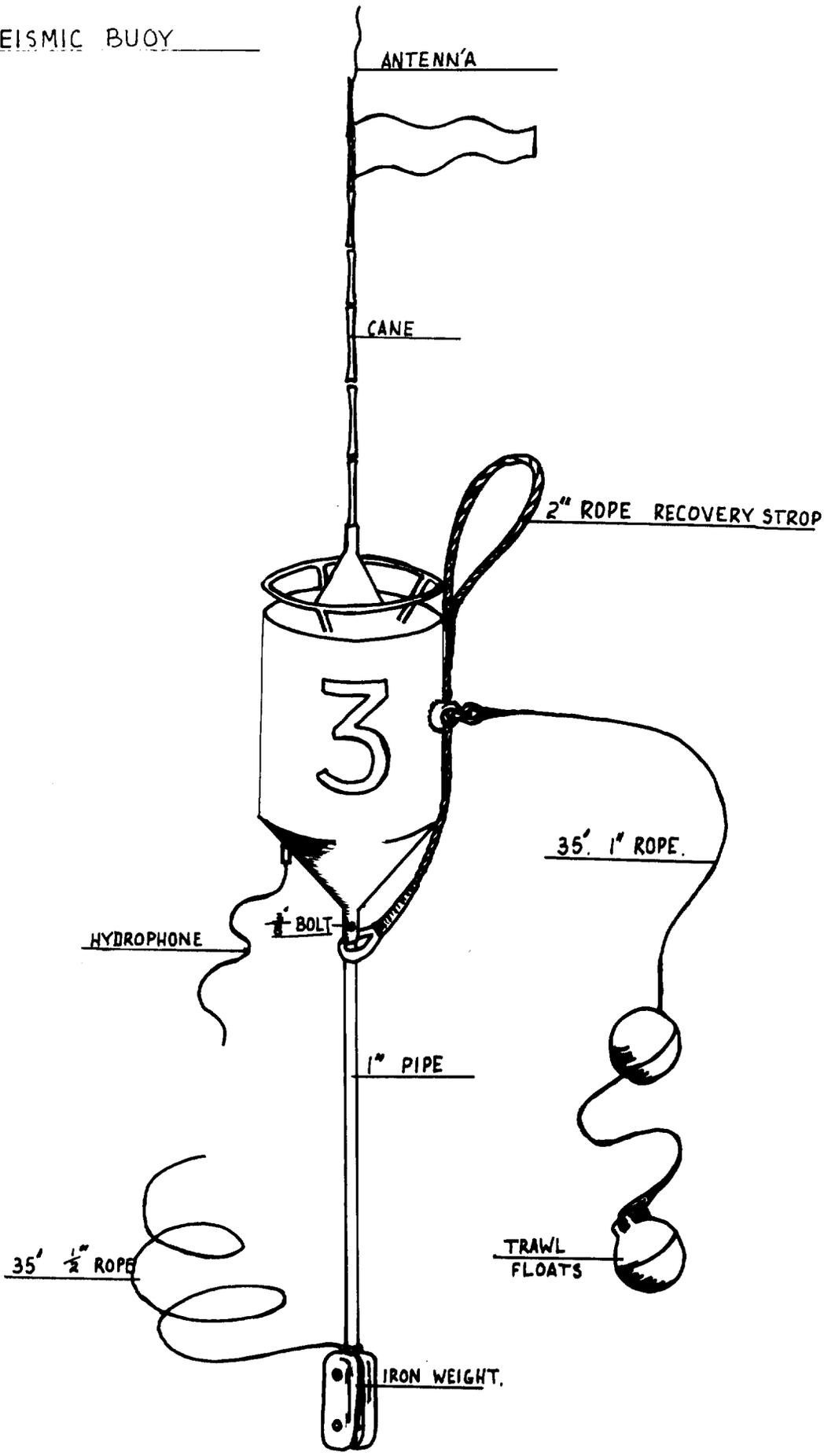
SEISMIC BUOY

This is a special buoy used for seismic refraction work, weight about 20 lbs. They are dropped over the stern (four or six at a time) at about half mile intervals with the ship doing about half a knot forward speed.

There is a one inch sisal rope 35 feet long, with two trawl floats attached to aid in recovery. This line is picked up by a small grapnel; the buoy is then hauled on board by hand with the aid of another 35 foot line attached to the weights at the bottom of the pole. The ship is stopped for this operation. The hydrophone cables are quite long (150 feet) so there is a danger of them getting round the screw if underway.

When launching, the hydrophone is first put over the side, followed by the cable. Once the cable is within 30 feet of the buoy, it is held by hand until the buoy is placed in the water. A test is then carried out to ensure that the buoy is switched on and that it is working. The hydrophone is then released, and the shock of its weight coming on to the buoy is dampened out by the buoy being in the water. The buoy is then paid out with the aid of the picking up rope until all is neatly in line and nothing is seen to be fouled up. It is then released, the bridge is informed of its release (to mark the chart position), and speed is put up to two knots to the next half mile position. When returning to pick them up (after 12-24 hours) they are more easily seen from near sea level with a pair of binoculars, the cane and flag standing out against the sky background.

SEISMIC BUOY

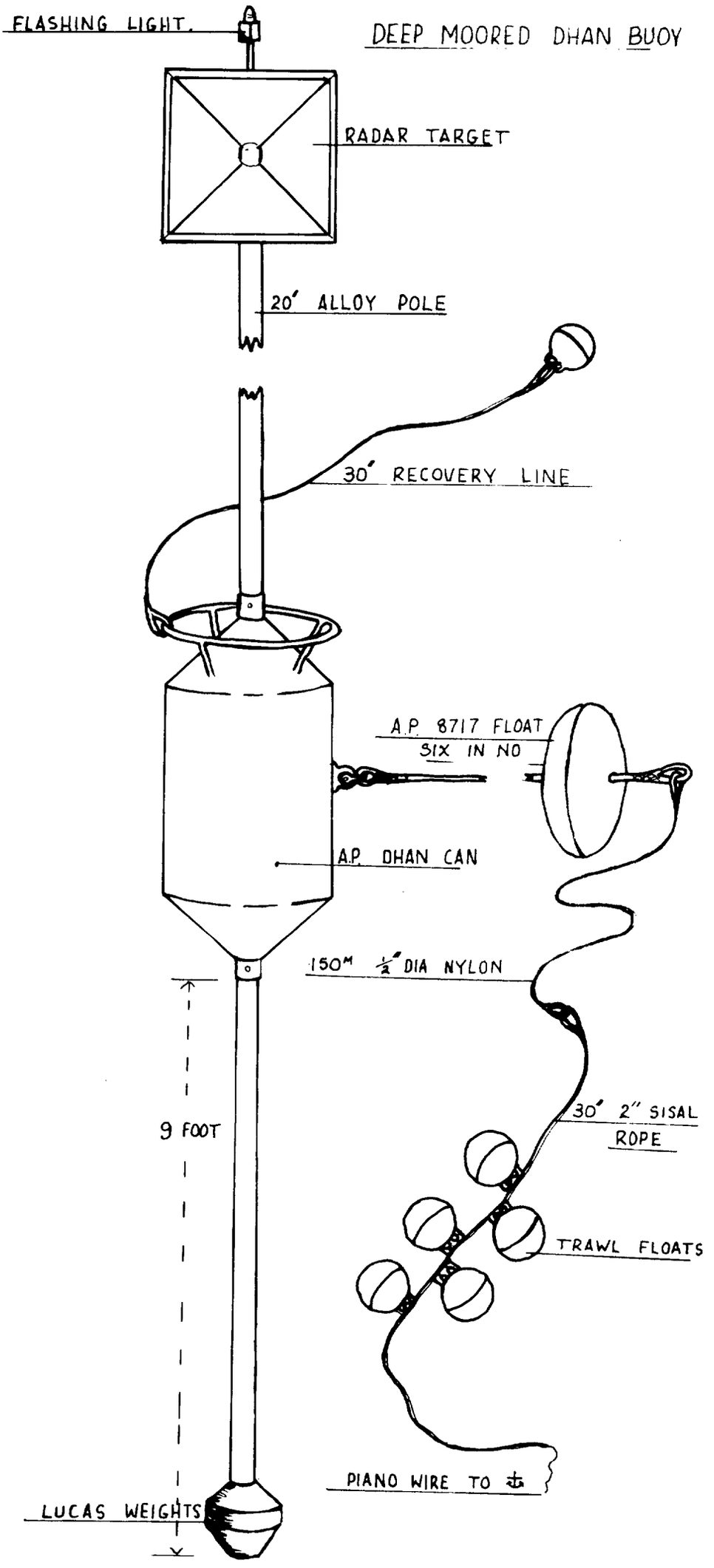


DEEP WATER DHAN BUOY

This is an 'Admiralty Pattern Buoy' with an 80 lb concrete sinker for mooring. There is a 30 foot length of 2 inch sisal rope each end to lay the piano wire into. The sinker is lowered over a metre wheel on piano wire under the control of the brake drum until it is within 50 metres of the bottom. The wire is then stoppered off with a clamp stopper, cut and laid up into the 30 feet of 2 inch sisal. Stops are put at intervals of about one foot, using nettle stuff with a constrictor knot.

There are a number of 'deep' trawl floats attached to the 30 foot sisal. The number of floats is dependent on the depth of water and weight of piano wire out. The 30 foot sisal rope is then shackled to a 150 metre length of $\frac{1}{2}$ inch diameter nylon cord. The weight of the mooring is then taken by hand with the 2 inch rope (about four able-bodied men can handle it), the mooring is then paid out by hand until the sinker is on the bottom (the weight will come off the rope indicating this).

The 150 metres of nylon is then attached to the six (AP8717) floats and the floats to the buoy. The whole is then cast off. To recover, pick up the 30 foot recovery line, hook the buoy can to a 'whip' or tackle, haul in until all the nylon cord and floats have been recovered. Cut piano wire and abandon mooring. Switch off battery operated flashing light and stow away all gear.


FLASHING LIGHT.
DEEP MOORED DHAN BUOY
RADAR TARGET
20' ALLOY POLE
30' RECOVERY LINE
A.P. 8717 FLOAT
SIX IN NO
A.P. DHAN CAN
150M ½" DIA NYLON
9 FOOT
30' 2" SISAL
ROPE
TRAWL FLOATS
PIANO WIRE TO
LUCAS WEIGHTS

PISTON CORER

The corer is much the same as the one on page 1. It has a 45 feet free fall actuated by a trigger weight. There is a piston pump arrangement on the inside of the core tube, which comes into operation once the corer has fallen the 45 feet. There is a strong rope stop (sail twine or roping twine) at the top of the corer to stop the piston wire pulling up before the corer has reached the bottom. A long soft eye is needed in the end of the piston wire to enable the main warp to be shackled into it on recovery at the surface.

The corer is slung and lifted horizontally from the gallows head and placed on deck in a special shaped crutch. The coring tubes are disassembled and the core removed and stored. The corer is then washed down with a deck hose and assembled ready for the next operation.

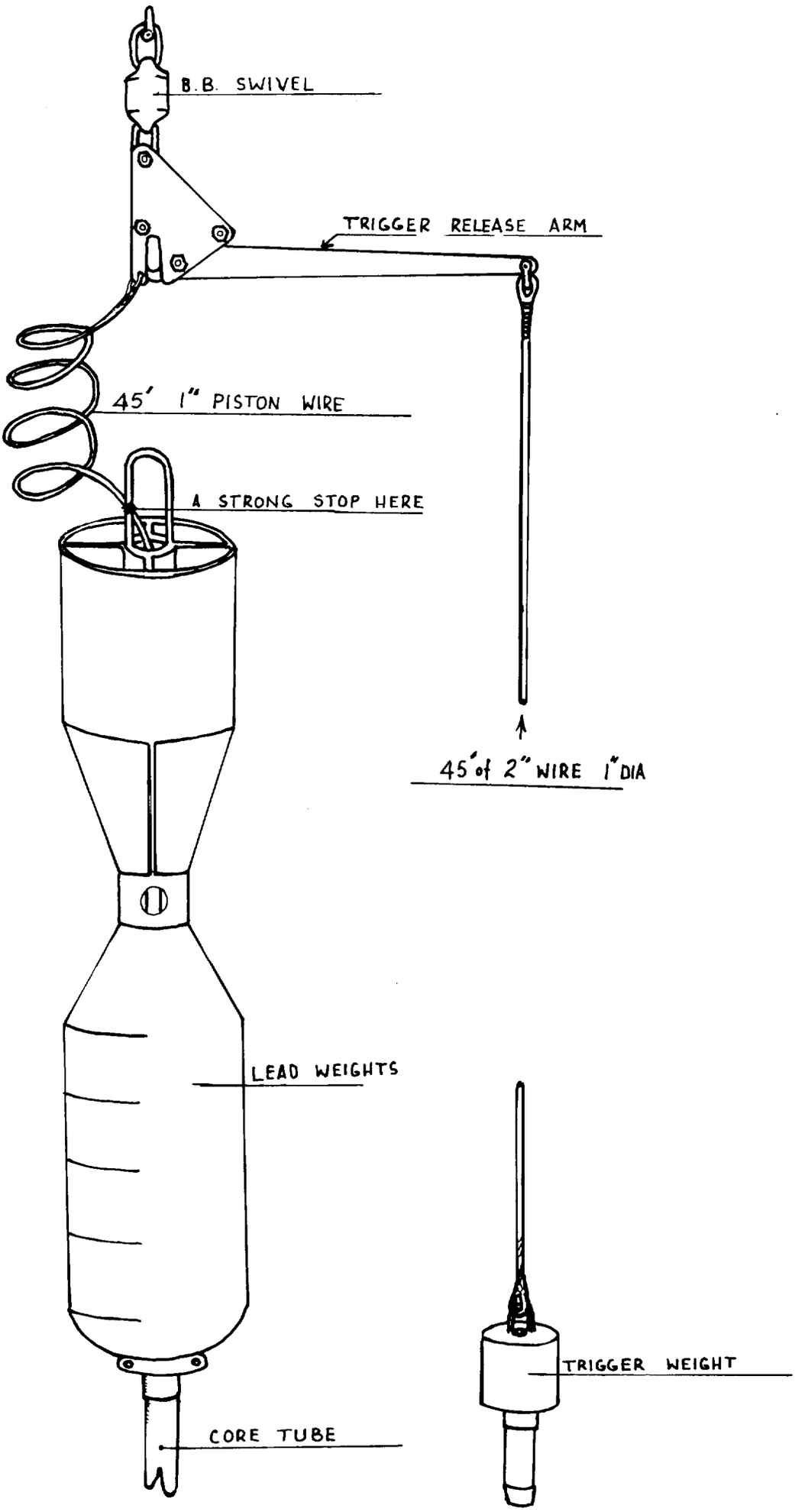
The trigger release mechanism is also used for Sir Edward Bullard's temperature probe.

Note: A free fall must not be used with this rig, otherwise it will fire before the corer hits the bottom and snap the piston wire, resulting in the loss of the corer (this has happened).

A phosphor bronze piston wire, and stainless steel tube with a compass wire is also used on this rig.

Length of p.b. piston wire	37 feet
Length of trigger arm wire	38 feet
Length of compass wire	15 feet

TRIGGERED CORER



GRAVITY CORER

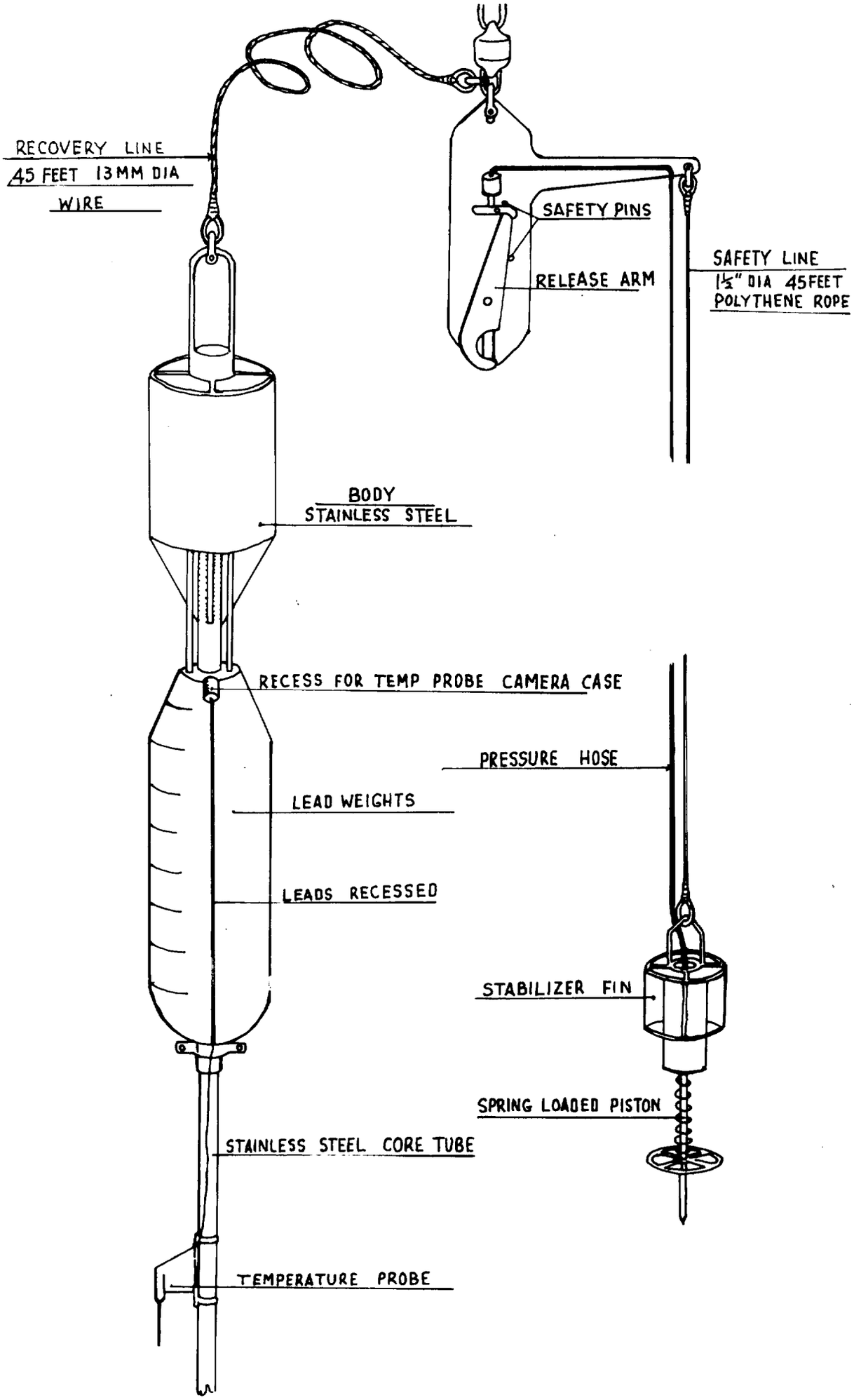
This stainless steel corer and temperature probe is very similar to the other corers. It is rigged the same way as the piston corer with the exception of the piston wire being replaced with a recovery wire. The recovery wire is pushed down into the fins of the corer in an orderly manner so that it does not become entangled with itself, and also to prevent it from becoming fouled on shackles and pins on the way down. There are two safety pins to be removed before sending the corer down and after it has been hung over the ship's side.

The trigger release works when the spring loaded piston touches the sea bed. It pushes a piston up compressing the water in the chamber, this pressure is then transmitted up the hose pipe to the chamber on the trigger arm. This moves a pin down depressing the trigger, allowing the release arm to fall away. The corer free falls to the bottom under its own weight.

There is a flap valve at the bottom of the core tube to keep the core in when the corer is withdrawn from the sediment. There is another safety device incorporated into the release arm. It is a pressure operated pin, which works at a predetermined depth. This is to stop premature releasing of the corer.

A pinger is attached to the main warp 200 metres above the corer, which gives the distance of the corer from the bottom.

HYDRAULIC TRIGGERED CORER

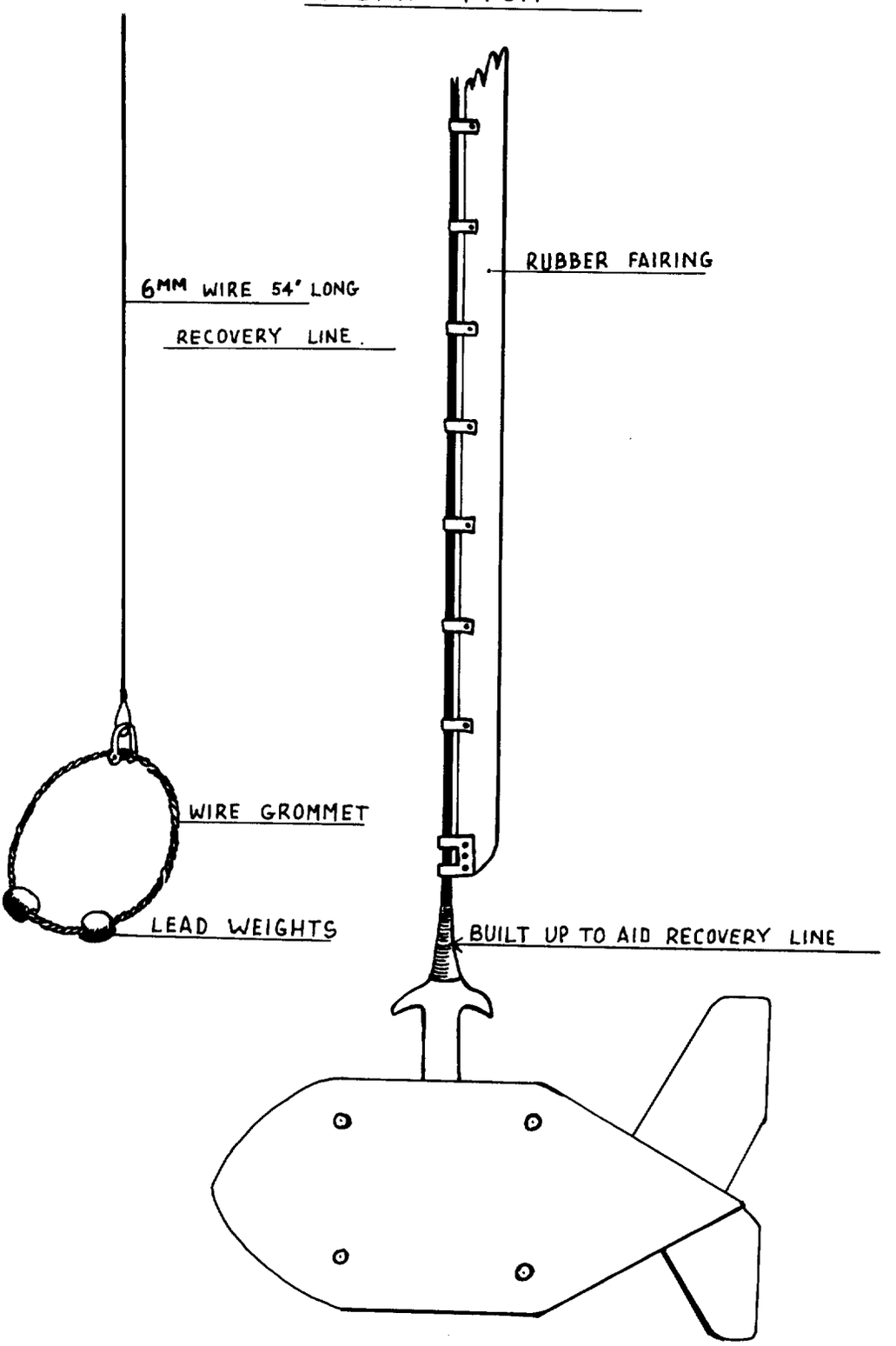


PRECISION ECHO SOUNDER

This is lowered over the starboard side on a 6 mm wire, tailed with a 3 inch sisal rope. A wire grommet is hooked over one of the lugs on the P.E.S. gunmetal moulding. The fish is hoisted out on this wire and lowered over the side of the ship, until its weight is taken up on its own electric towing cable. The grommet is then shaken free from the hook and slid back up the faired cable clear of the water and secured. The fish is then ready for towing. It is lowered to the full extent of its towing cable and shackled on to the boom used for towing it.

To recover the P.E.S. a wire grommet (the one used to lower it) is slid down the faired cable. The grommet has two small lead weights attached to one side of it to influence it under the lugs of the fish. Care must be taken to ensure the grommet has caught under the lugs and not under the end of the fairing on the cable. This can be done by feel (the grommet hooked under the lugs has a metallic 'clunk' to it whereas under the rubber fairing it is 'squishy'). When the grommet is felt to be in place, it is tailed by the 3 inch rope taken to the forecastle head windlass drum end, and the fish heaved up to the boom end. The fish is brought inboard by block and tackle and secured in the scuppers.

P.D.R. FISH


6MM WIRE 54' LONG
RECOVERY LINE.
RUBBER FAIRING
WIRE GROMMET
LEAD WEIGHTS
BUILT UP TO AID RECOVERY LINE

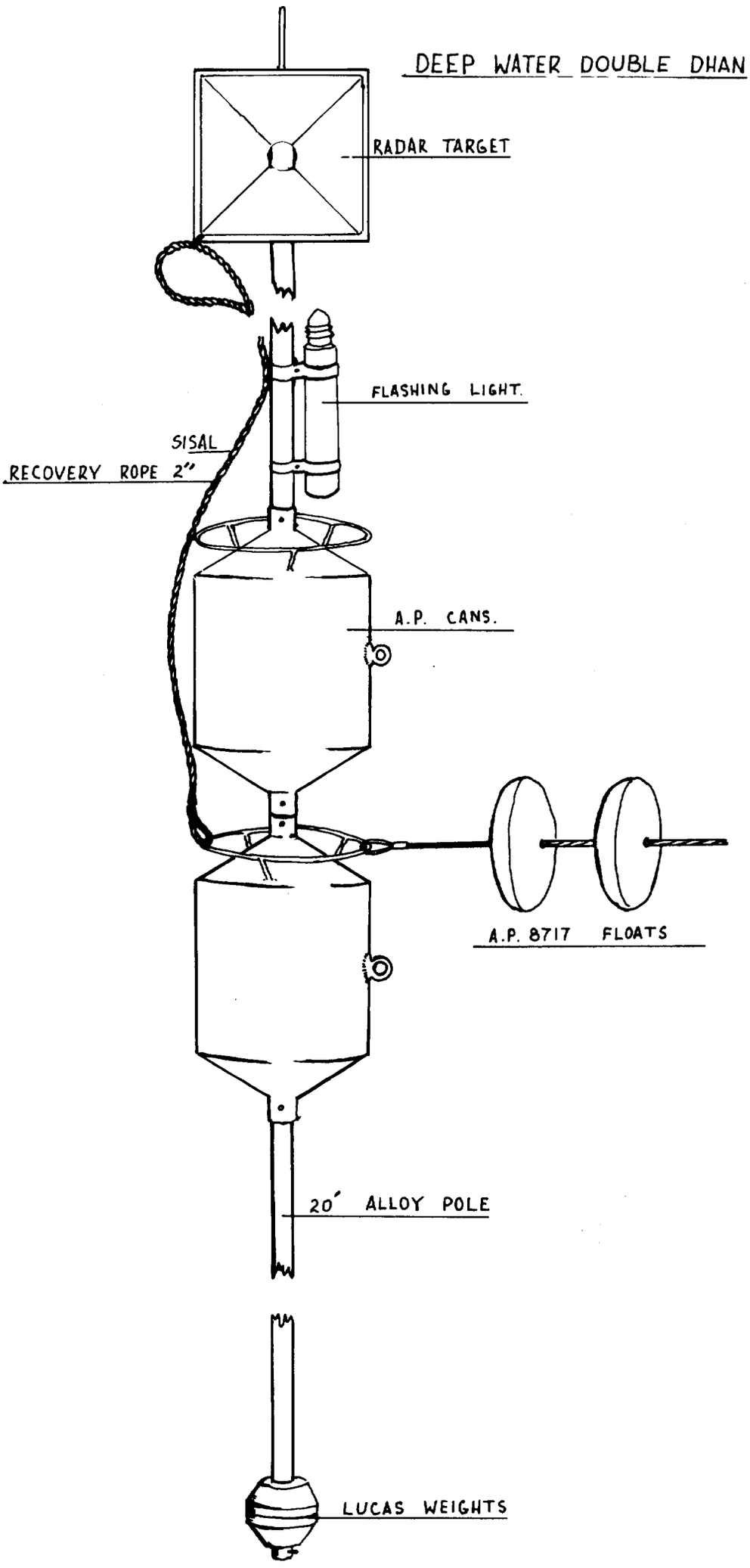
DEEP WATER DOUBLE DHAN

This is a straightforward moored buoy with 2 mm wire for mooring cable. An anchor of 200 lbs is slung over the ship side via the metre wheel. The anchor is attached by 4 mm wire with a soft eye at the end for the 2 mm wire to be tied with a double sheet bend and two half hitches. The anchor is then lowered until it reaches the bottom (indicated by reduced tension in the mooring wire) and also by depth sounding on the P.E.S. fish. More than 10% of the actual depth is usually allowed for rise and fall and yawing in bad weather. The 2 mm wire mooring is then stoppered off with a clamp stopper (Discovery type stopper) and cut, tied to the end of the wire coming from the (AP8717) floats of the buoy, with a double sheet bend and two half hitches.

The stopper is then removed and the buoy lowered into the water and cast off by its picking up rope or recovery rope. The double buoy part is for floating heavy equipment such as flashing lights, radar targets, and transponders.

To recover the 35 foot recovery rope is hooked on to the crane and the buoy is lifted inboard until the mooring is within reach (this may take two lifts). The 2 mm wire is cut and the mooring abandoned.

The buoy is secured and lights switched off.


DEEP WATER DOUBLE DHAN
RADAR TARGET
FLASHING LIGHT.
SISAL
RECOVERY ROPE 2"
A.P. CANS.
A.P. 8717 FLOATS
20' ALLOY POLE
LUCAS WEIGHTS

SMALL MARKER BUOY

Small marker buoys are very often required for measuring surface currents, for buoying some small piece of equipment, or marking a patch of drifting plankton etc. A very rough and ready but just as effective one can be made from a piece of expanded polystyrene lashed to a pole with a piece of rag tied to the top.

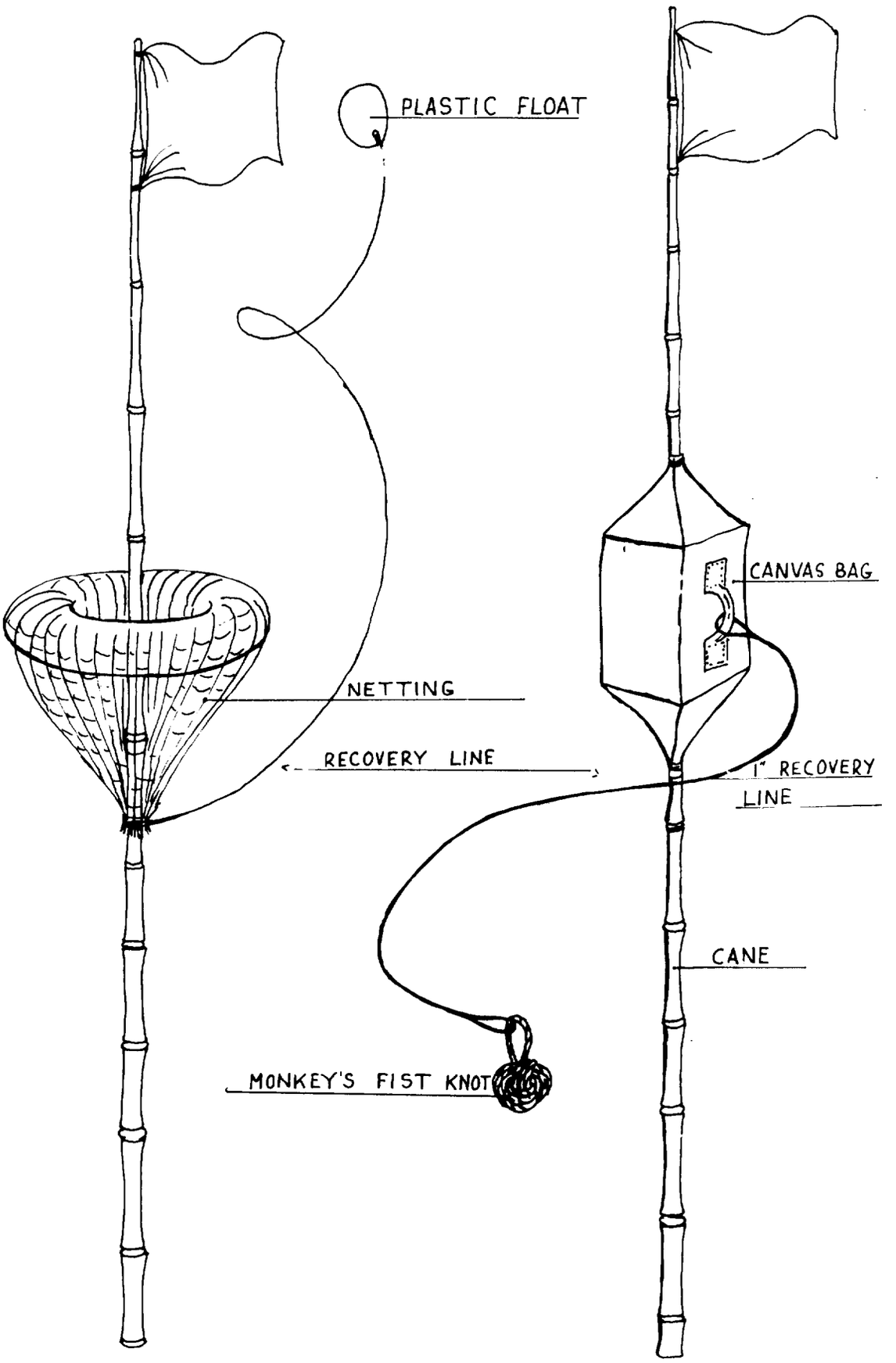
A more seamanlike job however is a canvas bag made to the shape of a buoy (round or square) and filled with chips of polystyrene. The bag, which is about 2 foot long and 1 foot in diameter, has a great amount of buoyancy.

A lorry or car inner tube can also be used wrapped in an old piece of netting, tied in the middle to a cane.

A 20 foot polythene rope is attached for recovery, with a trawl float or plastic pellet at the end to stop the grapnel from sliding off the line.

A monkey's fist knot, or manrope knot, made from polythene 2" circumference rope, makes a good float at the end of a recovery line.

LIGHT MARKER BUOYS

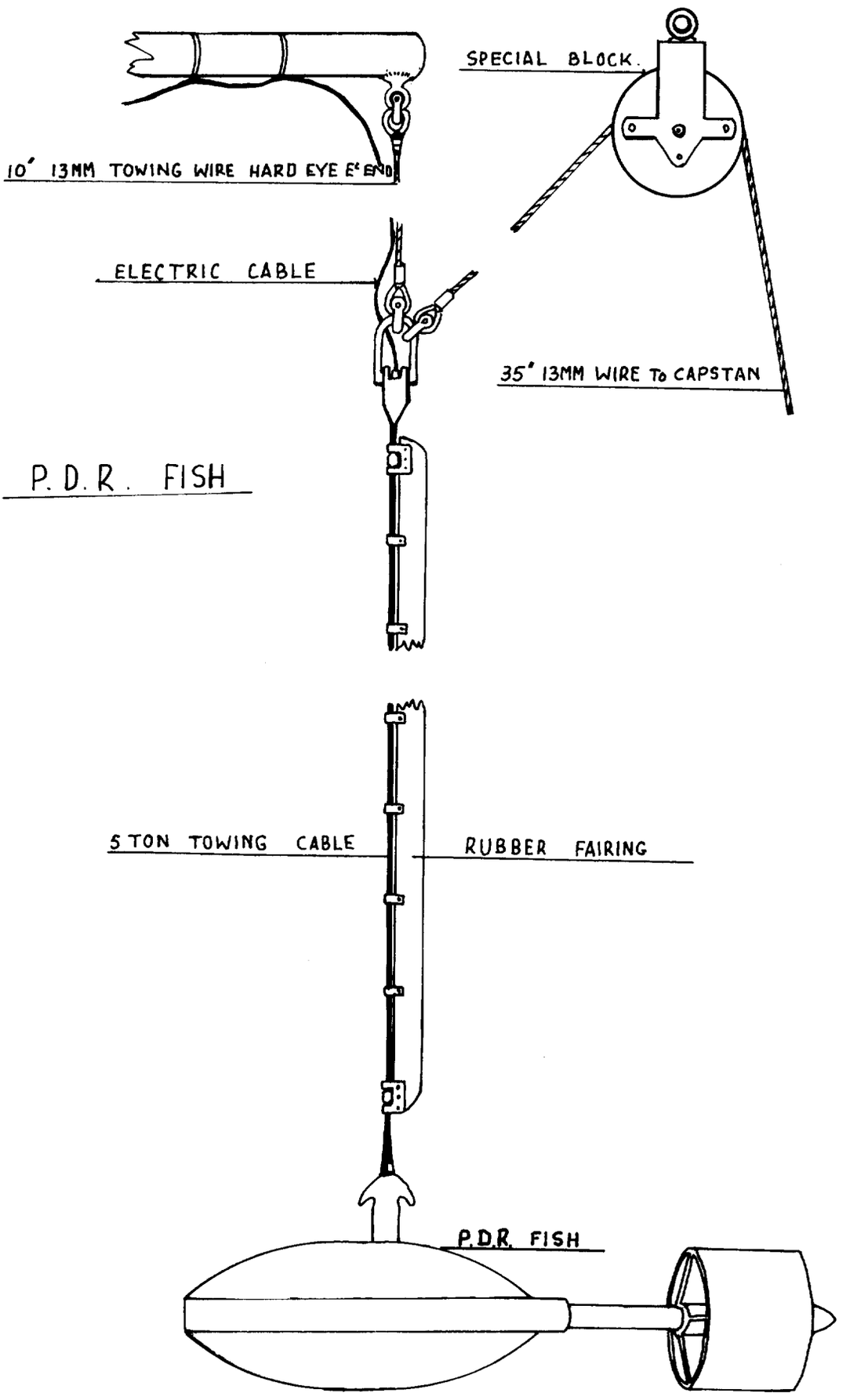


PRECISION ECHO SOUNDER

This is an improvement on the one mentioned on page 7. This is hoisted out and in by its own cable through a special block, tailed by a 3 inch nylon rope taken to the capstan or to its own winch. It is towed from its own boom on a 10 foot wire pendant with hard eyes at each end. All shackles used are moused with $\frac{1}{8}$" soft wire.

This rig can easily be hoisted by hand in the event of a power failure by half a dozen strong lads.

There are four small hydrophones of the same design used on 'Discovery' for current measuring. These are towed from port and starboard booms which are 93 feet apart fore and aft.


SPECIAL BLOCK.
10' 13MM TOWING WIRE HARD EYE E'END
ELECTRIC CABLE
35' 13MM WIRE To CAPSTAN
P. D. R. FISH
5 TON TOWING CABLE
RUBBER FAIRING
P.D.R. FISH

STREAMLINED BUOY

This is a fibreglass moulded streamlined buoy for use in strong currents. It is very narrow, so presents a small amount of resistance to currents.

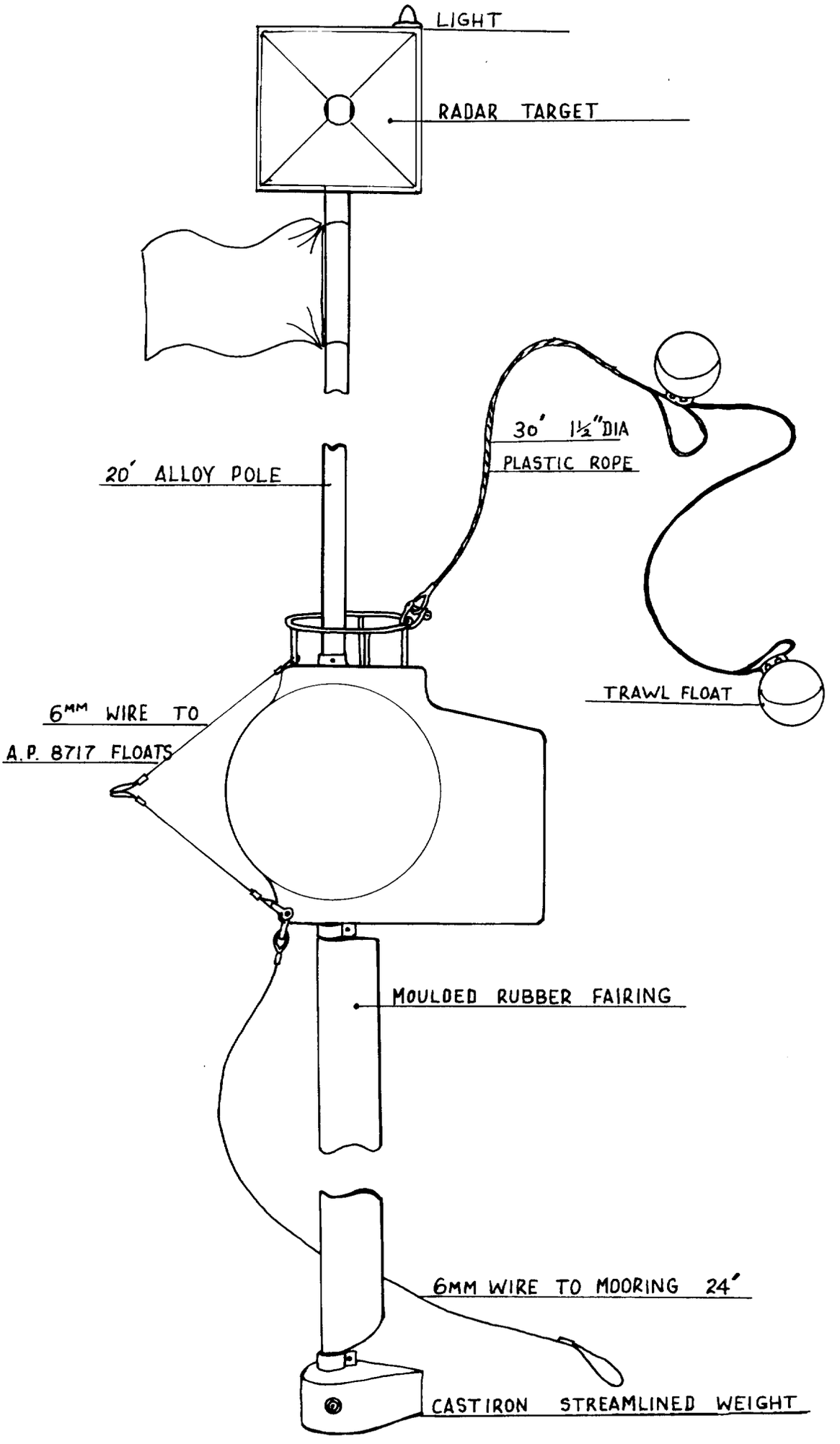
There is a streamlined rubber fairing for the bottom pole. It is moored exactly the same as the other 2 mm wire moored buoys, but is put over the ship's side on a slip hook by the crane.

Recovery is by the 30 foot $1\frac{1}{2}$" polythene rope on the crane (two lifts are required). It is sometimes used with (AP8717) floats on two 6 mm wire strops from top and bottom of the front end of the buoy.

There are two compartments in the buoy housing batteries for radar transponders and flashing lights.

Buoyancy is about 400 lbs. The buoy is filled with expanded polystyrene so if holed will not sink.

STREAMLINED BUOY FOR FAST CURRENTS



CARBON 14

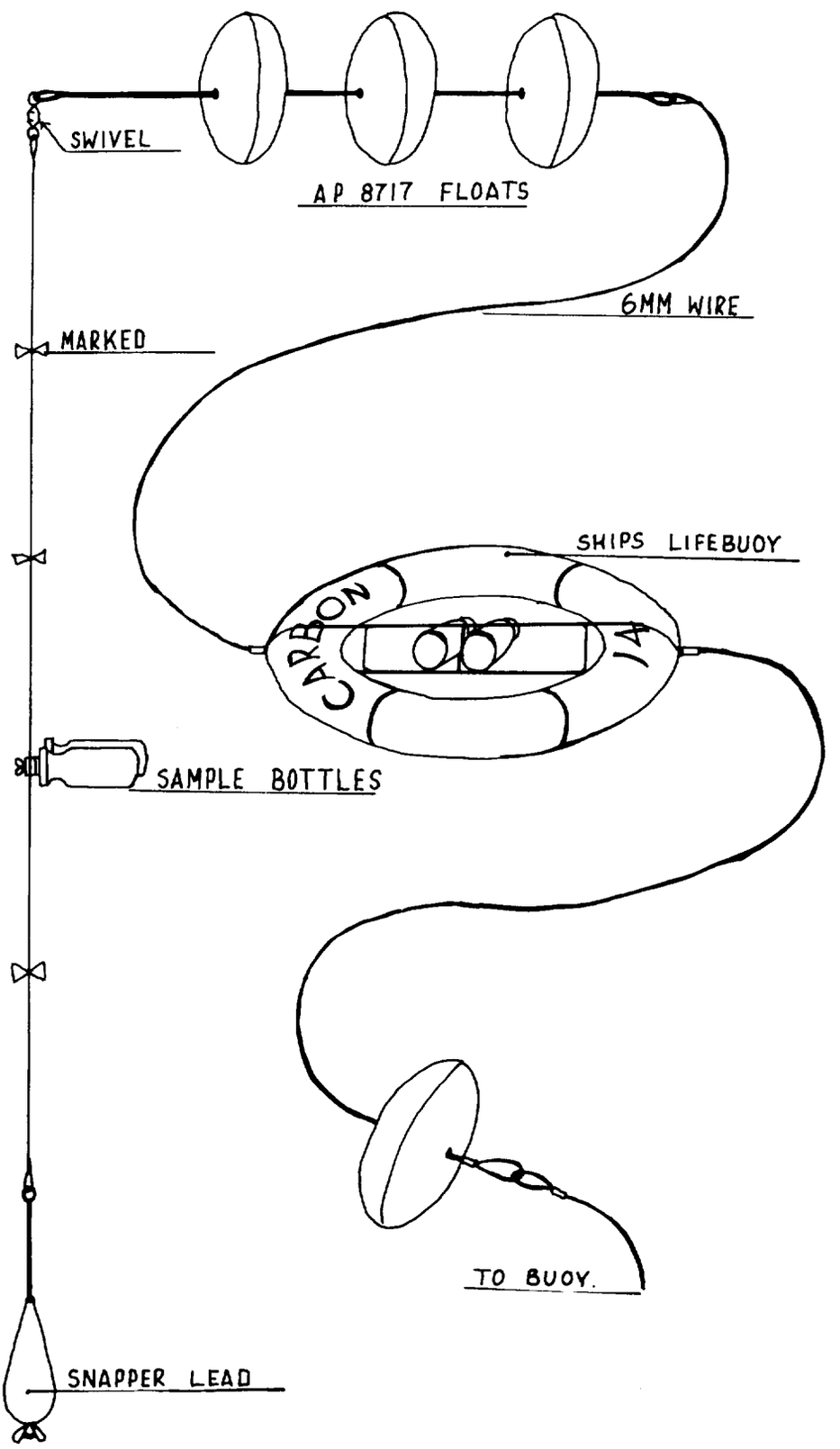
This consists of two lengths of 4 mm wire made up in lengths of 60 metres and 40 metres marked every 10 metres with pieces of cloth. A 20 lb snapper lead is used as a sinker. The wire is lowered over the side on a snatch block, and the sample bottles attached by a special clamp at their appropriate depths.

A surface sample is clamped between wires fixed to a surface life buoy (standard Board of Trade life buoy). The whole is then set adrift attached to a buoy with radar target to mark its position.

The samples are taken before sunrise at various depths, injected with a carbon 14 solution and put in sample bottles attached to the buoy wire at their correct depths. They are taken in again at sunset, and the amount of carbon 14 that has been absorbed by the phytoplankton in the sample is measured.

An orange dayglow flag is attached to the buoy for ease in plotting its position during the day.

CARBON 14


SWIVEL
AP 8717 FLOATS
6MM WIRE
MARKED
SHIPS LIFEBUOY
CARBON 14
SAMPLE BOTTLES
TO BUOY.
SNAPPER LEAD

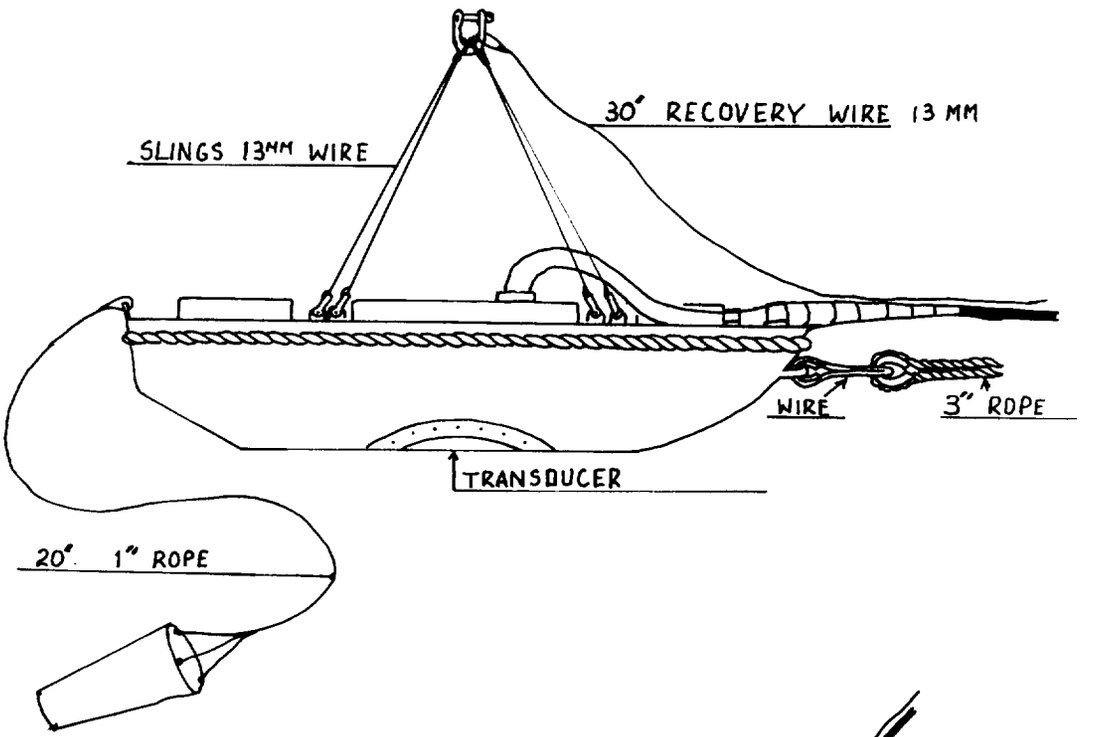
THUMPER BOAT

This is a fibreglass boat, with a built in electrical noise maker. The voltage is 4,000 volts so the power must be switched off before working on it. It is towed astern on a 6 inch circumference hawser with the electric cable lashed to it at intervals. There is a 13 mm lifting wire tied to this hawser used to lift the boat in and out. A small canvas drogue is used when towing to damp down the yawing. The electric cable should be slack when stopping it to the 6 inch towing hawser otherwise it will take the strain of the tow.

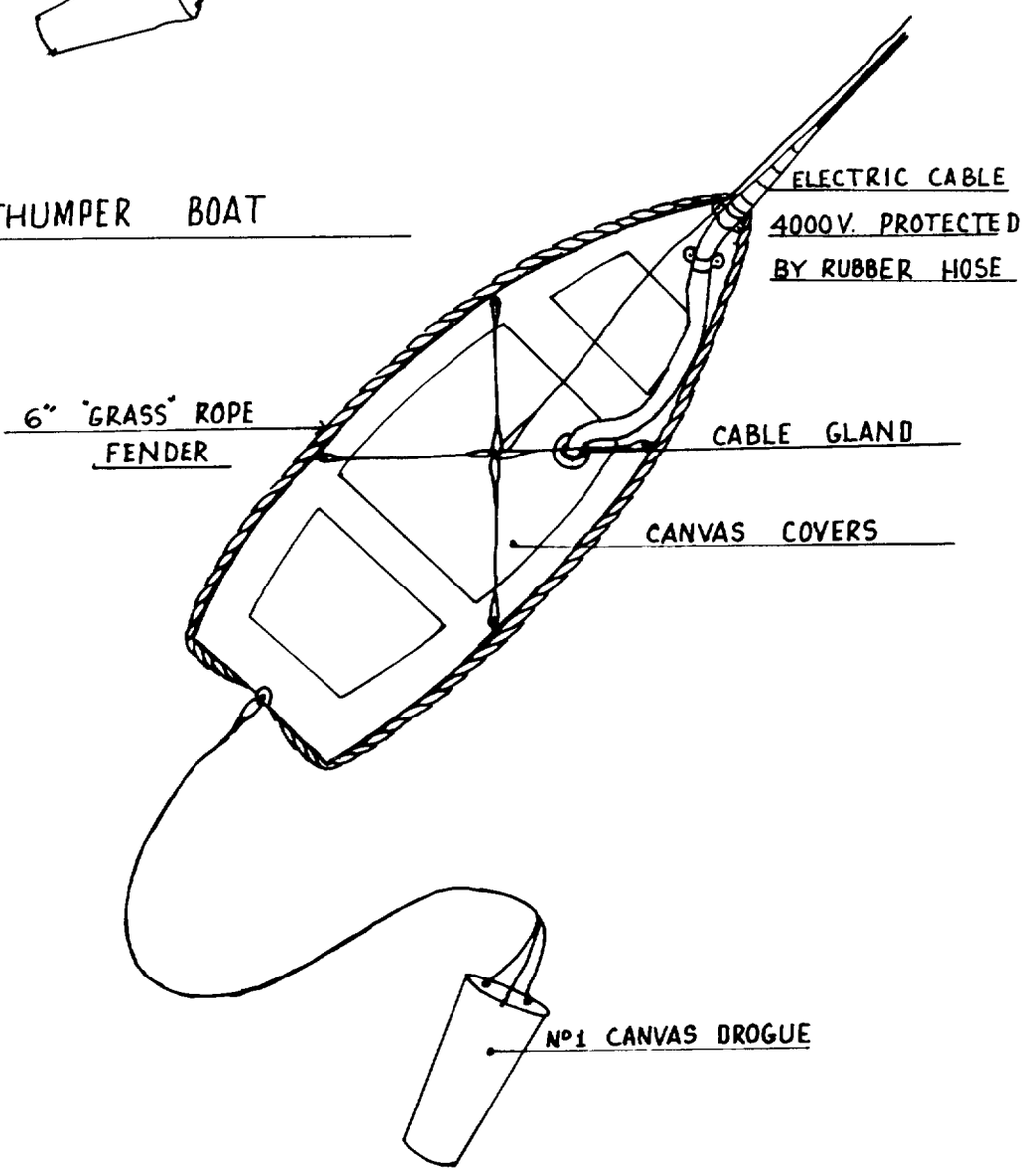
A 13 mm wire strop is shackled to the bow and passed through a thimble eye in the six foot piece of 3 inch double sisal rope which is attached to the eye of the 6 inch towing hawser.

All hatches are covered by canvas covers which are tight fitting to stop water getting inside the boat, as when under tow in some seas the boat dips under quite a bit.

Note:- The power must be switched off before working on the cable.



THUMPER BOAT



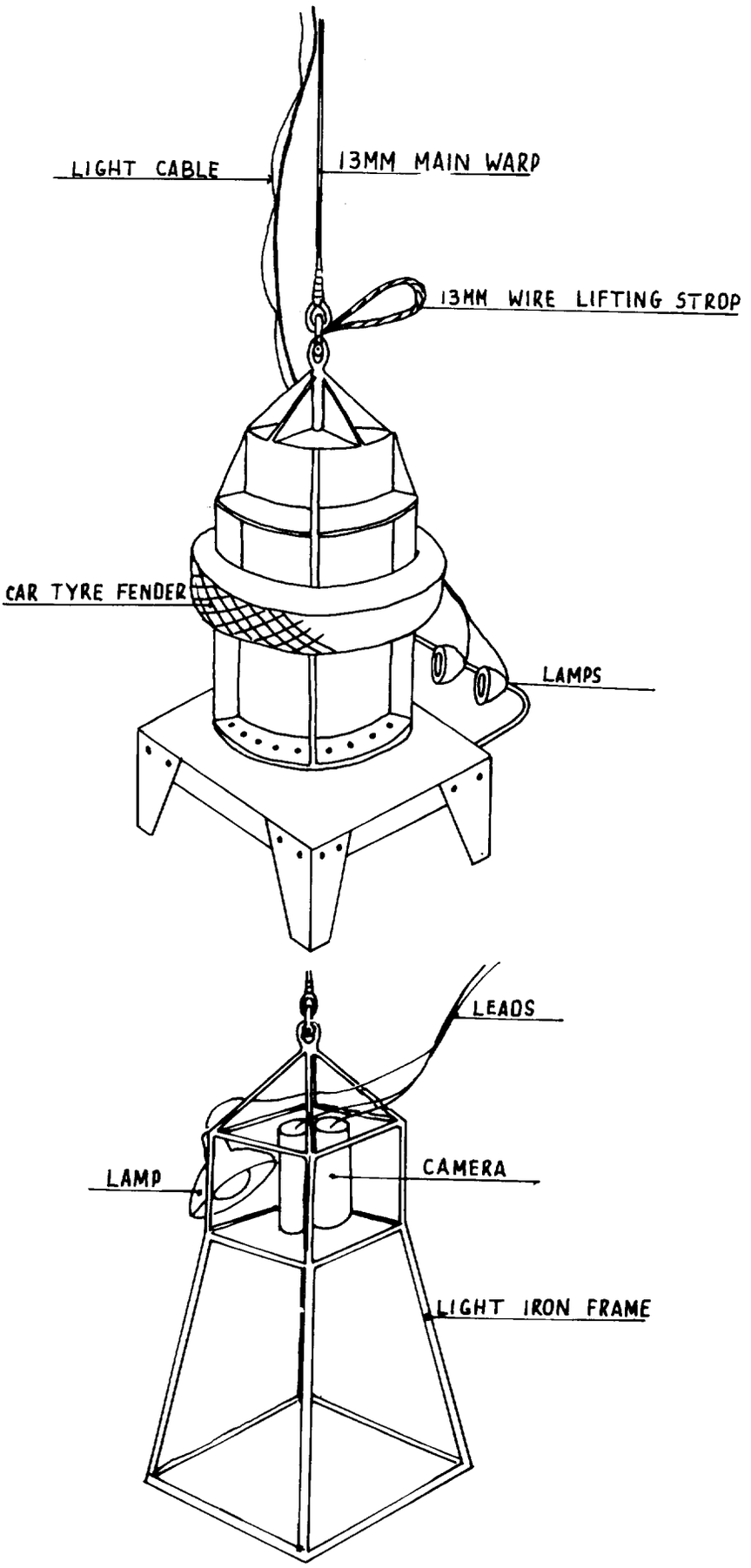
UNDERWATER T.V. CAMERAS

These are lowered over the side on the main warp through the gallows on one quarter or the other depending on the wind and sea. This is a straightforward operation with no complications other than the camera cable twisting round the main warp as the camera rotates at the end of the wire.

The camera cables are attached to the main warp at intervals of about three fathoms, or 20 feet, by the rubber band and toggle method described later in this report. A 13 mm wire grommet is attached to the top of the camerafor lifting purposes.

A car tyre is placed around the camera as a fender to take the knocks as the camera comes out of the water and up the ship's side.

T. V. CAMERAS.


LIGHT CABLE
13MM MAIN WARP
13MM WIRE LIFTING STROP
CAR TYRE FENDER
LAMPS
LEADS
LAMP
CAMERA
LIGHT IRON FRAME

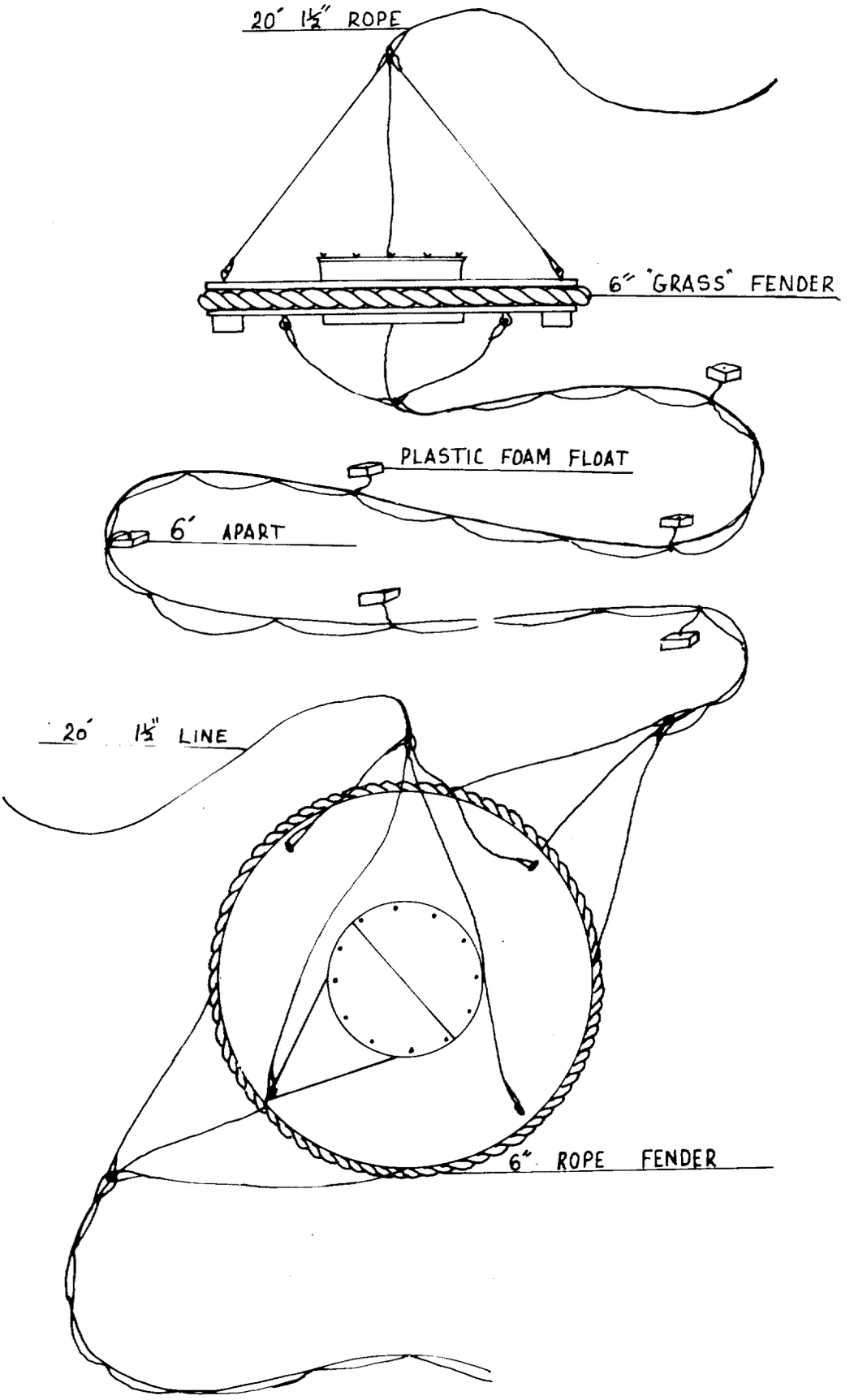
PITCH AND ROLL BUOYS

Four of these are towed from the stern of the ship, in series at different distances apart, connected together with a polythene $1\frac{1}{2}$" rope and electric cable. About every six feet there is a plastic foam float to keep the electric cable buoyant. A 20 lb snapper lead is lashed on the cable between the last buoy and the ship, to act as a damper when the cable snatches.

There is a length of polythene rope from the four legged sling on each buoy which is used to lift the buoy from the water by the crane. It is tied back along the cable when the buoy has been put in the water.

The plastic foam floats are secured to the electric cable by codline.

PITCH & ROLL BUOYS

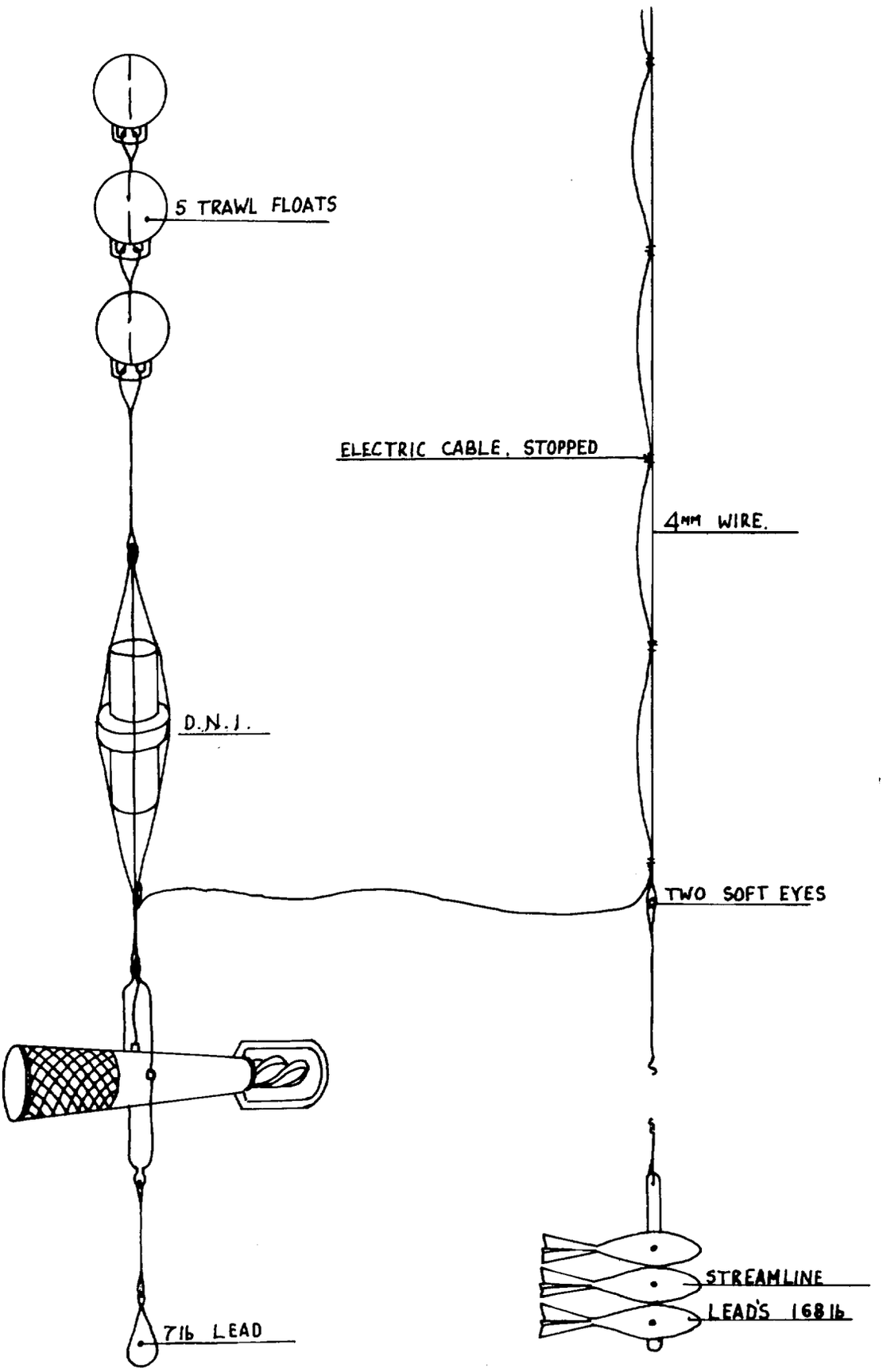


KELVIN HUGHES CURRENT METER NO. 1

This is used from one of the hydrographic davits - usually the amidships one. Three 56 lb streamlined lead weights on a single bar are shackled on to a length of 6 mm wire, then this in turn is attached to the hydrographic wire with a swivel. The current meter cable is attached at the join of the 6 mm wire and the 4 mm hydrographic wire. The whole is then lowered into the water to the required depth stopping the electric cable to the hydrographic wire at intervals of one metre with the rubber band and toggle method.

The current meter and depth of instrument indicator slung above it have five deep sea trawl floats attached to them to keep them neutrally buoyant and steady in the water. The floats are recovered by grappling for them with a grapnel and lifting them and the current meter from the water at the same time as the hydrographic wire is heaved in on the winch.

KELVIN HUGHES. C/M ARRAY

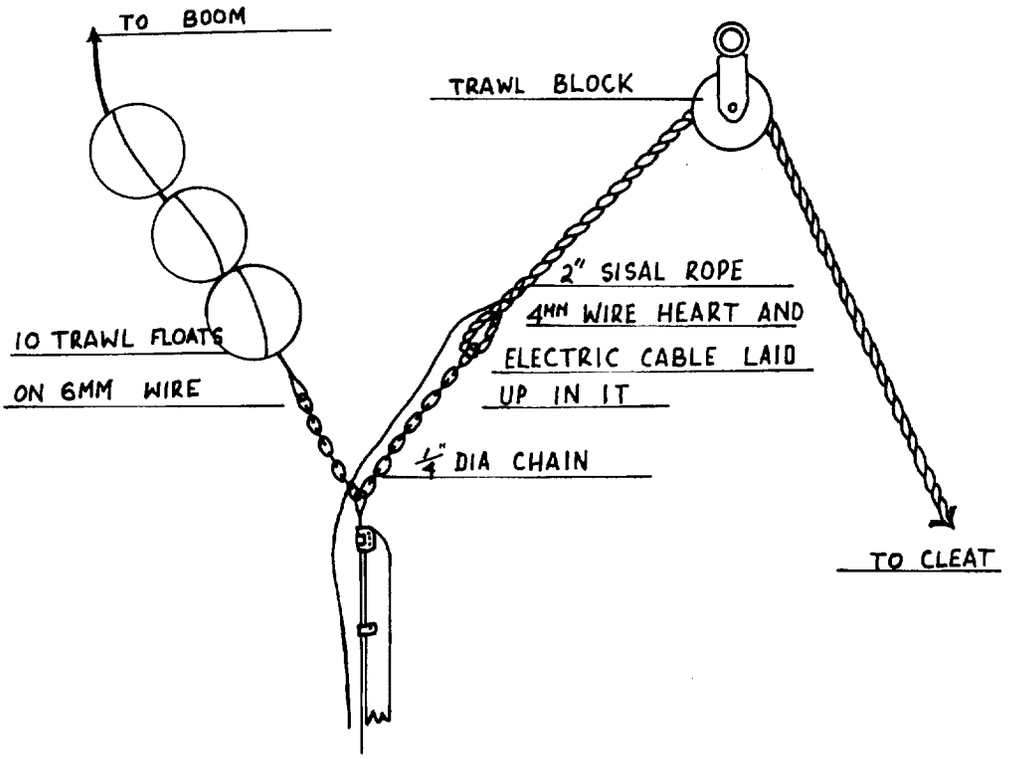


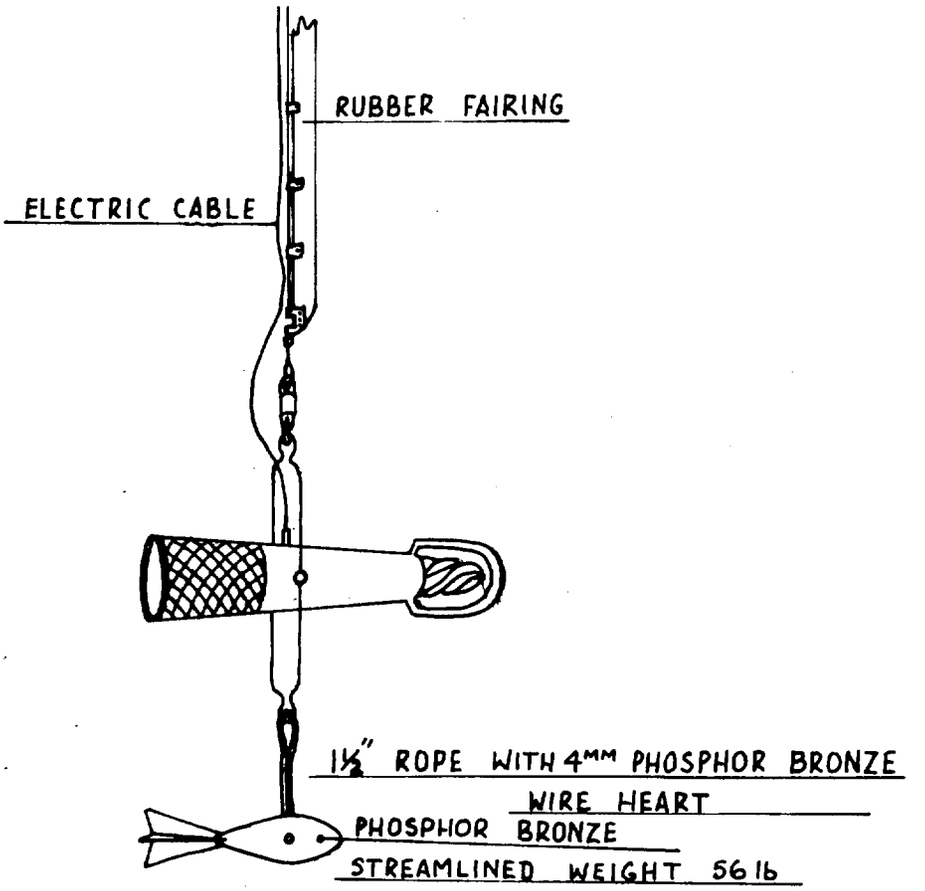
CURRENT METER ARRAY FOR FAST SURFACE CURRENTS

The current meter is slung on a faired cable with a non ferrous metal 56 lb streamlined weight beneath it attached by a $1\frac{1}{2}$ inch polythene rope with a 4 mm wire heart (phosphor bronze wire). The top of the faired cable is attached to a link of a small diameter chain by a moused shackle. The chain in turn is attached at one end to a series of ten trawl floats and at the other to the eye of a 2 inch circumference rope with a 4 mm wire heart. The electric cable of the current meter is also laid up into the lay of the 2 inch rope which passes through a wide trawl block at the head of a small davit.

The ten trawl floats are in turn shackled to a 6 mm wire from a boom about 30 feet forward of the davit. The complete set up is then lowered into the water until the trawl floats have the weight of the current meter and each rope and wire are turned up on a cleat. It is recovered by hauling in on the 2 inch rope and cable by hand.

KELVIN HUGHES ARRAY





CLOVERLEAF BUOY

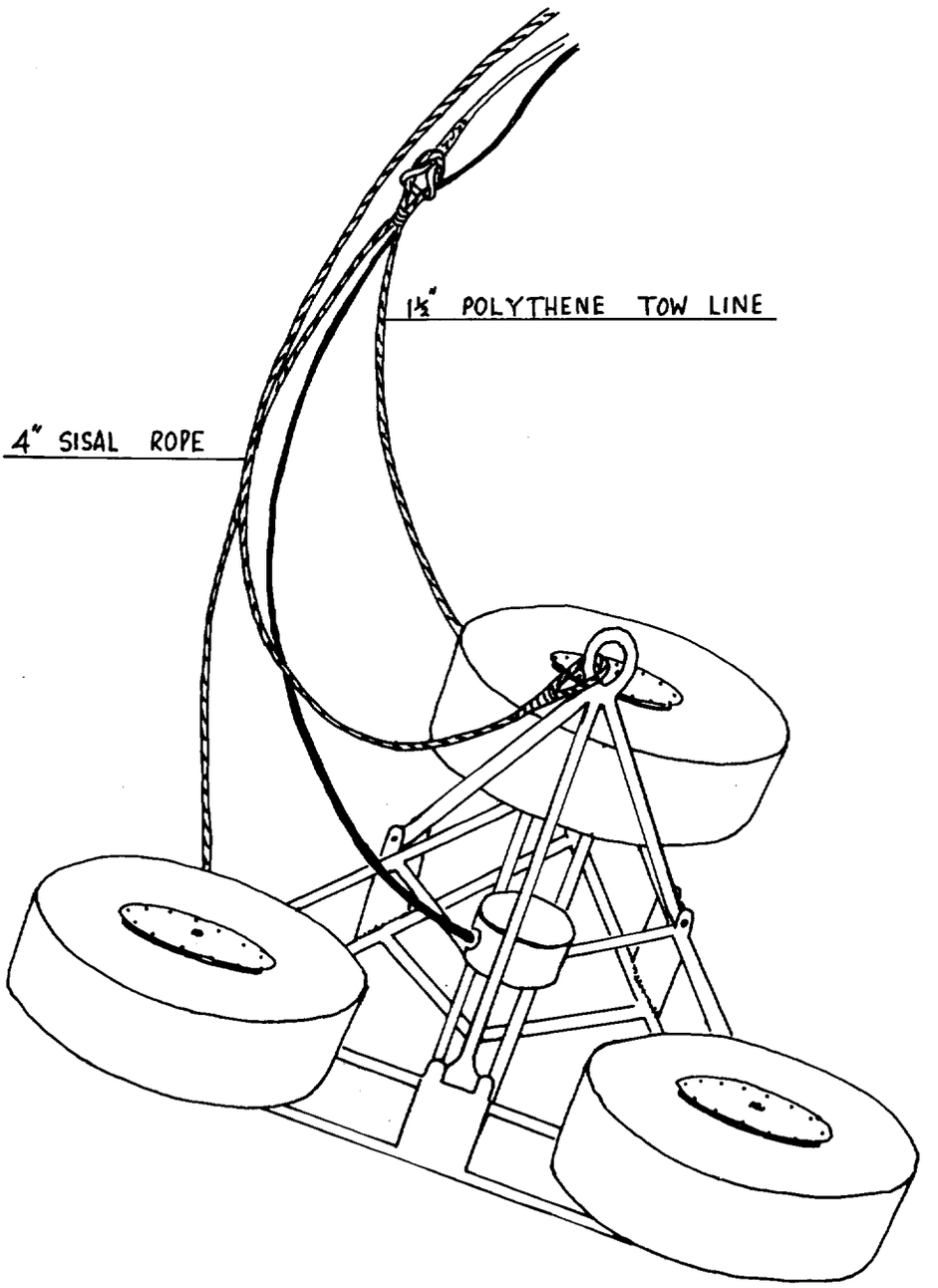
This buoy is lowered into the water by means of the forward crane with a slip hook on its wire. The buoy is placed in the water and slipped from the crane and paid out by hand over the guard rails. The cable from the buoy and its retaining rope are taped together at intervals of about one fathom with P.V.C. tape. Also at intervals of one fathom there is a foam float attached to the rope and cable by codline.

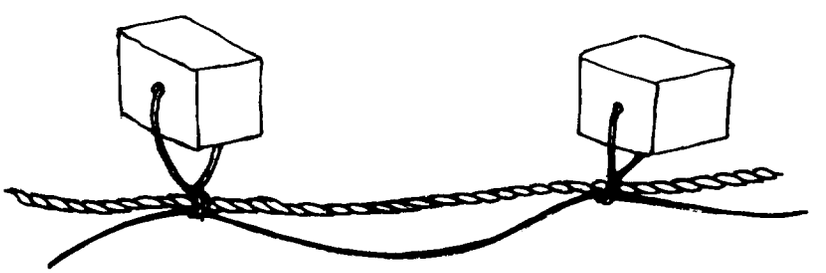
The buoy is paid out to a distance of 300 to 500 feet and the ship keeps station on the buoy for a period of half an hour. During this period it may be necessary to haul in or pay out more cable depending on how well the ship keeps its station on the buoy.

To recover the buoy, all the rope and cable is hauled in by hand until the 35 foot recovery line is reached. The eye of this rope is then turned up on a cleat and the bight is placed in a snatch block at the end of the crane hoist wire.

The crane then hoists the buoy until it is clear of the water and over the rails. The buoy is then steadied by hand and placed on deck and lashed down.

CLOVER LEAF BUOY





PLASTIC FOAM FLOAT AT 6' INTERVALS SECURING CABLE AND TOW LINE

NEUSTON NET

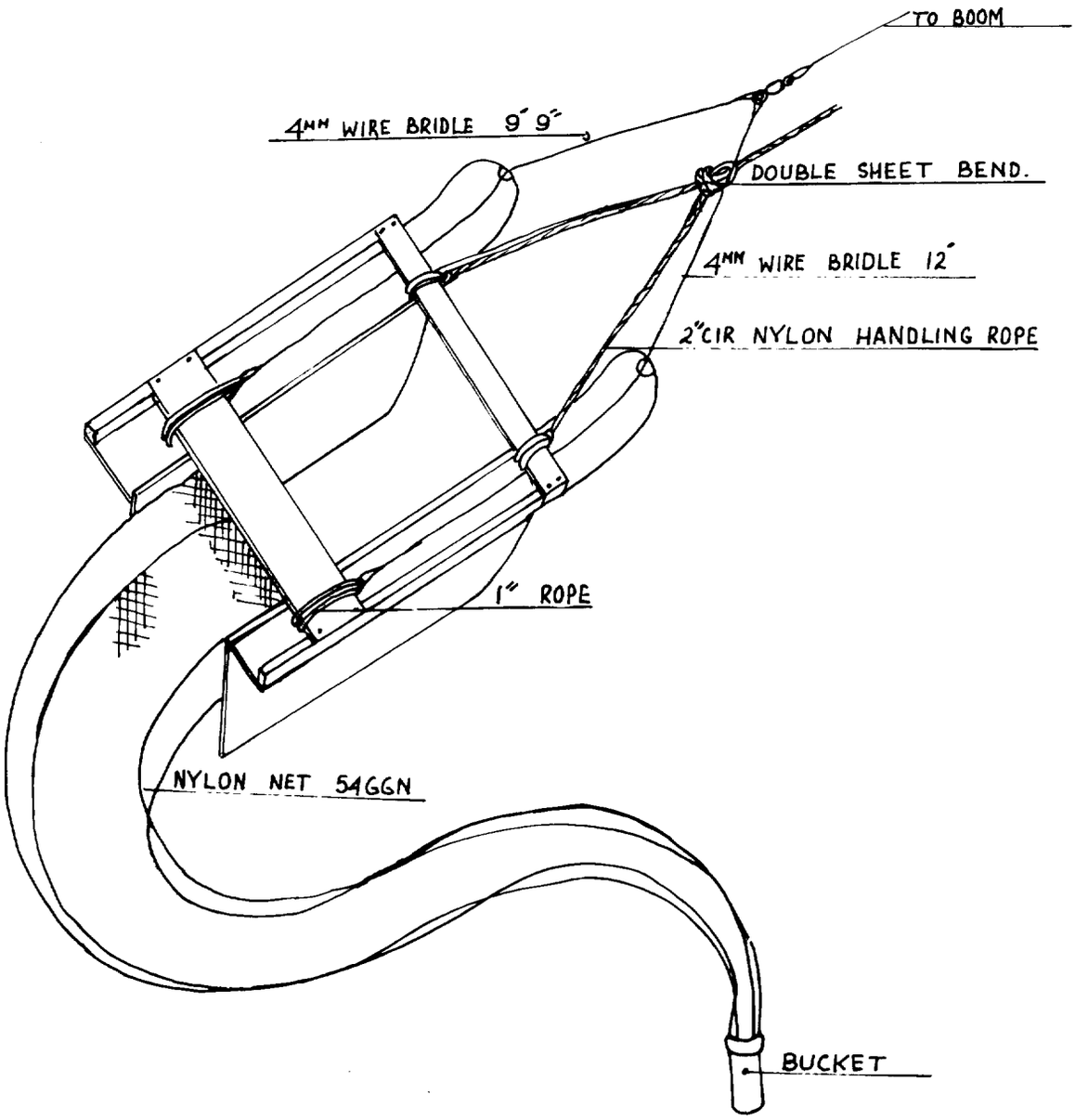
A 20 foot scaffold pole is rigged on the port side of the fore-castle deck. This pole is stayed fore and aft, and has a standing topping lift to the truck of the foremast. There is a small snatch block fitted to the end of the pole on the outboard side. The net is on a wooden skid frame towed by a 6 mm wire rigged through the snatch block and secured to the after bits on the port side fore-castle deck.

There is a 2 inch circumference nylon handling line attached to the front of the wooden frame. This is used to haul the net in and to put it into the water. The towing bridles of the net frame are of different lengths, one 9 foot 9 inches, the other 12 feet. The shorter of the two bridles is on the inboard side of the frame causing it to sheer away from the ship thus keeping it away from the disturbed water from the bow wave when towing.

The net is of nylon bolting cloth 12 foot long. The mouth is $12\frac{1}{2}$ inches across by $6\frac{1}{2}$ inches deep. The bucket at the cod end is 10 inches in circumference and screws into a fitting at the cod end. The 2 inch nylon handling line is fed through a clump block at the head of a small davit.

The net is towed for periods of 15 minutes at 6 knots to collect samples of surface life (mostly at night).

NEUSTON NET

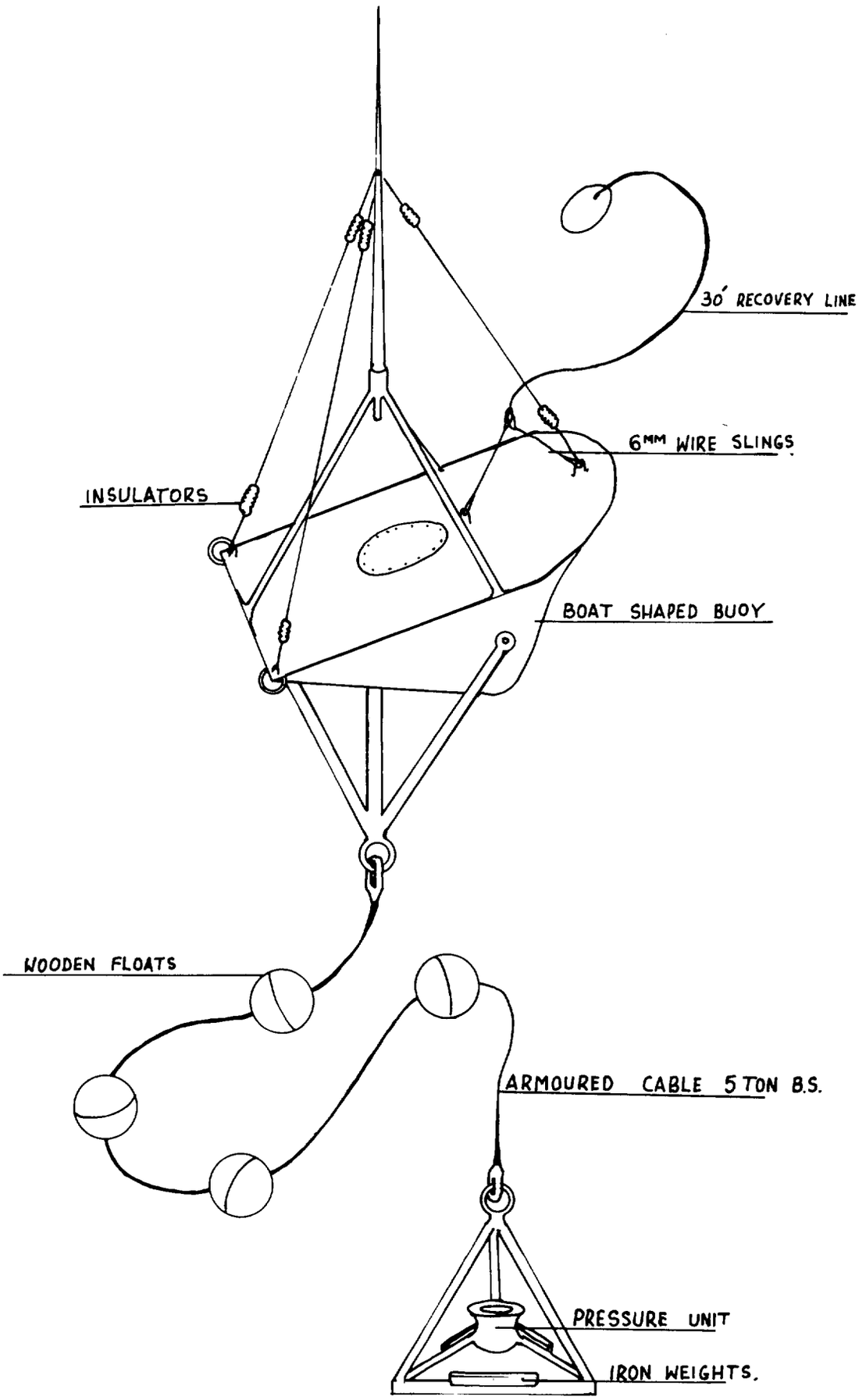

TO BOOM
4MM WIRE BRIDLE 9' 9"
DOUBLE SHEET BEND.
4MM WIRE BRIDLE 12'
2"CIR NYLON HANDLING ROPE
1" ROPE
NYLON NET 54GGN
BUCKET

PRESSURE UNIT 1

This is a boat shaped buoy containing electrical equipment with an anchor in the shape of a tripod frame weighted at the bottom with cast iron weights. A recording instrument is fixed to the tripod with an electric cable coming from it to the buoy. The cable is used to moor the buoy, and has a breaking strain of 5 tons.

There are wooden floats fixed to the cable at intervals of 10 fathoms, in order to keep the cable buoyant. Two 3 ton snatch blocks are used to lift the buoy in and out, one on the end of the crane hoist, the other on the deck as a lead block.

Once the mooring is on the bottom, speed is essential to get the boat away before strain causes the mooring to be tipped over on its side.

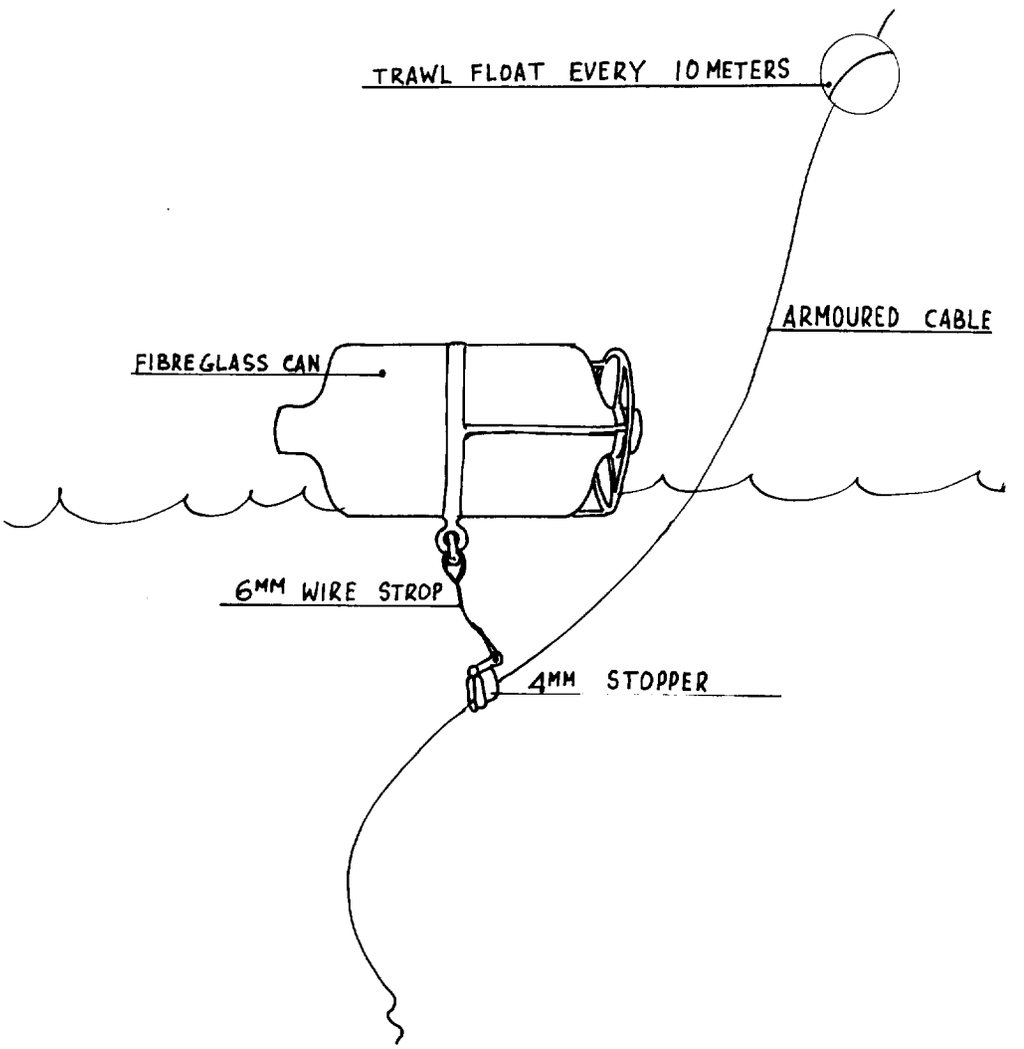

30' RECOVERY LINE
6MM WIRE SLINGS
INSULATORS
BOAT SHAPED BUOY
WOODEN FLOATS
ARMOURED CABLE 5 TON B.S.
PRESSURE UNIT
IRON WEIGHTS.

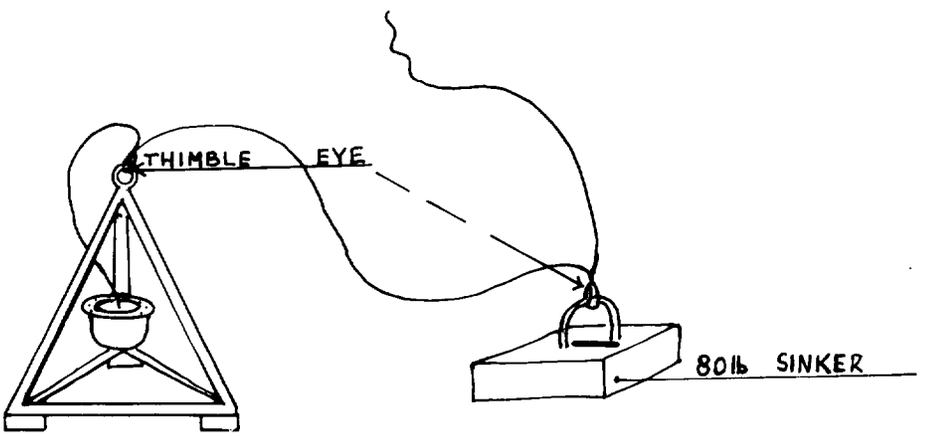
PRESSURE UNIT 2

The pressure unit is shackled to the eye of the conductor cable on the amidships winch. The unit is then lowered until it is at the surface. An 80 lb concrete sinker is then clamped to the wire, and the whole is then lowered to the bottom. On reaching the bottom the cable will be seen to go slack; the winch is then stopped.

A fibreglass dhan can is then clamped to the cable with a 'Discovery' type stopper. This can is then lowered into the water and paid out until it is out on the beam. The ship then keeps station on it. The cable is paid out or heaved in as required. The can is used to take the weight of the cable. Care must be taken not to put too much strain on the mooring or the unit will be pulled over on its side. The concrete sinker is to take the initial strain.

As the ship drifts away from the dhan can the cable is paid out and a trawl float is attached to the cable at intervals to keep it buoyant. If the ship drifts in toward the can the floats are removed. The object is to keep the cable from the ship to the can in as straight a line as possible.


TRAWL FLOAT EVERY 10 METERS
ARMOURED CABLE
FIBREGLASS CAN
6MM WIRE STROP
4MM STOPPER

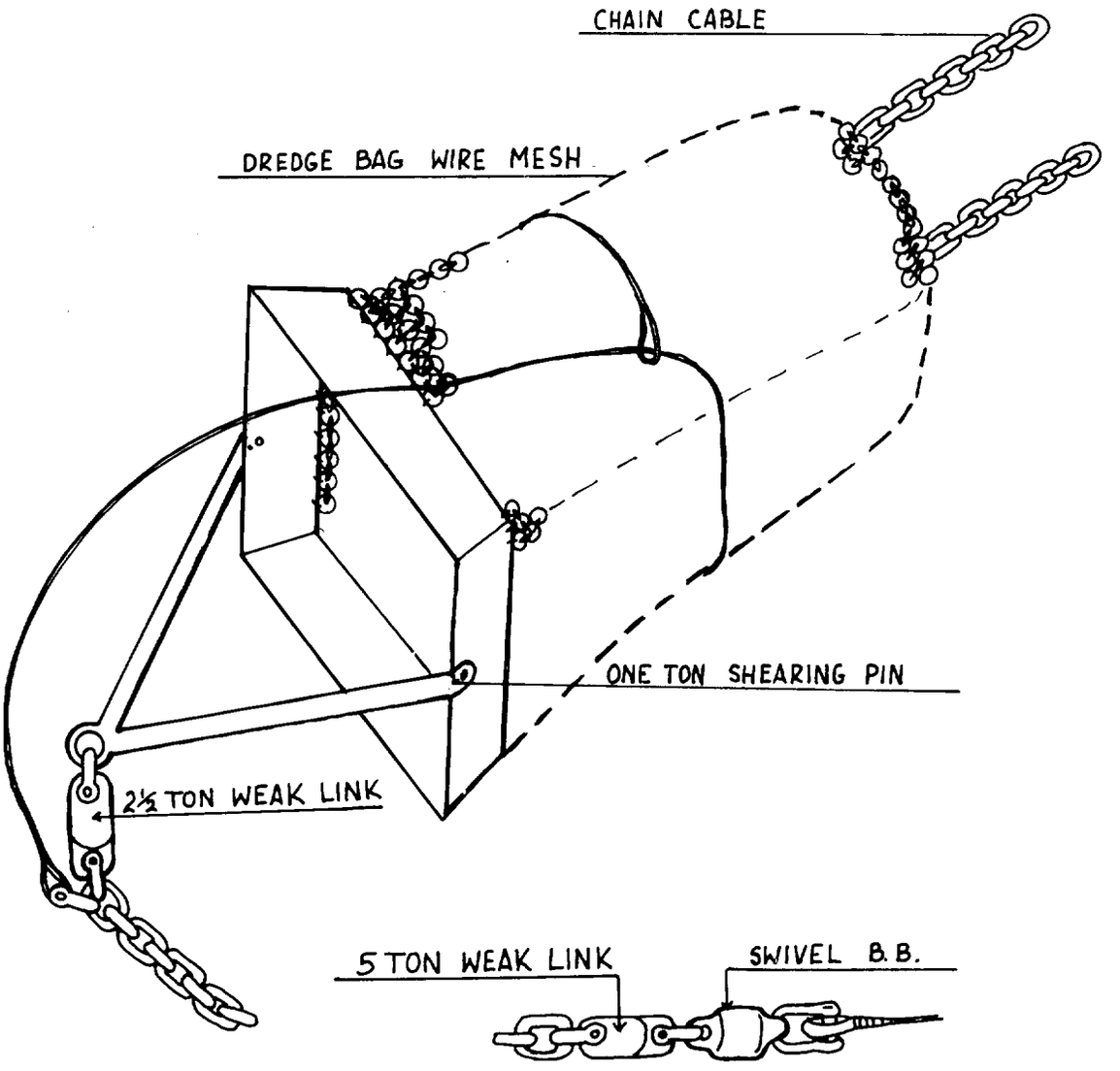

THIMBLE
EYE
80lb SINKER

ROCK DREDGE

The dredge bag is made of wire grommets linked together and shaped like a purse. It is wired onto a stout iron frame. If the dredge fouls up, there are a series of weak links to help in freeing it or to stop the main warp from parting. Between the frame and the towing arm there is a pin which sheers at one ton strain. The dredge can then tilt for 30°. The next weak link is between the dredge and chain cable. It is a $2\frac{1}{2}$ ton sheering link. A 13 mm wire safety line is threaded through the links of the bag. When the $2\frac{1}{2}$ ton link parts, the bag is throttled by this wire and turns completely over, usually freeing it and saving the sample in the bag at the same time.

Between the chain cable and the main warp there is a 5 ton sheering link. If the other safety devices fail to free the dredge this will eventually part with the loss of the dredge and the chain but the main warp will still be intact. Before using this last resort everything else will have been tried. The ship is allowed to fall off down wind and come back on the opposite course to the one when the bag was fouled; this usually frees the bag.

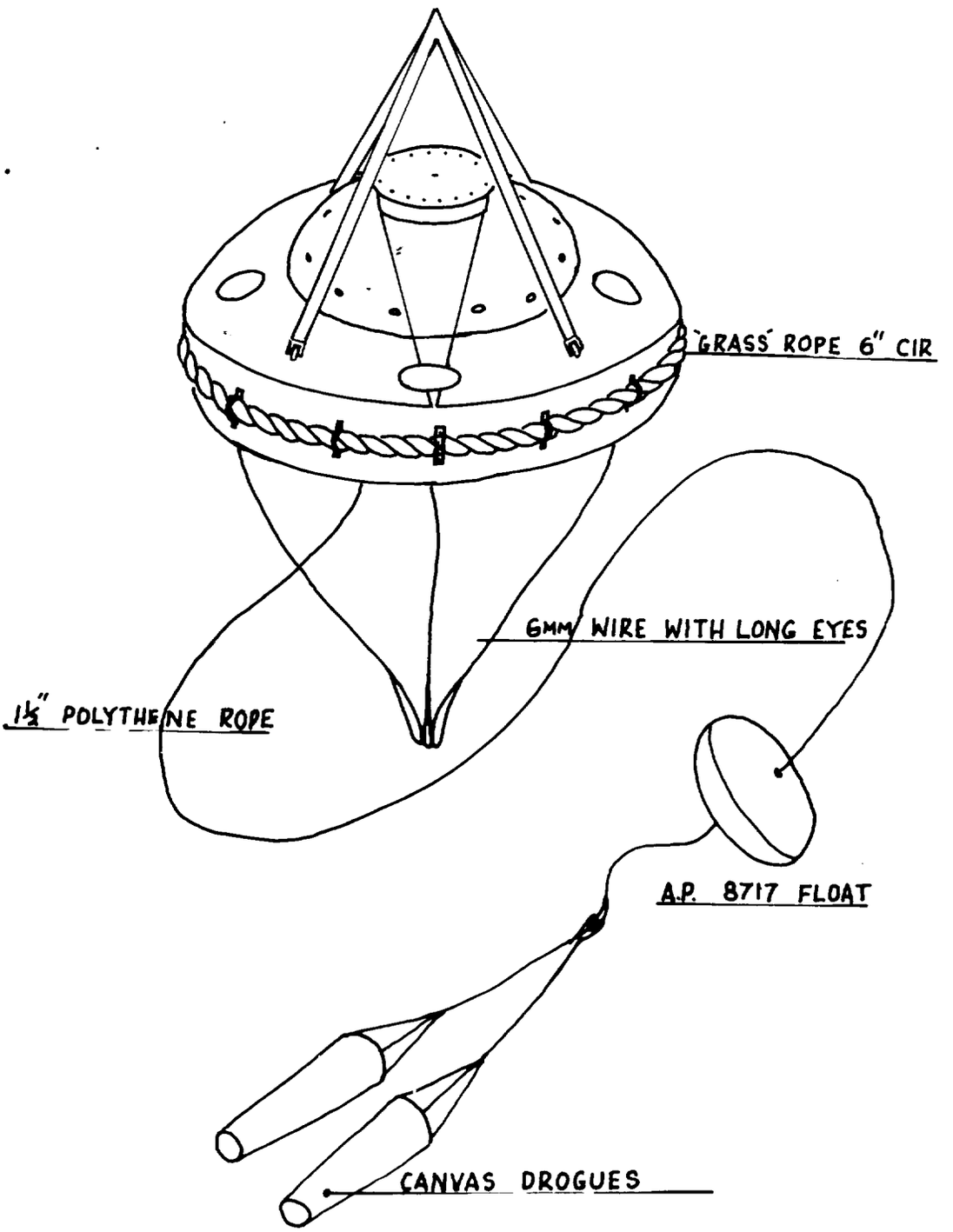
The chain cable used is small ship's cable, tested in excess of 5 tons. The dredge is put over the side and taken in by the crane.


CHAIN CABLE
DREDGE BAG WIRE MESH
ONE TON SHEARING PIN
2½ TON WEAK LINK
5 TON WEAK LINK
SWIVEL B.B.

PITCH AND ROLL BUOY

This buoy is put over the side by crane and cast adrift. There can be no picking up rope attached to it, as it would interfere with the motion of the buoy and give a false reading, so the buoy has to be grapneled for, and a Davy recovery hook on a pole used to get the recovery line hooked on. On the under side of the buoy there are four 6 mm wire slings to hook into and recover it when it comes back upside down. There is also a small canvas 'dodger' about 4 inches high pegged around the rubbing strake used when the sea is a bit choppy to stop the buoy shipping too much water.

Two small canvas drogues are used to act as a sea anchor and to stop the buoy from spinning. A (AP8717) float is also used to keep the drogues near the surface.


GRASS ROPE 6" CIR
6MM WIRE WITH LONG EYES
1½" POLYTHENE ROPE
A.P. 8717 FLOAT
CANVAS DROGUES

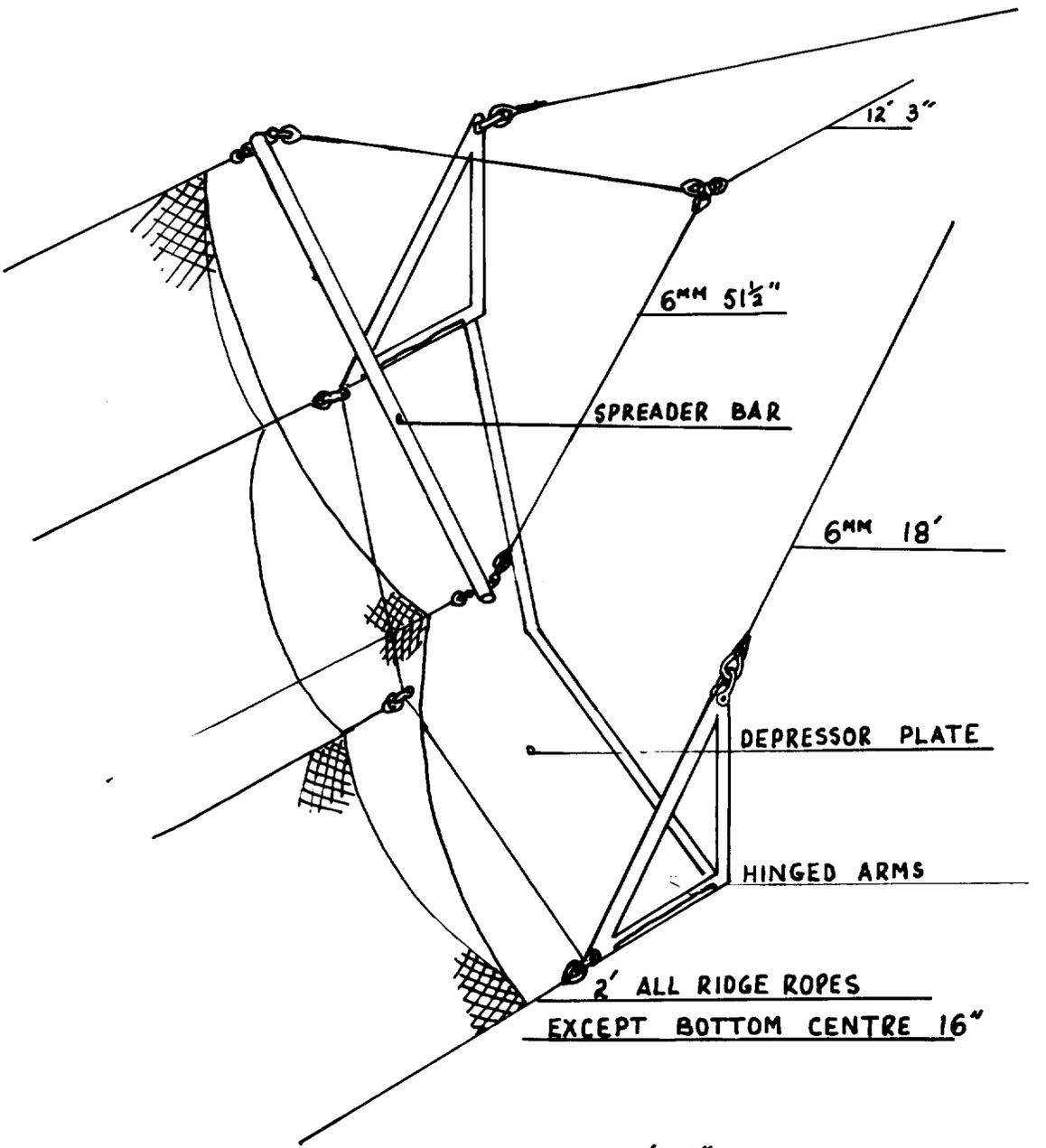
I.K. MIDWATER TRAWL

This is hoisted in and out by the crane. A 13 mm grommet is put at the end of the towing bridles at the junction to the main warp. This grommet is hooked to the crane hoist and the net lifted until the depressor plate is clear of the after rail. The net is cast over the side and the depressor lowered until just clear of the water.

The main winch is then heaved in until the grommet can be reached by hand. The crane is then unhooked from it and the net lowered into the water. For recovery the procedure is reversed.

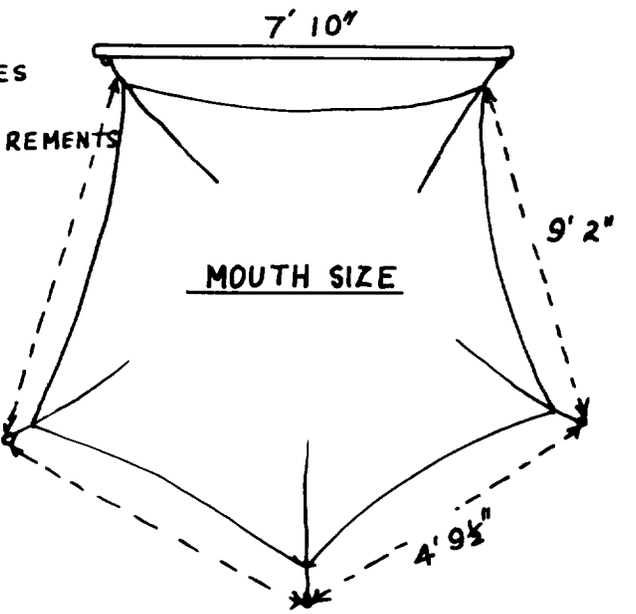
When using the catch dividing the buckets at the cod end of the net, a canvas drogue is used to keep the bucket towing out behind the net. It is important that all measurements are exact on the towing bridles and net ribs, otherwise too much strain is put on the ribs of the trawl and they nearly always part. The drogue is a canvas bag used on the conical dredge (on next page). All eyes on the net and bridles are thimble eyes.

I. K. MIDWATER TRAWL



ALL EYES ARE HARD EYES

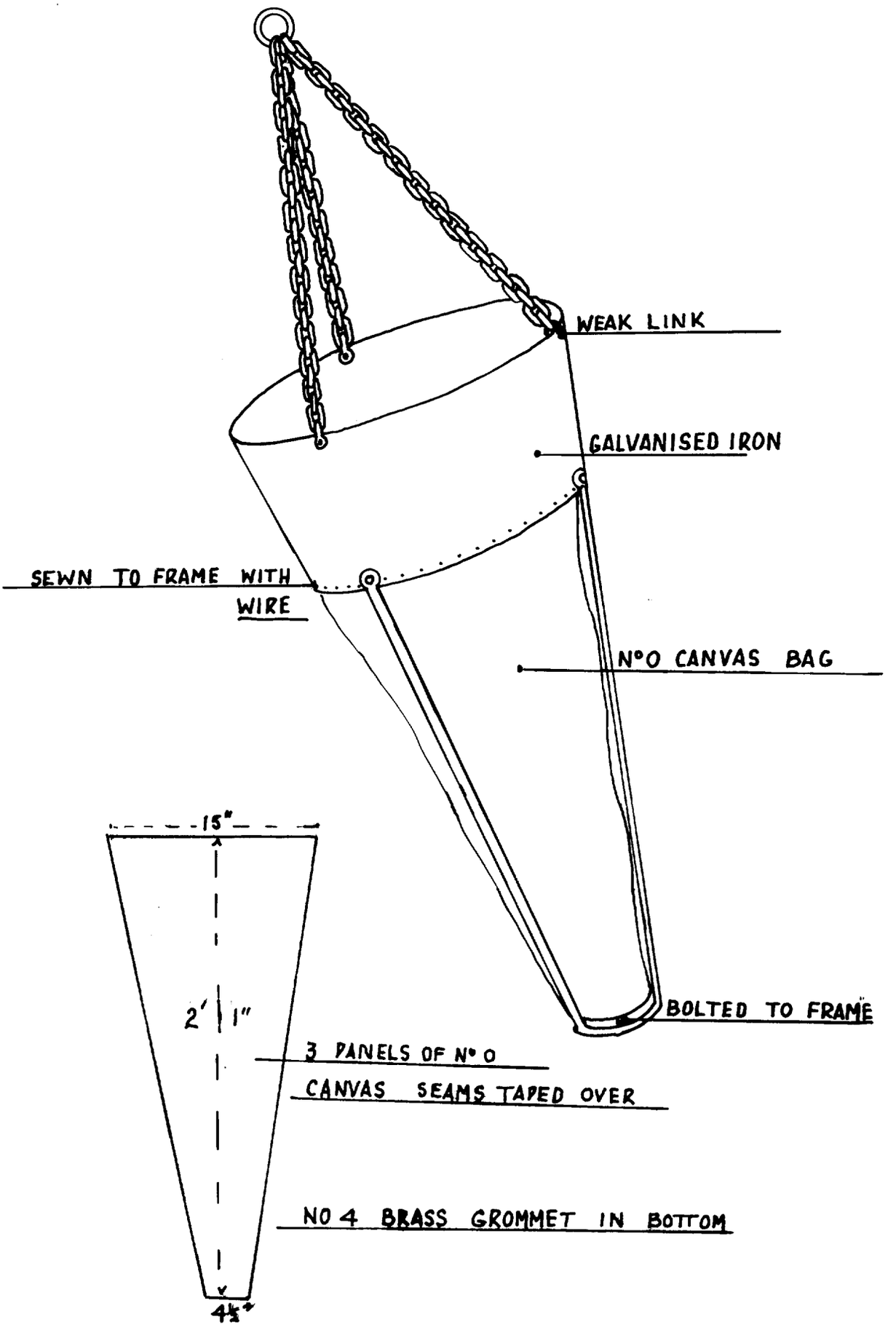
ALLOW 3½" ON ALL MEASUREMENTS FOR THIMBLES



CONICAL DREDGE

This dredge is usually used on the chain of the rock dredge to collect a sample of mud. The bridles are of $\frac{1}{2}$" diameter chain, one of which is connected to the dredge frame by a weak link.

The canvas bag (no. 0 or no. 1 canvas) is made up of three panels with taped seams. It is held down at the bottom by a $\frac{3}{8}$" nut and bolt through a brass eyelet in the bottom of the bag. This bag is also used as a drogue on various pieces of equipment. The canvas bag is laced to the dredge frame at the top by $\frac{1}{8}$" seizing wire.

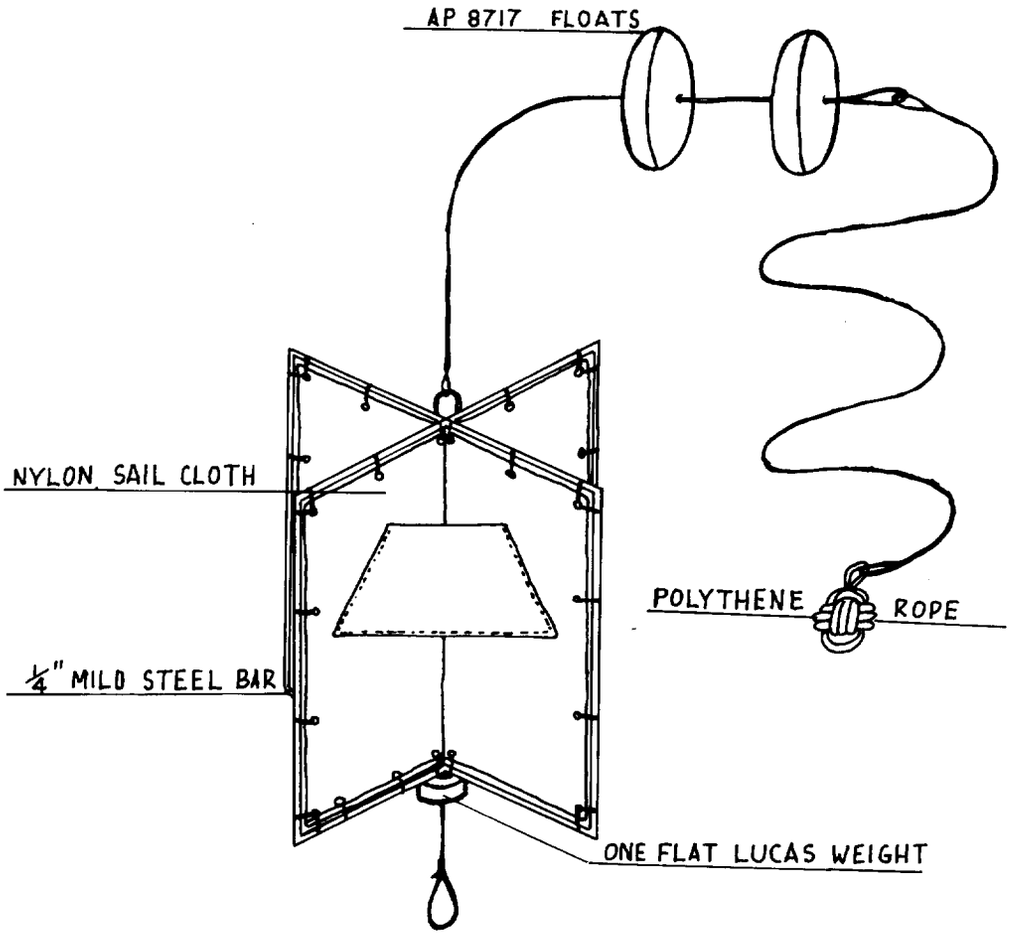

WEAK LINK
GALVANISED IRON
SEWN TO FRAME WITH WIRE
N°O CANVAS BAG
BOLTED TO FRAME
15"
2'1"
3 PANELS OF N° O CANVAS SEAMS TAPED OVER
NO 4 BRASS GROMMET IN BOTTOM
4½"

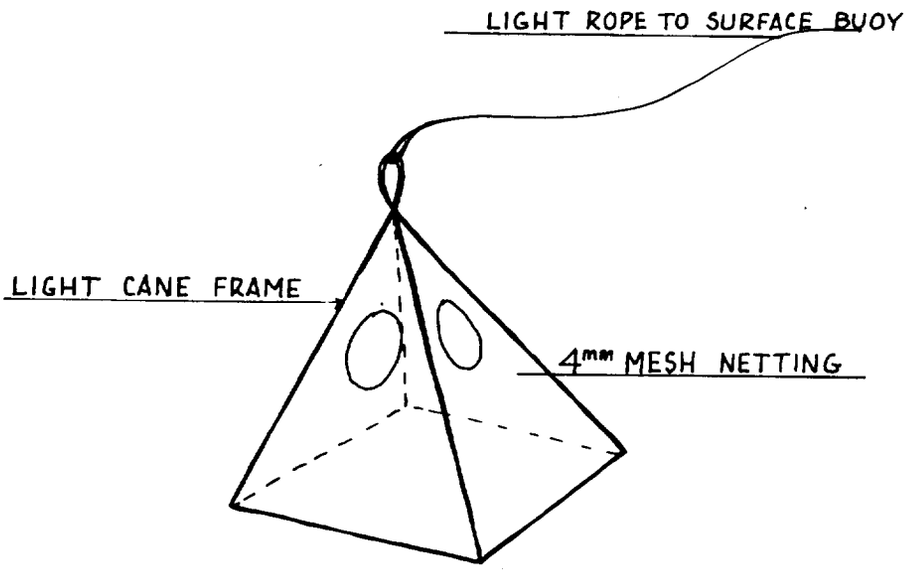
TIDE FRAMES

These are used to measure currents at various depths and are of various shapes and sizes. The frames at deep depths are held by piano wire or 2 mm wire, the shallow ones by codline or nylon cord.

A (AP8717) float or two, depending on the weight of wire, is used to keep the frame at its depth. They are put over the ship's side by hand and recovered the same way.

Sometimes a small marker buoy is used to track their drift. Pingers are also attached to them and they are tracked by hydrophones.


AP 8717 FLOATS
NYLON SAIL CLOTH
POLYTHENE ROPE
¼" MILD STEEL BAR
ONE FLAT LUCAS WEIGHT


LIGHT ROPE TO SURFACE BUOY
LIGHT CANE FRAME
4mm MESH NETTING

THUMPER UNIT

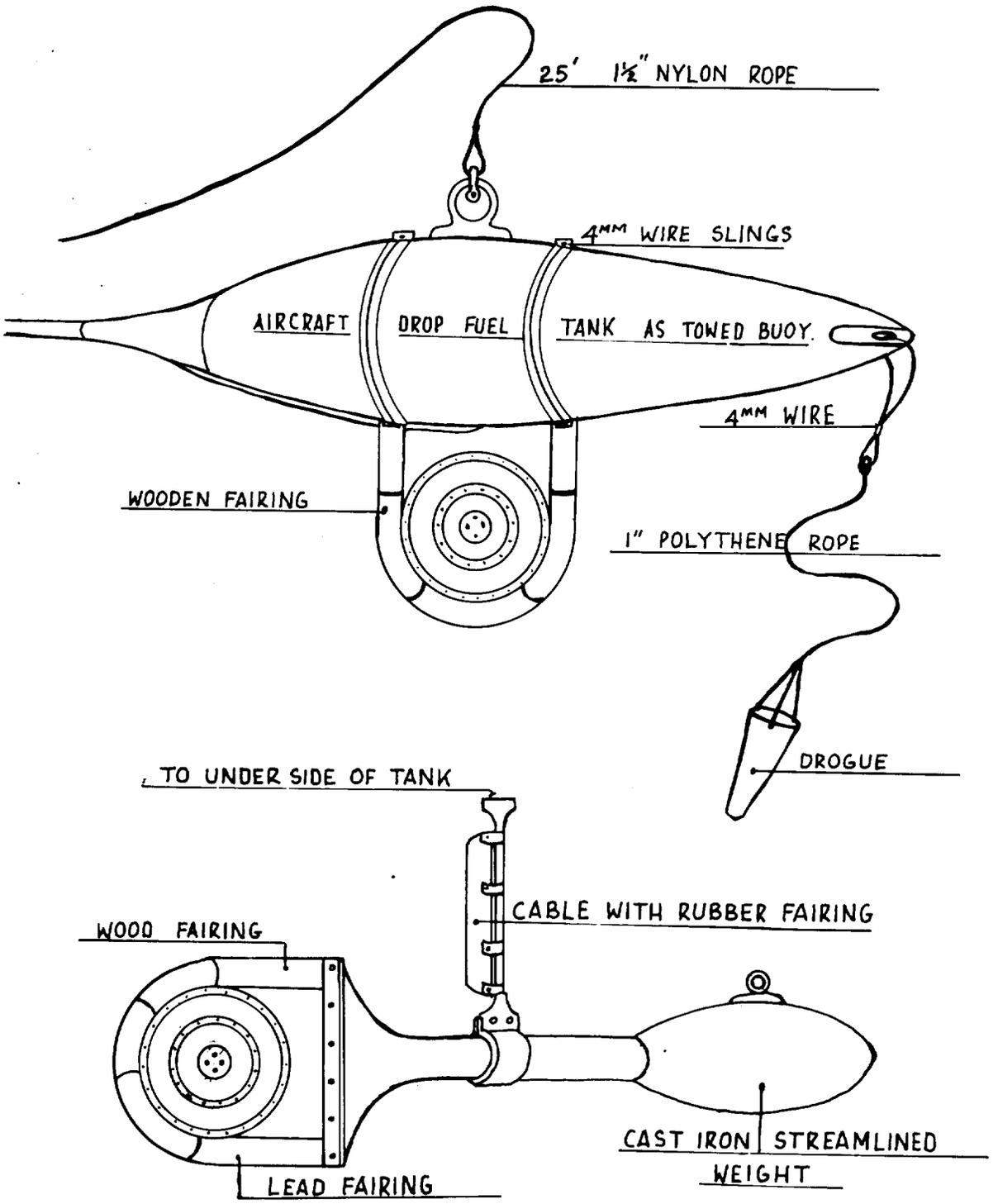
This piece of equipment is very similar to the thumper boat described on page 12. It is towed from the ship's stern on its own cable. The buoy is a fuel tank used on aircraft. The diaphragm is slung under it and held in place by metal straps and two 4 mm wire safety straps. The unit is put into the water by the crane with a slip hook.

A drogue (pattern conical dredge, page 25) is used to keep the float from yawing about under tow. A 30 foot polythene recovery rope 2" circumference is taped along the towing cable. When recovering this rope is reeved through a snatch block at the end of the crane hoist, the end secured to a cleat on deck. The unit is hoisted in one operation on deck, and placed in a special cradle.

The towing cable is built up on the nose of the tank with strips of plastic and P.V.C. tape to give it a streamlined shape for towing through the water.

Note: This equipment works on high voltage (4000 volts) so it must be switched off before working on it.

There is a second method of slinging the diaphragm under the float with a counterbalance weight on a length of cable.

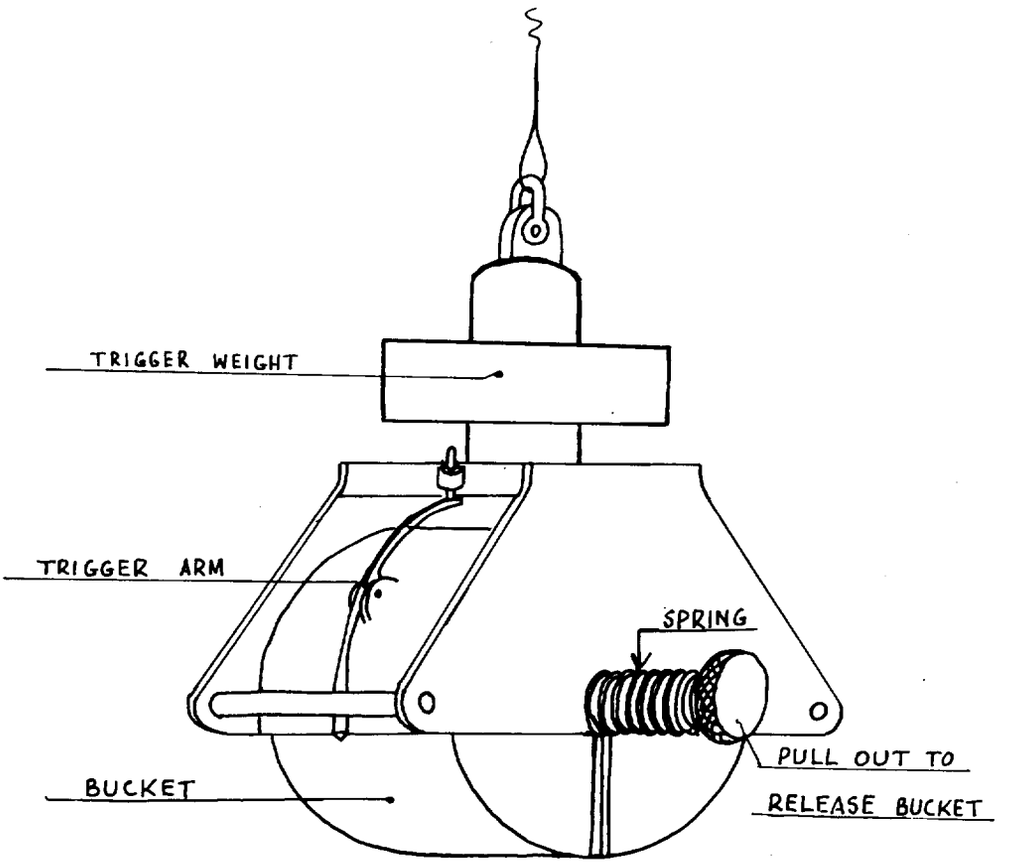

25' 1½" NYLON ROPE
4MM WIRE SLINGS
AIRCRAFT DROP FUEL TANK AS TOWED BUOY.
4MM WIRE
WOODEN FAIRING
1" POLYTHENE ROPE
DROGUE
TO UNDER SIDE OF TANK
CABLE WITH RUBBER FAIRING
WOOD FAIRING
CAST IRON STREAMLINED WEIGHT
LEAD FAIRING

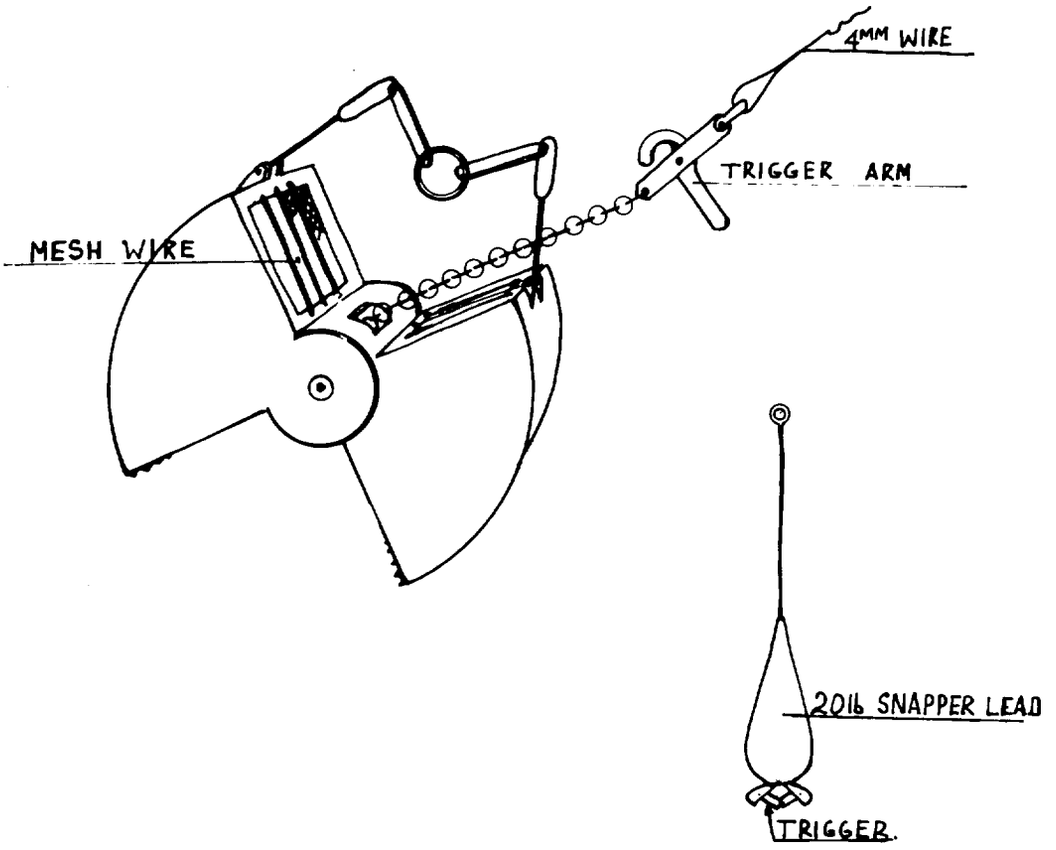
GRABS

These are used from one of the 4 mm wire hydrographic davits. They vary in weight from 20 lbs to 300 lbs. The grab is shackled to the wire and lowered to the surface of the water. The metre wheel counters are set to zero. After finding the depth of the water from the P.E.S. the grab is lowered until it strikes the bottom (this is usually seen by the hydrographic wire going slack) or until the correct depth is reached on the counters.

The grab shuts on its own and takes a sample. It is then hoisted by the hydrowinch and brought inboard. The sample is bottled, the grab is washed down to clean it and then cocked ready for the next operation. They all work in much the same way and are quite straightforward to operate.

Care must be taken when lowering to ensure the hydrowire does not run slack (through being lowered too fast) or the wire will become kinked and be ruined.


TRIGGER WEIGHT
TRIGGER ARM
SPRING
PULL OUT TO
RELEASE BUCKET
BUCKET


4MM WIRE
TRIGGER ARM
MESH WIRE
2016 SNAPPER LEAD
TRIGGER.

N.70 F.V. NET

This is the N70 Flowmeter vertical net used by the I.O.S. It consists of three solid brass bridles shackled to a galvanised iron net ring of 1 metre diameter. To this is laced a nylon sail-cloth tube 4 feet long. This nylon top is clamped to the top of a fibreglass drum, which houses the flowmeter. From the centre of this drum to the ring at the top are three phosphor bronze 4 mm wire stays 4 foot 2 inches in length. To the bottom of the flowmeter drum is clamped the top of the net.

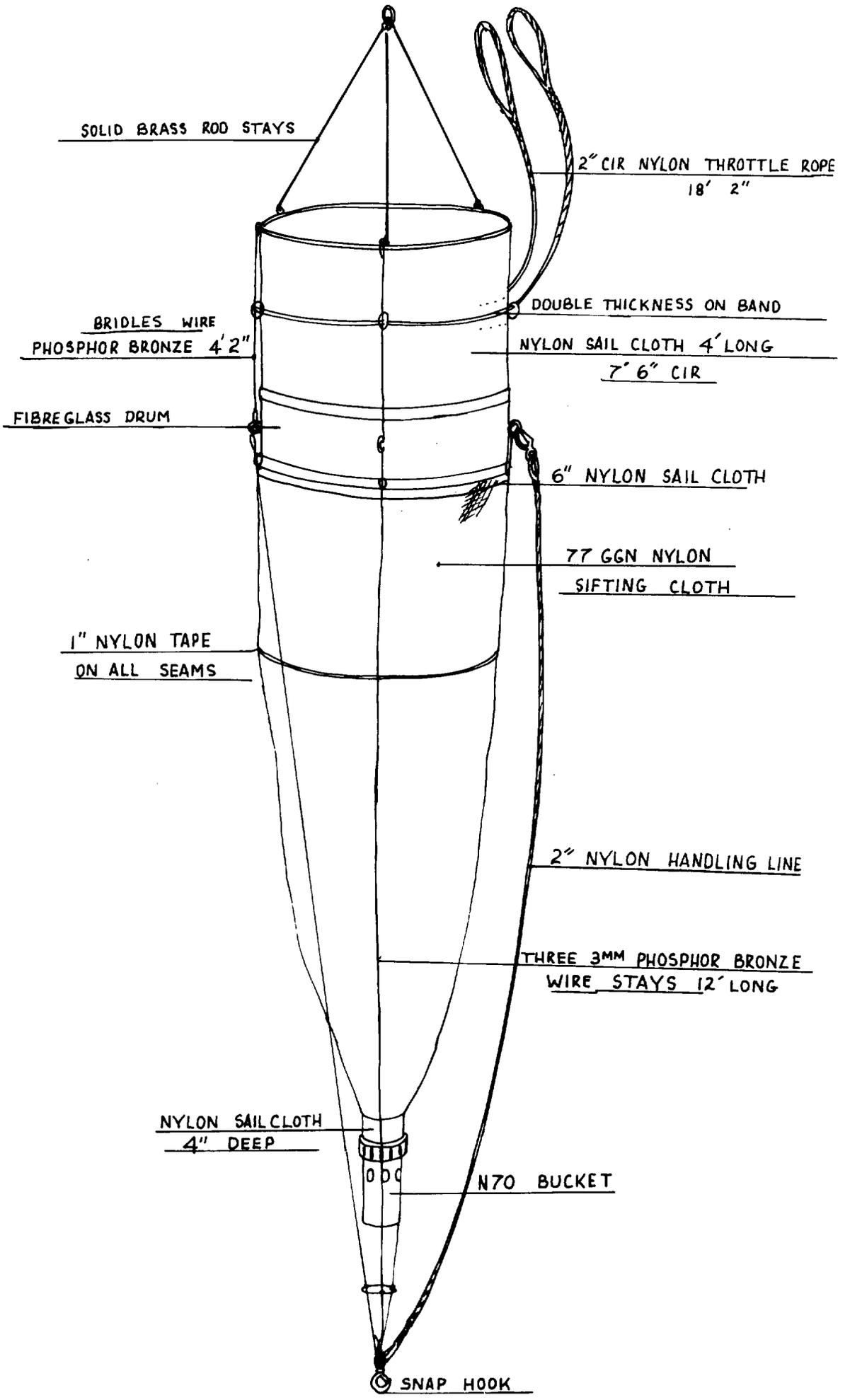
The net is made of three panels of 77GGN nylon sifting cloth, all seams are taped with 1 inch nylon tape. There are three phosphor bronze 4 mm wire stays 12 feet long from the centre of the flowmeter drum to a snap hook at the bottom of the net. The net terminates in a 4 inch long nylon sailcloth collar. The top of the screwed net bucket is clamped to this collar.

There is a 2 inch nylon handling line from the centre of the flowmeter drum to the snap hook at the bottom of the net to aid in bringing the weight inboard. The weight is 64 lbs cast iron 'Lucas' weights, two conical and one flat.

There is a 2 inch nylon throttle rope around the sailcloth tube at the centre held in place by six brass rings sewn to the sail-cloth. The throttle rope is 18 feet 2 inches in length with a soft eye at each end.

This net is used vertically on the hydrographic davit.

N70 FLOWMETER



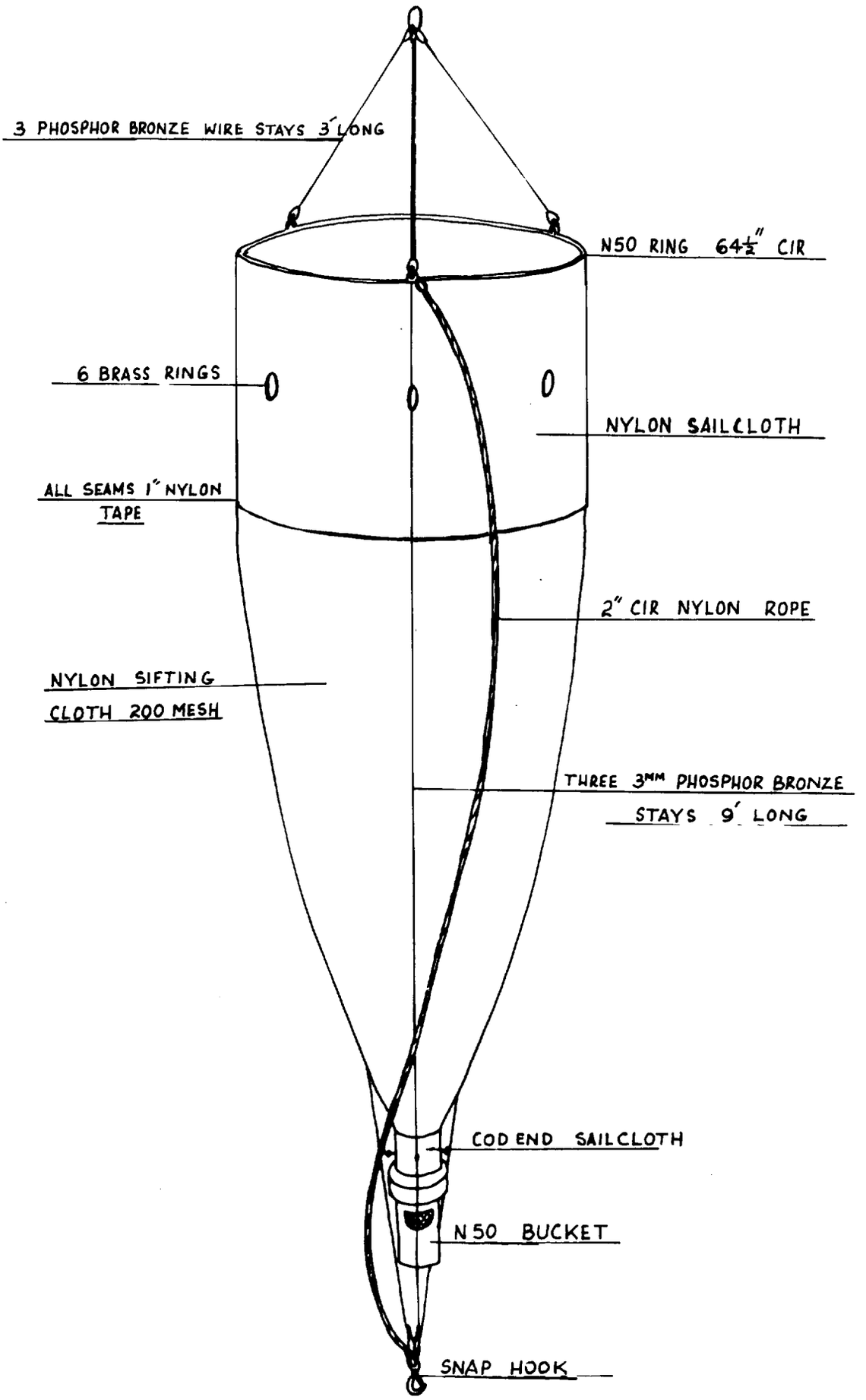
N.50 V NET

The N50 vertical net used by IOS consists of three phosphor bronze bridles of 4 mm wire 3 feet long with brass thimble eyes at each end. It is shackled to a galvanised iron net ring 50 cm in diameter. To this ring is laced a canvas or nylon sailcloth tube, which is the top of the net itself. The net is made of nylon sifting cloth 200 meshes to the inch. There are three panels and all seams are taped with one inch wide nylon tape. There are three phosphor bronze bridles of 4 mm wire from the net ring to the snap hook at the bottom of the net.

This net can be made into a closing net by using the brass bridles of the N70 net in place of the 4 mm wire bridles, and a closing rope through 6 brass rings sewn to the net top. There is a 2 inch nylon handling rope from the net ring to the snap hook at the bottom to assist in getting the weight inboard. The weight consists of two conical 'Lucas' weights, 44 lbs in all.

This net must be hauled through the water very slowly; if hauled fast the fine mesh is unable to filter the water fast enough and this results in a split down one of the panels.

N50 V


3 PHOSPHOR BRONZE WIRE STAYS 3' LONG
N50 RING 64½" CIR
6 BRASS RINGS
NYLON SAILCLOTH
ALL SEAMS 1" NYLON TAPE
2" CIR NYLON ROPE
NYLON SIFTING CLOTH 200 MESH
THREE 3MM PHOSPHOR BRONZE STAYS 9' LONG
COD END SAILCLOTH
N50 BUCKET
SNAP HOOK

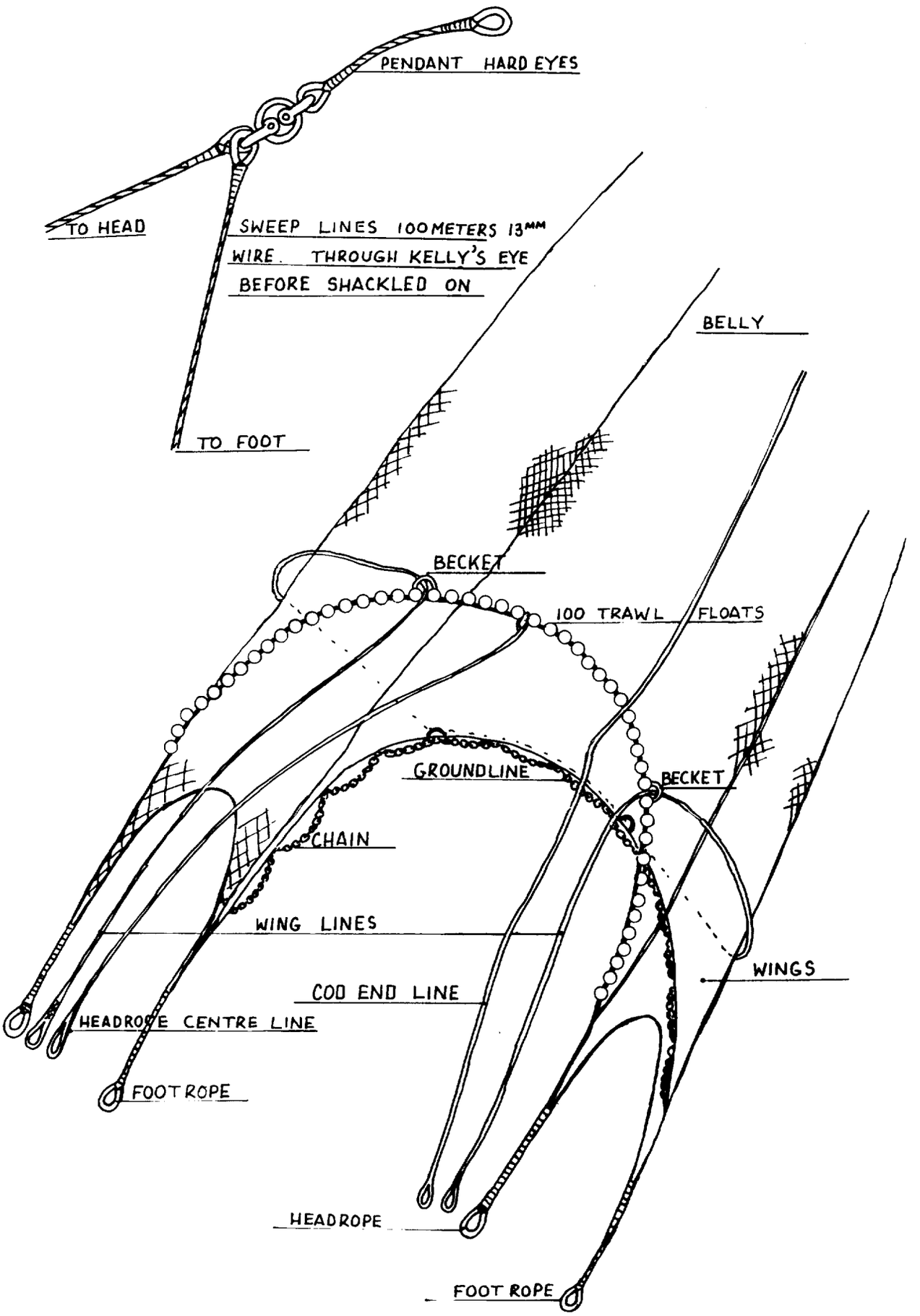
THE ENGEL TRAWL

This is a commercial trawl used for midwater fishing. The net is 300 feet in length and 100 feet across the mouth. The otter boards weigh 15 cwt each.

For our use the cod end is lined for 14 feet with 4 mm mesh nylon netting and a canvas bucket is laced at the cod end to take the catch. There are 100 deep sea trawl floats along the length of the headrope. The trawl is towed on a single warp, once it has been streamed.

To cut down on handling time once the trawl has been streamed, the trawl is brought right up to the stern of the vessel and the cod end rope is taken through a snatch block at the end of the crane hoist to a snatch block on the deck. It is taken to the capstan and hauled in until the cod end is on board. The bucket is taken off and the catch taken out. The bucket is replaced again and the trawl streamed to its fishing depth.

THE ENGEL TRAWL



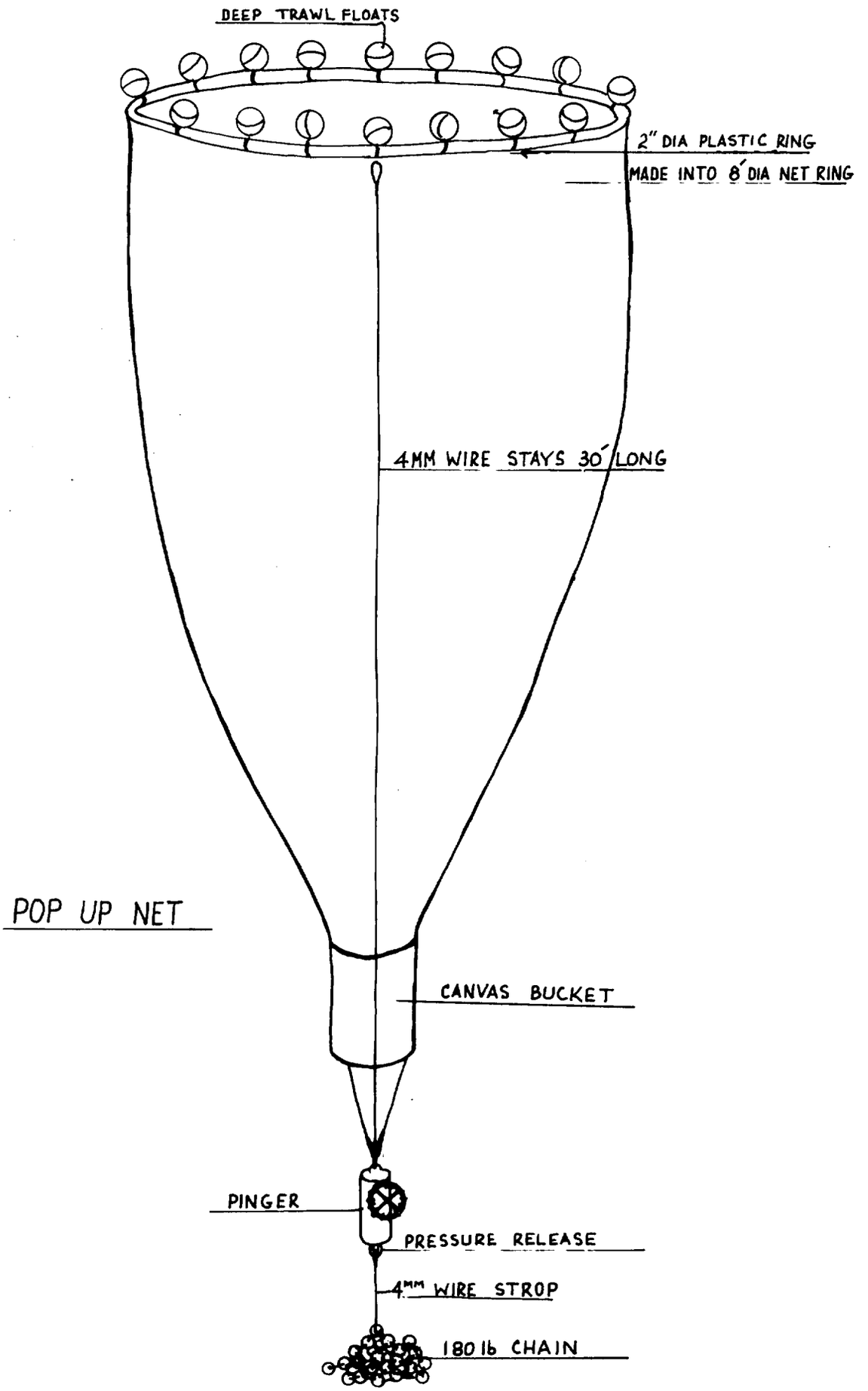
POP UP NET

This is a large net lashed to a polythene ring about 26 feet in circumference. A number of trawl floats (deep sea type) are lashed to the ring to give it buoyancy. 180 lbs of chain cable are used at the bottom of the net which is slung from a 4 mm wire strop to the underside of a pressure release unit.

The net ring is put over the ship's side by the crane in two halves and assembled in the water with the aid of a rubber boat and two swimmers. When the net has been assembled and is ready for sinking, the 180 lbs of weight is attached to the pressure release gear and lowered over the side on a long strop by the crane. A slip hook is used on the end of the crane hoist.

Once the weight is in the water and everything looks clear, the slip hook is released. The net sinks under the weight of the 180 lbs until the pressure release unit operates. The net then rises to the surface under the buoyancy of the trawl floats, fishing on the way up. There is a flashing light attached to the polythene ring of the net to aid in recovering it after sunset.

Once the net has surfaced the ship is brought alongside it and the net ring is grapneled for and brought inboard by the crane, taking several lifts to complete the operation.


DEEP TRAWL FLOATS
2" DIA PLASTIC RING
MADE INTO 8' DIA NET RING
4MM WIRE STAYS 30' LONG
POP UP NET
CANVAS BUCKET
PINGER
PRESSURE RELEASE
4MM WIRE STROP
180 lb CHAIN

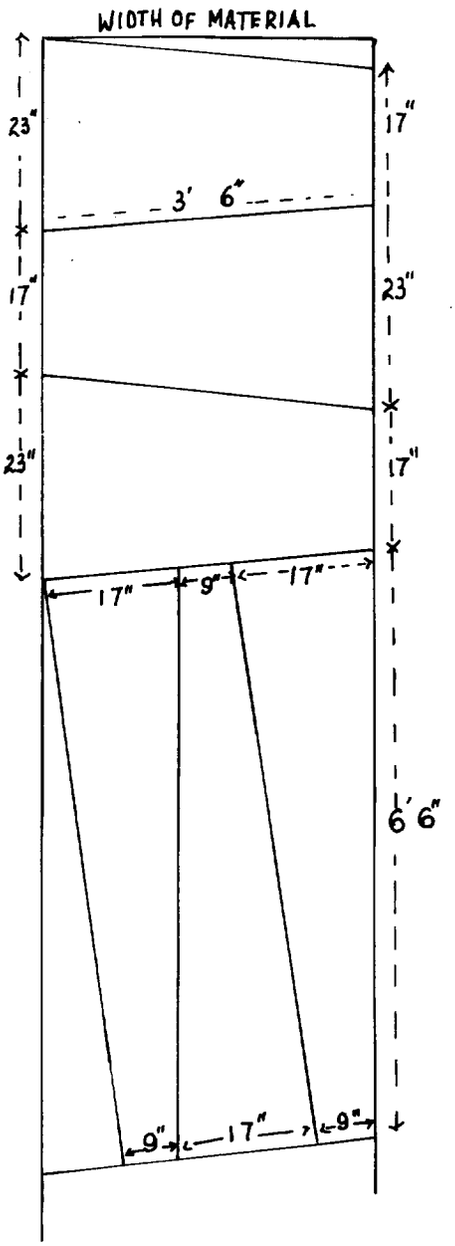
I.K. MIDWATER TRAWL COD END

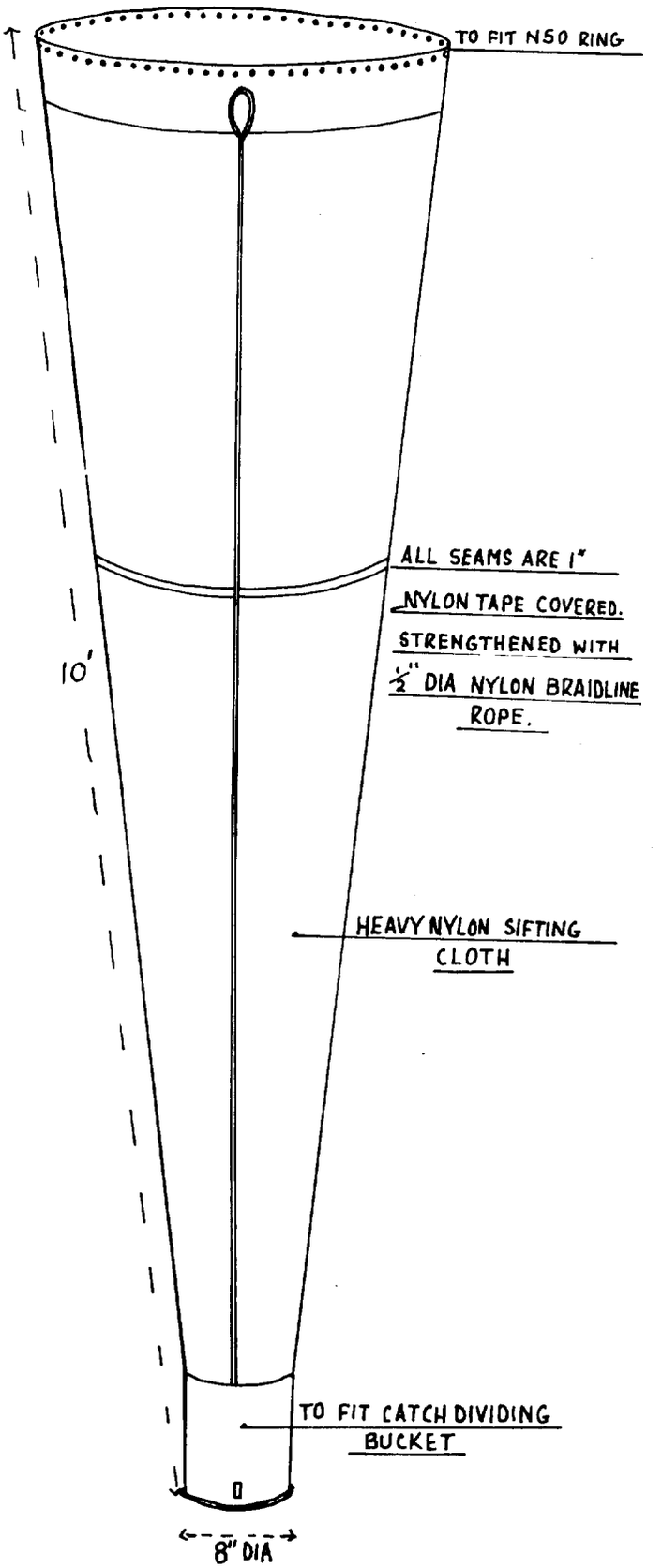
The cod end of the I.K. trawl is adapted to take a catch dividing bucket. A N50 net ring is laced onto the cod end of the trawl to keep the net open. A 1 inch nylon rope is used from the N50 ring to the catch dividing bucket to assist in getting it inboard.

The net is made in three panels from heavy gauge nylon sifting cloth. All seams are taped with 1 inch nylon tape and braided with half inch nylon 'braidline' rope to strengthen them. The cod end collar is made from nylon sailcloth 8 inches deep to fit a catch dividing bucket top.

The cod end net is 10 feet in length. The top of the net has a nylon sailcloth band 4 inches deep, with eyes pierced in the double thickness with a hot spike to lace it to the N50 ring.

I.K.M.T. COD END


WIDTH OF MATERIAL
23"
17"
3' 6"
17"
23"
23"
17"
17"
9"
17"
6' 6"
9"
17"
9"


TO FIT N50 RING
ALL SEAMS ARE 1"
NYLON TAPE COVERED.
STRENGTHENED WITH
½" DIA NYLON BRAIDLINE
ROPE.
10'
HEAVY NYLON SIFTING
CLOTH
TO FIT CATCH DIVIDING
BUCKET
8" DIA

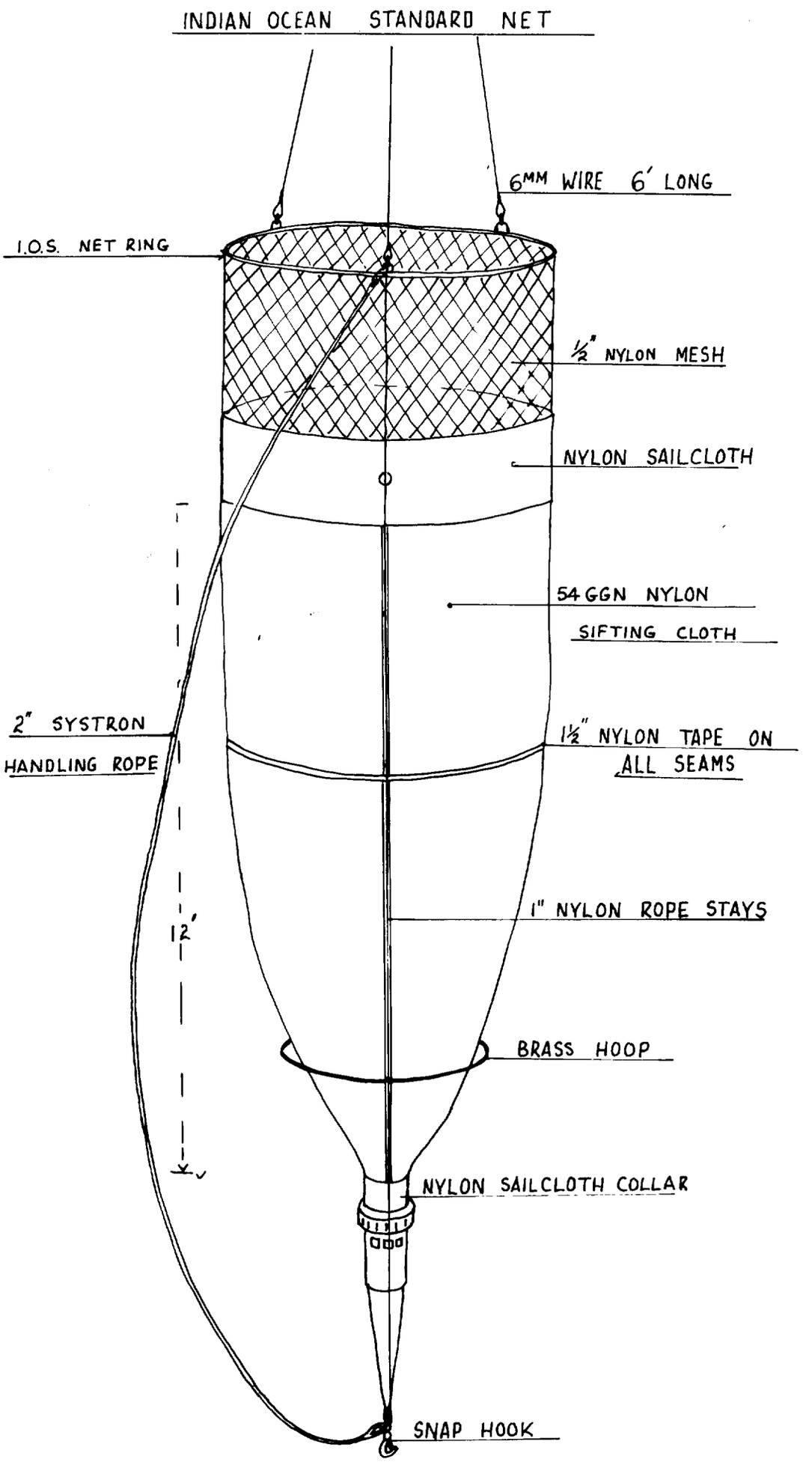
INDIAN OCEAN STANDARD NET

This was a net designed for use in the Indian Ocean by the ships taking part in the International Indian Ocean Expedition 1963/64. It is a vertical net but can be used obliquely. It has been used as an oblique net with a catch dividing bucket, without the French netting. It has also been used as a closing net on the 'Levit' principle without the French netting described on the next page.

To use it as an oblique net with a catch dividing bucket, the net is cut off at the circumference of the C.D.B. and a nylon sail-cloth collar sewn on. The nylon stays are shortened to that length. A handling line is secured to the C.D.B. to aid in recovery.

When used as a vertical net a weight of 64 lbs, comprising of two conical and one flat 'Lucas' weights, is used. This net with a nylon sailcloth top in place of the French netting and a sailcloth bottom to fit a 2 metre net bucket is used as a T.Y.F. (N113). Also rigged like this on the 'Levit' release, three nets in series can be towed obliquely.

The old nets are used for taking surface samples during a trawl and are used from a boom on the same side as the trawl familiarly called 'the Oxfam Net'.

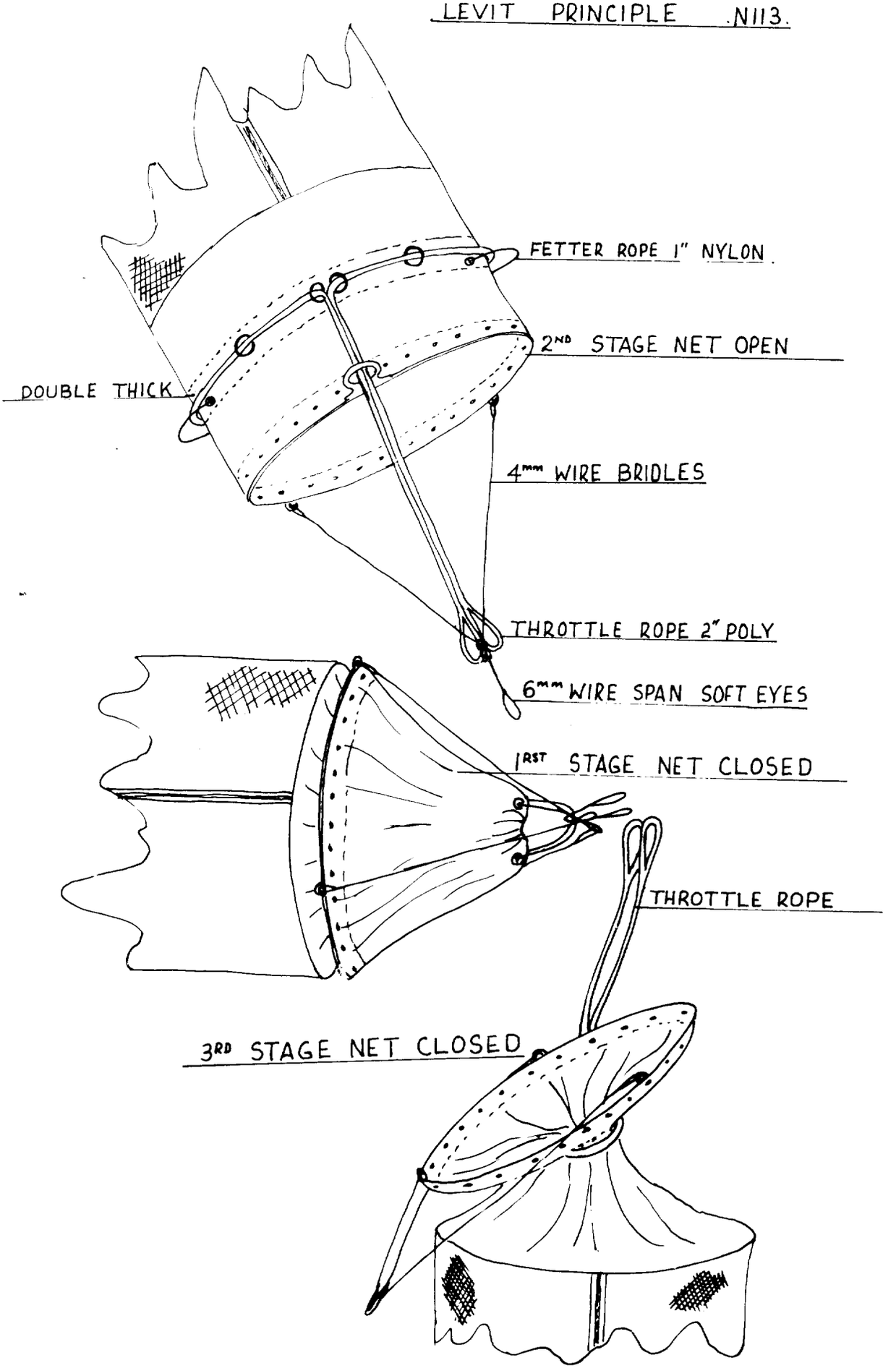

INDIAN OCEAN STANDARD NET
6MM WIRE 6' LONG
I.O.S. NET RING
½" NYLON MESH
NYLON SAILCLOTH
54 GGN NYLON
SIFTING CLOTH
2" SYSTRON
HANDLING ROPE
1½" NYLON TAPE ON
ALL SEAMS
1" NYLON ROPE STAYS
12'
BRASS HOOP
NYLON SAILCLOTH COLLAR
SNAP HOOK

I.O.S.N. RIGGED FOR CLOSING ON THE LEVIT PRINCIPLE

This is an ordinary Indian Ocean Standard Net with the French netting removed, and replaced with nylon sailcloth. There is an alloy ring inside the net at the join of the sailcloth. The closing band is double thick nylon sailcloth with six brass rings sewn on the outside. Through these rings a 2 inch polythene throttle rope is reeved with soft eyes at each end. There is also a fetter rope at this point. This is made of 1 inch polythene rope in an endless band (short spliced together). Four brass eyelets are put in the closing band at equal distances apart; the fetter rope is fed through these before being spliced.

Three 4 mm wire bridles are used for towing. There is also a short 6 mm wire span (soft eyes) shackled to the towing bridles and clipped into the 'Levit' release. When the 'Levit' has been placed on the main warp the slack throttle ropes are shackled to the eye at the bottom of the release. The fetter ropes are taken from the inside of the net in two opposite bites, and placed in the first stage of the release (which is the inside one). The towing bridles are then placed in the second stage (outside) release position. The net is now ready for streaming: pay out on the main winch, hold the cod end of the net until the last minute. This will keep the net streamed out. The winch should be stopped with the net just under the surface. When satisfied that the release is not fouled up paying out can be continued.

INDIAN OCEAN STANDARD NET RIGGED FOR CLOSING ON THE LEVIT PRINCIPLE .N113.



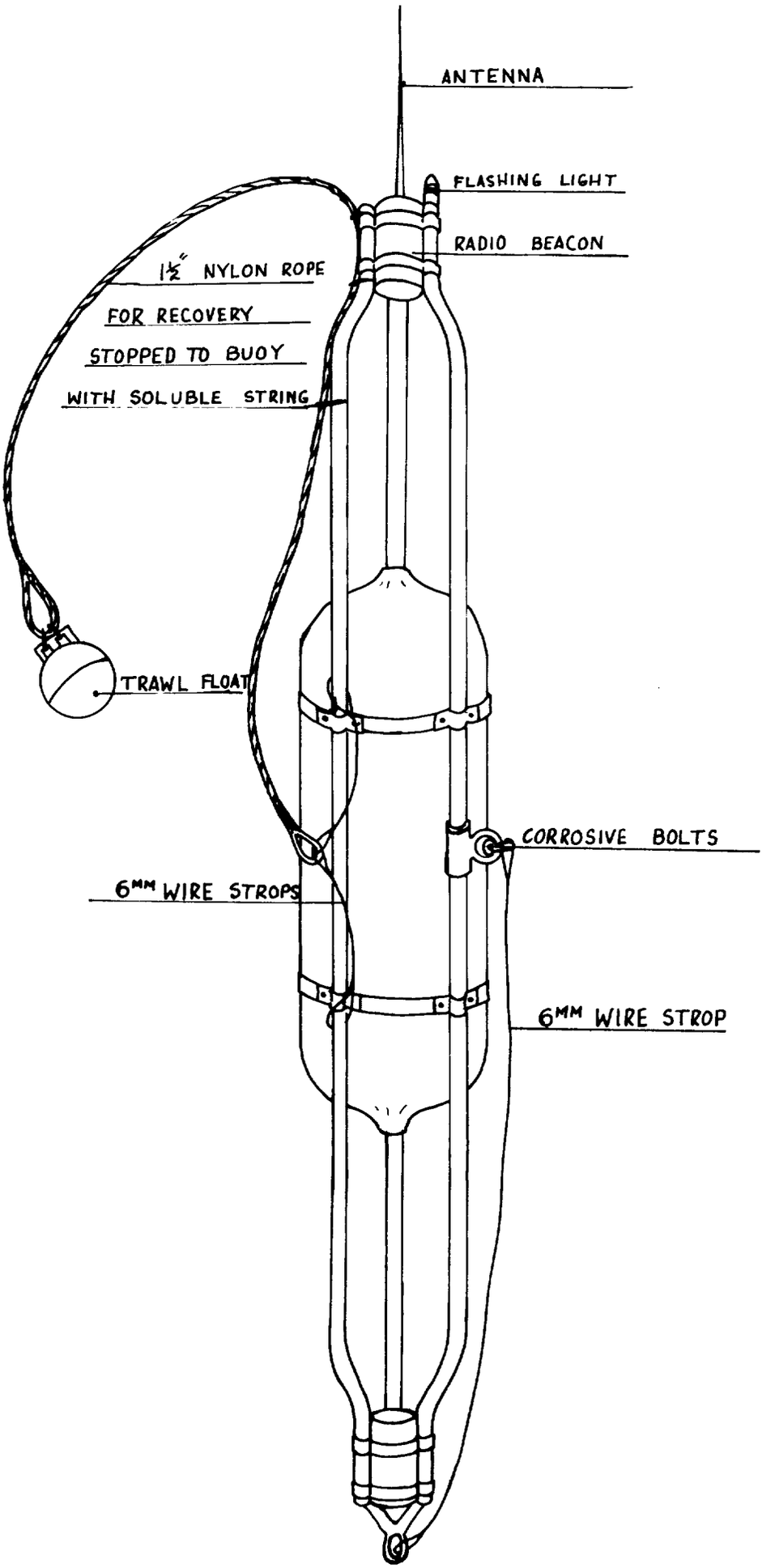
POP UP BUOY

This is a subsurface buoy moored with 4 mm wire with an explosive link just above the anchor weight. The explosive link is fired from the ship by sound pulse through the water. The buoy is released from its anchor and comes to the surface with its current meters etc.

The buoy is moored horizontally at first but after a certain time in the water a corrosive bolt at the centre of the buoy breaks away and the buoy upends itself. The flashing light and radio beacon are operated by a pressure switch on coming to the surface.

A picking up rope with a trawl float attached is shackled to the buoy for recovery. The whole mooring is made up on deck before it is laid. It is laid over a block on the after gallows, the current meters being inserted in the mooring at their prearranged depths.

As many as three buoys in series have been used to take the weight of a mooring.


ANTENNA
FLASHING LIGHT
RADIO BEACON
1½" NYLON ROPE
FOR RECOVERY
STOPPED TO BUOY
WITH SOLUBLE STRING
TRAWL FLOAT
CORROSIVE BOLTS
6MM WIRE STROPS
6MM WIRE STROP

2 mm WIRE FOR MOORING BUOYS

A table has been devised to find how much wire is left on a drum of the special winch drums used for mooring dhan buoys. By measuring from the outside rim of a spool into the remaining wire, the number of inches read off on the scale gives the approximate number of metres of wire left on the drum. This only applies to the special drums for mooring buoys which are filled with 2 mm wire.

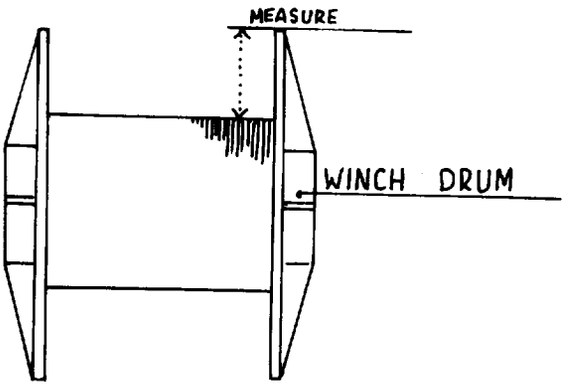
A quick way of securing a cable to a wire is by taking an old car inner tube and cutting it into strips about $\frac{1}{2}$ inch wide. Cow hitch one end of this strip to a wodden toggle, the other to the electric cable to be secured. Wrap the rubber band tightly around the cable and wire, stretching it all the time. Then stick the toggle between the wire and cable on the bottom side, where it will stay under its own tension.

To release it just flick the toggle from between the two wires and it will come away under the tension in the rubber band.

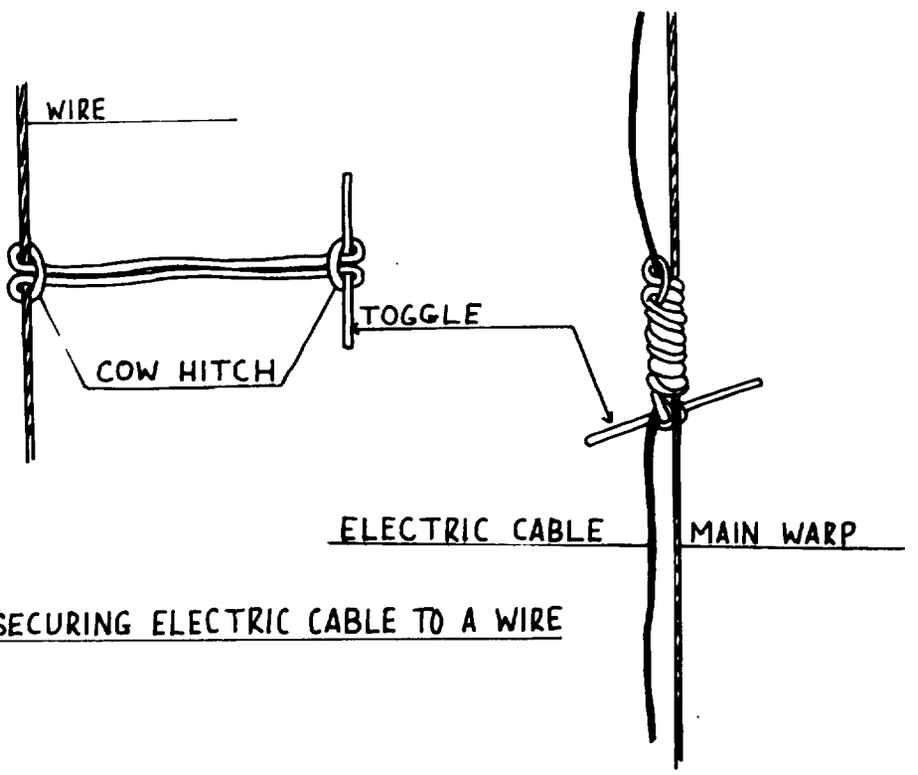
To float the electric cable cut blocks of foam plastic into boat shaped forms, score the centre and sandwich the cable between two pieces and tape together with P.V.C. tape at intervals along the cable.

2MM WIRE FOR MARKER BUOY MOORINGS

INCHES IN DEPTH	NUMBER OF METERS	ON DRUM
7"	500	"
6"	1000	"
5½"	1500	"
4¾"	2000	"
4"	3500	"
3"	4000	"
2¼"	5000	"
1¾"	6000	"
1"	7000	"
½"	8000	"

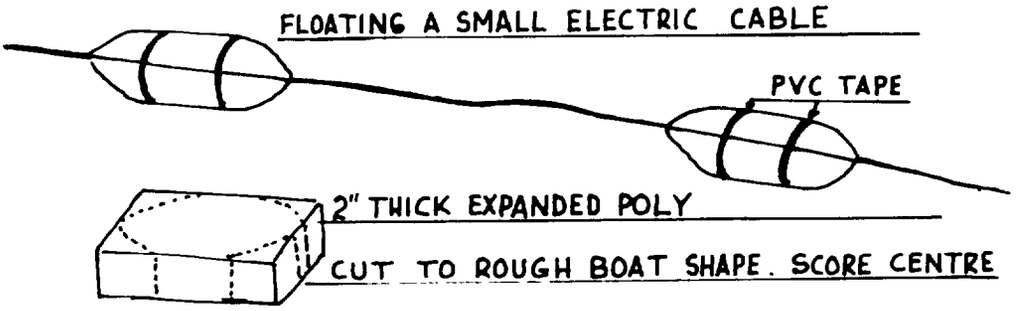


THIS IS FOR SPECIAL METAL DRUMS OF DHAN BUOY WINCH



SECURING ELECTRIC CABLE TO A WIRE

FLOATING A SMALL ELECTRIC CABLE



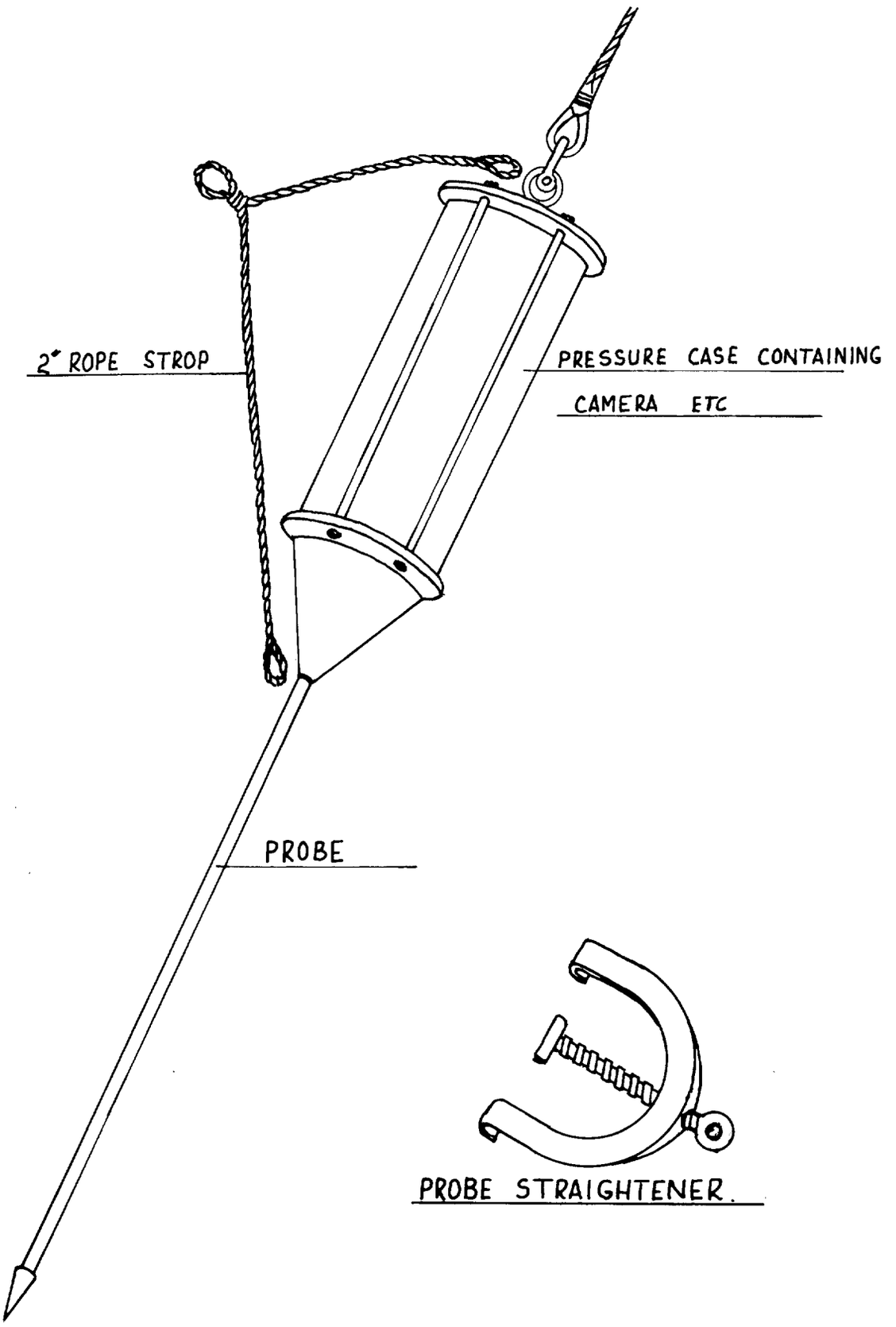
TEMPERATURE PROBE

This instrument is treated in the same manner as for a corer. It is left embedded in the sea bed for a certain length of time to record the temperature of the sediments. After each operation it is brought inboard for the removal of the camera. The probe always comes up with a bend in it, due to the ship drifting away from the point of entry and pulling it out at an angle. A probe straightener is provided for straightening it out after each operation.

The scientist must always switch on the camera and remove the drying agent before lowering it over the side.

This operation is now incorporated on the gravity corer (as described on page 6).

SIR EDWARD BULLARD TEMPERATURE PROBE



PROBE STRAIGHTENER.

DECCA SEAFIX BUOYS

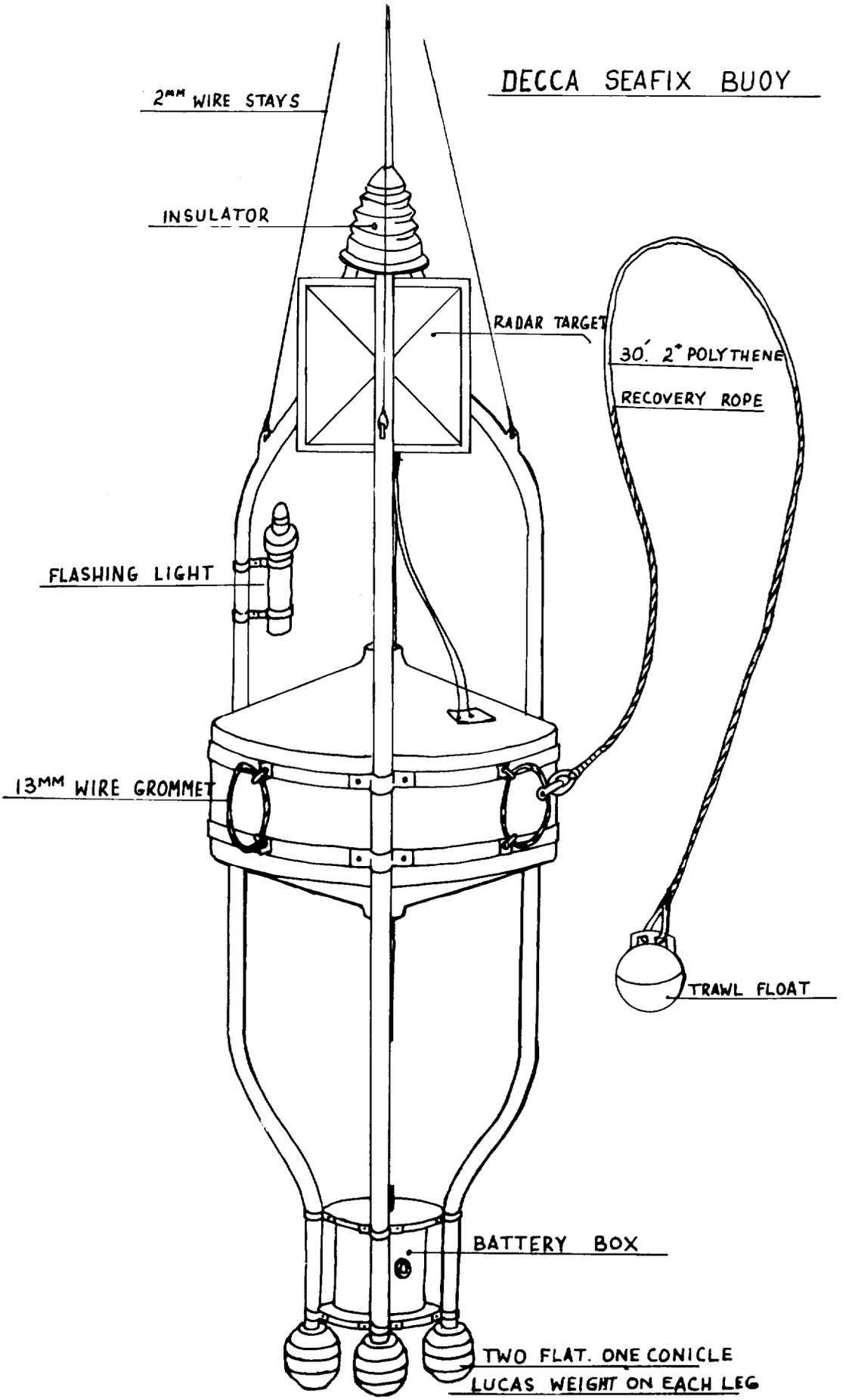
This is a moored buoy moored in the same way as a deep water dhan buoy. It contains electrical equipment and must be handled with reasonable care.

Two 13 mm wire grommets are shackled to the buoy for use in slipping from a slip hook, and for hooking on the crane hoist when recovering. Two lifts are required to get the buoy on deck.

The transponder unit at the top of the pole is very liable to knocks and care must be taken to try not to damage it when streaming and recovering.

The bottom compartment of the buoy contains wet batteries, so must be kept in a fairly upright position to avoid spilling the acid, so for this reason it is brought inboard and lashed upright against the rails or foremast.

DECCA SEAFIX BUOY



LARGE SONAR BUOYS

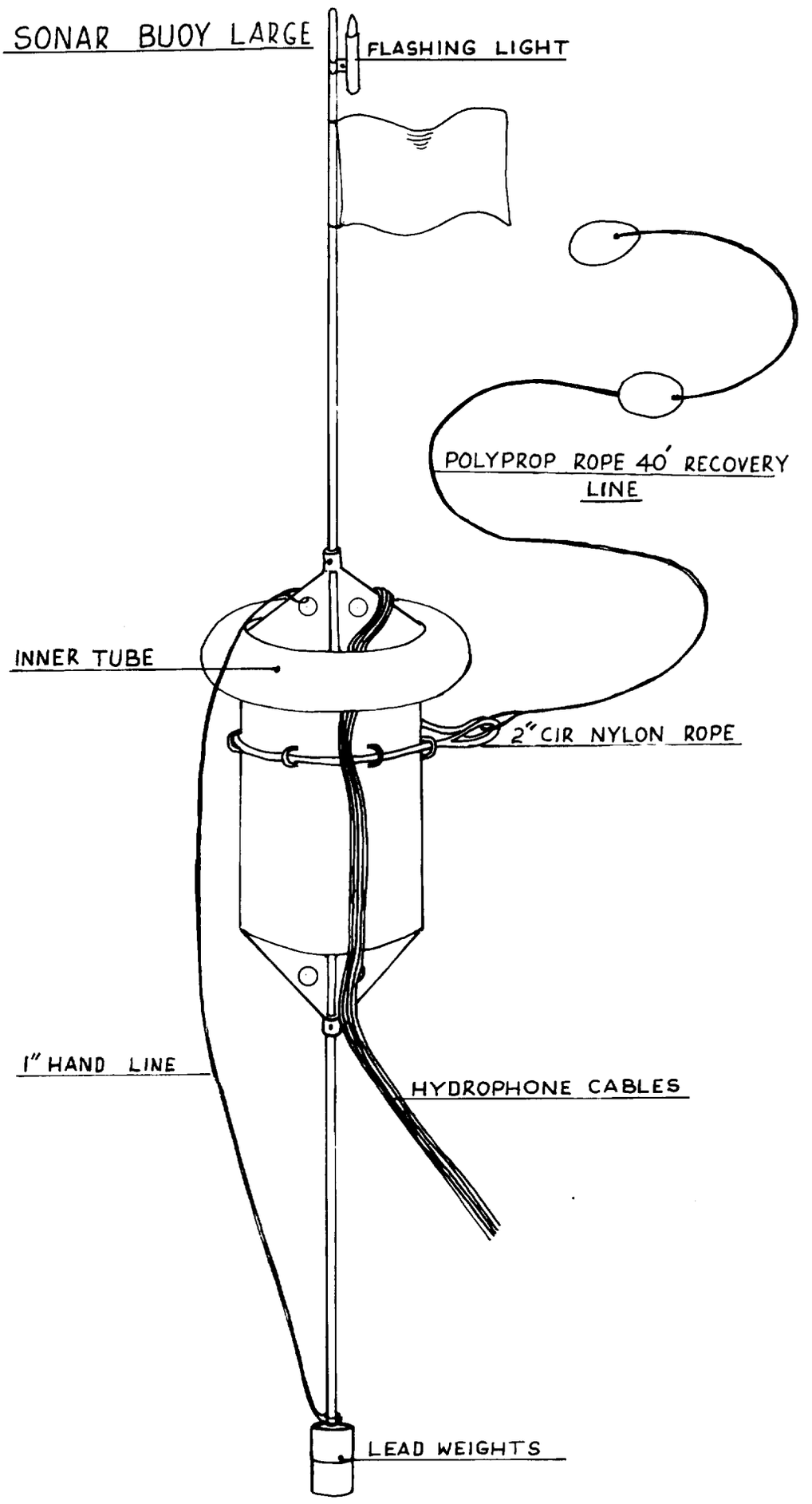
This buoy is similar to the other sonar buoys described previously, but it is quite a lot heavier and has to be launched and recovered by the crane.

The hydrophones are launched first and paid out until there is about 20 feet left. The aerial and flag are then connected to the buoy. The buoy is then switched on and tested. If found to be working the buoy is then lowered into the water by the recovery line round a cleat. Once the buoy is in the water the hydrophone cables are released and the buoy set adrift. The bridge is informed at the moment of release (to mark the chart).

To recover, the recovery line is grapneled from the forecastle deck, and passed along by hand to the after deck, hooked on the crane hoist and lifted until the hydrophone cables are within reach. The buoy is held until cables are on the deck, then brought in and kept upright (because of acid batteries). The top and bottom poles are taken off and the buoy is then stowed in a rack upright for attention later.

The ship's screw is stopped during the recovery operation. Then once everything is clear of the screw the bridge is informed.

It is sometimes launched with a free floating buoy in tandem with a radar target to assist the ship in locating the buoys after a shot firing run.


SONAR BUOY LARGE
FLASHING LIGHT
POLYPROP ROPE 40' RECOVERY LINE
INNER TUBE
2" CIR NYLON ROPE
1" HAND LINE
HYDROPHONE CABLES
LEAD WEIGHTS

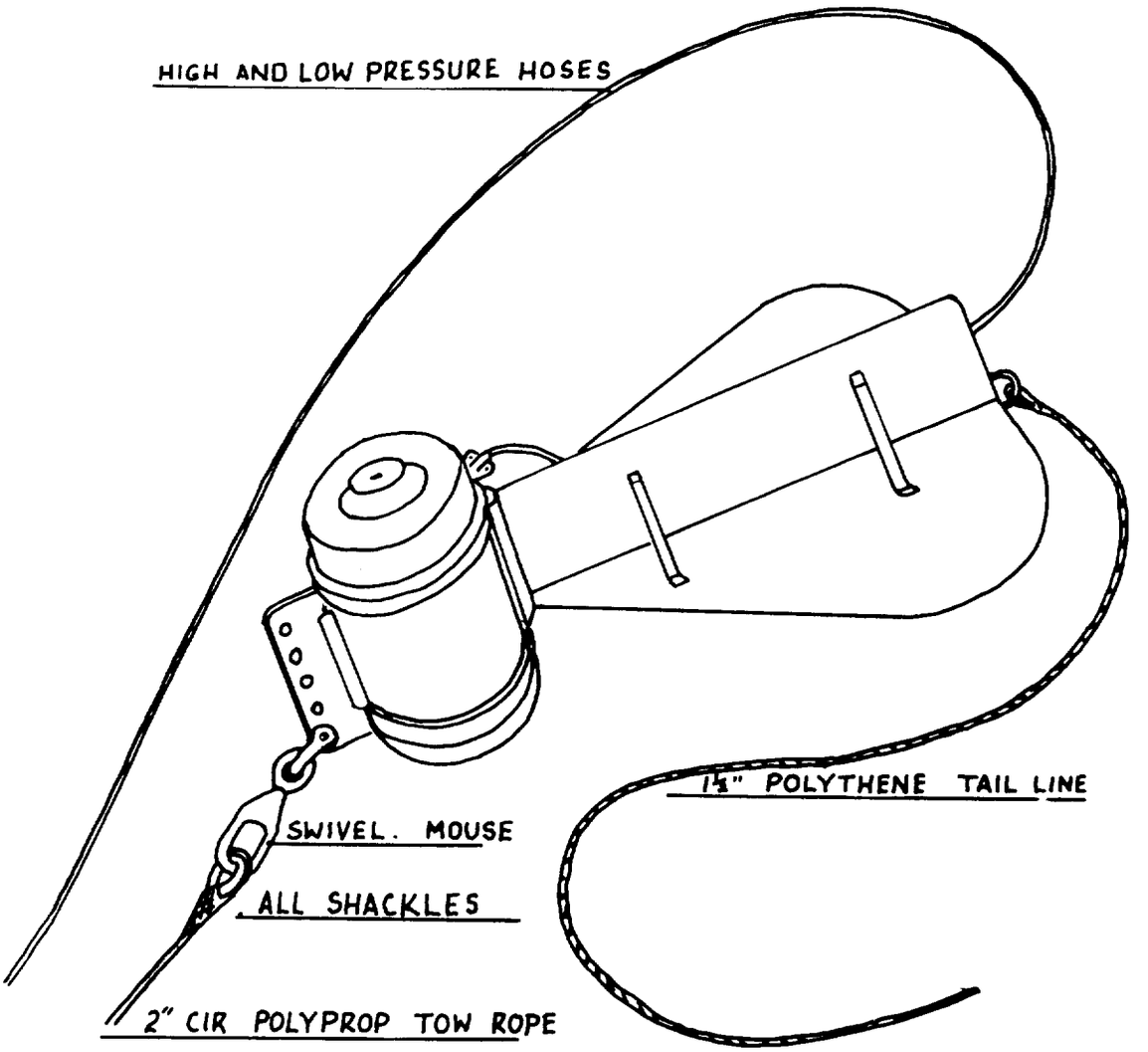
AIR GUN

This gun is towed astern from the gallows on a 2 inch polythene or nylon rope 80 feet long. There is a 1 inch rope tail attached to the rear of the gun to assist in recovery.

The two pressure hoses are stopped to the towing rope at intervals of five metres with rubber band and toggle method. It is sometimes necessary to put a rope stop on the cables as it is occasionally towed at 8-10 knots. All shackles are moused on this rig.

The gun is paid out and recovered by taking the tow rope around the after capstan through the lead blocks from the gallows.

AIR GUN


HIGH AND LOW PRESSURE HOSES
1½" POLYTHENE TAIL LINE
SWIVEL. MOUSE
ALL SHACKLES
2" CIR POLYPROP TOW ROPE

POP UP CORER (BOOMERANG)

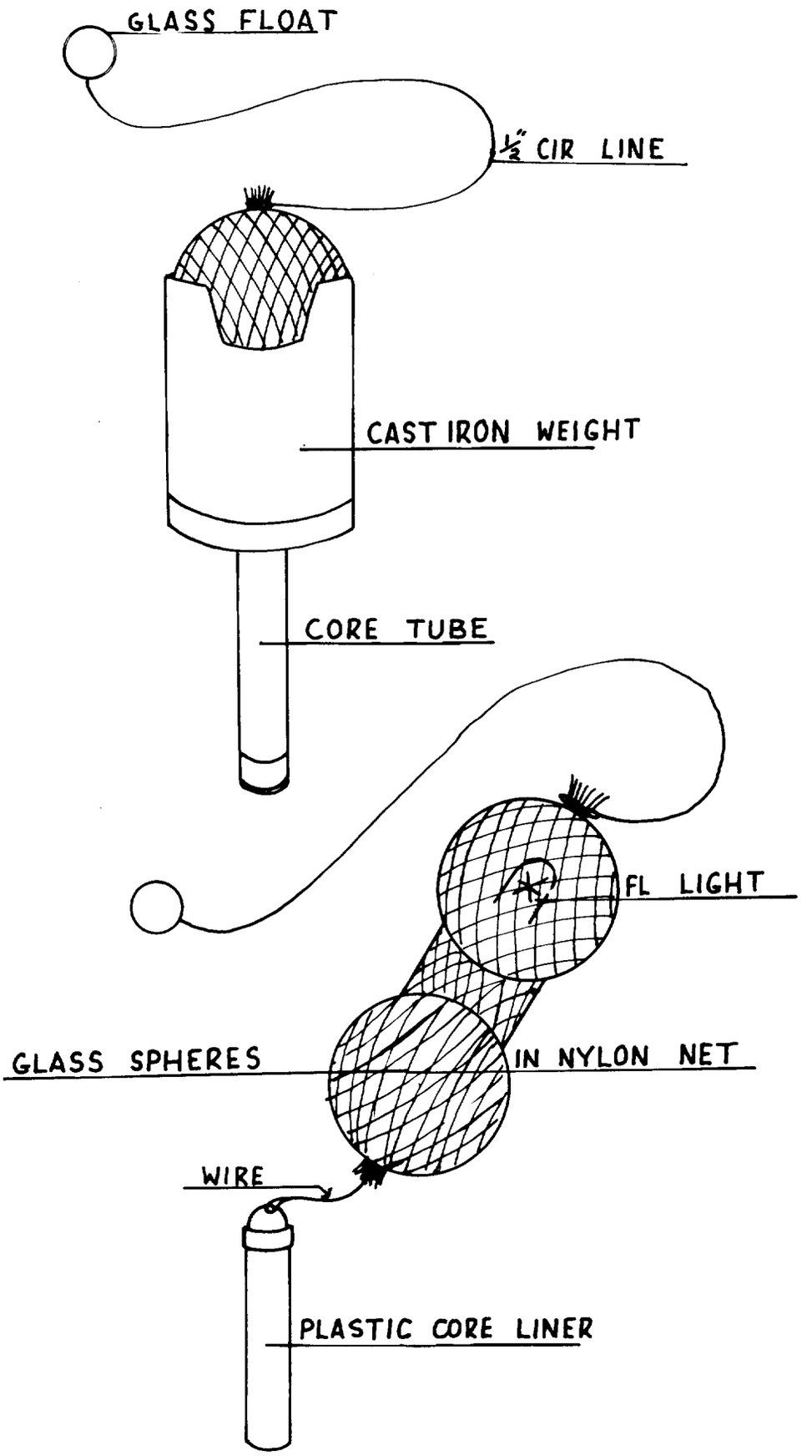
This is a free fall corer consisting of a heavy metal body and a core tube. There are two glass spheres, containing batteries and flashing light equipment in a nylon net attached to the core liner by a small wire. The spheres are held in the core body by two metal flaps or wings, which are held in place by the water pressure as the corer falls through the water.

When the corer strikes the bottom, the two flaps fall away, releasing the glass floats, which then rise to the surface taking the core liner and sample therein with them.

The glass spheres turn over (the top one being heavier than the bottom one) on the way up. This actuates a mercury switch and starts the flashing light which can be seen on the surface in decent weather at night for about two miles.

There is a small glass float about the size of a tennis ball on the end of a light line used for recovering the spheres.

BOOMERANG CORER



GRAPNELS

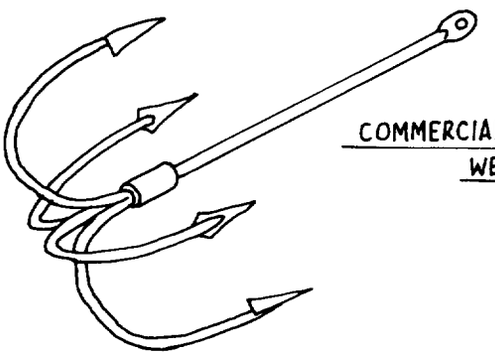
Grapnels are used quite extensively in oceanographic work. There are various sizes and weights, each one for its own job of work.

Recovering a delicate instrument from the water will require a delicate grapnel. Recovering a one ton buoy will need a grapnel that can lift one ton without endangering personnel around it.

There are various types of grapnels for dragging for lost moorings, most of these are made commercially and used by telephone cable companies. The ones usually used can be obtained through Her Majesty's Dockyards.

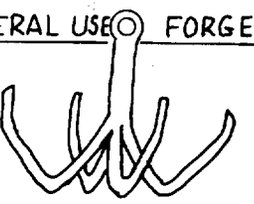
The larger types of grapnels are known as 'creepers' and can also be obtained through H.M. Dockyards.

GRAPPLING - IRONS



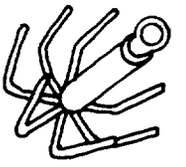
COMMERCIAL GALVANISED MILD STEEL
WELDED. GENERAL USE

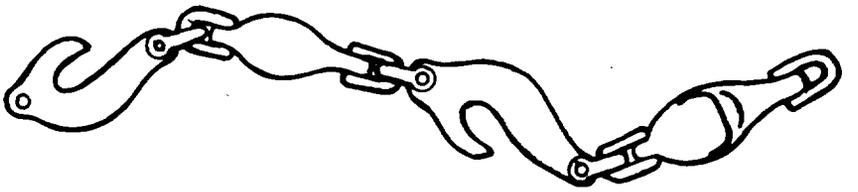
STRONG FOR GENERAL USE FORGED IRON



¼" DIA MILD STEEL WELDED. LIGHT FOR SMALL BUOYS ETC

3/16" MILD STEEL BAR VERY LIGHT
FOR CURRENT FLOAT RECOVERY.





GIFFARD GRAPNEL A.P FROM HM DOCKYARD

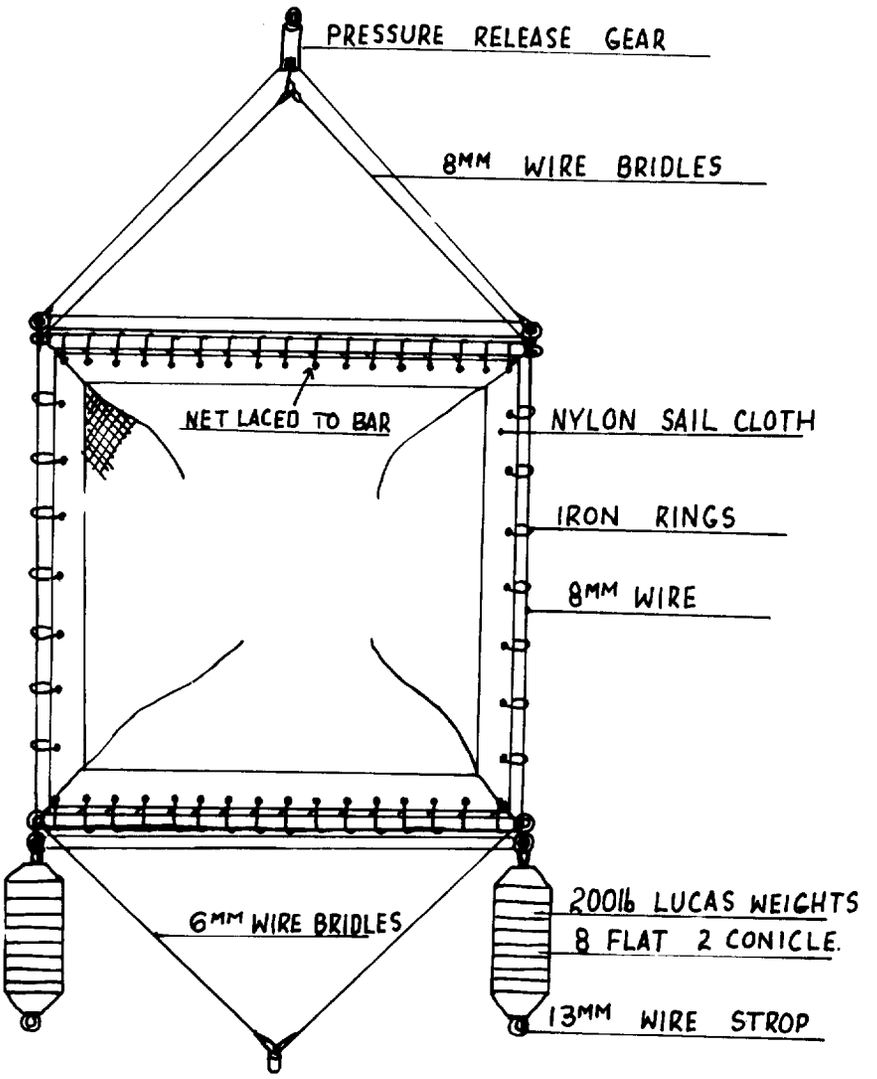
R.M.T.8 Mk 1

This is a net used for oblique hauls. The net is laced onto the two inside bars. Each bar has its own set of bridles which are attached to a pressure release unit.

At a predetermined depth the second bar from the bottom falls away taking the net with it, thus opening it.

When the net has fished for its allotted time the whole unit is lowered until the second pressure release comes into operation. This releases the third bar and closes the net which is then hauled to the surface and taken in on deck.

The net is put over the side with the crane and fished from the main warp.



R.M.T. 8 MARK 1

REARRANGEMENT OF WEIGHTS

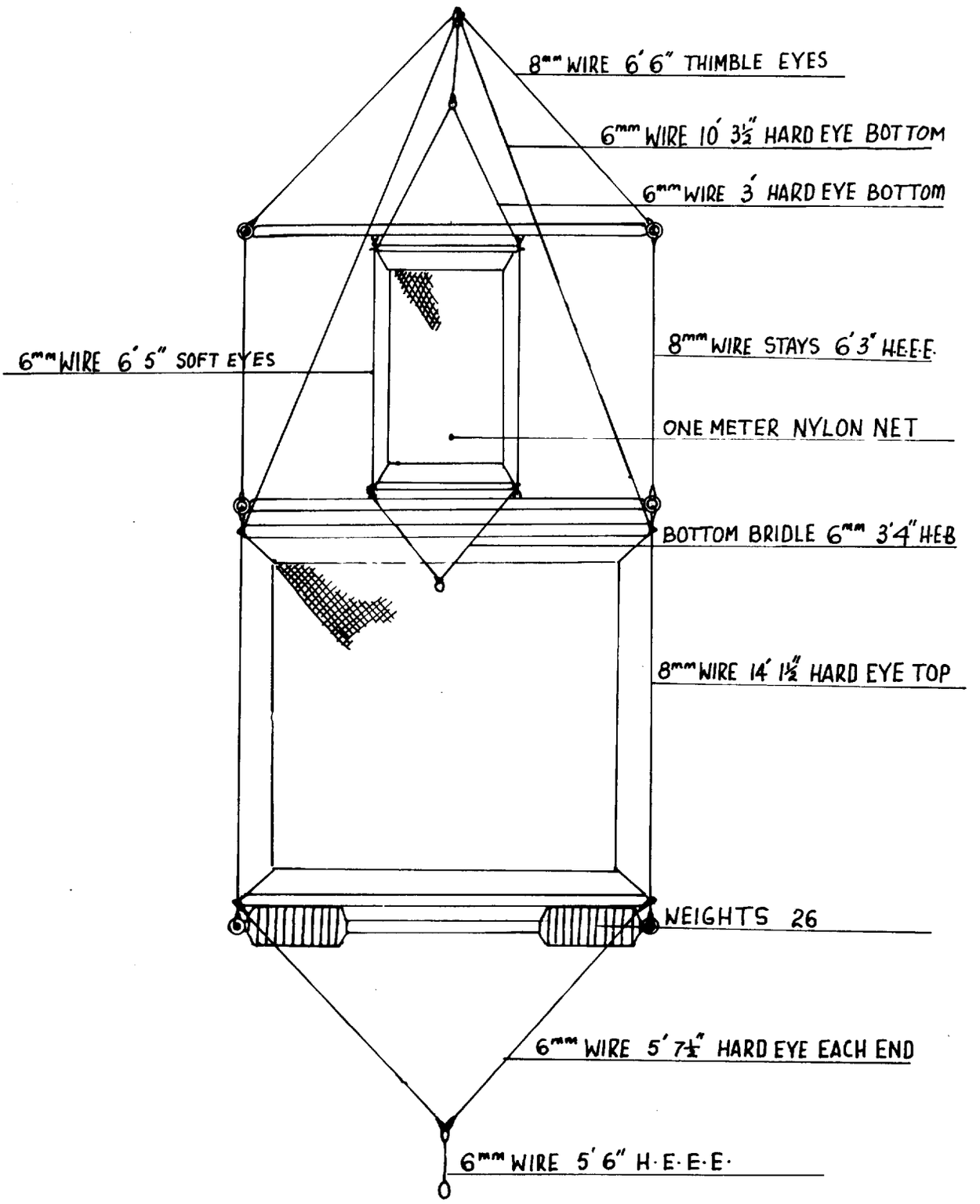
R.M.T. COMBINATION NET

This net consists of an RMT1 and an RMT8 rigged together in one frame. The nets are opened and closed acoustically by a signal from the towing ship so that the layer the nets fish in can be controlled. The measurements of all wires for bridles and side wires are critical, to keep the nets towing straight. The nets are laced on bars which slide down side wires. The net enters the water closed and is lowered to its fishing depth. A signal is sent to the acoustic release which causes the bottom bars of the two nets to fall away taking the nets with them, thus opening them. When the nets have fished their allotted time another signal is transmitted to the release gear, causing the top bars to fall away taking the top of the nets down with them and closing them.

The nets are monitored by the P.E.S. fish both for depth and position of net, i.e. open or closed.

The complete net and acoustic release gear is hoisted out by crane in one operation.

COMBINATION NET RMT 1 RMT 8



WIRES FOR RELEASE GEAR 6mm 1' 10½" SOFT EYE ONE END. NYLON OTHER

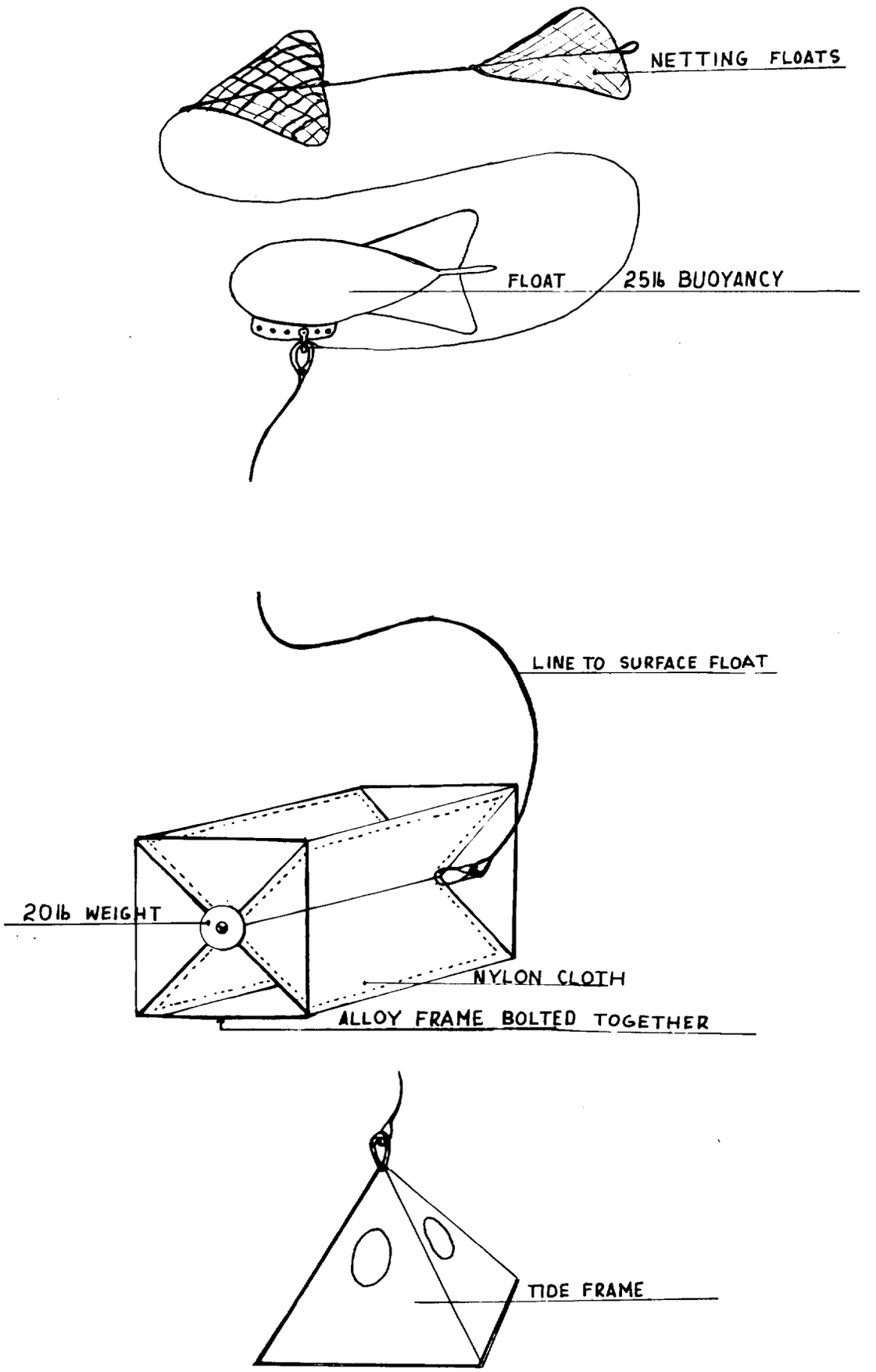
CURRENT FRAMES

The frames are made of tubular alloy bolted together. The nylon covering is made with wide seams at the edges. Before assembling the frame the rods are pushed through these seams and then the frame is bolted together holding the nylon covering in place.

On some frames the nylon covering is laced on through brass eyelets at the edges.

The surface current floats have a buoyancy of 25 lbs. The recovery line for these floats have netting triangles at the end instead of trawl floats or plastic floats. This is to stop the current float from being influenced by wind at the surface, pushing the floats along.

The small grapnel gets entangled in these small net triangles and the current float is brought inboard by this means.


NETTING FLOATS
FLOAT
25lb BUOYANCY
LINE TO SURFACE FLOAT
20lb WEIGHT
NYLON CLOTH
ALLOY FRAME BOLTED TOGETHER
TIDE FRAME

M.B.A. DREDGE

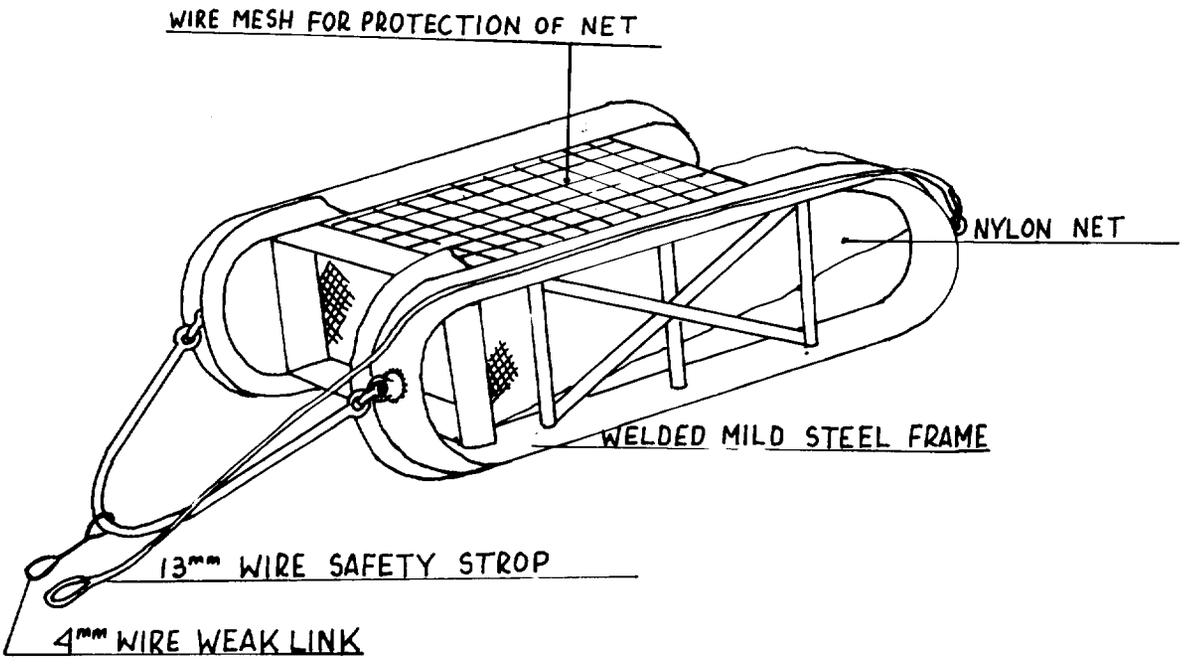
This is a frame with skids on the sides. It will dredge as easily upside down as the right way up so both sides are the same. The net is made of heavy nylon cord and protected by wire mesh across the frames.

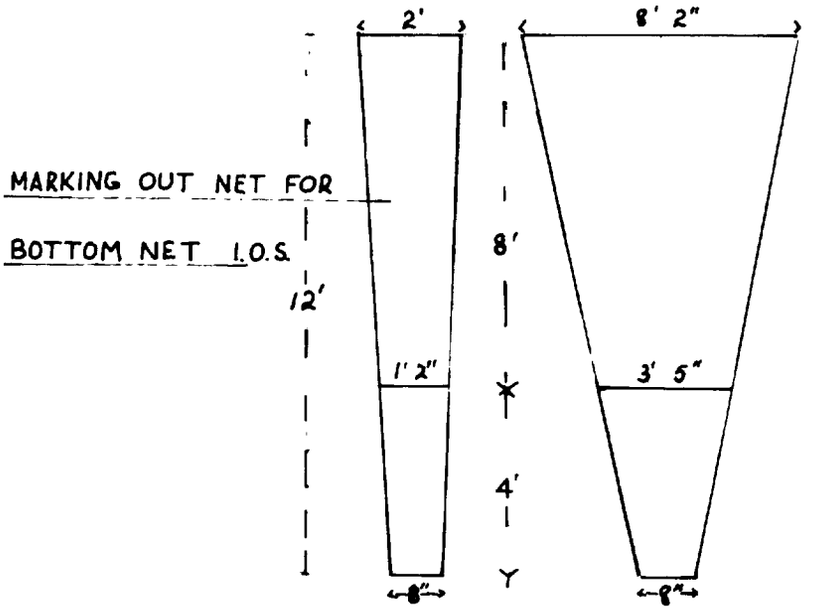
There is a safety line of 13 mm wire attached to the back of the frame that turns the net upside down if it gets fouled up and the weak link parts. Unfortunately the catch is lost if this happens!

The weak link is a short strop of 4 mm wire which will break at 1 ton.

This dredge is used on sea beds known to be free of obstructions.

M.B.A. DREDGE.


WIRE MESH FOR PROTECTION OF NET
NYLON NET
WELDED MILD STEEL FRAME
13mm WIRE SAFETY STROP
4mm WIRE WEAK LINK


2'
8' 2"
MARKING OUT NET FOR
BOTTOM NET I.O.S.
12'
8'
1' 2"
3' 5"
4'
8"
8"

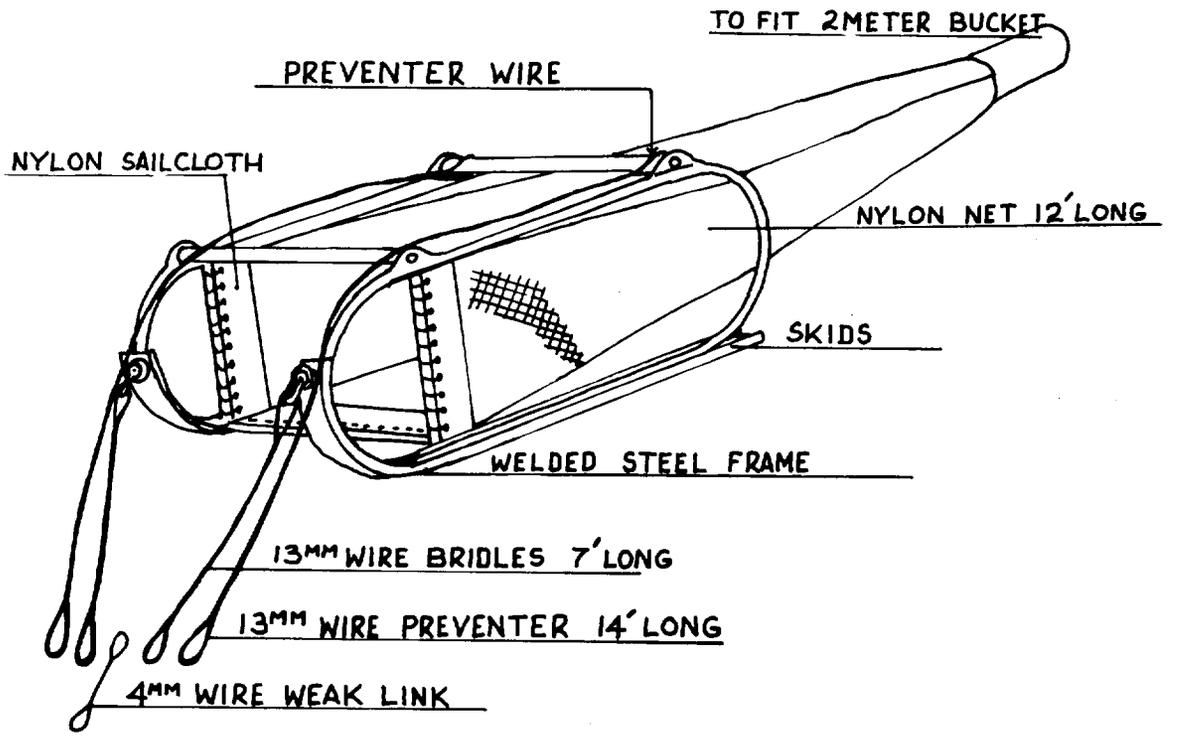
BOTTOM NET I.O.S.

This is an oval frame with skids attached with a nylon net fixed between the skids. It is similar to the M.B.A. dredge and used in the same manner in obstruction free areas.

The net is towed on 13 mm wire bridles and a 4 mm wire weak link system. The safety strops are of 13 mm wire attached to the top rear bar of the net from in front of the weak link. If the weak link parts the net frame will turn over and free itself. The catch will not be lost with this net as it will fold up on itself on turning over and trap the contents.

A piece of old trawl netting is laced to the bottom bar of the frame to protect the nylon net. A pinger is placed on the trawl wire at 200 metres above the net, and monitored on the P.E.S. to indicate the position of the net relative to the sea bed.

BOTTOM NET



OLD TRAWL ALONG BOTTOM TO PROTECT THE NET

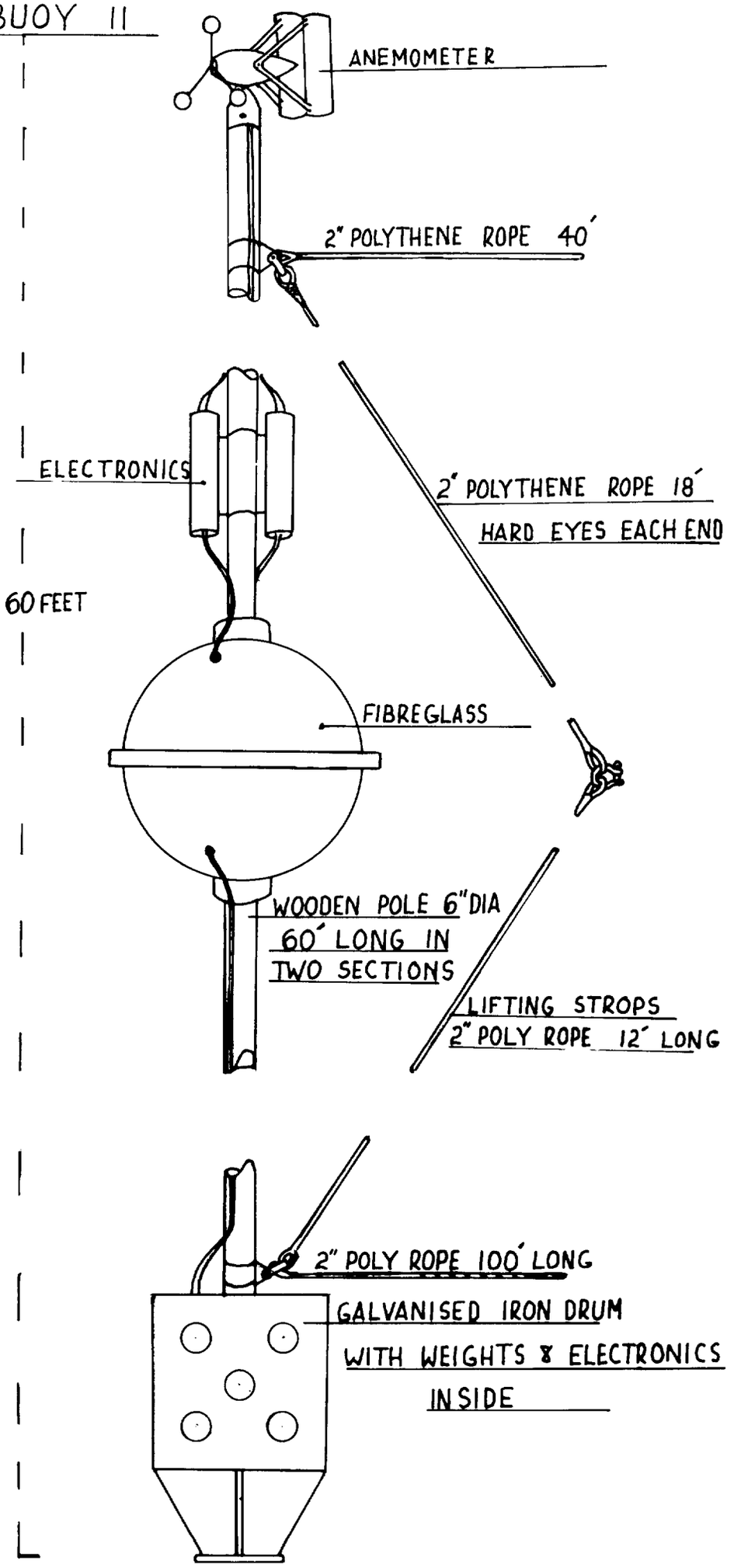
SPAR BUOY

This is a spar 60 feet in length with a fibreglass buoy midway along it. The bottom of the spar has a galvanised iron container fitted with lead weights and electronic equipment.

The buoy is lowered over the ship's side by the crane and main trawl winch in a horizontal position. The 2 inch polythene 40 foot rope is taken to the crane hoist once the spar buoy is outboard and lashed to the rail and the 2 inch polythene 100 foot rope is taken to the trawl winch. The weight of the spar is then taken on the winch, the spar is unlashed and both crane and winch lower away into the water. Once the buoy has taken the weight of the spar in the water and the spar has taken a vertical position in the water the two ropes will become slack and can be disconnected from the winch and crane. A trawl float is attached to each one and the buoy is set adrift.

To recover the buoy, the two ropes are picked up with a grapnel, the 100 foot one goes to the winch, the other to the crane. Hoist in on the winch until the buoy takes a horizontal position in the water. Take in the slack on the crane rope and hoist together until the buoy is in a position to be lashed at the rail. The crane is then transferred to the lifting point between the 18 foot and 12 foot polythene ropes. The buoy is then brought in on deck by the crane and placed in its crutch.

SPAR BUOY II


ANEMOMETER
2" POLYTHENE ROPE 40'
ELECTRONICS
2" POLYTHENE ROPE 18'
HARD EYES EACH END
60 FEET
FIBREGLASS
WOODEN POLE 6" DIA
60' LONG IN
TWO SECTIONS
LIFTING STROPS
2" POLY ROPE 12' LONG
2" POLY ROPE 100' LONG
GALVANISED IRON DRUM
WITH WEIGHTS & ELECTRONICS
INSIDE

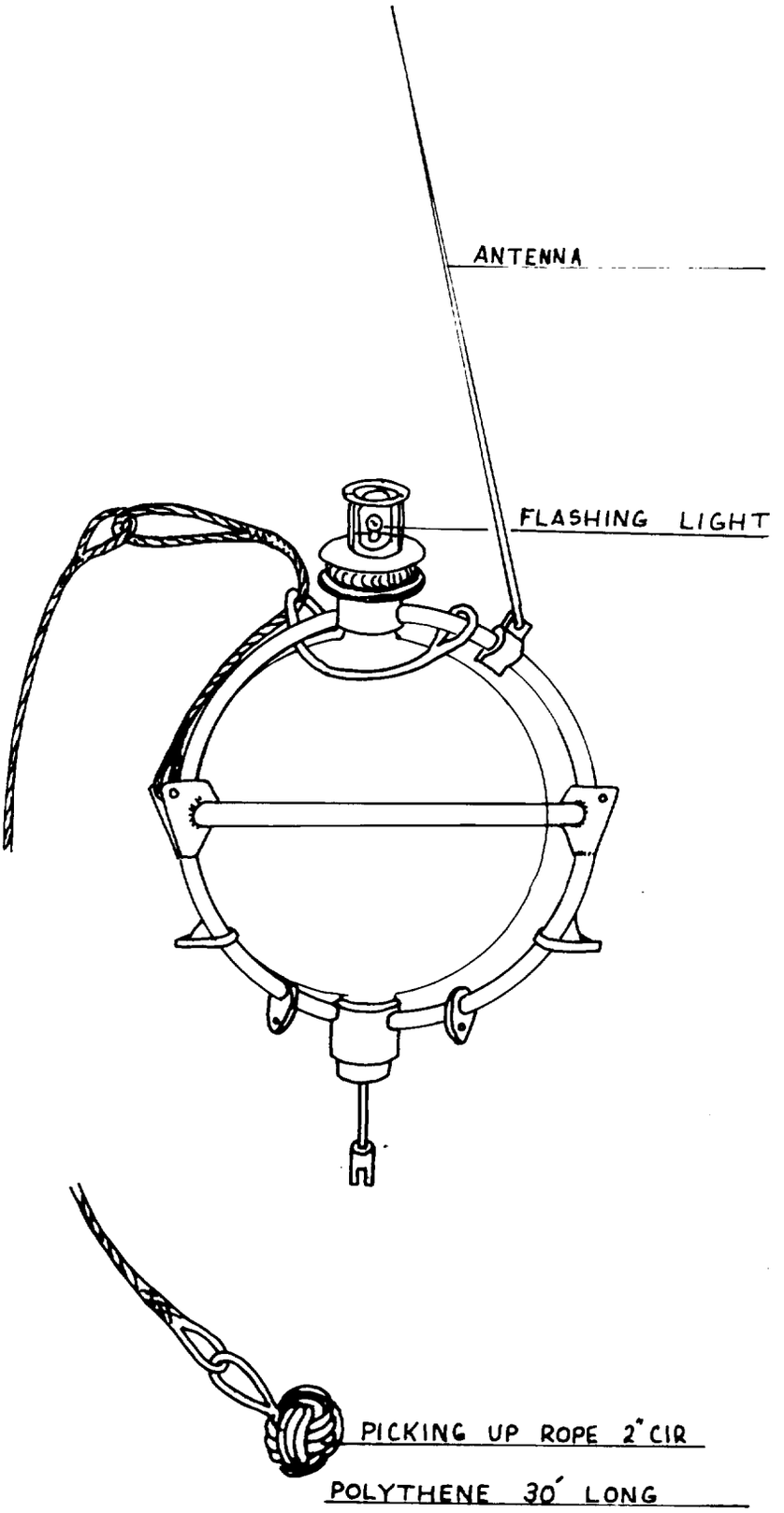
POP UP BUOY (P.U.B.S.) SPHERE

This buoy is free falling; it is put into the water and slipped by means of the slip hook. When it is required to bring the buoy to the surface, a certain frequency is transmitted to it. This fires the release mechanism, shedding the anchor weight.

The buoy comes to the surface after a period of time where it is recovered by the rope knot at the end of the recovery line. A rope knot is used because the pressure at 4000 metres or so would cause the trawl float to collapse. This recovery line is turned up on a cleat at the rails. The bight of the rope is then placed in a snatch block at the end of the crane hoist wire. The sphere is hoisted inboard in one operation.

The sphere rises at just under one metre per second.

POP UP BUOY SPHERE (PUBS)



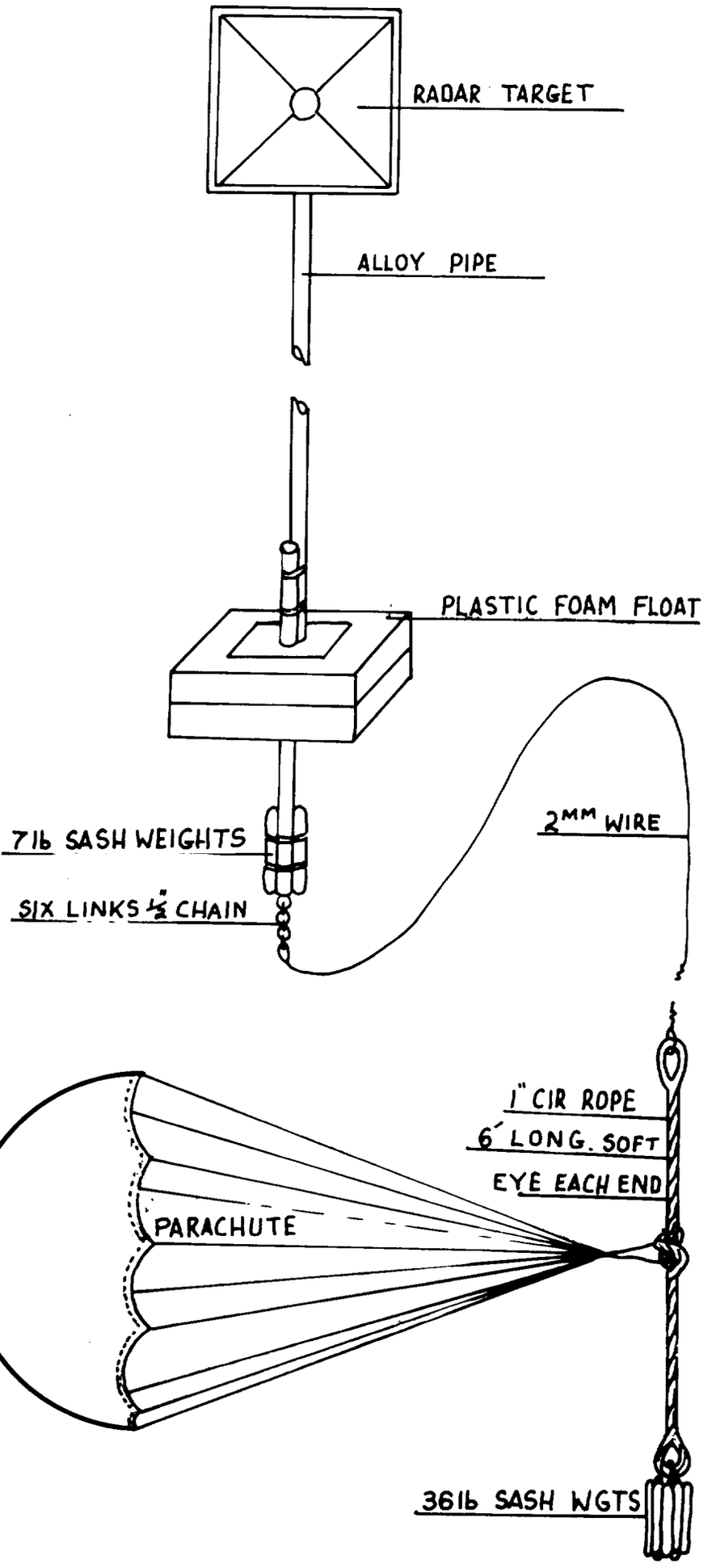
TIDE FLOAT USING A PARACHUTE

This consists of a number of sash cord weights, a parachute, some iron pipe and slab foam plastic. The plastic float with the radar target attached to the one inch alloy pipe and 2 mm wire attached to the bottom pole is lowered over the side by hand.

This buoy is then streamed out on the 2 mm wire to the depth required. The 2 mm wire is then cut, and the end passed through the thimble eye of the 1 inch sisal rope and spliced into the eye with a 'talurit' ferrule. The parachute with the 36 lb weight of sash cord weights attached is then passed out over the side and the buoy set adrift.

There is no recovery for this rig; it is abandoned after a number of readings are taken.

The iron pipe bottom pole of the buoy is passed through the foam float and through a piece of plywood at the top of the foam float and clamped to the one inch pipe that carries the radar target by 'jubilee' clips. The idea of the plywood is to stop the pipe from being pulled through the foam float.


RADAR TARGET
ALLOY PIPE
PLASTIC FOAM FLOAT
7lb SASH WEIGHTS
SIX LINKS ½" CHAIN
2MM WIRE
1" CIR ROPE
6' LONG. SOFT
EYE EACH END
PARACHUTE
36lb SASH WGTS

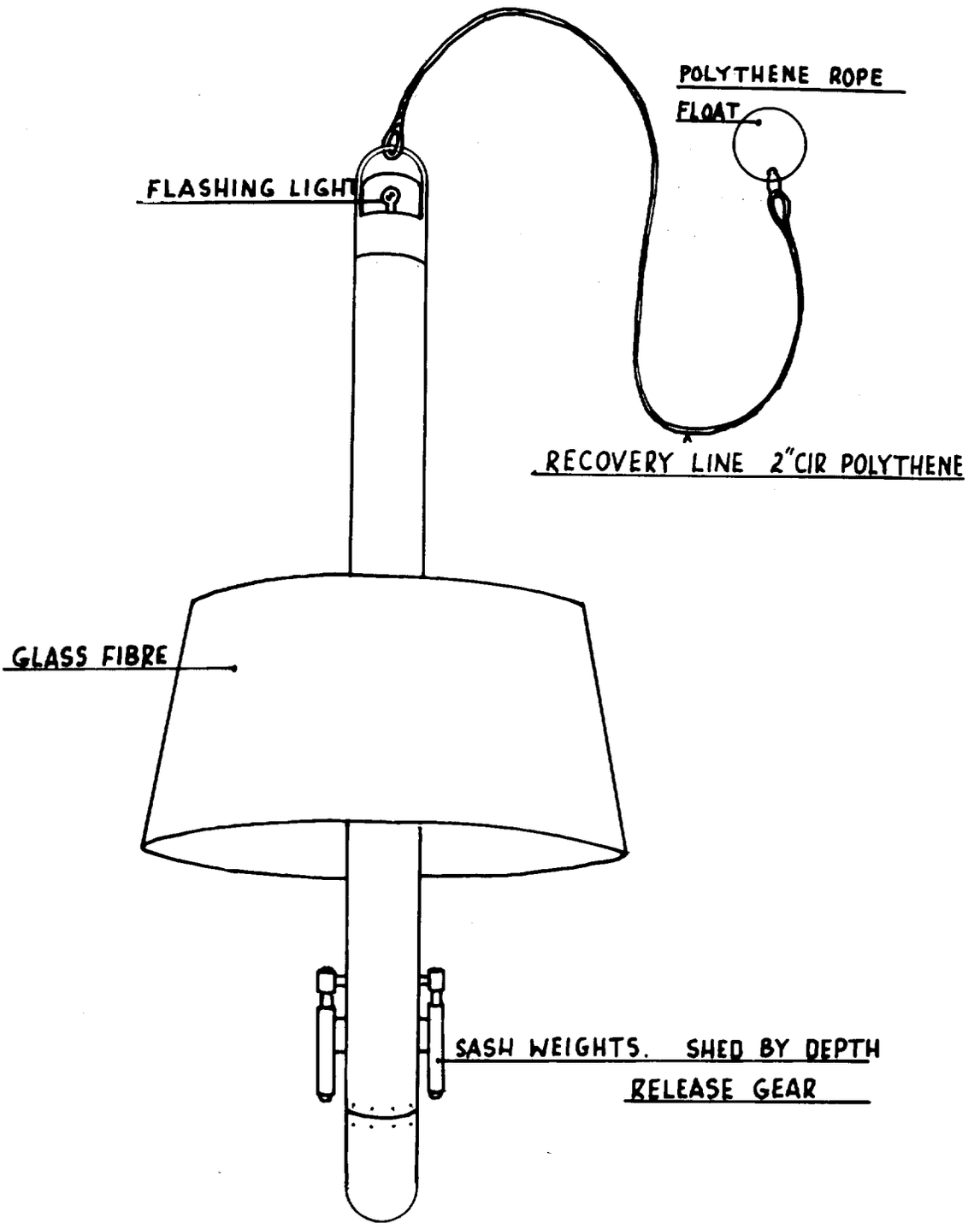
POP UP CURRENT FLOAT

This apparatus is lowered into the water by crane hoist with a slip hook. It sinks to its working depth, sheds its weights by pressure release and returns to the surface where it is grapneled for and recovered by crane.

There is a flashing light visible about 2 miles away in good weather for aiding recovery at night.

The ball at the end of the recovery line is made of polythene rope (because of the pressures involved).

POP UP CURRENT FLOAT

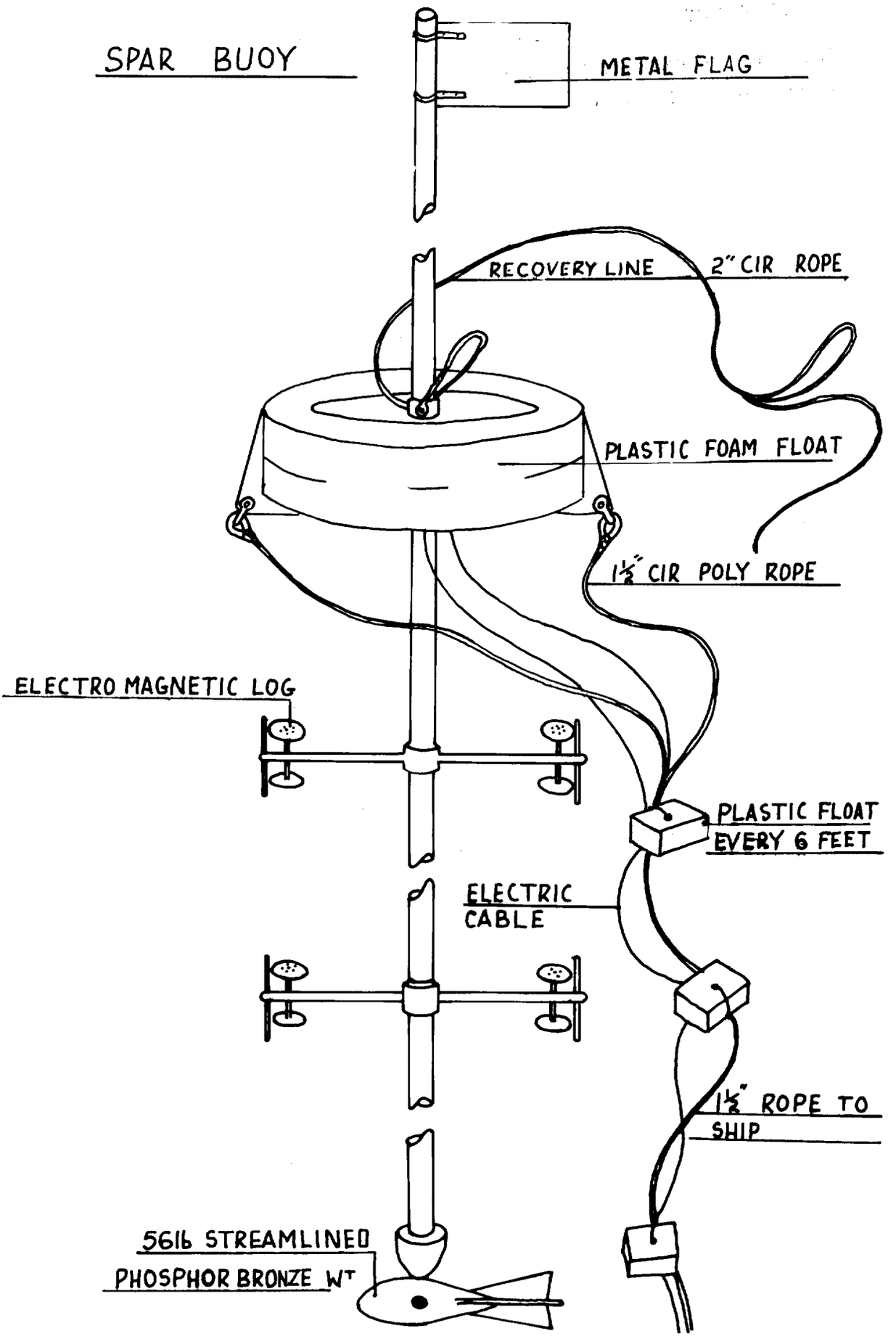


SPAR BUOY

This buoy is made of light weight material and weighs about 250 lbs in all. It is assembled on deck and put over the side by crane.

The buoy is attached to the ship by $1\frac{1}{2}$ inch polythene rope and electric cable. There are a number of foam floats at intervals of one fathom on the cable and rope which are secured by cod line to keep the cable floating on the surface. The ship keeps station on the buoy for certain lengths of time.

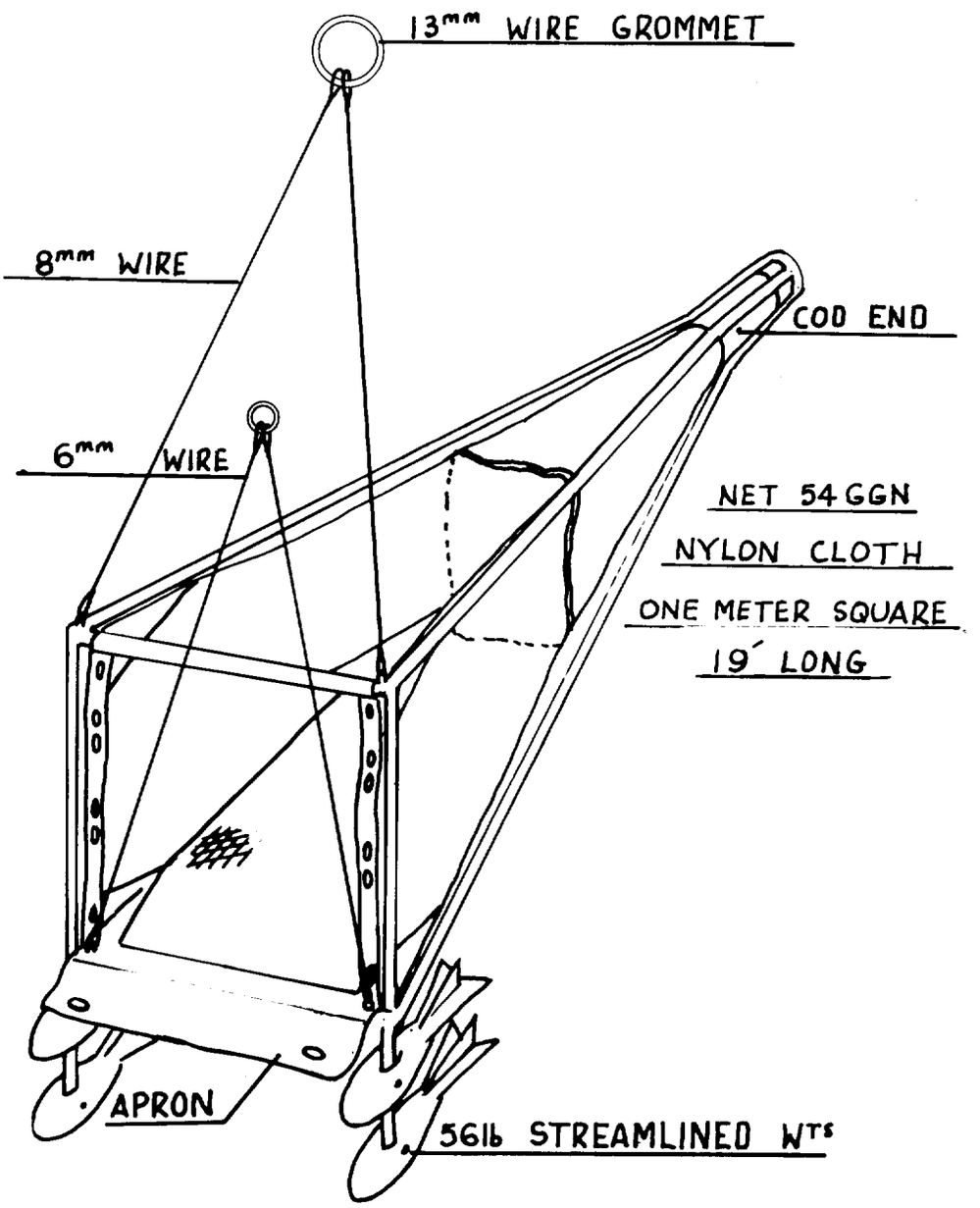
The buoy is recovered by grapneling for the recovery rope, and brought inboard by crane, placed on deck and secured.


SPAR BUOY
METAL FLAG
RECOVERY LINE
2" CIR ROPE
PLASTIC FOAM FLOAT
1½" CIR POLY ROPE
ELECTRO MAGNETIC LOG
PLASTIC FLOAT
EVERY 6 FEET
ELECTRIC
CABLE
1½" ROPE TO
SHIP
5616 STREAMLINED
PHOSPHOR BRONZE WT

LONGHURST NET

This net works on the same principle as the RMT nets. It is lowered over the side by crane and towed by trawl wire (midwater).

LONGHURST NET



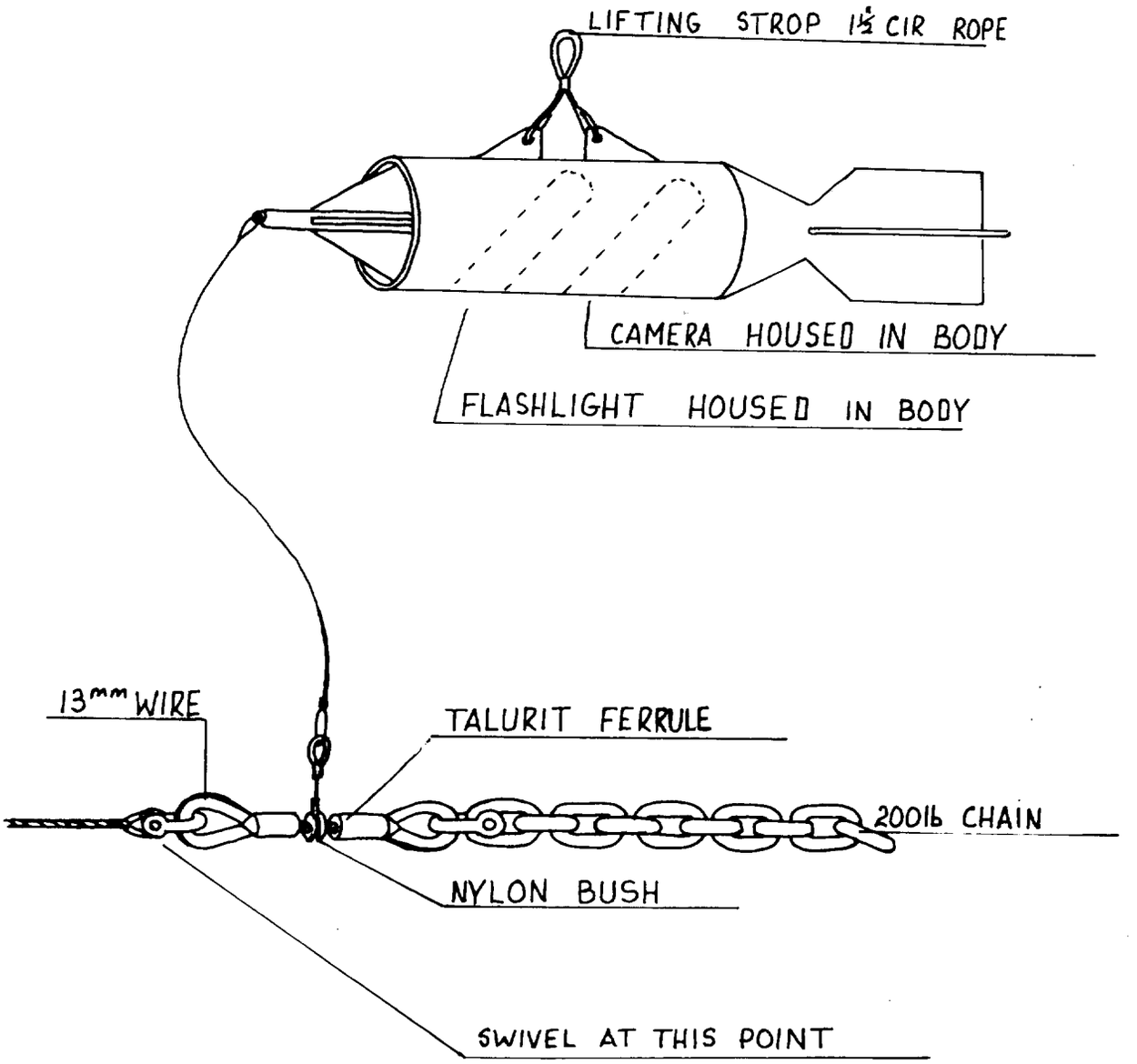
TOWED CAMERA

This instrument is towed from the main trawl wire. A length of chain cable 200 lb in weight is shackled to the end of the warp with a swivel between it and the warp.

The camera is attached by a special strop which is of 13 mm wire with hard eyes at each end and a nylon bush in the centre free to revolve. A 6 mm wire is spliced around this bush and connected to the towing point on the camera housing.

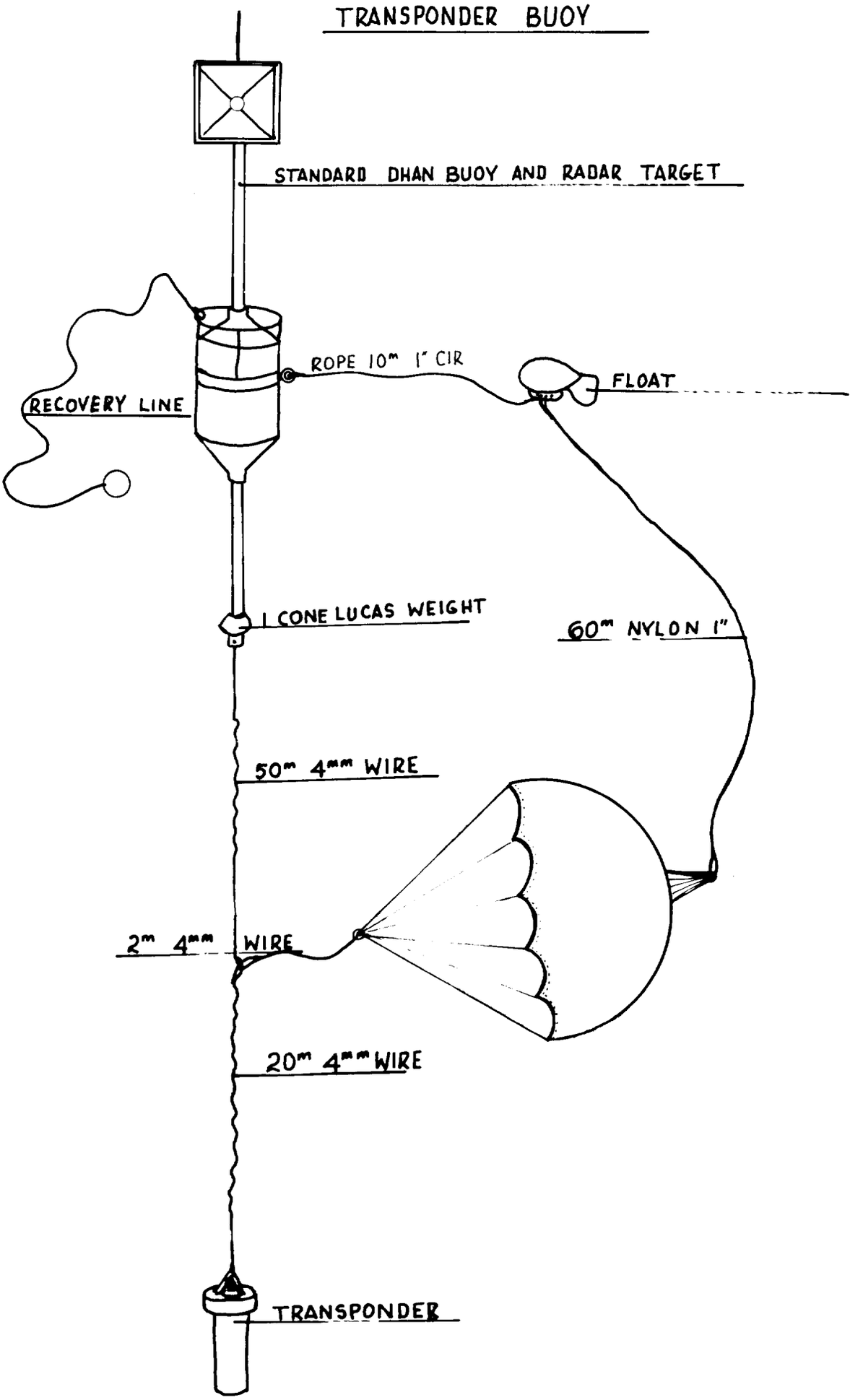
The camera housing is lowered into the water by hand using a 1 inch rope. The camera housing is made of polythene and will float so if it breaks adrift it will eventually surface. It is recovered by grapnel in the lifting strop by a special hook on the end of a long pole.

TOWED CAMERA.



TRANSPONDER BUOY

This is a transponder suspended from a surface buoy and a parachute is used as a sea anchor. The buoy is lowered and recovered by crane. It is free floating (not moored).

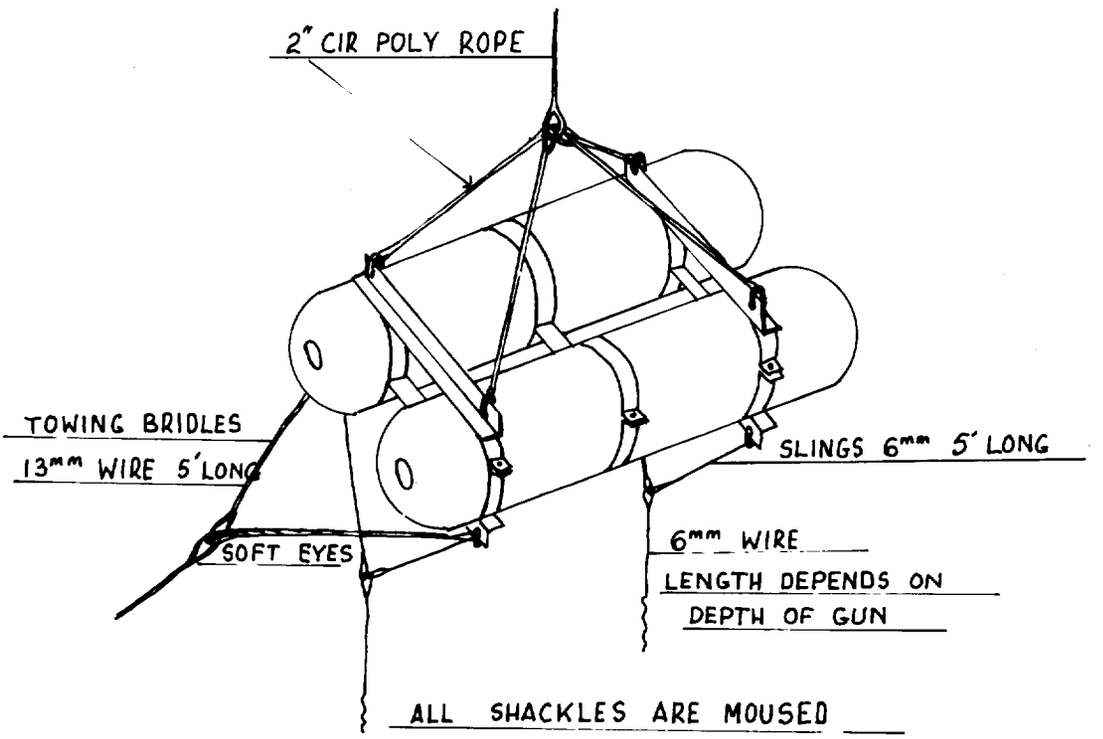

TRANSPONDER BUOY
STANDARD DHAN BUOY AND RADAR TARGET
ROPE 10m 1" CIR
FLOAT
RECOVERY LINE
1 CONE LUCAS WEIGHT
60m NYLON 1"
50m 4mm WIRE
2m 4mm WIRE
20m 4mm WIRE
TRANSPONDER

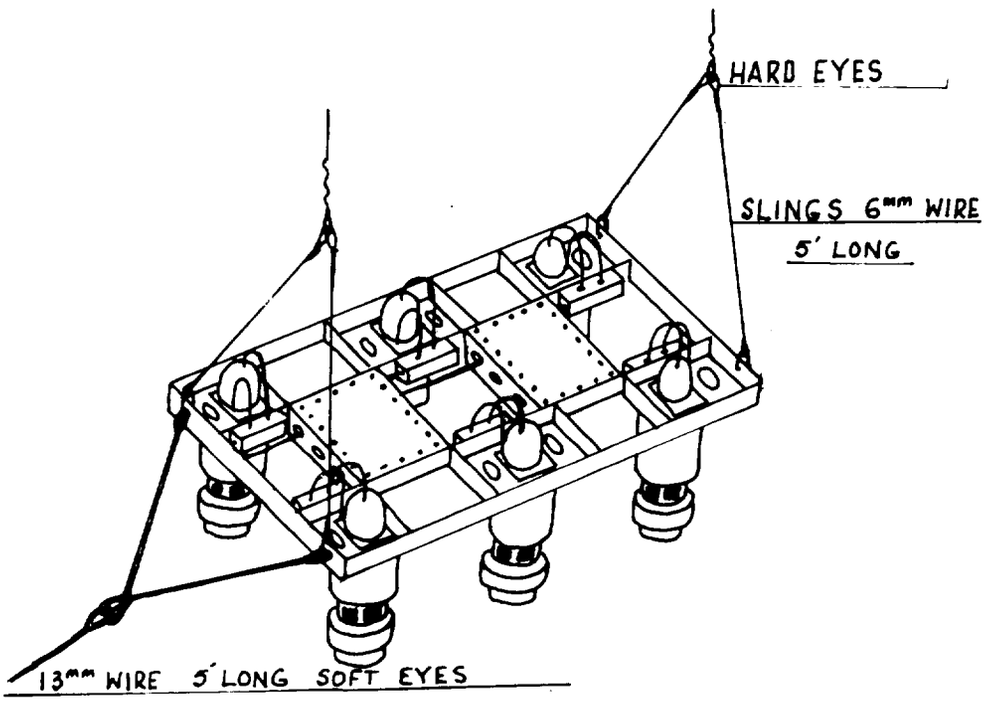
AIR GUN ARRAY

The float for this instrument is made from two cigar shaped sub-surface floats bolted together in an iron frame. The airgun array is slung under this buoy on 6 mm wire, spliced with thimbles at all eyes. All shackles are moused with soft wire.

The array is put in and out of the water by the after crane and towed on the main trawl warp by 13 mm wire bridles. A four legged 3 inch circumference polythene rope sling is used for lifting purposes. The end being towed is taped onto the main warp in easy reach when recovering.

AIR GUN


2" CIR POLY ROPE
TOWING BRIDLES
13mm WIRE 5' LONG
SOFT EYES
SLINGS 6mm 5' LONG
6mm WIRE
LENGTH DEPENDS ON
DEPTH OF GUN
ALL SHACKLES ARE MOUSED


HARD EYES
SLINGS 6mm WIRE
5' LONG
13mm WIRE 5' LONG SOFT EYES

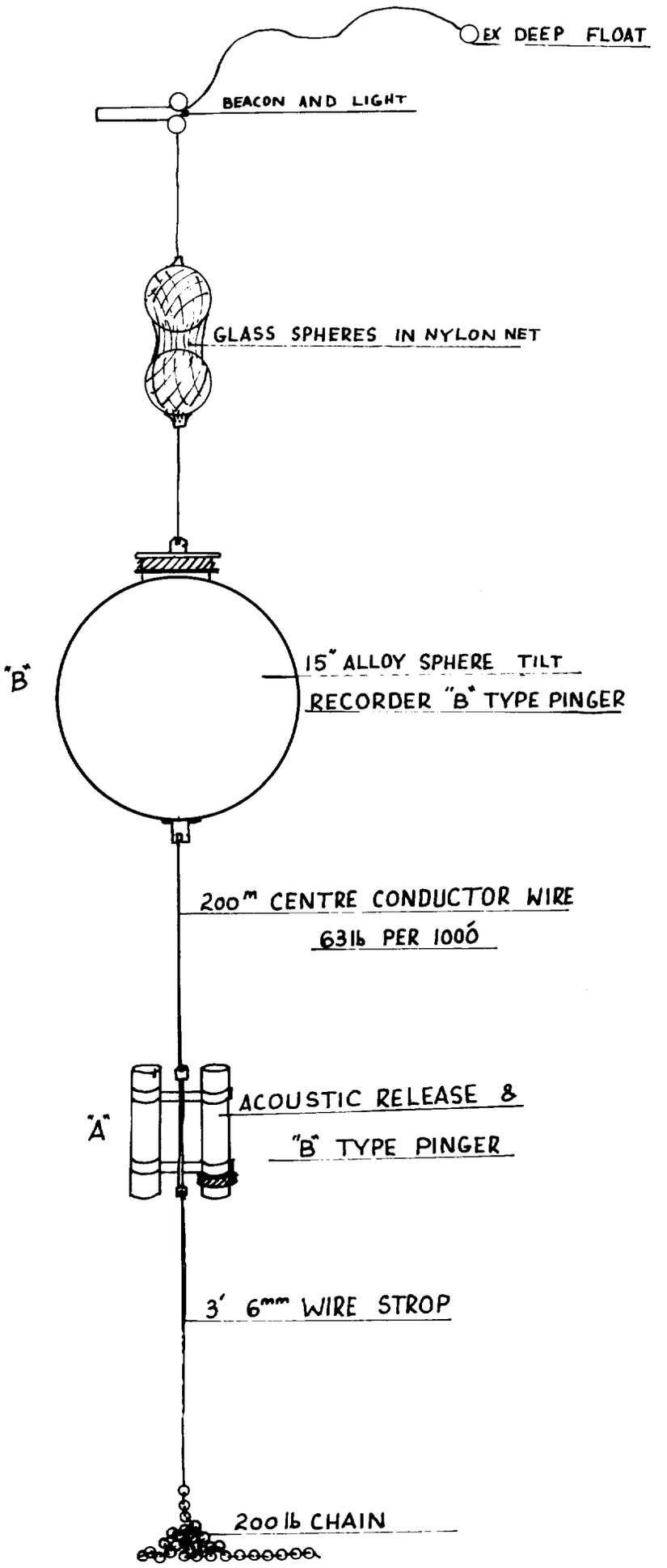
HYDROGRAPHIC LAY

This is put out from the forward hydrographic davit, the mooring having been wound on the winch drum beforehand. The buoy is laid first and the ship drifts slowly away from it keeping the mooring out in a straight line.

The 200 lbs of chain used for the anchor is attached to an N70 release mechanism and released by messenger well down in the water from the hydrographic wire.

To recover it, pick up the recovery line by grapnel, lift the buoy from the water by crane and stop off at the underside of the buoy. When the buoy has been detached recover the acoustic release by hand over a snatch block at some convenient spot.

HYDROGRAPHIC LAY



HYDROPHONES AND MAGNETOMETERS

These are numerous and varied, but all work the same way. They all tow over the ship's side or stern from their own cables.

No. 1 is a snake hydrophone. It is a long nylon tube with electrical components inside, filled with oil. A steel wire runs the length of it on the inside to take the strain when on tow.

No. 2 is a plastic tube made watertight at each end with electronics inside.

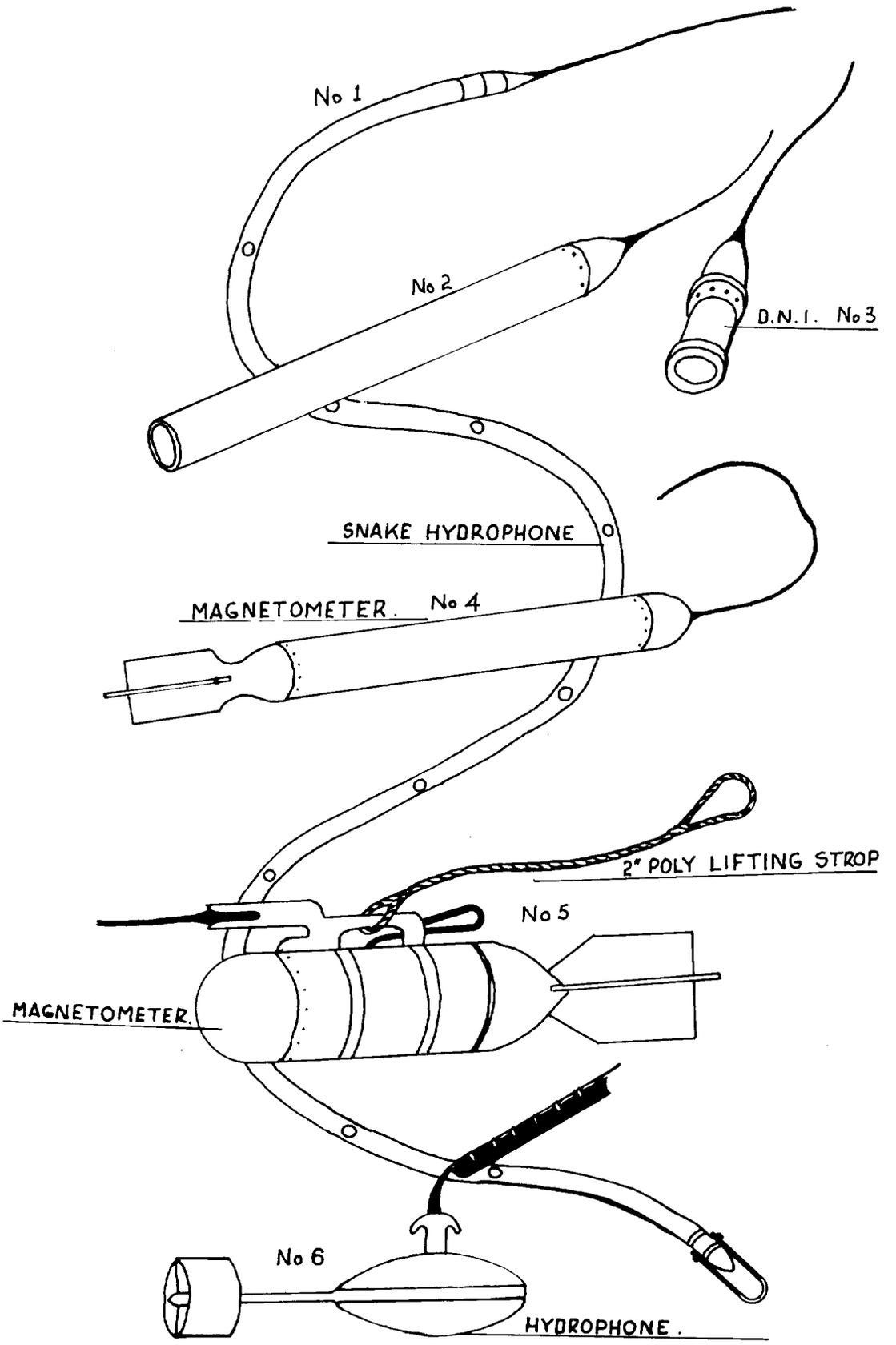
No. 3 is the I.O.S. hydrophone for the depth of net indicator.

No. 4 is the Cambridge magnetometer. It is a fibreglass tube with a wooden fin tail and nose piece.

No. 5 is the Liverpool magnetometer. It has a fibreglass and non-ferrous metal body, with its own towing point at each end.

No. 6 is the I.O.S. hydrophone towed over the ship's side on a boom. It has a rubber faired cable to reduce water noise.

MAGNETOMETERS & HYDROPHONES



BOTTOM NET (OPENING AND CLOSING)

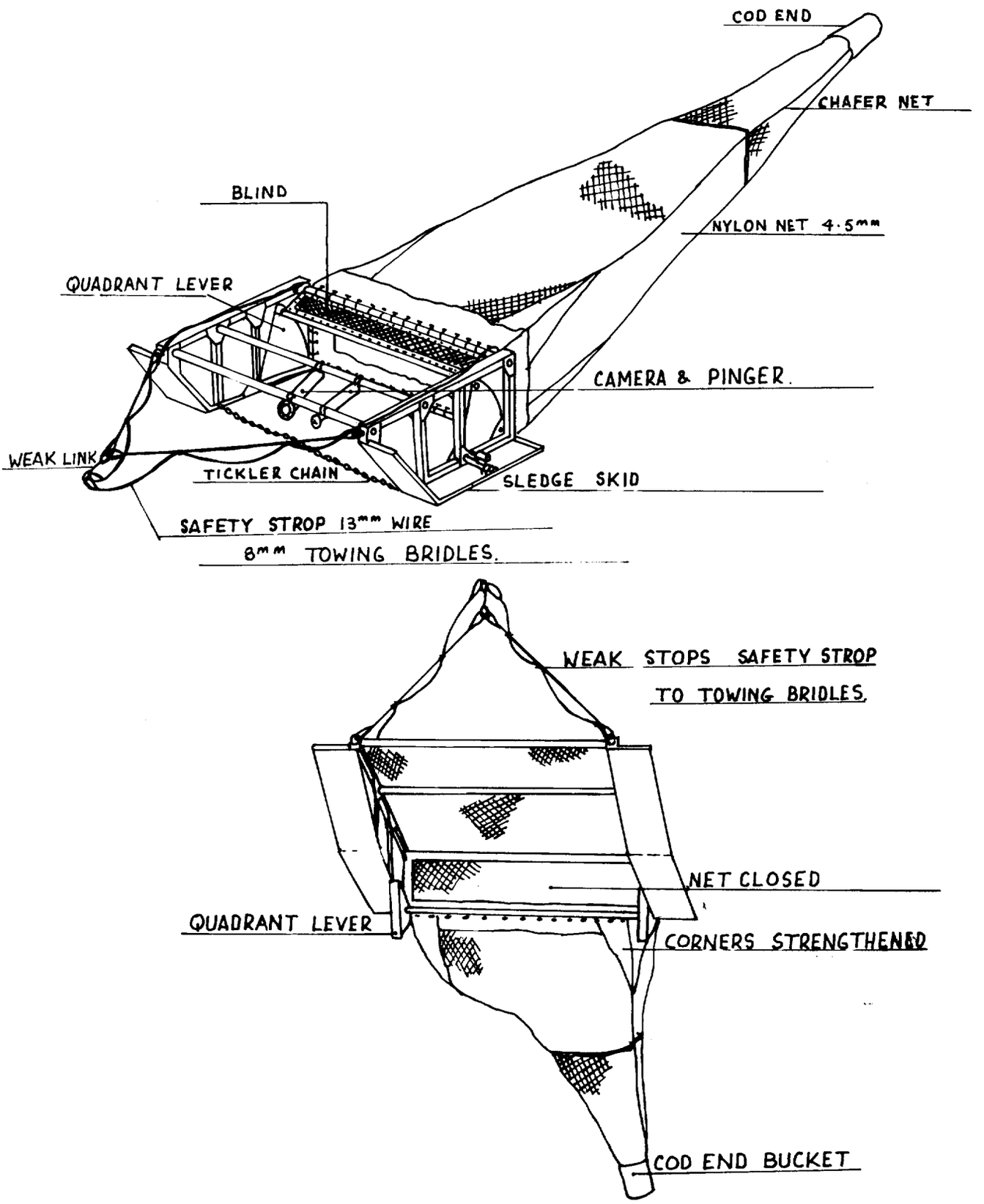
This net, made from 4.5 mm knotless terylene mesh, is attached to a steel frame which is fitted with two broad skids and which also supports the opening-closing mechanism. A netting blind is stretched between the top of the net mouth, and a bar joining the top corners of two quadrant shaped levers. The levers are free to pivot in the vertical plane. In the closed position, that is when the net is off the bottom, the levers hang beneath the main skids, pulling the blind across the mouth of the net.

When the net makes contact with the sea bed the levers are raised, and carry the blind upwards and forwards. The net is only fishing when on the sea bed. The net has a 4 mm wire weak link and 13 mm safety lines, connected to the top after bar of the sledge.

The net is towed on the main trawl wire and put in and out by crane. A wire grommet is shackled to the top of the swivel for the hook of the crane.

There is a pinger device attached to the quadrant levers which gives a signal when the net is open and fishing.

BOTTOM NET SLEDGE.
OPENING & CLOSING



GENERAL INFORMATION

Floats Adm Patt 8717	Elliptical Floats Admiralty Pattern 8717 will support 17 lbs. The weight in air is 10 lbs. The circumference of a float is 3'8". The centre hole is $\frac{3}{4}$" diameter. It is 10" thick. 600 metres of 4 mm wire will need four floats to support it.
AP8717	For every 500 metres of 4 mm wire three floats are required to support it (this is a rough estimate and on the safe side).
Buoy Poles	The weight of an alloy pole 20 feet in length is 25 lbs in air.
Breaking Strain of Wire Rope	To find the breaking strain of a wire, when makers' tables are not available, break a single strand and multiply by number of strands in the wire, then subtract 10 per cent.
Floats Trawl	An ordinary trawl float will support 6 lb. 250 fathoms of 2 mm wire will need 3 floats. 550 fathoms of 2 mm wire will need 5 floats.
Floats Streamlined	The weight in air of a streamlined float used for small current drogues is 8 lb 5 ozs. The buoyancy is 25 lbs.
Adm Patt Dhan Can	The can will support 144 lbs. The weight in air of a can is 58 lbs. The circumference of a can is 4'4$\frac{1}{2}$". The length overall is 2'7". The centre hole is 4$\frac{1}{4}$" in diameter (they vary in size).
Lucas Weights	A conical weight in air is 22 lbs. A flat weight in air is 20 lbs.
Streamlined Lead	The weight of a streamlined lead is 56 lbs.

Snapper Lead	The weight of a snapper lead is 20 lbs.
Bucket 2 metre	The circumference of a 2 metre bucket is 2'2".
Bucket N70	The circumference of an N70 bucket is 10".
Bucket N50	The circumference of an N50 bucket is $7\frac{1}{2}$".
Radar Target	The weight of the large alloy radar target is 16 lbs.
Wire 2 mm	The breaking strain of 2 mm wire used for buoy laying is 500 lbs.
	The weight in air is 6.1 lbs per 100 fathoms. The weight in salt water is 5.2 lbs per 100 fathoms.
4 mm	The weight in air of 4 mm wire is 3.7 lbs per 100 feet.
6 mm	The weight in air of 6 mm wire is 7.9 lbs per 100 feet.
13 mm	The weight in air of 13 mm (main trawl wire) construction of 6 x 19 average weight 31 lbs per 100 feet.
4 mm Phosphor Bronze	The breaking strain of 4 mm PB wire is 8 cwt.