The Scripps Institution of Oceanography

MARINE TECHNICIANS HANDBOOK

PISTON CORING

Frederick S. Dixon and Daniel Karig

Available from:
Institute of Marine Resources
P. O. Box 109
La Jolla, California 92037

IMR TR-38
Sea Grant Publication No. 19

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GENERAL INTRODUCTION

This publication is one of a series intended to provide explicit instructions for the collection of oceanographic data and samples at sea. Individual chapters are being issued separately so that they may be made available as they are prepared and may be replaced by updated versions without replacing the entire series. It can, therefore, be considered as an open-ended "marine technician's handbook".

For many years there have been such manuals in existence within various groups at the Scripps Institution of Oceanography for internal use. These manuals are being updated, and new ones are being prepared where no satisfactory ones existed; they will be issued as they are ready.

The instructions on physical, biological, and chemical oceanographic data collection and processing have been prepared by members of the Data Collection and Processing Group (DCPG), part of the Marine Life Research Group of Scripps. They cover procedures used by that group. Other chapters on geological and geophysical techniques are based on the "Marine Technician's Handbook" series originally prepared by Mr. Frederick S. Dixon, and issued by the Oceanic Research Division some years ago. It is expected that chapters on techniques used by other groups within Scripps will be added.

Since the sections will be published individually, there will undoubtedly be some repetition. This should not detract from the overall purpose of the manual, since it is expected that a single section will be the only one needed for a particular operation. We do not wish to suggest that the methods described are the only methods, we have merely attempted to describe the methods and procedures which we use and which we have found to be reliable and up-to-date. As new information becomes available, attempts are made to test techniques, incorporate them into routine procedures, and then revise the chapter concerned.

In the final analysis the reliability and quality of the data obtained is in your hands. It is imperative that meticulous attention be given to details to insure reliability and usefulness in the results you obtain.

While we have attempted to be thorough in descriptions of techniques, this cannot be considered to be a complete "cookbook" for the novice. It is in most cases assumed that the reader has some prior knowledge and training in the field concerned. We hope, however, that these instructions can serve as a training aid for the novice marine technician, a "cookbook" for the scientist who is taking his own observations, and a reference manual for the experienced technician.

Preparation of these chapters over the years has been supported by the University of California and by grants and contracts from the many federal agencies to the Scripps Institution of Oceanography and to the Institute of Marine Resources. Support for preparation of this more complete and revised manual has come from the National Sea Grant Program.

For this "Piston Coring" section of the Handbook, Frederick S. Dixon has supplied the material on the small-diameter corer and Daniel Karig is author of the text on the large-diameter corer. Additional help and advice were offered during compilation by George Hohnhaus and Thomas Walsh of Scripps Institution of Oceanography.

G. G. Shor, Jr.
Sea Grant Program Manager

Piston Coring
May 26, 1972

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PISTON CORING

The piston coring operation, like gravity coring, achieves penetration of the ocean floor by corers under gravity force. When the release mechanism on the instrument is tripped, the specific gravity of the device is great enough to cause the corer to free-fall so rapidly through the water that it strikes the bottom with sufficient force to penetrate. Piston-type bottom coring has an advantage over gravity coring in that piston devices have been designed to offset the downward force of the corer on the sediment in order to render relatively undisturbed core samples. The piston within the coring tube serves to reduce distortion in the sample, promotes deeper penetration of the bottom, and has been described by some authorities as providing "a more representative sample of the bottom sediment *in situ*" (H. O. Publication 607, 1968).

The research vessels of Scripps Institution of Oceanography are equipped with the Kullenberg piston corer. Since 1970 the R/V MELVILLE has used an improved large-diameter piston corer developed by Daniel Karig. In this section of The Marine Technician's Handbook the earlier small-diameter corer and the new large-diameter device are treated separately. Although the two operate similarly once in the water, differences exist in assembly and in launching. Appropriate descriptive figures or photos follow each portion of the text material respectively.

SMALL-DIAMETER PISTON CORER

The small-diameter Kullenberg piston corer consists of a weight stand, weights, barrel, catcher-cutter, plastic liner and tripping arm. A standard gravity corer is used as a tripping device (Figure 1). On Scripps Institution ships these corers are normally handled end-wise over the stern.

The corer slides on a pair of rails, two 4-in. diameter pipes laid parallel and separated so that the weights will just clear the cross member by one inch. The length (approximately 20 ft.) depends upon the space available on the fantail of the ship (Figure 2). This track is tack-welded to the deck.

A saddle, or cut-out, is provided at the end of the fantail for the corer to rest in (Figure 3). This is usually a removable plate so that a solid plate conforming to the curve of the fantail may be installed when other equipment (such as nets) is being handled. A large sheave for the main wire is suspended from an A-frame directly above the saddle. Another sheave large enough to take a 3-in. line should be installed about three feet from the large wire sheave.

Iron weights, usually of 65 lbs. each, are placed on the weight stand and secured by the locking collar. The number of weights needed is arbitrary and depends on the type of bottom to be sampled and the depth of penetration. On Scripps ships fifteen to eighteen weights, dimpled for interlocking are used. When added to the barrel and other equipment, these give the complete corer sufficient weight for the penetration and coring of the ocean bottom.

The weight stand is placed on the forward end of the rails, with the bail vertical. A 20-ft. core barrel is laid in the saddle of the two saw horses (Figure 3) and a plastic liner is inserted into the barrel. At this point the liners are usually 6 to 8 inches longer than the core barrel. When the forward end of the liner is flush with that end of the barrel, the aft end of the liner is cut on a 45° angle.

On deck there should be enough of the dredge wire (usually 3/8, 1/2, or 9/16-in. wire) to go through the sheave on the A-frame, with about 60 ft. left on deck. The bitter end of the wire is fed through the weight stand and through the forward end of the core barrel; this leaves about 6 ft. on deck. The "feejee" fitting that requires a skilled technician to install is seldom used on Scripps ships; instead the piston uses a Nicopress sleeve of the correct size, with a brass dummy. One end of the wire is inserted through the piston and a Nicopress is installed on the end of the wire. Enough presses are made to form a completely rounded end. The wire is pulled back through the piston and threaded tightly to the piston end, locking with an Allen screw. A leather cup washer is placed on the end of the piston; this washer is formed of well-soaked leather and has a center hole punched to admit the bolt. The cupped end of the washer is installed toward the wire with a large flat washer bolted securely over the flat side of the leather one. The slack wire is pulled back through the core barrel until the piston is in the liner, with the leather up to the 45° cut in the aft end. (Note: the first time a leather washer is used, it will be too large for easy insertion. In this case, the leather is pulled as far as possible into the liner and, while a crescent wrench is slowly turned clockwise on the bolt end, the leather is tucked completely into the liner.) With the leather inserted, the piston is hammered into the liner with a brass drift pin. When the liner-enclosed piston is flush with the end of the barrel, the liner is cut even with that end and the head of the piston is bolted. The cutter-catcher is placed on the end of the barrel and two staging double-headed 8 penny nails are inserted. If the barrel is not a true round, filing may be necessary to enable the cutter to slip on easily. The barrel can then be attached to the weight stand. (Details shown in Figure 5).

With the forward end of the barrel placed in the aft end of the weight stand, one man pulls the slack wire out of the bail end of the weight stand while another holds the aft end of the barrel parallel to the weight stand and four nails are inserted into the stand and barrel. Care must be taken to insure that the barrel hits the end of the stop in the weight stand so that the grooves in the barrel line up with those in the stand. The nail heads are bent over lightly and friction-taped to prevent the heads being knocked off during launch or retrieval operations. If a nail head should break off, however, the technician should take a fine pointed prick punch and tap the nail out carefully.

The tripping arm is attached to the bail of the corer and a pin is inserted in the hole. The pin is taped to prevent its falling out. The wire is placed in the clamp on the tripping arm, with the end from the winch at the top of the clamp. Should the clamp not be serrated, a piece of sheet lead is used on the side (of the clamp) to prevent wire slippage. The three nuts on the tripping arm clamp should be made as tight as possible since the whole weight of the corer is carried here until tripped.

Ideally the piston rests at the surface of the mud while the barrel penetrates the bottom, with the piston wire pulling on the piston to relieve pressure (Figure 6). Several lowerings may be required in order to reach the correct amount of free-fall wire. An approximate measure can be made by using the distance from the end of the gravity core barrel to the end of the piston core barrel, with the tripping arm in the down position. The free-fall wire is taped lightly to the top of the weight stand to prevent its catching on anything as it goes over the side. An extra foot of free-fall wire is allowed to provide for the time delay in the tripping arm. At the point where the tripping arm is clamped to the wire, the wire should be spray-painted white as an identifying mark. It may be necessary to adjust this position, however, if there is either sucking action or water in the core.

Either 3/16-in. wire or a length of galvanized chain connects with the tripping gravity corer. Some chief scientists are finding chain preferable since wire tends to get "wild" and unmanageable after several lowerings. Whether the 3/16-in. wire or chain is used, however, the length needed for either is figured with the tripping arm in the down position. It is measured from the end of the arm, at the shackle hole, to three feet from the end of the piston core barrel. Six extra inches are allowed at each end for a Nicopress on the 1/4-in. thimble. In the water this will permit about 6 ft. or the length of the gravity core barrel, to hang below the end of the piston core barrel. About 7-ft. of free-fall on the dredge wire is recommended with this. Before Nicopressing a small loop at the top end of the tripping wire, the technician should put an extra 3/16-in. sleeve on the wire and then Nicopress a 1/4-in. thimble at the bottom end and a small loop at the top. He Nicopresses this, with the extra sleeve that is on the tripping wire, so that the loop is about 2 inches from the looped end of the tripping wire. No thimbles are used on the top end of the wire. Small loops must be used; otherwise the wire will not run through the sleeve. When chain has been substituted for wire, the loops described are formed by adding links. The lengths of the chain or wire given here apply to perfect sea conditions. Adjustments will be necessary to allow for rough seas, rolling and pitching of the ship, and for varying depths.

A 2-in. line is made up to run from the end of the fantail, through the small block on the top of the A-frame, to a snatch block on the forward end of the fantail, and over to a capstan - with enough left over to wrap around the capstan several times. This line should have a small eye splice at the fantail end, with a 1/4-in. shackle on it. This is used to raise and lower the gravity corer trigger weight. A 3-in. line is made up to go from the aft end of the fantail to a snatch block on the forward end of the fantail, in line with the corer tracks, and from there to the capstan, also with line to spare. This 3-in. line should have a large hook spliced on the aft end to be used as a backhaul line for the piston corer. With these operations completed, the piston corer is ready to be lowered over the stern.

When the gravity corer is in the water, the safety pin pulled, and the A-frame has been extended all the way out to clear the ship, the core head is lowered to the water surface and the meter wheel is zeroed to begin registering wire-out.

After the operation has been completed, the back haul line is used to retrieve the core and it brings the barrel up, parallel to the deck, on the tracks. The piston core barrel is disassembled from the weight stand and laid on the saw horses. Beginning at the bottom of the barrel, (i.e. that portion which reached deepest penetration) the liner is extruded and is cut (usually in 150 cm. lengths), packaged, and marked according to the specific instructions from the research institution that will receive the samples.

FIGURES

SMALL DIAMETER PISTON CORER

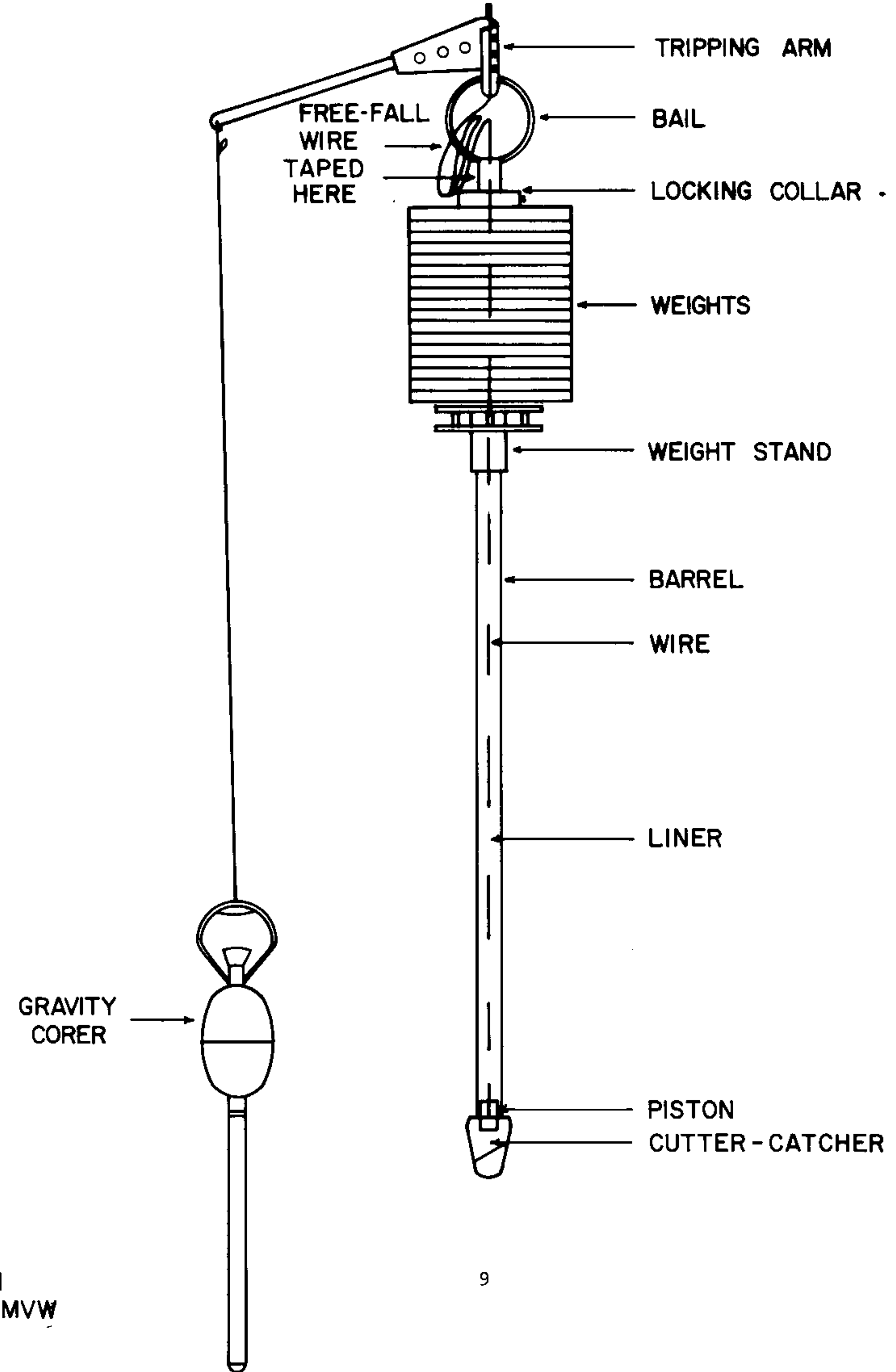

TRIPPING ARM
BAIL
FREE-FALL
WIRE
TAPED
HERE
LOCKING COLLAR
WEIGHTS
WEIGHT STAND
BARREL
WIRE
LINER
GRAVITY
CORER
PISTON
CUTTER - CATCHER

FIG. I
FSD:MVW

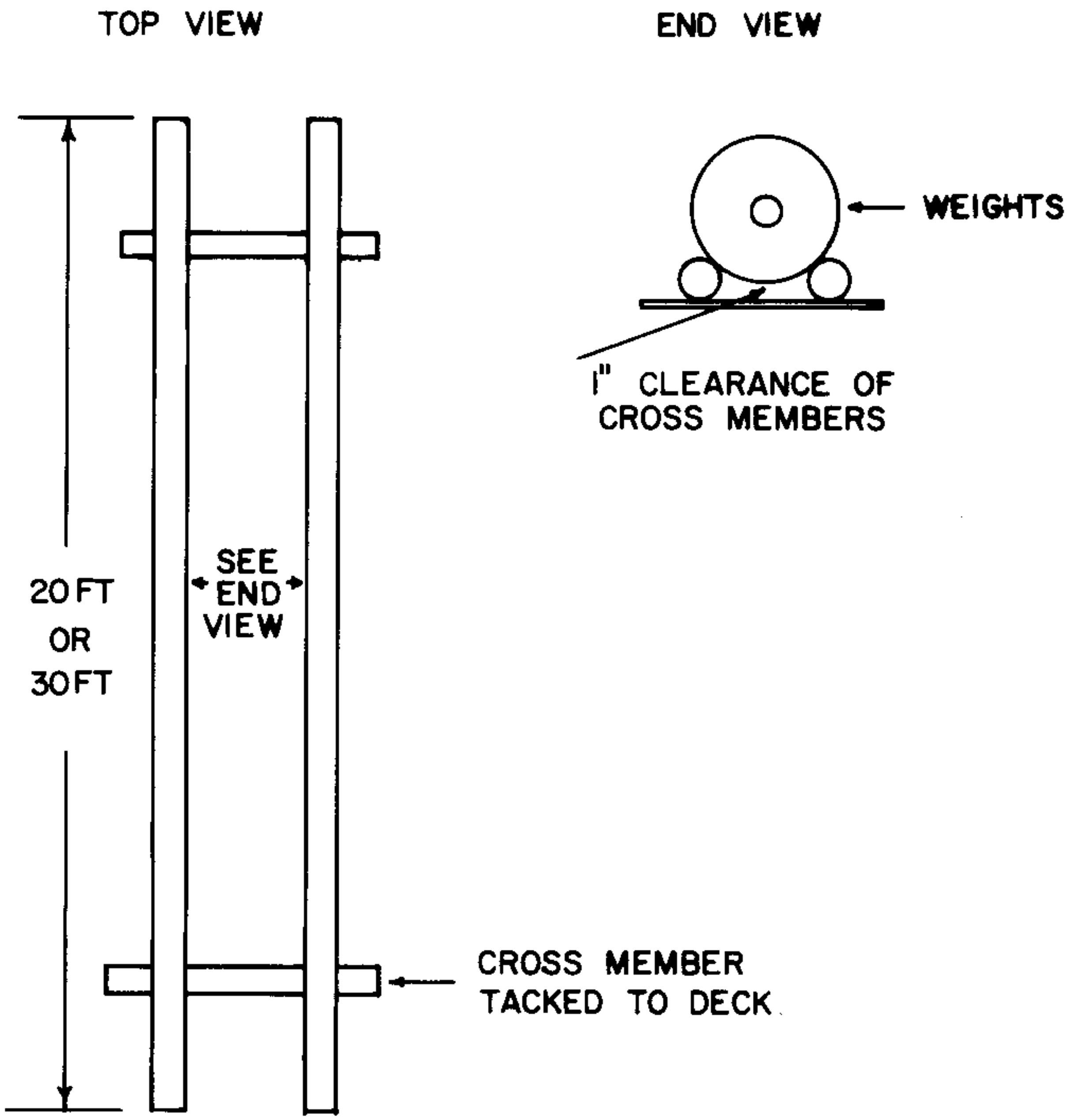

TOP VIEW
END VIEW
WEIGHTS
1" CLEARANCE OF CROSS MEMBERS
20 FT OR 30 FT
SEE END VIEW
CROSS MEMBER TACKED TO DECK

FIG. 2
FSD:MVW

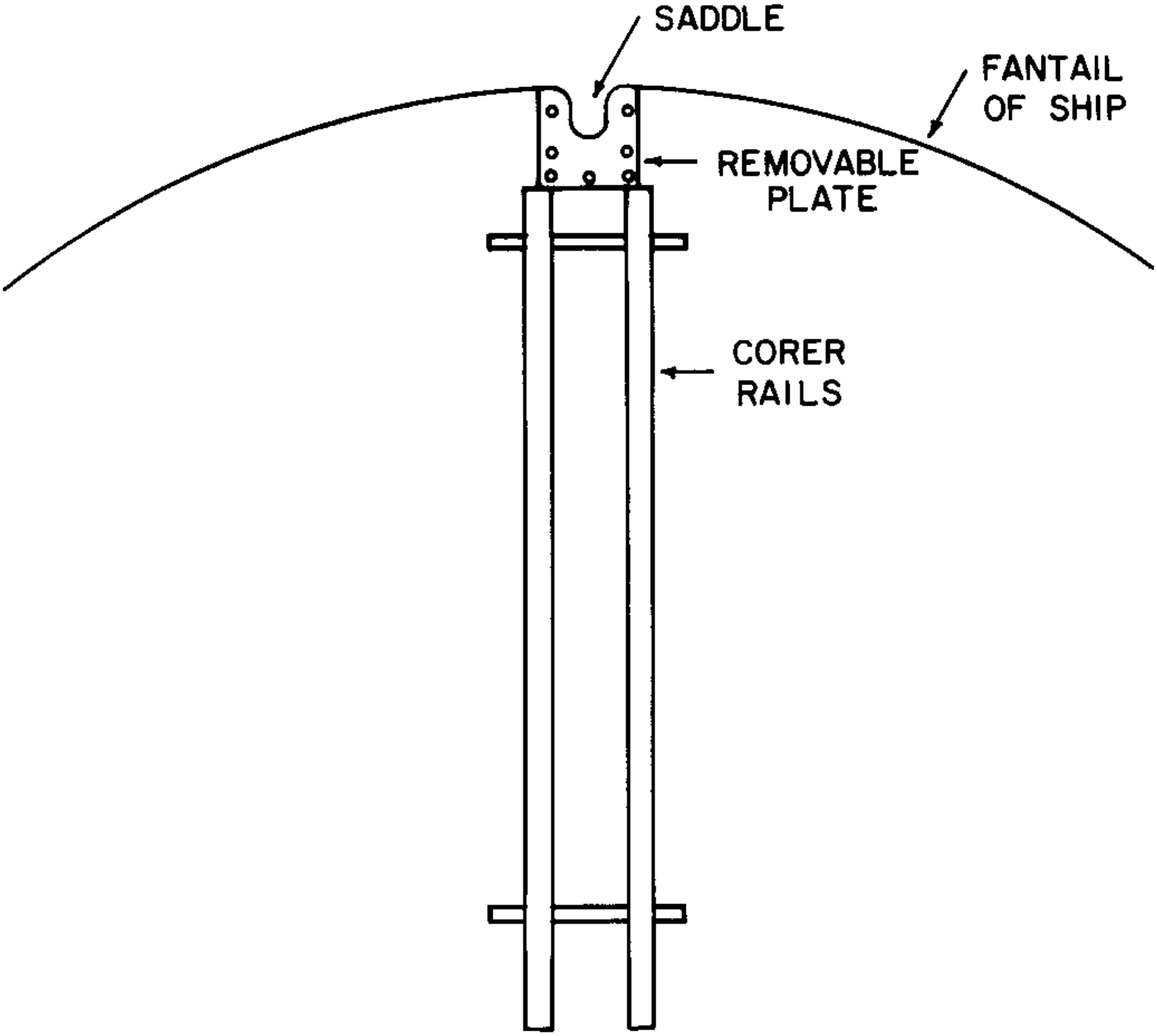


FIG. 3
FSD:MVW

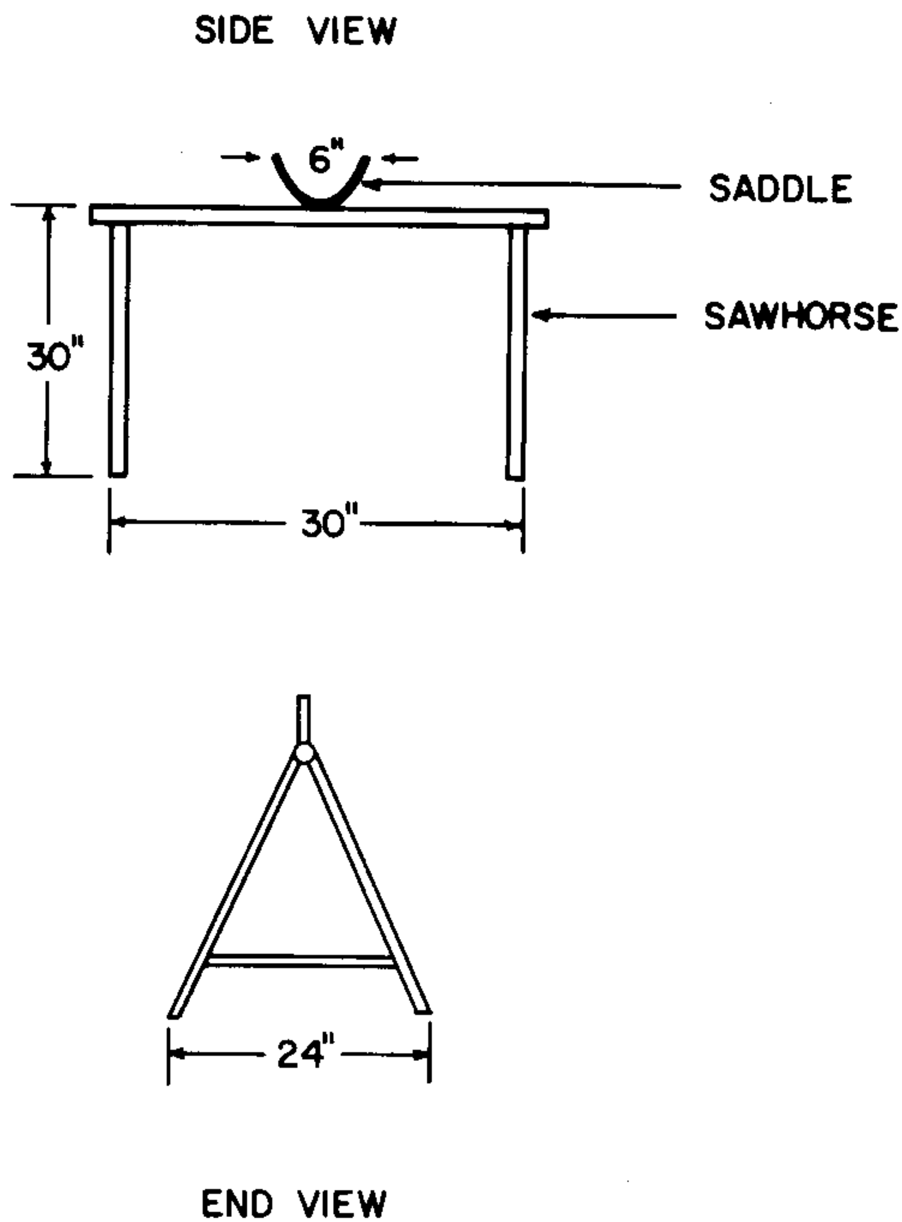
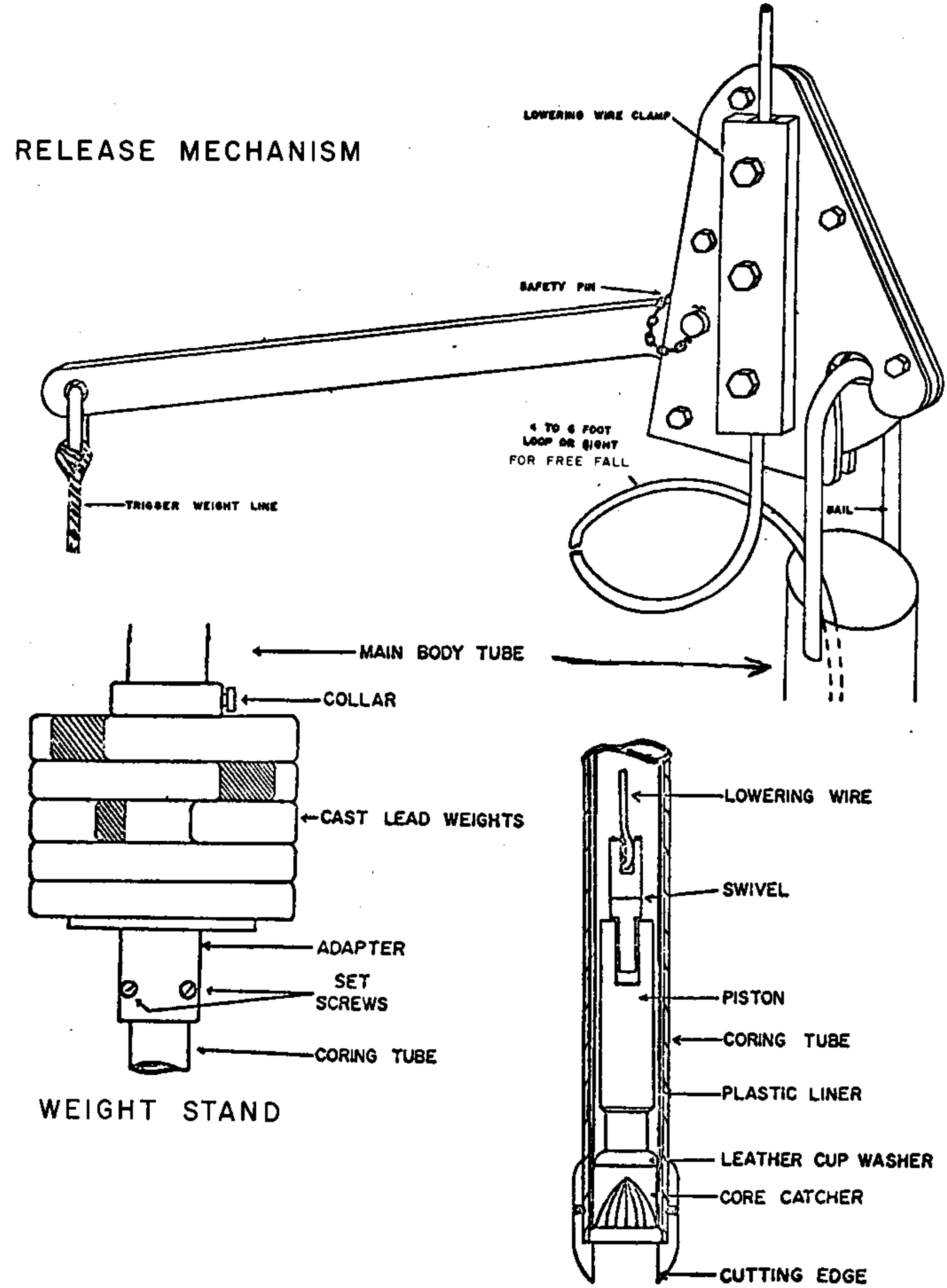


FIG. 4
FSD:MVW



PISTON CORER ASSEMBLY

FIG. 5

PRINCIPLE OF PISTON CORER OPERATION

(Gravity Corer Used Here as Trigger Weight)

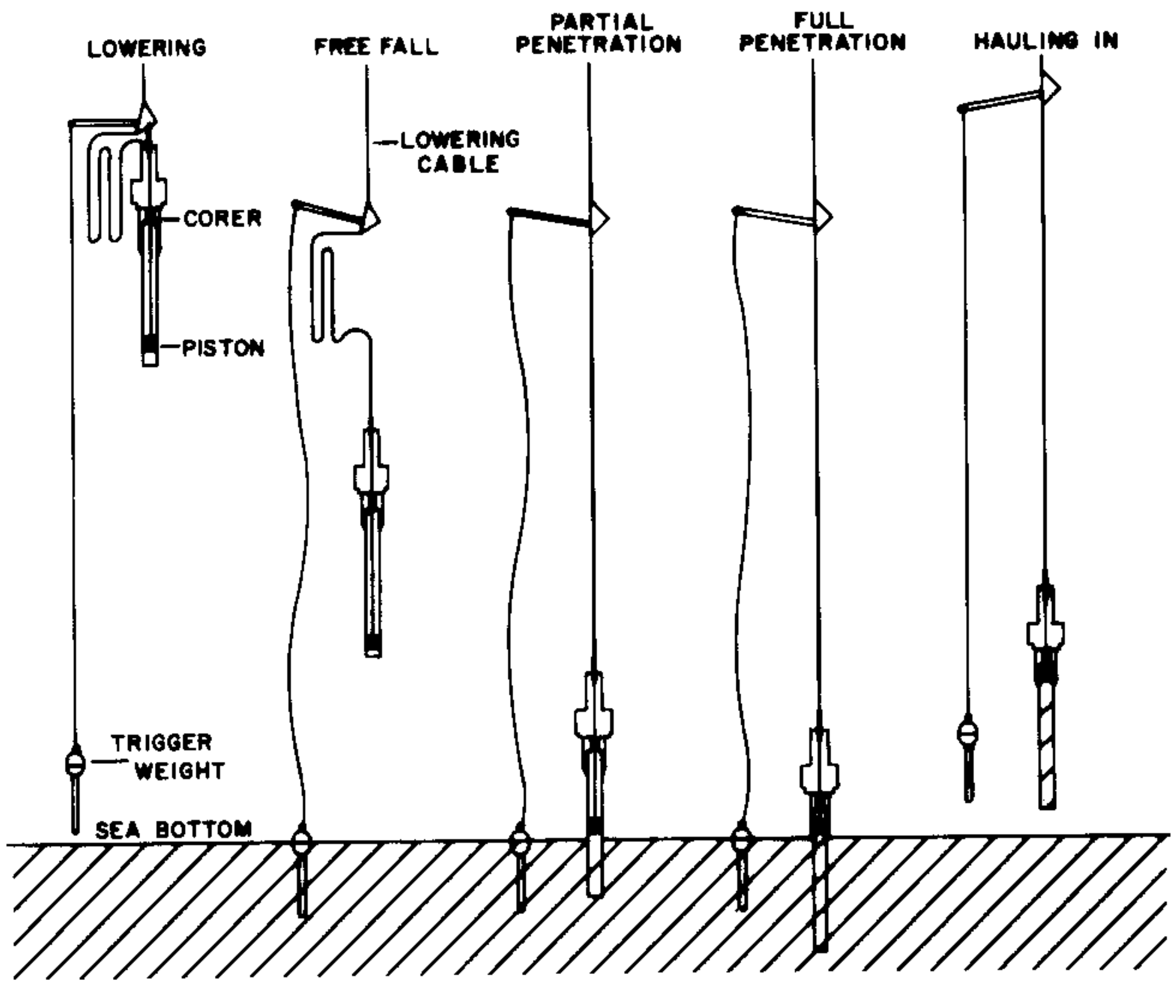


FIG. 6

LARGE DIAMETER PISTON CORER

A new large-diameter piston corer has been built to obtain longer and better preserved sediment samples. A number of accessories have been designed also to provide flexibility in a variety of coring situations. The corer may be used with or without a liner, and with several core noses. It is handled along the side of the ship. On a ship with the configuration of the R/V MELVILLE, cores from 10' to 90' can be obtained without special techniques.

DESCRIPTION OF UNITS

Barrel, noses, and liner: The core pipe of 1/4-in. Shelby tubing is 4" O.D. (outside diameter) and is cut into 10' lengths to permit easier handling and less wastage when the core string is bent. Pipe lengths are joined with collars and nail pins.

The liner is clear butyrate with a 3.43 O.D. and a 0.1" wall thickness, in 20-ft. lengths. Because the liner has a high coefficient of thermal expansion, a steel sleeve has been developed which fits inside the lower end of the liner and attaches to the core pipe. As the liner shortens in cold deep water, it can slide up the sleeve without admitting mud into the space between the liner and the barrel and inhibiting liner removal.

Several core noses have been designed for different types of sediment. The flap valve core nose is for general use, with a liner, in soft sediment. A screw-on, thin-wall nose is used for coring consolidated sediment; it uses no liner but requires a special threaded barrel. A DSDP (Deep Sea Drilling Project) type core-catcher is used for coring sand. It too requires a special barrel with screw fittings and a liner is used in its operations.

Core head: (Photo 1) At present only a solid lead-filled 2500-pound core head is available. This has vertical water vents to reduce water resistance against the piston as it moves up the barrel. Future core heads may have instrument wells and shrouding.

Trigger arm: A heavier, longer tripping arm is required for the large core but it is similar in operation to the older model. One innovation is a pressure-activated safety pin which arms the piston corer at a selected depth below the water surface. In adverse sea conditions this should be used instead of the hand-pulled pin in order to minimize the danger of the corer's pre-tripping.

Piston core launching assembly: The present launching assembly is a saw-horse like affair with two axes of rotation. (See Figures 1 and 2 and blue print). The core head is seated in a length of large-diameter pipe in which a keyhole slot has been cut in the bottom and up one side, large enough to admit the barrels. A large shaft-cylinder assembly lying along the top of the saw-horse allows this pipe socket to rotate the corer from its horizontal position along the rail (Photo 2) to the vertical (Photo 1). The shaft assembly is perpendicular to the edge of the deck and also rotates from horizontal to vertical position, allowing the core head to be brought inboard. A heavy pin and locking plate prevent motions about the two axes.

Lifting and lowering of the pipe is done with the hydrowinch or with the capstan and davit (Photo 3). The latter method is more common; very long cores, however, require the use of both.

METHOD OF OPERATION

Preparation

Step 1: If the system is completely unrigged, the core head will be inboard and the barrels will be stowed. In this case, remove the locking plate and rotate the core head outboard using the large pad eye and either the crane or a 1" manila line. Because of the weight of the core head, the use of the crane is preferable. Between the core stations, the core head is usually left outboard, with one or two sections of pipe attached for stability.

Step 2: Place the davit roughly half way along the planned length of the barrel and swing the davit outboard.

Step 3: Starting from the core head, load the pipe in 10' lengths and the liner in 20' lengths (if the liner is used). Offset the liner joints from the pipe joints several inches. The liner joints should be squared off.

Step 4: If slack wire is available, run it through the pipe, taking care that the wire goes in above the bail. (Note: the bail is horizontal when the pipe is horizontal). Screw on the piston. The piston must be serviced each time it is used to see that: (a) the orifice screw is clean and of the correct size, (b) mud and sand have been removed from the "O" ring groove; (c) the shear pin is seated with the matchstick, and (d) the end plate is loosened so that the rubber is contracted. When the flap valve core nose is used, the liner sleeve is inserted first; then the piston is pushed into the liner and the end plate is tightened until the piston can just be pushed with the thumbs. Put on the core nose.

Step 5: If a fixed lifting wire system is used, fasten the hydrowire with a small shackle to the rod that is welded on the lowest barrel length and tape it along the barrel. This lifting wire must reach to the base of the core head.

Step 6: If enough slack wire is available, measure out the required free-fall and bolt this onto the tripping arm. Lift the tripping arm into place, using an auxiliary line and block on the A-frame, prior to swiveling the corer into vertical position. The arm should be trailing aft and will rest on the rail. All of the main wire must be on the same side of the tripping arm and the bail. Screw on the pressure release pin. (Note: This Step 6 must be delayed until the station is reached if the slack wire was not pulled out on the previous station).

On station

Step 1: Put the retrieving collar on with the handle pointing toward the core head, directly beneath the davit, and with the lowering line running to the forward capstan. (If no retrieval collar is available, a chain choke can be substituted.) If the hydrowire is to be used for core recovery, the retrieval collar can still be used but must be placed over the recovery wire in order to slide over the nose cone.

Step 2: Pull the pin from the launching assembly and slowly rotate the pipe into vertical position. As the pipe gradually descends, fill the barrel with water from the salt water hose. Fill slowly enough that the water level inside the pipe is never much above that on the outside. Equalizing the water levels prevents the piston from moving up the barrel or being forced out the nose. Replace the pin when the pipe reaches the vertical, and slack off on the retrieval collar - letting it fall off over the nose.

Step 3: Take up the slack on the dredge wire until the core is just hanging on the wire; tape the free-fall wire loop to the wire over the core head. Put on the gravity core. Raise the core head on the wire and lower the A-frame so that the core head lifts free of the socket. If the manual pin is used, pull the pin while you can still reach it; note, however, that use of the pressure pin is recommended in almost all cases, with one of the weakest shear pins inserted. As soon as the A-frame is all the way out, lower the core head to the water (Photo 4) and zero the wire counter.

If the pinger is used, place it at 92 m (50 fm) along the wire; the trip will occur when the distance approximately equals the 92 m plus the length of the gravity core chain.

Step 4: Experience has indicated that the best cores result from slowing the descent of the coring rig shortly before touching bottom, and then lowering the rest of the way very slowly (10-20 meters per minute). When the corer releases, stop the winch immediately. Wait one minute for the piston to separate, then begin retrieval very slowly. Increase the winch speed only after the corer is clearly off the bottom.

Raising the corer

Step 1: Pull in the A-frame, bringing the wire inboard, and take off the gravity core; remove the tripping arm and lower the A-frame again.

Step 2: Raise the core head almost to the block and raise the A-frame. Raising the A-frame can cause the core head to drop a little, in which case it may need to be raised almost to the block again. Guide the pipe through the keyhole and drop the core head into the socket of the launching assembly. Slack off the wire, getting enough slack for the next core if it is to be taken soon. Either put on the retrieving collar, having measured the chain so that the collar will end up under the davit, or fasten the lifting wire to the hydrowire taped along the barrel.

Step 3: Raise the core with the collar, remembering to change the pin position on the launching assembly.

Step 4: Disassemble from the nose end of the core. If possible leave 10' or 20' of pipe attached to the core head.

ADJUSTMENTS

The adjustments on the core rig include the length of the barrel, the length of the free-fall, the length of the trip wire or chain, the type of core nose, the use of a liner, and the orifice size in the piston.

The length of the barrel depends on the type of sediment; this can be anticipated by previous core results and by the character of the bottom returns on the 3.5 kHz profiling system. In the latter, the relative intensity of the reflections of the bottom and shallow sub-bottom is a measure of penetrability. If there are no sub-bottom returns, penetration seldom exceeds 5-10 ft. and no more than 20 ft. of barrel should be used. When the intensity of the surface reflector is the same or less than the sub-bottom reflectors, the depth of acoustic penetration gives some indication of possible core penetration. Experience is the best guide here.

The lengths of the free-fall are still being explored. Experiments to date indicate that penetration in a single location increases when free-fall is increased from 8 to 14 ft. Free-fall of 18 to 20 ft. has been used routinely, with the corer remaining stable after dropping that distance. Cores over 40 ft. long should probably not have quite as much free-fall as the shorter cores. In determining the length of wire to be coiled and taped, an extra length must be added to the desired free-fall to compensate for the shortening of the main wire after the weight of the piston is removed. The amount depends on the water depth and on the speed at which the corer is being lowered; experience so far suggests a range of 2 to 5 ft.

The length of trip wire or chain depends on the length of the barrel, the amount of free-fall, and to a lesser degree the character of the bottom. An approximate formula is:

Length of trip wire = Length of barrel + Length of trip wire + 2 feet

If the bottom sediment is very soft, add 1 or 2 more feet; if it is very hard, subtract one foot.

A perfect core has a small amount of water between the piston and the top of the sediment, but adjustment closer than several feet is impossible because of ship roll and wire oscillation. If there is too much water between the sediment and the piston, the corer is released too soon; the trip wire or chain should therefore be shortened to compensate. (Note: The corer will also release too soon if water has not been poured into the barrel during lowering to prevent the piston's floating upward.) If the external penetration, as measured by observing the mud smear, is much greater than the core length, the trip wire is too short and should be lengthened by the amount of difference in external and internal penetration.

The type of core nose and the use of the liner depend on the type of sediment and the purpose of the core. Routine cores in soft sediment, especially if no specialized technicians are aboard, should be done with liners and with a flap valve core nose. To preserve the structure after extrusion, cores in noncohesive (sandy) sediment are best taken with a liner, using the DSDP type core catcher. A special barrel, with one end beveled and with tapped screw holes, must be used at the bottom of the barrel assembly. The core catcher is screwed into the barrel after the liner has been inserted. A sheet of plastic cut into strips should be used with the core catcher to form a solid block to trap the sand.

Cores in consolidated sediment or through manganese pavement are best done without liners and with the screw-on core nose-catcher assembly. The lowest barrel must be threaded and, again, a plastic sleeve may be used behind the catcher. The catcher screws into the nose and can be removed from damaged noses and repaired. The core must be extruded.

A split piston is used in the large core rig to prevent sucking and liner collapse; this piece of equipment, however, must be carefully maintained and adjusted if it is to work properly.

The principle of the piston operation is that the outer piston section of the unit remains at the surface of the sediment and the inner section, to which the main wire is attached, rides to the top of the barrel (piston stop) and lifts the entire core assembly. The two sections are held together by a shear pin which breaks when all of the slack is taken out of the free-fall wire - and the core nose enters the sediment. Hydraulically coupled by an internal piston and cylinders, the sections do not separate immediately; sea water, leaking into the cylinder through the hole in the adjustment screw, slowly breaks this hydraulic seal. The size of this orifice is critically important since it determines the timing of separation. If the orifice is too small and the core is pulled up too soon, the piston will not break, thus causing liner damage and sucking. If the orifice is too large, the piston breaks too soon and penetration is reduced. A balance must be achieved because small orifices clog easily and long bottom times can cause pull-out difficulties. A 1/16" orifice and a bottom time of 45 seconds to 1 minute are fairly safe. For short cores, the screw can be removed, giving a 1/8" orifice.

PHYSICAL PARAMETERS

D_s	inside diameter of barrel	=	3.50 with no liner 3.23 with liner
D_t	outside diameter of barrel	=	4.00

			Flap valve	DSDP	Dart
D_w	outside diameter of cutter (nose)	=	4.50	4.00	4.125
D_e	inside diameter of cutter (nose)	=	3.20		3.45
d	core nose angle	=	(Approx.)	30°	30°

A. Flap valve core nose with liner configuration:

$$C_i = \frac{D_s - D_e}{D_e} 100 \text{ (inside clearance)} = .94$$

$$C_o = \frac{D_w - D_t}{D_e} 100 \text{ (outside clearance)} = 12.5$$

$$C_a = \frac{D_w^2 - D_e^2}{D_e^2} 100 = 98$$

B. Dart configuration - screw on nose:

C_i = 1.45

C_o = 3.1

C_a = 43

C. DSDP - sand corer:

C_i = (Approx.) 1

C_o = 0

C_a = 56

FIGURES

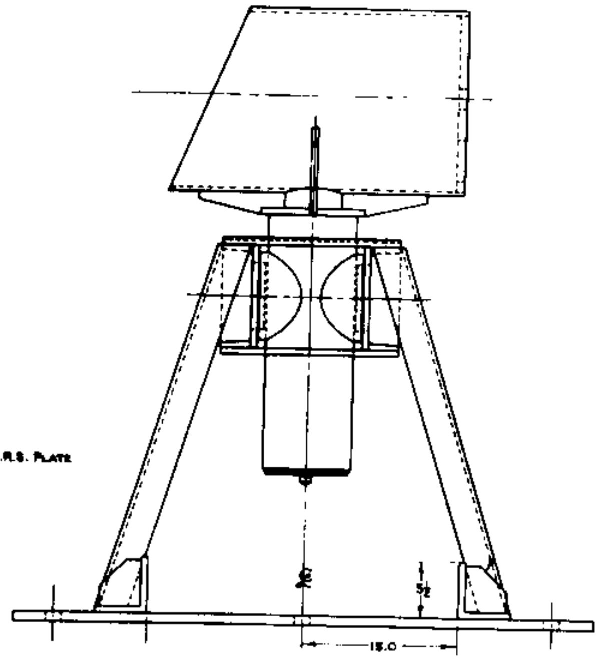
LARGE DIAMETER PISTON CORER

with

Photos and Blue Prints

Note: For full-scale drawings of Large Diameter Piston Corer blueprints, contact: Don Betts, Marine Science Development and Outfitting Shops: SIO; P.O.Box 109; La Jolla, California 92037

FIG. 1



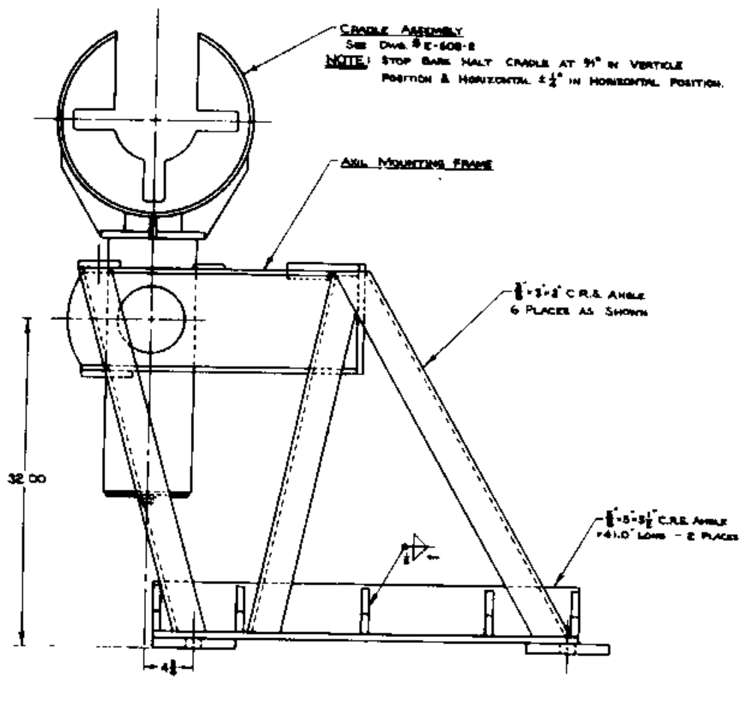


FIG. 2

HANDLING CRADLE FOR LAUNCHING ASSEMPLY

PHOTOS

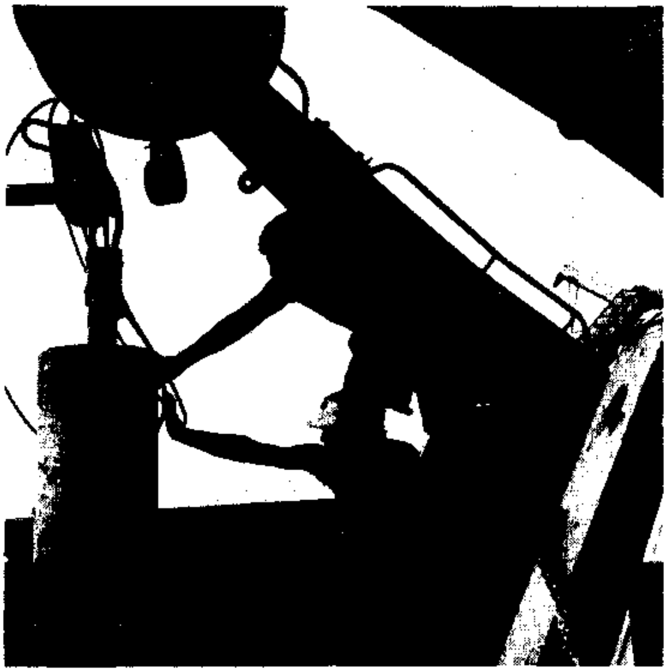


PHOTO 1 - Core head, with trigger arm attached, being lifted from launching assembly/

PHOTO 1

PHOTO 2 - Launching **assembly** with core head rotated into horizontal position. Keyhole slot shows on bottom and outboard side of the pipe socket.

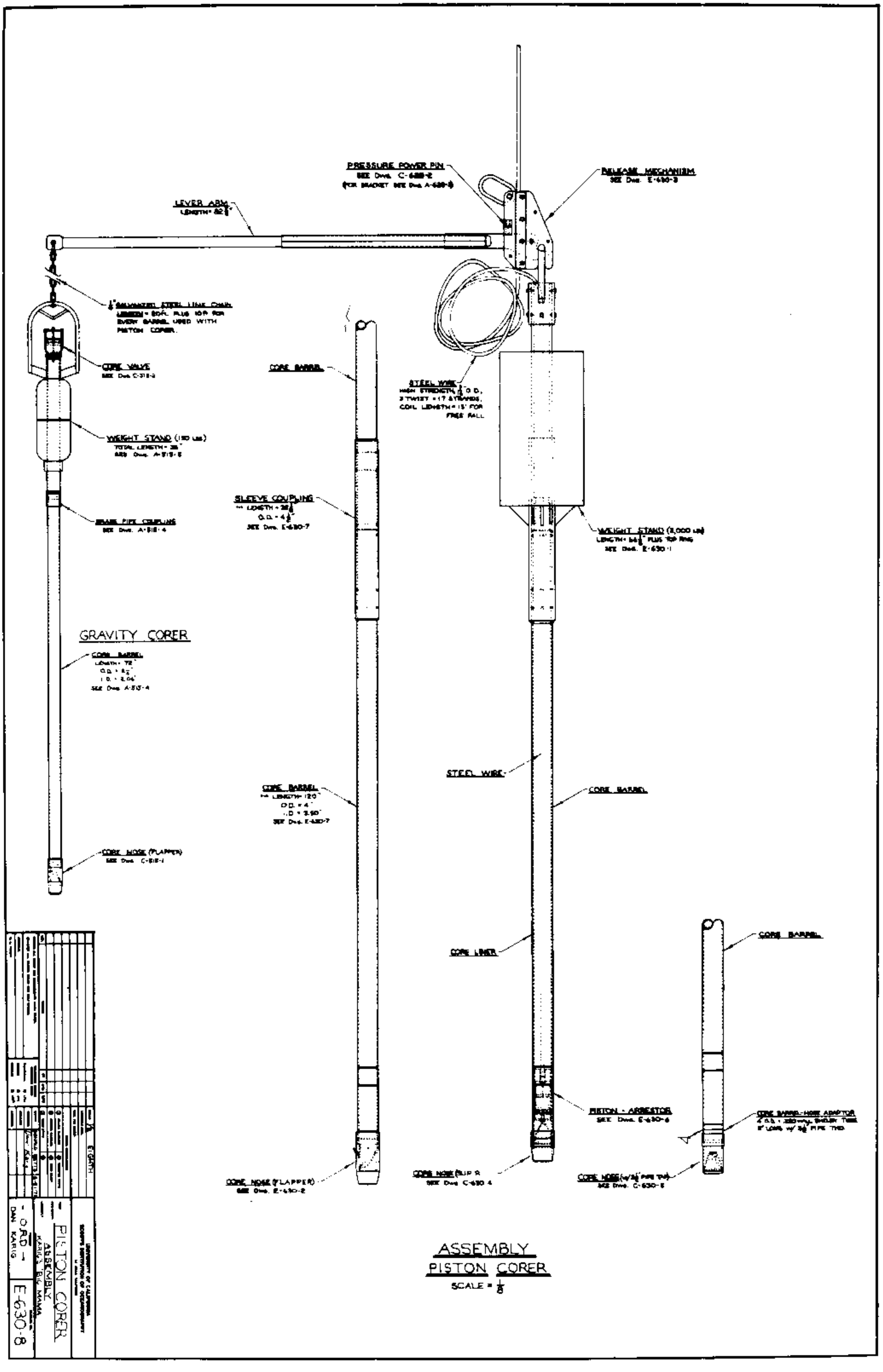
PHOTO 2

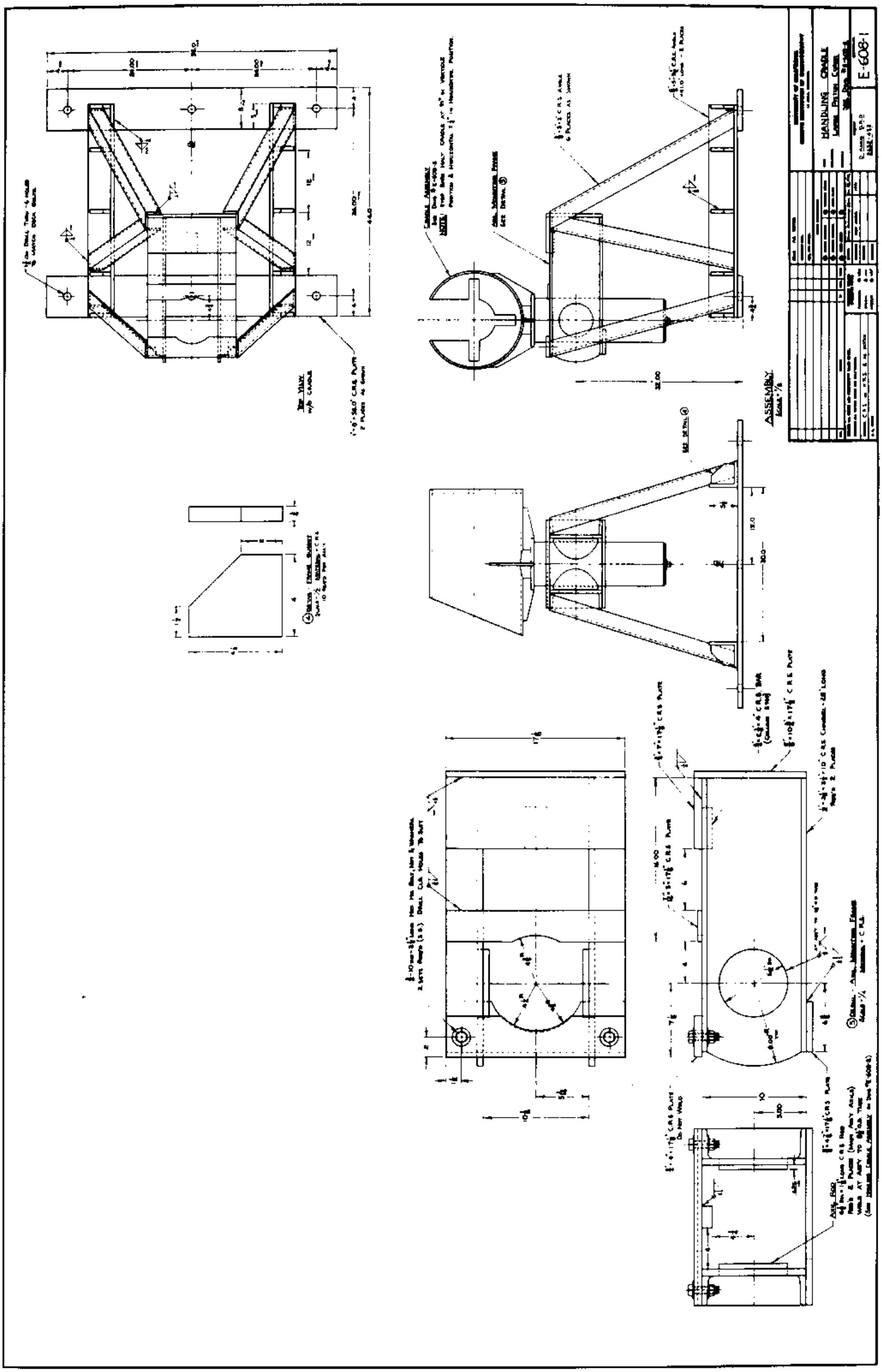
PHOTO 3

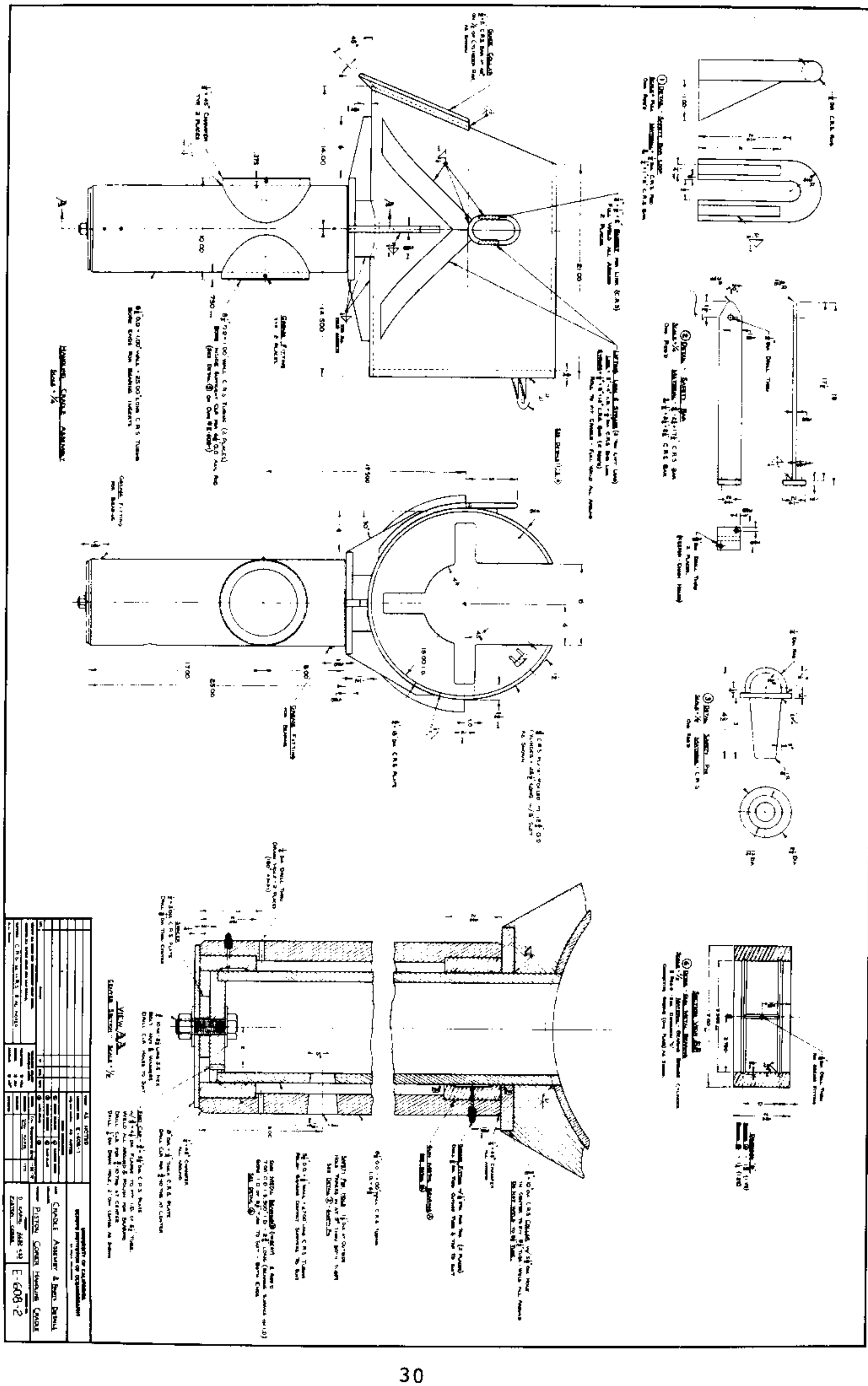
PHOTO 3 - Davit assembly and hydro-winch used in tandem to lower long core barrel (i.e., greater than 50 feet).

PHOTO 4 - Core head and trigger arm, in coring position, being lowered to the water surface.

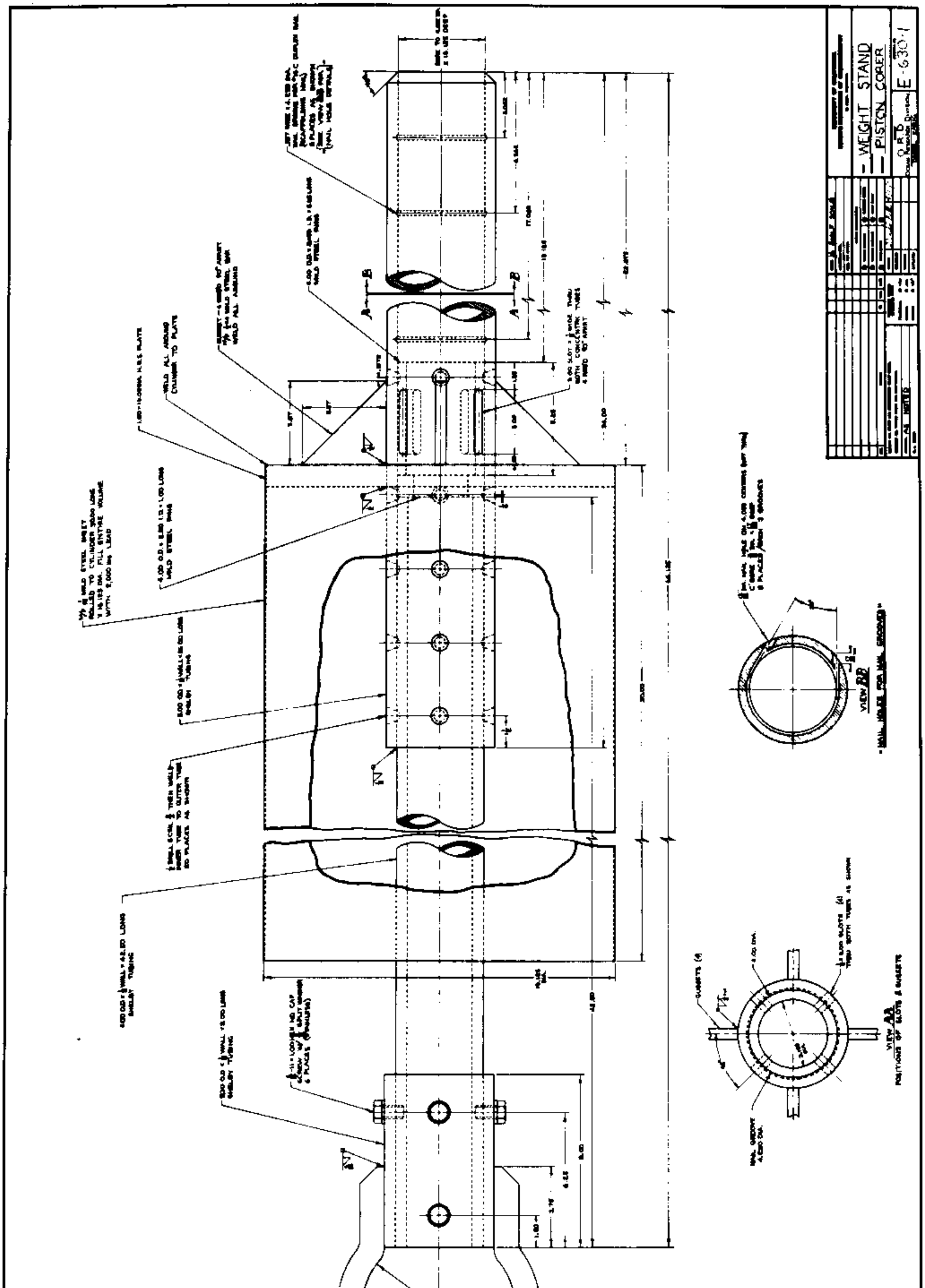
PHOTO 4

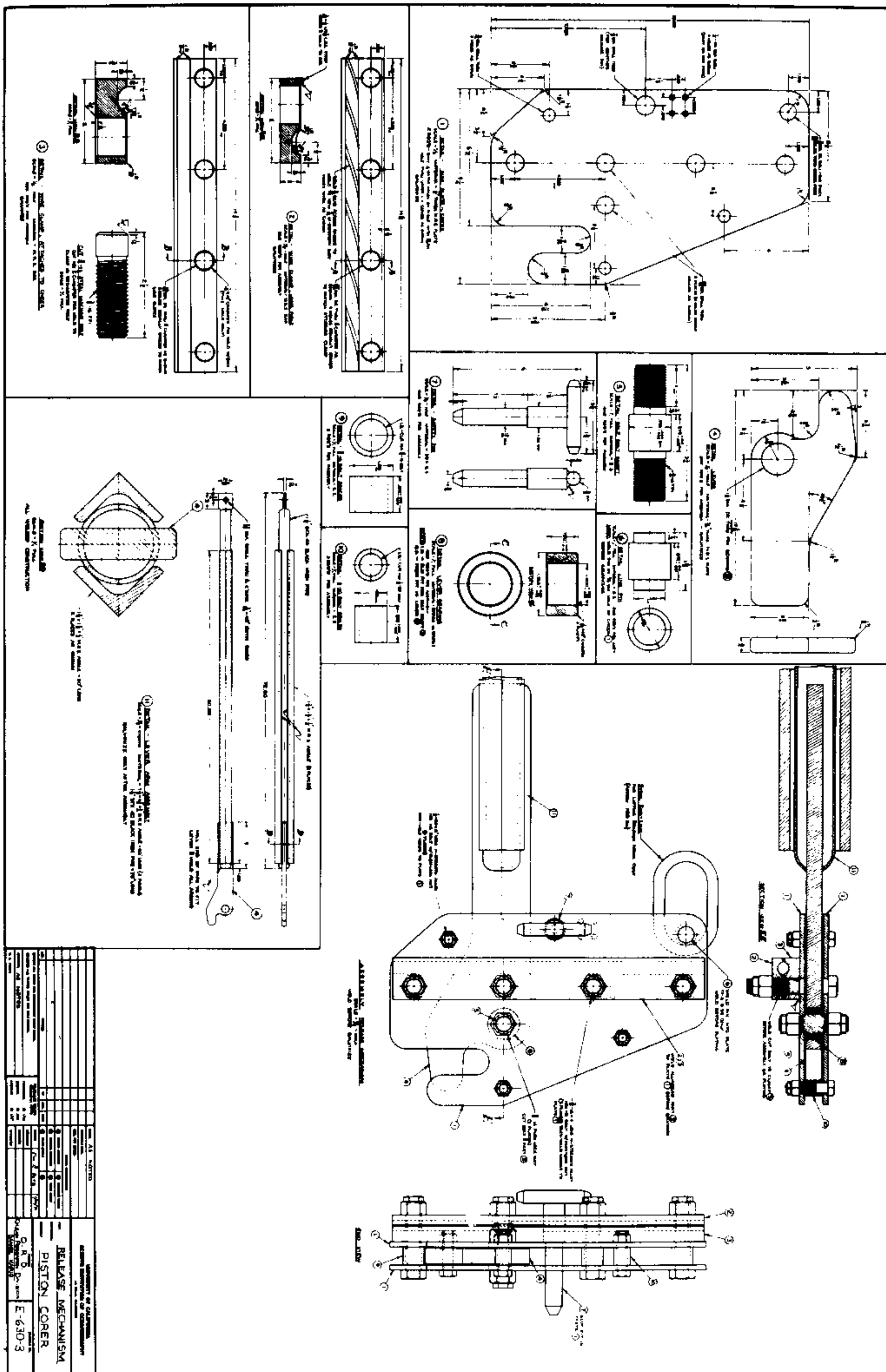

PRESSURE POWER PIN
RELEASE MECHANISM
LEVER ARM
CORE VALVE
CORE BARREL
STEEL WIRE
COIL LENGTH = 15' FOR FREE FALL
WEIGHT STAND
SLEEVE COUPLING
SEE Dwg. E-630-7
GRAVITY CORER
STEEL WIRE
CORE BARREL
CORE LINER
PISTON - ARRESTOR
CORE NOSE (FLAPPER)
CORE BARREL
PISTON CORER
ASSEMBLY
E-630-8
ASSEMBLY
PISTON CORER


HANDLING CRADLE
E-608-1
ASSEMBLY
TOP VIEW

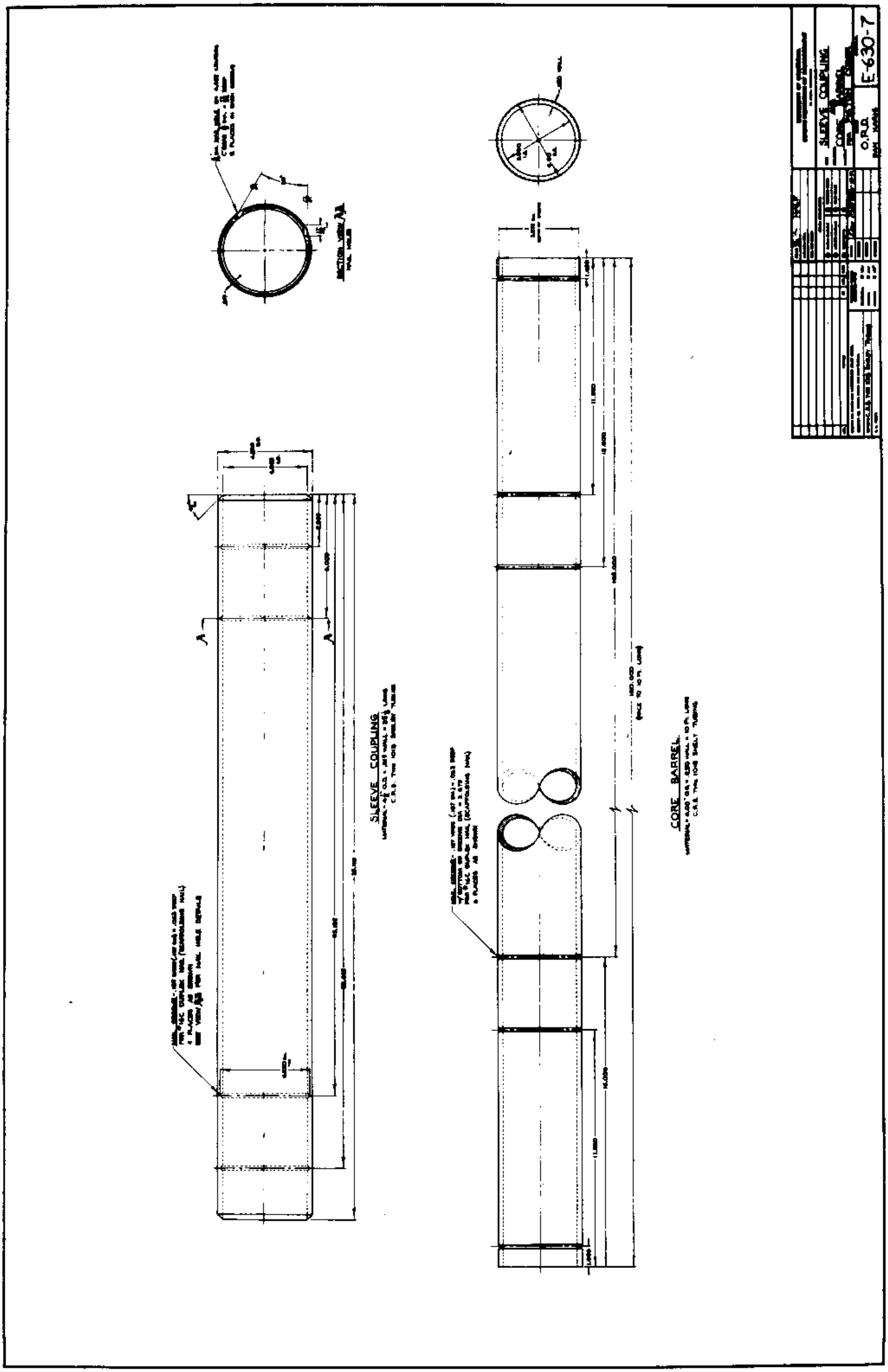


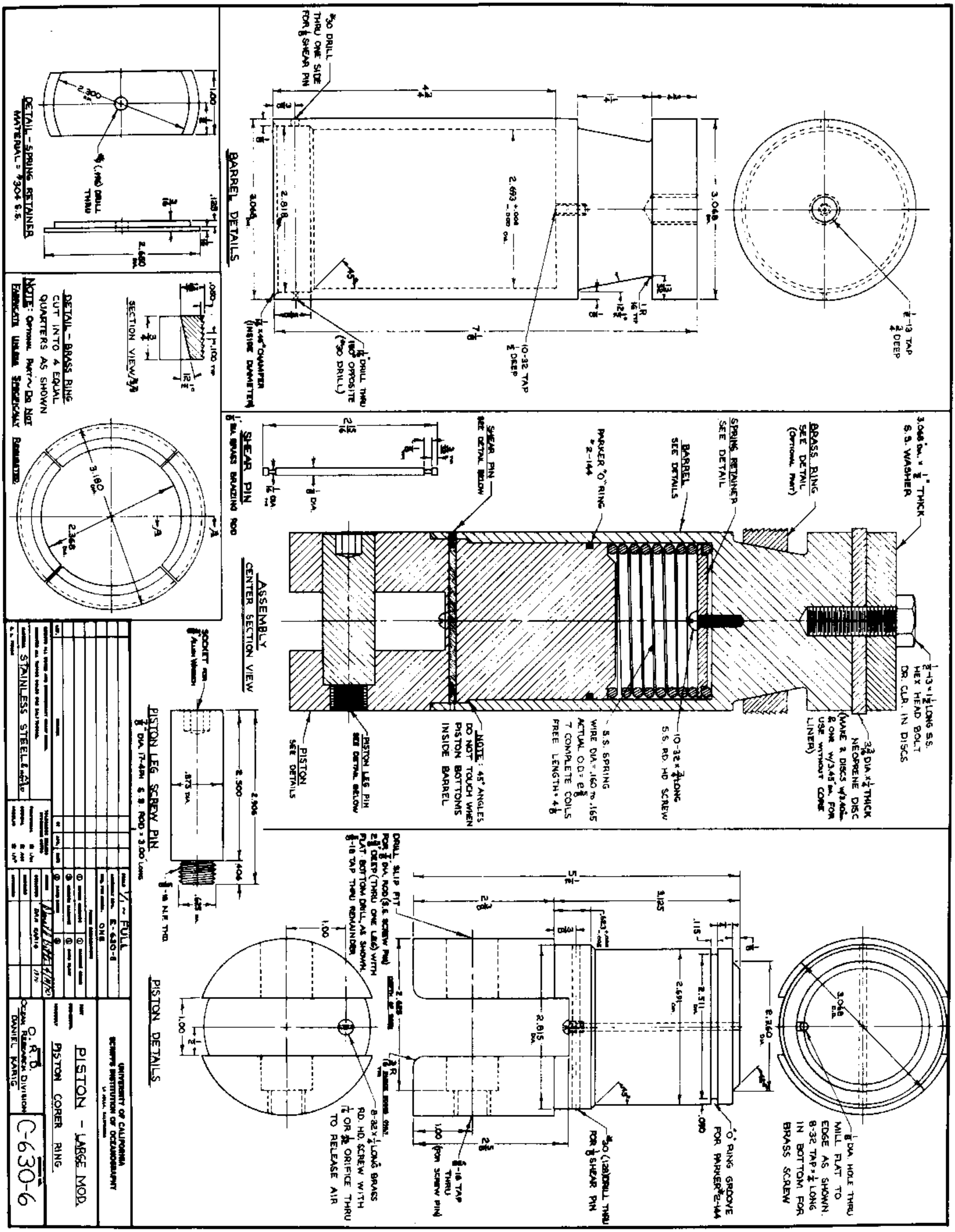
E-608-2
PISTON CORER HANDLING CRADLE


WEIGHT STAND
PISTON CORER
E-630-1
VIEW AA
VIEW BB

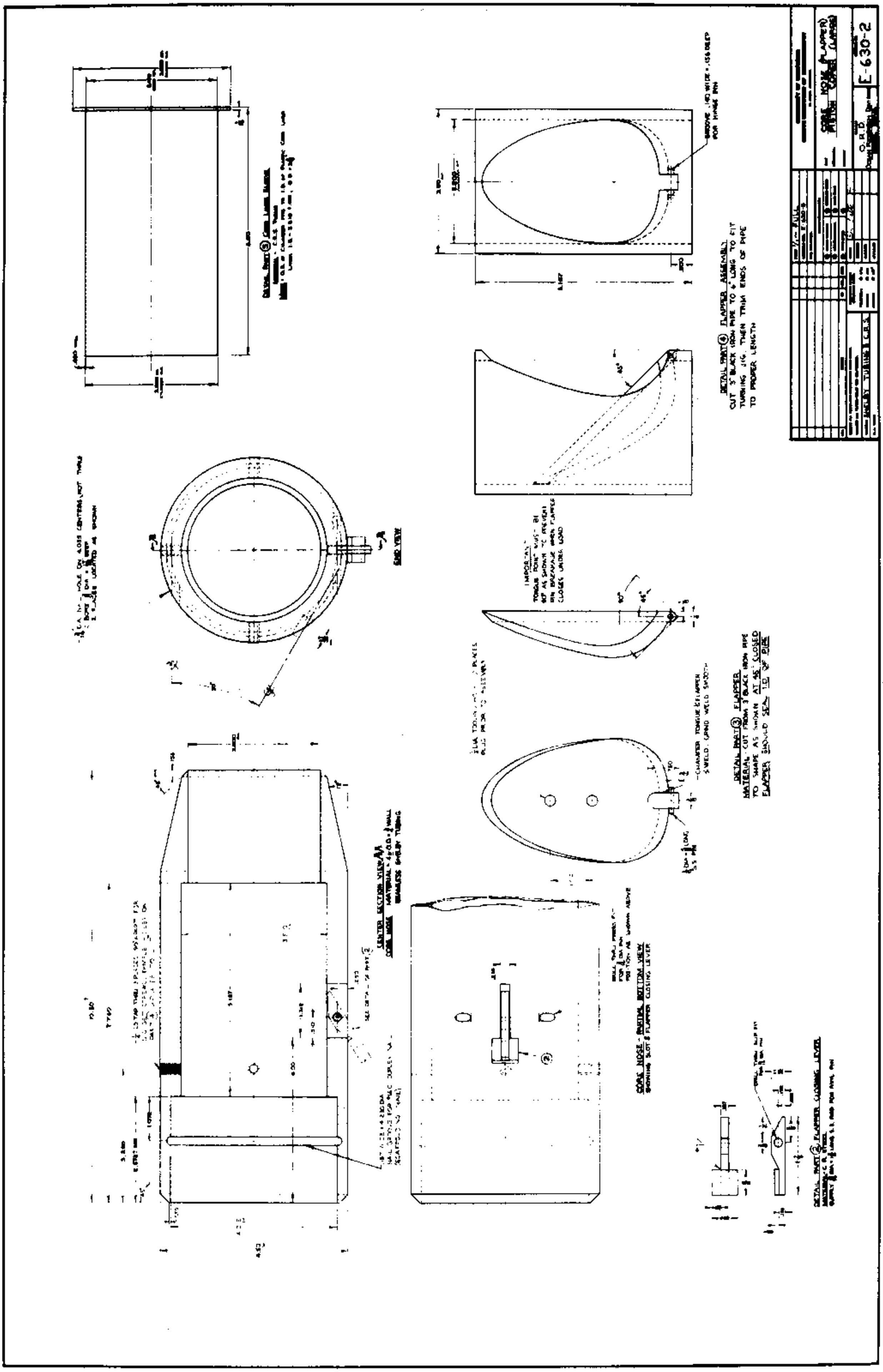


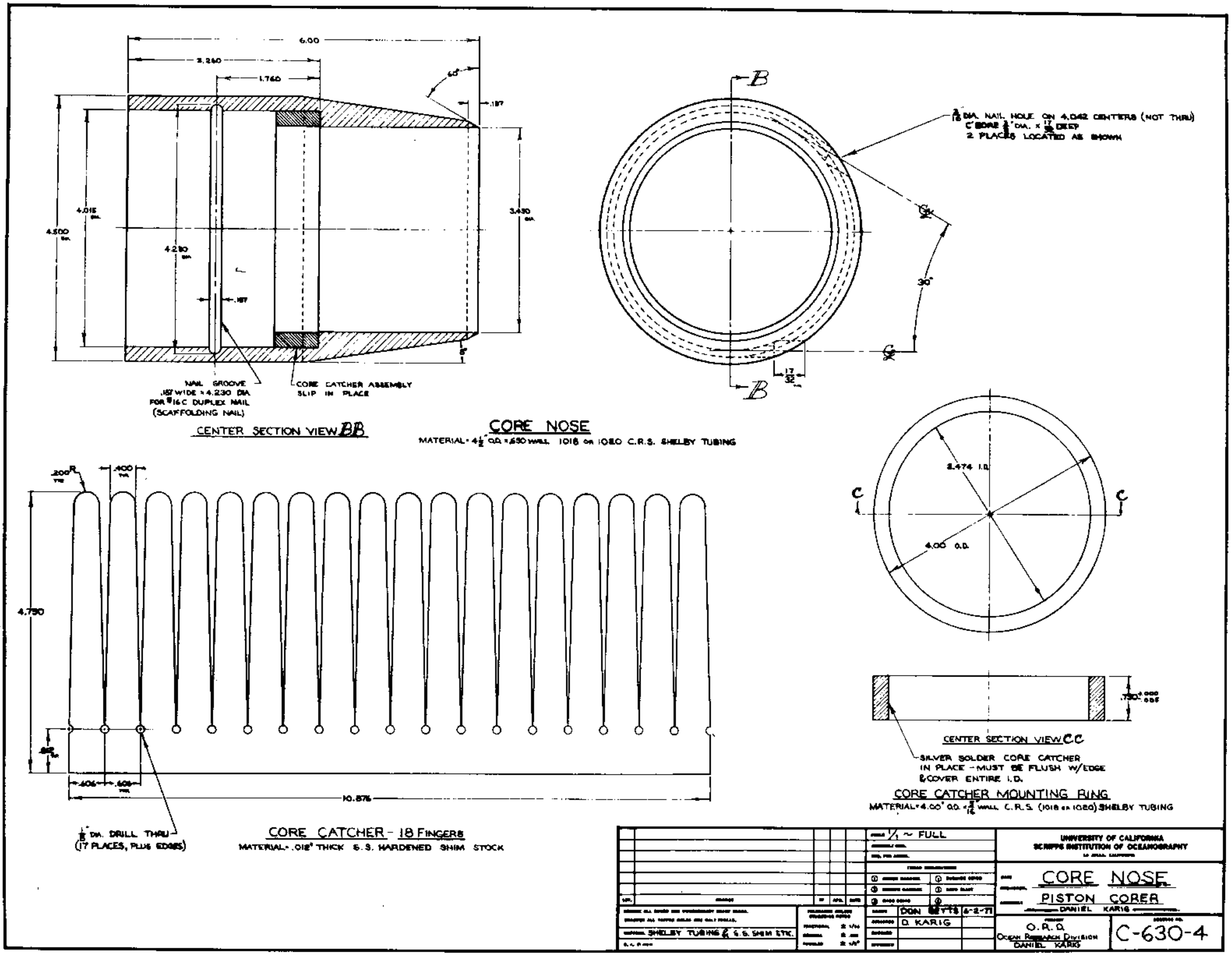
RELEASE MECHANISM
PISTON CORER
E-630-3
O. R. D.
AS NOTED

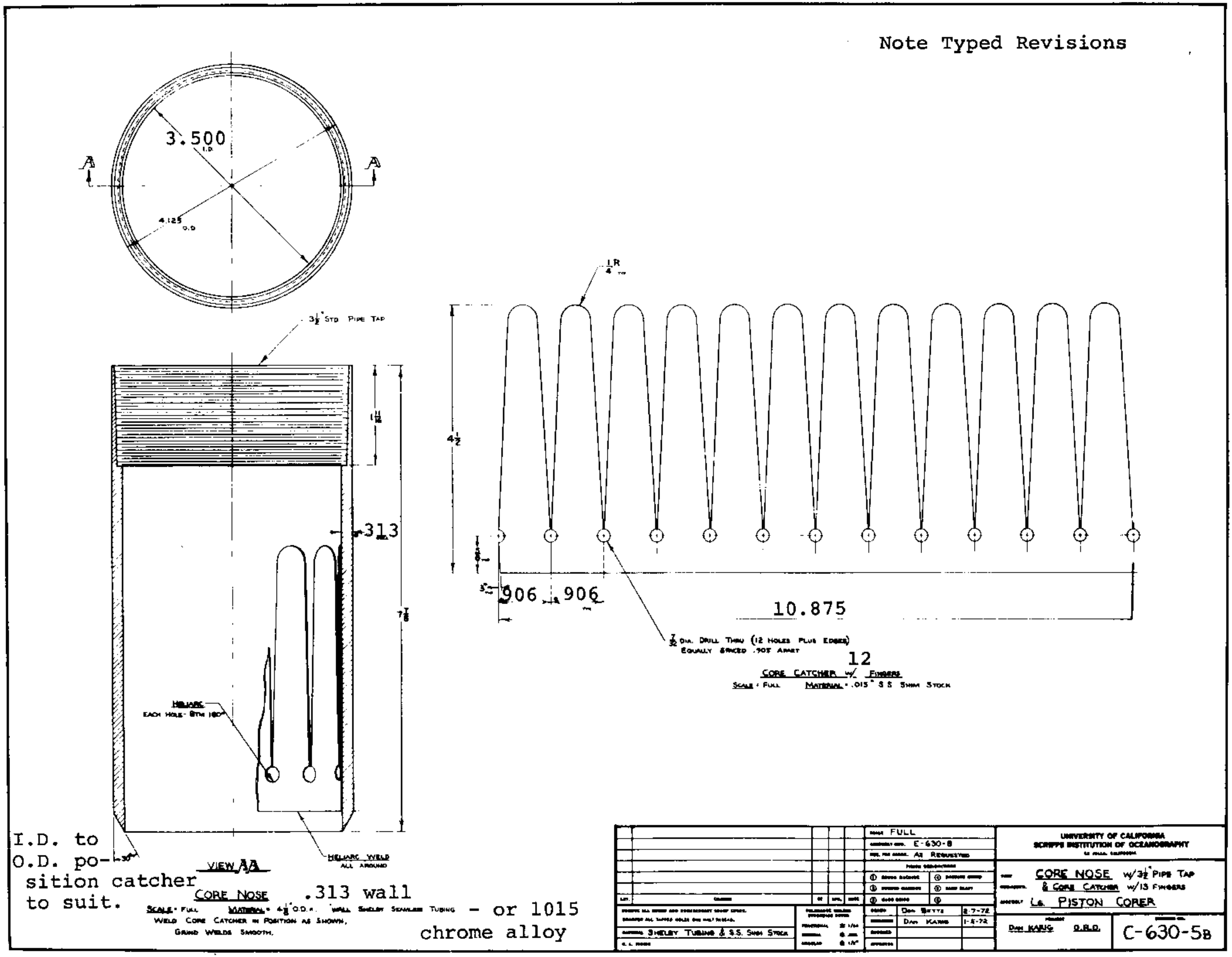

SLEEVE COUPLING
CORE BARREL
E-630-7



BARREL DETAILS
ASSEMBLY CENTER SECTION VIEW
PISTON DETAILS
PISTON LEG SCREW PIN
SHEAR PIN
DETAIL - SPRING RETAINER
MATERIAL - #304 S.S.
DETAIL - BRASS RING
CUT INTO 4 EQUAL QUARTERS AS SHOWN
STAINLESS STEEL
UNIVERSITY OF CALIFORNIA
SCRIPPS INSTITUTION OF OCEANOGRAPHY
PISTON - LARGE MOD.
PISTON CORER RING
O.R.D.
OCEAN RESEARCH DIVISION
DANIEL KARIG
C-630-6


CENTER SECTION VIEW A-A
CORE NOSE
END VIEW
DETAIL PART ⑤ CORE LINER SLEEVE
CORE NOSE - PARTIAL BOTTOM VIEW
SHOWING SLOT & FLAPPER CLOSING LEVER
IMPORTANT
TONGUE POINT MUST BE
90° AS SHOWN TO PREVENT
PIN BREAKAGE WHEN FLAPPER
CLOSES UNDER LOAD
CHAMFER TONGUE & FLAPPER
S.WELD, GRIND WELD SMOOTH
DETAIL PART ③ FLAPPER
MATERIAL: CUT FROM 3" BLACK IRON PIPE
TO SHAPE AS SHOWN AT 45° CLOSED
FLAPPER SHOULD SEAL I.D. OF PIPE
DETAIL PART ④ FLAPPER ASSEMBLY
CUT 3" BLACK IRON PIPE TO 6" LONG TO FIT
TURNING JIG, THEN TRIM ENDS OF PIPE
TO PROPER LENGTH
GROOVE .140 WIDE x .156 DEEP
FOR HINGE PIN
DETAIL PART ② FLAPPER CLOSING LEVER
MATERIAL: C.R. STEEL
CORE NOSE (FLAPPER)
PISTON CORER (LARGE)
SHELBY TUBING & C.R.S.
O.R.D.
E-630-2


6.00
2.260
1.760
60°
.187
4.500 DIA.
4.015 DIA.
4.230 DIA.
3.430 DIA.
NAIL GROOVE
.187 WIDE × 4.230 DIA.
FOR #16C DUPLEX NAIL
(SCAFFOLDING NAIL)
CORE CATCHER ASSEMBLY
SLIP IN PLACE
CENTER SECTION VIEW BB
CORE NOSE
MATERIAL - 4½" O.D. × .650 WALL 1018 OR 1020 C.R.S. SHELBY TUBING
3/16 DIA. NAIL HOLE ON 4.042 CENTERS (NOT THRU)
2 PLACES LOCATED AS SHOWN
30°
17/32
B
B
C
C
3.474 I.D.
4.00 O.D.
.200 R
.400
4.750
.606
10.876
1/8" DIA. DRILL THRU
(17 PLACES, PLUS EDGES)
CORE CATCHER - 18 FINGERS
MATERIAL - .012" THICK S.S. HARDENED SHIM STOCK
CENTER SECTION VIEW CC
SILVER SOLDER CORE CATCHER
IN PLACE - MUST BE FLUSH W/EDGE
& COVER ENTIRE I.D.
CORE CATCHER MOUNTING RING
MATERIAL - 4.00" O.D. × 3/16 WALL C.R.S. (1018 OR 1020) SHELBY TUBING
1/1 ~ FULL
UNIVERSITY OF CALIFORNIA
SCRIPPS INSTITUTION OF OCEANOGRAPHY
CORE NOSE
PISTON CORER
DANIEL KARIG
SHELBY TUBING & S.S. SHIM STK.
D. KARIG
O.R.D.
OCEAN RESEARCH DIVISION
DANIEL KARIG
C-630-4


Note Typed Revisions
3.500 I.D.
4.125 O.D.
3½" STD PIPE TAP
.313
VIEW AA
CORE NOSE
.313 wall
SCALE: FULL MATERIAL: 4⅛" O.D. × WALL SHELBY SEAMLESS TUBING - or 1015 chrome alloy
WELD CORE CATCHER IN POSITION AS SHOWN.
GRIND WELDS SMOOTH.
HELIARC WELD ALL AROUND
HELIARC EACH HOLE - BTH 180°
I.D. to O.D. position catcher to suit.
1/4 R
4½
.906
.906
10.875
7/32 DIA. DRILL THRU (12 HOLES PLUS EDGES) EQUALLY SPACED .905 APART
CORE CATCHER w/ 12 FINGERS
SCALE: FULL MATERIAL: .015" S.S. SHIM STOCK
FULL
E-630-B
AS REQUESTED
SHELBY TUBING & S.S. SHIM STOCK
DAN BETTS 2-7-72
DAN KARIG 1-5-72
UNIVERSITY OF CALIFORNIA
SCRIPPS INSTITUTION OF OCEANOGRAPHY
CORE NOSE w/3½" PIPE TAP
& CORE CATCHER w/13 FINGERS
LG. PISTON CORER
DAN KARIG
G.R.D.
C-630-5B