HANDBOOK FOR MEGACORER

Supplied by
Ocean Scientific International Ltd
C8 Endeavour Business Park
Penner Road
Havant
PO9 1QN
United Kingdom

Introduction

Corer Design

This corer has been developed to take undisturbed cores of 100 mm diameter by 400 mm long with 200 mm of supernatant water. The core tubes are driven into the sediment by the weight of the corer head and its attached lead weights and the rate of descent is controlled by an hydraulic damper. The corer, when assembled, weighs 435 Kg of which the frame weighs 235 Kg and the head and drop bars weigh 88 Kg. In addition to this 300 Kg of lead may be added to the head to aid penetration.

Construction Materials

The corer is built of stainless steel and plastics, with the exception of the damper head plate and top-cap arms which are made of Aluminium Bronze (AB), the head block which is made of Leaded Gunmetal (LG. 2).

Dimensions

The corer stands 2.28 metres high when fully extended and 1.65 metres high when lowered. The diameter of the base of the frame is 1.5 metres.

The 12 core tubes are arranged in four rows of 3 tubes each, 740 mm apart, centre to centre. Each core tube is 110 mm O.D. (outside diameter), with 100 mm I.D. (internal diameter) by 600 mm long.

Appendix A describes the schematic operation of the corer and Appendix B explanes how to set-up the top caps and bottom closers.

Components

The Frame. (Fig. 1)

The frame is built of 25 mm solid bar with a 19 mm reinforcing ring. At the top of the frame (1.5 metres above the ground) is the Frame Top Plate that has two guide holes for the drop bars that connect the Damper Head Plate and the Top-Plate that carries the Lifting Eye. This Frame Top Plate also has a latch on it (Fig. 5.) which holds the corer head in the up position after it has taken cores (to prevent attempts at multiple sampling if the corer is replaced on the bottom).

The Locking Pin

When the corer is on deck, the 6 mm pin (attached to the 10 mm bolt head by a nylon line) should be inserted through the top plate from above. This prevents the bar of the latch from being moved over and effectively locks up the head. When the corer is to be deployed, this pin is removed and once the weight of the corer has been taken up by the warp, the bar of the latch may be moved over to the right and the pin inserted from below through the top plate and the bar. Now the latch is immobilised until the head and damper have moved down far enough for the cord to pull out the pin. This should be when the core tube ends are entering the sediment. Thus the frame can move up and down a little during deployment without affecting the latch. When the corer returns to deck the pin should immediately be put into the frame top plate from the top.

The frame top plate also carries beneath it the piston of the Hydraulic Damper. The lower ring of the frame which is made of 25.4 mm bar has a 12.7 mm bar welded to its upper surface. This is to reduce the drag on the ring during lowering.

The Hydraulic Damper.

This is composed of a Stainless Steel cylinder and piston. The piston contains a non-return valve and floods up from holes at the bottom of the cylinder. When the corer reaches the sea-bed the weight of the corer head forces the cylinder down and the water inside the cylinder is forced out through an 8 mm tapped hole at the top. This restricts the flow such that the rate of descent of the cylinder, and thus of the Head and core tubes, is about 50 mm per second. Should anyone wish to have even slower descent rates into the sediment an M8 set screw with a suitably smaller hole drilled through it may be screwed into the tapped hole.

The Head.

This is built up from 9 machined Lead Bronze castings which are bolted together and then bolted to the base of the Damper. The ends of the M20 studding that is used to hold the castings together are also be used to carry up to 6 lead weights (each of ~20 Kg) at each end. The two outer head castings will each carry two lead weights of ~15 Kg each and so a total of ~300 Kg can be carried. The amount to be used will vary with the type of sediment being sampled and the number of tubes used and will have to be determined empirically. Along the lower sides of the head are bolted 25 mm square section lengths of Brass bar which carry the mounting pins for the tube carriers.

There are two feet under the head which prevent damage to the bottom closers if the head (with tube carriers installed) is lowered onto the deck either for transit or to put more weights on.

The Tube Carriers. (Figs. 2 & 3)

Each core tube is held in a carrier. A tube carrier is basically an open fronted box. The rear of the carrier has two pairs of holes that slide over the mounting pins on the Head.

When the carrier has been mounted on the Head by sliding it down its pair of pins a Drive Block is dropped over the end of the long pin and screwed down. (At this stage the carrier should slide freely up and down). The right hand pin, that has a spring fixed in its upper end, is beneath the rear end of the top cap arm with the spring pushing up against its lower surface. The bottom board of the Carrier has a stepped hole through it into which locates the collar of the core tube.

The core tube is held in position by sliding a retaining ring up flush with the underside of the bottom board and rotating it as far as it will go (above the retaining blocks) in a clockwise direction. The top board also has a stepped hole through it and this holds the O-ring that seals around the outside of the core tube. On top of the top plate are pivots that carry the top cap arm and top cap, and beneath the outer end of the top-cap arm is the bottom closer plunger. The Bottom Closer is carried on a tube that passes through the top and bottom boards. The carrier can be set up for operation as follows on the next page (assuming you are facing the tube holder):

Tube Carrier Set Up

1. Push the L-shaped piece back along the top-cap arm as far as it will go
2. Swing the bottom catcher clear of the core tube area and insert a core tube. Make sure the collar of the core tube is firmly up in the recess in the bottom board. If it is difficult to insert the tube through the O-ring in the top board take the tube out and smear some petroleum jelly around the O-ring.
3. Lock the core tube up with a retaining ring.
4. Swing the bottom catcher below the core tube and pull the front of it towards you until it locks in position. This is when the 8 mm rod, that passes down the centre of the tube that carries the bottom catcher, engages in a cut-out in the shutter of the bottom catcher.
5. Slide the bottom catcher up round the tube until it latches up at the top of its travel.
6. Continue to lift the bottom catcher so that it lifts the whole of the tube carrier up its pins until the top of the carrier comes up against the drive block. Then, holding the carrier in that position with one hand, lift the front end of the top cap arm until the rear end is down against the board. Then slide the top cap arm to the left against the spring pressure which engages the M6 bolt head in the notch beneath the top cap arm. When the arm is to the left of the spring pin, lower the whole tube carrier down, thus locking the top cap arm over to the left and in an open position.
7. Slide the L-shaped piece forward to the end of the top-cap arm.

The tube carrier is now ready for deployment. When it reaches the sediment there is resistance to the bottom of the core tube being pushed into the sediment and so the core tube and its carrier slide up the two mounting pins until the top board meets the drive block and the head then pushes the core tube down into the sediment. When the carrier slides up the mounting pins the top of the spring goes down level with the top of the board and so the spring on the pivot bar is able to push the top cap arm over to the right until its rear end is above the spring.

When the warp starts to withdraw the corer, the head moves up and the carrier slides down the pins until the block on the rear of the carrier meets the bar which carries the mounting pins. Thus the mounting pins are pushed up through the top plate and the spring in the top of the right hand pin engages the bottom of the top cap arm and pushes it upwards. This pushes down the top cap arm which closes the top cap and depresses the bottom closer plunger until it is stopped by the latch plate.

The top cap is now closed and the end of the top-cap arm has depressed the bottom release plunger allowing the bottom closer to drop until it sits on the sediment surface. The bottom closer remains there until the bottom of the tube comes into it. At this point the adjusting screw meets the L-shaped piece and the 8 mm rod is withdrawn from the shutter and the linear springs pull the shutter across beneath the base of the core tube. The sample is now locked in between the bottom catcher and the top cap because the top cap is held down by the adjusting screw against the L-shaped piece.

Since the operation of the carriers is dependent on their being lifted relative to the head, there is obviously a potential problem of pre-triggering due to drag on the open bottom closer shutters. This is overcome by inserting a plastic fork between the top cap arm and one of its pivot blocks so that the arm is held over away from the spring pin. By tying the fork to the frame with a suitable length of monofilament nylon line, the carrier is not activated until just before the core tubes reach the sediment. Thus as long as the frame does not lift relative to the damper by more than about 150 mm during deployment, the carrier cannot pre-trigger. The lines should be spaced out around the top ring of the frame so that each is opposite to its top cap arm.

These carriers have been designed to be removed from the corer with the sample intact and taken away in a sealed condition. However, the core tubes can be installed and removed from the corer as if the carrier were fixed to the head although this will not be as convenient. If it is done this way the core tubes should be loaded up working from left to right and unloaded working from right to left. This can be done because the bottom catchers do drop sufficiently to pass under neighbouring closed catchers.

Operating procedure.

Deployment

With the corer in the raised position and the top latch secured by the 6 mm pin inserted through the frame top plate from above:

1. Put carriers on pins and screw down drive blocks.
2. Rotate the bottom catcher out of the way (it should be down since the carriers will not go into the pins with the bottom catcher locked up) and put the core tube into the left hand end carrier and secure the tube retaining ring..
3. Rotate the bottom catcher under the tube end and pull the shutter towards you until it latches.
4. Slide the bottom catcher up round the tube until it latches.
5. Continue to lift the bottom catcher so that it lifts the whole of the tube carrier up its pins until the top of the carrier comes up against the drive block. Then, holding the carrier in that position with one hand, lift the front end of the top cap arm until the rear end is down against the board. Then slide the top cap arm to the left against the spring pressure and engage the M6 bolt head in the notch beneath the top cap arm. (Fig. 4.) When the arm is to the left of the spring pin, lower the whole tube carrier down, thus locking the top cap arm over to the left and in an open position.
6. Slide the L-shaped piece to the front end of the top-cap arm.
7. Repeat for the other tube carriers working from left to right and then the same for the other side.
8. If they are not already installed, put on the required amount of lead weights.
9. When the weight of the corer is taken on the warp remove the 6 mm pin from the top latch, slide the bar to the right from under the hook and insert the pin from the underside through the frame top plate and the latch bar.

The corer is now ready for deployment.

Recovery

On recovery: (assuming you are not removing the tube carriers complete)

1. Put the 6 mm pin in to the top plate from the top, thus locking the latch in the engaged position.
2. Whilst holding the bottom catcher of the carrier, (starting at the right hand end), slide the L-shaped piece to the rear. This allows the bottom catcher to drop clear of the bottom of the tube. Rotate the bottom catcher clear of the tube and put in a bung.
3. Remove the tube retaining ring by rotating it until its flats line up with the blocks and then dropping it.
4. Crack the seal of the top cap against the top board and twist the core tube downwards and free of the carrier.
5. Repeat for the other carriers working from right to left.

General Points.

1. If the core tubes become difficult to insert into the top board give the O-ring a smear of petroleum jelly.

2. The bottom catcher shutters should not be fired in air with no restraint as they can break under these conditions. Care should be taken that the shutters are not released when fingers are up the tube since, although it will not draw blood, it can be quite painful. Care should also be taken when handling the linear springs as the edges can be quite sharp. Industrial gloves should be worn when handling them.

3. The weights should be removed from the corer head before transporting it and the head should be lowered in transit.

4. All of the moving parts should be thoroughly washed out after deployment.

5. When deploying the corer it is a good idea to insert about 100 metres or more of buoyant rope between the corer and the main warp so that when slack is paid out, after the corer reaches the sediment, there is less likelihood of the warp entering the corer frame and causing damage.

6. The leaded gunmetal parts take on a green coloration when immersed in seawater. This is part of the metal sealing process and nothing to worry about.

Please call, fax or send a letter if you have any problems at all. We will be pleased to help with any questions, queries or requests for further information.

Fig 1

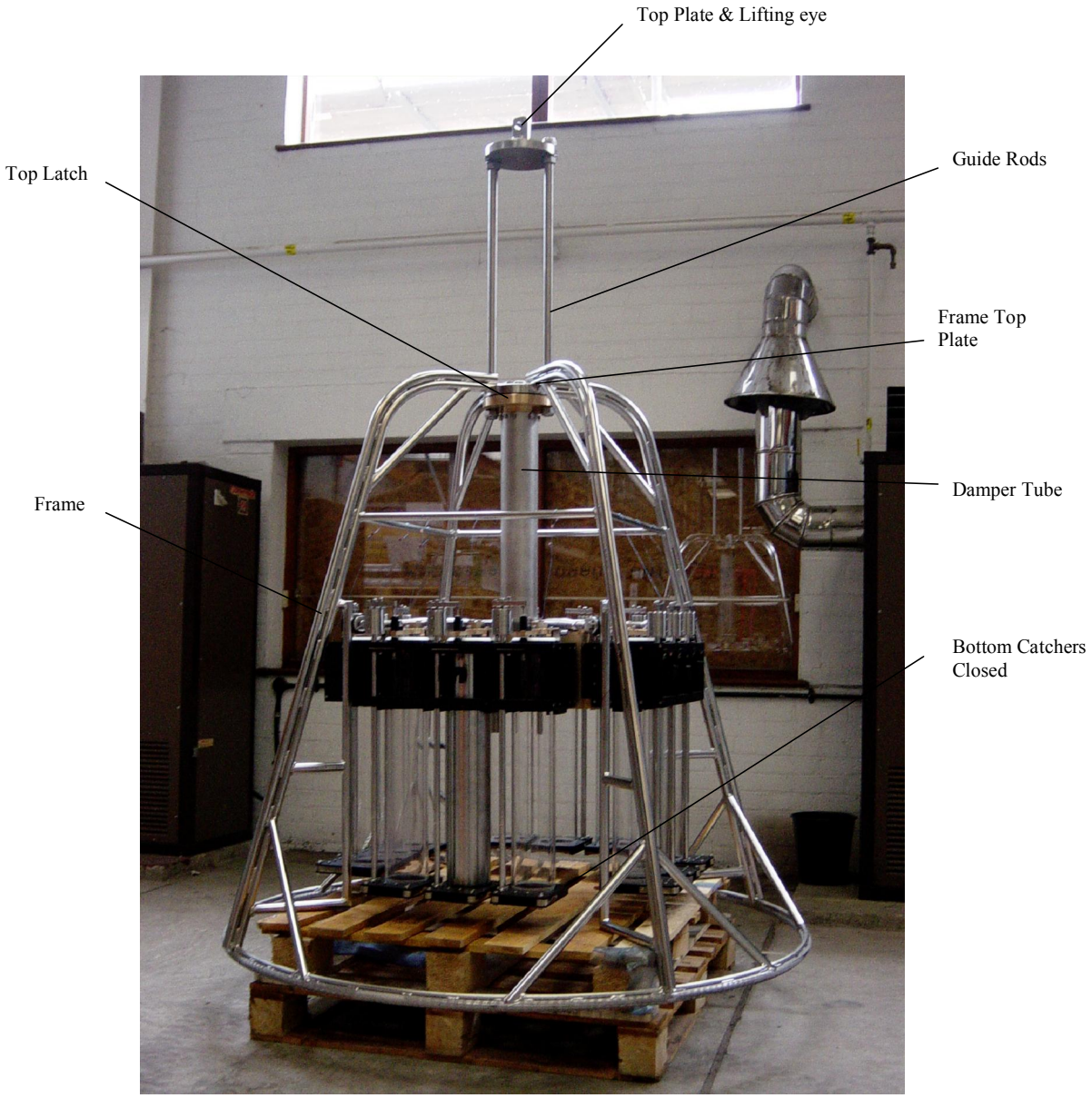

Top Plate & Lifting eye
Top Latch
Guide Rods
Frame Top Plate
Damper Tube
Frame
Bottom Catchers Closed

Fig 2

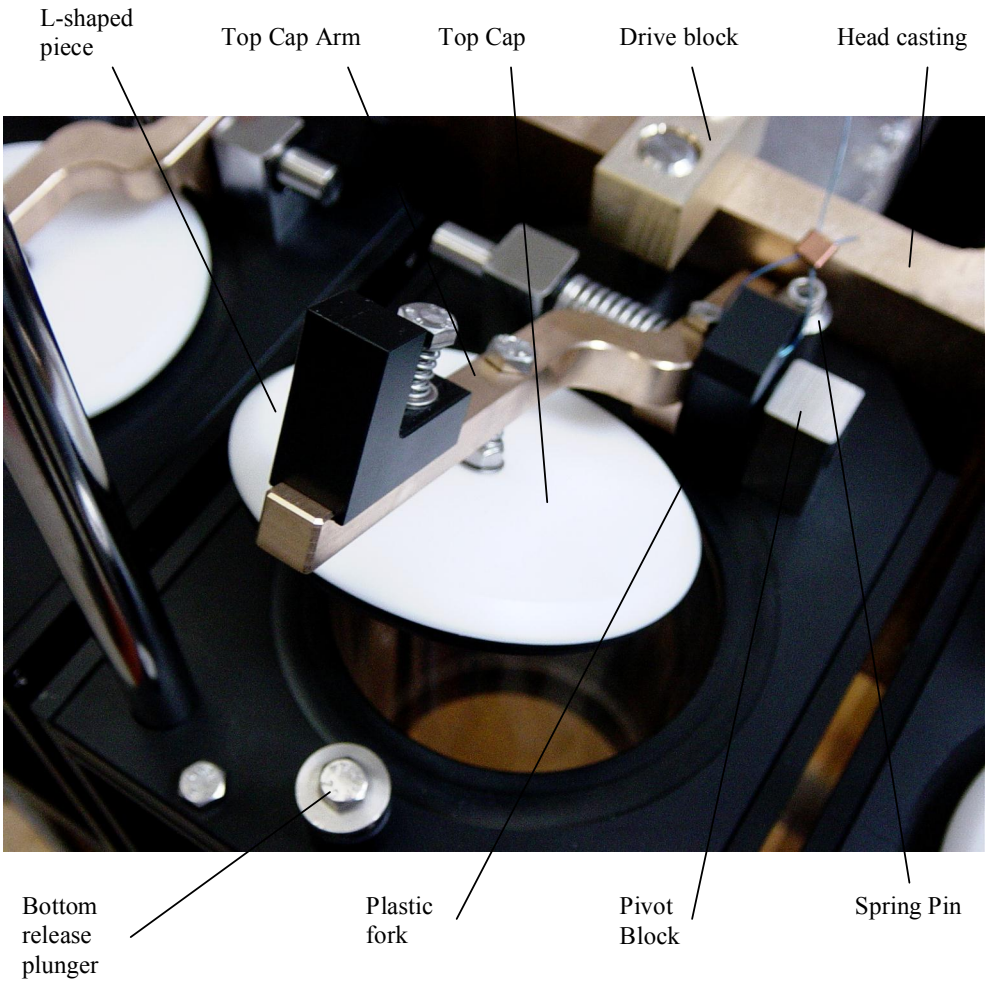

L-shaped piece
Top Cap Arm
Top Cap
Drive block
Head casting
Bottom release plunger
Plastic fork
Pivot Block
Spring Pin

Fig.3

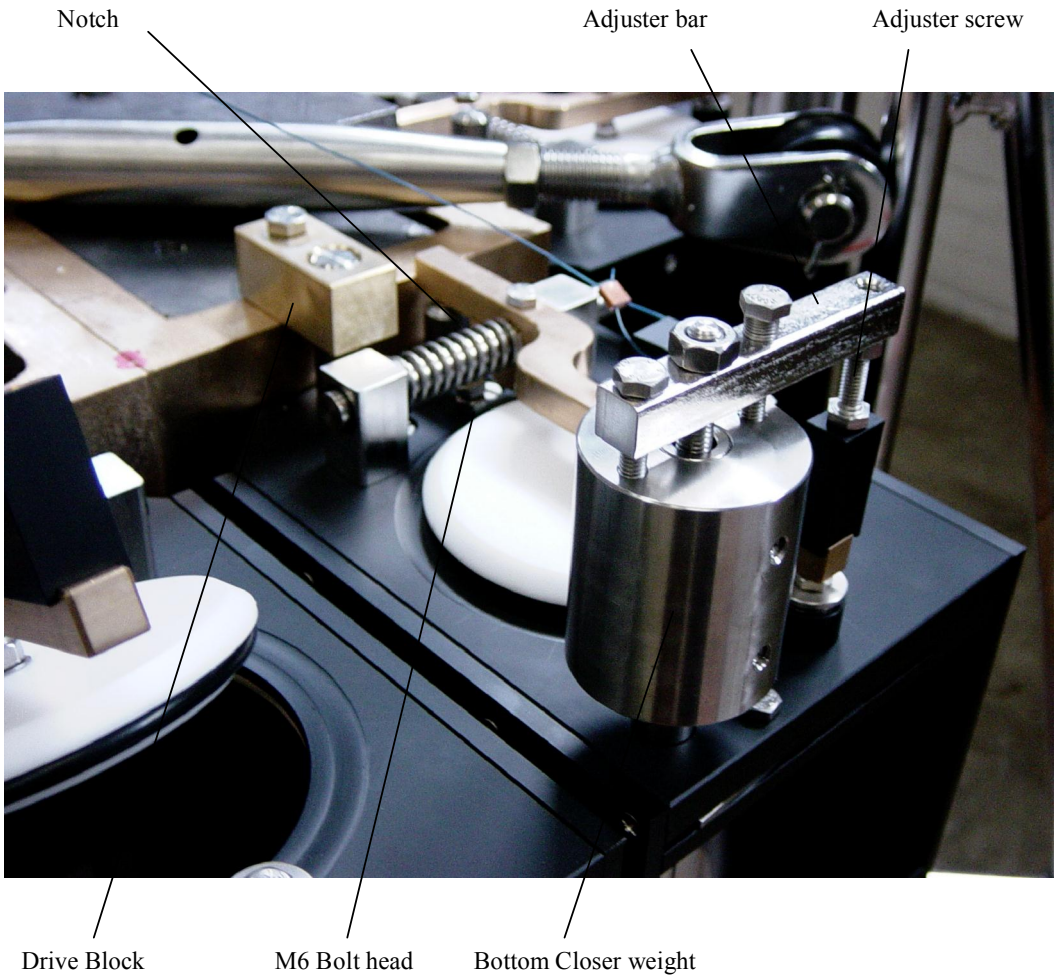

Notch
Adjuster bar
Adjuster screw
Drive Block
M6 Bolt head
Bottom Closer weight

Fig. 4

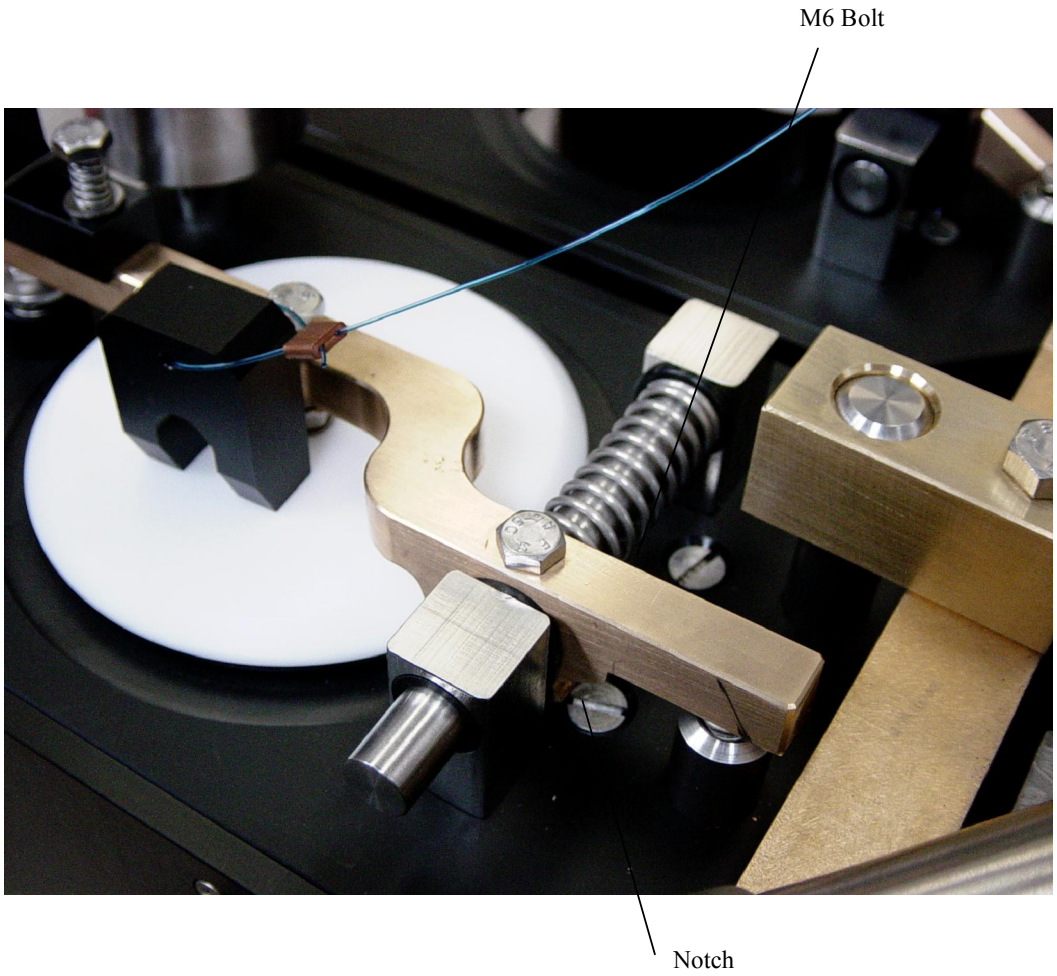
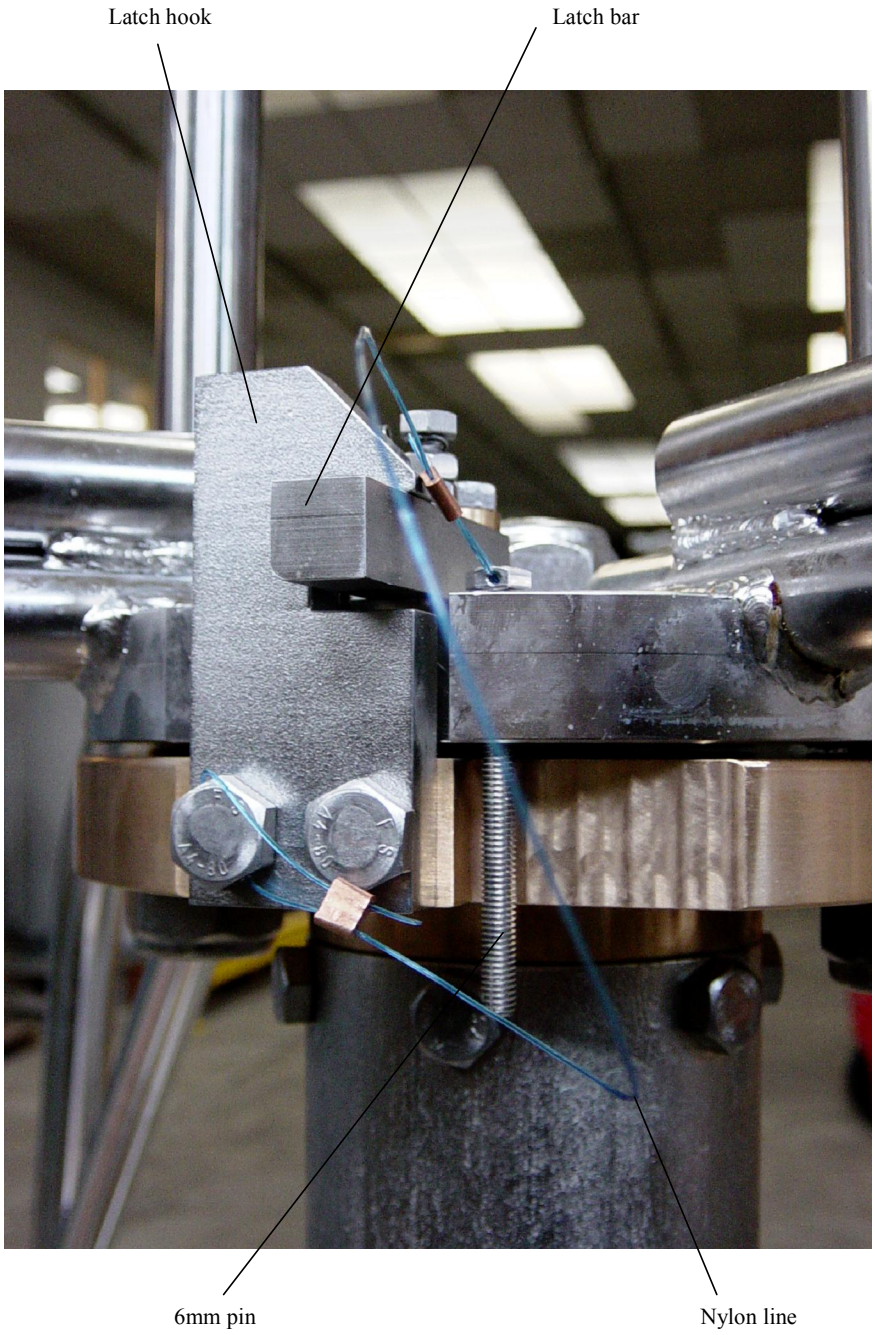


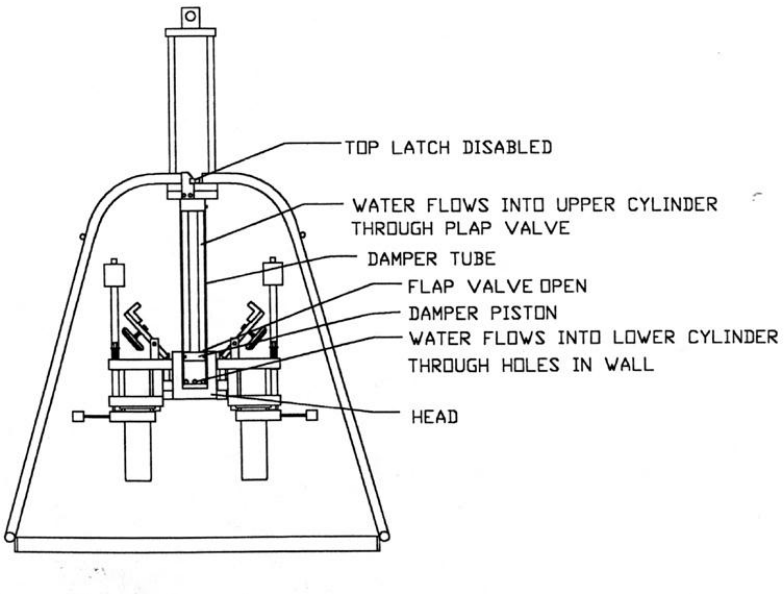
Fig. 5



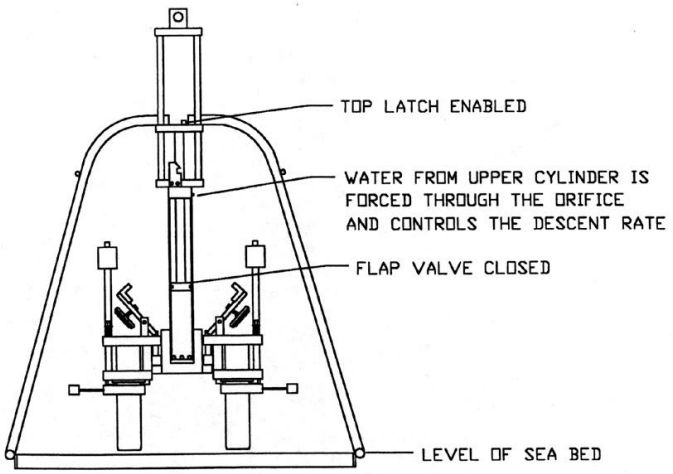
APPENDIX A Schematic Operation: Page 1.

When the corer is lowered into the water the damper is full of air. Sea water floods into the lower end of the damper tube through holes in the tube wall and then through the flap valve on the piston into the upper cylinder.

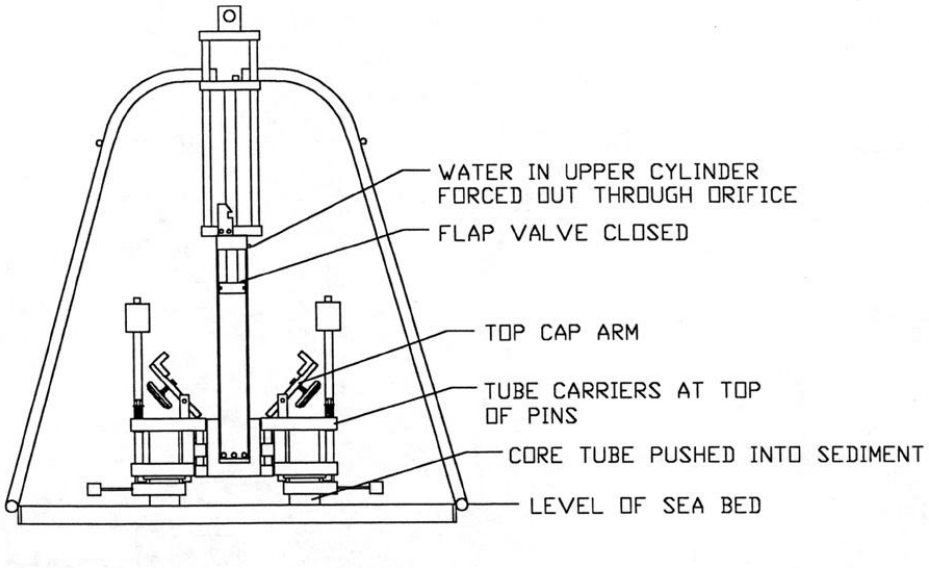
The top latch is held open by a pin at this time so that the corer head has to travel nearly 200mm down before the latch is activated.



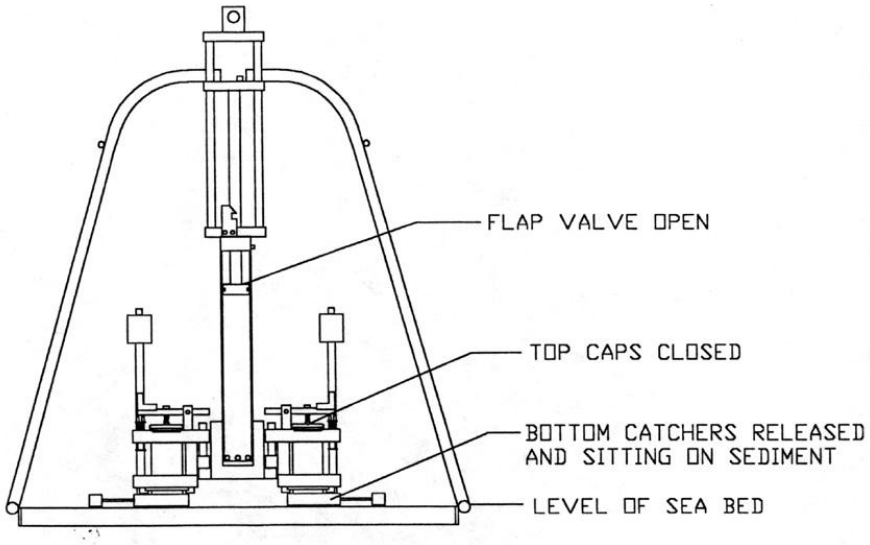
When the corer arrives at the sea bed, the head and damper start to drop and the flap valve closes. The descent rate is determined by the flow of water from the upper cylinda through the orifice. Just before the ends of the core tubes reach the sediment the top latch is enabled.



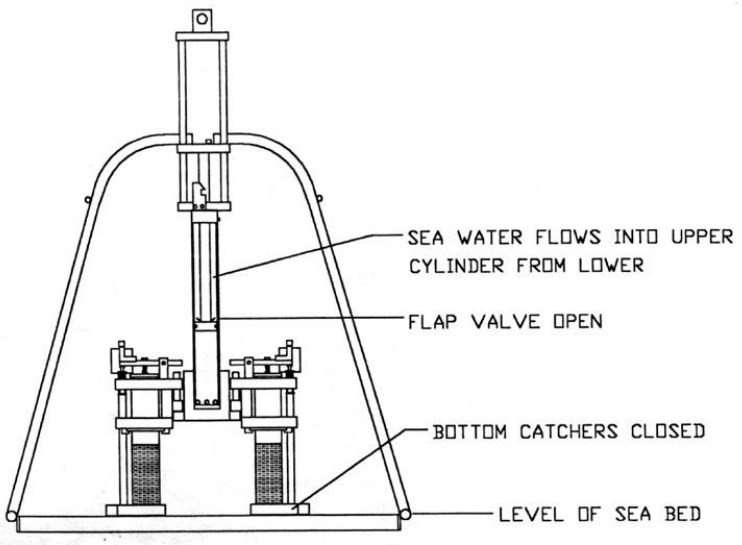
When the core tubes are pushed into the sediment the core tube holders slide up their mounting pins and the top cap arm is released and pushed over the spring pin.



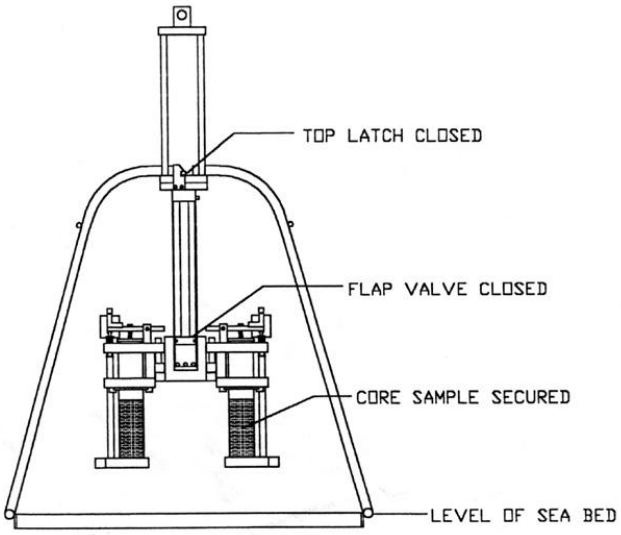
When the warp starts to lift the damper and head, the core tube holders slide down their pins and the top caps are shut. When they shut they release the bottom catchers which will drop down and sit on top of the sediment.



As the warp is pulled further, the core tubes are with drawn from the sediment and as they clear it the bottom catchers close.
During this relative movement between the damper tube and piston, the flap valve opens and the water flows from the lower cylinda into the upper.



When the damper is fully up, the top latch engages which prevents any damage to the corer should the corer be replaced on the sea bed (with the bottom closers shut).
The corer is recovered in this state with the core sample and supernatent water securely held beteen the bottom catcher and the top cap.



Appendix B

Should the top-caps or the bottom closers get out of adjustment for any reason the following system for setting them up should be followed.

Setting up Top-Caps

1. The top-cap is held on to the top cap arm with an M6 x 40 bolt which has had an extra 3 turns of thread put on it. To install a top-cap insert the modified M6 bolt through the top-cap arm, put a string on it and then an M6 nut screwed on as far as it will go. Then put on a washer and screw on the top-cap up to the nut. Put a washer and an M6 Nyloc nut on the end of the bolt.

2. Place a 24mm high block under the end of the top-cap arm and hold the arm down in contact with it. Now unscrew the top-cap whilst holding the bolt head down until the top-cap O-ring seats firmly against the top of the top board. (Just keep turning until the top-cap stops.)

3. Whilst holding the bolt head, screw the nut down until it is locked against the upper side of the top-cap and then screw up the Nyloc nut in the recess in the underside of the top-cap until it is locked up.

4. Remove the 24mm block and push down the bottom catcher release plunger until it comes up solid against the latch plate. Now the M6 bolt in the top of the plunger should be adjusted so that when the top-cap arm is down on top of the bolt head and with the plunger down on the latch plate there is about 1mm clearance between the top-cap arm and the head of the M6 bolt that holds the top-cap. When this is achieved the bolt in the top of the plunger should be locked up with the nut. The top-cap is now set-up.

Fitting and setting up Bottom Catchers.

1. With the shutter removed from the bottom closer, insert the drop tube into the bottom closer body with the notch to the front and fasten it with M4 countersunk screws. The 35mm ones go through the outside of the body and the 30mm ones through the inside; excess screw length should be sawn off after fixing.
2. Replace the shutter and its closing springs.
3. Depress the bottom closer plunger at the front of the core tube carrier and push the bottom closer latch plate out of the side of the hole. Keep pushing on the plunger to hold the plate out of the hole and insert the drop tube up through the carrier plates. Release the plunger and push the drop tube up until it latches in the up position.

4. Fix the drop tube weight to the drop tube with the two M6 grub screws (on the same side as the notch) with the top of the weight flush with the top of the tube and with the M6 tapped holes parallel with the end of the shutter body.
5. Screw the 8mm drop bar into the adjuster bar until it is flush with the upper surface and insert it down the drop tube. Pull out the shutter until the drop bar engages wit the shutter. Now wind the adjuster bar down the drop bar rod until the end of the bar is flush with the bottom surface of the shutter. Put on the M8 nut and lock it up.
6. Pull up the drop bar and close the shutter. With the end of the drop bar resting on the shutter, put in the M6x35 bolt through the adjuster bar and into the weight (on the side furthest from the top-cap arm) until the head has about 1mm clearance above the adjuster bar.
7. Put the coil spring over the shank of the other M6x35 bolt and screw it through the adjuster bar and into the weight until the spring is just short of being fully compressed when the adjuster bar is pulled up against the head of the first M6 bolt.
8. Check that with the shutter pulled out to the open position the bar moves freely up and down.
9. Put a core tube into the carrier and put on its retaining ring.
10. Screw the M6x30 bolt (with locknut) into the end hole of the adjuster bar and screw it into a position so that with the top-cap arm fully down and the L-shaped piece at the end of the arm, the shutter closes about 3mm below the bottom of the core tube. Lock up the lock nut.
11. With the adjuster bar in the released position put some penetrating adhesive on the threads of the M6x35mm bolts and leave to cure. Then wipe off the excess. (Or put thread-locking adhesive on when you put them in.)